APPENDIX F

Attachment 1

1977

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
FOOD AND DRUG ADMINISTRATION
ROCKVILLE, MARYLAND 20857

SEP 22 19

Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

(15)
PROPOSED RULE PR - Misc (42FR 37458)

Attention: Docketing and Service Branch

Gentlemen:

In response to the Federal Register notice of July 21, 1977 (42 FR 37458), we offer our comments on the report, "Regulation of Naturally Occurring and Accelerator-Produced Radioactive Materials--A Task Force Review."

In April 1977, our Bureau of Radiological Health (BRH) commented on an earlier draft of this report which did not include the conclusions and recommendation of the Executive Summary contained on pages 3-4 of the final report. Therefore, we have limited our response mainly to general comments because our specific comments have already been considered by the Task Force.

As a long-range goal, it appears logical to include all radioactive material under the authority of one agency with the intent of having one national, uniformly applied program to control user radiation safety and to set performance standards for products and devices, regardless of the origin of the radioactive material.

In pursuing the goal of obtaining Federal legislative authority to regulate naturally occurring and accelerator-produced radioactive materials, it is suggested that consideration be given to the following:

1. Upon the recommendation of Workshop No. 7 of the Seventh Annual National Conference on Radiation Control in 1975, the Executive Committee of the conference appointed Task Force No. 1:

   "To develop the criteria needed to perform an adequate evaluation of devices, sealed sources, foils, dials, and matrices which contain naturally occurring or accelerator-produced radioactive material (NARM) and factors regarding their interstate distribution. By means of these criteria to provide a mechanism for State-Federal control of the manufacture and distribution of subject sources and products not covered under the Atomic Energy Act."

   This Task Force is composed of State personnel representing the Conference of Radiation Control Program Directors (CRCPD) and representatives of the Nuclear Regulatory Commission, the Environmental Protection Agency, and the Bureau of Radiological Health, FDA. The Task Force has met several times over the past two years and has developed a set of NARM Guides as part of a nationwide system for the uniform evaluation and control of products containing NARM (which includes the Radioactive Materials Reference Manual and the Suggested State Regulations for Control of Radiation) through the

cooperative efforts of the States and the Federal Government. The NARM Guides will also provide assistance to manufacturers, assemblers, and distributors regarding radiation safety aspects for NARM sources and products. Uniform application of the NARM Guides by radiation control agencies will serve to promote radiological safety in the manufacture, assembly, and distribution of NARM sources and products.

It is important that this voluntary NARM program which has received a great many man-hours of effort in its development by members of the CRCPD, NRC, EPA, and DRH be supported by the participating groups and given sufficient opportunity to function now that work on the NARM Guides has been completed. The NARM Guides were not available in 1974 when the Agreement States recommended Federal legislation governing naturally occurring and accelerator-produced radioactive material. The States through the CRCPD have now indicated their support of the NARM Guide program.

As a long-term goal, Federal regulatory control should be sought for imported NARM items, exempt NARM items, and all NARM items manufactured and used in non-licensing States. However, the process of seeking legislative authority for Federal control of NARM at this time should not detract from continued development of the voluntary State-Federal cooperative NARM program. The voluntary NARM program should be compatible, to the extent possible, with the Federal NARM control program which is to be developed in the future. Therefore, supporting and strengthening the voluntary NARM program at this time should contribute toward development of the Federal NARM control program as a long-range goal.

2. Although the Task Force report reflects considerable effort and provides a useful overview of the current status of agency responsibilities and limitations in the control of NARM material, it appears that there is a lack of sufficient current data to justify and serve as the basis for requiring a new initiative of Federal legislative authority to establish a regulatory control program. Much of the data in NUREG-0301 was taken from an FDA report (FDA 72-8001) published in 1971 and based on a study now almost ten years old. Considerable portions of this latter report were based on initial surveys of users made by State agencies during the 1950's and 1960's when State radiation control programs were just developing.

The report points out that various Federal Agencies have authority for control over various aspects of the use of NARM and correctly notes that these agencies have not instituted specific controls. The report fails to note, however, that when specific actions were

proposed at the Federal level, it was not possible to show that the use of NARM represents sufficient hazard to the public to warrant action when compared to other agency priorities.

The Task Force report provides a basis for a further study on the comparative effectiveness and costs of a Federal licensing program versus a voluntary State-Federal program to assure the health and safety of the public in the use of the radioactive materials. The Task Force report provides no data on actual radiation hazards or injuries due to NARM, by-product, source, or special nuclear materials upon which to make a comparative hazard analysis. A further study would evaluate the effectiveness of the voluntary Federal-State NARM program. The Food and Drug Administration would be interested in participating in such a study, which should be accomplished with the support of all interested Federal Agencies as well as the CRCPD.

3. As indicated in the report, the FDA has authority to regulate medical radiation sources under the Medical Device Amendments of 1976 (Public Law 94-295, 90 Stat 539-583) of the Federal Food, Drug, and Cosmetic Act. This authority would include medical radiation sources containing NARM. BRH is the lead Bureau in FDA dealing with manufacturers of the following types of medical devices: (a) all medical devices which are electronic products subject to the Radiation Control for Health and Safety Act (x-ray machines, medical lasers, microwave and acoustic devices); (b) medical devices other than electronic devices subject to the Radiation Control for Health and Safety Act of 1968 but which emit ionizing radiation essential to their intended function (cobalt-60, teletherapy, brachytherapy sources, etc.); and (c) accessories or components of products falling under categories (a) or (b) which may influence the quantity, quality, or direction of the radiation emitted or produced (x-ray film, screens, image receptors, film processors, nuclear medicine scanners, etc.). We believe the second paragraph on page 30 of the NRC Task Force report may give the impression that BRH is only involved with voluntary recommendations in this area, whereas they are responsible for a regulatory program under the authority of the Medical Device Amendments for the types of medical devices indicated above.

Under (1) of Conclusions on page 43 of the report, the impression may be given that FDA does not have authority for pre-market approval of NARM radioactive medical sources under the Medical Device Amendments of 1976. The statement should be clarified by deleting the following sentence: "There is no Federal program requiring pre-market approval of NARM radioactive medical sources or requiring the sources to conform with specified manufacturing and quality control standards." The classification of medical devices is actively under development by FDA as is the promulgation of regulations on "good manufacturing prac-

tice." The FDA classification program involves a systematic examination of the risk of injury and will provide a reasonable basis for the decision on requiring Federal pre-market approval.

At the top of page 30 discussing regulatory functions of the Department of Health, Education, and Welfare, the impression is given that only the regulations of Agreement State programs may be exempted from preemption at this time. The proposed rule regarding exemption from preemption under Section 521 of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360k) indicates that State or local requirements applicable to medical devices would be preempted only when a corresponding FDA requirement becomes applicable to a particular device by operation of the Act (see 42 FR 30383; June 14, 1977). Therefore, at the present time, the regulations of non-agreement States would not be preempted because FDA has not imposed any corresponding requirements under the Federal Food, Drug, and Cosmetic Act.

In summary, we would like to stress the NARM program being developed in cooperation with the CRCPD and the Federal Agencies--NRC, FDA, and EPA. The States through the CRCPD have indicated their support of the NARM Guide program. The NARM Guides were not developed in 1974 when the Agreement States recommended Federal legislation governing naturally occurring and accelerator-produced radioactive material. However, developmental work has now been completed on this project, and time is needed to evaluate the effectiveness of this collaborative approach. We would be interested in participating in such an evaluation which should provide a firm basis for determining whether Federal legislation may be needed in the future. This should be accomplished with the support of all interested Federal Agencies as well as the CRCPD.

Sincerely yours,

Joseph P. Hile

Joseph P. Hile
Associate Commissioner for Compliance

CONFERENCE
PUBLICATION
87-3

PROFILE

OF

STATE AND LOCAL

RADIATION CONTROL PROGRAMS

IN THE

UNITED STATES

FOR

FISCAL YEAR 1985

PREPARED AND PUBLISHED BY

OFFICE OF THE EXECUTIVE SECRETARY
CONFERENCE OF RADIATION CONTROL PROGRAM DIRECTORS, INC.
71 FOUNTAIN PLACE
FRANKFORT, KENTUCKY 40601

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TABLE 6
LEGISLATIVE AUTHORITY FOR
LICENSING/REGISTRATION OF NARM*

STATE	LEGIS.	STATUTE	DATE
ALASKA	MANDATED	AS18.60.475-545	01/01/78
ALABAMA	YES	ACT 582	09/18/ 3
ARKANSAS	MANDATED	82-1516	01/01/61
ARIZONA	YES	ARS 30-672	01/01/80
COLORADO	YES	25-11	01/01/65
CONNECTICUT(NP)			
CA LA COUNTY			
CA ORANGE CTY			
CA ST HLTH (NP)			
CA ST IND RLNS	YES	H&S 25815-25862	01/01/61
DIS OF COLUMBIA		DC MR 20	01/01/84
DELAWARE	MANDATED	16-7405	12/31/80
FLORIDA	MANDATED	F.S. 404.061	07/01/84
GA STATE HEALTH	YES	CH. 31-13 OCGA	01/01/64
GA NAT RESOURCE			
HAWAII		HRS CHAP. 321	
IOWA	MANDATED	CH 136C,IA CODE	04/01/84
IDAHO	MANDATED	39-3000	05/05/81
ILLINOIS	MANDATED	111 1/2-216.0	10/01/83
INDIANA	MANDATED	410-IAC-5	09/01/72
KANSAS	MANDATED	48-1601 ET SEQ	01/01/84
KENTUCKY	MANDATED	KRS 211.842	06/17/78
LOUISIANA	MANDATED	LRS 30:1104.A	06/22/84
MASSACHUSETTS	YES	CH. 111-SEC. 5B	01/01/55
MARYLAND	MANDATED	HE ART. 8-301	12/06/82
MAINE	YES	10 MRSA 677	05/25/83
MICHIGAN	MANDATED	MCL 333.3515	09/30/78
MINNESOTA	MANDATED	144.12	01/01/58
MISSOURI	MANDATED	192.400-490	01/01/64
MISSISSIPPI	MANDATED	45-14-1/69	05/25/76
MONTANA	YES	MCA 75-3-202	01/01/67
NORTH CAROLINA	YES	GS 104 E-7	01/01/63
NORTH DAKOTA	YES	23-20.1-03,04	01/01/81
NEBRASKA	YES	71-3501-3519	01/01/68
NEW HAMPSHIRE	MANDATED	RSA 125:62	01/01/63
NEW JERSEY (NP)			
NEW MEXICO	YES	74-3-1 - 16	01/01/74
NEVADA	MANDATED	NRS 459	01/01/69
NY STATE HEALTH	YES	10NYCAR PART 16	01/01/79
NY ST. ENVIR.	YES		
NY STATE LABOR	YES	1C, RULE 38	12/01/55
NY CITY HEALTH	MANDATED	ARTICLE 175	01/01/62
OHIO	MANDATED	ORC 3701.912	03/28/85
OKLAHOMA	YES	63 O.S.SUPP '81	04/01/69
OREGON	YES	453.605 TO 745	01/01/65
PENNSYLVANIA	MANDATED	ACT #1984-147	07/10/84
PUERTO RICO	NO		
RHODE ISLAND	MANDATED	23-1.3	05/01/76
SOUTH CAROLINA	MANDATED	13-7-40	01/01/76
SOUTH DAKOTA	YES	34-21-18	01/01/67
TENNESSEE	MANDATED	TCA 68 CH. 23	01/01/59
TEXAS	MANDATED	4590F, VTCS	04/01/61
UTAH	YES	UC 26-1-27, 29	11/08/82
VIRGINIA	MANDATED	32.1-229	01/01/79
VERMONT	YES		01/01/77
WASHINGTON	MANDATED	RCW 70.98	01/01/65
WISCONSIN	MANDATED	140.50-63	07/01/79
WEST VIRGINIA	YES	CHAP. 16-ART. 1	05/01/79
WYOMING	YES	35-4-301/303	01/01/53

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* Naturally Occurring or Accelerator Produced Radioactive Material

TABLE 5
LEGISLATIVE AUTHORITY TO
LICENSE AGREEMENT RADIOACTIVE MATERIAL

STATE	LEGIS.	STATUTE	DATE
ALASKA	NO		
ALABAMA	YES	ACT 582	09/18/63
ARKANSAS	MANDATED	82-1516	01/01/61
ARIZONA	MANDATED	ARS 30-654	01/01/80
COLORADO	YES	25-11	01/01/65
CONNECTICUT(NP)			
CA LA COUNTY			
CA ORANGE CTY			
CA ST HLTH (NP)			
CA ST IND RLNS	YES		01/01/61
DIS OF COLUMBIA			
DELAWARE	NO		
FLORIDA	MANDATED	F.S. 404.061	07/01/84
GA STATE HEALTH	YES	CH. 31-13 OCGA	01/01/64
GA NAT RESOURCE			
HAWAII	NO		
IOWA	NO	CH 136C,IA CODE	04/01/84
IDAHO	MANDATED	39-3000	05/05/81
ILLINOIS	MANDATED	111 1/2-216.B	10/01/73
INDIANA	MANDATED	IC 13-1-2	09/01/59
KANSAS	MANDATED	48-1601 ET SEQ	01/01/84
KENTUCKY	MANDATED	KRS 211.842	06/17/78
LOUISIANA	MANDATED	LRS 30:1104.A	06/22/84
MASSACHUSETTS	NO		
MARYLAND	MANDATED	HE ART. 8-301	12/06/82
MAINE	MANDATED	10 MRSA 677	05/25/83
MICHIGAN	YES	MCL 333.13515	09/30/78
MINNESOTA	YES		
MISSOURI	NO		
MISSISSIPPI	MANDATED	AG'S OPINION	07/01/62
MONTANA	NO		
NORTH CAROLINA	YES	GS 104 E-7,-10	01/01/63
NORTH DAKOTA	YES	23-20.1-03,04	01/01/81
NEBRASKA	YES	71-3501-3519	01/01/63
NEW HAMPSHIRE	MANDATED	RSA 125:62	05/16/66
NEW JERSEY (NP)			
NEW MEXICO	MANDATED	74-3-1 - 16	01/01/74
NEVADA	MANDATED	NRS 459	01/01/69
NY STATE HEALTH	YES	10NYCAR PART 16	01/01/79
NY ST. ENVIR.	YES		
NY STATE LABOR	YES	1C, RULE 38	10/01/62
NY CITY HEALTH	MANDATED	ARTICLE 175	01/01/62
OHIO	NO		
OKLAHOMA	NO		
OREGON	MANDATED	453.605-745	01/01/65
PENNSYLVANIA	YES	ACT #1984-147	07/10/84
PUERTO RICO	NO		
RHODE ISLAND	YES	23-1.3	05/01/75
SOUTH CAROLINA	MANDATED	13-7-40	01/01/76
SOUTH DAKOTA	NO		
TENNESSEE	YES	TCA 68 CH. 23	01/01/59
TEXAS	MANDATED	4590F, VTCS	04/01/61
UTAH	YES	UC 26-1-27	11/08/82
VIRGINIA	MANDATED	32.1-235	01/01/79
VERMONT	YES		01/01/77
WASHINGTON	MANDATED	RCW 70.98	01/01/65
WISCONSIN	NO		
WEST VIRGINIA	NO		
WYOMING	NO		

TABLE 35
BUDGET (DOLLARS)
PRIMARY RADIATION CONTROL PROGRAM

STATE	STATE REVENUE	FEE COLLECTION	FEDERAL GRANT	OTHER (AMOUNT)	TOTAL RCP
ALASKA	99,400				99,400
ALABAMA	443,026	66,000	140,000		649,026
ARKANSAS	355,430		140,222	304,352	800,004
ARIZONA	833,000	197,400	600	158,300	1,189,300
COLORADO	562,575	129,089	183,344	11,635,522	12,510,530
CONNECTICUT(NP)					
CA LA COUNTY	494,000	6,000			500,000
CA ORANGE CTY		238,000			238,000
CA ST HLTH (NP)					0
CA ST IND RLNS					0
DIS OF COLUMBIA					75,000
DELAWARE	75,000				
FLORIDA	612,724	1,869,669	39,002	432,078	2,953,473
GA STATE HEALTH	502,778	116,340		32,670	651,788
GA NAT RESOURCE	300,000		27,400		327,400
HAWAII	76,330				76,330
IOWA	66,000	102,000	54,000		222,000
IDAHO	144,000				144,000
ILLINOIS	4,137,800	7,105,400			11,243,200
INDIANA	207,300	17,400	20,000		244,700
KANSAS	410,008	48,725	20,000		478,733
KENTUCKY	559,543	127,800	8,757		696,100
LOUISIANA	417,320	561,000		12,000	990,320
MASSACHUSETTS	,716				330,716
MARYLAND	,296		19,266	19,683	403,245
MAINE	33,530	59,200	44,600	13,724	151,054
MICHIGAN	515,900	573,600	142,800	297,000	1,529,300
MINNESOTA	221,222		85,877		307,099
MISSOURI	103,370		62,178		165,548
MISSISSIPPI	327,000	105,000	38,000		470,000
MONTANA	103,936				103,936
NORTH CAROLINA	500,079	312,244	2,900	52,705	867,928
NORTH DAKOTA	149,500	22,000		13,500	185,000
NEBRASKA	247,625		12,000	68,153	327,778
NEW HAMPSHIRE	119,149	33,565	11,358	102,379	266,451
NEW JERSEY (NP)					
NEW MEXICO	628,000				628,000
NEVADA	92,000	117,600			209,600
NY STATE HEALTH	323,000	322,000	75,000		720,000
NY ST. ENVIR.	3,210,000				3,210,000
NY STATE LABOR	300,000				300,000
NY CITY HEALTH				1,284,355	1,284,355
OHIO	200,000		230,000	250,000	680,000
OKLAHOMA	456,663				456,663
OREGON	343,516	227,446	150,491	96,642	818,125
PENNSYLVANIA	940,000	940,000	146,000		2,026,000
PUERTO RICO	60,000				60,000
RHODE ISLAND	275,000		9,200		284,200
SOUTH CAROLINA	880,118	0	83,392		963,510
SOUTH DAKOTA	20,808		2,671		23,479
TENNESSEE	500,170	539,382	43,800	71,900	1,155,252

TABLE 35
BUDGET (DOLLARS)
PRIMARY RADIATION CONTROL PROGRAM

STATE	STATE REVENUE	FEE COLLECTION	FEDERAL GRANT	OTHER (AMOUNT)	TOTAL RCP
TEXAS	4,095,561		42,227		4,137,788
UTAH	302,900	58,900	175,000	15,000,000	15,536,800
VIRGINIA	318,605				318,605
VERMONT					0
WASHINGTON	241,300	1,439,600	22,900	238,900	1,942,700
WISCONSIN	84,250	285,000	44,000	10,000	423,250
WEST VIRGINIA	86,435		11,368	51,970	149,773
WYOMING	74,700				74,700
	26,745,613	15,620,360	2,088,353	30,145,833	74,600,159

Arkansas: levied $304,352 on utilities
Colorado: collected $11,635,522 for low-level waste site construction
Florida: collected $432,078 as grants from power companies for environmental surveillance and emergency response
Louisiana: collected $12,000 under NRC federal contract
Minnesota: collected $154,000 in fees, but which went into the General Fund, and were not dedicated for radiation control
New Hampshire: collected $102,379 from utilities
New York City: The $1,284,355 is a city budget, not state
North Carolina: collected $52,705 by emergency response fees
North Dakota: collected $13,500 under FDA contract
Ohio: collected $250,000 from nuclear utilities
Oregon: collected $96,642 as agency contracts
South Carolina: collected $380,985 in fees, but which went into the General Fund, and were not dedicated for radiation control
Tennessee: collected $50,000 as lab fees, and $21,900 from TVA, for a total of $71,900 under OTHER category
Utah: collected $15,000,000 under UMTRA
Washington: collected $238,900 as interagency reimbursement
West Virginia: collected $51,970 from Human Service
Wisconsin: collected $10,000 from utilities

TABLE 38
STAFF DISTRIBUTION
(FULL-TIME EQUIVALENTS)

SUMMARY BY PROGRAM AREA

STATE	ADMIN	X-RAY	RAD. MAT.	ENV.	CRED.	LLRW	NIR	OTHER*	TOTAL
ALASKA	0.3	0.9	0.1				0.1	0.2	1.6
ALABAMA	4.0	5.6	3.6	0.8				1.7	15.7
ARKANSAS	2.5	4.1	4.6	2.1		0.2		20.5	34.0
ARIZONA	6.0	5.5	5.0	5.0	2.0	0.5	0.5	5.5	30.0
COLORADO	5.0	1.0	5.5	4.5				10.0	26.0
CONNECTICUT(NP)									
CA LA COUNTY	3.0	6.0	2.0					0.0	11.0
CA ORANGE CTY		4.1	0.7					0.3	5.1
CA ST HLTH (NP)									
CA ST IND RLNS	1.5	0.7	4.8				0.1	0.0	7.1
DIS OF COLUMBIA		2.0						0.0	2.0
DELAWARE	1.1	1.9	0.2		0.1			0.4	3.7
FLORIDA	6.0	22.0	14.0	23.0	8.0	3.0	1.0	0.0	77.0
GA STATE HEALTH	3.0	8.0	8.0					2.0	21.0
GA NAT RESOURCE	0.5			2.2		0.1		1.2	4.0
HAWAII	1.0	1.6	0.3		0.4		0.2	0.0	3.5
IOWA	3.1	3.3	0.6		0.7		0.2	0.4	8.3
IDAHO	1.0	1.0	1.0					0.0	3.0
ILLINOIS	16.0	34.0	6.0	26.0	3.0	3.0	1.0	36.0	125.0
INDIANA	1.7	4.5	0.5	1.4	2.7	0.3	0.2	0.2	11.5
KANSAS	0.8	4.5	4.0	5.0		0.0	0.0	0.0	14.3
KENTUCKY	1.0	12.0	4.0	3.0	2.0			0.0	22.0
LOUISIANA	3.5	4.2	5.9	2.2		0.0	0.0	6.2	22.0
MASSACHUSETTS	1.9	6.8	0.3	3.0		0.2	0.2	0.8	13.2
MARYLAND	2.6	4.6	3.9	1.5		0.4	0.5	1.5	15.0
MAINE	1.5	0.5	0.3	0.9	0.4		0.3	0.3	4.2
MICHIGAN	3.0	16.7	1.0	3.9	0.0	1.5	0.0	3.3	29.4
MINNESOTA	1.5	3.4	0.2	1.0		0.5	0.1	2.3	9.0
MISSOURI	2.0	5.0	1.0				0.0	0.0	8.0
MISSISSIPPI	3.0	3.0	3.0	4.0		1.0		1.0	15.0
MONTANA	0.2	1.5		0.5		0.2		0.0	2.4
NORTH CAROLINA	3.0	10.0	5.0	5.0		1.0		2.0	26.0
NORTH DAKOTA	0.6	1.7	3.0			0.1		0.0	5.4
NEBRASKA	0.8	1.8	2.2	0.5		0.1	0.1	2.2	7.7
NEW HAMPSHIRE	0.6	1.7	0.9	1.5		0.0	0.0	1.1	5.8
NEW JERSEY (NP)									
NEW MEXICO	6.0	2.0	1.0	4.0	0.0			2.0	15.0
NEVADA	1.0	2.0	2.0			1.0		0.0	6.0
NY STATE HEALTH	4.0	13.1	5.6	4.6	4.0	0.4	0.1	2.3	34.1
NY ST. ENVIR.	1.0		3.0	2.5		11.0		0.0	17.5
NY STATE LABOR	0.9	0.5	6.2				1.0	0.8	9.4
NY CITY HEALTH	12.0	14.0	10.0				1.0	0.0	37.0
OHIO	1.5	2.4	0.7	1.0		0.2		2.2	8.0
OKLAHOMA	2.1	5.3	1.2	4.2		0.1	0.2	0.1	13.2
OREGON	2.0	6.5	1.5	4.5				5.0	19.5
PENNSYLVANIA	3.4	4.9	2.3	6.3		1.7		7.4	26.0
PUERTO RICO	1.1	1.4		1.2			0.4	0.0	4.1
RHODE ISLAND	0.4	5.1	1.7	1.0		0.2	0.2	0.2	8.8
SOUTH CAROLINA	3.0	8.0	10.0	7.0		2.0		0.0	30.0
SOUTH DAKOTA	0.1	1.0						0.0	1.1
TENNESSEE	8.0	13.0	8.0	2.0				0.0	31.0
TEXAS	31.8	24.4	22.7			2.2		23.2	104.3
UTAH	1.0	2.0	3.0	0.5				4.5	11.0
VIRGINIA	3.0	5.0	1.0	2.0				0.0	11.0
VERMONT	0.7	0.9	0.2	1.5		0.1	0.2	0.4	4.0
WASHINGTON	9.0	6.0	8.0	4.0		6.0		6.0	39.0
WISCONSIN	0.9	6.5		1.6		0.1	0.1	1.8	11.0
WEST VIRGINIA	1.3	2.3	0.1	0.4	0.1	0.2	0.1	1.0	5.5
WYOMING	0.8	0.7	0.3				0.0	0.1	1.9
	176.7	310.6	180.1	145.3	23.4	37.3	7.8	156.1	1037.3

* See Table 47 for breakdown of other areas.

TABLE 64
RADIOACTIVE MATERIALS PROGRAM
(GENERAL)

STATE	NRC AGRMNT.	CRCPD LICN'G. STATE	RAD. MAT'L. PROGRAM	NARM	NARM AS AGRMNT.	TOTAL* # LIC'S. ISSUED	TOTAL # LIC'S. INSPECTED
ALASKA		NO	C	R		6	
ALABAMA	YES	YES	R		YES	415	129
ARKANSAS	YES	NO	R		YES	250	151
ARIZONA	YES	YES	R		YES	445	157
COLORADO	YES	YES	R		YES	461	79
CONNECTICUT(NP)							
CA LA COUNTY	YES	NO	R	L	YES		
CA ORANGE CTY		NO	R			149	43
CA ST HLTH (NP)							
CA ST IND RLNS		NO	R		YES	0	400
DIS OF COLUMBIA		YES	R	R,L,C		13	13
DELAWARE		YES	R			20	
FLORIDA	YES	YES	R		YES	901	259
GA STATE HEALTH	YES	YES	R		YES	533	161
GA NAT RESOURCE		NO					
HAWAII		NO	R	R			
IOWA		NO	R	R		56	1
IDAHO	YES	YES	R		YES	122	29
ILLINOIS		YES	R	C		408	156
INDIANA		NO	C	R		121	55
KANSAS	YES	NO	R		YES	367	82
KENTUCKY	YES	NO	R		YES	311	146
LOUISIANA	YES	NO	R		YES	604	244
MASSACHUSETTS		YES	C	R		370	225
MARYLAND	YES	NO	R		YES	419	35
MAINE		NO	V	N		83	0
MICHIGAN		NO	C	R,N			
MINNESOTA		NO	C	R		56	0
MISSOURI		NO	R	R		116	116
MISSISSIPPI	YES	NO	R		YES	386	88
MONTANA		NO		N			
NORTH CAROLINA	YES	NO	R		YES	533	200
NORTH DAKOTA	YES	NO	R		YES	131	47
NEBRASKA	YES	NO	R		YES	244	92
NEW HAMPSHIRE	YES	NO	R		YES	91	13
NEW JERSEY (NP)							
NEW MEXICO	YES	NO	R		YES	300	54
NEVADA	YES	NO	R		YES	111	63
NY STATE HEALTH	YES	YES	R		YES	1,043	176
NY ST. ENVIR.	YES	NO					
NY STATE LABOR	YES	YES	R		YES	415	
NY CITY HEALTH	YES	YES	R		YES	779	689
OHIO		NO	R	R			
OKLAHOMA		NO	R	R		353	52
OREGON	YES	YES	R		YES	248	88
PENNSYLVANIA		NO	R	L		405	
PUERTO RICO		NO		N			
RHODE ISLAND	YES	YES	R		YES	53	19
SOUTH CAROLINA	YES	YES	R		YES	413	104
SOUTH DAKOTA		NO	R	L			
TENNESSEE	YES	YES	R		YES	669	213
TEXAS	YES	YES	R		YES	2,145	1,512
UTAH	YES	YES	R		YES	200	63
VIRGINIA		YES	C	L		132	
VERMONT		NO	R	R		18	1
WASHINGTON	YES	YES	R		YES	369	284
WISCONSIN		NO	R	R			
WEST VIRGINIA		NO	R	R			
WYOMING		NO	R	R,N			
	30	21			30	15,264	6,239

RADIOACTIVE MATERIAL PROGRAM: R=REGULATORY, V=VOLUNTARY, C=COMBINATION, N=NONE
NARM CONTROL: L=LICENSE, R=REGISTER, C=COMBINATION, N=NONE

NARM regulated similar to agreement material, not applicable for non-agreement state.

U.S. Department
of Transportation

**Research and
Special Programs
Administration**

400 Seventh Street, S.W.
Washington, D.C. 20590

DOT-E 9488
(FIRST REVISION)

APR 13 1987

1. Members of the Conference of Radiation Control Program Directors, Inc., (CRCPD) specifically designated in the records for this exemption in the CRCPD Executive Secretary's office in Frankfort, Kentucky and shippers authorized and identified in the records of these CRCPD members are hereby granted an exemption from those provisions of this Department's Hazardous Materials Regulations specified in paragraph 5 below to offer for transport in commerce packages prescribed herein containing not more than 500 millicuries of radium-226 subject to the limitations and special requirements specified herein. This exemption authorizes the use of specially sealed DOT specification 2R containers in concrete filled steel drums (certified as DOT Specification 7A) for one-time transport for disposal of not more than 500 millicuries of radium-226 in normal or special form without each shipper keeping a package test performance certification file, and provides no relief from any regulation other than as specifically stated.

2. BASIS. This exemption is based on CRCPD's letter of January 12, 1987, submitted in accordance with 49 CFR 107.105 and the public proceeding thereon.

3. HAZARDOUS MATERIALS (Descriptor and class). Radium sources being transported for disposal, classed as Radioactive Material.

4. PROPER SHIPPING NAME (49 CFR 172.101). Radioactive material, n.o.s., UN2982; and Radioactive material, special form, n.o.s., UN2974.

5. REGULATION AFFECTED. 49 CFR 173.431, 173.415(a).

6. MODES OF TRANSPORTATION AUTHORIZED. Motor vehicle.

7. SAFETY CONTROL MEASURES.

a. Each package shall be prepared in accordance with the detailed instructions and procedures provided by the Executive Secretary of the CRCPD which has been filed with this Office. Data demonstrating that the packaging design meets DOT Specification 7A shall be on file with the Executive Secretary of the CRCPD and does not need to be on file with each shipper.

b. Not more than 500 millicuries of radium-226 shall be contained in one package.

8. SPECIAL PROVISIONS.

a. The Executive Secretary of the CRCPD shall maintain a record or listing of those CRCPD members who have requested and been granted permission to use this exemption and have been provided the detailed instructions and procedures for use of the package.

A list of the CRCPD members who use this exemption must be on file with the Office of Hazardous Materials Transportation (OHMT).

b. Each CRCPD member who uses this exemption shall keep a record of each use of this exemption for a period of two years.

c. A copy of this exemption shall be attached to the shipping papers or to the radioactive waste mainifest provided to each radioactive waste disposal facility.

d. Any person authorized by a CRCPD member to prepare packages under this exemption shall offer them for transportation and shall sign the certification statement required by 49 CFR 172.204. The CRCPD member or his representative shall inspect and approve the package preparation, and shall write the name of the State, the name of the CRCPD member, and his signature and date on the lower margin of the front page of the copy of the exemption that accompanies the shipment per paragraph 8.c. above.

e. In addition to the marking requirements of 49 CFR Part 172, Subpart D, each package prepared under this exemption shall be clearly marked "DOT-E 9488" in figures at least two inches high.

9. REPORTING REQUIREMENTS. Any incident in transportation involving significant damage to the package must be reported to the OHMT as soon as practicable.

10. EXPIRATION DATE. November 30, 1989.

Issued at Washington, D.C.

APR 13 1987

Alan I. Roberts
Director
Office of Hazardous Materials Transportation

(DATE)

Address all inquiries to: Director, Office of Hazardous Materials Transportation, Research and Special Programs Administration, U.S. Department of Transportation, Washington, D.C. 20590. Attention: Exemptions Branch.

Dist: FHWA

§ 178.33a-8 Tests.

(a) One out of each lot of 25,000 containers or less, successively produced per day, shall be pressure tested to destruction and must not burst below 270 pounds per square inch gauge pressure. The container tested shall be complete with end assembled.

(b) Each such 25,000 containers or less, successively produced per day, shall constitute a lot and if the test container shall fail, the lot shall be rejected or ten additional containers may be selected at random and subjected to the test under which failure occurred. These containers shall be complete with ends assembled. Should any of the ten containers thus tested fail, the entire lot must be rejected. All containers constituting a lot shall be of like material, size, design, construction, finish and quality.

[Order 71, 31 FR 9074, July 1, 1966. Redesignated at 32 FR 5606, Apr. 5, 1967]

§ 178.33a-9 Marking.

(a) By means of printing, lithographing, embossing, or stamping, each container must be marked to show:

(1) DOT-2Q.

(2) Name or symbol of person making the mark specified in paragraph (a)(1) of this section. Symbol, if used, must be registered with the Director, OHMT.

[Amdt. 178-40, 41 FR 38181, Sept. 9, 1976]

§ 178.34 Specification 2R; inside containment vessel.

[Amdt. 178-35, 39 FR 45245, Dec. 31, 1974]

§ 178.34-1 General requirements.

(a) Each vessel must be made of stainless steel, malleable iron, or brass, or other material having equivalent physical strength and fire resistance.

(b) Each vessel must meet all of the applicable requirements of § 173.24 (c) and (d) of this subchapter. Letters and numerals at least 6 millimeters (¼-inch) in height are authorized for the marking of a vessel not exceeding 5 centimeters (2 inches) inside diameter.

[Amdt. 178-35, 39 FR 45245, Dec. 31, 1974]

§ 178.34-2 Manufacture.

The ends of the vessel must be fitted with screw-type closures or flanges (see § 178.34-4), except that one or both ends of the vessel may be permanently closed by a welded or brazed plate. Welded or brazed side seams are authorized.

[Amdt. 178-35, 39 FR 45245, Dec. 31, 1974]

§ 178.34-3 Dimensions.

(a) The inside diameter of the vessel may not exceed 30 centimeters (12 inches) exclusive of flanges for handling or fastening devices and must have wall thickness and length in accordance with the following:

Inside diameter maximum		Threaded closure		Wall thickness minimum—Flanged closure	Length maximum	
Inches	Centimeters	Inches	Millimeters		Inches	Centimeters
2	5	3/32	2.5	Not less than that prescribed for schedule 40 pipe	16	41
6	15	1/8	3.2		72	183
12	30	1/4	6.5		72	183

[Amdt. 178-35, 39 FR 45245, Dec. 31, 1974]

§ 178.34-4 Closure devices.

(a) Each closure device must be as follows:

(1) Screw-type cap or plug; number of threads per inch must not be less than United States standard pipe threads and must have sufficient length of thread to engage at least 5 threads when securely tightened. Pipe threads must be luted with an appropriate non-hardening compound which must be capable of withstanding up to 149° C. (300° F) without loss of efficiency. Tightening torque must be adequate to maintain leak tightness with the specific luting compound.

(2) An opening may be closed by a securely bolted flange and leak-tight gasket. Each flange must be welded or brazed to the body of the 2R vessel per (ANSI) Standard B16.5 or (AWWA) Standard C207-55, section 10. A torque wrench must be used in securing the flange with a corresponding torque of no more than twice the force necessary to seal the selected gasket. Gasket material must be capable of withstanding up to 149° C (300° F) without loss of efficiency. The flange, whether of ferrous or nonferrous metal, must be constructed from the same metal as the vessel and must meet the dimensional and fabrication specifications for welded construction as follows:

(i) Pipe flanges described in Tables 13, 14, 16, 17, 19, 20, 22, 23, 25 and 26 of ANSI B16.5.

(ii) For nominal pipe sizes, 6, 8, 10, and 12 inches, AWWA Standard C207-55, Table 1, class B, may be used in place of the tables prescribed by paragraph (a)(2)(i) of this section.

(iii) Sizes under 6 inches, nominal pipe size, the following table with the same configuration as illustrated in AWWA C207-55, Table 1, class B, may be used in place of paragraph (a)(2)(i) of this section.

Nominal pipe size		Flange O.D.		Number of bolts	Bolt circle diameter		Diameter of bolts		Flange thickness	
Inches	Centimeters	Inches	Centimeters		Inches	Centimeters	Inches	Centimeters	Inches	Centimeters
2	5	6	15	4	4¾	11.8	⅝	1.2	¾	1.6
2½	6.2	7	17.5	4	5½	13.8	⅝		¾	
3	7.5	7½	18.8	4	6	15	⅝		¾	
3½	8.8	8½	21.3	8	7	17.5	⅝		¾	
4	10	9	22.5	8	7½	18.8	⅝		¾	
5	12.6	10	25.4	8	8½	21.3	¾		¾	

(iv) Cast iron flanges prohibited.

[Amdt. 178-35, 39 FR 45245, Dec. 31, 1974; 40 FR 2435, Jan. 13, 1975, as amended at 40 FR 44327, Sept. 26, 1975]

§ 178.35 Specification 2S; polyethylene container.

[Amdt. 178-79, 49 FR 24692, June 14, 1984]

§ 178.35-1 General requirements.

(a) Compliance is required in all details.

(b) Removable head containers are not authorized.

(c) Each container must be capable of withstanding the performance test prescribed in § 178.35-5 without failure.

[Amdt. 178-79, 49 FR 24692, June 14, 1984]

§ 178.35-2 Material requirements.

(a) Containers shall be made of a polyethylene resin which has not been used previously. Regrind from the same production process may be used.

[Amdt. 178-79, 49 FR 24692, June 14, 1984]

§ 178.35-3 Construction, capacity and marking.

(a) Container must be constructed in accordance with the following table:

Marked capacity not over (gallons)[1]	Maximum capacity (gallons)	Minimum thickness—side wall and heads (inches)[2]	Minimum weight (pounds)
5	6	0.0625	1.4
13.5	14.5	.0625	3.25
15	16	.0625	3.5
30	32	.0625	5
55	58	.0625	9

[1] Marked capacity shall be minimum capacity.
[2] Side openings are not authorized.

(b) Marking: Each container must be permanently marked with figures and letters at least ¼ inch in size to show:

(1) DOT-2S.

(2) Name or symbol of person making the mark specified in paragraph (b)(1) of this section. Symbol, if used, must be registered with the Director, OHMT.

(3) Month and year of manufacture.

(4) Minimum capacity.

under Subpart B of Part 107 of this title, unless that person is the holder of or a party to the exemption.

(b) If an exemption authorizes the use of a packaging for the shipment or transportation of a hazardous material by any person or class of persons other than or in addition to the holder of the exemption, that person or a member of that class of persons may use the packaging for the purposes authorized in the exemption subject to the terms specified therein. However, no person may use a packaging under the authority of this paragraph unless he maintains a copy of the exemption at each facility where the packaging is being used in connection with the shipment or transportation of the hazardous material concerned. Copies of exemptions may be obtained from the Office of Hazardous Materials Transportation, U.S. Department of Transportation, Washington, D.C. 20590, Attention: Docket Section.

[Amdt. 173-93, 41 FR 3478, Jan. 23, 1976, as amended by Amdt. 173-121, 43 FR 48643, Oct. 19, 1978]

§ 173.23 Previously authorized packaging.

(a) Where the regulations specify Specification 34 polyethylene drums, a polyethylene drum manufactured and marked in accordance with a DOT exemption may be used if the polyethylene drum conforms to Specification 34 except for the specification marking required by §178.19-6(a)(2) of this subchapter and the drum is legibly marked "DOT-34" in characters at least one half inch in height in a location near the exemption marking.

(b) [Reserved]

(c) After July 2, 1982, a seamless aluminum cylinder manufactured in conformance with and for use under DOT exemption E 6498, E 7042, E 8107, E 8364, or E 8422, may be continued in use if marked before or at the time of the next retest with the specification identification "3AL" immediately above the exemption number, or the DOT mark (i.e., DOT 3AL 1800) is added in proximity to the exemption marking.

(d) Cylinders (spheres) manufactured and marked DOT-E 6616 prior to January 1, 1983, may be continued in use if marked before or at the time of the next retest with the specification identification "4BA" near the exemption marking.

(e) After October 1, 1984, cylinders manufactured for use under exemptions DOT E-6668 or E-8404 may be continued in use, and must be marked "DOT-4LXXXYY" (XXX to be replaced by the service pressure, YY to be replaced by the letters "AL", if applicable) in compliance with Specification 4L (§ 178.57 of this subchapter) on or before January 1, 1986. The "DOT-4LXXXYY" must appear in proximity to other required specification markings.

(49 U.S.C. 1803, 1804, 1808; 49 CFR 1.53, App. A to Part 1)

[Amdt. 173-3, 33 FR 14921, Oct. 4, 1968, as amended by Amdt. 173-90, 39 FR 45240, Dec. 31, 1974; Amdt. 173-94; 41 FR 16063, Apr. 15, 1976; Amdt. 173-152, 47 FR 13817, Apr. 1, 1982; 47 FR 26633, June 21, 1982; Amdt. 173-16, 48 FR 50460, Nov. 1, 1983; Amdt. 173-176, 49 FR 24689, June 14, 1934; Amdt. 173-180, 49 FR 42735, Oct. 24, 1984]

§ 173.24 Standard requirements for all packages.

(a) Each package used for shipping hazardous materials under this subchapter shall be so designed and constructed, and its contents so limited, that under conditions normally incident to transportation:

(1) There will be no significant release of the hazardous materials to the environment;

(2) The effectiveness of the packaging will not be substantially reduced; and

(3) There will be no mixture of gases or vapors in the package which could, through any credible spontaneous increase of heat or pressure, or through an explosion, significantly reduce the effectiveness of the packaging.

(b) Materials for which detailed specifications for packaging are not set forth in this part must be securely packaged in strong, tight packages meeting the requirements of this section.

(c) Packaging used for the shipment of hazardous materials under this subchapter shall, unless otherwise specified or exempted therein, meet all of the following design and construction criteria:

(1) Each specification container must be marked as follows:

(i) In an unobstructued area with letters and numerals identifying the container specification (e.g., DOT-1A, DOT-17E-304HT, DOT-23G40). See § 178.0-2 of this subchapter.

(ii) The name and address or symbol of person making the mark specified in paragraph (c)(1)(i) of this section. Symbol letters, if used, must be registered with the Director, OHMT. Duplicate symbols are not authorized.

(iii) The markings must be stamped, embossed, burned, printed, or otherwise marked on the packaging to provide adequate accessibility, permanency, and contrast so as to be readily apparent and understood.

(iv) Unless otherwise specified, letters and numerals must be at least ½ inch high.

(v) Packaging which does not comply with the applicable specification listed in Parts 178 and 179 of this subchapter must not be marked to indicate such compliance (see § 178.0-2 and § 179.1 of this subchapter).

(2) Steel used shall be low-carbon, commercial quality steel. Stainless, open hearth, electric, basic oxygen, or other similar quality steels are acceptable. Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness (inches)	Minimum thickness (inches)
12	0.1046	0.0946
13	0.0897	0.0817
14	0.0747	0.0677
15	0.0673	0.0603
16	0.0598	0.0533
17	0.0538	0.0478
18	0.0478	0.0428
19	0.0418	0.0378
20	0.0359	0.0324
22	0.0299	0.0269
23	0.0269	0.0239
24	0.0239	0.0209
26	0.0179	0.0159
28	0.0149	0.0129
30	0.0120	0.0110

(3) Lumber used shall be well seasoned, commercially dry and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength.

(4) Welding and brazing shall be performed in a workmanlike manner using suitable and appropriate techniques, materials, and equipment.

(5) Packaging materials and contents shall be such that there will be no significant chemical or galvanic reaction among any of the materials in the package.

(6) Closures shall be adequate to prevent inadvertent leakage of the contents under normal conditions incident to transportation. Gasketed closures shall be fitted with gaskets of efficient material which will not be deteriorated by the contents of the container.

(7) Nails, staples, and other metallic devices shall not protrude into the interior of the outer packaging in such a manner as to be likely to cause failures.

(8) The nature and thickness of the packaging shall be such that friction during transport does not generate any heating likely to decrease the chemical stability of the contents.

(d) *Polyethylene packagings and receptacles.* (1) Polyethylene used in packagings and receptacles must be of a type compatible with the lading and may not be permeable to an extent that a hazardous condition occurs during transportation, handling or refilling.

(2) Each polyethylene packaging or receptacle which is used for liquid hazardous materials must be capable of withstanding without failure the procedure specified in Appendix B of this part ("Procedure for Testing Chemical Compatibility and Rate of Permeation in Polyethylene Packagings and Receptacles") and the maximum rate of permeation of hazardous lading through or into the polyethylene packaging or receptacles may not exceed the following rates:

(i) 0.5 percent for materials meeting the definition of a poison according to this subchapter and 2.0 percent for other hazardous materials, when subjected to temperatures no lower than 18°C. (64°F.) for 180 days in accordance with Test Method I;

(ii) 0.5 percent for materials meeting the definition of a poison according to this subchapter and 2.0 percent for other hazardous materials, which subjected to a temperature no lower than

STATE OF NEVADA
DEPARTMENT OF HUMAN RESOURCES
HEALTH DIVISION
RADIOLOGICAL HEALTH SECTION
505 East King Street, Room 202
Carson City, Nevada 89710
(702) 885-5394

RICHARD H. BRYAN
Governor

JERRY GRIEPENTROG
Director

Memorandum

DATE: March 9, 1987

TO: Low Level Radioactive Waste Generators or Other Interested Parties

FROM: Stanley R. Marshall, Supervisor, Radiological Health Section

SUBJECT: REQUIREMENTS TO USE THE ROCKY MOUNTIAN COMPACT REGIONAL FACILITY NEAR BEATTY, NEVADA

This information is a revised summary of the requirements to ship low-level radioactive waste for burial at the Rocky Mountain Compact regional facility near Beatty, Nevada. This information includes regulatory changes which supercede memorandum dated August 7, 1986.

The summary includes requirements and information for the following:

I. Nevada Site User Permit

II. Nevada Public Service Commission Carrier Permit

III. Facility Operator Requirements

IV. Surcharges

V. Rocky Mountain Compact Board Approval for Import of Low-Level Radioactive Waste

I. Nevada Site User Permit

A user permit must be obtained from the Nevada Division of Health prior to shipment of radioactive waste to the regional facility near Beatty, Nevada. A broker who takes responsibility for shipment of low-level radioactive waste from a generator or a generator who ships low-level waste to the Beatty site without relinquishing responsibility for the waste must obtain a site user permit.

An applicant must submit the following information:

a. Application Form

Complete the application form (Attachment A) and return it to:

Radiological Health Section
Nevada Division of Health
505 E. King Street
Carson City, NV 89710
(702) 885-5394

b. Indemnification Agreement

A notarized letter must be submitted which will commit the applicant to indemnify and hold harmless the Nevada Health Division and State of Nevada and to comply with all federal and state transportation regulations (Sample language for the letter is enclosed as Attachment B).

The letter must also indicate the applicant will comply with Section 459.870 of the Nevada Administrative Code (NAC) which requires the applicant to make arrangements for a qualification audit of the waste preparation and packaging procedures by the following company:

Nevada Inspection Services
P.O. Box 4100
Gainesville, Florida 32613
(904) 373-6066

NAC Section 459.870 was revised on May 14, 1986 to permit a waiver of the qualification audit/inspection requirement. If you choose to request this waiver you are required to make the request in writing and submit all waste packaging and transportation procedures including quality control procedures to ensure compliance with all Nevada regulations and site operator license conditions.

Criteria for exemption from third-party inspection include:

1. a satisfactory history of compliance at any other low-level radioactive disposal site, and;

2. an adequate quality assurance plan, including waste preparation, packaging and transportation procedures as determined by review by the Nevada Division of Health.

You are advised that recent revisions to Chapter 459 of the Nevada Administrative Code have also prohibited shipment of solid bulk waste contaminated with Radium 226 to the Beatty, Nevada site. Radium 226 may be acceptable in discrete, sealed source forms.

If you are interested in shipping Radium 226 sealed sources for burial, the Conference of Radiation Control Program Directors, Inc. Radium Project may be of interest to you.

For details, contact Bill Dornsife, Pennsylvania Division of Nuclear Safety, telephone: (717) 787-2163 or Stan Marshall, Nevada Division of Health, telephone (702) 885-5394.

c. Annual Permit Fee

The Nevada Administrative Code (NAC) was recently revised and includes the following site user permit fee schedule.

Annual Permit Fee for Permit Holders Shipping Radioactive Waste to the Beatty Site

Greater than 1,000 cubic feet	$3,396.00
Less than 1,000 cubic feet from outside the Rocky Mountain Compact	$500.00
Less than 1,000 cubic feet from within the Rocky Mountain Compact	$100.00

Fees may be submitted in check form, money order or wire transfer to the Nevada Division of Health in Carson City, Nevada or by delivery to the State inspector at the Beatty site.

Assistance with payment may be obtained by contacting the Nevada Division of Health or U.S. Ecology, Inc.

II. Nevada Public Service Commission Carrier Permit

Any person transporting low-level radioactive waste for purposes of disposal at the Beatty site must obtain a state motor carrier permit for transportation of radioactive waste in Nevada by contacting:

Transportation Division
Nevada State Public Service Commission
505 E. King Street
Carson City, Nevada 89710
Telephone: (702) 885-4117
fee $10.00

Any carrier is also required to notify the Nevada State Highway patrol no less than 4 hours nor greater than 48 hours prior to entry into Nevada.

The telephone number for the 24-hour dispatch officer are as follows:

(702) 885-5300

III. Regional Facility Operator Requirements

The regional facility operator may be contacted as follows:

U.S. Ecology, Inc. - Corporate
P.O. Box 7246
Louisville, KY 40207
Telephone: (502) 426-7160

U.S. Ecology, Inc. - Site
P.O. Box 578
Beatty, NV 89003
Telephone: (702) 553-2203

The facility operator should be contacted to obtain specific information concerning disposal requirements including allowable waste forms and concentrations, shipping documentation requirements, etc.

IV. Surcharges

You are advised that surcharges will be imposed pursuant to the Low-Level Radioactive Waste Policy Amendments Act (LLRWPAA) of 1985 for waste shipped to the regional facility. A copy of the surcharge payment (check or wire transfer) must accompany the shipping manifest or be delivered to the state inspector at the site before shipments may be received for burial.

The surcharge should be delivered to the Nevada Radiological Health Section (see address above) by postal or electronic mail or may be transferred to the state in check form at the time of the shipment delivery at the regional facility. Escrow payment may also be arranged.

You may contact the Radiological Health Section, Nevada Division of Health or the facility operator if you have any questions regarding the surcharges.

V. Rocky Mountain Compact Board Approval for Import of Low-Level Radioactive Waste

The Low-Level Radioactive Waste Policy Amendments Act of 1985 limits the waste received at the regional facility near Beatty, Nevada to 200,00 cubic feet per year.

The Compact Board has determined that a Nevada site user will be required to obtain an allocation from the Board to use or continue use of the site when the total waste volume to be received at the site reaches 190,000 cubic feet for the year.

You will be advised by the Radiological Health Section, Nevada Division of Health when the allocation approval is required.

SM:kf;d2

NEVADA STATE DIVISION OF HEALTH ATTACHMENT A

APPLICATION FOR SITE PERMIT

This application is for a permit to use the State site near Beatty, Nevada for disposal of radioactive waste. Provisions requiring all persons shipping radioactive waste to the site to obtain a permit are contained in chapter NAC 459 of Nevada Regulations for Radiation Control. Mail this application in duplicate to: Radiological Health Section, Nevada Division of Health, 505 East King Street, Carson City, Nevada 89710.

1. NAME AND STREET OF APPLICANT. (Institution, firm, hospital, person, etc.)

2. STREET ADDRESS AT WHICH RADIOACTIVE WASTE IS STORED. (If different from 1).

3. NAME, ADDRESS AND TELEPHONE NUMBER OF THE CHIEF EXECUTIVE OF THE COMPANY OR INSTITUTION.

4. NAME, ADDRESS AND TELEPHONE NUMBER OF THE PERSON RESPONSIBLE FOR RADIATION SAFETY.

5. INDICATE WHETHER TRANSPORT WILL BE BY COMMON CARRIER, CONTRACT CARRIER OR PRIVATE CARRIER AND GIVE THEIR NAME AND ADDRESS.

6. INDICATE WHETHER THE RADIOACTIVE WASTE SHIPMENT WILL BE SENT THROUGH A BROKER. IF SO, GIVE THE NAME AND ADDRESS.

CERTIFICATE

The Applicant, and any official authorized to execute this certificate on behalf of the Applicant certify to the State of Nevada that:

All radioactive waste will be packaged in accordance with: the regulations of the U.S. Department of Transportation, 49 CFR Parts 100-199; the applicable regulations of the U.S. Nuclear Regulatory Commission and Chapter 459 of Nevada Regulations for Radiation Control; and the conditions of the site operator's license which, (a) do not allow liquids to be received on site, absorbed or otherwise. (b) requires that solidified liquid waste be absolutely dry. They are aware that violations of any of the above provisions may result in refusal of acceptance of the shipment at the site, or the requirement of over-packing of the shipment and removal from the site or suspension or revocation of the user permit.

NAME OF APPLICANT

BY: _____

DATE: _____ TITLE: _____

SAMPLE LETTER AGREEMENT

(Company or institution's name) hereby covenants to the State of Nevada and agrees hereby to comply with the following conditions in consideration of the issuance of a Permit to ship radioactive waste to the Beatty, Nevada disposal site:

1. Contract with Nevada Inspection Services, Inc., to carry out the functions of the third party inspection system and to pay for such services directly to Nevada Inspection Services, Inc.; and

2. Indemnify and hold the Health Division of the Department of Human Resources and the State of Nevada harmless for any liability or consequential damages arising from out of the transportation of any radioactive material or waste to the Beatty site regardless of any prior inspection by Nevada Inspection Services, Inc.; and

3. Comply with all Federal and State Regulations relating to the transportation of radioactive waste. This company (or institution) understands that an Nevada Inspection Services, Inc., inspection is not a guarantee of suitability for shipment and the ultimate responsibility for compliance with Federal and State Regulations and safe transportation is upon this company (or institution).

Date _____
(Must be sworn before a Notary Public)

_____
Signature of Person Authorized to Sign on Behalf of the Company (or institution)

_____
Typed Name of Signatory

ROUTING AND TRANSMITTAL SLIP

Date 9/16/87

TO: (Name, office symbol, room number, building, Agency/Post)	Initials	Date
1. John Austin		
2.		
3.		
4.		
5.		

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X	As Requested		For Correction		Prepare Reply
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	Coordination		Justify		

REMARKS Enclosed is the information you requested. If you have any questions please contact:

Mr. William W. Cloe, Jr., Statistician
Office of Data Analysis
Room N3626 - Frances Perkins Building
200 Constitution Avenue, N.W.
Washington, D.C. 20210

Telephone: 202/523-9296

DO NOT use this form as a RECORD of approvals, concurrences, disposals, clearances, and similar actions

FROM: (Name, org. symbol, Agency/Post)	Room No.—Bldg.
William Cloe JB for WCloe	N3626/FPB
	Phone No. 202/523-9296

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OPTIONAL FORM 41 (Rev. 7-76)
Prescribed by GSA
FPMR (41 CFR) 101-11.206

Occupational Injuries and Illnesses in the United States by Industry, 1985

U.S. Department of Labor
Bureau of Labor Statistics
May 1987

Bulletin 2278

Occupational Injuries and Illnesses in the United States by Industry, 1985

U.S. Department of Labor
William E. Brock, Secretary

Bureau of Labor Statistics
Janet L. Norwood, Commissioner
May 1987

Bulletin 2278

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, DC 20402

Definitions

The definitions of occupational injuries and illnesses and lost workdays are from *Recordkeeping Guidelines for Occupational Injuries and Illnesses*.

Recordable occupational injuries and illnesses are:

1. Occupational deaths, regardless of the time between injury and death, or the length of the illness; or
2. Nonfatal occupational illnesses; or
3. Nonfatal occupational injuries which involve one or more of the following: Loss of consciousness, restriction of work or motion, transfer to another job, or medical treatment (other than first aid).

Occupational injury is any injury such as a cut, fracture, sprain, amputation, etc., which results from a work accident or from exposure involving a single incident in the work environment.

Occupational illness is any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or disease which may be caused by inhalation, absorption, ingestion, or direct contact.

Lost workday cases are cases which involve days away from work, or days of restricted work activity, or both.

1. *Lost workday cases involving days away from work* are those cases which result in days away from work, or a combination of days away from work and days of restricted work activity.
2. *Lost workday cases involving restricted work activity* are those cases which result in restricted work activity only.

Lost workdays—away from work are the number of workdays (consecutive or not) on which the employee would have worked but could not because of occupational injury or illness.

Lost workdays—restricted work activity are the number of workdays (consecutive or not) on which, because of injury or illness:

1. The employee was assigned to another job on a temporary basis; or
2. The employee worked at a permanent job less than full time; or
3. The employee worked at a permanently assigned job but could not perform all duties normally connected with it.

The number of days away from work or days of restricted work activity does not include the day of injury or onset of illness or any days on which the employee would not have worked even though able to work.

Incidence rates represent the number of injuries and/or illnesses or lost workdays per 100 full-time workers and were calculated as: (N/EH) X 200,000 where:

N	= number of injuries and/or illnesses or lost workdays.
EH	= total hours worked by all employees during calendar year.
200,000	= base for 100 full-time equivalent workers (working 40 hours per week, 50 weeks per year).

Table 1. Occupational injury and illness incidence rates by industry, 1984 and 1985 [1]

Industry [2]	SIC code [3]	1985 annual average employment (thousands) [4]	Incidence rates per 100 full-time workers [5]							
			Total cases [6]		Lost workday cases		Nonfatal cases without lost workdays		Lost workdays	
			1984	1985	1984	1985	1984	1985	1984	1985
Private sector [7]		81,601.3	8.0	7.9	3.7	3.6	4.3	4.3	63.4	64.9
Agriculture, forestry, and fishing [7]		955.2	12.0	11.4	6.1	5.7	5.9	5.6	90.7	91.3
Agricultural production [7]	01-02	n.a.	13.5	12.7	6.8	6.2	6.7	6.5	100.4	95.6
Agricultural services	0700	n.a.	10.2	10.1	5.1	5.3	5.0	4.8	73.6	86.6
Forestry	0800	n.a.	14.1	11.1	8.4	5.7	5.7	5.4	186.1	97.5
Fishing, hunting, and trapping	0900	n.a.	6.1	4.1	3.8	2.5	2.1	1.6	115.5	78.7
Mining [8]		930.0	9.7	8.4	5.3	4.8	4.3	3.6	160.2	145.3
Metal mining [8]	1000	46.8	6.3	6.1	3.5	3.3	2.7	2.7	97.4	113.5
Anthracite mining [8]	1100	2.4	7.1	8.7	6.3	7.0	.8	1.5	281.4	445.8
Bituminous coal and lignite mining [8]	1200	184.7	7.1	6.6	5.5	5.1	1.4	1.5	192.3	199.2
Oil and gas extraction	1300	585.2	11.8	10.1	6.0	5.3	5.9	4.8	173.1	143.8
Crude petroleum and natural gas	1310	n.a.	3.0	2.7	1.4	1.3	1.6	1.4	34.4	25.8
Natural gas liquids	1320	n.a.	3.4	4.6	1.2	1.7	2.1	2.9	32.2	46.6
Oil and gas field services	1380	328.9	18.2	15.8	9.3	8.4	8.9	7.4	273.2	233.7
Nonmetallic minerals, except fuels [8]	1400	110.5	4.0	3.9	2.7	2.6	1.2	1.3	73.2	87.3
Construction		4,687.0	15.5	15.2	6.9	6.8	8.6	8.4	128.1	128.9
General building contractors	1500	1,251.3	15.4	15.2	6.9	6.8	8.5	8.4	121.3	120.4
Residential building construction	1520	617.6	12.6	12.3	6.3	6.2	6.2	6.2	111.1	107.8
Operative builders	1530	59.2	11.5	9.2	5.8	4.1	5.7	5.1	74.8	63.5
Nonresidential building construction	1540	574.5	18.9	18.7	7.7	7.8	11.2	10.9	137.2	138.8
Heavy construction contractors	1600	781.0	14.9	14.5	6.4	6.3	8.5	8.1	131.7	127.3
Highway and street construction	1610	258.8	14.6	13.8	6.3	6.1	8.2	7.6	133.3	117.2
Heavy construction, except highway	1620	522.3	15.1	14.8	6.4	6.4	8.6	8.4	131.0	132.2
Special trade contractors	1700	2,654.1	15.8	15.4	7.1	7.0	8.7	8.4	130.1	133.3
Plumbing, heating, air conditioning	1710	611.0	16.4	15.7	6.3	6.3	10.1	9.4	108.1	112.3
Painting, paper hanging, decorating	1720	162.2	10.3	9.3	5.5	5.0	4.9	4.3	127.3	123.2
Electrical work	1730	489.6	14.4	14.3	5.5	5.5	8.9	8.8	87.5	94.0
Masonry, stonework, and plastering	1740	427.1	17.3	16.6	8.6	8.0	8.7	8.7	154.2	150.9
Carpentering and flooring	1750	159.2	14.9	13.5	7.8	7.5	7.1	6.0	131.5	142.7
Roofing and sheet metal work	1760	195.6	21.4	19.1	11.6	10.5	9.8	8.6	248.8	218.5
Concrete work	1770	n.a.	14.6	15.9	7.2	8.5	7.4	7.3	126.5	151.8
Water well drilling	1780	n.a.	12.9	13.4	7.4	6.9	5.4	6.4	142.7	117.7
Miscellaneous special trade contractors	1790	n.a.	15.8	16.5	7.2	7.5	8.6	9.0	141.8	153.6
Manufacturing		19,314.0	10.6	10.4	4.7	4.6	5.9	5.8	77.9	80.2
Durable goods		11,516.0	11.1	10.9	4.8	4.7	6.3	6.2	79.9	82.0
Lumber and wood products	2400	700.3	19.6	18.5	9.9	9.3	9.7	9.2	172.0	171.4
Logging camps and logging contractors	2410	82.7	21.7	20.0	13.9	12.2	7.7	7.6	320.1	317.2
Sawmills and planing mills	2420	195.8	18.9	17.6	9.8	9.2	9.1	8.4	174.4	169.9
Sawmills and planing mills, general	2421	161.3	18.4	17.5	9.7	9.3	8.6	8.1	175.3	176.3
Hardwood dimension and flooring	2426	31.1	20.4	17.6	9.2	7.7	11.2	9.9	154.2	103.8
Special product sawmills, n.e.c.	2429	n.a.	-	28.8	-	19.2	-	9.6	-	467.6
Millwork, plywood and structural members	2430	231.3	18.1	17.7	8.5	8.4	9.5	9.3	135.2	140.6
Millwork	2431	89.0	19.9	17.9	8.5	7.6	11.3	10.3	137.1	133.9
Wood kitchen cabinets	2434	61.2	17.8	17.6	8.7	8.3	9.0	9.2	125.6	119.9
Hardwood veneer and plywood	2435	22.8	16.2	15.6	6.8	6.3	9.4	9.3	112.5	123.1
Softwood veneer and plywood	2436	37.5	11.4	13.0	6.4	7.7	5.0	5.3	134.7	154.3
Structural wood memebers, n.e.c.	2439	n.a.	27.5	28.5	14.6	15.9	12.9	12.6	185.1	222.6
Wood containers	2440	41.3	18.0	16.9	10.0	9.2	8.1	7.6	172.4	152.2
Nailed wood boxes and shook	2441	n.a.	18.2	18.3	10.1	9.9	8.1	8.4	143.2	137.9
Wood pallets and skids	2448	n.a.	18.9	17.4	10.8	9.7	8.0	7.6	197.4	158.7

See footnotes at end of table.

Table 1. Occupational injury and illness incidence rates by industry, 1984 and 1985 [1]—Continued

Industry [2]	SIC code [3]	1985 annual average employment (thousands) [4]	Incidence rates per 100 full-time workers [5]							
			Total cases [6]		Lost workday cases		Nonfatal cases without lost workdays		Lost workdays	
			1984	1985	1984	1985	1984	1985	1984	1985
Holding and other investment offices	6700	160.7	-	2.2	-	0.8	-	1.3	-	16.7
Holding offices	6710	n.a.	-	2.1	-	.9	-	1.3	-	16.3
Miscellaneous investing	6790	n.a.	-	3.0	-	.8	-	2.2	-	-
Services		21,421.1	5.2	5.4	2.5	2.6	2.7	2.8	41.1	45.4
Hotels and other lodging places	7000	1,338.6	9.8	10.0	4.1	4.3	5.7	5.8	63.4	64.1
Hotels, motels, and tourist courts	7010	1,293.0	10.0	10.2	4.2	4.4	5.8	5.8	65.1	64.7
Personal services	7200	1,056.3	2.9	2.9	1.5	1.5	1.4	1.5	24.7	28.4
Laundry, cleaning, and garment services	7210	379.7	5.2	5.4	2.6	2.8	2.5	2.6	42.9	57.6
Business services	7300	4,452.0	4.9	4.7	2.2	2.2	2.6	2.5	39.2	46.6
Services to buildings	7340	652.0	7.9	7.0	3.9	3.4	4.0	3.6	63.4	48.1
Personnel supply services	7360	915.9	8.1	9.0	3.7	4.1	4.4	5.0	51.3	61.8
Computer and data processing services	7370	540.0	1.4	1.1	.6	.5	.7	.6	9.6	9.1
Miscellaneous business services	7390	1,870.6	4.5	4.2	2.0	2.0	2.5	2.1	41.0	61.2
Auto repair, services, and garages	7500	729.6	6.9	6.5	3.2	3.2	3.7	3.3	52.6	51.5
Automotive rentals, without drivers	7510	151.9	7.3	8.4	3.8	4.5	3.5	3.9	63.8	73.7
Automobile parking	7520	n.a.	3.7	3.5	1.7	1.7	2.0	1.8	29.7	20.2
Automotive repair shops	7530	447.1	7.4	6.4	3.3	3.0	4.1	3.4	53.2	49.3
Automotive services, except repair	7540	n.a.	4.4	5.0	1.9	2.5	2.5	2.6	40.2	37.6
Miscellaneous repair services	7600	322.4	8.2	7.9	4.0	4.0	4.2	3.9	68.8	69.4
Electrical repair shops	7620	102.2	6.2	5.4	3.0	2.8	3.1	2.5	55.8	44.5
Miscellaneous repair shops	7690	n.a.	10.1	10.0	4.9	4.9	5.2	5.0	82.3	90.4
Motion pictures	7800	218.0	4.1	4.1	1.7	1.6	2.4	2.6	30.7	31.7
Motion picture production and services	7810	100.5	5.4	4.6	2.2	1.9	3.2	2.7	39.4	40.2
Motion picture theaters	7830	106.5	-	3.6	-	1.0	-	2.6	-	20.8
Amusement and recreation services	7900	838.5	9.0	8.2	3.9	3.5	5.1	4.6	52.0	51.2
Bowling and billiard establishments	7930	n.a.	5.0	2.8	2.7	1.3	2.3	1.5	40.3	26.1
Miscellaneous amusement, recreational services	7990	n.a.	8.4	8.3	3.5	3.4	4.8	4.9	44.6	46.9
Health services	8000	6,309.5	6.3	7.1	3.3	3.6	2.9	3.5	57.1	63.2
Offices of osteopathic physicians	8030	n.a.	-	(7)	-	(7)	-	(7)	-	(7)
Nursing and personal care facilities	8050	1,210.1	11.6	13.3	6.5	7.3	5.1	6.0	121.3	136.4
Hospitals	8060	2,998.6	7.3	8.1	3.8	3.9	3.5	4.1	62.6	67.9
Legal services	8100	689.2	.5	.6	.2	.3	.2	.3	5.3	7.3
Educational services	8200	1,343.8	3.3	3.4	1.3	1.4	2.0	2.0	21.7	22.6
Colleges and universities	8220	832.7	3.9	4.1	1.6	1.6	2.3	2.5	26.9	25.7
Libraries and information centers	8230	n.a.	-	1.5	-	.9	-	.6	-	8.6
Social services	8300	1,344.0	5.3	6.0	2.5	2.6	2.8	3.3	39.1	45.0
Individual and family services	8320	261.7	3.7	4.8	2.1	2.5	1.6	2.3	41.2	50.3
Job training and related services	8330	208.5	8.3	8.1	3.6	3.3	4.7	4.8	41.9	45.3
Residential care	8360	291.8	8.4	8.5	3.9	4.2	4.4	4.4	62.8	78.3
Social services, n.e.c.	8390	n.a.	4.6	4.6	2.2	2.1	2.5	2.6	33.9	30.7
Museums, botanical, zoological gardens	8400	42.2	6.3	6.0	2.7	2.7	3.5	3.3	40.0	39.3
Museums and art galleries	8410	n.a.	4.2	3.8	2.0	1.9	2.2	1.9	25.2	26.6
Botanical and zoological gardens	8420	n.a.	15.0	15.3	6.0	6.1	9.0	9.2	102.5	92.7
Miscellaneous services	8900	1,221.3	1.4	1.7	.6	.7	.8	1.0	9.0	8.3
Engineering and architectural services	8910	667.6	1.9	2.2	.8	.9	1.1	1.3	11.5	10.5
Noncommercial research organizations	8920	115.4	2.5	2.6	1.2	1.2	1.3	1.4	16.5	13.0
Accounting, auditing and bookkeeping	8930	412.8	.3	.5	.2	.3	.2	.3	3.3	3.3

[1] To maintain comparability with the rest of the series, a statistical method was used for generating the estimates to represent the small nonfarm employers in low-risk industries who were not surveyed for 1984. The estimating procedure involved averaging the data reported by small employers for the 1980, 1981, and 1982 surveys.

[2] Totals for divisions and 2- and 3-digit SIC codes include data for industries not shown separately.

[3] *Standard Industrial Classification Manual*, 1972 Edition, 1977 *Supplement*.

[4] Employment is expressed as an annual average and is derived primarily from the BLS-State Current Employment Statistics program. Annual average employment for the agriculture, forestry, and fishing division is a composite of employment data for agricultural production (SIC's 01 and 02) as obtained from the Annual Survey of Occupational Injuries and Illnesses and employment data for agricultural services (SIC 07); forestry (SIC 08); and fishing, hunting, and trapping (SIC 09) as obtained from State unemployment insurance programs.

[5] Incidence rates represent the number of injuries and illnesses per 100 full-time workers and were calculated as: (N/EH) X 200,000 where,

N = number of injuries and illnesses or lost workdays
EH = total hours worked by all employees during the calendar year
200,000 = base for 100 full-time workers (working 40 hours per week, 50 weeks per year).

[6] Includes fatalities. Because of rounding, the difference between the total and the sum of the rates for lost workday cases and nonfatal cases without lost workdays may not reflect the fatality rate.

[7] Excludes farms with fewer than 11 employees.

[8] Data conforming to OSHA definitions for employers in the railroad industry and for mining operators in coal, metal, and nonmetal mining were provided to BLS by the Federal Railroad Administration, U.S. Department of Transportation and the Mine Safety and Health Administration, U.S. Department of Labor. Independent mining contractors are excluded from the coal, metal, and nonmetal mining industries.

[9] Incidence rate less than 0.05.

n.a. = data not available.
n.e.c. = not elsewhere classified.
NOTE: Dashes indicate that data do not meet publication guidelines. Because of rounding, components may not add to totals.

Table 6. Number of occupational injuries and illnesses by industry, 1985

Industry [1]	SIC code [2]	Injuries and illnesses			Injuries			Illnesses		
		Total cases (thousands)	Lost workday cases (thousands)	Average lost workdays per lost workday case	Total cases (thousands)	Lost workday cases (thousands)	Average lost workdays per lost workday case	Total cases (thousands)	Lost workday cases (thousands)	Average lost workdays per lost workday case
Private sector [3]		5,507.2	2,537.0	18	5,381.7	2,484.7	18	125.6	52.3	22
Agriculture, forestry, and fishing [3]		91.7	46.1	16	88.3	45.2	16	3.4	1.0	10
Agricultural production [3]	01-02	53.2	25.9	15	51.1	25.3	16	2.0	.6	11
Agricultural services	0700	36.4	19.1	16	35.1	18.7	17	1.2	.4	10
Forestry	0800	1.6	.8	17	1.6	.8	17	.1	(*)	6
Fishing, hunting, and trapping	0900	.5	.3	31	.5	.3	32	(*)	(*)	Y
Mining		78.0	44.3	30	76.9	43.9	30	1.0	.5	20
Metal mining [4]	1000	2.2	1.2	34	2.1	1.1	36	.1	.1	19
Anthracite mining [4]	1100	.2	.1	64	.2	.1	64	(*)	(*)	68
Bituminous coal and lignite mining [4]	1200	11.2	8.6	39	10.9	8.5	39	.3	.1	22
Oil and gas extraction	1300	59.1	30.9	27	58.6	30.7	27	.6	.2	19
Nonmetallic minerals, except fuels [4]	1400	5.2	3.5	33	5.1	3.5	33	.1	(*)	17
Construction		613.3	275.0	19	606.6	272.8	19	6.6	2.3	14
General building contractors	1500	159.6	71.7	18	158.1	71.1	18	1.4	.6	16
Heavy construction contractors	1600	105.7	45.8	20	103.9	45.3	20	1.8	.5	8
Special trade contractors	1700	348.0	157.5	19	344.6	156.3	19	3.4	1.2	15
Manufacturing		1,937.6	8 [illegible].1	17	1,865.2	825.1	17	72.3	31.9	24
Durable goods		1,226.8	531.2	17	1,182.5	512.4	17	44.2	18.8	24
Lumber and wood products	2400	121.3	61.0	18	119.4	60.1	18	1.9	.9	23
Furniture and fixtures	2500	69.7	29.3	16	67.9	28.4	16	1.8	.9	23
Stone, clay, and glass products	3200	81.0	39.0	19	79.0	38.1	19	1.9	.8	25
Primary metal industries	3300	102.2	46.6	20	99.7	45.8	20	2.5	.8	26
Fabricated metal products	3400	234.7	99.0	16	227.4	95.8	16	7.3	3.1	21
Machinery, except electrical	3500	102.2	48.3	17	98.5	46.3	17	3.7	2.0	22
Electric and electronic equipment	3600	138.3	57.6	17	129.4	53.7	17	8.9	3.9	25
Transportation equipment	3700	179.1	78.8	18	171.2	75.5	18	7.9	3.3	25
Instruments and related products	3800	36.4	15.2	17	34.1	14.1	17	2.2	1.0	27
Miscellaneous manufacturing industries	3900	33.3	14.2	18	31.9	13.6	17	1.3	.5	22
Nondurable goods		710.8	325.9	18	682.7	312.7	17	28.1	13.2	23
Food and kindred products	2000	258.4	125.9	17	244.4	119.0	17	14.0	6.9	20
Tobacco manufactures	2100	4.4	1.8	17	4.4	1.8	17	(*)	(*)	23
Textile mill products	2200	50.8	20.4	19	49.7	19.9	18	1.2	.5	44
Apparel and other textile products	2300	66.4	26.1	17	64.2	25.1	16	2.3	1.0	30
Paper and allied products	2600	70.3	32.2	20	68.9	31.7	20	1.3	.6	26
Printing and publishing	2700	81.1	36.6	17	79.5	35.8	17	1.7	.8	28
Chemicals and allied products	2800	52.6	23.4	17	49.9	22.6	17	2.7	.8	18
Petroleum and coal products	2900	9.2	4.3	21	9.1	4.3	21	.1	(*)	-
Rubber and miscellaneous plastics products	3000	102.2	48.3	17	98.5	46.3	17	3.7	2.0	22
Leather and leather products	3100	15.4	6.8	19	14.2	6.2	18	1.2	.6	35
Transportation and public utilities		422.7	246.2	21	416.9	243.5	21	5.8	2.6	14
Railroad transportation [4]	4000	29.6	20.5	16	29.2	20.3	16	.4	.2	8
Local and interurban passenger transit	4100	19.6	11.3	22	19.4	11.3	22	.2	.1	23
Trucking and warehousing	4200	182.1	111.5	25	181.1	111.1	25	.9	.5	-
Water transportation	4400	22.2	12.3	34	21.9	12.2	34	.3	.1	-
Transportation by air	4500	61.0	34.5	16	60.0	33.8	16	1.0	.7	9
Pipe lines, except natural gas	4600	.7	.3	28	.7	.3	29	-	-	-
Transportation services	4700	9.8	5.6	19	9.4	5.3	20	.3	.2	9
Communication	4800	35.8	19.4	16	34.8	19.0	16	1.1	.5	18
Electric, gas, and sanitary services	4900	62.0	30.6	18	60.5	30.3	18	1.5	.3	15

See footnotes at end of table.

Table 6. Number of occupational injuries and illnesses by industry, 1985—Continued

Industry [1]	SIC code [2]	Injuries and illnesses			Injuries			Illnesses		
		Total cases (thousands)	Lost workday cases (thousands)	Average lost workdays per lost workday case	Total cases (thousands)	Lost workday cases (thousands)	Average lost workdays per lost workday case	Total cases (thousands)	Lost workday cases (thousands)	Average lost workdays per lost workday case
Wholesale and retail trade		1,356.7	592.9	16	1,345.3	588.2	16	11.4	4.7	28
Wholesale trade		386.5	189.7	17	382.7	188.4	17	3.8	1.4	26
Wholesale trade-durable goods	5000	211.0	96.1	16	209.1	95.5	16	1.9	.7	30
Wholesale trade-nondurable goods	5100	175.4	93.6	18	173.6	92.9	18	1.9	.7	-
Retail trade		970.2	403.2	15	962.6	399.9	15	7.6	3.3	29
Building materials and garden supplies	5200	60.0	27.3	16	59.7	27.2	16	.3	.1	-
General merchandise stores	5300	162.8	67.0	16	162.1	66.7	16	.7	.3	-
Food stores	5400	213.9	91.7	18	213.1	91.3	18	.7	.4	27
Automotive dealers and service stations	5500	121.9	45.9	16	120.7	45.4	16	1.1	.5	-
Apparel and accessory stores	5600	19.2	7.6	13	19.1	7.6	13	-	-	-
Furniture and home furnishing stores	5700	27.6	13.6	17	27.0	13.3	17	.5	.4	12
Eating and drinking places	5800	302.5	121.5	12	299.4	120.3	11	3.2	1.2	-
Miscellaneous retail	5900	62.4	28.6	16	61.5	28.2	16	.9	-	-
Finance, insurance, and real estate		103.6	47.0	17	100.9	45.5	17	2.7	1.6	26
Banking	6000	25.6	10.2	16	25.0	9.8	16	.5	.3	29
Credit agencies other than banks	6100	8.5	3.9	14	8.3	3.7	14	.3	.2	31
Security, commodity brokers and services	6200	2.1	.9	15	2.0	.9	14	-	(4)	-
Insurance carriers	6300	21.4	9.6	22	20.9	9.3	22	.5	.4	32
Insurance agents, brokers and service	6400	3.5	1.5	17	3.4	1.5	17	.1	-	-
Real estate	6500	39.4	19.7	16	38.2	19.2	16	1.2	.5	21
Holding and other investment offices	6700	3.0	1.1	20	2.9	1.1	21	.1	.1	6
Services		903.8	428.3	18	881.5	420.6	18	22.3	7.7	15
Hotels and other lodging places	7000	101.9	43.5	15	100.1	42.9	15	1.7	.6	-
Personal services	7200	23.5	11.8	19	23.0	11.6	20	.6	.2	5
Business services	7300	168.3	79.1	21	165.1	78.1	21	3.1	1.0	-
Auto repair, services, and garages	7500	43.5	21.3	16	43.0	21.1	16	.5	.2	11
Miscellaneous repair services	7600	23.2	11.7	17	22.8	11.5	17	.4	.2	7
Motion pictures	7800	6.5	2.4	20	6.1	2.3	20	.3	.1	30
Amusement and recreation services	7900	44.6	19.3	15	43.6	18.9	15	.9	.4	13
Health services	8000	349.0	177.1	18	337.8	173.3	18	11.2	3.9	17
Legal services	8100	3.5	1.6	28	3.4	1.5	23	.1	(4)	19
Educational services	8200	31.2	12.9	16	30.5	12.7	16	.7	.2	-
Social services	8300	59.7	26.3	17	58.5	25.9	17	1.2	.4	16
Museums, botanical, zoological gardens	8400	1.9	.8	14	1.8	.8	14	.1	(4)	25
Miscellaneous services	8900	18.7	8.0	12	18.0	7.8	12	.7	.2	-

[1] Industry division totals include data for industries not shown separately.

[2] *Standard Industrial Classification Manual*, 1972 Edition, *1977 Supplement*.

[3] Excludes farms with fewer than 11 employees.

[4] Estimates of fewer than 50 cases.

[5] Data conforming to OSHA definitions for employers in the railroad industry and for mining operators in coal, metal, and nonmetal mining were provided to BLS by the Federal Railroad Administration, U.S. Department of Transportation and the Mine Safety and Health Administration, U.S. Department of Labor. Independent mining contractors are excluded from the coal, metal, and nonmetal mining industries.

NOTE: Dashes indicate that data do not meet publication guidelines. Because of rounding, components may not add to totals.

The number of lost workdays for the industries shown in this table can be approximated by multiplying the number of lost workday cases by the average lost workdays per lost workday case.

Table 2. Number of occupational injuries and illnesses and lost workdays by industry division, 1984 and 1985[1]

(In thousands)

Industry division	Total cases [2]		Lost workday cases		Nonfatal cases without lost workdays		Lost workdays	
	1984	1985	1984	1985	1984	1985	1984	1985
Injuries and illnesses								
Private sector [3]	5,419.7	5,507.2	2,501.5	2,537.0	2,913.4	2,965.9	42,983.8	45,188.9
Agriculture, forestry, and fishing [3]	93.6	91.7	47.4	46.1	46.0	45.4	709.6	736.4
Mining [4]	94.1	78.0	52.0	44.3	41.7	33.3	1,560.7	1,342.4
Construction	582.0	613.3	258.8	275.0	322.4	337.1	4,794.9	5,196.0
Manufacturing	1,988.6	1,937.6	873.6	857.1	1,114.1	1,079.6	14,644.1	14,973.7
Durable goods	1,261.3	1,226.8	543.0	531.2	717.8	694.9	9,071.9	9,261.0
Nondurable goods	727.3	710.8	330.7	325.9	396.3	384.6	5,572.2	5,712.7
Transportation and public utilities	427.9	422.7	251.6	246.2	175.4	175.7	5,131.5	5,268.7
Wholesale and retail trade	1,314.5	1,356.7	579.1	592.9	734.4	763.2	8,925.9	9,261.4
Wholesale trade	379.8	381.5	181.1	189.7	198.1	196.4	2,910.3	3,224.9
Retail trade	934.7	970.2	398.0	403.2	536.3	566.8	6,015.6	6,036.5
Finance, insurance, and real estate	98.6	103.6	45.1	47.0	53.3	56.5	691.0	818.2
Services	820.5	903.8	393.9	423.3	426.0	475.1	6,525.9	7,592.1
Injuries								
Private sector [3]	5,294.8	5,381.7	2,449.7	2,484.7	2,841.1	2,893.1	41,921.9	44,050.3
Agriculture, forestry, and fishing [3]	90.2	88.3	46.3	45.2	43.7	43.1	699.7	726.2
Mining [4]	92.9	76.9	51.4	43.9	41.1	32.8	1,552.0	1,333.0
Construction	575.9	606.6	256.5	272.8	318.6	332.8	4,741.6	5,164.7
Manufacturing	1,916.1	1,865.2	841.8	825.1	1,073.6	1,039.3	13,944.5	14,213.2
Durable goods	1,217.5	1,182.5	524.5	512.4	692.4	669.5	8,654.2	8,808.6
Nondurable goods	698.7	682.7	317.3	312.7	381.2	369.8	5,290.3	5,404.6
Transportation and public utilities	422.1	416.9	249.3	243.5	172.0	172.6	5,086.0	5,231.3
Wholesale and retail trade	1,302.9	1,345.3	574.3	588.2	728.0	756.6	8,833.6	9,130.6
Wholesale trade	374.9	382.7	179.3	188.4	195.3	194.1	2,871.3	3,189.4
Retail trade	928.0	962.6	395.0	399.9	532.7	562.5	5,962.3	5,941.2
Finance, insurance, and real estate	96.7	100.9	44.3	45.5	52.2	55.4	689.0	776.9
Services	798.1	881.5	385.8	420.6	411.9	460.6	6,395.5	7,474.5
Illnesses								
Private sector [3]	124.8	125.6	51.8	52.3	72.3	72.8	1,061.9	1,138.6
Agriculture, forestry, and fishing [3]	3.4	3.4	1.1	1.0	2.3	2.4	9.9	10.2
Mining [4]	1.3	1.0	.6	.5	.6	.6	8.8	9.4
Construction	6.1	6.6	2.2	2.3	3.8	4.3	53.3	31.3
Manufacturing	72.4	72.3	31.9	31.9	40.5	40.3	699.7	760.5
Durable goods	43.9	44.2	18.5	18.8	25.3	25.4	417.8	452.5
Nondurable goods	28.6	28.1	13.4	13.2	15.1	14.9	281.9	308.1
Transportation and public utilities	5.8	5.8	2.3	2.6	3.4	3.1	45.5	37.3
Wholesale and retail trade	11.5	11.4	4.8	4.7	6.5	6.7	92.4	130.8
Wholesale trade	4.9	3.8	1.8	1.4	2.8	2.4	39.0	35.5
Retail trade	6.7	7.6	3.0	3.3	3.6	4.3	53.4	95.3
Finance, insurance, and real estate	1.9	2.7	.8	1.6	1.0	1.1	22.0	41.4
Services	22.4	22.3	8.1	7.7	14.1	14.4	130.4	117.6

[1] To maintain comparability with the rest of the series, a statistical method was used for generating the estimates to represent the small nonfarm employers in low-risk industries who were not surveyed for 1984. The estimating procedure involved averaging the data reported by small employers for the 1980, 1981, and 1982 surveys.

[2] Includes fatalities.

[3] Excludes farms with fewer than 11 employees.

[4] Excludes independent mining contractors.

NOTE: Because of rounding, components may not add to totals. The difference between the number of total cases and the sum of the lost workday cases and nonfatal cases without lost workdays may not equal the fatality estimate.

Table 11. Distribution of fatalities by industry division: Occupational injury and illness fatalities for employers with 11 employees or more, 1984-85 average [1]

(In percent)

Cause [2]	Total private sector [3]	Agriculture, forestry, and fishing	Mining--oil and gas extraction only	Construction	Manufacturing	Transportation and public utilities [4]	Wholesale and retail trade	Finance, insurance, and real estate	Services
Total, all causes	100	3	5	22	23	21	12	2	12
Highway vehicles	100	[5]	4	13	16	36	15	2	12
Industrial vehicles or equipment	100	4	10	31	29	10	13	2	2
Heart attacks	100	5	5	18	22	15	13	4	20
Falls	100	3	6	41	20	8	12	6	7
Electrocutions	100	2	3	40	18	12	3	[5]	22
Caught in, under, or between objects other than vehicles or equipment	100	2	2	41	27	18	8	0	3
Aircraft crashes	100	7	2	9	22	28	8	5	18
Explosions	100	1	8	10	39	22	13	0	7
Struck by objects other than vehicles or equipment	100	4	21	16	46	5	5	[5]	3
Assaults	100	2	0	2	9	11	42	1	33
Gas inhalation	100	0	12	22	17	47	0	0	3
Fires	100	9	17	25	35	4	4	0	6
Plant machinery operations	100	0	0	3	84	8	2	0	4
All other [6]	100	6	3	22	24	20	6	2	18

[1] Results are the average of the 2 years because sampling errors for data by cause of fatality are too large to provide reliable annual estimates at the industry division level.

[2] Cause is defined as the object or event associated with the fatality.

[3] Excludes coal, metal, and nonmetal mining and railroads, for which data are not available.

[4] Excludes railroads.

[5] Between 0.1 and 0.5 percent.

[6] The "All other" category includes, for example, contact with carcinogenic or toxic substances, drowning, train accidents, and various occupational illnesses.

NOTE: Because of rounding, components may not add to totals.

NUMBER AND PERCENT OF CASES BY SELECT INDUSTRIES BY NATURE OF INJURY/ILLNESS INVOLVING RADIATION AFFECTS.

1983 SDS CURRENT CASES INVOLVING DISABILITY.

WEIGHTED

NATURE OF INJURY OR ILLNESS	Total	HEALTH SERVICES	OFFICES OF PHYSICIANS	OFFICES OF DENTISTS	OFFICES OF OSTEO-PATHIC PHYSICIANS	OFFICES OF OTHER HEALTH PRACTI-TIONERS	NURSING AND PERSONAL CARE FACILITIES	HOSPITALS	MEDICAL LABORA-TORIES	DENTAL LABORA-TORIES
Total	999,703	66,375	885	398	16	295	21,631	40,370	280	66
Percent	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	.00.00	100.00
100 AMPUTATION OR ENUCLEATION	6,161	46	3	-	-	-	11	29	-	-
Percent	.62	.07	.34	-	-	-	.05	.07	-	-
110 ASPHYXIA, STRANGULATION, DROWNING, SUFFOCATION	92	1	-	-	-	-	-	-	-	-
Percent	.01	.00	-	-	-	-	-	-	-	-
120 BURN (HEAT)	22,610	1,106	8	6	1	5	414	624	3	3
Percent	2.26	1.66	.90	1.51	6.25	.69	1.91	1.55	1.07	4.55
130 BURN (CHEMICAL)	6,856	302	5	5	-	2	90	189	3	2
Percent	.69	.45	.56	1.26	-	.68	.42	.47	1.07	3.03
140 CONCUSSION	5,235	255	2	8	-	2	57	162	4	-
Percent	.52	.38	.23	2.01	-	.68	.26	.40	1.43	-
INFECTIVE OR PARASITIC DISEASE	2,102	852	18	16	-	7	119	663	2	-
Percent	.21	1.28	2.03	4.02	-	2.37	.55	1.64	.71	-
150 INFECTIVE OR PARASITIC DISEASE, UNS	68	26	-	1	-	-	2	18	1	-
Percent	.01	.04	-	.25	-	-	.01	.04	.36	-
151 AMEBIASIS	7	4	2	-	-	-	-	2	-	-
Percent	.00	.01	.23	-	-	-	-	.00	-	-
153 BRUCELLOSIS	58	1	-	-	-	-	-	1	-	-
Percent	.01	.00	-	-	-	-	-	.00	-	-

See footnotes at end of table.

NUMBER AND PERCENT OF CASES BY SELECT INDUSTRIES BY NATURE OF INJURY/ILLNESS INVOLVING RADIATION AFFECTS.

1983 SDS CURRENT CASES INVOLVING DISABILITY.-Continued

WEIGHTED

NATURE OF INJURY OR ILLNESS	Total	HEALTH SERVICES	OFFICES OF PHYSICIANS	OFFICES OF DENTISTS	OFFICES OF OSTEO-PATHIC PHYSICIANS	OFFICES OF OTHER HEALTH PRACTI-TIONERS	NURSING AND PERSONAL CARE FACILITIES	HOSPITALS	MEDICAL LABORA-TORIES	DENTAL LABORA-TORIES
154 CONJUNCTIVITIS AND OPHTHALMIA	314	136	-	2	-	2	24	96	-	-
Percent	.03	.20	-	.50	-	.68	.11	.24	-	-
156 TETANUS	1	1	-	-	-	-	-	1	-	-
Percent	.00	.00	-	-	-	-	-	.00	-	-
157 TUBERCULOSIS	151	80	-	-	-	-	7	73	-	-
Percent	.02	.12	-	-	-	-	.03	.18	-	-
159 OTHER INFECTIVE OR PARASITIC DISEASE	1,503	604	16	13	-	5	86	472	1	-
Percent	.15	.91	1.81	3.27	-	1.69	.40	1.17	.36	-
160 CONTUSION, CRUSHING, BRUISE	100,647	6,041	46	15	1	22	1,832	3,888	31	4
Percent	10.07	9.10	5.20	3.77	6.25	7.46	8.47	9.63	11.07	6.06
170 CUT, LACERATION, PUNCTURE	129,272	3,445	61	74	-	16	912	2,192	29	8
Percent	12.93	5.19	6.89	18.59	-	5.42	4.22	5.43	10.36	12.12
DERMATITIS	8,904	835	3	31	1	-	205	568	4	5
Percent	.89	1.26	.34	7.79	6.25	-	.95	1.41	1.43	7.58
180 DERMATITIS, UNS	428	36	-	1	-	-	18	17	-	-
Percent	.04	.05	-	.25	-	-	.08	.04	-	-
181 CONTACT DERMATITIS	6,193	425	-	11	-	-	121	276	4	5
Percent	.62	.64	-	2.76	-	-	.56	.68	1.43	7.58
182 ALLERGENIC DERMATITIS	1,315	86	-	3	-	-	19	60	-	-
Percent	.13	.13	-	.75	-	-	.09	.15	-	-

See footnotes at end of table.

NUMBER AND PERCENT OF CASES BY SELECT INDUSTRIES BY NATURE OF INJURY/ILLNESS INVOLVING RADIATION AFFECTS.

1983 SDS CURRENT CASES INVOLVING DISABILITY.-Continued

WEIGHTED

NATURE OF INJURY & ILLNESS	Total	HEALTH SERVICES	OFFICES OF PHYSICIANS	OFFICES OF DENTISTS	OFFICES OF OSTEO-PATHIC PHYSICIANS	OFFICES OF OTHER HEALTH PRACTI-TIONERS	NURSING AND PERSONAL CARE FACILITIES	HOSPITALS	MEDICAL LABORA-TORIES	DENTAL LABORA-TORIES
183 PRIMARY INFECTIONS OF THE SKIN	655	245	3	13	1	-	30	192	-	-
Percent	.07	.37	.34	3.27	6.25	-	.14	.48	-	-
184 OTHER SKIN CONDITIONS	206	18	-	1	-	-	7	10	-	-
Percent	.02	.03	-	.25	-	-	.03	.02	-	-
189 SKIN CONDITION, NOT SPECIFIED	107	25	-	2	-	-	10	13	-	-
Percent	.01	.04	-	.50	-	-	.05	.03	-	-
190 DISLOCATION	17,838	789	25	14	-	7	240	482	.5	-
Percent	1.78	1.19	2.82	3.52	-	2.37	1.11	1.19		-
200 ELECTRIC SHOCK, ELECTROCUTION	1,099	49	1	-	-	-	6	42	-	-
Percent	.11	.07	.11	-	-	-	.03	.10	-	-
210 FRACTURE	97,167	3,611	118	33	-	24	761	2,502	12	9
Percent	9.72	5.44	13.33	8.29	-	8.14	3.52	6.20	4.29	13.64
220 EFFECTS OF EXPOSURE TO LOW TEMP	360	8	-	-	-	-	2	6	-	-
Percent	.04	.01	-	-	-	-	.01	.01	-	-
230 HEARING LOSS, OR IMPAIRMENT	2,048	14	-	-	-	-	3	8	-	-
Percent	.20	.02	-	-	-	-	.01	.02	-	-
240 EFFECTS OF ENVIRONMENTAL HEAT	1,179	22	-	-	-	-	4	18	-	-
Percent	.12	.03	-	-	-	-	.02	.04	-	-

See footnotes at end of table.

NUMBER AND PERCENT OF CASES BY SELECT INDUSTRIES BY NATURE OF INJURY/ILLNESS INVOLVING RADIATION AFFECTS.

1983 SDS CURRENT CASES INVOLVING DISABILITY.-Continued

WEIGHTED

NATURE OF INJURY OR ILLNESS	Total	HEALTH SERVICES	OFFICES OF PHYSICIANS	OFFICES OF DENTISTS	OFFICES OF OSTEO-PATHIC PHYSICIANS	OFFICES OF OTHER HEALTH PRACTI-TIONERS	NURSING AND PERSONAL CARE FACILITIES	HOSPITALS	MEDICAL LABORA-TORIES	DENTAL LABORA-TORIES
250 HERNIA, RUPTURE	16,847	490	9	6	1	5	106	346	-	1
Percent	1.69	.74	1.02	1.51	6.25	1.69	.49	.86	-	1.52
260 INFLAMMATION OR IRRITATION OF JOINTS, TENDONS, OR MUSCLES	11,810	414	9	9	-	4	119	241	3	1
Percent	1.18	.62	1.02	2.26	-	1.36	.55	.60	1.07	1.52
POISONING, SYSTEMIC	9,704	486	11	3	-	8	92	334	4	1
Percent	.97	.73	1.24	.75	-	2.71	.43	.83	1.43	1.52
270 POISONING, SYSTEMIC, UNS	1,201	57	-	-	-	-	9	46	-	-
Percent	.12	.09	-	-	-	-	.04	.11	-	-
271 DUE TO TOXIC MATERIALS	5,253	251	6	2	-	4	57	161	2	-
Percent	.53	.38	.68	.50	-	1.36	.26	.40	.71	-
272 DISEASES OF THE BLOOD AND BLOOD FORMING ORGANS	60	3	-	-	-	-	-	2	1	-
Percent	.01	.00	-	-	-	-	-	.00	.36	-
273 UPPER RESPIRATORY CONDITIONS	472	27	2	-	-	2	4	17	-	-
Percent	.05	.04	.23	-	-	.68	.02	.04	-	-
274 INFLUENZA, PNEUMONIA, ETC	1,965	82	-	-	-	2	9	63	-	-
Percent	.20	.12	-	-	-	.68	.04	.16	-	-
275 TOXIC HEPATITIS	45	18	1	1	-	-	-	13	1	1
Percent	00	.03	.11	.25	-	-	-	.03	.36	1.52

See footnotes at end of table.

NUMBER AND PERCENT OF CASES BY SELECT INDUSTRIES BY NATURE OF INJURY/ILLNESS INVOLVING RADIATION AFFECTS.

1983 SOS CURRENT CASES INVOLVING DISABILITY.-Continued

WEIGHTED

NATURE OF INJURY OR ILLNESS	Total	HEALTH SERVICES	OFFICES OF PHYSICIANS	OFFICES OF DENTISTS	OFFICES OF OSTEO-PATHIC PHYSICIANS	OFFICES OF OTHER HEALTH PRACTI-TIONERS	NURSING AND PERSONAL CARE FACILITIES	HOSPITALS	MEDICAL LABORA-TORIES	DENTAL LABORA-TORIES
276 OTHER DISEASES OF THE GASTROINTESTINAL TRACT	90	10	-	-	-	-	-	10	-	-
Percent	.01	.02	-	-	-	-	-	.02	-	-
279 OTHER TOXIC EFFECTS OF ONE SYSTEM ONLY	618	38	2	-	-	-	13	22	-	-
Percent	.06	.06	.23	-	-	-	.06	.05	-	-
PNEUMOCONIOSIS	1,382	1	1	-	-	-	-	-	-	-
Percent	.14	.00	.11	-	-	-	-	-	-	-
280 PNEUMOCONIOSIS, UNS	73	1	1	-	-	-	-	-	-	-
Percent	.01	.00	.11	-	-	-	-	-	-	-
281 ALUMINOSIS	2	-	-	-	-	-	-	-	-	-
Percent	.00	-	-	-	-	-	-	-	-	-
282 ANTHRACOSIS	730	-	-	-	-	-	-	-	-	-
Percent	.07	-	-	-	-	-	-	-	-	-
283 ASBESTOSIS	288	-	-	-	-	-	-	-	-	-
Percent	.03	-	-	-	-	-	-	-	-	-
284 BYSSINOSIS	3	-	-	-	-	-	-	-	-	-
Percent	.00	-	-	-	-	-	-	-	-	-
285 SIDEROSIS	4	-	-	-	-	-	-	-	-	-
Percent	.00	-	-	-	-	-	-	-	-	-
286 SILICOSIS	118	-	-	-	-	-	-	-	-	-
Percent	.01	-	-	-	-	-	-	-	-	-
287 OTHER PNEUMOCONIOSES	163	-	-	-	-	-	-	-	-	-
Percent	.02	-	-	-	-	-	-	-	-	-
289 PNEUMOCONIOSIS WITH TUBERCULOSIS	1	-	-	-	-	-	-	-	-	-
Percent	.00	-	-	-	-	-	-	-	-	-

See footnotes at end of table.

NUMBER AND PERCENT OF CASES BY SELECT INDUSTRIES BY NATURE OF INJURY/ILLNESS INVOLVING RADIATION AFFECTS.

1983 SDS CURRENT CASES INVOLVING DISABILITY.-Continued

WEIGHTED

NATURE OF INJURY OR ILLNESS	Total	HEALTH SERVICES	OFFICES OF PHYSICIANS	OFFICES OF DENTISTS	OFFICES OF OSTEO-PATHIC PHYSICIANS	OFFICES OF OTHER HEALTH PRACTI-TIONERS	NURSING AND PERSONAL CARE FACILITIES	HOSPITALS	MEDICAL LABORA-TORIES	DENTAL LABORA-TORIES
RADIATION EFFECTS	2,070	12	2	-	-	-	2	4	-	-
Percent	.21	.02	.23	-	-	-	.01	.01	-	-
290 RADIATION EFFECTS, UNS	43	-	-	-	-	-	-	-	-	-
Percent	.00	-	-	-	-	-	-	-	-	-
291 NON-IONIZING RADIATION	104	7	-	-	-	-	-	3	-	-
Percent	.01	.01	-	-	-	-	-	.01	-	-
292 MICROWAVE	2	-	-	-	-	-	-	-	-	-
Percent	.00	-	-	-	-	-	-	-	-	-
293 IONIZING RADIATION--X-RAY	6	2	2	-	-	-	-	-	-	-
Percent	.00	.00	.23	-	-	-	-	-	-	-
294 IONIZING RADIATION--ISOTOPES	3	-	-	-	-	-	-	-	-	-
Percent	.00	-	-	-	-	-	-	-	-	-
295 WELDERS FLASH	1,912	3	-	-	-	-	2	1	-	-
Percent	.19	.00	-	-	-	-	.01	.00	-	-
300 SCRATCHES, ABRASIONS	30,281	813	11	25	1	6	192	526	9	7
Percent	3.03	1.22	1.24	6.28	6.25	2.03	.89	1.30	3.21	10.61
310 SPRAINS, STRAINS	396,336	38,777	363	72	3	152	13,916	23,008	137	12
Percent	39.65	58.42	41.02	18.09	18.75	51.53	64.33	56.99	48.93	18.18
320 HEMORRHOIDS	499	9	-	-	-	-	1	8	-	-
Percent	.05	.01	-	-	-	-	.00	.02	-	-

See footnotes at end of table.

NUMBER AND PERCENT OF CASES BY SELECT INDUSTRIES BY NATURE OF INJURY/ILLNESS INVOLVING RADIATION AFFECTS.

1983 SDS CURRENT CASES INVOLVING DISABILITY.-Continued

WEIGHTED

NATURE OF INJURY OR ILLNESS	Total	HEALTH SERVICES	OFFICES OF PHYSICIANS	OFFICES OF DENTISTS	OFFICES OF OSTEO-PATHIC PHYSICIANS	OFFICES OF OTHER HEALTH PRACTI-TIONERS	NURSING AND PERSONAL CARE FACILITIES	HOSPITALS	MEDICAL LABORA-TORIES	DENTAL LABORA-TORIES
330 HEPATITIS (SERUM AND INFECTIVE)	675	323	15	14	1	-	/	245	13	-
Percent	.07	.49	1.69	3.52	6.25	-	.03	.61	4.64	-
400 MULTIPLE INJURIES	25,462	1,156	34	13	2	6	323	683	7	8
Percent	2.55	1.74	3.84	3.27	12.50	2.03	1.49	1.69	2.50	12.12
500 EFFECTS OF CHANGES IN ATMOSPHERIC PRESSURE	455	3	-	-	-	-	-	3	-	-
Percent	.05	.00	-	-	-	-	-	.01	-	-
510 CEREBROVASCULAR AND OTHER CONDITIONS OF THE CIRCULATORY SYSTEM	1,876	113	13	1	-	-	12	81	-	-
Percent	.19	.17	1.47	.25	-	-	.06	.20	-	-
520 COMPLICATIONS PECULIAR TO MEDICAL CARE	245	123	2	-	-	-	4	107	-	-
Percent	.02	.19	.23	-	-	-	.02	.27	-	-
530 EYE, OTHER DISEASES OF THE EYE	3,292	259	4	1	-	3	51	185	-	-
Percent	.33	.39	.45	.25	-	1.02	.24	.46	-	-
540 MENTAL DISORDERS	5,307	491	27	3	-	6	15	337	-	-
Percent	.53	.74	3.05	.75	-	2.03	.07	.83	-	-

See footnotes at end of table.

NUMBER AND PERCENT OF CASES BY SELECT INDUSTRIES BY NATURE OF INJURY/ILLNESS INVOLVING RADIATION AFFECTS.

1983 SDS CURRENT CASES INVOLVING DISABILITY.-Continued

WEIGHTED

NATURE OF INJURY OR ILLNESS	Total	HEALTH SERVICES	OFFICES OF PHYSICIANS	OFFICES OF DENTISTS	OFFICES OF OSTEO-PATHIC PHYSICIANS	OFFICES OF OTHER HEALTH PRACTI-TIONERS	NURSING AND PERSONAL CARE FACILITIES	HOSPITALS	MEDICAL LABORA-TORIES	DENTAL LABORA-TORIES
NEOPLASM, TUMOR	276	2	2	-	-	-	-	-	-	-
Percent	.03	.00	.23	-	-	-	-	-	-	-
550 NEOPLASM, TUMOR, UNS	14	-	-	-	-	-	-	-	-	-
Percent	.00	-	-	-	-	-	-	-	-	-
551 MALIGNANT	126	-	-	-	-	-	-	-	-	-
Percent	.01	-	-	-	-	-	-	-	-	-
552 BENIGN AND UNSPECIFIED	136	2	2	-	-	-	-	-	-	-
Percent	.01	.00	.23	-	-	-	-	-	-	-
NERVOUS SYSTEM, CONDITIONS OF	2,133	84	4	7	-	2	13	49	1	-
Percent	.21	.13	.45	1.76	-	.68	.06	.12	.36	-
560 NERVOUS SYSTEM, CONDITIONS OF, UNS	61	3	-	-	-	-	-	3	-	-
Percent	.01	.00	-	-	-	-	-	.01	-	-
561 DISEASES OF THE CENTRAL NERVOUS SYSTEM	87	6	-	-	-	-	1	5	-	-
Percent	.01	.01	-	-	-	-	.00	.01	-	-
562 DISEASES OF THE NERVES AND PERIPHERAL GANGLIA	1,985	75	4	7	-	2	12	41	1	-
Percent	.20	.11	.45	1.76	-	.68	.06	.10	.36	-
RESPIRATORY SYSTEM, CONDITIONS OF	1,563	78	-	-	1	-	3	65	-	-
Percent	.16	.12	-	-	6.25	-	.01	.16	-	-
570 RESPIRATORY SYSTEM, CONDITIONS OF, UNS	114	4	-	-	-	-	-	3	-	-
Percent	.01	.01	-	-	-	-	-	.01	-	-

See footnotes at end of table.

NUMBER AND PERCENT OF CASES BY SELECT INDUSTRIES BY NATURE OF INJURY/ILLNESS INVOLVING RADIATION AFFECTS.

1983 SDS CURRENT CASES INVOLVING DISABILITY.-Continued

WEIGHTED

NATURE OF INJURY OR ILLNESS	Total	HEALTH SERVICES	OFFICES OF PHYSICIANS	OFFICES OF DENTISTS	OFFICES OF OSTEO-PATHIC PHYSICIANS	OFFICES OF OTHER HEALTH PRACTI-TIONERS	NURSING AND PERSONAL CARE FACILITIES	HOSPITALS	MEDICAL LABORA-TORIES	DENTAL LABORA-TORIES
571 UPPER RESPIRATORY	283	12	-	-	-	-	1	11	-	-
Percent	.03	.02	-	-	-	-	.00	.03	-	-
572 INFLUENZA, PNEUMONIA, BRONCHITIS, ASTHMA	1,166	62	-	-	1	-	2	51	-	-
Percent	.12	.09	-	-	6.25	-	.01	.13	-	-
580 SYMPTOMS AND ILL-DEFINED CONDITIONS	3,486	287	4	4	-	-	70	190	-	-
Percent	.35	.43	.45	1.01	-	-	.32	.47	-	-
900 NO INJURY OR ILLNESS	146	29	5	-	-	-	4	14	2	-
Percent	.01	.04	.56	-	-	-	.02	.03	.71	-
950 DAMAGE TO PROSTHETIC DEVICES	416	68	-	3	-	-	13	49	-	-
Percent	.04	.10	-	.75	-	-	.06	.12	-	-
990 OCCUPATIONAL DISEASE, NEC	690	29	-	-	-	-	3	25	-	-
Percent	.07	.04	-	-	-	-	.01	.06	-	-
991 HEART CONDITIONS (INCLUDES HEART ATTACK)	3,528	102	7	4	1	-	12	64	-	-
Percent	.35	.15	.79	1.01	6.25	-	.06	.16	-	-
995 OTHER INJURY, NEC	2,787	182	4	-	-	1	51	117	-	1
Percent	.28	.27	.45	-	-	.34	.24	.29	-	1.52

See footnotes at end of table.

NUMBER AND PERCENT OF CASES BY SELECT INDUSTRIES BY NATURE OF INJURY/ILLNESS INVOLVING RADIATION AFFECTS.

1983 SDS CURRENT CASES INVOLVING DISABILITY.-Continued

WEIGHTED

NATURE OF INJURY OR ILLNESS	Total	HEALTH SERVICES	OFFICES OF PHYSICIANS	OFFICES OF DENTISTS	OFFICES OF OSTEO-PATHIC PHYSICIANS	OFFICES OF OTHER HEALTH PRACTI-TIONERS	NURSING AND PERSONAL CARE FACILITIES	HOSPITALS	MEDICAL LABORA-TORIES	DENTAL LABORA-TORIES
999 NONCLASSIFIABLE	76,867	4,674	68	31	3	17	1,966	2,316	15	4
Percent	7.69	7.04	7.68	7.79	18.75	5.76	9.09	5.74	5.36	6.06

- Data not available.
NOTE: A CURRENT CASE IS ONE WHICH WAS RECEIVED OR WHICH OCCURRED IN THE REFERENCE YEAR.
SOURCE: 18 JURISDICTIONS IN THE SUPPLEMENTARY DATA SYSTEM (SDS) PROGRAM PROVIDED CURRENT CASE DATA INVOLVING DISABILITY FOR 1983: ALASKA, ARIZONA, CALIFORNIA, COLORADO, INDIANA, IOWA, KENTUCKY, MARYLAND, MICHIGAN, MINNESOTA, MISSISSIPPI, MISSOURI, NEW MEXICO, OHIO, OREGON, TENNESSEE, WASHINGTON, AND WISCONSIN.

Major Group 80.—HEALTH SERVICES

The Major Group as a Whole

This major group includes establishments primarily engaged in furnishing medical, surgical, and other health service to persons. Associations or groups primarily engaged in providing medical or other health services to members are included, but those which limit their services to the provision of insurance against hospitalization or medical costs are classified in Major Group 63.

Group No. Industry No.

801 OFFICES OF PHYSICIANS

8011 Offices of Physicians

Establishments of licensed practitioners having the degree of M.D. and engaged in the practice of general or specialized medicine and surgery. Establishments such as group clinics, in which a group of physicians are associated for the purpose of carrying on their profession, are included in this industry. Osteopathic physicians are classified in Industry 8031.

Clinics, operated by groups of physicians
Dispensaries, operated by groups of physicians
Gynecologists, offices of
Neurologists, offices of
Obstetricians, offices of
Oculists, offices of
Ophthalmologists, offices of
Pathologists, offices of
Physicians (M.D.), including specialists: offices of
Plastic surgeons, offices of
Psychiatrists, offices of
Psychoanalysts, offices of
Radiologists, offices of
Surgeons, offices of

802 OFFICES OF DENTISTS

8021 Offices of Dentists

Establishments of licensed practitioners having the degree of D.D.S. (or D.D. Sc.) and engaged in the practice of general or specialized dentistry, including dental surgery.

Dental surgeons, offices of
Dentists, offices of
Orthodontists, offices of

803 OFFICES OF OSTEOPATHIC PHYSICIANS

8031 Offices of Osteopathic Physicians

Establishments of licensed practitioners engaged in the practice of general or specialized osteopathy.

Osteopathic physicians, offices of

804 OFFICES OF OTHER HEALTH PRACTITIONERS

8041 Offices of Chiropractors

Establishments of licensed practitioners engaged in the practice of chiropraxis.

Chiropractors, offices of

8042 Offices of Optometrists

Establishments of licensed practitioners engaged in the practice of optometry.

Optometrists, offices of

8049 Offices of Health Practitioners, Not Elsewhere Classified

Establishments of licensed practitioners engaged in practice in health fields, not elsewhere classified.

Chiropodists, offices of
Christian Science practitioners, offices of
Dieticians, offices of
Midwives, offices of
Naturopaths, offices of
Nurses, registered and practical, offices of
Nutritionists, offices of
Occupational therapists, offices of
Podiatrists, offices of
Physiotherapists, offices of
Psychologists, clinical: offices of
Psychotherapists (not M.D.), offices of

445-987—72——21

Group No. Industry No.

805 NURSING AND PERSONAL CARE FACILITIES

This group includes establishments primarily engaged in providing nursing and health-related personal care, with inpatient beds. Establishments providing diagnostic, surgical and extensive medical services are classified in Group 806.

8051 Skilled Nursing Care Facilities

Establishments primarily engaged in providing care and treatment for patients who require continuous health care, but not hospital services. These establishments have an organized medical staff, including physician and continuous nursing services. Included are extended care facilities as well as other types of continuous nursing care facilities.

Extended care facilities
Nursing homes, skilled

8059 Nursing and Personal Care Facilities, Not Elsewhere Classified

Establishments primarily engaged in providing some nursing and health-related personal care, but not continuous nursing services. These establishments have at least one shift with a licensed or registered nurse to provide routine health care and observation. Included are rest homes, convalescent homes and other institutions where health care is a major element. Establishments primarily engaged in providing day-to-day personal care but not health care by registered or licensed nurses are classified in Industry 8361.

Convalescent homes with health care
Domiciliary care with health care
Homes for retarded with health care
Personal care facilities with health care
Personal care homes with health care
Rest homes with health care

806 HOSPITALS

This group includes establishments primarily engaged in providing diagnostic services, extensive medical treatment including surgical services, and other hospital services, as well as continuous nursing services. These establishments have an organized medical staff, inpatient beds, and equipment and facilities to provide complete health care.

8062 General Medical and Surgical Hospitals

Establishments primarily engaged in providing general medical and surgical services and other hospital services. Specialty hospitals are classified in Industries 8063 and 8069.

General medical and surgical hospitals

8063 Psychiatric Hospitals

Establishments primarily engaged in providing diagnostic medical services and inpatient treatment for the mentally ill.

Mental hospitals
Psychiatric hospitals

8069 Specialty Hospitals, Except Psychiatric

Establishments primarily engaged in providing diagnostic services, treatment and other hospital services for patients with specified types of illnesses, except mental. Psychiatric hospitals are classified in Industry 8063.

Children's hospitals
Chronic disease hospitals
Eye, ear, nose, and throat hospitals
Geriatric hospitals
Hospitals, specialty except psychiatric
Maternity hospitals
Orthopedic hospitals
Tuberculosis hospitals

Group No. | Industry No.

807 MEDICAL AND DENTAL LABORATORIES

8071 Medical Laboratories

Establishments primarily engaged in providing professional analytic or diagnostic services to the medical profession, or to the patient on prescription of a physician.

Bacteriological laboratories (not manufacturing)
Biological laboratories (not manufacturing)
Chemists, biological (not manufacturing), laboratories of
Medical laboratories (clinical)
Pathological laboratories
X-ray laboratories (not manufacturing)

8072 Dental Laboratories

Establishments primarily engaged in making dentures and artificial teeth to order for the dental profession. The manufacture of artificial teeth other than to order is classified in Industry 3843.

Dental laboratories
Dentures, made in dental laboratories to order for the dental profession
Teeth, artificial—made in dental laboratories to order for the profession

808 OUTPATIENT CARE FACILITIES

8081 Outpatient Care Facilities

Establishments primarily engaged in outpatient care with permanent facilities and with medical staff to provide diagnosis, treatment, or both for patients who are ambulatory and do not require inpatient care. Associations or groups formed primarily to provide medical or other health service to their members, and which themselves provide these facilities, are included in this industry.

Family planning clinics
Clinics, not operated by groups of licensed health practitioners
Dental insurance (providing services through own facilities)
Dispensaries, not operated by groups of licensed health practitioners
Group health associations, providing medical services (not insurance) only
Health maintenance organizations (HMO)
Medical insurance (providing services through own facilities)
Outpatient treatment clinics for alcoholism
Outpatient treatment clinics for drugs
Rehabilitation centers, outpatient (medical treatment)
Speech defect clinics

809 HEALTH AND ALLIED SERVICES, NOT ELSEWHERE CLASSIFIED

8091 Health and Allied Services, Not Elsewhere Classified

Establishments primarily engaged in rendering health and allied services, not elsewhere classified. Establishments of registered or practical nurses engaged in the independent practice of their profession are classified in Industry 8049; and nurses' registries in Industry 7361. Establishments, such as Blue Cross and Blue Shield plans, whose members are supplied these services by independent physicians or hospitals under contract are classified in Industry 6324.

Blood banks
Blood donor stations
Medical photography and art
Oxygen tent service
Visiting nurse associations

Injury and Illness Data Available From 1983 Workers' Compensation Records

U.S. Department of Labor
Bureau of Labor Statistics
March 1986

Announcement 86-1

Occupational injury and illness data from State workers' compensation records for 1983 have been tabulated by the Bureau of Labor Statistics and are available from the National Technical Information Service (NTIS). This large body of data, which includes individual case records for 29 States organized into multi-State files, can be obtained at moderate cost on machine-readable magnetic tapes. In addition, tabulations of injury and illness data from 31 States organized into three groups are available in microfiche. The data are derived from a Federal-State cooperative program, the Supplementary Data System (SDS), established under the Occupational Safety and Health Act.

The SDS provides valuable information about the major characteristics of injuries and illnesses for various occupations and industries. State and Federal agencies and safety and health professionals can use this information to develop standards, to target accident and disease prevention activities, to identify areas for enforcement activities, and to develop educational and training materials for employers and employees.

Because the SDS is not a comprehensive survey of occupational injuries and illnesses, it does not provide national estimates of the number of such cases. The best source of such information is the Bureau's annual survey of occupational injuries and illnesses.

Although cases from each State are classified uniformly, interstate comparisons should be made with care because State workers' compensation laws and administrative practices differ. These differences are summarized in the last column of table 3.

Multi-State tabulations in microfiche. Data from States which provide similar kinds of cases are organized into three groups of tabulations. Individual State tabulations are not available from the National Technical Information Service, but may be available from participating State agencies.

The tabulations are organized as follows:

Group 1 includes data submitted by eight States and the Virgin Islands. Although some cases involve days of disability, others involve medical treatment only.

Group 2 includes data submitted by 18 States. Each case involves disability; the minimum number of days of disability required for inclusion of a case by each State is indicated in table 3.

Group 3 includes data submitted by 10 States. All cases were closed during 1983 regardless of year of occurrence.

Table 1 lists the contents of each tabulation. Since States participating in the SDS are not required to provide day of occurrence of injury, time of accident, time workday began, associated object or substance, age of injured worker, length of service of injured worker, weekly wage of injured worker, or kind of insurance provided by employer, tabulations involving those elements usually do not include data from all participating States. Except for fatality data available for California and New Mexico, information on extent of disability, indemnity compensation, and medical costs are available only for closed cases. Table 2 indicates which States provided data for specific tabulations in each of the three groups.

Tabulations may be purchased in microfiche (paper copy is not available) from the National Technical Information Service. (See "Ordering information" below.)

Microdata files. Individual case records, which contain no information that can be used to identify employees or employers, are organized in three multi-State magnetic tape files. Table 3 identifies the data elements available for each State and indicates which file contains the records for a particular State. Users who are interested in data from a single State should have the software to extract the desired records, using the State code which appears on each record.

Microdata files are organized as follows:

File 1 contains records submitted by seven States and the Virgin Islands. Although some cases involve days of disability, others involve medical treatment only.

File 2 contains records submitted by 17 States. Each case involves disability; the minimum number of days of disability required for inclusion of a case by each State is indicated in table 3.

File 3 contains records submitted by nine States. All cases were closed during 1983 regardless of year of occurrence.

Records from five States—Colorado, Iowa, Montana, Oregon, and Wisconsin—appear on files 1 or 2, as well as file 3.

Microdata files may be purchased from the National Technical Information Service. (See "Ordering information" below.)

Data for years other than 1983. From 1976 through 1981, the Supplementary Data System produced data annually. Since then, the system has been on a biennial basis; no data are available for 1982, nor will they be available for 1984.

Multi-State tabulations in microfiche are available for 1980, 1981, and 1983 from the National Technical Information Service. For 1978 and 1979, multi-State tabulations are not available for purchase but may be viewed and excerpted as indicated below under "Additional information." Multi-State tabulations were not prepared for 1976 and 1977.

Multi-State microdata files are available for 1979 through 1983 from the National Technical Information Service. (See "Ordering information" below.)

Ordering information. The following items may be purchased from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161. When ordering, refer to the NTIS Accession Number(s). There is a $3.00 handling charge for each order. Cost of microfiche and paper copy (when available) is indicated below, but is subject to change:

Multi-State tabulations in microfiche
(Paper copy is not available.)

Occupational injuries and illnesses:	*NTIS Accession Number*		
	1983	*1981*	*1980*
Disability and medical only cases	PB86-129830	PB84-204486	PB83-172213
Cost	$10.00	$10.00	$10.00
Disability Cases	PB86-129848	PB84-204494	PB83-172221
Cost	$10.00	$10.00	$10.00
Closed Cases	PB86-129855	PB84-204502	PB83-172239
Cost	$10.00	$10.00	$10.00

Multi-State microdata files
(Contact the National Technical Information Service for cost of these items.)

Supplementary Data System:	*NTIS Accession Number*			
	1983	*1981*	*1980*	*1979*
File 1	PB85-238152/AS	PB84-120062	PB83-154963	PB82-179318
File 2	PB85-238178/AS	PB84-120088	PB83-154955	PB82-186180
File 3	PB85-238160/AS	PB84-120054	PB83-154948	PB82-179243

Technical documentation for multi-State microdata files
(These items may be ordered separately.)

Year covered and title of documentation	*NTIS Accession Number*
For 1980, 1981, 1983: Supplementary Data System, Microdata Files, User's Guide, 1980 Edition. Cost $11.95 in paper, $5.95 in microfiche	PB83-133553
For 1978 and 1979: Supplementary Data System, Microdata Files, User's Guide, 1978-79. Cost $9.95 in paper, $5.95 in microfiche	PB80-149982

Additional information

Tabulations for individual participating States as well as for the groupings of States decribed above may be viewed and excerpted in the Office of Occupational Safety and Health Statistics, Room 4014, Patrick Henry Building, 601 D Street, NW., Washington, D.C., or the may be viewed in microfiche in any of the BLS regional offices listed at the end of this announcement.

For additional information, contact the Office of Occupational Saftey and Health Statistics, U.S. Department of Labor, Washington, D.C. 20212. (Telephone: 202—272-3463.)

Table 1. Occupational injuries and illnesses, Supplementary Data System standard tabulations, 1983

Tabulation Number	Primary classification	Secondary classification	Content of tabulation
101	Nature of injury or illness		Number and percent of cases
102	Part of body affected		Number and percent of cases
103	Source of injury or illness		Number and percent of cases
104	Type of accident or exposure		Number and percent of cases
105	Associated object or substance		Number and percent of cases
121	Nature of injury or illness	Indemnity compensation and medical payments	Number and percent of cases and average payments
122	Part of body affected	Indemnity compensation and medical payments	Number and percent of cases and average payments
123	Source of injury or illness	Indemnity compensation and medical payments	Number and percent of cases and average payments
124	Type of accident or exposure	Indemnity compensation and medical payments	Number and percent of cases and average payments
125	Associated object or substance	Indemnity compensation and medical payments	Number and percent of cases and average payments
126	Extent of disability	Indemnity compensation and medical payments	Number of cases and average payments
161	Kind of insurance	Nature of injury or illness	Number and percent of cases
162	Kind of insurance	Indemnity compensation and medical payments	Number and percent of cases
163	Kind of insurance	Extent of disability	Number and percent of cases
201	Industry	Nature of injury or illness	Number and percent of cases
202	Industry	Part of body affected	Number and percent of cases
203	Industry	Source of injury or illness	Number and percent of cases
204	Industry	Type of accident or exposure	Number and percent of cases
205	Industry	Associated object or substance	Number and percent of cases
215	Industry	Extent of disability	Number and percent of cases
220	Industry division	Month of occurrence	Number and percent of cases
221	Industry division	Day of week of occurrence	Number and percent of cases
222	Major industry group	Hour of shift during which injury occurred	Number and percent of cases
223	Major industry group	Duration of employment	Number and percent of cases
224	Major industry group	Weekly wages	Number and percent of cases
230	Major industry group	Occupational illnesses	Number and percent of cases
240	Major industry group	Age	Number and percent of cases
250	Industry	Indemnity compensation and medical payments	Number of cases and total payments
260	Major industry group	Kind of insurance	Number and percent of cases
301	Occupation	Nature of injury or illness	Number and percent of cases
302	Occupation	Part of body affected	Number and percent of cases
303	Occupation	Source of injury or illness	Number and percent of cases
304	Occupation	Type of accident or exposure	Number and percent of cases
305	Occupation	Associated object or substance	Number and percent of cases
310	Occupation	Industry division	Number and percent of cases
311	Occupation	Major durable manufacturing industry group	Number and percent of cases
312	Occupation	Major nondurable manufacturing industry group	Number and percent of cases
313	Occupation	Duration of employment	Number and percent of cases
330	Occupation	Occupational illnesses	Number and percent of cases
340	Occupation	Age	Number and percent of cases
350	Occupation	Indemnity compensation and medical payments	Number of cases and total payments
400	Major industry division, nature of injury or illness	Type of accident or exposure	Number of fatalities
511	Nature of injury or illness	Part of body affected	Number and percent of cases
512	Nature of injury or illness	Source of injury or illness	Number and percent of cases
513	Nature of injury or illness	Type of accident or exposure	Number and percent of cases
514	Type of accident or exposure	Source of injury or illness	Number and percent of cases
515	Associated object or substance	Type of accident or exposure	Number and percent of cases

NOTE: All tabulations are provided for "All Workers" and for "Women."

Table 3. Occupational injuries and illnesses, Supplementary Data System microdata files, data elements included by State, 1983

Jurisdiction	Number of records 1/	Date of occurrence 2/	Time 3/	Occupation 4/	Industry 5/		Injury or illness characteristics 6/	Age	Sex	Length of service 9/	Weekly wages	Kind of insurance 10/	Extent of disability 11/	Costs		Brief description of cases included 12/
					Public sector 6/	Private sector 7/								Indemnity compensation	Medical payments	
File 1: Some cases involve medical treatment only, while others involve days of disability. Available from National Technical Information Service. NTIS Accession Number PB85-238152/AS.																
Hawaii	39,019	X	-	X	X	3/4	X	X	X	-	-	-	-	-	-	Received during year and involve death, 1 or more lost workdays, or medical treatment.
Maine	49,214	X	-	X	X	3/4	X,AOS	X	X	E	-	X	-	-	-	Occurred during year and involve death, 1 or more lost workdays, medical treatment, or first aid.
Mont.	31,138	X	-	X	X	4/4	X	X	X	-	X	-	-	-	-	Occurred during year and involve death, 1 or more lost workdays, or medical treatment.
Nebr.	56,515	X	LT	X	X	4/4	X	X	X	-	X	X	-	-	-	Occurred during year and involve death, 1 or more lost workdays, or medical treatment.
Utah	53,164	X	-	X	X	4/4	X,AOS	-	X	-	-	-	-	-	-	Received during year and involve death, 1 or more lost workdays, medical treatment, or first aid.
Vt.	20,738	X	-	X	X	3/4	X,AOS	X	X	-	-	-	-	-	-	Received during year and involve death, 1 or more lost workdays, or medical treatment.
V. Isls.	1,433	X	LT	X	X	4/4	X	X	X	E	X	-	-	-	-	Received during year and involve death, 1 or more lost workdays, medical treatment, or first aid.
Wyo.	14,793 (S)	X	TOA,TVB, LT	X	X	3/4	X,AOS	X	X	E	-	-	-	-	-	Occurred during year and involve death, 1 or more lost workdays, or medical treatment beyond first aid. Total weighted cases: 19,417.
File 2: Each case involves disability. The minimum number of days of disability required for inclusion of a case by each State is indicated below. Available from National Technical Information Service. NTIS Accession Number PB85-238178/AS.																
Alaska	10,849	X	TOA,TVB, LT	X	X	4/4	X	X	X	J	X	X	-	-	-	Occurred during year and involve death, or 1 or more lost workdays.
Ariz.	17,964	X	-	X	X	4/4	X	X	X	-	-	-	-	-	-	Received during year and involve death, permanent disability, or 8 or more days of disability.
Calif.	172,248 (S)	X	-	X	X	3/4	X,AOS	X	X	E	-	-	F	-	-	Received during year and involve death, or 1 or more lost workdays. Total weighted cases: 344,060.
Colo.	39,658	X	-	X	X	4/4	X	X	X	E	-	X	-	-	-	Received during year and involve death or more than 3 shifts or days of disability.
Ind.	44,540	X	-	X	X	4/4	X	X	X	E	X	-	-	-	-	Received during year and involve death or lost worktime beyond the day of injury.
Iowa	20,663	X	TOA,TVB, LT	X	X	4/4	X,AOS	X	X	E	X	X	-	-	-	Received during year and involve death, permanent disability, or more than 3 days of disability.
Ky.	34,450	X	LT	X	X	4/4	X,AOS	X	X	J	X	-	-	-	-	Received during year and involve death or 1 or more lost workdays.
Md.	40,520	X	-	X	X	4/4	X,AOS	X	X	E	X	-	-	-	-	Occurred during year and involve death or 4 or more days of disability.
Mich.	54,138	X	-	X	X	4/4	X	X	X	-	-	-	-	-	-	Occurred during year and involve death, specific losses, or 7 or more days of disability.
Minn.	41,721	X	-	X	X	4/4	X,AOS	X	X	-	X	-	-	-	-	Occurred during year and involve death, permanent disability, or 3 or more days of disability.
Miss.	13,321	X	-	X	X	4/4	X	X	X	E	X	X	-	-	-	Received during year and involve 5 or more lost workdays.
No.	77,336	X	-	X	X	4/4	X	X	X	-	X	X	-	-	-	Occurred during year and involve death, permanent disability, or 4 or more lost workdays.
N. Mex.	5,408	X	-	X	X	4/4	X,AOS	X	X	E	-	-	F	-	-	Received during year and involve death, permanent disability, or 8 or more days of disability.
Oreg.	34,037	X	TOA,TVB, LT	X	X	4/4	X	X	X	E	X	X	-	-	-	Received during year and involve death, permanent disability, or 4 or more days (1 to 3 days if worker is hospitalized) of temporary disability.
Tenn.	24,573	X	-	X	X	4/4	X	X	X	-	X	-	-	-	-	Received during year and involve death, permanent disability, or 8 or more days of disability.
Va.	14,379 (S)	X	-	X	X	4/4	X,AOS	X	X	E	X	X	-	-	-	Occurred during year and involve death, permanent disability, 8 or more days of disability, and a considerable number of cases involving less than 8 days of disability. Total weighted cases: 43,137.
Wis.	50,453	X	-	X	X	4/4	X,AOS	X	X	-	X	-	-	-	-	Received during year and involve death, permanent disability, or 4 or more days of disability.

See footnotes at end of table.

Table 2. States providing information for multi-State tabulations, Supplementary Data System, 1983

Group I 1/	Tabulation Number 4/																		
	101-104	105	201-204	205	220	221	222	223	224	230	240	301-304	305	310-312	313	330	340	511-514	515
Hawaii	x		x		x	x				x	x	x		x		x	x	x	
Maine	x	x	x	x	x	x		x		x	x	x	x	x	x	x	x	x	x
Montana	x		x		x	x			x	x	x	x		x		x	x	x	
Nebraska	x		x		x	x	x		x	x	x	x		x		x	x	x	
Utah	x	x	x	x	x	x				x		x	x	x		x		x	x
Vermont	x	x	x	x	x	x				x	x	x	x	x		x	x	x	x
Virgin Islands	x		x		x	x	x	x	x	x	x	x		x	x	x	x	x	
Washington	x	x	x	x	x	x			x	x	x	x	x	x		x	x	x	x
Wyoming	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x

Group II 2/	Tabulation Number 4/																		
	101-104	105	161	201-204	205	220	221	222	223	224	230	240	260	301-304	305	312	330	340	511-514	515
Alaska	x		x	x		x	x	x		x	x	x	x	x		x	x	x	x	
Arizona	x			x		x	x				x	x		x		x	x	x	x	
California	x	x		x	x	x	x		x		x	x		x	x	x	x	x	x	x
Colorado	x		x	x		x	x		x		x	x	x	x		x	x	x	x	
Indiana	x			x		x	x		x	x	x	x		x		x	x	x	x	
Iowa	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Kentucky	x	x		x	x	x	x	x		x	x	x		x	x	x		x	x	x
Maryland	x	x		x	x	x	x		x	x	x	x		x	x	x	x	x	x	x
Michigan	x			x		x	x				x	x		x		x		x	x	
Minnesota	x	x		x	x	x	x			x	x	x		x	x	x		x	x	x
Mississippi	x		x	x		x	x		x	x	x	x	x	x		x	x	x	x	
Missouri	x		x	x		x	x			x	x	x	x	x		x		x	x	
New Mexico	x	x		x	x	x	x		x		x	x		x	x	x	x	x	x	x
Ohio	x		x	x		x	x				x	x	x						x	
Oregon	x		x	x		x	x	x	x	x	x	x	x	x		x	x	x	x	
Tennessee	x			x		x	x			x	x	x		x		x		x	x	
Virginia	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x
Wisconsin	x	x		x	x	x	x			x	x	x		x	x	x		x	x	x

Group III 3/	Tabulation Number 4/																					
	121-124	125	126	161	162-163	201-204	205	215	221	223	224	230, 240	250	260	301-304	305	310-312	313	330, 340	350	400	511-514	515
Arkansas	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Colorado	x		x	x	x	x		x	x	x		x	x	x	x		x	x	x	x	x	x	
Delaware	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Iowa	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Montana	x		x			x		x	x		x	x	x		x		x		x	x	x	
New York	x	x	x			x	x	x	x		x	x	x		x	x	x		x	x	x	x	x
North Carolina	x		x			x		x	x	x	x	x	x		x		x	x	x	x	x	
Oregon	x		x	x	x	x		x	x	x	x	x	x	x	x		x	x	x	x	x	
Washington	x	x	x			x	x	x	x		x	x	x		x	x	x		x	x	x	x	x
Wisconsin	x	x	x			x	x	x	x		x	x	x		x	x	x		x	x	x	x	x

1/ Group I: All cases either occurred or were received during 1983. Some cases involve medical treatment only, while others involve days of disability.

2/ Group II: All cases either occurred or were received during 1983. Although all cases involve disability, most States excluded cases of short-term disability.

3/ Group III: All cases were closed during 1983 regardless of year of occurrence.

4/ See table 1 for contents of individual tabulations.

NOTE: "x" indicates the State provides data elements for the specified tables(s).

Table 3. Occupational injuries and illnesses, Supplementary Data System microdata files, data elements included by State, 1983—Continued

Jurisdiction	Number of records 1/	Date of occurrence 2/	Time 3/	Occupation 4/	Industry 5/ Public sector 6/	Industry 5/ Private sector 7/	Injury or illness characteristics 8/	Age	Sex	Length of service 9/	Weekly wages	Kind of insurance 10/	Extent of disability 11/	Costs Indemnity compensation	Costs Medical payments	Brief description of cases included 12/
File 1: All cases were closed during 1983, regardless of year of occurrence. Available from National Technical Information Service. NTIS Accession Number PB85-234160/AS.																
Ark.	9,662	X	-	X	-	3/4	X,AOS	X	X	X	X	X	D	X	X	Involve death, permanent disability, or 8 or more days of disability.
Colo.	39,512	X	-	X	X	4/4	X	X	X	X	-	X	D	X	-	Involve death, permanent disability, or more than 3 shifts or days of disability.
Del.	4,400	X	-	X	X	4/4	X,AOS	X	X	X	X	X	D	X	-	Involve death, permanent disability, or 4 or more days of disability.
Iowa	21,103	X	TOA, TWB, LT	X	X	4/4	X,AOS	X	X	X	X	X	D	X	X	Involve death, permanent disability, or more than 3 days of disability.
Mont.	3,691	X	-	X	X	4/4	X	X	X	-	X	-	D	X	-	Involve death, permanent disability, or 6 or more lost workdays.
N.Y.	113,270	X	-	X	X	3/4	X,AOS	X	X	-	X	-	D	X	-	Involve death, permanent disability, or 8 or more days of disability.
N.C.	54,531	X	-	X	X	3/4	X	X	X	X	X	-	D	X	X	Involve death, permanent disability, 8 or more days of disability, or medical costs greater than $300, plus some cases with smaller amounts of medical costs.
Oreg.	30,994	X	TOA, TWB, LT	X	X	4/4	X	X	X	X	X	X	D	X	X	Involve death, permanent disability, or 4 or more days (1 to 3 days if worker is hospitalized) of disability.
Wis.	47,729	X	-	X	X	4/4	X,AOS	X	X	-	X	-	D	X	-	Involve death, permanent disability, or 4 or more days of disability.
Files available only from State agencies. 13/																
Ohio	102,875	X	-	-	X	4/4	X	X	X	-	-	X	-		-	Received during year and involve death, or 1 or more lost workdays for cases compensated by State Fund, or 7 or more days of disability for cases compensated by self-insurers.
Wash.	178,815	X	-	X	X	4/4	X,AOS	X	X	-	X	-	-	-	-	Received during year and involve death or medical treatment.
	44,126	X	-	X	X	4/4	X,AOS	X	X	-	X	-	D	X	-	Closed during year and involve death, permanent disability, or 4 or more days of disability.

1/ Total records: File 1 = 266,014; file 2 = 696,256; file 3 = 324,896.

An "(X)" indicates the State is sampling. The number of weighted cases for each State which is sampling appears in the column headed "Brief description of cases included" and is obtained by weighting each case by the inverse of the sampling ratio used in selecting that case for inclusion in the sample. Although weighting introduces sampling error, weighted totals by State are shown in unrounded form to aid data users in verifying totals. Total weighted cases: File 1 = 270,633; file 2 = 696,836; file 3 = 324,896.

2/ Year, month, and day are provided for date of occurrence of injury, or onset or diagnosis of illness.

3/ "Time workday began" and "Time of accident," if provided, are expressed in hours and minutes on a 24-hour basis, e.g., 10:29 a.m. = 1029, 10:29 p.m. = 2229. "Lapsed time" specifies the hour of shift during which employee was injured. These elements are not given for illness cases. Presence of these elements is indicated by:

TOA = time of accident
TWB = time workday began
LT = lapsed time

4/ Occupation of injured or ill workers is classified according to the U. S. Bureau of the Census Occupational Classification System utilized in the 1970 Census of Population.

5/ The industry of the injured or ill worker is classified according to the 1972 version of the Standard Industrial Classification Manual. An ownership code indicates whether the worker is employed by the private sector, by State government, or by local government.

6/ Public sector industry data represent State and local government workers only. Police protection, correctional institutions, fire protection, and refuse systems are coded at the 4-digit level. Other public sector nonmanufacturing data are coded at either the 2-, 3-, or 4-digit level. Public sector manufacturing data are coded at either the 3- or 4-digit level.

7/ Private sector industry data are coded at either the 3- or 4-digit level for private sector nonmanufacturing, and at the 4-digit level for private sector manufacturing. The first figure represents the level of coding detail for nonmanufacturing, the second for manufacturing.

8/ All cases include data on Nature of Injury or Illness, Part of Body Affected, Source of Injury or Illness, and Type of Accident or Exposure, classified according to the American National Standards Institute Z16.2 Method of Recording Basic Facts Relating to the Nature and Occurrence of Work Injuries. In addition, some States supply data for Associated Object or Substance (AOS), which identifies the object, substance, or person with respect to which measures could have been introduced to prevent the accident or mitigate the injury or illness.

9/ States supplied length of service in accordance with one of the following definitions:

E = length of service with employer
J = length of service in job

10/ Describes insurance carried by employers of injured or ill worker: Coverage is classified as private insurance, State fund, self-insurance, or no insurance.

11/ Extent of disability:

D = fatalities, permanent-total disabilities, permanent-partial disabilities, temporary disabilities, and other disabilities.
F = fatalities only

12/ This column describes the type of file and the selection criteria for the cases included.

13/ Data for the following States are available from the State agencies indicated:

Ohio: Industrial Commission, Division of Safety and Hygiene, Research and Statistics, 246 North High Street — 4th Floor, Columbus, Ohio 43215.

Washington: Department of Labor and Industries, Research and Statistics, General Administration Building — Room 335, Olympia, Washington 98501.

NOTE: X indicates the element is included in the file.
A dash indicates the element is not included in the file.

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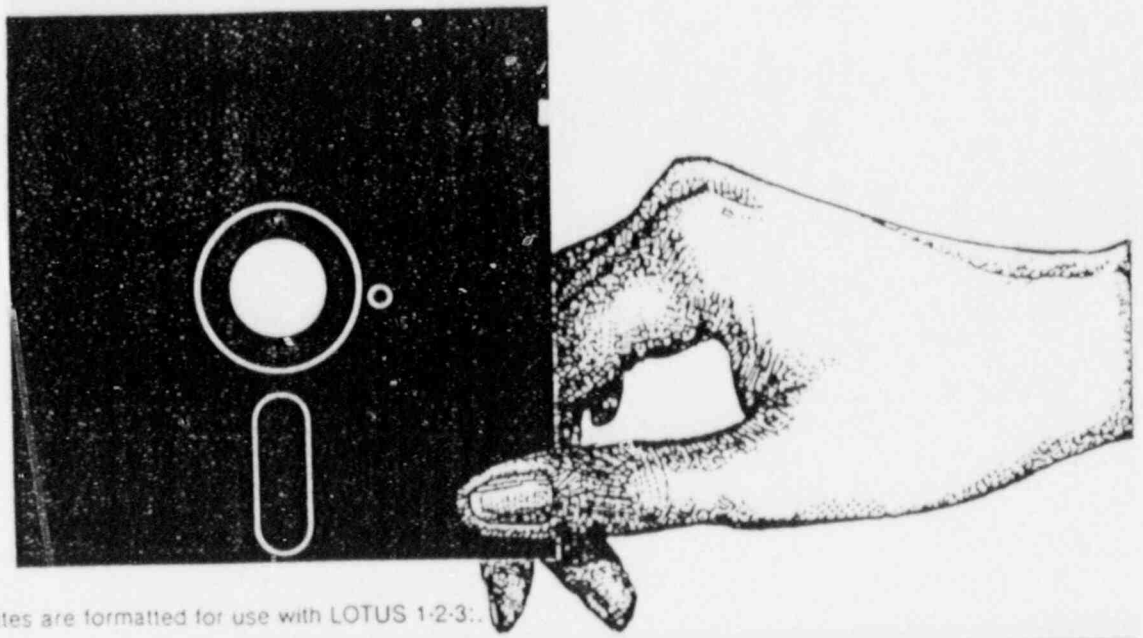

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NATIONAL CENTER FOR DEVICES AND RADIOLOGICAL HEALTH

PROBLEM REPORTING PROGRAM FOR RADIATION THERAPY DEVICES

SUMMARY OF REPORTS RECEIVED FROM January, 1980 to December, 1981

Prepared by Robert J. Morton, Chief, Radiation Therapy Branch

This is a summary of the seventy-seven reports received by the Problem Reporting Program (PRP) on radiation therapy devices between January 1, 1980 and December, 1981. These are reports that were submitted by practitioners to the U. S. Pharmacopeia, who then forwarded a copy to the manufacturer and to the National Center for Devices and Radiological Health (NCDRH), formerly the Bureau of Radiological Health, and sent an acknowledgement to the reporter. In this summary, the type of device, the manufacturer, the model and the problem or suspected problem as stated by the reporter are listed. The purpose of this summary is to inform users/owners of radiation therapy devices of the nature of problems observed and reported by others and to encourage the use of the PRP for reporting additional concerns.

All reports received by the USP are regarded as unverified information until the report can be analyzed by the manufacturer and NCDRH. As a result of these analyses, some of the problems have been found to be caused by poor understanding, care, or operation on the part of the user as well as by manufacturing processes or inherent problems with the product. There is no intent in this summary to claim or imply that a particular manufacturer's device or model is unsafe. Because the reporting is voluntary and may not be at all representative, you are cautioned not to draw conclusions about the equipment quality of the listed manufacturers. Also, no reflection on any specific manufacturer, distributer, reporter or product is intended or should be inferred from these examples.

When a problem is found to be generic, that is, it has a possibility of occurring on all models of the same or simular design, the manufacturer may initiate a device recall (field repair or component replacement). In the case of such a recall the manufacturer will notify all owners/users of the affected models, and will submit a corrective action plan (CAP) to the NCDRH for review. As of December 31, 1981, the following seven recalls were in effect; four resulting from PRP reports and three from information submitted directly by the manufacturer.

Co-60 12
Lin. Acc 17
Brachytherapy 2 Co-1 Ir-1

1. An AECL Cord Reel Assembly, which was sold to upgrade the field light system of the Theratron 60 and 80 and Eldorado 6 and 8 models was recalled because the assembly failed and restrained the source in the exposed position (PRP source).

2. The Siemens wedge filters for Mevatron 6 and 12 were recelled because the wedges did not meet specifications. (PRP source).

3. The Siemens flattening filter for certain serial numbers of the Mevatron 6 model was recalled because the filter could move.

4. The Siemens bending magnet coils in Mevatron 6 and 12 models with serial numbers greater than 1100 were recalled because the coils could move.

5. The Cascade Therapy Simulator electrical relay failed, allowing the patient couch to be raised into the x-ray collimator. (PRP source).

6 The Varian Patient Support Assembly, Model E854811-02, which includes the treatment couch has two major defects; breakage of plexiglass insert, and the lateral and vertical brake failures. Rewiring of the deadman switch and enable switch so that switches operate independently. (PRP source).

7. The AECL digital treatment model A 102409-654 (G7200), may malfunction when a battery pack overheats or a circuit board has not been properly seated. Timer found on 6 different models of units: Theratron 60, 80, 780 and Eldorodo 6, 8, and 78.

The additional problems listed below in chronological order by device catagory are either still under investigation and are therefore unverified, or were felt to be "one of a kind" isolated incidences and received individual repair or other response. They never-the-less remain in the data bank which is periodically queried for problem trends.

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United State Pharmacopeia
12601 Twinbrook Parkway
Rockville, Maryland 20852
Attention: Dr. Joseph G. Valentino

or by telephone at 800-638-6752 (in Maryland, call collect at 301-881-0256).

Device	Manufacturer/Model	Problem as Stated by Reporter
Cobalt-60 Teletherapy		
	Siemens Gammatron S 80	Heliowat timer failure.
	AECL Theratron 780	Mechanical timer dials stick when switch is turned on.
	AECL Theratron 780	The lateral and longitudinal breaks for the treatment couch are not reliable.
	AECL Theratron 80	Front source drawer stop bracket broke in half.
	AECL Theratron 780	Collimator and cover assembly was found ready to fall off, allen screws had worked loose.
	AECL Theratron 780	Table moves causing near falls by patient and damage to healthy tissue.
	AECL Theratron 780 Model 20 couch	Serious problems with the brake assembly
	AECL THeratron 780	Detachable stretcher fell off the carriage assembly while operating the machine.
	AECL Theratron 780	The distance indicator support rod fell out while it was "locked" in position.
	AECL Theratron 80	Field defining light cable shorted the 6 volt AC to ground when the field light was left in the on position.
	AECL Theratron 780	No provision for automatic cessation of couch movement in case of collision with other objects.
	AECL Theratron 780	Collimator setting display on the collimator does not function properly.

Device	Manufacturer/Model	Problem as Stated by Reporter
Linear Accelerator		
	Varian Clinac-18	Unit failed to terminate by primary or secondary dose monitor.
	Siemens Mevatron 20	Loose lead shield in front of collimator sheared several wires.
	Siemens Mevatron 20	Dose monitor automatically reset itself to zero after 399 and continued to run.
	Varian Clinac 18	Patient support assembly dropped suddenly during patient set-up.
	Siemens Mevtron 20	Light field mirror wraps; high voltage capacitor breaks on gantry rotation.
	Siemens Mevatron 12	Target not secured, electrons produce x-rays by striking flattening filter.
	Siemens Mevatron 6	"Z" table went down too far bypassing limit and safety switches, jammed in position and could not be raised.
	Siemens Mevatron 12	Small piece of lead, apparently from beam stopper, jammed same and caused retract motor to fall.
	Siemens Mevtron 6 & 12	Wedge interlock systems inoperative.
	Varian Clinac 6-100	Patient support assembly: locks slip, top not level, patient's fingers can get caught under top.

Device	Manufacturer/Model	Problem as Stated by Reporter
Linear Accelerator		
	AECL Sagittaire	Table top incapable of supporting heavy patients without sagging.
	AECL Therac 20 Scanner	Scanner for the electron beam was not scanning the full therapy field.
	Varian Clinac 6/100	The table drove to full up position upon depression of the deadman switch.
	Siemens Mevatron 20	Program counter did not terminate radiation upon coincidence of the set monitor units and the accumulated monitor units. Radiation could not be terminated by the "RAD OFF" button or turning the key switch. Main power switch had to be used.
	Siemens Mevatron 12	Optical distance indicator can become loose.
	Varian Clinac 6/100	Thumb wheels on hand pendant stick or jam in operating position.
	Varian Clinac 4	Calibration of dose integrator abruptly changed by 27%. Corrected by changing printed circuit board.

Device	Manufacturer/Model	Problem as Stated by Reporter
Simulator	Picker Ther-X	Gantry loadnut wear
	Toshiba LX-8-AA	Significant radition outside light field.
	AECL Therasim 750	Fifteen major malfunctions; hand and table controls.
	Siemens Ximatron	Operator's manual not provided with unit.
	Cascade RTS	Film cassette holding device fell on patient.
Orthovoltage X-ray		
	Philips RT-255	Rotation of inner x-ray aperture with respect to aperture of treatment cone.
	Siemens Stabilipan	If timer is accidently set between two time increments, x-rays can be produced, but exposure will not terminate automatically.
Superficial X-ray		
	Picker Zephyr (85kVp)	Time selection errors can occur due to "play" in timer. X-ray switch remains in "ON" position after exposure, accidental exposure can occur if time is reset.
	Bucky X-Ray International C-2 Bucky Comb.	Machine failed while treating a patient, pressure diaphragm failed after patient removal and sprayed oil around room.
	Bucky X-Ray International	Machine has failed to work despite being replaced and/or repaired several times.

Device	Manufacturer/Model	Problem as Stated by Reporter
Brachytherapy		
	Nuclear Associates CS-137 Hairpins	Sources found to be leaking on arrival of shipment.
	Rad-Irid shipping container	Both ends of container are open and Iridum-192 seeds may fall through.
Radiation Monitor		
	Victoreen Primapak	Installation instructions incorrect, input and output receptacles interchanged.

NATIONAL CENTER FOR DEVICES AND RADIOLOGICAL HEALTH

PROBLEM REPORTING PROGRAM FOR RADIATION THERAPY DEVICES

SUMMARY OF REPORTS RECEIVED FROM January, 1982 to June, 1982

Prepared by Robert J. Morton, Chief, Radiation Therapy Branch

This is a summary of the thirty reports received by the Problem Reporting Program (PRP) on radiation therapy devices between January 1, 1982 and June 15, 1982. There have been a total of 107 reports from the beginng of the program in January 1980 until the end of the period covered by this report. These are reports that were submitted by practitioners to the U. S. Pharmacopeia, who then forwarded a copy to the manufacturer and to the National Center for Devices and Radiological Health (NCDRH), fromerly the Bureau of Radiological Health, and sent an acknowledgement to the reporter. In this summary, the type of device, the manufacturer, the model and the problem or suspected problem as stated by the reporter are listed. The purpose of this summary is to inform users/owners of radiation therapy devices of the nature of problems observed and reported by others and to encourage the use of the PRP for reporting additional concerns.

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Co-60 21
Lin Acc- 9
Brachytherapy- 0

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Device	Manufacturer/Model	Problem as Stated by Reporter
Linear Accelerator		
	Varian Clinac 4	Intermittently the dose counter on the console jumps in one of the decades. On occasion, the jump could pass the preset levels, in which case the machine would not shut off as it should. When interlock systems are activated and machine is shut down during treatment, there is no provision of lowering the table to evacuate the patient.
	Varian Clinac 18	Excessive radiation leakage occurs at the distal end of the primary electron carrier when the collimators are set at 30 x 30 cm.
	Siemens Mevatron 67	High voltage tension lead to waveguide filament arced to adjacent wires resulting in significant damage to electronics and fire potential.
	Varian Clinac 4	Small ball bearings started falling out of unit's head. Found ball bushing assembly on lower jaw assembly had broken open.
	Siemens Mevatron 74	When machine was turned on and allowed to stabilize and to come up to temperature, a transistor shorted and burned some transistors on the pulsar control board. The transformer shorted out and damaged the injector.
	Varian Clinac 4	When radiation beam was on, no indication of it was recorded by the monitor units and no time was indicated on the timer.
	Varian Accelerators	When hand control, which is made of heavy duty hard plastic, drops, small plastic pieces break loose inside the unit and jam the safety switch and machine movement control wheels.

Linear Accelerator		
	Varian Clinac 4	The cadmium plating on the interior surface of the collimator port is flaking.
	Varian Clinac 6-100	The mylar film on the patient support assembly may break loose from the supply roll when nearing the end of the roll.
Co^{60}		
	AECL Theratron 780	Breaking of a coupling pin which ties the source drawer to a hydraulic cylinder. In a certain position of arm rotation, if this pin should break, the pin can be wedged into the source mechanism, preventing the source from returning to the safe position.
		Two malfunctions caused by a malfunction of the cord retraction spool associated with the beam defining light system. Malfunction was indicated by a failure of the beam defining light to illuminate.
	AECL Theratron 80	Gantry continued to rotate after the rotate button on the hand control was released. Unit stopped rotating after pushing the emergency stop button.
	Picker C9	Disintegrating belt jammed source drive mechanism. Source jammed in the "on" position.
	Picker V-10,000	The timer on the control panel will usually turn off the CO^{60} exposure when it reaches zero, but not always.
	AECL Theratron 780	Source did not withdraw completely after treatment due to insufficient air pressure within the source withdrawal system.
	AECL Eldorado 6; Theratron 60	Radiation beam was unable to meet its specifications because of the increased transmission outside the useful beam

Co^{60}

AECL Theratron 780	Source would not extend completely due to a defective cord reel which caused wire to obstruct source cylinder. Prior to this the source retract very slowly.
AECL Theratron 780	No operative strain gauge on the couch to cause an interruption in couch and/or gantry motion in case of collision.
	The collimator setting display on the collimator does not function properly. Elements of the LED display are burned out.
ker C8m/80	Clockwise drive relay: The neutral wire insulation became worn and the wire shorted to ground energizing a relay, continually driving the "C" arm in a clockwise direction.
Siemens Gammatron S	One of the buttons on the digital display stuck. One display digit continually rolled over. The other two timers did not count at all. The machine did not turn off.
AECL Theratron 780	Norgren compressed air regulator in the source drawer pneumatic drive system has excessive number of air leak failures.
AECL Theratron 80	Electronic Digital Treatment Timer failed. As a result, the LED's did not display the usual letters and numbers and the source remained on.
	Source remained in exposed position after unit had been shut off. Both the emergency shutdown button and the interlocked treatment room door failed to retract the source. When the main power circuit was turned off, the source retracted. Problem was in a circuit board.
	Since replacement of the "cord reel" assembly with the "conductor tape" assembly the field defining light would fade occasionally and become very dim.

Device	Manufacturer/Model	Problem as Stated by Reporter
Cobalt-60 Teletherapy		
	Picker Model 6223	Loose light bulb from source location indicator jammed source in exposed position.
	AECL Theratron 80	Lights incorrectly indicated source still exposed after treatment.
	Picker C-9	Source sticking in exposed position.
	AECL Theratron 80	Air cylinder malfunction, source would not retract.
	Picker C-9	Tabs to limit arc slip, and fail to reverse gantry.
	Picker Table #3702	Patient treatment table failed to stop when being lowered.
	AECL Theratron 80	Unit stops during rotation.
	AECL Eldorado 8	Field light housing installed improperly. Source drawer stuck in exposed position.
	AECL Theratron 80	Source remained exposed at termination of treatment. Replaced detent pin and air cylinder.
		t undergoes 360 rotation when

NATIONAL CENTER FOR DEVICES AND RADIOLOGICAL HEALTH

PROBLEM REPORTING PROGRAM FOR RADIATION THERAPY DEVICES

SUMMARY OF REPORTS RECEIVED FROM June, 1982 to December, 1982

Prepared by Frank Kearly and Robert J. Morton, Radiation Therapy Branch

This is a summary of the thirty-three reports received by the Problem Reporting Program (PRP) for Radiation Therapy Devices from June, 1982 through December, 1982. There have been a total of 140 reports from the beginning of the program in January 1980 until the end of the period covered by this report. These are reports that were submitted by practitioners to the U.S. Pharmacopeia, who then forwarded a copy to the manufacturer and the National Center for Devices and Radiological Health (NCDRH), formerly the Bureau of Radiological Health (BRH), and sent an acknowledgement to the reporter. In this summary, the type of device, the manufacturer, the model and the problem or suspected problem as stated by the reporter are listed. The purpose of this summary is to inform users/owners of radiation therapy devices of the nature of problems observed and reported by others and to encourage the use of the PRP for reporting additional safety hazards.

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Co-60 7
Linac- 18
Brachy.- 4 (3 Ir-192)
1 Cs-137

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Device	Manufacturer/Model	Problem as Stated by Reporter
Linear Accelerators	Varian/Clinac 20	Spring loaded latch assembly for electron applicator/accessory mount can be unintentionally released.
	Toshiba/LMR-13-3A	Cooling hoses broke in gantry
	Varian/Clinac 4	Dirty contacts in counting module caused increased resistance and "jumping over" of prescribed dose. Unit failed to terminate by prescribed dose.
	Siemens/Mevatron 6 Z11 Couch	When at 5° or more, pedestal was in collision path with gantry. Also, cable shield on pedestal protruded, contacting gantry.
	Varian/Clinac 18	If modulator start switch is fixed in "Momentary On" position all "Emergency off" switches are defeated.
	Philips/SL 75/5	Welds broke on main bearing that holds gantry to main frame.
	Siemens/Mevatron 74	Two key switches, Rad On and Reset, are sticking and not returning to proper position when released.
	AECL/Therac 6 & Therac 20	Optical distance indicator is blocked by patient's head and shoulders.
	ATC/Therapi-4	"X-Ray On" and "Complete" switches failed in closed position.
	Varian/Clinac 18	On several occasions port verification film, taken using tray with metal markers to indicate central axis, showed field was too high or too low, while central ray was positioned correctly.
	Varian/Clinac 6/100	Slippage device wears out on clutch connecting chain drive to power unit. Gantry can rotate rapidly without control.
	AECL/Therac-20	Drive shaft fractured during ascent resulting in a 6" drop of table and patient.

Device	Manufacturer/Model	Problem as Stated by Reporter
Linear Accelerators	Varian/Clinac-12	While running, Rads-1, Rads-2 and Time would reset to zero and begin counting again with accelerator continuing to run. Back-up dose counter not fully independent of primary dose counter.
	Varian/Clinac 4	While gantry rotating during a rotational treatment, table moved in longitudinal direction several centimeters.
	Varian/Clinac 4	Unexpected table motion results when deadman switch is depressed, because spring on hand control snapped.
	Siemens/Mevatron 20	24% beam asymmetry and 1 cm light-field/-radiation field offset caused by sticking mode slide, and not sensed by either flatness and symmetry interlock or mode slide interlock.
	Siemens/Electron Beam Applicators	Openings at mounting end of applicator a potential hazard to accidental exposure to patient's fingers during chest wall treatment.
	Philips/SL-75-14	Unit was to be set at 8 MeV but had been set at 10 MeV
Cobalt-60 Teletherapy	AECL/Theratron 80	Due to broken connection of NR13 wire at the low air pressure safety switch, primary and back-up timer did not activate.
	AECL/Theratron 80	Machine started in rotation mode because mode selection was not turned back to "fixed" after previous patient.
	Picker/C-9	Clock spring was broken and source stuck open.
	Picker	Weak shutter spring and tight drive belt caused unit to remain in "beam on" after timer went to zero and timer switch went to "off".
	AECL/Theratron-80	Short in wiring of hand control pendant caused head swivel motor to be energized.
	AECL/Theratron-80	Burnt relay caused source head to continue rotation after button on hand control was released.
	AECL/Theratron-80	Source drawer stuck because auxilliary source retaining bracket scraped source drawer cylinder.

Device	Manufacturer/Model	Problem as Stated by Reporter
Simulator	Cascade/RTS	If film cassette holding device not properly locked in, nothing to keep it from falling.
	Picker/Ther-X	Failure in rocker switch at remote console caused x-ray tube to be driven radially outward after local switch was released.
	ATC	One of the soft metal bolts on cassette holder cantilever mechanism sheared allowing extended beam to loosen.
Low Energy Photon	Philips/RT100	Filter loose, fell out of holder. Machine could produce x-rays with holder in place and filter out of machine.
Brachytherapy	Nuclear Assoc./Fletcher-Suit Applicator	Bucket carrier too small for source insertion. One cap missing a shield. Difficulty in screwing tube caps on and off. Snap-on ovoid plastic chipping and tearing. Bucket carrier broke off leaving source in applicator. G-137
	Rad-Irid/Ir-192 Ribbons	Of 19 ribbons, 7 have improper seed configuration with dose variation of more than 10% for each ribbon.
	Alpha-Omega/Ir-192 Ribbons	Ir-192 seeds are not firmly secured in plastic tubing. Seeds fell out when taken out of lead container.
	Alpha-Omega/Ir-192 Ribbons	Seeds shifted in the ribbon.

NATIONAL CENTER FOR DEVICES AND RADIOLOGICAL HEALTH
PROBLEM REPORTING PROGRAM FOR RADIATION THERAPY DEVICES

SUMMARY OF REPORTS RECEIVED FROM JANUARY 1983 TO JUNE 1983
Prepared by Robert J. Morton, Division of Professional Practices

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Co-60 9
Lin. Acc. 4
Brachytherapy 5 3 + 192
1 Unknown
1 Pa (apparent)

Teletherapy: Cobalt-60

Manufacturer/Model	Abridged Stated Problem
AECL/Theratron-80	Source drive air cylinder leeked causing excessive source retraction time.
Picker/C-9	Source remained in exposed position until tech pushed emergency bar on control panel. Discovered frozen gear in drive train.
AECL/Eldorado-8	Digital timer installed to replace analog timer failed to return source to stored position occasionally. Timer replaced, problem continued. Firm supplied "noise filter kit" to correct.
AECL/Eldorado-8	Conductor tape for field defining light broke and source position light falsely showed "ON". Radiation monitor indicated source in stored position. More frequent "tape" replacement might be indicated.
AECL/Theratron-780	Two cord retraction assembly failures in 15 months caused by either breakage or slippage of tension spring.
AECL/Theratron-780	Cord reel assembly jams causing source to fail to retract completely. Brakes for table poor and foot pedal inadequate for table.
AECL/Theratron-80	Source failed to return to stored position due to mechanically sticking air valve.
AECL/Theratron-80	Source stuck in "ON" position due to kinked/twisted springsteel conductor for field light.
AECL/Theratron-80	Source stuck in "ON" position. Found three of four screws connecting source drawer to hydraulic ram were loose, fourth was missing.

Teletherapy: Linear Accelerator

Manufacturer/ModeL	Abridged Stated Problem
AECL/Therac 20	High output noted for electrons during routine calibration. Fuse to "Y" scanning magnet had blown stopping movement in this axis. Possible patient overdose or non-uniform dose.
AECL/Therac 20	Uses unsealed monitor chamber for both x-ray and electron mode. Variations up to 3.5% seen for 18 MV x-ray output

	over several months due to variations in temperature and atmospheric pressure.
Varian/Treatment Couch	Mylar does not support patient properly, plastic inserts warp under moderate pressure from mylar, difficulty in obtaining level surface; too much "see-saw" motion.
Siemens/Z3 Treatment Table	Vertical motion chain broke and table top fell down onto pedestal top (in this case only about two inches.)

Brachytherapy

Manufacturer/Model	Abridged Stated Problem
Nuclear Associates/ 67-905 Colpostat	New source carrier without source became stuck in Fletcher-Suit afterloading colpostat. Sent to manufacturer for removal.
Best Industries/ Ir-192 Ribbons	Incorrect seed spacing and source activity variation in same ribbon indicated on autoradiography.
Radium Chemical/ Fletcher-Suit Tandem	Rounded end came off tandem and was seen in patient's uterus on simulation with dummy sources.
Alpha-Omega/ Ir-192 Ribbons	Migration of seeds within the ribbon observed on localization radiograph of patient.
Alpha-Omega/ Ir-192 Ribbons	Seeds shifted in ribbons; alters dose.

Low Energy Photon

Manufacturer/Model	Abridged Stated Problem
Picker/Orthovoltage	Lead collimator became un-glued from collimator cone.
Bucky/Superficial	Unit turned on by itself and could not be turned off.
G.E./Maximar 100	Toggle switch to select high (50-100 KV) or low (0-50KV) energy inadvertently switched to "low", but dual-reading analog meter remained at "high". Possibility of patient underdose.

CENTER FOR DEVICES AND RADIOLOGICAL HEALTH
PROBLEM REPORTING PROGRAM FOR RADIATION THERAPY DEVICES

SUMMARY OF REPORTS RECEIVED FROM July 1983 TO JUNE 1984

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Co-60 5
Linac 14
Brachy. 3 2 I-125
1 Unknown

Teletherapy: Cobalt-60

Manufacturer/Model Access Number	Abridged Stated Problem
AECL/Theratron 780 R-20147	Source drawer did not return to fully stored position. Dislodged electrical clip jammed light field wire.
AECL/Theratron 780 R-20156	Set screw fell out of vertical drive pulley allowing instantaneous 15 cm drop of couch top.
AECL/Theratron 780 R-20157	Loose screw on one collimator hinge allowed measured field size to change although readout size remained the same. Output changed by 44 percent.
AECL/Theratron 80 R-20196	Gantry rotated additional 30 degrees after rotation button was released, but stopped when table rotate button was pushed.
Siemens/Gammatron S R-20199	In arc mode, gantry overshot actuator at 150 degrees and came to rest at actuator at 350 degrees.

Teletherapy: Linear Acclerator

Manufacturer/Model Access Number	Abridged Stated Problem
AECL/Therac 20 R-20144	Malfunction of electromechanical device allowed flattening filter to be misaligned at gantry angle of 270 degrees resulting in fifteen percent overdose to right lateral fields.
Varian/Clinac 4 R-20145	Reporter learned of control "chip" that tends to malfunction and called for better communication from manufacturer.
Varian/Clinac 4/100 R-20152	Collimator accessory holder latch accidentally released while attempting to remove wedge filter. Twenty-five pound block fell. Minor injuries to tech.
AECL/Therac 6 R-20154	Malfunction of "interface board" allowed gantry to rotate on its own, up to 180 degrees, on several occasions. Beam was not on, dead-man switch not depressed and gantry not set for arc.
Siemens/Mevatron XII R-20158	Tech received electrical shock when touching control pendant and treatment table at the same time.

Varian/Clinac 4 R-20167	Nixie tubes and backup counter intermittently self cleared after treatment due to faulty "stopgate card."
Varian/Clinac 18 R-20173	Treatment table would not stop rising during electron treatment. Water in table well had shorted controls. Tech pulled patient from table averting injury.
Varian/Clinac 4 R-20174	Nickel plating on uranium flattening filter was flaking off. Some flakes were radioactive.
Siemens/Mevatron 77 R-20186	Treatment table frame attenuates a 40 x 40 cm field from 180 degree direction by about 10 percent of central ray.
Varian/Clinac 18 R-20191	Extreme force necessary to insert or remove electron treatment cones resulted in injury of an operator.
Varian/Clinac 4/100 R-20192	Machine set for fixed field treatment went into arc mode. Gantry rotated 25 degrees and delivered 23 monitor units before stopped by tech.
Varian/Clinac 20 R-20198	Electron cone was placed in accessory mount without removing zero cone plug. As a result, cone was not locked and fell out when gantry was rotated.
Siemens/Mevatron XII R-20203	Mark II treatment couch vertical lift mechanism failed. Drive sprocket came off motor shaft and safety strap pulled loose. Patient dropped approximately 20 inches.
Varian/Clinac 6/100 R-20204	Accessory tray bar disconnected from treatment head and fell to table narrowly missing patient's head.

Simulator

Manufacturer/Model Access Number	Abridge Stated Problem
Old Delft R-20182	Several motions (table, tube support and gantry) operated simultaneously without operator control.
Cascade R-20183	Patient couch top dropped spontaneously.

Kermath R-20201	With gantry at 45 degrees, motorized cassette holder fell to floor. Two mounting bolts had come loose.

Brachytherapy

Manufacturer/Model Access Number	Abridged Stated Problem
3M/I-125 Seeds R-20150	Three cases of seeds ruptured during implant procedure.
3M/Colpostat R-20178	Welds on Fletcher-Suit-Delcos colpostats failed in four units.
3M/I-125 Seeds R-20205	Bottom of glass shipping bottle fell off spilling I-125 seeds on floor. Unbreakable bottle recommended

Low Energy Photon

Manufacturer/Model Access Number	Abridged Stated Problem
Picker/Zephyr R-20142	About 6.7 R/min detected 3 cm from end of cone when key and timer in off position and filament control set to minimum.
Siemens/Stabilipan R-20146	Timer failed to terminate radiation at end of treatment.

Miscellaneous

Manufacturer/Model Access Number	Abridged Stated Problem
S&S X ray/Calipers R-20168	Patient thickness measured inaccurately by 3 to 4 cm, could lead to overdose.

CENTER FOR DEVICES AND RADIOLOGICAL HEALTH
PROBLEM REPORTING PROGRAM FOR RADIATION THERAPY DEVICES

SUMMARY OF REPORTS RECEIVED FROM JULY 1984 TO DECEMBER 1984

Prepared by Clifford D. Evans and Robert J. Morton

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Teletherapy: Cobalt-60

Manufacturer/Model Access Number	Abridged Stated Problem
AECL/Eldorado 78 R-20208	Failure in control circuit panel. This caused the source to become stuck in the open position.
Picker/V-9 R-20218	Distortion of the source wheel, due to heat build-up, from a high activity source (9000 RHM). This resulted in the unit sticking in the "off" position.
AECL/Theratron 780 R-20224	A short in the hand control cable caused extensive damage to the card file, printed circuit boards, and main frame components.
AECL/Eldorado 78 R-20236	A defective solid-state relay in a circuit board caused the source to move to the exposed position.

Teletherapy: Linear Accelerator

Manufacturer/Model Access Number	Abridged Stated Problem
Varian/Clinac 6/100 R-20212	Machine did not stop at thumbwheel dose. The mechanical detents on the thumbwheel switches became erratic with use, and the switches would not properly decode the preset numbers.
Varian/Clinac 18 R-20216	Latches on accessory, wedge, and electron cone mounts can release without warning from pressure on latch hook. (See company warning letter of 4-12-84).
Siemens/Mevatron 67 R-20217	Radiation levels beyond beamstopper exceed 1% for field sizes 27x27 to 40x40 cm.
Varian/Clinac 6/100 R-20221	Numerous problems with patient support assembly. These included intermittent failure of lateral and longitudinal locks for treatment couch top, and failure of PSA to lower on command from the hand pendant.
Siemens/Mevatron XII R-20225	Tech was using the hand control to set up treatment parameters while a patient was on the treatment couch. When the hand control arm was moved on its axis, the entire hand control assembly fell.

Varian/Clinac 18 R-20227	The beam was able to be turned on again without reprogramming when the thumbwheel monitor unit setting was increased and the "beam off reset" was pressed.
Siemens/Mevatron 74 R-20229	A defective Q6 transistor on the S3 panel printed circuit board allowed the machine, when configured for electrons, to radiate x-rays when so programmed on the console.
Varian/Clinac 18 R-20231	Tech hit his head on the protruding latch lever of the accessory mount. This caused the electron cone to fall and strike the patient. (See R-20216).
Varian/Clinac 20 R-20238	Center lock of the patient support assembly malfunctioned. Pressure on the couch top caused the hinged end of the couch to raise up in a catapult manner.
Varian/ Clinac 18 R-20240	Radiation therapy treatment was administered to at least one patient while the machine was miscalibrated, causing an overexposure.

Simulator

Manufacturer/Model Access Number	Abridged Stated Problem
Kermath R-20245	While the gantry was being rotated, the tray containing the cross hair popped out of its seated position in the collimator head.

Brachytherapy

Manufacturer/Model Access Number	Abridged Stated Problem
3M/I-125 Seeds R-20210	Several weeks after implantation, one of the implanted seeds was determined to be a dummy seed.
3M/Colpostat R-20239	Defective welds on Fletcher-Suit colpostats.

CENTER FOR DEVICES AND RADIOLOGICAL HEALTH
PROBLEM REPORTING PROGRAM FOR RADIATION THERAPY DEVICES

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Teletherapy: Cobalt-60

Manufacturer/Model Access Number	Abridged Stated Problem
AECL/Theratron 80 R-20252	Source retracted to the off position only after an extensive delay (2 minutes).
Toshiba/Not Known R-20257	Source did not retract at the completion of treatment due to broken teeth on two of the bevel gears.
Picker/C-9 R-20264	Source would not come on when the unit was rotated 180°.
Picker/C-9 R-20271	When the C-arm was placed at 90° and the large tray was attached, the machine began to drift towards the floor approximately 5 to 7 degrees.
Picker/C-9 R-20272	On routine calibration the measured output was 7.8% higher than expected, due to a pellet shift within the source.

Teletherapy: Linear Accelerator

Manufacturer/Model Access Number	Abridged Stated Problem
Siemens/Z-11 Couch R-20248	The main drive chain broke while the couch was at its highest position, causing it to drop approximately 20 inches.
Varian/Clinac 4 R-20258	The dose integrator meter was not working so treatment dose was registered only in the mehcanical counter.
Siemens/Mevatron 77 R-20266	The hand-pendant ceiling cover fell off.
Philips/SL75-20 R-20274	The tongue on the latching mechanism of the tray holder may not fully insert into the holding plate if the tongue is not fully extended.
Varian/Clinac 6/100 R-20276	While the gantry was being rotated the accessory mount from the machine fell off onto the floor.

Simulator

Manufacturer/Model Access Number	Abridged Stated Problem
AECL/Therasim 750 R-20247	In the gantry lateral position, with the image intensifier at its lowest travel, the table locked in the alarm position.
AECL/Therasim 750 R-20250	When the dead man switch was pressed, the image intensifier moved towards, and actually touched the patient, but the alarm failed to sound.

Brachytherapy

Manufacturer/Model Access Number	Abridged Stated Problem
Alpha-Omega/Ir-192 Seeds R-20265	During removal of an implant it was found that seeds had shifted in 4 of 7 nylon ribbons, so that proper spacing had not been maintained.
Alpha-Omega/Ir-192 Seeds R-20269	During removal of an implant, seeds slipped out of the nylon ribbon.

Low Energy Photon

Manufacturer/Model Access Number	Abridged Stated Problem
Bucky/Superficial R-20268	Unit turned on by itself and could not be turned off.

Hyperthermia

Manufacturer/Model Access Number	Abridged Stated Problem
RSD Medical/SB-035 R-18120	Output varied + or - 20 watts from the set power level.

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Teletherapy: Cobalt-60

Manufacturer/Model Access Number	Abridged Stated Problem
Siemens/Gammatron S R-20278	Defect in timer caused it to stop before the completion of treatment, but the source remained in the exposed position.
Siemens/Gammatron S R-20288	The posterior field, after being locked, would shift laterally, by up to 1.5 cm.
AECL/Theratron 66 R-20296	A pressure regulator switch (S15) on the pneumatic system failed. This caused the compressor to continue running, resulting in an overpressure condition in the holding tank.
Picker/C-9 R-20311	The source rotor stuck as it was rotating towards the "on" position.
AECL/Theratron 780 R-44456	A failure in the timer motor and treatment solenoid driver (Board B12) caused the therapy beam to be turned on and off solely by the door interlock switch.

Teletherapy: Cesium-137

Manufacturer/Model Access Number	Abridged Stated Problem
Picker/PX-65 R-20314	A difference in the output between horizontal and vertical beam directions caused by the corrosion and disintegration of a retaining spring inside the capsule.

Teletherapy: Linear Accelerator

Manufacturer/Model Access Number	Abridged Stated Problem
AECL/Therac 25 R-20277	Gantry rotated on its own, with enough force to crush equipment that was located where a patient would normally be positioned.
Varian/Clinac 18 R-20281	Lower collimating jaw was wide open (35 cm), but the jaw size indicators indicated 16 cm. Lower jaws were not parallel to one another and moved slowly and erratically.

Siemens/Mevatron 20 R-20294	Numerous weld fractures at the load bearing struts caused a 3 to 4 mm shift in the gantry rotational center.
Varian/Clinac 2500 R-44625	Apparent drift in machine output due to the upper chamber being damaged by a protruding screw. The greatest patient exsposure was 8% greater than intended.
AECL/Therac 20 R-44628	Malfunction in the video terminal while treating the patient in the electron mode. Display on the screen was filled with the "@" symbol.
Varian/Clinac 1800 R-44647	Upon starting the machine it was observed that the dose rate indicator was showing 240 rad/min, but the integral dose meters remained at zero.

Simulator

Manufacturer/Model Access Number	Abridged Stated Problem
Oldefelt/Simulix-Y R-20312	Due to a bad circuit board the machine began to move on its own. The shutters opened up to the largest field size, the patient table moved up 3 feet, and the gantry began to rotate.
AECL/Therasim 750 R-44464	A ceiling-mounted hand control came loose and fell on a patient, who suffered a contusion of the left shin. It was found that a roll pin which supported the control had become loose and fallen out.
AECL/Therasim 750 R-44475	While performing a patient simulation the hand control assembly abruptly fell. The metal elbow joint appeared to be sheared, as if the metal had been stressed.

Brachytherapy

Manufacturer/Model Access Number	Abridged Stated Problem
Radium Chemical/ Fletcher-Suit Applicator R-20308	There was a broken weld at the end opposite the ovoid.

Low Energy Photon

Manufacturer/Model Access Number	Abridged Stated Problem
Siemens/Stabilipan R-20310	The beam indicator light was on and the timer had been activated, but no x rays were produced.

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Teletherapy: Cobalt-60

Manufacturer/Model Access Number	Abridged Stated Problem
AECL/Theratro 780 R-44779	A shorted filter capacitor in the braking and and drive disable circuit caused the couch and gantry to move without the technician operating the direction control switches.
AECL/Theratron 80 R-44781	The machine continued to rotate an additional 60 to 90 degrees despite the fact that the button on the had control had been released.
AECL/Theratron 780 R-18661	Defective timer did not shut off at the end of treatment, resulting in an overexposure to the patient of approximately 10 R.
AECL/Theratron 780 R-18687	Interlock on the treatment room door failed to terminate treatment when the technologist prematurely opened the door and entered the room.
AECL/Theratron 780 R-45180	The machine would operate when the "on" button was pushed, without the timer being set.
Picker/C-9 R-45371	The source remained in the exposed position after treatment had been completed.
Picker/C-9 R-45418	Table short circuits whenever it is moved, causing several fuses to blow.

Linear Accelerator

Manufacturer/Model Access Number	Abridged Stated Problem
Varian/Clinac 18 R-44770	The bolts that hold the counterweight in place came loose, and the counterweight fell to the floor.
Varian/Clinac 18 R-44817	Collimator jaws would change size whenever the couch was moved.
Varian/Clinac 6 R-44807	A shorted coaxial cable in the head caused the dose integrator to not register the accumulated dose.
Varian/Clinac 6 R-44809	Inspection of depleted uranium shielding at the back of the accelerator guide revealed two rough, uncoated areas or uranium that upon wipe testing demonstrated a small quantity of removable contamination.

Varian/Clinac 6 R-45106	Loss of power to the water pump due to the fusion and subsequent melting of a male/female connector plug.
AECL/Therac 25 R-45210	The photon beam mode was mistakenly entered instead of the electron beam mode. When the correction was enetered into the machine it moved the photon target out of position but did not turn on the scanning magnets and retained the original 25 MeV energy and the photon beam current. The result was an electron beam at the photon beam parameters. Two patients were treated in this manner. Both received large overdoses, and one death has resulted.
Varian/Clinac 4 & 6 R-45225	Dose integrator in three machines would count when the beam was "off". It was discovered that none of these machines contained the most recent integrator PCB's.
Varian/Clinac 4 R-45227	Freon 22 was mistakenly loaded into the machine instead of Freon 12. This caused arcing and the Freon 22 to breakdown and contaminate the machine with an oily film.
Varian/Clinac 18 R-45318	Symmetry meter failed to terminate the machine's operation although all planes, at all energies, were found to be asymmetric by as much as 5 percent.
Siemens/Mevatron 74 R-45313	A loose drive chain on the table caused the table to drop 2-4 inches when being lowered.

Simulator

Manufacturer/Model Access Number	Abridged Stated Problem
Kermath/TSL-XY R-45284	Intermittant problem of of uncommanded gantry rotation when only the deadman switch had been pressed.
Toshiba/LX-30A R-45342	Installation error caused the cassette holder to not be fastened to the image intensifier. When the tube stand was rotated the loaded cassette holder fell to the floor.
Oldfeldt/Simulix-Y R-45467	Tube gantry moved without operator control. This motion continued until the safety touch bar hit the table top.

Brachytherapy

Manufacturer/Model Access Number	Abridged Stated Problem
Alpha-Omega/Ir-192 Seeds R-44844	Upon removal of twelve ribbons from a patient it was found that the seeds had shifted in three of the ribbons, and one seed had fallen out of a fourth ribbon.
Alpha-Omega/Ir-192 Seeds R-44845	Seeds had shifted in two ribbons, so that the proper spacing had not been maintained.
Best/Ir-192 Seeds R-45064	The encapsulation on one seed was defective, causing the seed to become dislodged from the encapsulation.
Radium Chemical/ Fletcher-Suit Applicator R-45439	Pins that act as the pivot of the source holder on two ovoid afterloaders are faulty. One pin is half-way out and the other is missing.

Low Energy Photon

Manufacturer/Model Access Number	Abridged Stated Problem
Bucky/Superficial R-44903	Upon installation, due to a faulty transformer, the machine would produce radiation without being turned on.

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Brachytherapy 2 1 Ir-192
1 Ra needle

Teletherapy: Cobalt-60

Manufacturer/Model Access Number	Abridged Stated Problem
AECL/Theratron 80 R-45867	The gantry failed to rotate, the collision arm came on spontaneously, and the emergency power off buttons on the couch failed as a result of the radiation therapy clinic being flooded with 3 inches of water.
AECL/Theratron 780 R-45871	When treatment was initiated, the timer started but the beam did not come on. The problem was due to a faulty solenoid.
Picker/C-9 R-45934	A small metal tab became lodged near the gantry head terminal stop at the source on/off position. This caused the source wheel to be turned to the "on" position after the technologist had rotated the gantry 90 degrees.
AECL/Eldorado 78 R-45941	When the optical distance indicator beam passes through the manufacturer supplied plastic tray block support there is a distortion of 0.5 cm in SSD readings.
AECL/Theratron 80 R-46013	A short developed in relays K7 and/or K9, which caused the gantry to continue to rotate even though the actuating button had been released.
Picker/C-9 R-46038	The timer failed to terminate the treatment at the preset time.

Linear Accelerator

Manufacturer/Model Access Number	Abridged Stated Problem
Varian/Clinac 4 R-45504	Mechanical counter would, on occaision, either fail to count or would count incorrectly.
AECL/Therac 25 R-45647	Software bug resulted in an excessively high start-up dose rate.
Varian/Clirac 18 R-45652	Two helicoils that worked loose caused 42 lbs. of lead shielding to break free of its mounting.

AECL/Therac 25	During the machine warm-up procedure a R-45799 malfunction "12" was observed. The software indicated that a gun current higher than 4.1 amps was not acceptable, although the unit requires 4.88 amps to operate properly.
Varian/Clinac 4 R-45791	After the installation of a new pendant, the treatment table would move longitudinally whenever the gantry was rotated.
Siemens/Mevatron 67 R-45813	The "Z" couch table dropped 6-8 inches with a patient on the table.
AECL/Therac 20 R-45907	A malfunction occurred while treating in the electron mode with 13 MeV. The dose rate, accumulated dose, and % elapsed time did not register on the CRT. After treatment it was not possible to access the computer through the keyboard.
Siemens/Mevatron VI R-45933	The dose meter failed to terminate treatment at dose set on the thumb wheel switch selector.
Siemens/Mevatron 12 R-45945	Electron applicator fell apart at the seams as the technologist was connecting the applicator to the electron dose chamber.
Siemens/Mavatron 12 R-45953	A faulty high voltage canister caused the machine to catch on fire, burning it beyond repair.
Varian/Clinac 6 R-45981	The release lever for the accessory holder was activated instead of the release lever for the wedge tray, due to their closeness of location. The safety pin that is supposed to keep the accessory holder in place has also failed on two occaisions.
Varian/Clinac 6 R-46052	The eight cap head screws were beginning to pull through the counterbored land areas.
ATC/Therapi 4 R-46083	The blocking tray assembly was about to fall off the machine. The entire weight of the blocking tray assembly falls on two thumb screws that depend on the frictional holding power of only two small set set screws.
Raytheon/Sagittaire 25 R-46116	Twelve of the twenty-four bolts holding the gantry to the wall sheared off.

Simulator

Manufacturer/Model Access Number	Abridged Stated Problem
Toshiba/LX-30A R-45723	X-ray arm occaisionally extends spontaneously, without technologist operating any of the controls.
Phillips/Universal Localizer-Simulator R-45878	A sheared bolt caused the x-ray cassette assembly to fall off of the fluroscopic screen and strike a patient.
AECL/Therasim 750 R-45974	Failure of diode on the limit switch allowed the image intensifier to over-travel. The power cables to the intensifier were subsequently pinched by unit covers, causing an electrical shock to the patient.

Brachytherapy

Manufacturer/Model Access Number	Abridged Stated Problem
Rads S. L./Ir-192 wires R-46041	The radioactive portion of the wire was certified to be 7.0 cm long, but was in fact only 3.8 cm long.
Radium Chemical/ Fletcher Suit Applicator R-46096	The closed end of the applicator came off in the cervix of a patient.

Low Energy Photon

Manufacturer/Model Access Number	Abridged Stated Problem
Philips/RT-250 R-46049	The unit was able to produce a beam with the incorrect filter in place.
Siemens/Stabilipan R-46102	A failure occurred in the unit's voltage selection circuitry, driving the kVp to its maximum value, regardless of the value set at the console.

Miscellaneous

Manufactuer/Model Access Number	Abridged Stated Problem
G.E./Target Treatment Planning System R-45726	In the implant dosimetry calculation, a sub-program draws curves of the isotope dose rate and the user can specify a location and have the dosage calculated for a particular point in time. Above 20 half-lives, the program gives erratic numbers, and sometimes will not calcualte the dose at all.
Brown Boveri/Betatron R-45849	Intermitttent problems have been reported with the dosimetry system, leading to infrequent random erroors of up to 7 percent in dose delivered.

CENTER FOR DEVICES AND RADIOLOGICAL HEALTH
PROBLEM REPORTING PROGRAM FOR RADIATION THERAPY DEVICES

SUMMARY OF REPORTS RECEIVED FROM JANUARY 1987 TO JUNE 1987

Prepared by Clifford D. Evans

This is a summary of the reports received by the Problem Reporting Program (PRP) for Radiation Therapy Devices from January 1987 through June 1987. These are reports that were submitted by practitioners to the U.S. Pharmacopeia (USP), who then forwarded a copy to the manufacturer and to the Center for Devices and Radiological Health (CDRH), and sent an acknowledgement to the reporter. In this summary, the type of device, the manufacturer, the model, and the abridged stated problem or suspected problem are listed. The purpose of this summary is to inform users/owners of radiation therapy devices, of the nature of the problems observed and reported by others, and to encourage the use of the PRP for reporting additional safety hazards.

All reports received by the PRP are regarded as unverified information until the report can be analyzed by the manufacturer and CDRH. As a result of these analyses, some of the problems have been found to be caused by poor understanding, care, or operation on the part of the user, as well as manufacturing processes or inherent problems with the product. There is no intent in this summary to claim or imply that a particular manufacturer's device or model is unsafe. Because the reporting is voluntary and may not be at all representative, you are cautioned not to draw conclusions about the equipment quality of the listed manufacturers.

When a problem is found to be generic, that is, it has the possibility of occurring on all models of the same or similar design, the manufacturer may initiate a device recall (field repair or component replacement). In the case of such a recall the manufacturer will notify all users/owners of the affected models, and will submit a corrective action plan (CAP) to the CDRH for review. To date, eight recalls have occurred; four resulting from PRP reports, and four form information submitted directly by the manufacturer. The additional problems listed below in chronological order by category are either still under investigation, and are therefore unverified or were felt to be "one of a kind" isolated incidences and received individual repair or other response.

The PRP is important to the quality of patient care as a method of maintaining the quality of radiation therapy devices. The PRP works because concerned radiation oncologists, radiological physicists, radiation therapy technologists, and dosimetrists take the time to report and because manufacturers analyze the problems and develop corrective action plans as needed. Periodically, the USP mails reporting forms and information regarding the PRP to members of participating societies in radiation therapy. Reports may be submitted to the USP in writing at the following address: United States Pharmacopeia, 12601 Twinbrook Parkway, Rockville, Maryland, 20852, Attention Dr. Joseph G. Valentino, or by telephone at 800-638-6725 (in Maryland, call collect at 301-881-0256). A report form is attached for your convenience.

Co-60 7
Linac 6
Brachyth. 3 2 Cs-137
1 Radium source

Teletherapy: Cobalt-60

Manufacturer/Model Access Number	Abridged Stated Problem
Picker/C-9 M-46329	A new radioactive source, five days after installation, did not fully return to the off position after treatment of a patient.
AECL/Theratron 780 M-46398	The rod assembly that moves the source to the exposed position was coated with molycoat, a lubricant, which had thickened, creating enough resistance to keep the source from moving out.
AECL/Eldorado 78 M-46512	An electrical short in the hand control cable energized the motor, causing the unit to move in a vertical direction.
AECL/Theratron 80 M-46528	A malfunction caused the unit to rotate during a fixed-field teletherapy treatment.
Picker/C-9 M-46626	A new timing system, retrofitted to the C-9 unit two months previously, failed to terminate a treatment. This timer was replaced with another new timing system, which failed to terminate a treatment just one month after installation.
AECL/Theratron 780 M-46693	During treatment the timer failed to run down, and the treatment had to be terminated manually by switching off the treatment switch.
AECL/Eldorado 6 M-46720	Due to a spider gear that was not fully engaged, the head descended at a high rate of speed onto a patient, resulting in death.

Linear Accelerator

Manufacturer/Model Access Number	Abridged Stated Problem
Varian/Clinac 4 M-46150	Upon delivery of the first of 47 monitor units of dose to a patient the counter went from 000 to 095. This situation was not able to be reproduced.
Varian/Clinac M-19139	A terminally ill cancer patient was struck with a 3 lb. lead shadow block that fell from a height of 20 inches when then therapist accidently toppled it off of the accessory mount.

AECL/Therac 20 M-46324	Improper centering of the electron aperture on the target-slide assembley could result if, after the electron mode is selected at the console, a machine function button were first pressed on the hand control followed by a return to the "console" position on the hand control in too short of a time span. In this "misposti:oned" situation (electron beam aperture in the wrong position), it would be possible to turn the elctron beam on and keep it on indefinitely without any indicatio. of error.
Siemens/Mevatron 74 M-46398	The verification system for this unit, which is contolled by punch cards from the control console, has consistently not functioned since the unit was installed in the Spring of 1985.
Varian/Clinac 20 M-46529	The door interolck transistor (2N-440) malfunctioned. This allowed the beam to be turned on while the the door was open.
Varian/Clinac 6 M-46582	The release lever for the wedge came loose due to the threads being stripped on the pivot bolt.

Simulator

Manufacturer/Model Access Number	Abridged Stated Problem
Varian/Ximatron 5 M-46663	When the gantry was being rotated, the cassette holder assembly, weighing approximately 20 lbs., came loose and fell to the floor, glancing off the head of a patient. The accident was caused by two sheared cassette holder screws, which were to have been replaced by the manufacturer in late 1985.

Brachytherapy

Manufacturer/Model Access Number	Abridged Stated Problem
3M/Fletcher Suit Applicator M-46139	Upon removal from the patient it was noted that the weld on the pivot point of the applicator had broken. This left a sharp semicircular piece of stainless steel in the patient, which had to be removed by the physician.

Radium Chemcial/ Fletcher Suit Applicator M-46513	When the applicator was removed from a patient the tandem tip was missing. Subsequent radiographs showed that the tip was still located inside the patient's uterus.
3M/Miniaturized Cs-137 Tube Source M-46492	Upon testing of a new source it was found that the actual activity was only 1/100 of the activity stated by the manufacturer.

Low Energy Photon

Manufacturer/Model Access Number	Abridged Stated Problem
Siemens/Stabilipan 2 M-46512	Multitude of problems over a two-month time period, including non-functional buzzer, oil leak, broken collimator light, and non-functional vertical motion of the tube head.

Miscellaneous

Manufactuer/Model Access Number	Abridged Stated Problem
AECL/Theraplan L Treatment Planning Computer M-46436	In the "QSEEDS" program, the computer prompt requests radiation activity in mgm while in fact the computation of dosage requires the units in mCi.

NUREG-0301

REGULATION OF NATURALLY OCCURRING AND ACCELERATOR-PRODUCED RADIOACTIVE MATERIALS

A Task Force Review

Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission

Available from
National Technical Information Service
Springfield, Virginia 22161
Price: Printed Copy $5.00; Microfiche $3.00

The price of this document for requesters outside of the North American Continent can be obtained from the National Technical Information Service.

NUREG-0301

REGULATION OF NATURALLY OCCURRING AND ACCELERATOR-PRODUCED RADIOACTIVE MATERIALS

A Task Force Review

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This document is a report of an NRC Task Force. The results, opinions, conclusions and recommendations expressed in this report are those of the Task Force and do not necessarily express the positions of NRC or other Federal or State agencies.

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REPORT OF THE

TASK FORCE

FOR THE

MATTER OF REVIEW OF REGULATION OF NATURALLY OCCURRING

AND

ACCELERATOR PRODUCED RADIOACTIVE MATERIALS

HISTORY AND PURPOSE OF TASK FORCE

Following the October 1974 meeting of the Agreement States in Bethesda, Maryland, the Agreement States developed several requests and recommendations for NRC (then AEC) action, one of which was the following:

> "The States recommend that the AEC, or it's successor agency, move immediately to bring accelerator-produced and naturally occurring radioactive material under it's jurisdiction" (Appendix A).

On May 8, 1975, the Executive Committee of the Conference of Radiation Control Program Directors (CRCPD) met with the Commissioners. One of the points discussed at the meeting was later summarized by the Conference in a letter to Commissioner Kennedy:

> "There is concern on the part of several States regarding the need for Federal control of radioactive material not being regulated by Agreement States or the NRC. Most Agreement States have included naturally occurring and accelerator-produced radioactive material under the same regulatory control as materials coming under the Atomic Energy Act when these agreements were signed. However, since there are 25 non-Agreement States, there is a definite gap existing in the proper control of these non-Agreement materials. Therefore, we strongly urge the NRC to consider taking appropriate actions to place this type material under the same control as is now applied to materials falling under the Atomic Energy Act" (Appendix B).

In response to these requests, in January, 1976, NRC established a task force to review the matter of regulation of these materials. Representatives from SP, IE, NMSS, ELD and SD were appointed. Resource persons representing Agreement and non-Agreement States and Federal agencies also participated. This report is the product of that Task Force review.

TASK FORCE PARTICIPANTS

Members of the Task Force were:

Donald A. Nussbaumer, Office of Nuclear Material Safety & Safeguards, Chairman,

Joel O. Lubenau, Office of State Programs, Coordinator,

Walter S. Cool, Office of Standards Development,

L. J. Cunningham, Office of Inspection & Enforcement,

Jane R. Mapes, Office of the Executive Legal Director,

Sheldon A. Schwartz, Office of State Programs, and

Donovan A. Smith, Office of Standards Development.

In addition, the following persons served as resource persons to the Task Force:

For the Agreement States,

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EXECUTIVE SUMMARY

Conclusions

1. The regulation of naturally occurring and accelerator-produced radioactive material (NARM) is fragmented, non-uniform and incomplete at both the Federal and State level. Yet, these radioactive materials are widely used -- excluding those who would be exempt from licensing, about 30% of all users of radioactive materials use NARM. There are an estimated 6,000 users of NARM at present. The use of accelerator-produced radioisotopes, particularly in medicine, is growing rapidly.

2. One NARM radioisotope - ^{226}Ra - is one of the most hazardous of radioactive materials. ^{226}Ra is used by about 1/5 of all radioactive material users. Also, there are about 85,000 medical treatments using ^{226}Ra each year.

3. All of the 25 Agreement States and 5 non-Agreement States have licensing programs covering NARM users. The Agreement States' programs for regulating NARM are comparable to their programs for regulating byproduct, source and special nuclear materials under agreements with NRC. But there are 7 States who exercise no regulatory control over NARM users, and the remaining States have control programs which are variable in scope. There are no national, uniformly applied programs to regulate the design, fabrication and quality of sources and devices containing NARM or consumer products containing NARM which are distributed in interstate commerce.

4. Naturally occurring radioactive material (except source material) associated with the nuclear fuel cycle is only partially subject to NRC regulation, i.e., when it is associated with source or special nuclear material being used under an active NRC license.

5. Because of the fragmented and non-uniform controls over radium and other NARM, information on the impact of the use of NARM on public health and safety is fragmentary. Thus, it is difficult to know, in an overall sense, whether proper protection is being provided to workers and the public. A number of the incidents involving NARM and other data, however, which have come to the attention of public health authorities give definite indications of unnecessary and possibly excessive radiation exposure of workers and the public.

6. Although outside the scope of this study, data and evidence gathered in support of this study showed that the regulatory control for radiation safety for accelerators (which can be used to produce NARM) may also be fragmented and incomplete.

Recommendation

The Task Force recommends that the NRC seek legislative authority to regulate naturally occurring and accelerator-produced radioactive materials for the reason that these materials present significant radiation exposure potential and present controls are fragmentary and non-uniform at both the State and Federal level.

SCOPE OF WORK

The primary objective was to assess the need for, and feasibility of, the Federal government regulating naturally occurring and accelerator-produced radioactive materials. The task force examined the existing State and Federal programs concerning these materials and attempted to assess their effectiveness. The examination included the existing rules and regulations, the sources and uses of materials (including wastes), and the number and frequency of incidents involving these materials. With regard to feasibility, an assessment was made of the public policy and legal questions with regard to whether the Federal government can and should regulate these materials. With respect to Federal government involvement, the task force considered recommendations for new or improved NRC actions for regulating the various sources and uses of the materials (including radium associated with mineral industry tailings). Finally, the task force considered the value/impact of these recommendations and developed estimates of NRC resources which may be required to carry out the recommendations.

SOURCES AND USES OF NATURALLY OCCURRING AND ACCELERATOR PRODUCED RADIOACTIVE MATERIAL

Sources

All radioactive materials, for purposes of this study, were divided into two groups, namely, one group that is subject to the regulation at this time by the Nuclear Regulatory Commission (NRC) and a second group over which the NRC presently does not exercise jurisdiction. The first group consists of byproduct material, source material and special nuclear material as defined in the Atomic Energy Act.* This group was not of direct interest to this study except that it was used as a reference point in consideration of the second group. The second group is referred to in this study as naturally occurring and accelerator-produced radioactive material (NARM). This group includes the following subgroups:

1. Primordial and cosmic ray induced radionuclides, and
2. Radioactive materials produced as a result of nuclear interactions in accelerators.

*The Atomic Energy Act of 1954, as amended (68 Stat. 919), Sections 11.e, z and aa.

Examples of primordial radionuclides and major cosmic ray activated radionuclides are shown in Tables 1 and 2.* It should be noted that uranium and thorium, although primordial radionuclides, were not included in this study as primordial radionuclides since these are defined in the Atomic Energy Act as "source material" and are subject to NRC regulation (when certain criteria are met). However, some of the decay daughters in the uranium and thorium series are included in the listing of primordial radionuclides since they are not defined as "source material". Certain isotopes occur as primordial or cosmic ray radionuclides, but also are produced in reactors. When they are produced in a reactor, they meet the definition of byproduct material. Examples are ^{210}Pb, ^{210}Po and ^{3}H.

Naturally Occurring Radioactive Materials

Naturally occurring radioactive materials exist in soil, rocks, air, and water.[1] Generally speaking, unless removed from their places in nature, or processed for some type of use, they are not considered to be a threat to the public health and safety. The following is a partial listing of current uses in which these materials can contribute to the population dose and may adversely affect the public health and safety: [2,3,4,5]

1. Drinking waters having concentrations of ^{226}Ra and daughters, in excess of established standards,
2. Rn in natural gas,
3. Rn in caves,
4. Agricultural gypsums (^{226}Ra),
5. Construction materials (brick, concrete blocks and aggregate, fossil fuel flyash products, gypsum wall boards, etc.),
6. Tobacco and other agricultural products (^{210}Po),
7. Mining and milling tailings (including U, Th and phosphate industries),
8. Fossil fuels (^{226}Ra),

*Tables are found on pp 52 to 62.

9. Smoke detectors (^{226}Ra),
10. Lightning rods (^{226}Ra),
11. Static eliminators (^{226}Ra, ^{210}Po),
12. Radioluminous sources (^{226}Ra) (wrist watches, clocks, compasses, instrument dials, etc.),
13. Industrial gages (^{226}Ra),
14. Vacuum tubes (^{226}Ra),
15. Vacuum gages (^{226}Ra),
16. Ion Generators (^{226}Ra),
17. Well logging devices (^{226}Ra),
18. Calibration and check sources (^{226}Ra, Ra D,E,F),
19. Educational materials (^{226}Ra, Rn D,E,F, ^{210}Po), and
20. Medical sources (^{226}Ra, ^{222}Rn, Ra D,E,F).

In addition to this partial listing, past activities have resulted in the distribution of a wide spectrum of consumer products, most using radium as the radiation source. These consumer products include radioluminous devices and devices to inject radioactivity into water.[5,6] Manufacturing activities associated with the radium production and utilization industries have resulted in contaminated buildings, structures and sites which have required remedial action.[7]

Uranium Mill Tailings

Radiological problems associated with certain mining and milling activities have been recognized and, in some cases, remedial action has been indicated as necessary to protect the public health and safety.[8,9,10]

Although the processing of uranium ore which contains .05% uranium (by weight) or greater is subject to NRC regulation, radium and other radionuclides in the uranium decay series are not subject to NRC regulation as licensed material. However, NRC does require uranium and thorium mill licensees to control radium and its daughters associated with licensed activities. These requirements include stabilization of tailings piles and their isolation from wind and water and are designed to control release of radium, radon and other radionuclides.

In the past, materials taken from uranium mill tailings piles were not recognized as potentially hazardous and were not adequately regulated. As a result, tailings have been used in a variety of construction activities, e.g., roads, homes, schools, and public buildings. Exposures of the public to radiation have resulted and in some cases, remedial action became necessary. For example, in Colorado, a study of locations where tailings were used in construction showed 170 locations where remedial action was suggested or indicated because of excessive radon levels.[10] The matter of uranium mills including tailings management is the subject of an Environmental Impact Statement being prepared by NRC.

It has been estimated that there are 2.5×10^7 tons of uranium mill tailings in "inactive" piles, containing 14,000 curies of radium. Additional tailings contain 58,000 curies of radium in "active" piles at 16 operating mills in the United States. Projections of the demand for uranium ore have been prepared for the generic environmental impact statement on mixed oxide fuels (GESMO). These projections are dependent upon a number of assumptions including whether or not there will be recycling of irradiated fuel for the recovery of uranium and plutonium. If it is assumed that uranium and plutonium are recycled, and using other GESMO assumptions, it can be projected that the number of tons of ore produced from mines will increase from 6.6 million in 1975 to 113.1 million in the year 2000. The number of mills producing 1,050 tons of U_3O_8 per year will increase from 10 in 1975 to 77 in the year 2000. If there is no recycling, the projected values would be increased for the year 2000 to 160 million tons of ore from mines and to 109 mills, each producing 1,050 tons of U_3O_8 per year.

In May, 1975, the National Resources Defense Council, Inc. filed a petition for rule making with the NRC. The petitioners requested the NRC to issue regulations that would require uranium mill operators licensed by NRC or by Agreement States to post a performance bond to cover stabilization and ultimate disposal of tailings.[11] The petitioners also requested the NRC to issue or renew no mill licenses while a programmatic environmental impact statement which they requested on the regulation of uranium mills was being prepared. The NRC is preparing a generic environmental impact

statement (GEIS) on uranium mills including management of uranium mill tailings. NRC is working with individual States in which licensed mills are located to develop performance bond arrangements to cover management of tailings following termination of NRC licensed activities. NRC and Agreement States are incorporating a condition into uranium mill licenses specifying that the licenses may be subject to modification as a result of the GEIS. EPA, under the authority of the Resource Conservation and Recovery Act of 1976, will draft regulations concerning management of mill tailings.

Other Industry Tailings and Products

Studies have been conducted by EPA on the radiological aspects of the phosphate industry in Florida.[9,12,13] The results suggest a potential may exist for problems similar to those resulting from uses of uranium mill tailings, e.g. EPA reported that about one third of the houses located on land reclaimed following the mining of uranium bearing phosphate deposits have levels of radon sufficiently high to warrant consideration of remedial action.[9] Concern has also been expressed by EPA over the potential radiological impact of uses of products and residues from the phosphate industry, such as agricultural fertilizer and aggregates.[2,12] Data obtained by EPA indicates occupational exposures in the phosphate industry do not exceed guidelines for the general population, but EPA has recommended more studies are needed to better define the problem.[13]

Limits for acceptable levels of naturally occurring radioactivity incidentally present in articles or products from the phosphate industry have not been established in the United States. NRC does not exert control over processing and refining of ores, or possession of chemical mixtures, compounds, solutions or alloys in which source material is by weight, less than 0.05% of the mixture, compound, solution or alloy.*

Radium

Radium, one of the nuclides in the uranium decay series is the principal naturally occurring radioisotope in use today. The characteristics of radium have led to its wide use in a large number of medical, industrial and military applications, and in consumer items (Tables 3 and 4).

*10 CFR 40.13 (a) and (b).

Between 1912 and 1961, nearly 2,000 gm. (i.e. about 2,000 Ci) of radium have been processed in, or imported into, the United States.[14]* Of this amount, 712 grams were imported during 1951-61. Approximately 3,600 persons are known to regulatory agencies to possess radium sources.[15] These include 1,800 medical users and 1,300 industrial users. These figures do not include owners of consumer type products presently in the public domain. It is believed that the numbers of users of radium have decreased in recent years as other alternative isotopes have become available. But, in the absence of national data, (or a national regulatory program controlling its distribution and use) the change is difficult to quantify. Radium salts are no longer manufactured in the United States. However, at least 36 U.S. companies manufacture or distribute radium sources or devices containing radium which could be subject to regulation by the States.[5] This figure includes 3 companies which manufacture smoke detectors containing radium for distribution to persons exempt from State licensing or other regulation.** Lastly, at least 5 companies received radium luminous powder in 1976 from a U.S. supplier, presumably for radium luminous paint applications.

There is no national regulatory program to require radium source and device manufacturers and distributors to comply with accepted standards for fabrication, testing, quality control and distribution of radium and radon sources used in consumer products, medicine and in industry. A voluntary control effort has been fostered by FDA's Bureau of Radiological Health in cooperation with the States.[5] However, the adequacy of this program is strongly influenced by the efforts of individual State regulatory programs. Seven States have neither a licensing nor a registration program for radium.[15]

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*This figure applies only to sources, or devices containing radium or into which radium has been deliberately incorporated. It does not include products incidentally contaminated with radium, e.g. phosphate or other ores.

**The manufacture of such devices, however, is an activity that would be subject to licensing and to regulation.

Despite competent licensing and regulatory efforts by Agreement States and some non-Agreement States to control the users of radium who are subject to licensing or registration, there is not always assurance that products containing radium sources, including consumer products, will be manufactured and distributed in conformance with quality control and shipping practices comparable to those which are imposed by NRC upon its licensed manufacturers and distributors.

As an example, one might review the documentation NRC requires to support an application for distribution of ^{241}Am sources contained in smoke detectors to persons exempt from licensing.[16] Among other things the data must include evaluation of doses that might be received from external radiation and the potential for exposure to airborne ^{241}Am resulting from fires. Hazards from storage of large quantities of such detectors also must be evaluated. These evaluations are done in compliance with the requirements of 10 CFR 32.26 and 32.27.

Equivalent Federal regulations do not exist which require similar evaluation for smoke detectors using NARM and comparable evaluations have not been made for all currently available smoke detectors containing NARM. Guidelines for the States for such evaluations are being prepared by the Conference of Radiation Control Program Directors (CRCPD) and the Suggested State Regulations are to be revised to conform with the guidelines.

As another example, the application of byproduct material to timepieces (as the activating agent for self-luminosity) for distribution to persons exempt from licensing requires a specific license from NRC or an Agreement State and compliance with certain requirements for manufacturing and quality control.* Further, NRC (i.e., Federal) authorization is needed to distribute such devices to persons exempt from licensing.** An NRC license is required to import such devices.*+ There are no requirements for a Federal license to distribute timepieces containing radium nor is a Federal license required to import timepieces containing radium. Of five companies reported to have received radium luminous compounds in 1976, one is located in an Agreement State, three are in States which conduct radium licensing programs and one is located in a State with no licensing program. Product and quality control standards equivalent to

*10 CFR 30.15 and 32.14.
**10 CFR 150.15 (a) (6).
+10 CFR 36.31

those of the NRC have not been uniformly applied to these companies. Although the States can control distribution within their borders, the States cannot control distribution of radium in interstate commerce or importation of radium into the U.S.

Health and safety problems associated with radium users have been significant. As an example, a Wisconsin study of 39 medical radium facilities found radiation levels in uncontrolled areas up to 100 mR per hour.[17] In 4 facilities, workers in unrestricted areas may have received more than 500 mrem in a year.[17]

Initial surveys of medical users in 8 States* disclosed between 13% to 53% of the facilities surveyed possessed sources which were leaking or were contaminated.[18] The relatively high percentages of medical facilities initially found to have leaking or contaminated sources (13% to 53%) is a significant finding. FDA pointed out that these sources are used for superficial and intracavitary treatment. The inadvisability of using leaking sources is obvious. The threat of contamination of the medical facility is equally unacceptable.[18]

Leak-test requirements imposed by Agreement States and many other States can serve to alleviate this problem by assuring timely identification of leaking sources. Nonetheless, leaking radium sources continue to be a problem. Data reported by Agreement State licensees to the Agreement States for the 18 month period, January 1, 1975 to June 30, 1976 disclosed that of 23 reports of leaking sources, 9 (39%) involved radium and five of these were medical sources.[19] The ages of the 9 leaking sources were unknown in 6 cases and ranged from 10 to over 21 years for 3 cases.**

Older sealed radium sources present special safety problems. Some were fitted only with friction plugs without threads.[14] Inadequate drying of the radium salts prior to encapsulation leads to residual water which is dissociated into oxygen and hydrogen gases by the radiation. The

*Alabama, Georgia, Indiana, Kansas, Kentucky, Minnesota, New York and Pennsylvania.

**A search was made of [illegible] available on computer, for comparable data. The results [illegible] were inconclusive - the computer program has not been [illegible] to permit outputting of data in a form suitable for the [illegible] it as a comparison base for this study.

resultant pressures can reach several hundred atmospheres and lead to rupture, especially in a friction fitted capsule.[14] New medical radium sources use improved sealing techniques and are reportedly doubly encapsulated. However, there are singly encapsulated sources with threaded ends which are soldered that are still in possession of medical users. An early FDA report stated that examinations of over 970 sources containing 45.4 Ci of radium disposed through the joint EPA-BRH radium disposal project (many of which were disposed of because they were discovered to be leaking) disclosed corrosion and failure of encapsulation threads and brazed areas.[18]

As noted earlier, there is no national regulatory program which requires present radium source and device manufacturers to comply with fabrication, testing and quality control standards, that is, a pre-market clearance program. Few of the radium sources in use today in medicine have been subjected to the same kind of an evaluation by a regulatory agency to assure adequate design and integrity as are made by NRC and the Agreement States of sealed sources containing byproduct, source or special nuclear materials.[5,20,21]

Accelerator-Produced Radioisotopes

The availability and use of accelerator-produced radioisotopes has increased rapidly in recent years. Particularly rapid growth in the use of accelerator-produced radionuclides has taken place in medicine for purposes of tumor localization, organ scanning or imaging, tomography, cisternography, and heart shunt detection (Table 5).

James Blackburn, from Illinois, a non-Agreement State which licenses NARM, provided the following observations to the Task Force on the proliferation of ^{57}Co sources:

> "With the increased use of production accelerators, large numbers of Cobalt 57 sources have entered the market place. These sources include a multitude of items including marker sources, radioactive rulers, flexible markers, flexible rulers, orientation indicators, etc., all designed to assist the physician to outline the organ of interest, mark the anatomical landmarks, provide a scale for organ size

*This project accumulated 2,350 sources during the period 1974-76, most of which were medical sources. Total radium in storage, as of April, 1977, is over 92.5 grams.

> determination and provide orientation of images on the film. Although these sources are relatively low in activity, (less than 1 mCi) many of them are designed to be taped directly to the patient's skin during the medical procedure. These sources are marketed by a variety of firms using private labeling. A recent search for the manufacturer of a particular source revealed that the source had been labeled and sold by a minimum of 3 different firms. Each time the source was sold it changed regulatory jurisdiction. This entire sequence occurred before any competent regulatory agency had even documented the existence of such a source. Without pre-marketing evaluation and clearance, the entire regulatory program governing the distribution of radioactive sources becomes marginal".

Typically, accelerator-produced radioisotopes are short-lived (months, days or less) and many are so short-lived they must be produced on-site. In such cases, the radiation safety problems associated with accelerators are additional health physics considerations.[22] Such problems can range from activation of accelerator components (i.e. production of NARM) to prevention of inadvertent, potentially lethal exposures to radiation during operation.

The matter of accelerator radiation safety, other than that associated with NARM production, is outside the scope of this study. Nonetheless, the question arises that if the regulatory control of the production of accelerator produced radioisotopes is incomplete, is the regulatory control over other radiation safety aspects of accelerators adequate? At a recent public meeting on the regulation of nuclear medicine by NRC, a distributor of sources for teletherapy units made the following observation concerning one possible consequence of the differences in the regulation of accelerators compared to ^{60}Co teletherapy units:

> "It is our observation, and I believe you will find it widely shared, that our society has become so highly regulated that regulatory considerations have come to play an important part in decisionmaking.
>
> "Particularly, in matters where the decision is for a choice among near equals, in the field of radiation therapy. There is little, if any, known clinical differences between the use of photons emitted by cobalt-60, and the use of photons produced by four MeV and six MeV electron accelerators.

"To some extent the outcome of competition between these two techniques is already influenced by differences in regulatory status deriving not from any substantive differences in hazard to either user or patient, but rather from the fact that photons emitted by cobalt-60 sources fall within the scope of the Atomic Energy Act, and photons produced by electron accelerators do not.

"We do not want to overstate this position, and without doubt, there are other more consequential nonclinical factors that affect the competition between these two systems that are outside the scope of this hearing.

"Nevertheless, at current levels of NRC regulatory involvement, there exist delays, inconveniences and disadvantages that are substantive.

"Furthermore, we believe that increased regulatory involvement for cobalt users that are not applied simultaneously and equally to accelerator users, would simply induce many responsible users to abandon cobalt therapy in favor of a clinically equal, less regulated alternative.

"I would like to analyze for you this thesis in the context of the considerations outlined in the notice of this hearing.

"The physician in exercising his right and his duty to apply his best professional judgment in the practice of medicine would be compelled to choose the least regulated alternative, if for no other reason than to have more time available to devote to the patient-oriented demands of his practice.

"In the absence of a major change in regulatory technique, we doubt very much that on balance, patients would receive more competent medical care and protection against exposure, as a result of increased regulatory involvement.

"More skilled and responsible practitioners who demonstrate satisfactory performance will either have their productive effort reduced by the time demands of additional regulation or will convert their practice to a less regulated mode.

"We seriously question that the restriction of choice that would result will be balanced by whatever improvements are made in the practice of those that would still come under the increased regulatory involvement.

"The NRC responsibility to regulate so as to protect the public health and safety would be compromised in two ways.

"In these times of soaring hospital costs, the use of cobalt-60 therapy, the less expensive of two substantially equal alternatives, would be discouraged.

"And as previously noted, we believe that any further imbalance in the relative degree of regulation of alternative techniques would result in a flight from the more highly-regulated to the less-regulated method.

"With regard to the possible involvement of other regulatory bodies or peer groups, it appears to us that any regulatory program that is to command respect should provide equal or at least comparable regulation of different methods involving comparable hazards.

"If, by law, the NRC is able only to regulate one of two competing alternatives, then we think its responsibilities to the patients and to the public would best be met if it cooperated with those agencies that have broader authority in the field of use, so that competing alternatives receive more or less uniform regulation.

"I think that what is required for cooperation is really not something that needs legislation.

"We think that the various agencies who are involved in the regulation of the medical practice have the authority to achieve uniformity promptly, if they have the will and the administrative ability.

"In any event, we believe that the dichotomy of the regulations, two available alternatives for producing and using one to two MeV photons can be and should be properly resolved and until such regulation is effected, any increase in the regulation of one alternative would be counterproductive."[23]

States which have followed the format of the Suggested State Regulations for Control of Radiation have specific regulatory requirements for accelerators.[24] In FY 1975, 14 percent of the accelerators reported by the States were inspected by the States.[15] Such data, however, does not reflect accelerators at Federal facilities and does not adjust for possible differences in the depth and qualities of the regulatory efforts. FDA is expected to develop performance standards and guidelines concerning medical applications of accelerators.

Scope of NARM Use

Some perspective for the scope of the use of NARM was gained in a study on "Non-SNM/Source Material" shipments.[25] The information was obtained from questionnaires completed by 1,334 NRC and Agreement State licensees and ERDA contractors in 1975. The total number of packages of these materials shipped in 1975 approached 1.1 million. Of these, about 14% were NARM shipments. About 25% of the different radionuclides involved were NARM. However, NARM constituted only 0.06% of the total curies shipped.

About two/thirds of the NARM shipments were made by five suppliers including one who conducts operations at seven locations in six States. For these five suppliers, NARM shipments constituted about 20% of their shipments. About 16% of the NARM was intended for research purposes and 84% was intended for medical purposes. The other sources of NARM are university cyclotrons and imports, mainly from Holland and South Africa. It should be pointed out that with respect to radium, a major domestic supplier did not choose to participate in this study and the data does not reflect its activities. It has been estimated that this company originated between 3000 to 4000 shipments involving radium (all forms) and radon in 1976.

The annual sales of fire detectors containing radium was estimated in a 1971 FDA report to be 10,000 per year.[18] However, partial data for 1976 indicated 2 companies manufactured 200,000 units. Complete updated data including imports are not available. In comparison, annual sales of fire detectors containing byproduct material averaged 820,000 per year during the period 1970-75. However, it is interesting that 9 companies currently listed as distributors and manufacturers of radium fire detectors were not included in the 1971 report and apparently are new distributors, again suggesting an expanding market.[5,18]

The FDA report estimated 3 million timepieces containing radium were sold in 1975. It is believed that this volume has decreased significantly since, but no hard data is available.

The annual whole body dose rate in the United States from all sources (natural and artificial) was estimated by the BEIR Committee to be, in 1970, 37,400,000 person-rem per year.[26] Moghissi has estimated the population doses from radium and tritiated luminous timepieces to be 2500 and 3600 person-rem/year respectively, or about 0.01%.[27]

The contribution to the population dose from radium luminous timepieces is small, but the dose to individuals wearing or having contact with them can be considerable.

Average values of radium content in ordinary wrist watches have been reported from 0.014 μCi to 0.36 μCi with a maximum observed value of 4.5 μCi.[28] The following annual radiation doses have been reported as received by critical organs from a wrist watch containing 0.15 μCi of ^{226}Ra:[18]

Organ	Estimated Annual Dose (mRem)
Skin of the Wrist	4,800
Lens of the Eye	110
Blood-Forming Tissue	30
Gonads	10

For comparisons, natural background in the U.S. contributes an average dose to the gonads of 80 to 100 mrem per year and the mean average bone marrow dose to adults from diagnostic radiology in the U.S. in 1970 is estimated to have been 103 mrad.[29]

The results of a survey by Oak Ridge National Laboratory of luminescent clocks in 43 Tennessee households suggested that 1 out of every 3 households has a clock which emits penetrating radiation (i.e., gamma rays from radium) and that these clocks are responsible for a 10 percent increase in the gamma ray background to 5 percent of the population.[30]

These data do not suggest a clear answer to the question of whether a need exists for a Federal regulatory program to control the distribution of radium luminous timepieces. In 1975, it was reported that there are nearly three times as many tritium luminous timepieces as there are radium luminous timepieces.[27] They contribute only slightly more to the population dose than radium timepieces.[27] Nonetheless, the

distribution (including import) of tritium luminous watches is controlled by the Federal government (through licensing by NRC) and the distribution of radium luminous timepieces is not.

As noted earlier, at least 36 companies are listed as U.S. manufacturers or distributors of radium sources and devices which are considered to be subject to State licensing or registration.[5,24] An additional 21 companies are engaged in the manufacture and distribution of consumer items containing radium.[5]

The FDA report indicated that licensable radium users possessed 330 Ci contained in 50,000 to 55,000 sources used in medicine at 2,300 facilities.[18] These facilities provided 85,000 medical treatments annually. Non-medical applications accounted for 150 Ci at 1,900 facilities.[18*]

There are about 19,000 NRC and Agreement State licenses authorizing possession and use of byproduct, source, and special nuclear material.[19] Data from Agreement States suggest persons who only use NARM constitute another 5% or 1000 licensable users.[31] The total of licensable users of byproduct, source, special nuclear, and NARM is then about 20,000. There are about 3,600 persons reported by FDA to possess or use radium who are licensed or would be subject to State licensing requirements similar to those applied to byproduct, source and special nuclear material users.[15,24] Radium users, therefore, constitute about 18% of users subject to licensing, a significant portion.** As previously shown, the health and safety problems with these users have been significant.

*The total, 4,200 facilities appears to be at variance with the previous cited figure of 3,600. However, the 3,600 represents persons identified by States in an annual survey (1975) as subject to State regulation. The 4,200 is the total identified in a special survey of the States conducted in 1969.

**The actual number of radium users may be somewhat higher since the FDA data is restricted to persons subject to State regulation. The use by Federal agencies is not included. See pp. 33-34.

About 25% of Agreement State licenses authorize NARM in addition to byproduct, source and special nuclear materials.* Another 5% are for NARM only.[31] Thus, of the approximately 20,000 persons who are or could be subject to license requirements in the U.S., an estimated 30% use NARM.

Some additional insight on the scope of NARM use, and the problems associated with its use, was provided to the Task Force by David Lacker, Administrator of the Texas Radiation Control Program:

> "Radium has been a regulated material in Texas since March 1, 1963. I have reviewed our incident/accident files since March 1, 1970 and in that period we have had a total of 56 reported incidents involving radium sources or contamination. Almost half of these incidents involved the loss of radium sources by licensees. (25 reported lost sources.) Of these in only eleven instances were the sources found or returned to the licensee. In 5 /cases/ medical sources were presumed to have been buried in sanitary land fills at a depth which prevented location. The fate of the others is still unknown.
>
> "We have had seventeen reported leaking radium sources with eleven of these revealing contamination of storage areas and in two cases, office areas.
>
> "There were three radium sources found in different locations beside one highway ranging from 10 to 40 millicuries for which no owners have been located.
>
> "In performing environmental sampling in the last eight months, we have located three areas with significant radium contamination. The source of this contamination is now under investigation but it is possible that it came from oil field pipe cleaning operations.
>
> "We have one case reported and investigated relating to an individual who purchased a watch repairman's tools and supplies which contained a dial paint repair kit. He used the radium paint in his home to make costume jewelry which glowed in the dark. Fortunately for that individual, he only made one application of the radium before learning that it could be dangerous and called us. There was minimal contamination in his home.

*This figure was furnished to the Task Force by the Office of State Programs, NRC. For certain types of licenses, the percentage of NARM use is much higher, for example, most of the medical licensees who perform imaging studies possess ^{57}Co "flood" sources.

"These incidents represent to me a serious potential hazard since tney occurred in a regulating State. What happens in those areas of the country where there are essentially no regulations requiring the usual radiation safety precautions?

"We have also been made aware of four incidents in non-Agreement States where ^{57}Cobalt sources used in x-ray fluorescent analyzer's were ruptured and contamination resulted. Although there was no regulatory requirement for reporting, the supplier learned of these when new sources were ordered and the contamination was properly cleaned up and the sources disposed of as radioactive waste.

"It seems to me that we must recognize that NARM, particularly radium, in the non-regulatory States probably is in much wider use than in States with regulatory programs. The reporting of incidents such as the areas I have cited is not required therefore we must assume that the potential for serious injury is greater in that contamination and other exposure could go on for extended periods of time".

One consequence of the lack of a national, uniformly applied control program for NARM is that information on its use and on the problems associated with its use is fragmentary. However, the information that is available - especially from States actively engaged in the regulation of NARM - definitely indicate that the use of NARM, both in articles subject to licensing and in consumer products, constitutes a significant part of radioactive materials usage in the United States, in terms of numbers of users, numbers of consumer product articles, and the potential for radiation exposure of users and other persons in contact with NARM sources.

Other Issues

Currently operating commercial low-level radwaste burial sites accept NARM for disposal. The need to continue to provide for disposal of NARM wastes at these sites must be considered in the development of a national policy for low-level waste disposal. The Resource Conservation and Recovery Act of 1976 (P.L. 94-580) which deals with solid waste disposal only excludes source, byproduct and special nuclear materials but NARM is included.

EPA, in cooperation with FDA, operates a radium disposal facility at the Eastern Environmental Radiation Facility in Alabama. Its current capability is limited by a lack of adequate numbers of shipping containers. States have reported waiting for up to six months for an opportunity to dispose of radium. For persons and States disposing radium, however, this endeavor provides a simple and inexpensive means of removing surplus radium sources from the public sector.

"Excess sites" (former AEC licensed or ERDA facilities released for unrestricted use) are currently being reexamined by ERDA and NRC in cooperation with the States to reevaluate any potential health and safety hazards that may result from residual radioactivity at these sites. Some of these sites contain NARM such as the former Vitro facility in Cannonsburg, Pennsylvania.

There is evidence indicating that there are many radium sources currently in the possession of members of the public which are not known to regulatory authorities and would be subject to licensing. They range from radium activated luminous devices to medical sources possessed by widows of physicians. Several of the latter have been discovered in bank safe deposit vaults. In the past, these sources have been located by State regulatory agencies through publicity efforts, contacts with State and local medical and other professional societies, personal contacts and, when available, review of old sales and transfer records of radium manufacturers and distributors.

INCIDENTS INVOLVING NARM

For purposes of discussion, incidents are considered to be unplanned events usually involving the loss or theft of sources, contamination, or overexposures.

FDA/Bureau of Radiological Health Data

The Bureau of Radiological Health has reported data on radium incidents which occurred from 1966 to 1969. (Table 6). Although this is the best source of information available, it should be noted that the information was obtained through voluntary participation of State radiological health

programs. In turn, the information submitted by each of the State programs is influenced, in large part, by the quality of the program and the intensity of their effort to learn of, and investigate, incidents involving NARM. An annual average of 29 radium incidents was reported. The majority of these involved loss of material. Because of the uncertainties in these data, it is believed that the extent of the problem may be significantly underestimated.

U.S. Department of Transportation Data

The U.S. Department of Transportation (DOT) is currently preparing a report on radioactive material incidents. Preliminary information collected for this report indicates that, of 32,000 reports of incidents during the period 1971 to 1975 which involved the transportation of hazardous materials, 144 (0.45%) included or involved radioactive material. Of these, less than one half were classified by DOT as having a potential for release of contents. Most of these cases involved packages containing radiopharmaceuticals which had been run over by vehicles and actual release of the radioactive materials was not verified in all cases. Although data is not readily available, few of these cases are believed to have involved NARM.

The actual hazard to the public resulting from the transportation of radioactive materials is considered by DOT to be small, especially relative to the hazards resulting from transportation of other hazardous materials.[32] According to DOT, most of their concern was over companies which lease radium to physicians on a short-term (case rental) basis.* According to DOT information, these companies are involved in about 8,000 to 10,000 shipments per year. DOT stated that they received only one report per year regarding lost radium needles or radium contamination.**

*In March, 1977, one of these companies ceased its case rental of radium brachytherapy sources. Two companies are known to remain, a large one located in New York City and a much smaller concern located in California.

**Most radium transportation incidents are handled by State authorities without DOT assistance.

Interagency Radiological Assistance Plan

ERDA serves as contact for the Interagency Radiological Assistance Plan (IRAP). Although the IRAP team identifies levels and hazards, they do not always identify the radioactive material involved in their team reports.

Consumer Products Safety Commission

The Consumer Products Safety Commission indicated they have no information regarding NARM incidents.

EPA

The Environmental Protection Agency indicated that they have no specific information on NARM incidents.

U.S. Department of Defense

The United States Air Force, Army and Navy were contacted. No information on NARM incidents was available.

NRC-State Agreements Program

The State Agreements Program of NRC receives reports of incidents from Agreement States. Reports for the years 1974 and 1975 were reviewed (Table 7). The data appears to be consistent with the numbers and types of incidents reported by the Bureau of Radiological Health for the late 1960's (Table 6).

Non-Agreement States

Information on incidents involving NARM in non-Agreement States is only available from the Bureau of Radiological Health program described above. There are no national information collecting centers or inventories to which information on NARM incidents is required to be reported.

Summary - NARM Incidents

The available information indicates that radium is the NARM isotope which is most often identified in reports of incidents. However, the available information is incomplete. Present available information does not permit an overall assessment of the possible or actual impact or threat to the public health and safety. It is known that available data represents an underreporting but the degree is unknown.

AGREEMENT AND NON-AGREEMENT STATE PROGRAMS AND RESOURCES COMMITTED TO THE REGULATION OF NARM

Agreement State Programs

Agreement States currently are responsible for 10,800 licenses.[19] Of these, about 5% or about 540 are NARM only licenses.[31] However, about 25% of Agreement State licenses authorize both Agreement material and NARM.* The Agreement States do not normally differentiate between the two in their regulatory activities.**

As a result, it is difficult to establish a dollar value for administering the portion of a regulatory program for NARM. Estimates of costs can be made, however. The expenditures for regulatory programs for NARM were requested by the Task Force from individual Agreement States and were reported to be from $650 per year to $12,000. These estimates do not include the costs to States responsible for regulation of uranium and phosphate mining and milling industries. Some estimates for the costs for the regulation of uranium and phosphate industries were $30,000 annually on compliance and surveillance activities for the regulation of uranium mining and milling operations in one State and $218,000 was allocated in one year for a special study of the NARM hazards associated with the phosphate mining industry in another State. It is not possible to estimate the annual costs for regulating the phosphate mining industry until studies of its impact have been completed, the results analyzed, and the needs for regulation established.

It is apparent that, for Agreement States, the costs of including a regulatory program for NARM (excluding mills and mill tailings and phosphate mining industry) are relatively small compared to the cost of establishing a regulatory program for Agreement materials. As an example, a large Agreement State spent approximately $42,000 in FY 1976 on all NARM activities. This represented 13.5% of their total radioactive material control expenditures for FY 1976 and 7.5% of their total radiation control budget. For a small State program, the added cost for NARM

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*See Footnote, P. 20.

**An exception to this exists in three Agreement States which apply OSHA standards and enforcement practices to non-Agreement material licensees.

control is also relatively small, in one case, 4.5% of their radioactive material budget was for NARM.

The Agreement States reported that the major problems encountered in regulating NARM relate to the lack of nationally uniform regulations and the failure by States to evaluate NARM sources, for example, by utilizing available draft guidelines on NARM which would provide quality assurance for sources and devices manufactured in any State in the United States and for imported sources and devices.

The States could refuse to issue a license to an applicant proposing to use unevaluated sources. In general, they have not done so because such action taken by an individual State would not be effective in limiting their use and such action could be construed as discriminatory, especially in the practice of medicine. As it now stands, the States can impose and inspect quality control programs only over those sources and devices which are manufactured within their jurisdiction. Items which are manufactured in States where such a program is not carried out, or which are imported, are generally of unknown quality although some exceptions exist where the Bureau of Radiological Health (FDA), as a result of a request, has evaluated the device or source and distributed an evaluation report. Not all of these evaluations, however, are subject to inspections to confirm manufacturing practices because not all States have a viable regulatory program for NARM. The Bureau of Radiological Health only participates when requested by a State and only in States which have authority to perform such inspections.

A significant regulatory problem relates to the fact that radium sources have been distributed in the United States since the beginning of this century without effective regulatory controls over their manufacture, distribution or use. States having aggressive regulatory programs for NARM have been successful in locating and regulating many of these sources which are subject to their jurisdiction. These States found a significant number of these radium sources to be leaking.[18] In some cases, resulting contamination presented hazards to public health and safety and

decontamination was required. It has been the experience of Agreement States that when radium is regulated in the same manner as other radioactive materials, some radium users will switch to byproduct materials or relinquish possession of the sources.

The uranium industry presents another problem since their tailings contain concentrated levels of naturally occurring materials, principally radium and its daughters, which must be adequately controlled. In the absence of direct Federal control of NARM as licensed material, after milling licenses are terminated the States have been forced to develop their own procedures for controlling hazards from inactive tailings. Regulatory requirements and practices of the States for controlling inactive tailings have not been uniform. At the present time, Agreement State control of active uranium mill tailings is confined to 4 States. As a result of the passage of the Resource Conservation and Recovery Act of 1976, EPA will draft regulations concerning management of such tailings. With rising prices for uranium and development of new technologies for extracting uranium from lower grade ores, including uranium as a byproduct from phosphate minerals, involvement of additional Agreement States is likely. Commercial contracts have been announced for the extraction of uranium from phosphates in two Agreement States.[33] Such extraction should now be considered a part of the nuclear fuel cycle.

Notwithstanding the utilization of phosphates as a source of uranium, the radiological impact of the phosphate mining and milling industry* has not been fully assessed at this writing but it is under study. It is clear that the phosphate industry could impact upon the environment in a manner similar to that of the older and traditional uranium industry and could require additional regulatory attention.

*Nearly all present domestic phosphate mining occurs in Florida, North Carolina, Tennessee, Idaho and Montana. All of these States except Montana are Agreement States.

In summary, the Agreement States' programs for NARM are integrated with the regulatory program for Agreement materials. The problems that do exist are related to the fact that NARM is not uniformly regulated in all States and is not adequately regulated at the Federal level. As a result, there does not exist a full reciprocal exchange of information and control over manufacture, distribution, use, and import of NARM. It is the Agreement States' position that all radioactive materials present potential public and occupational health and safety hazards and they believe that, in the absence of uniform State control, Federal regulation is needed (Appendices A and B). This would insure adequate protection to all citizens from unnecessary exposure to radioactive material without regard to its source or origin.

Non-Agreement State Programs

The Task Force requested information from the 28 non-Agreement States programs (25 States and 3 territories) on their programs for controlling NARM. Thirteen of these agencies responded (Table 8). The regulatory efforts of these 13 States can be categorized as follows:

1. States with Licensing Programs - Four non-Agreement States indicated that they are presently licensing the use of NARM using regulations they stated are "compatible" with the Council of State Government's Suggested State regulations. (No attempt was made by the Task Force to assess the degree of compatibility). The estimated budgets for NARM ranged from $60 to $646 per license with a weighted mean of $302 per license. [In comparison, in FY 1976, Agreement State expenditures for all licensed materials ranged from $158 to $418 per license and the weighted mean was $273 per license.[31] The NRC's recommended guideline is $200 to $350 per license].[34]

2. States With Legislation Authorizing Regulatory Programs But No License Program - Five States indicated that, although appropriate legislation has been passed, they do not, at this time, extend more than minimum amounts of effort on NARM control. Each of these States identified "insufficient

funds" as the restraint which kept them from engaging in this activity. One of these States has promulgated regulations which provide for licensing but has not implemented the regulations because of a lack of financial resources.

3. States With No Legislation, No Regulations or No Programs - Four of the States who responded indicated that they have not received legislative authority to enable them to implement a radiation control program for NARM.

Information available from other sources indicates that of the 24 non-Agreement States and territories not licensing NARM, 17 conduct registration programs (i.e., require persons possessing NARM to register with the State) and 7 have neither a licensing nor registration program.[15*]

REGULATORY FUNCTIONS OF FEDERAL AGENCIES

Department of Health, Education & Welfare

The Department of Health, Education and Welfare (HEW) is involved in both regulatory and indirect control programs. Within HEW's Food and Drug Administration (FDA), the Bureau of Drugs approves New Drug Applications for radiopharmaceuticals and applications for use of investigative new drugs. Without such approval, manufacturers cannot commercially distribute radiopharmaceuticals or release them for investigative use. The Bureau of Foods has the authority to set tolerances on the presence of radioactive material in foods and requires premarketing clearance of radiation sources used in food processing. The Bureau of Medical Devices and Diagnostic Products has purview over medical devices and *in vitro* diagnostic products which utilize radioactive material. The Bureau of Biologics currently licenses hepatitis associated antigens, whereas all other radiobiologicals used as diagnostic agents are under the authority of the Bureau of Drugs.

The Bureau of Medical Devices and Diagnostic Products, through recent legislative action (Pub. L. 94-295, 90 Stat. 539-583) has the authority to classify an item as requiring premarketing clearance based on performance

*The seven States are Alaska, Delaware, Iowa, Rhode Island, Utah, Vermont and Wyoming.

review, as subject to specified standards of safety and performance, or as exempt from standards or preclearance. The Bureau has stated it has not established any requirements under the act for devices of the kind covered by the State radiation program requirements that have been developed under the Atomic Energy Act, and accordingly, State requirements are not preempted at this time.[35] This position, however, is not entirely clear with respect to medical devices using NARM (principally ^{226}Ra, ^{222}Rn and ^{57}Co) in non-Agreement States where no formal mechanism exists to certify the adequacy of State radiation program requirements.

The FDA's Bureau of Radiological Health (BRH) issues guidelines on the safe use and disposal of radioactive products, participates in the development of standards, and acts jointly with the NRC and the Council of State Governments to produce model regulations in the form of Suggested State Regulations for the Control of Radiation. In addition, as noted earlier, this Bureau conducts a voluntary, cooperative program with the States to evaluate the safety of products containing NARM sources according to guidelines paralleling those utilized by the NRC for evaluating sources containing byproduct material. Recently, a joint BRH-EPA-NRC-State Task Force developed regulatory guides for NARM. Unused and defective radium sources are collected for disposal through a joint program of the Bureau and the Environmental Protection Agency (EPA).

Other agencies of HEW which can have an impact on the use of radioactive material are the Social Security Administration (SSA) and the Center for Disease Control (CDC). The Bureau of Health Insurance of the SSA approves payment under Medicare and Medicaid programs to about four hundred private certified laboratories for diagnostic procedures which include radioactive bioassays. Certification is provided by the CDC, or its State contractors, based on standards for qualifications of personnel, and evaluation of proficiency testing and quality control programs. The Bureau of Quality Assurance of the SSA sets standards for Radiology and Nuclear Medicine facilities as minimum criteria for eligibility to participate in the Federal Health Care for the Aged (Medicare) program.

The National Institutes of Health (NIH) support research and develop health care guidelines which may recommend continuance or cessation of use of specific radionuclide procedures. The National Institute of Occupational Safety and Health (NIOSH) has a program for testing and certification of devices and equipment used in industry and makes recommendations to the Occupational Safety and Health Administration (OSHA) of the Department of Labor and to other Federal agencies. NIOSH also develops criteria for substances used in the work-place as guidelines for future regulations.

Consumer Products Safety Commission

The Consumer Products Safety Commission (CPSC) has regulatory authority to require appropriate brands and labeling of articles containing radioactive substances if determined to be sufficiently hazardous to warrant control. Their jurisdiction is limited to products introduced or delivered for introduction into interstate commerce. The CPSC is excluded from regulating materials regulated by the NRC. CPSC has not, to date, determined that any NARM article is sufficiently hazardous to warrant control. The CPSC has decided not to take action pertaining to radioactive materials in consumer products generically although it may still regulate radioactive materials on a case-by-case basis.[2]

Environmental Protection Agency

Under authorities from the Public Health Service Act, and the Atomic Energy Act, transferred to the Agency, EPA can advise the President with respect to radiation matters, directly or indirectly affecting health, including guidance for all Federal agencies in the formulation of radiation standards and in the establishment and execution of programs of cooperation with States; establish generally applicable environmental standards for the protection of the general environment from radioactive material; and conduct research and provide technical assistance to States.

The Federal Water Pollution Control Act, as amended, authorizes EPA to establish National Effluent Limitations Guides for various industries to control discharge of pollutants including NARM. The Act also authorizes

the Agency to issue discharge permits for facilities limiting pollutant releases including NARM. The Agency must also develop water quality criteria. The Clean Air Act authorizes EPA to establish national emission standards for hazardous air pollutants.

The Ocean Dumping Act prohibits the dumping of high-level radioactive waste in the ocean. A permit is required from the Agency in order to dump other radioactive materials including NARM in the ocean.

The Safe Drinking Water Act requires EPA to establish regulations for the maximum contaminant levels of radioactivity allowed in public drinking water supplies. Enforcement of these regulations is by the States, or EPA should a State fail to act.

The Resource Conservation and Recovery Act of 1976 (P.L. 94-580) requires the Administrator to identify hazardous wastes and establish standards and a permit system for generators, transporters, users, storage, and disposal of hazardous waste. The Toxic Substances Control Act allows the Administrator to prescribe requirements on the manufacturing, processing, distribution, use, or disposal of chemical substances or mixtures which present an unreasonable risk of injury to health or the environment. EPA will be required to develop regulations under these Acts to control NARM.

EPA operates a radium disposal project at its Eastern Environmental Radiation Facility in cooperation with the Bureau of Radiological Health.

EPA has drafted a proposed bill to enable EPA to directly regulate naturally occurring radioactive materials. NRC, along with other Federal agencies provided comments to the Office of Management and Budget. The bill would apparently coordinate and extend in some circumstances direct EPA regulatory control over radiation hazards occurring *in situ*, e.g. radon in caves, or geographical areas having naturally occurring high external radiation levels. The bill would also coordinate and extend direct EPA control over the use, storage and disposal of naturally occurring radioactive materials, including authority to evaluate and approve products containing these materials. The EPA bill is being redrafted at the present time.

Department of Labor

Within the Department of Labor the Occupational Safety and Health Administration (OSHA) has a program to assure safety during employment in a work-place. OSHA has promulgated standards and set regulations concerning exposure to ionizing radiation.* Persons operating under NRC or Agreement State licenses and in compliance with applicable requirements are deemed to be in compliance with respect to materials subject to NRC regulation or NRC-State Agreements. Policies have been established in cooperation with NRC for handling the regulation of persons using both Agreement and NARM sources.[36] States can receive financial support from OSHA to conduct occupational radiation protection programs on behalf of OSHA relative to x-ray and NARM use.

The jurisdiction of OSHA does not extend to working conditions of employees covered by statutory authority of other Federal agencies who are actively exercising such authority. However, by Executive Order, Federal agencies are required to meet OSHA standards for their own employees. For military personnel, the Department of Defense has a policy of adhering to OSHA standards.

Nuclear Regulatory Commission

The NRC does not regulate accelerator produced radioactive materials nor naturally occurring radioactive material other than thorium and uranium pursuant to 10 CFR 40. NRC does require uranium mill licensees to control NARM in the course of their licensed activities. The NRC exerts influence on the control of NARM through the promulgation of standards and guidelines, participation in the development of model legislation for the States, and licensing and inspection of facilities which utilize NARM in addition to licensed byproduct, source and special nuclear materials. Through its Agreement State program, it has encouraged States to develop regulatory programs for NARM comparable with those for Agreement materials. However, NRC cannot insist upon State action with respect to NARM as a matter of compatability or adequacy of the State program.

Federal agencies, except for ERDA and certain activities of the Department of Defense, are subject to the requirements of the Atomic Energy

*29 CFR 1910.96.

Act and the U.S. Nuclear Regulatory Commission, including requirements for a license. Federal agencies are not subject to State requirements.* Consequently, while NRC approval may be required (i.e. a license) prior to a Federal agency obtaining byproduct, source or special nuclear materials, there are no similar restrictions placed upon Federal agencies when they obtain NARM.

One consequence of this is that there is very little information available on the extent of use of NARM by the Federal government. Government surplus channels were identified in 1964 as an inadequately controlled source of radioactive materials entering the consumer market.[37]

Energy Research and Development Administration

ERDA directly, or through contract, controls about 1/4 of the accelerator facilities in the United States including most of the largest units. Radioactive material is synthesized both as an incidental product of high energy particle research and directly for use in medical and other research programs but is not normally available for commercial purposes. ERDA has responsibility for the safety of personnel and conduct of operations at ERDA and contractor facilities. ERDA and its prime contractors are exempted by statute from NRC licensing except in certain limited instances. Radiation safety control is achieved through contract requirements. ERDA inspects and enforces compliance at its facilities and contractor sites in accordance with OSHA standards under agreement with that agency. ERDA has recently considered asking the States to assist in the regulation of their accelerators.

The agency also actively participates in standards development.

Department of Transportation and U.S. Postal Service

The transport of radioactive material is governed by the regulations of the Department of Transportation (DOT) and the U.S. Postal Service (USPS). DOT encompasses the Federal Highways, Railroad and Aviation Authorities and the Coast Guard, all of whom are responsible for the enforcement of packaging and labeling requirements and the prescribed degree of control

*Some individual Federal facilities have requested State agencies to review their radiation safety programs as a means of obtaining an independent audit. Such action is voluntary, however.

to be exercised by carriers in interstate commerce. The USPS has promulgated regulations on packaging, labeling and maximum allowable activity. Parcels not meeting these requirements are non-mailable.

Customs Service

The Customs Service of the Department of Treasury may, at the request of other Federal agencies, act to control the import of products containing radioactive materials not in conformity with Federal regulations.

Federal Trade Commission

Intermittent control over the use of radioactive material has been exercized by the Federal Trade Commission (FTC). As an example, the FTC prohibited the interstate advertising of alleged beneficial health effects resulting from intake of air and water containing radon.

National Bureau of Standards

The National Bureau of Standards (NBS), Department of Commerce, provides reference standards for radioactive materials, calibration and evaluation services, and technical expertise in the development of standards.

Department of Interior

The Mining Enforcement and Safety Administrator (MESA) has established radon daughter exposure limits in mine facilities based upon Federal guidelines established for that purpose by EPA.

Other Federal Agencies

The Department of Defense, the Veterans Administration, and the General Services Administration are able, through procurement specifications, to influence the design and quality of major lines of products containing radioactive material. These agencies also set requirements for use and disposal of sources by their facilities. The Army recently reported that procurement of radium activated phosphors is now forbidden.[2]

National Council on Radiation Protection and Measurements

The National Council on Radiation Protection and Measurements (NCRP) is not a Federal agency but has been chartered by Congress to collect, analyze, develop and disseminate information and recommendations about protection against radiation, and radiation measurements, quantities and

units, particularly those concerned with radiation protection. The Council does not have regulatory authority but its recommendations do serve as the basis for nearly all Federal and State regulations on radiation protection and for the evaluation of radiation hazards.

Federal Regulation of NARM-Present Status

Authority to regulate NARM by the Federal government is fragmented among many departments and commissions and agencies each having some limited authority. The jurisdictions of these agencies overlap in some areas and leave gaps in others. Existing authorities have not been uniformly exercised.

The regulatory picture for NARM is one of disarray, especially when compared to the regulation of byproduct, source and special nuclear materials. Users of the latter materials are generally excluded from regulation by Federal agencies other than NRC with respect to radiation safety. However, users of byproduct, source and special nuclear materials who also use NARM can find themselves subject to regulation by additional, and frequently more than one, Federal agencies. The following example serves to illustrate this:

Type of Radioactive Material	Activity	Federal Agency Having Primary Jurisdiction
Byproduct, Source and Special Nuclear Materials	Occupational Exposure.....	NRC
	Effluents to Air and Water.....	NRC
	Distribution of Consumer Products..	NRC
	Solid Waste Disposal.....	NRC
NARM	Occupational Exposure.....	OSHA
	Effluents to Air and Water.....	EPA
	Distribution of Consumer Products..	CPSC
	Solid Waste Disposal.....	EPA

Excluding fissile materials, these divisions of regulatory authority do not seem to be related to any system of differentiation based upon the hazards from NARM and from NRC licensed materials.

NRC (AEC) LEGISLATIVE HISTORY AS TO WHY NRC DOES NOT NOW REGULATE NARM

The reasons why NRC does not regulate naturally occurring and accelerator-produced radioactive materials today may be traced back to the origins of the NRC's predecessor agency, the United States Atomic Energy Commission. In enacting the Atomic Energy Act of 1946 and establishing the U.S. Atomic Energy Commission as the government agency solely responsible for the production and the use of fissionable material, Congress responded to the urgent and serious public concerns for the peace and security of the Nation which followed the development and military use of the atomic bomb. These concerns recognized the necessity and the importance of subjecting all aspects of the nuclear fission process to tight control. At the same time, Congress was equally concerned that this control, which included exclusive government ownership of fissionable material, not become all-pervasive and that basic freedoms not be threatened.* In an effort to reconcile these conflicting concerns, the provisions of the Atomic Energy Act of 1946 were kept sharply and narrowly focused on fissionable materials, on source materials from which fissionable materials could be obtained, and on radioactive material yielded in or made radioactive by exposure to the fission process.

Naturally occurring radioactive materials (other than source materials), such as radium, which could not be used in the nuclear fission process were deliberately left outside the reach of the Act. Also excluded were the materials which were fissionable but in which a self-sustaining nuclear reaction could not be maintained. In contrast to the overwhelming peril of the atomic bomb, any health and safety problems which these materials might cause were considered manageable and relatively insignificant. Given

*See Senate debate on bill which became the Atomic Energy Act of 1946, June 1, 1946, Congressional Record, pp. 6082, 6086, and explanation of bill by Senator McMahon, Congressional Record June 1, 1946, pp. 6094-6098. See also House debate, July 17, 1946, Congressional Record, pp. 9268-9269.

the state of the art -- at that time comparatively few uses of radioactive materials had been developed and supplies of radioactive materials were limited (the available radium had been distributed and seldom moved in interstate commerce and significant quantities of man-made radioactive materials were not as yet available) -- there appeared to be no urgent need and, from the standpoint of the common defense and security, no basis for federal regulation of these materials.

Section 5 of the Atomic Energy Act of 1946 provided for the control of fissionable, source and byproduct materials. Byproduct material was defined in subsection 5(c)(1) as:

> "...any radioactive material (except fissionable material) yielded in or made radioactive by exposure to the radiation incident to the processes of producing or utilizing fissionable materials."*

Subsection 5 (c)(2) authorized the Commission to distribute byproduct materials with or without charge:

> "...to applicants seeking such materials for research or development activity, medical therapy, industrial uses, or such other useful applications as may be developed. In distributing such materials, the Commission shall give preference to applicants proposing to use such materials in the conduct of research and development activity or medical therapy. The Commission shall not distribute any byproduct materials to any applicant, and shall recall any distributed material from any applicant, who is not equipped to observe or who fails to observe such safety standards to protect health as may be established by the Commission or who uses such materials in violation of law or regulation of the Commission or in a manner other than as disclosed in the application therefor."

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*Section 5 (a)(1) of the 1946 Act defined "fissionable material" as "plutonium, uranium enriched in the isotope 235, any other material which the Commission determines to be capable of releasing substantial quantities of energy through nuclear chain reaction of the material, or any material artificially enriched by any of the foregoing; but does not include source materials, as defined in section 5 (b)(1)."
Section 5 (b)(1) defined "source material" as "uranium, thorium, or any other material which is determined by the Commission, with the approval of the President, to be peculiarly essential to the production of fissionable materials; but includes ores only if they contain one or more of the foregoing materials in such concentration as the Commission may by regulation determine from time to time."

Section 12 (a)(2) gave the Commission broad authority to:

> "...establish by regulation or order such standards and instructions to govern the possession and use of fissionable and byproduct materials as the Commission may deem necessary or desirable to protect health or to minimize danger from explosions and other hazards to life and property;..."

Although the 1946 Act authorized the Commission to regulate byproduct material from the standpoint of radiological health and safety, it did not establish a licensing system. In lieu of licenses, the Commission issued authorizations for radioactive material procurement to persons able to comply with the requisite regulatory requirements applicable to byproduct material. These authorizations were also used by the Commission to allocate byproduct material, then in short supply, in a manner which would best serve the overall purposes of the Act.

By 1954 the advances in nuclear medicine and technology had reached the point where participation by private industry in developing peaceful uses of atomic energy was considered both feasible and necessary. In order to encourage this development and to facilitate the team work between industry and government which Congress regarded as essential to optimum progress towards the goal of peacetime nuclear power, Congress undertook a major revision of the law. The Atomic Energy Act of 1954 was enacted to provide a legal framework within which government and industry could work together effectively. That Act authorized the Atomic Energy Commission (AEC) to license private industry to possess and use, but not to own,* special nuclear material and to own, construct and operate reactors designed to produce and utilize such material. At the same time, the Commission retained its continuing responsibilities for the development and promotion of the industrial and commercial uses of atomic energy.

Except for substituting the term "special nuclear material" for the term "fissionable material",** the Atomic Energy Act of 1954 made little

*In 1964, the Atomic Energy Act of 1954 was further amended to end the requirement for exclusive government ownership of special nuclear material and to permit such material, subject to licensing requirements, to be privately owned. (Pub. L. 88-489, 78 Stat. 602)

**This change extended Commission control to materials essential to the process of nuclear fusion. Prior to this change, the Commission was only authorized to control materials essential to the process of nuclear fission.

substantive change in the definition of byproduct material contained in the 1946 Act.* The Commission's prior authority to distribute byproduct material was modified by the grant of additional authority to issue byproduct material licenses. Section 81 of the 1954 Act authorized the Commission to exempt certain classes of byproduct materials from licensing requirements after first finding that:

> "...the exemption of such classes and quantities of material or such kinds of uses or users will not constitute an unreasonable risk to the common defense and security and to the health and safety of the public."

The Commission's authority to promulgate standards and regulations governing the possession and use of byproduct material was retained and ownership of byproduct materials by private persons continued to be permitted. The 1954 Act made no change in the Commission's regulatory authority over source, byproduct and special nuclear (formerly fissionable) materials.**

On September 23, 1959, a new section was added to the Atomic Energy Act of 1954 which provided for cooperation with the States (Public Law 86-273, 42 U.S.C. 2021). Among other things, the Commission was authorized to enter into agreements with the Governor of any State providing for relinquishing to the State the regulatory authority of the Commission with respect to byproduct and source materials and special nuclear material in quantities not sufficient to form a critical mass. On March 26, 1962, Kentucky became the first "Agreement State". Since then, the Commission has entered into similar agreements with 24 additional States. A list of the Agreement States follows:

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*Section 11e of the Atomic Energy Act of 1954 defines "byproduct material" as "...any radioactive materials (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material."

**Section 161b of the Atomic Energy Act of 1954 authorizes the Commission to "establish by rule, regulation, or order, such standards and instructions to govern the possession and use of special nuclear material, source material, and byproduct material as the Commission may deem necessary or desirable to promote the common defense and security or to protect health or to minimize danger to life or property;..."

State	Became an Agreement State On
Kentucky	March 26, 1962
Mississippi	July 1, 1962
California	September 1, 1962
New York	October 15, 1962
Texas	March 1, 1963
Arkansas	July 1, 1963
Florida	July 1, 1964
North Carolina	August 1, 1964
Kansas	January 1, 1965
Oregon	July 1, 1965
Tennessee	September 1, 1965
New Hampshire	May 16, 1966
Alabama	October 1, 1966
Nebraska	October 1, 1966
Washington	December 31, 1966
Louisiana	May 1, 1967
Arizona	May 15, 1967
Colorado	February 1, 1968
Idaho	October 1, 1968
North Dakota	September 1, 1969
South Carolina	September 15, 1969
Georgia	December 15, 1969
Maryland	January 1, 1971
Nevada	July 1, 1972
New Mexico	May 1, 1974

The provisions of the Atomic Energy Act of 1954 relating to byproduct material remained unchanged until 1974 when Congress amended Section 81 to make clear that persons licensed by Agreement States under Section 274 of the Act stood on the same footing as AEC licensees with respect to the distribution of byproduct material (Public Law 93-377, 88 Stat. 475).

On January 19, 1975, in accordance with the Energy Reorganization Act of 1974, the U.S. Nuclear Regulatory Commission assumed the licensing and related regulatory functions vested in the former U.S. Atomic Energy Commission by the provisions of the Atomic Energy Act of 1954, as amended. These functions included the authority to license and regulate among other things (not NARM), the manufacture, production, transfer, possession, use, import and export of byproduct material.

In summary, in 1946, Congress focused its concern on the overwhelming peril of the atomic bomb and the problems related to control of material associated with the fission process. (The use of accelerators to produce

radioactive materials was relatively insignificant.) NARM was excluded from the Atomic Energy Act and has remained excluded. In the succeeding three decades, a need to regulate NARM in various activities has become recognized. Since the Atomic Energy Act excluded these materials, authority for Federal regulation of these materials has been included in various legislation affecting other Federal agencies. Administration of these authorities has been assigned by Congress to agencies responsible for such things as employee health and safety (OSHA), discharges to streams and solid wastes (EPA), etc.

The exclusion of NARM from the 1946 Act has profoundly influenced the course of legislative action with respect to the Federal control of NARM and has led to two systems for regulating radioactive materials in the United States. The hazards from NARM are not uniquely different from those from NRC regulated materials (except fissile material) and, therefore, there is no health and safety basis for regulating these groups of materials differently.

CONCLUSIONS, RECOMMENDATIONS AND PUBLIC POLICY ISSUES

Conclusions

The NCRP identifies 5 categories of radiation exposure of the public:

1. Medical,
2. Industrial,
3. Production of Nuclear Power (Nuclear Fuel Cycle),
4. Consumer Products,
5. Natural Background.

A sixth category, often identified separately from any of the others is transportation. Current regulatory authorities and gaps for the control of NARM in these categories can be summarized as follows:

(1) Medical Sources (Brachytherapy, tumor localization, organ scanning and imaging, in-vitro tests, markers, etc.) - Some, but not all States regulate the users and the manufacturers of medical NARM sources for purposes of radiation protection. A voluntary, cooperative Federal/State program is in effect for manufacturing and quality control standards. FDA has authority to regulate these sources under the Medical Device Amendments of 1976 (Public Law 94-295, 90 Stat. 539-583), however, implementing regulations with respect to specific devices have not yet been adopted. There is no Federal program requiring pre-market approval of NARM radioactive medical sources or requiring the sources to conform with specified manufacturing and quality control standards. Occupational hazards to employees from the use of NARM medical sources are subject to OSHA regulations.

(2) Industrial Sources (gauging, ionization sources, calibration and check sources) - Some, but not all States regulate the manufacturers and users of industrial NARM sources. Only a voluntary, cooperative Federal/State program exists for establishing nationally applicable manufacturing and

quality control standards. Occupational hazards to employees from the use of NARM industrial sources are subject to OSHA regulations.

(3) Fuel Cycle (Radium and daughters, primarily in association with mining and milling of source material ores) - The Mining Enforcement and Safety Administration and the States exercise control over mining of source materials. NARM encountered in activities which are part of, or in support of, the fuel cycle licensed by NRC and Agreement States (primarily as the contaminant in mill tailings) must be controlled by the licensee. However, NRC does not exercise any control over the NARM as licensed material. Hence, after termination of an NRC license, NRC control over NARM ends. Agreement States do exercise direct control in such cases but their regulation and control of the NARM in inactive tailings piles after termination of an NRC license varies. Under the Solid Waste Act and Toxic Substances Act, EPA will be required to develop regulations to control these materials.

(4) Consumer Products (radioactive luminous timepieces, radon in drinking water and natural gas, ionization smoke detectors, agricultural gypsums, aggregates, building blocks, and wallboard manufactured from phosphates, etc.) - No Federal authority has been exercised to establish limits for permissible NARM radioactivity in manufactured consumer products or to impose standards and conditions for their manufacture and distribution. The Consumer Products Safety Commission has declined to proceed with regulations pertaining to radioactive materials in consumer products, although it may take action on a case-by-case basis. Many, but not all States, license and regulate some manufacturers and distributors of products into which NARM is deliberately introduced or incorporated. States have not uniformly regulated the manufacture of products which may be contaminated by NARM, e.g. phosphate industry byproducts. There is no

existing Federal program for requiring pre-marketing approval for importation of consumer products containing or contaminated with NARM. EPA has established radioactivity standards for drinking waters. The new Toxic Substances Control Act provides the EPA with authority to control manufacture, use, and disposal of toxic substances which may provide effective control over certain consumer products once regulations are developed. EPA is asking Congress for broader authority to regulate in this category.

(5) Background NARM (high terrestial radiation, radon in caves) - Limited authorities exist in Federal agencies to exercise controls over this source.

(6) Transportation - Adequate Federal authority exists through DOT and USPS. Intra-State transportation (excluding air transport and military) is subject to State regulation. NARM is a small part of the radioactive materials transportation picture. Incidents resulting from the transportation of all radioactive materials are not a significant problem.

Radium users alone constitute 18% of all radioactive material users subject to licensing. Health and safety control of these users has been a serious, continuing problem to State regulatory agencies.

Radium sources are frequently found to leak. Most radium sources have not been subjected to a regulatory evaluation equivalent to NRC practices for assessing source integrity design.

Radium and daughters in the tailings of uranium mills constitute a continuing regulatory problem especially since NRC control ends with termination of the NRC license. EPA intends to develop regulations in this area.

The use of accelerator-produced radioisotopes has grown rapidly.

There is no regulatory assurance that all NARM sources, devices and consumer products currently in use, or being distributed today, meet

minimum manufacturing and quality control standards or limits for NARM contamination. States actively engaged in regulating NARM have expressed special concern over the lack of uniformly applied standards governing the manufacture and distribution of NARM devices.

Whether or not radioactive material is subject to adequate regulatory control seems to be not related to the hazards of the radioactive material but, whether or not it is material defined in the Atomic Energy Act, as amended, and therefore subject to licensing and regulation by NRC. There is existing regulatory authority to control NARM under the Consumer Product Safety Act, the Toxic Substances Control Act, the Resource Conservation and Recovery Act, and the Medical Device Amendments of 1976. However, these authorities have not been exercised uniformly. The situation is confusing, especially to persons who, as a result of handling both NARM and NRC regulated materials find themselves subject to, and required to know and comply with, many different sets of regulations.

One result of the fragmented and non-uniform regulation of NARM is that it is difficult to develop information which can be definitive in describing the extent and kinds of problems experienced in using NARM. However, the available information strongly indicates that workers and the public are being exposed to unnecessary, and possibly excessive, levels of radiation from NARM. In this regard, most of the regulatory experience over NARM comes from the States. The concern of the States has been that the potential problems from inadequate regulation of NARM are sufficiently serious to have resulted in State requests to NRC to fill the regulatory gaps.

Recommendations

There is no apparent justification for continuing the regulation of radioactive material in this confusing and probably wasteful manner. State regulatory efforts should be encouraged to develop in those States having no programs. However, if no State program is put into effect, the Federal government should act to assure that workers and the public in these States are provided the same protection from unnecessary or excessive exposure from NARM as is provided in other States. It is recommended that the existing

NRC-Agreement State regulatory pattern be expanded to fill the gaps in a manner which would be consistent with Section 274 of the Atomic Energy Act, as amended, (Cooperation with States). Such an approach has the advantage of building upon existing pools of regulatory expertise and experience, an efficient solution in terms of utilization of personnel resources which also serves to simplify a presently confusing, fragmented regulatory picture. The licensing approach used by NRC is an effective regulatory tool and should be applied to manufacturers, distributors and users of NARM sources and devices along the same lines currently applied by NRC to byproduct, source and special nuclear materials.

However, when existing State NARM licensing efforts are found to be adequate and compatible with existing Agreement material licensing practices, provisions should be made in Section 274 of the Act to recognize those State programs and NRC authority discontinued in those States. In these cases, NRC review of Agreement State programs currently conducted with respect to byproduct, source, and special nuclear materials should be expanded to include NARM.

With respect to new or improved NRC actions, it is recommended that the Commission seek legislative authority to:

A. License and regulate NARM as follows:*

1. In any activity that is part of, or in support of, the nuclear fuel cycle regulated by NRC.
2. In any activity where: (a) NARM is manufactured (e.g. production of accelerator radioisotopes, the separation of radium and radium daughters, and radon generators); (b) NARM is incorporated into sources or devices subject to licensing; or (c) NARM is used in the same manner as radioactive materials subject to NRC regulation.

*One possible mechanism to accomplish this would be to amend the definition of "Byproduct Material" to include NARM.

3. In any activity where NARM is introduced into products intended for distribution to persons exempt from licensing.*
4. In any activity involving the management of NARM wastes which result from licensed activities.

B. Extend authority under Section 274 of the Atomic Energy Act to relinquish authority to regulate NARM (except control of the distribution of NARM to persons exempt from licensing) to Agreement States and to other States having existing regulatory programs for NARM which are determined to be adequate and to be compatible.

Adequate provision should also be made to encourage proper disposition of unwanted NARM sources. Towards this end, the Federal radium disposal project should be continued and expanded.

The results of the joint NRC-ERDA reexamination of excess sites may dictate a need for Federal support if additional clean-up of these sites is needed. Standards applicable to such sites may need to be developed.

A modest program to publicize the need for removing previously manufactured and distributed radium sources from the public domain is recommended. An effort should also be mounted to review existing records of past sales and transfers of radium to identify recipients of licensable medical and industrial sources who may still possess the sources unknown to regulatory authorities.

Public Policy Issues

It is believed that public reaction to NRC taking the actions recommended would be favorable since the proposed actions would serve to promote the public health and safety.

Conversion by many radium users to other isotopes, particularly in medicine, will probably occur, but this would be consistent with numerous recommendations already issued by Federal, State and medical groups.

*It is intended that this include only activities where the introduction of NARM is deliberate and has as a purpose the utilization of its radioactive properties.

The States look to the NRC as a lead agency in the regulation of nuclear energy and radioactivity and have specifically requested NRC to regulate NARM. The essential public policy question to be addressed is the matter of how much Federal control is needed. Regulatory efforts by Agreement States and certain other State have been adequate in those areas where States have traditionally regulated and have exercised their authority to act. There is no reason to discontinue State authority in these areas.

All radioactive material used in the nuclear fuel cycle, or otherwise utilized for its radioactive properties, in the United States, would be subject to uniform regulatory control to protect the public health and safety.

In licensed activities which are part of, or in support of, the nuclear fuel cycle, NARM would be subject to direct regulation by the NRC as licensed material, including tailings from uranium mill sites. This should enable improved regulatory management of mill tailings and minimize the adverse impact upon the environment and the public health and safety from tailings from active and inactive mills.

All users of NARM, including manufacturers and distributors, would be subject to the same requirements as NRC and Agreement State licensees. This will have positive impact upon the health and safety in 1600 facilities where NARM is used but where the NARM is not subject to licensing. About 1300 of these users are presently licensed by NRC for use of byproduct, source, and special nuclear materials. In many of these cases, the existing radiation safety procedures developed for the NRC licensed program also cover the use of NARM. The impact of complying with additional license requirements for NARM should be minimal for these users.

The remaining 300 users would be newly subject to license requirements (and to fees). Based upon the experiences of many States, the initial contacts with these users will likely disclose many significant hazardous conditions. The impact of the NRC regulatory process upon these users should be positive by causing corrections to be made since these users will be subject to more stringent regulations requiring development of adequate, documented radiation safety programs for using NARM.

The establishment and enforcement of Federal regulatory standards for the design and fabrication of NARM sources should eventually lead to a significant reduction in the numbers of sources which leak and can potentially contaminate persons and property.

All NARM deliberately incorporated into products to utilize, directly or indirectly, its radioactive properties and which is intended for distribution to the public as exempt items, or imported into the U.S., would be subject to the same requirements as are currently applied by NRC. A national pre-marketing approval would, in effect, be required for the distribution of consumer products into which NARM has been deliberately introduced. None is required now.

The extension of NRC control over management of NARM wastes resulting from licensed activities should clarify Federal responsibilities over radioactive wastes by providing a uniform regulatory program for all radioactive wastes generated as a result of licensed activities.

Overall, the impact upon States would be positive. State programs for licensing for NARM would be recognized by the Federal government and Federal authority relinquished. In other States, development of regulatory programs for NARM would be encouraged. State cooperation and participation in development of standards and regulations for NARM would be enhanced. The regulation of abandoned uranium mill tailings by NRC in non-Agreement States will be a positive impact. A slight negative impact will be felt by those States having certain contracts with OSHA in that funding for coverage of NARM users would probably be lost.

NRC's responsibilities in certain areas, e.g. mill tailings management will be clarified. The cost impact upon NRC is difficult to estimate because the number and mix of radium licensees cannot be accurately determined. New annual costs are estimated to be between $150,000 to $300,000. This estimate primarily reflects the costs of administering licensing and compliance programs for new (i.e. NARM only) licenses. Professional staff requirements would increase by at least 4 person-years. However, additional one-time costs will probably be incurred as the result of non-routine tasks such as the need to develop new standards applicable to

"exempt" devices containing NARM, evaluation of sealed sources and devices using NARM, initial licensing and compliance actions, and initial assessments of State NARM regulatory programs.

The recommendations do not cover activities where NARM, or more particularly, naturally occurring radioactive material, is encountered *in-situ*, is incidentally present in mineral industry activities outside of the fuel cycle, or is an incidental contaminant in consumer products (i.e., has not been deliberately introduced or reconcentrated in a product for the purpose of utilizing its radioactive properties). NRC involvement in these areas was not specifically requested by the States.

The recommendations for NRC action will be consistent with NRC's recognized role as a lead Federal agency in the control of hazards from radioactive materials.

Table 1

Primordial Radionuclides

Nuclide	Half-life (Years)	Primary Mode of Decay
^{40}K	1.3×10^{9}	Beta
^{50}V	6×10^{16}	Electron Capture
^{87}Rb	4.7×10^{10}	Beta
^{115}In	6×10^{14}	Beta
^{138}La	1.1×10^{11}	Beta
^{142}Ce	5×10^{16}	Alpha
^{144}Nd	5×10^{15}	Alpha
^{147}Sm	1.06×10^{11}	Alpha
^{148}Sm	1.2×10^{14}	Alpha
^{149}Sm	1×10^{15}	Alpha
^{152}Gd	1.1×10^{14}	Alpha
^{174}Hf	4.3×10^{15}	Alpha
^{176}Lu	3.6×10^{10}	Beta
^{187}Re	7×10^{10}	Beta
^{190}Pt	7×10^{11}	Alpha
^{192}Pt	1×10^{15}	Alpha
^{204}Pb	1.4×10^{17}	Alpha
^{235}U decay series	-	-
^{238}U decay series	-	-
^{232}Th decay series	-	-

Table 2

Major Cosmic Ray-Induced Radionuclides

Nuclide	Half-Life	Primary Mode of Decay
^{3}H (T)	12.26 yrs	Beta
^{7}Be	53 days	Electron Capture
^{10}Be	2.7×10^{6} yrs	Beta
^{14}C	5760 yrs	Beta
^{22}Na	2.58 yrs	Beta
^{32}Si	280 yrs	Beta
^{32}P	14.3 days	Beta
^{33}P	25 days	Beta
^{35}S	86.7 days	Beta
^{36}Cl	3×10^{5} yrs	Beta
^{39}Cl	.55 min	Beta

Table 3

Civilian Uses of Radium
(Including Radon and RaDEF)

Item	Typical Activity
Medical Sources	
Needles, Capsules & Tubes	0.1 to 100 mCi
Plaques	5 to 25 mCi
Nasopharangeal Applicators	50 mCi
Radium DEF Eye Applicators	No data
Radon Seeds	0.1 to 5 mCi
Industrial Sources	
Level, Thickness and Density Gauges	0.1 to 10 mCi
Gamma Well Logging	10 to 50 mCi
Ra-Be Neutron Well Logging	300 to 600 mCi
Soil Moisture and Density Gauges	3 to 5 mCi
Radiography	up to 150 mCi
Ionization Sources, Static Eliminators (Ra)	3 µCi to 3 mCi
Calibration, Check & Compensating Sources	1 pCi to 1 Ci
Gamma & Neutron Sources for Research	1 pCi to 1 Ci
Gas Chromatograph Sources and Dew Point Meter Sources	6.25 to 100 µCi 22.5 to 100 µCi
Consumer Items	
Self-luminous Products (excluding Diver's Watches and Depth Gauges)	0.01 to 5 µCi
Smoke Detectors	0.05 to 40 µCi
Electron Tubes	0.001 to 6 µCi
Educational Sources (Cloud Chambers, Spinthariscopes)	1 pCi to 50 µCi

Table 4

Military Uses of Radium

Item	Typical Activity μCi
Alidades, Pelorus	15
Calibration sources	10^{-3} to 10^{3}
Circuit Breakers	60
Compass, Rose	1000
Compass, Divers, Wrist	15
Compass, Unmounted	15
Compass, Lensatic	15
Direction Finder	15
Distress Markers	No data
Electron Tubes, Glow Lamps, Spark Gap Tubes	10^{-3} to 6
Fuse Setter	No data
Generator Gauges	2.5
Indicator, Fuel Gage	No data
Indicator, Battery	0.5
Indicator, Air speed	1 to 15
Indicator, Tachometer, Speedometer	1 to 15
Indicator, Manifold Pressure	.009
Indicator, Oil Pressure	1 to 15
Indicator, Water Pressure	0.8
Indicator, Suction	1 to 15
Indicator, Altimeter	1 to 15
Indicator, Temperature	15
Indicator, Turn and Bank	15
Indicator, Azimuth	3.7
Indicator, Vertical	0.002
Indicator, Rate of Climb	0.027
Indicator, Directional Gyro	0.026
Instrument Dials, Voltmeter	0.08
Instrument Dials, Ammeter	0.35

Table 4 (Cont'd)

Item	Typical Activity μCi
Instrument Dials, Galvanometer	1
Instrument Dials, Audio Level	0.7
Luminous Markers	7
Oxygen Pressure Reducer	No data
Phone Jack Boxes	No data
Switches, Push Button	0.37
Switches, Toggle	0.37
Switches, Barrel	0.37
Switches, Rotary	0.37
Tensiometers	No data
Timepieces, Wrist Watches	15
Timepieces, Marine Clock	10
Timepieces, Chronometer	15
Timepieces, Interval Timer	6
Transit	15

Table 5

Selected Accelerator-Produced Radionuclides
(including some examples of uses)

Nuclide	Half-Life	Primary Mode of Decay	Uses
^{11}C	20.4 minutes	Positron	Lung Uptake & Metabolism, Prostrate tumor localization, Pancreas visualization
^{13}N	10.0 minutes	Positron	Pancreatic scanning, Brain scanning
^{15}O	123 seconds	Positron	Brain scanning, left-right shunt detection
^{18}F	109 minutes	Positron	Uptake in normal and abnormal bone, brain function scan, cancer chemotherapy
^{22}Na	2.62 years	Positron	Extra-cellular water
^{28}Mg	21.2 hours	Beta	Parent of ^{28}Al
^{28}Al	2.31 minutes	Beta	
^{33}P	24.4 days	Beta	Palliative treatment for osseous neoplasms
^{37}Ar	35.1 days	Electron Capture	Total Body calcium determination
^{43}K	22.4 hours	Beta	Myocardial imaging
^{49}Sc	57.5 minutes	Beta	
^{52}Mn	5.60 days	Electron Capture	
^{52m}Mn	21.1 minutes	Positron	
^{52}Fe	8.2 hours	Positron	Parent of ^{52m}Mn
^{56}Co	77.3 days	Electron Capture	Tumor localization
^{57}Co	270 days	Electron Capture	Vitamin B-12, tumor imaging calibration sources, anatomical (scanning) makers, Mossbauer studies, X-ray fluorescence lead analyzers, simulated tumors in phantoms.

Table 5 (Cont'd)

Nuclide	Half-Life	Primary Mode of Decay	Uses
^{58}Co	71.3 days	Electron Capture	Intestinal absorption studies
^{62}Cu	9.76 minutes	Positron	Radiopharmaceuticals
^{67}Cu	58.5 hours	Beta	Studies of Wilson's Disease
^{62}Zn	9.13 hours	Electron Capture	Parent of ^{62}Cu
^{66}Ga	9.45 hours	Positron	
^{67}Ga	77.9 hours	Electron Capture	Lung scan, Bowel scan, Parotid gland uptake (Sjogren's syndrome)
^{68}Ga	68.3 minutes	Positron	Brain scan, Positron emission tomography for cerebral hemodynamics
^{68}Ge	275 days	Electron Capture	Parent of ^{68}Ga
^{73}As	80.3 days	Electron Capture	
^{74}As	17.9 days	Electron Capture	Brain Tumor localization
^{73}Se	7.1 hours	Positron	
^{77}Br	57 hours	Electron Capture	
^{77}Kr	1.19 hours	Positron	Brain Scan, Positron tomography
^{81m}Kr	13 seconds	Isomeric Transition	Lung ventilation studies, imaging
^{81}Rb	4.7 hours	Electron Capture	Myocardial imaging
^{82}Rb	1.25 minutes	Positron	Imaging
^{84}Rb	33 days	Electron Capture	Radiopharmaceuticals
^{82}Sr	25 days	Electron Capture	Parent of ^{82}Rb
^{87m}Sr	2.83 hours	Isomeric Transition	Bone scanning, Index of bone growth
^{87}Y	80 hours	Electron Capture	Parent of ^{87m}Sr

Table 5 (Cont'd)

Nuclide	Half-Life	Primary Mode of Decay	Uses
^{97m}Tc	91 days	Isomeric Transition	
^{111}In	2.81 days	Electron Capture	Cisternography, Tomography, Tagged Platelets & Lymphocytes
^{123}I	13.3 hours	Electron Capture	Thyroid studies, Imaging, Labelled fibrinogen for in-vivo identification of thrombophlebitis
^{124}I	4.15 days	Electron Capture	
^{125}I	60.2 days	Electron Capture	Bone mineral analysis, Interstitial treatment of cancer, Uptake studies
^{126}I	12.8 days	Electron Capture	
^{127}Xe	36.4 days	Electron Capture	Cardiac studies, Bloodflow studies, Pulmonary function studies
^{129}Cs	32.1 hours	Positron	Myocardial imaging
^{131}Cs	9.70 days	Electron Capture	Thyroid scanning
^{145}Pm*	5.98 hours	Beta	Bone mineralization studies
^{157}Dy	8.1 hours	Electron Capture	Bone tumor localization
^{190m}Os	9.9 minutes	Isomeric Transition	
^{190}Ir	11 days	Electron Capture	
$^{190m1}Ir$	1.2 hours	Isomeric Transition	
$^{190m2}Ir$	3.2 hours	Electron Capture	Parent of ^{190m}Os
^{193m}Pt	11.9 days	Isomeric Transition	Tumor Scanning
^{195}Au	183 days	Electron Capture	
^{195m}Au	30.6 seconds	Isomeric Transition	

*Also produced as a fission product.

Table 5 (Cont'd)

Nuclide	Half-Life	Primary Mode of Decay	Uses
^{197}Hg	65 hours	Electron Capture	Brain and kidney scanning
^{199}Tl	7.4 hours	Electron Capture	Cardiac scanning
^{201}Tl	74 hours	Electron Capture	Cardiac scanning
^{203}Pb	52.1 hours	Electron Capture	Detection of malignant melonoma
^{204}Bi	11.2 hours	Electron Capture	Soft tissue scanning
^{206}Bi	6.24 days	Electron Capture	Soft tissue scanning
^{207}Bi	30.2 years	Electron Capture	

Table 6

Reported Radium Incidents in United States 1966-1969

Type of Incident	Number	Average Rate Per Year
Loss	63	15.8
Theft	6	1.5
Contamination	19	4.8
Overexposure	4	1.0
Other	23	5.8
Total	115	29.0

Table 7

NARM Incidents in Agreement States, 1974-1975

	Number		Average Rate Per Year		
Type of Incident	Radium	Accelerator Isotopes	Radium	Accelerator Isotopes	Year Total NARM
Loss	19	13	9.5	1.5	11.0
Theft, Unauthorized Disposal	1	0	0.5	0	0.5
Contamination	2	3	1	1.5	2.5
Overexposure	2	0	1	0	1.0
Other	2	1	1	0.5	1.5
Total	26	17	13	3.5	16.5

Table 8

Non-Agreement States

State or Territory	Enabling Legislation[a]	Comprehensive Regulations[a]	Presently Licensing NARM[a]	Number of NARM Uses[b]	Responded to NARM Task Force Request for Information
Alaska				No Program	No
Connecticut				28	No
Delaware	Yes	No	No	17	Yes
District of Columbia				20	No
Hawaii				3	No
Illinois	Yes	Yes	Yes	121	Yes
Indiana				72	No
Iowa	No	No	No	20	Yes
Maine	Yes	No	No	19	Yes
Massachusetts	No	No	No	166	Yes
Michigan	Yes	Yes	No	135	Yes
Minnesota				33	No
Missouri				24	No
Montana				27	No
New Jersey	Yes	Yes	Yes	150	Yes
Ohio	No	No	No	196	Yes
Oklahoma	Yes	No	No	50	Yes
Pennsylvania	Yes	Yes	Yes	300	Yes
Rhode Island				48	No
South Dakota	Yes	No	No	24	Yes
Utah				No Program	No
Vermont				7	No
Virginia	Yes	Yes	Yes	50	Yes
West Virginia				50	No
Wisconsin				84	No
Wyoming	No	No	No	22	Yes
Puerto Rico				5	No

Notes: [a]Information recorded only for those States responding to NARM Task Force Inquiry.

[b]For States not responding to NARM Task Force Inquiry, data was obtained from Report of State and Local Radiological Health Programs, Fiscal Year 1975, DHEW Publication (FDA) 76-8005.

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Texas State Department of Health

[illegible], M.D., M.P.H.
COMMISSIONER OF HEALTH

[illegible], M.D., Dr. P.H.
DEPUTY COMMISSIONER

AUSTIN, TEXAS 78756

October 16, 1974

Mr. G. Wayne Kerr, Chief
Agreements & Export Branch
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Wayne:

At the Annual Meeting of the Agreement States, October 8-11, 1974, the State caucus held on October 9, made the following requests and recommendations of the A.E.C.

1. The States appreciate the Agreement and Export Branch's expressed interest in providing additional training for state regulatory personnel. The States request that the Agreement and Export Branch continue close coordination with the Government Liason Division in establishing priorities for training programs in order that the priorities established by the National Conference of Radiation Control Program Directors receive due consideration.

   The Texas Radiation Control Branch is currently developing an Oil Well Logging Course in cooperation with the Region VI training committee. The States request that the A.E.C. consider funding state attendees to that course and possibly others that may be developed to meet specific regulatory needs.

2. The States request that the A.E.C. reevaluate Generally Licensed Devices used in measuring levels, density and thickness with the intent to determine if the devices currently being distributed continue to meet radiation safety criteria which allow them to be eligible for general licensed distribution. The evaluation should include a determination that the devices continue to meet essential safety criteria throughout their useful life.

The States will provide the A.E.C. a list of observed circumstances which indicate that the requested evaluation may show that these devices may not be eligible for continued distribution for generally licensed use. The list will be sent to you by Aubrey Godwin, 1975 Chairman, in 60 days.

3. The States request that the A.E.C. consider changing 10 CFR 30.204 to allow land burial of small quantities of radioactive material by specific request only. (Similar to the current rule for specific approval of incineration.)

4. The States request the A.E.C. to investigate the possibility of providing the States with uniform soil contamination limits.

5. The States request that the A.E.C. provide descriptive Sealed Source and Device sheets for devices distributed under the terms of General Licensing. The States will provide similar sheets for devices distributed under their licensure.

6. The States request that the A.E.C. consider reestablishing notifications of shipments of large quantities of radioactive materials and quantities of S.N.M. sufficient to form a critical mass thru state jurisdictions.

7. The States recommend strongly that the A.E.C., or it's successor agency, move immediately to bring accelerator produced and naturally occurring radioactive material under it's jurisdiction.

The States also suggested that the A.E.C. should examine the possible impact of the Act creating a new agency upon agreements now in effect with the U. S. A.E.C.

The States expressed appreciation for the positive action of Mr. Brown of the Government Liason Division in committing funds to permit interaction of the States in emergency response planning.

I enclosing a copy of Dr. Paul Numerof's "shotgun" letter to state team personnel. The States feel that the establishment of an organization such as this may tend to dilute the proper routes for notification of incidents and accidents.

I want to express our appreciation to you and Don Nussbaumer in particular and the rest of the A.E.C. staff in general for a productive meeting with a minimum of controversy. We recognize that your problems and ours are many and varied and we look forward to working with you as we attempt to improve radiation safety practices in mutual areas of concern.

Yours truly,

David K. Lacker

David K. Lacker
Chairman, Agreement States
1974 Meeting

Encl.

CONFERENCE OF RADIATION CONTROL PROGRAM DIRECTORS

May 20, 1975

Richard T. Kennedy
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Commissioner Kennedy:

On behalf of the Conference of Radiation Control Program Directors, I want to thank you for giving members of our Executive Committee the opportunity to meet with you and discuss the activities of our Conference. I feel that the meeting was very fruitful in that we were able to learn of some of your concepts relating to state activities, and we hope we were able to provide you information as to the Conference's relationship with the Nuclear Regulatory Commission.

As indicated during our visit, the Conference of Radiation Control Program Directors represents the radiation control programs of each of the fifty states, the District of Columbia, certain metropolitan agencies, the Virgin Islands, and Puerto Rico. The Conference, therefore, not only represents those states which have signed agreements with the Nuclear Regulatory Commission but all radiation control programs. On the attached document I have listed the objectives of this Conference and the task forces which have been active during the past year. In addition to these task forces, the Conference also performs its work through workshop activiti at its annual meeting. Also attached is a listing of these specific workshops which were conducted at our last annual meeting. Proceedings of this annual meeting will be published, and we will provide you with a copy when the proceedings are available.

I would like to list some of the points which were discussed with you during our meeting.

1. The Agreement States have expressed concern regarding the organizational location of the Agreements and Exports Branch within the NRC. Prior to the reorganization of the AEC in May of 1972, the Agreement States communicated with the Division of State and Licensee Relations. Organizationally, this Division was only two levels below the Commission. It was felt by the Agreement States that this Division was able to express the concerns of the Agreement States to the Commission. It was also felt that the Division of State and Licensee Relations was involved in policy development for the Commission. Currently, the Agreement States communicate with the Agreements and Exports Branch within the Division of Materials and Fuel Cycle Facility Licensing. Several states have expressed concern that after the reorganization of May 3, 1972, of the AEC and the last reorganization of January 19, 1975, the communication point with the NRC is at such a

level in the organization that these concerns may not reach top management.

2. In light of the concern as expressed in item no. 1 above, another point discussed during our meeting was the consideration of the establishment of an advisory group to the Commission representing the states. Such an advisory group could not only express the concerns and interests of the Agreement States but, additionally, could inform the Commission of other state activities and concerns in matters dealing with environmental monitoring of nuclear facilities, emergency response planning and capabilities, and other topics of state concern. If such a group would be appropriate, the Executive Committee of the Conference could serve in this capacity.

3. Another suggestion for consideration regarding improved communications from states to the NRC would be the establishment of a regional position in each of the NRC regional offices whereby direct communication with states and the regional office could occur. Both the FDA and the EPA have such positions and have found these regional contacts with states to be very productive.

4. There is concern on the part of several states regarding the need for Federal control of radioactive material not being regulated by Agreement States or the NRC. Most Agreement States have included naturally occurring and accelerator produced radioactive material under the same regulatory control as materials coming under the Atomic Energy Act when these agreements were signed. However, since there are 25 non-Agreement States, there is a definite gap existing in the proper control of these non-Agreement materials. Therefore, we strongly urge the NRC to consider taking appropriate actions to place this type material under the same control as is now applied to materials falling under the Atomic Energy Act.

Again, let me thank you for giving us the opportunity to meet with you. We hope this is one of several opportunities that we will have to periodically meet with the Commission.

Yours very truly,

Charles M. Hardin
Past-Chairman

CMH:co

Attachments

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NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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