Statistics of Ionizing Radiation Applications and Management

Nuclear Safety Commission

2023/11

PreFace

As technology rapidly advances and develops, applications of ionizing radiation have been widely adopted in medicine, agriculture, industry, border controls, and academic research. As the use of radioactive materials and equipment capable of producing ionizing radiation increases, the demand for personnel qualified to operate radiation sources and manage radiation operations has also increased.

In order to provide a complete overview of ionizing radiation applications in various fields, the Nuclear Safety Commission (NSC) has compiled the latest data, tables, and figures for review by radiation personnel and related stakeholders. The 2022 statistics were summarized below, please feel free to contact us if there is any mistake.

1. Radiation source licenses:

   Radiation source licenses are divided into "medical use" and "non-medical use" depending on the specific use. There were 22,420 medical use licenses and 14,684 non-medical use licenses, with a total of 37,104 licenses in Taiwan.

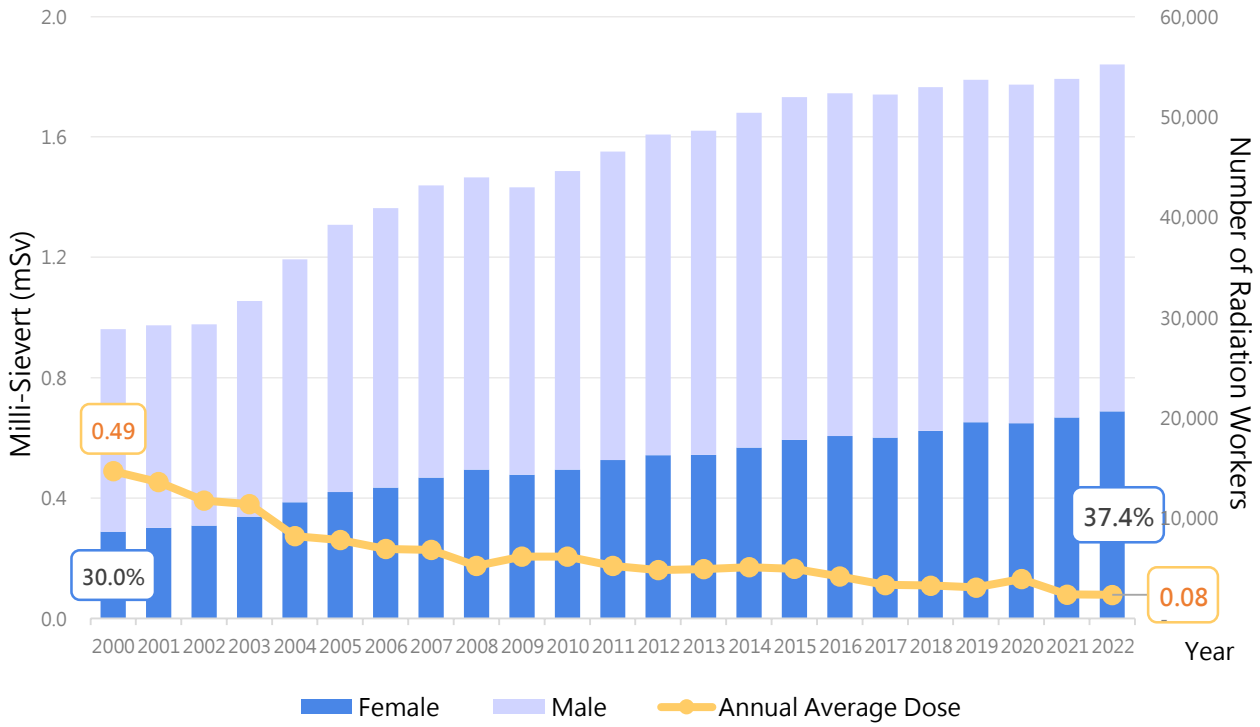
Radiation Sources / Type	Equipment	Materials	Total
Medical Use	21,901	519	22,420
Non-Medical Use	10,558	4,126	14,684
Total	32,459	4,645	37,104
Unit：Number of Licenses			

2. Personnel dose:

   In order to ensure the radiation safety of radiation workers, the NSC requires that the occupational exposure of radiation workers shall not exceed the dose limit in accordance with Article 15 of the "Ionizing Radiation Protection Act". Therefore, employers should implement personal radiation monitoring. Moreover, according

to the "Safety Standards for Protection against Ionizing Radiation" revised and implemented in 2003, the dose limits of occupational exposure for radiation workers is "the effective dose shall not exceed 100 mSv over a cycle of five consecutive years, and not exceed 50 mSv in any single year".

There were 55,228 radiation workers in Taiwan. The male to female ratio was 62.6%: 37.4%. Since 2011, the proportion of female employees has remained steady at more than 1/3 and has stably increased year by year. The annual average occupational dose was 0.08 mSv in 2022. For further details, please refer to the "Occupational Radiation Exposure Statistics Annual Report 2022". (https://www.nusc.gov.tw/u/v/58)



3. Personnel certificates:

Personnel certificates issued by the NSC are divided into two categories: (1) "Radiation Safety Certificate" for personnel who are only qualified to operate radiation sources; and (2) "Radiation Protection Personnel Certificate" for those

qualified to operate radiation sources and are also responsible for radiation operation management. The personnel certificates are valid for a period of 6 years. Within six months prior to its expiration, the applicant may fill out an application form and apply to the Competent Authority for a certificate renewal.

(1) Radiation Safety Certificate:

Since 2003, the NSC has issued a total of 13,739 Radiation Safety Certificates, with the male to female ratio of 84.3%:15.7%. In 2022, a total of 4,312 certificates had been issued, and the male to female ratio was 78.0%: 22.0%.

(2) Radiation Protection Personnel Certificate:

Since 2003, the NSC has issued a total of 3,996 Radiation Protection Personnel Certificates, with the male to female ratio of 65.4%:34.6%. In 2022, a total of 2,334 certificates had been issued, and the male to female ratio was 63.6%: 36.4%.

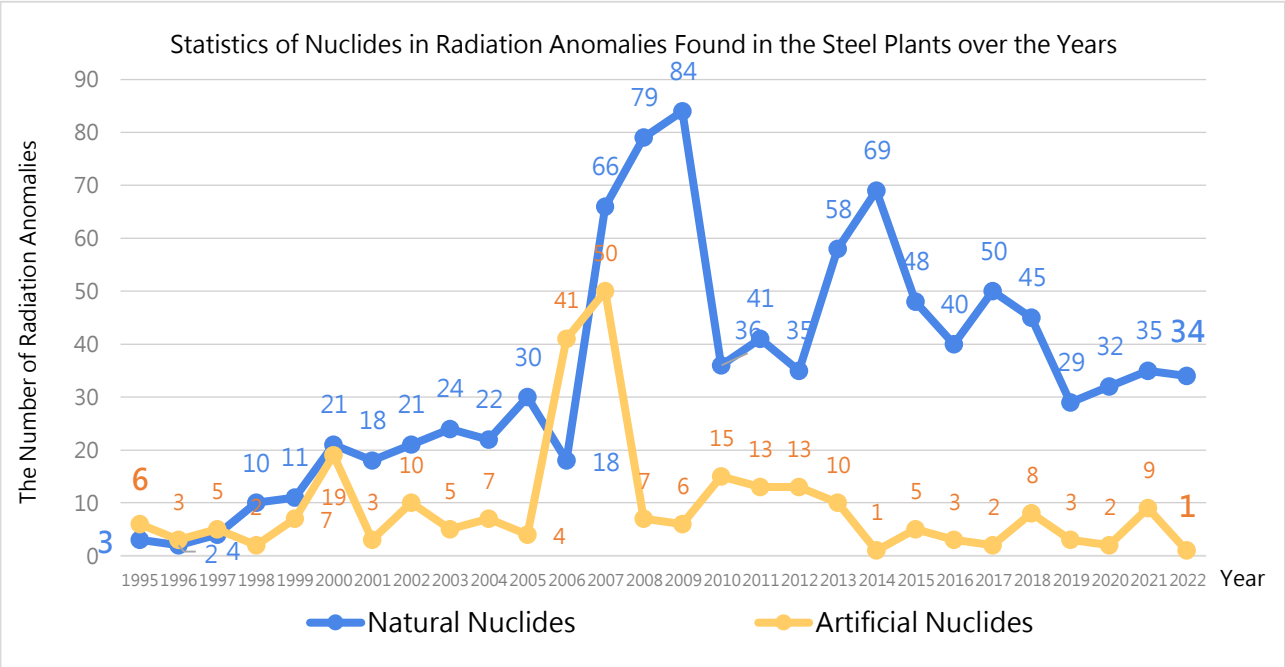
Number of Issued Certificates in 2022						
	Radiation Safety Certificate			Radiation Protection Personnel Certificate		
Age Interval	Female (Unit：people)	Male	Gender Ratio (Female: male, Unit: %)	Female (Unit：people)	Male	Gender Ratio (Female: male, Unit: %)
80~88	0	5	0：100	0	4	0：100
70~79	0	23	0：100	1	25	3.8：96.2
60~69	62	420	12.9：87.1	43	280	13.3：86.7
50~59	177	863	17.0：83.0	148	401	27.0：73.0
40~49	301	1,112	21.3：78.7	**320**	**379**	**45.8：54.2**
30~39	288	747	27.8：72.2	**280**	**337**	**45.4：54.6**
18~29	121	193	38.5：61.5	**58**	**58**	**50.0：50.0**
合計	949	3,363	22.0：78.0	850	1,484	36.4：63.6

The above table shows the gender ratio is getting closer among people aged between 18 and 49 who possess Radiation Protection Personnel Certificates. This sign indicates an increasing trend of women holding

important positions in the workplace. Through strengthening radiation protection knowledge and safety awareness of control measures, gender inequality in the workplace is declining.

4. The number of radiation anomalies found in the steel plants:

   A total of 35 cases were found in 2022. Anomalies caused by natural radionuclides account for 97.1% (34 out of 35) of radiation anomalies found in steel plants.

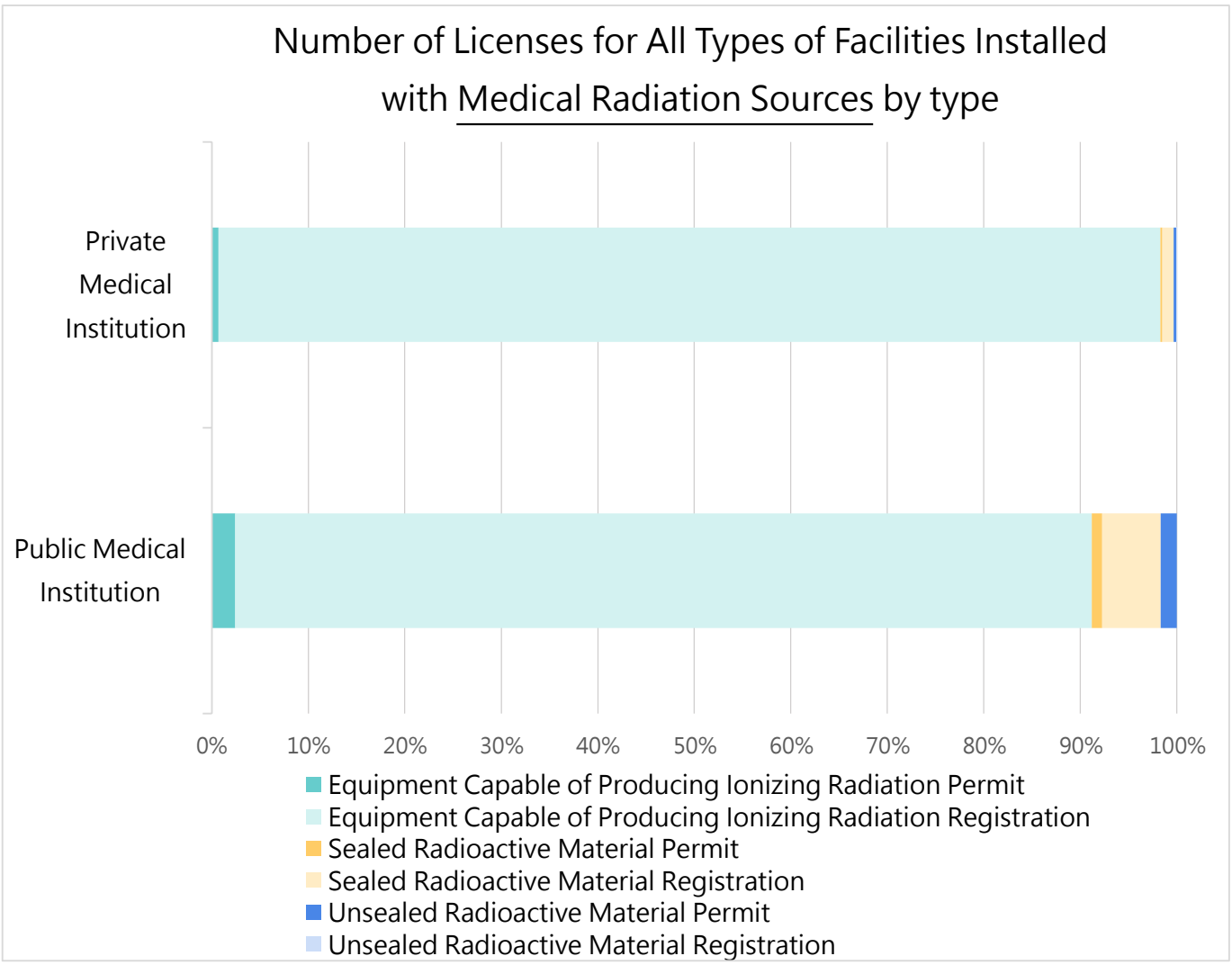


Content

1. Radiation Sources Licenses (Medical Use)

(1) Number of Licenses for All Types of Facilities Installed with Medical Radiation Sources by type

Type / Facility	Equipment Capable of Producing Ionizing Radiation		Sealed Radioactive Material		Unsealed Radioactive Material		Total
	Permit	Registration	Permit	Registration	Permit	Registration	
Public Medical Institution	47	1,714	21	117	32	0	1,931
Private Medical Institution	142	19,998	43	236	68	2	20,489
Total	189	21,712	64	353	100	2	22,420



(2) Number of Licenses for All Types of Medical Institution Installed with Medical Radiation Sources by county/city

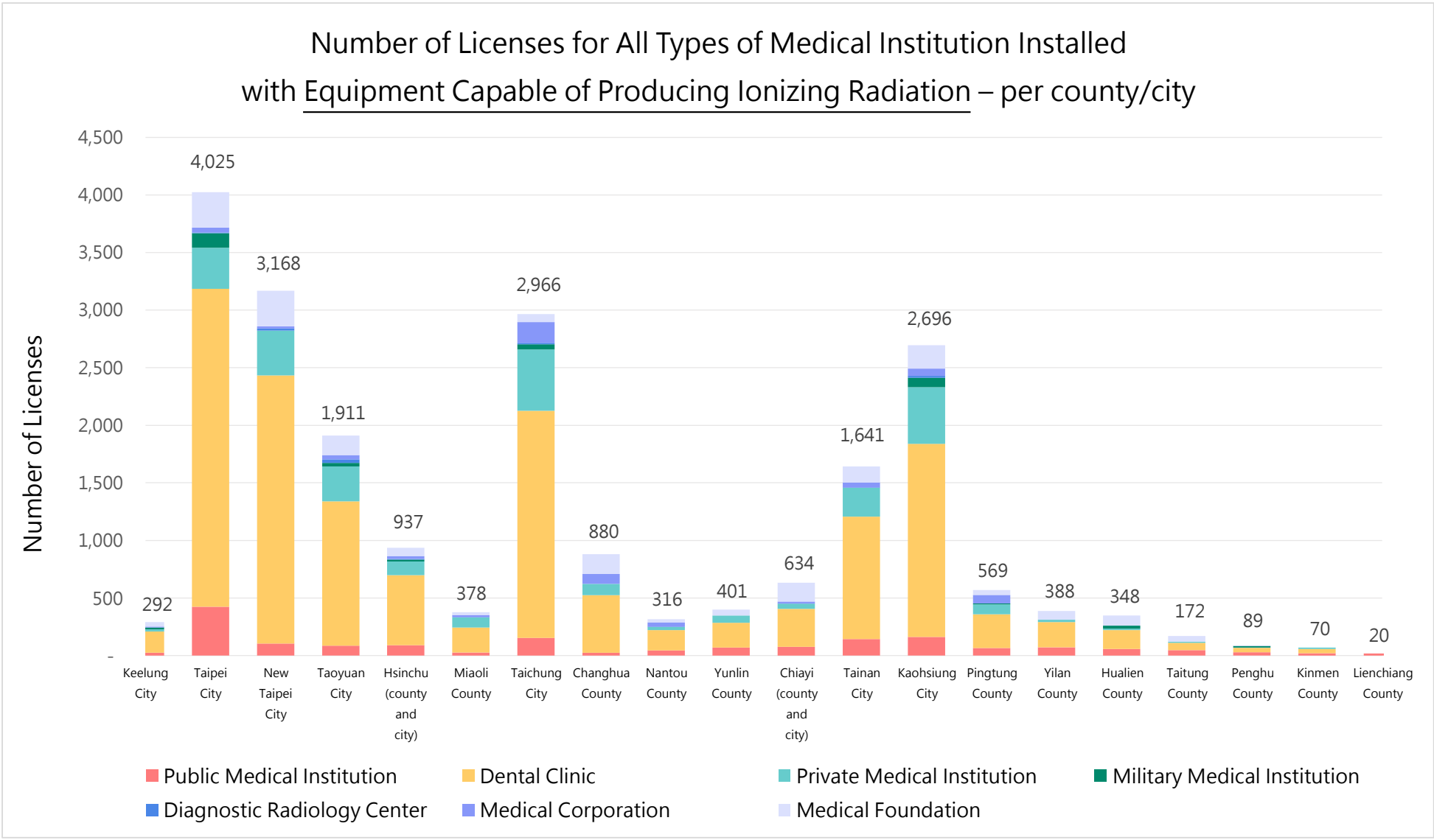
Institution / County/City	Permit						Registration					
	Public Medical Institutions			Private Medical Institutions			Public Medical Institutions			Private Medical Institutions		
	Equip-ment	Seal-ed	Un-sealed	Equip-ment	Seal-ed	Un-sealed	Equip-ment	Seal-ed	Un-sealed	Equip-ment	Seal-ed	Un-sealed
Keelung City	0	0	0	1	0	2	26	0	0	265	2	0
Taipei City	21	8	11	22	6	10	403	81	0	3,579	43	2
New Taipei City	2	0	2	23	7	9	104	1	0	3,039	35	0
Taoyuan City	1	1	2	15	3	7	86	4	0	1,809	31	0
Hsinchu (county and city)	2	2	2	3	1	2	89	4	0	843	10	0
Miaoli County	0	0	0	2	0	1	27	0	0	349	2	0
Taichung City	6	4	4	19	8	10	148	6	0	2,793	31	0
Changhua County	1	0	0	6	3	3	24	0	0	849	9	0
Nantou County	1	0	1	1	0	0	46	0	0	268	0	0
Yunlin County	2	1	2	2	0	1	69	6	0	328	0	0
Chiayi(county and city)	1	1	1	8	3	4	76	0	0	549	19	0
Tainan City	3	2	1	10	2	4	142	8	0	1,486	11	0
Kaohsiung City	5	2	4	21	6	7	158	3	0	2,512	25	0
Pingtung County	2	0	1	4	1	2	65	3	0	498	1	0
Yilan County	0	0	1	0	0	2	73	1	0	315	5	0
Hualien County	0	0	0	3	3	3	59	0	0	286	12	0
Taitung County	0	0	0	2	0	1	48	0	0	122	0	0
Penghu County	0	0	0	0	0	0	29	0	0	60	0	0
Kinmen County	0	0	0	0	0	0	22	0	0	48	0	0
Lienchiang County	0	0	0	0	0	0	20	0	0	0	0	0
Total	47	21	32	142	43	68	1,714	117	0	19,998	236	2

Remarks:

1. Equipment: Equipment capable of producing ionizing radiation.
2. Sealed: Sealed radioactive material.
3. Unsealed: Unsealed radioactive material.

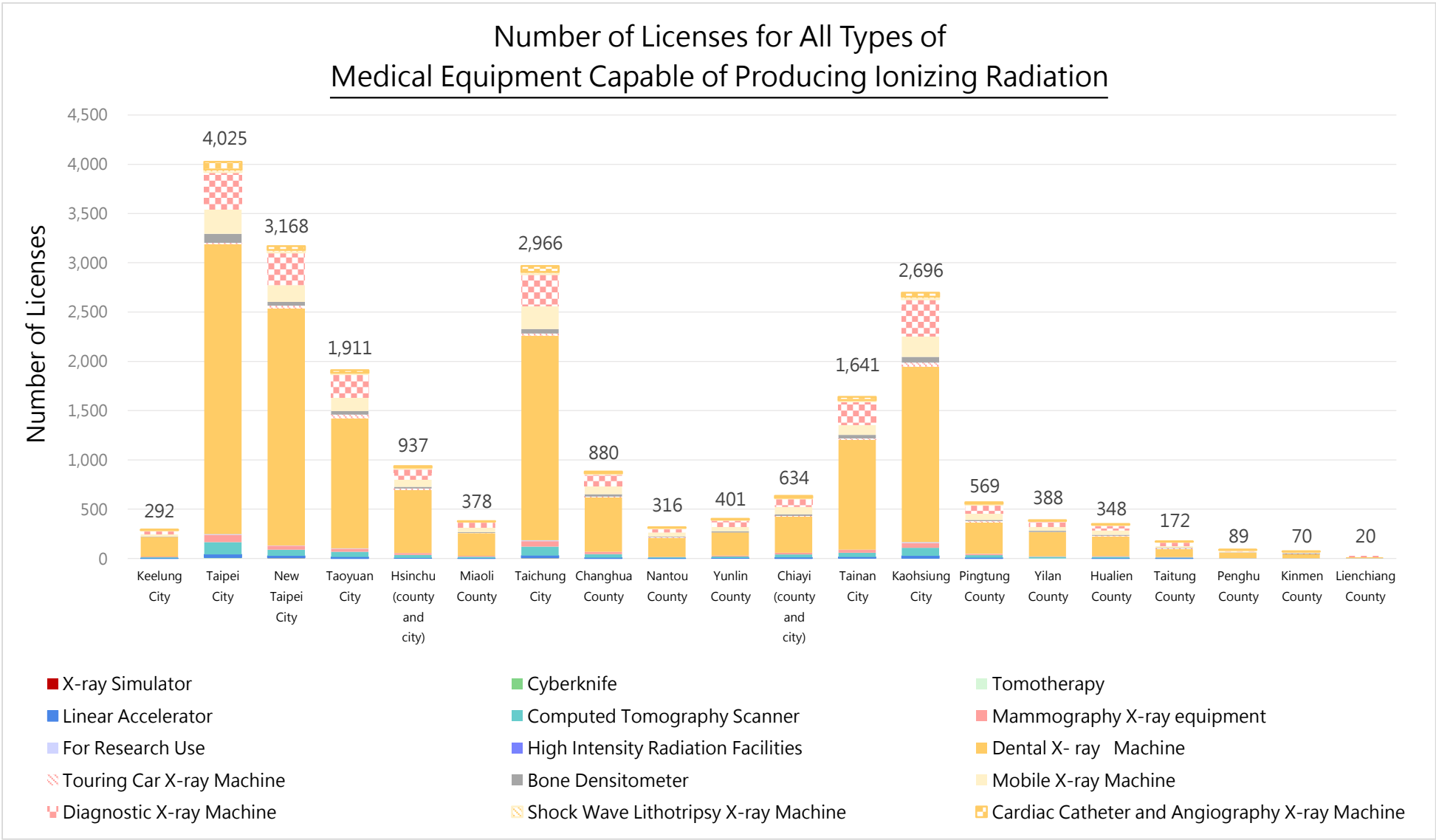
(3) Number of Licenses for All Types of Medical Institution Installed with Equipment Capable of Producing Ionizing Radiation by county/city

Institution / County/City	Public Medical Institution	Dental Clinic	Private Medical Institution	Military Medical Institution	Diagnostic Radiology Center	Medical Corporation	Medical Foundation	Total
Keelung City	26	184	18	17	-	7	40	292
Taipei City	424	2,761	355	126	6	46	307	4,025
New Taipei City	106	2,328	388	-	18	19	309	3,168
Taoyuan City	87	1,252	302	32	33	36	169	1,911
Hsinchu(county and city)	91	607	119	17	6	24	73	937
Miaoli County	27	217	89	-	-	21	24	378
Taichung City	154	1,973	532	45	12	179	71	2,966
Changhua County	25	499	99	-	-	86	171	880
Nantou County	47	175	27	-	4	36	27	316
Yunlin County	71	214	63	-	-	-	53	401
Chiayi (county and city)	77	330	45	-	1	17	164	634
Tainan City	145	1,062	250	-	1	44	139	1,641
Kaohsiung City	163	1,677	492	80	18	62	204	2,696
Pingtung County	67	293	86	7	-	74	42	569
Yilan County	73	218	21	-	-	-	76	388
Hualien County	59	163	12	26	-	-	88	348
Taitung County	48	63	10	-	-	-	51	172
Penghu County	29	39	3	15	-	-	3	89
Kinmen County	22	36	12	-	-	-	-	70
Lienchiang County	20	-	-	-	-	-	-	20
Total	1,761	14,091	2,923	365	99	651	2,011	21,901


Number of Licenses for All Types of Medical Institution Installed with Equipment Capable of Producing Ionizing Radiation – per county/city
Number of Licenses
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
-
292
4,025
3,168
1,911
937
378
2,966
880
316
401
634
1,641
2,696
569
388
348
172
89
70
20
Keelung City
Taipei City
New Taipei City
Taoyuan City
Hsinchu (county and city)
Miaoli County
Taichung City
Changhua County
Nantou County
Yunlin County
Chiayi (county and city)
Tainan City
Kaohsiung City
Pingtung County
Yilan County
Hualien County
Taitung County
Penghu County
Kinmen County
Lienchiang County
Public Medical Institution
Dental Clinic
Private Medical Institution
Military Medical Institution
Diagnostic Radiology Center
Medical Corporation
Medical Foundation

(4) Number of Licenses for All Types of Medical Equipment Capable of Producing Ionizing Radiation by county/city

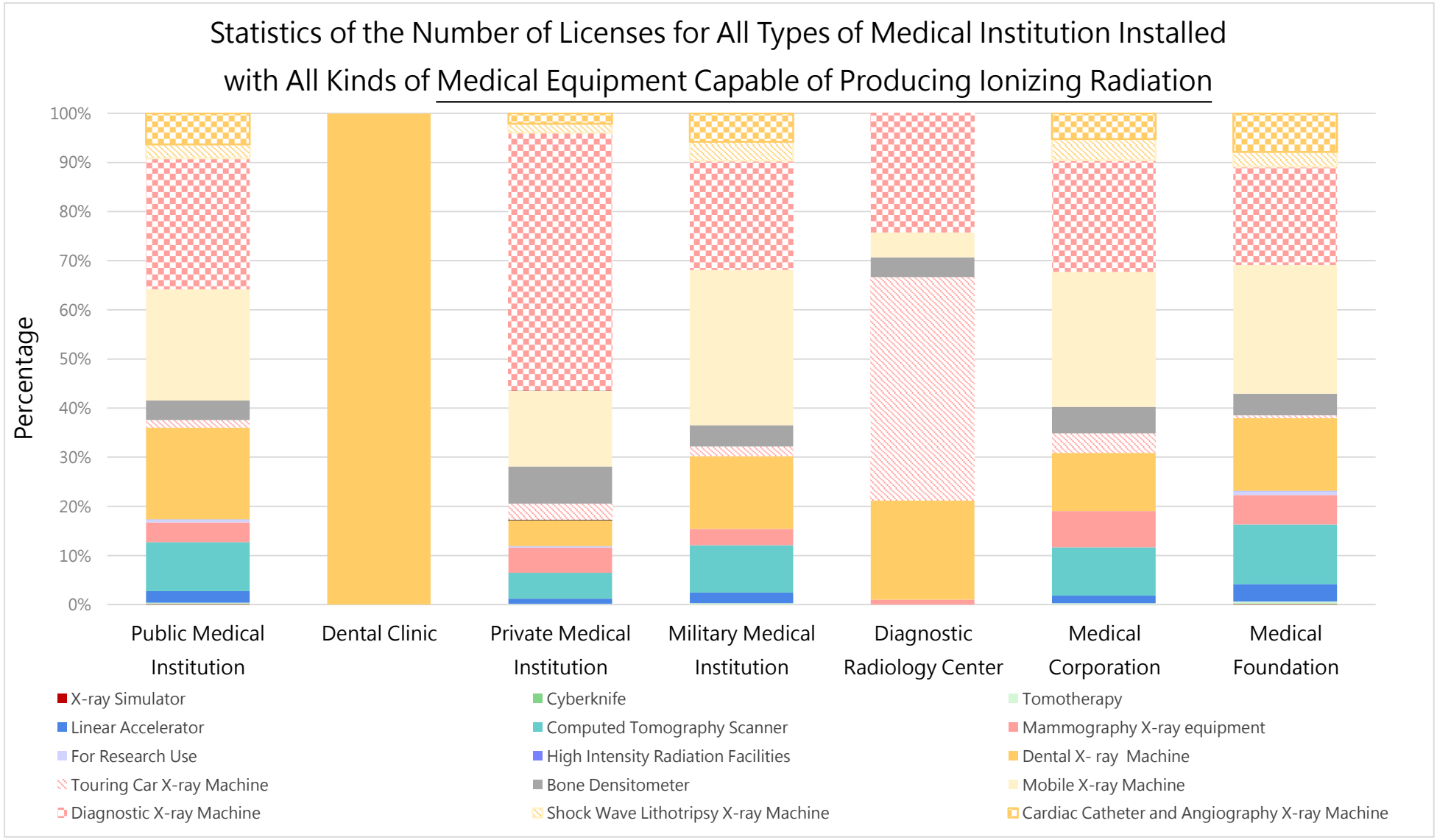
Equipment / County/City	X-ray Simulator	Cyberknife	Tomotherapy	Linear Accelerator	Computed Tomography Scanner	Mammog-raphy X-ray Equipment	For Research Use	High Intensity Radiation Facilities	Dental X- ray Machine	Touring Car X-ray Machine	Bone Densito-meter	Mobile X-ray Machine	Diagnostic X-ray Machine	Shock Wave Lithotripsy X-ray Machine	Cardiac Catheter And Angiography X-ray Machine	Total
Keelung City	0	0	0	1	11	6	1	0	198	0	4	27	33	6	5	292
Taipei City	0	1	7	33	123	74	7	2	2,941	14	90	250	379	25	79	4,025
New Taipei City	1	1	4	20	63	40	1	0	2,408	26	39	170	330	26	39	3,168
Taoyuan City	0	0	0	14	52	32	4	1	1,319	38	36	140	233	16	25	1,911
Hsinchu (county and city)	0	0	1	4	31	18	1	0	639	14	17	73	112	11	16	937
Miaoli County	0	0	0	2	15	9	0	0	230	3	7	45	59	5	3	378
Taichung City	2	1	3	21	93	55	8	0	2,078	22	44	230	325	24	60	2,966
Changhua County	0	0	0	7	35	25	0	0	553	8	23	78	126	8	17	880
Nantou County	0	0	0	2	9	6	0	0	191	7	7	41	41	6	6	316
Yunlin County	1	0	0	4	14	8	0	0	237	0	10	45	71	5	6	401
Chiayi (county and city)	0	0	0	9	30	18	1	0	366	7	16	74	86	8	19	634
Tainan City	0	1	2	10	44	31	1	0	1,117	13	36	105	235	12	34	1,641
Kaohsiung City	0	1	2	22	82	49	7	1	1,784	39	59	213	370	27	40	2,696
Pingtung County	0	0	0	6	28	12	1	0	322	8	14	67	86	11	14	569
Yilan County	0	0	0	0	16	5	1	0	244	1	13	39	58	4	7	388
Hualien County	0	0	0	3	14	6	0	0	202	5	8	44	54	5	7	348
Taitung County	0	0	0	2	8	4	0	0	84	5	4	25	34	3	3	172
Penghu County	0	0	0	0	2	1	0	0	56	0	3	7	15	1	4	89
Kinmen County	0	0	0	0	2	1	0	0	42	3	5	5	10	1	1	70
Lienchiang County	0	0	0	0	2	1	0	0	9	0	0	2	6	0	0	20
Total	4	5	19	160	674	401	33	4	15,020	213	435	1,680	2,663	204	385	21,901


Number of Licenses for All Types of
Medical Equipment Capable of Producing Ionizing Radiation
Number of Licenses
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
292
4,025
3,168
1,911
937
378
2,966
880
316
401
634
1,641
2,696
569
388
348
172
89
70
20
Keelung City
Taipei City
New Taipei City
Taoyuan City
Hsinchu (county and city)
Miaoli County
Taichung City
Changhua County
Nantou County
Yunlin County
Chiayi (county and city)
Tainan City
Kaohsiung City
Pingtung County
Yilan County
Hualien County
Taitung County
Penghu County
Kinmen County
Lienchiang County
X-ray Simulator
Cyberknife
Tomotherapy
Linear Accelerator
Computed Tomography Scanner
Mammography X-ray equipment
For Research Use
High Intensity Radiation Facilities
Dental X- ray Machine
Touring Car X-ray Machine
Bone Densitometer
Mobile X-ray Machine
Diagnostic X-ray Machine
Shock Wave Lithotripsy X-ray Machine
Cardiac Catheter and Angiography X-ray Machine

(5) Statistics of the Number of Licenses for All Types of Medical Institution Installed with All Kinds of Medical Equipment Capable of Producing Ionizing Radiation

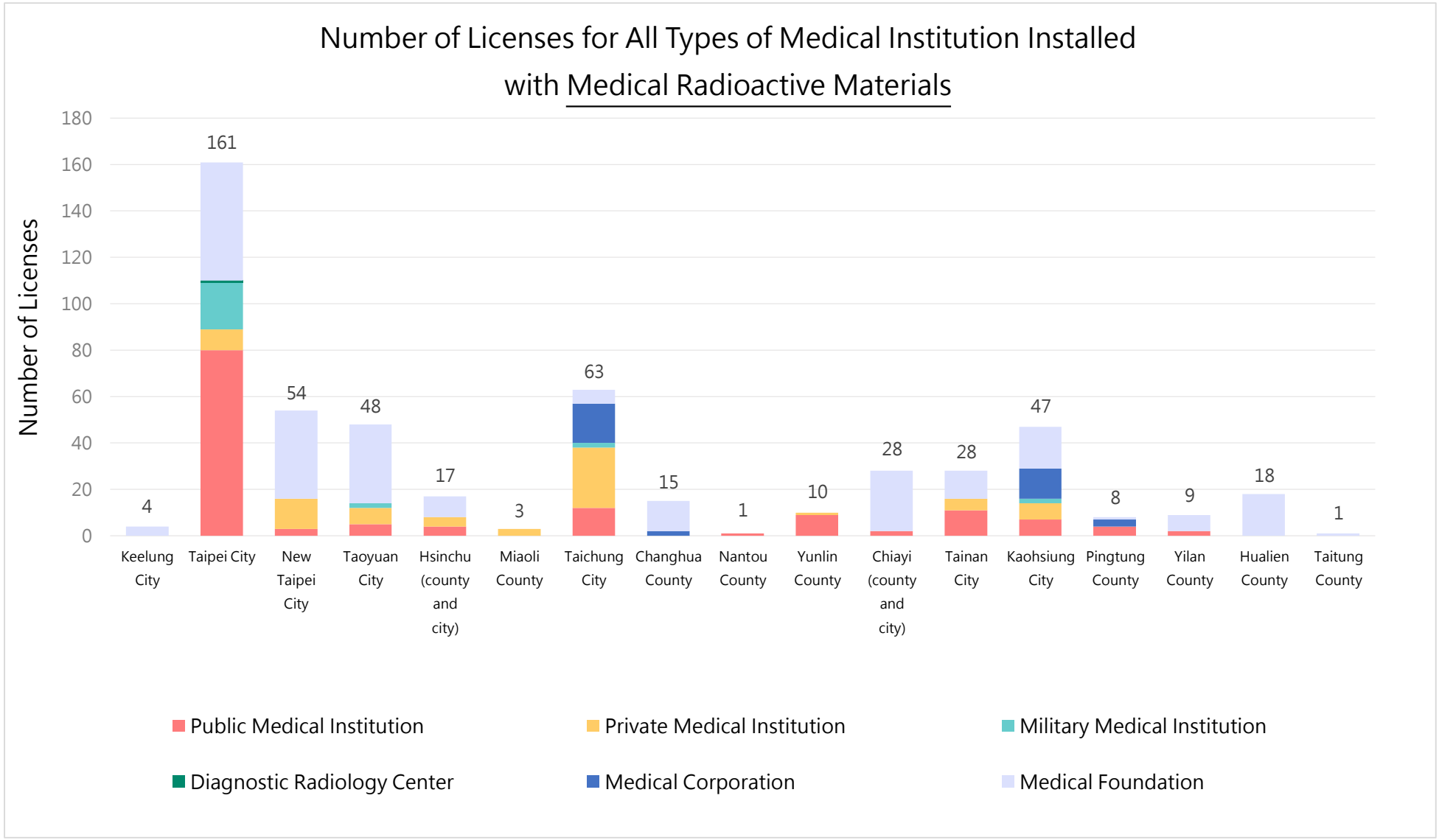
Equipment / Institution	X-ray Simulator	Cyberknife	Tomotherapy	Linear Accelerator	Computed Tomography Scanner	Mammography X-ray Equipment	For Research Use	High Intensity Radiation Facilities	Dental X- ray Machine	Touring Car X-ray Machine	Bone Densitometer	Mobile X-ray Machine	Diagnostic X-ray Machine	Shock Wave Lithotripsy X-ray Machine	Cardiac Catheter and Angiography X-ray Machine	Total
Public Medical Institution	2	2	3	41	176	71	10	1	328	28	70	398	470	50	111	1,761
Dental Clinic	0	0	0	0	0	0	0	0	14,086	0	0	5	0	0	0	14,091
Private Medical Institution	0	0	5	30	155	149	7	1	158	95	221	452	1,536	53	61	2,923
Military Medical Institution	0	0	1	8	35	12	0	0	54	7	16	115	81	14	21	365
Diagnostic Radiology Center	0	0	0	0	0	1	0	0	20	45	4	5	24	0	0	99
Medical Corporation	0	0	2	10	64	48	0	0	77	26	35	179	148	28	34	651
Medical Foundation	2	3	8	71	244	120	16	2	297	12	89	526	404	59	158	2,011
Total	4	5	19	160	674	401	33	4	15,020	213	435	1,680	2,663	204	385	21,901

Remarks: Equipment capable of producing ionizing radiation includes fixed-type and touring-type vehicles, excluding biopsy.


Statistics of the Number of Licenses for All Types of Medical Institution Installed with All Kinds of Medical Equipment Capable of Producing Ionizing Radiation
Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Public Medical Institution
Dental Clinic
Private Medical Institution
Military Medical Institution
Diagnostic Radiology Center
Medical Corporation
Medical Foundation
X-ray Simulator
Cyberknife
Tomotherapy
Linear Accelerator
Computed Tomography Scanner
Mammography X-ray equipment
For Research Use
High Intensity Radiation Facilities
Dental X- ray Machine
Touring Car X-ray Machine
Bone Densitometer
Mobile X-ray Machine
Diagnostic X-ray Machine
Shock Wave Lithotripsy X-ray Machine
Cardiac Catheter and Angiography X-ray Machine

(6) Number of Licenses for All Types of Medical Institution Installed with Medical Radioactive Materials by county/city

Institution / County/City	Public Medical Institution	Private Medical Institution	Military Medical Institution	Diagnostic Radiology Center	Medical Corporation	Medical Foundation	Total
Keelung City	0	0	0	0	0	4	4
Taipei City	80	9	20	1	0	51	161
New Taipei City	3	13	0	0	0	38	54
Taoyuan City	5	7	2	0	0	34	48
Hsinchu (county and city)	4	4	0	0	0	9	17
Miaoli County	0	3	0	0	0	0	3
Taichung City	12	26	2	0	17	6	63
Changhua County	0	0	0	0	2	13	15
Nantou County	1	0	0	0	0	0	1
Yunlin County	9	1	0	0	0	0	10
Chiayi (county and city)	2	0	0	0	0	26	28
Tainan City	11	5	0	0	0	12	28
Kaohsiung City	7	7	2	0	13	18	47
Pingtung County	4	0	0	0	3	1	8
Yilan County	2	0	0	0	0	7	9
Hualien County	0	0	0	0	0	18	18
Taitung County	0	0	0	0	0	1	1
Total	144	75	26	1	35	238	519


Number of Licenses for All Types of Medical Institution Installed with Medical Radioactive Materials
Number of Licenses
180
160
140
120
100
80
60
40
20
0
4
161
54
48
17
3
63
15
1
10
28
28
47
8
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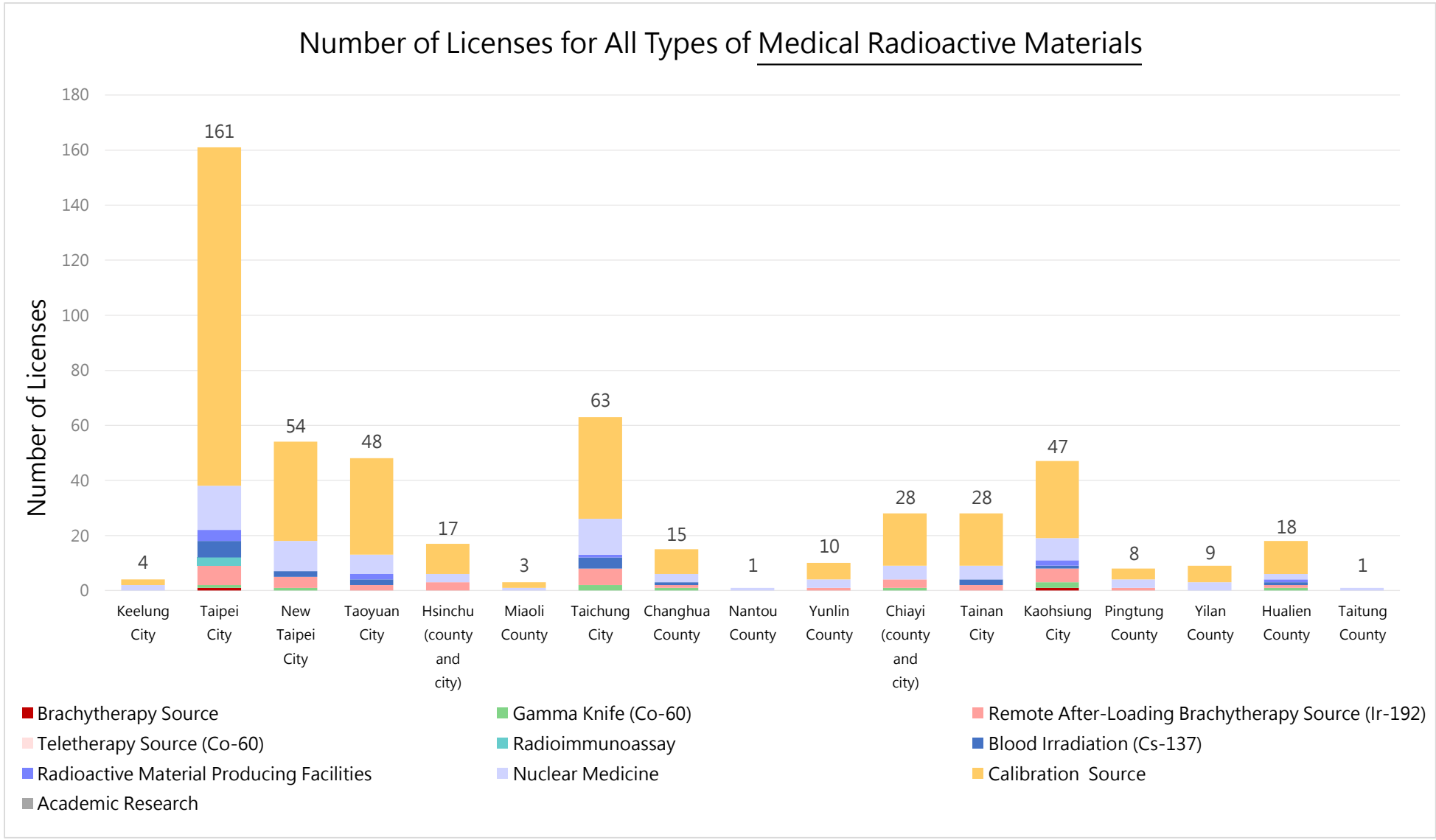
18
1
Keelung City
Taipei City
New Taipei City
Taoyuan City
Hsinchu (county and city)
Miaoli County
Taichung City
Changhua County
Nantou County
Yunlin County
Chiayi (county and city)
Tainan City
Kaohsiung City
Pingtung County
Yilan County
Hualien County
Taitung County
Public Medical Institution
Private Medical Institution
Military Medical Institution
Diagnostic Radiology Center
Medical Corporation
Medical Foundation

(7) Number of Licenses for All Types of Medical Radioactive Materials by county/city

Radioactive Material / County/City	Brachytherapy Source	Gamma Knife (Co-60)	Remote After-Loading Brachytherapy Source (Ir-192)	Teletherapy Source (Co-60)	Radioimmuno-assay	Blood Irradiation (Cs-137)	Radioactive Material Producing Facilities[1]	Nuclear Medicine[2]	Calibration Source[3]	Total
Keelung City	0	0	0	0	0	0	0	2	2	4
Taipei City	1	1	7	0	3	6	4	16	123	161
New Taipei City	0	1	4	0	0	2	0	11	36	54
Taoyuan City	0	0	2	0	0	2	2	7	35	48
Hsinchu (county and city)	0	0	3	0	0	0	0	3	11	17
Miaoli County	0	0	0	0	0	0	0	1	2	3
Taichung City	0	2	6	0	0	4	1	13	37	63
Changhua County	0	1	1	0	0	1	0	3	9	15
Nantou County	0	0	0	0	0	0	0	1	0	1
Yunlin County	0	0	1	0	0	0	0	3	6	10
Chiayi (county and city)	0	1	3	0	0	0	0	5	19	28
Tainan City	0	0	2	0	0	2	0	5	19	28
Kaohsiung City	1	2	5	0	0	1	2	8	28	47
Pingtung County	0	0	1	0	0	0	0	3	4	8
Yilan County	0	0	0	0	0	0	0	3	6	9
Hualien County	0	1	1	0	0	1	1	2	12	18
Taitung County	0	0	0	0	0	0	0	1	0	1
Total	2	9	36	0	3	19	10	88	352	519

Remarks:
1. Radioactive material producing facilities mainly produce F-18, C-11, N-13, O-15, etc.
2. Unsealed radioactive materials used in nuclear medicine include Tc-99m, Tl-201, Ga-67, etc.
3. Sealed radioactive materials for calibration include Co-57, Ge-68, Cs-137, etc.

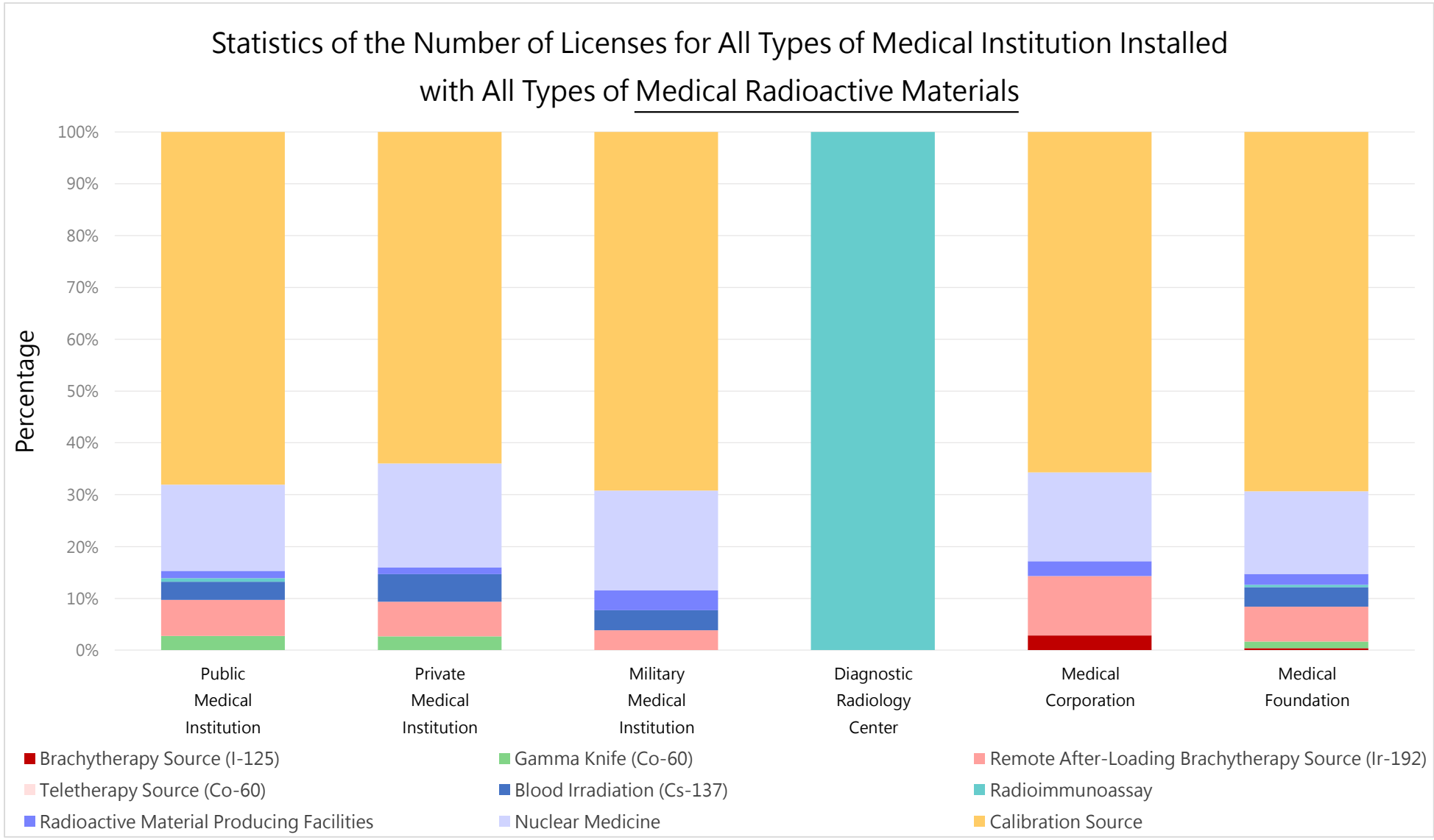

Number of Licenses for All Types of Medical Radioactive Materials
Number of Licenses
180
160
140
120
100
80
60
40
20
0
4
161
54
48
17
3
63
15
1
10
28
28
47
8
9
18
1
Keelung City
Taipei City
New Taipei City
Taoyuan City
Hsinchu (county and city)
Miaoli County
Taichung City
Changhua County
Nantou County
Yunlin County
Chiayi (county and city)
Tainan City
Kaohsiung City
Pingtung County
Yilan County
Hualien County
Taitung County
Brachytherapy Source
Gamma Knife (Co-60)
Remote After-Loading Brachytherapy Source (Ir-192)
Teletherapy Source (Co-60)
Radioimmunoassay
Blood Irradiation (Cs-137)
Radioactive Material Producing Facilities
Nuclear Medicine
Calibration Source
Academic Research

(8) Statistics of the Number of Licenses for All Types of Medical Institution Installed with All Types of Medical Radioactive Materials

Facility \ Radioactive Material	Brachytherapy Source (I-125)	Gamma Knife (Co-60)	Remote After-Loading Brachytherapy Source (Ir-192)	Teletherapy Source (Co-60)	Blood Irradiation (Cs-137)	Radioimmun-oassay	Radioactive Material Producing Facilities[1]	Nuclear Medicine[2]	Calibration Source[3]	Total
Public Medical Institution	0	4	10	0	5	1	2	24	98	144
Private Medical Institution	0	2	5	0	4	0	1	15	48	75
Military Medical Institution	0	0	1	0	1	0	1	5	18	26
Diagnostic Radiology Center	0	0	0	0	0	1	0	0	0	1
Medical Corporation	1	0	4	0	0	0	1	6	23	35
Medical Foundation	1	3	16	0	9	1	5	38	165	238
Total	2	9	36	0	19	3	10	88	352	519

Remarks:

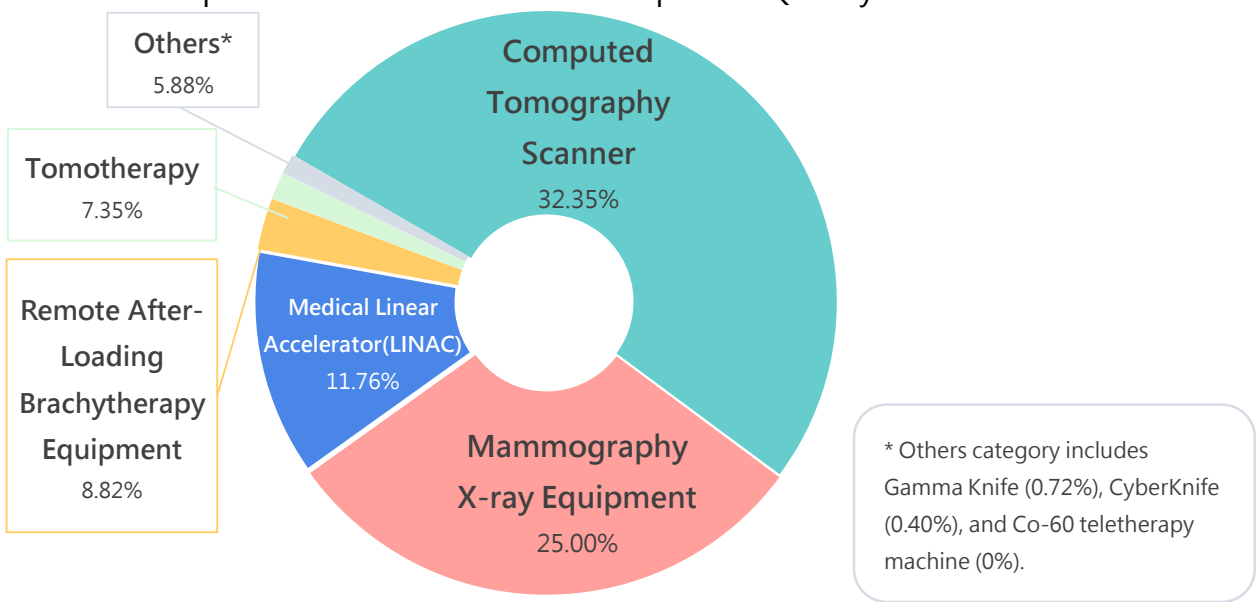
1. Radioactive material producing facilities mainly produce F-18, C-11, N-13, O-15, etc.
2. Unsealed radioactive materials used in nuclear medicine include Tc-99m, Tl-201, Ga-67, etc.
3. Sealed radioactive materials for calibration include Co-57, Ge-68, and Cs-137, etc.


Statistics of the Number of Licenses for All Types of Medical Institution Installed with All Types of Medical Radioactive Materials
Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Public Medical Institution
Private Medical Institution
Military Medical Institution
Diagnostic Radiology Center
Medical Corporation
Medical Foundation
Brachytherapy Source (I-125)
Gamma Knife (Co-60)
Remote After-Loading Brachytherapy Source (Ir-192)
Teletherapy Source (Co-60)
Blood Irradiation (Cs-137)
Radioimmunoassay
Radioactive Material Producing Facilities
Nuclear Medicine
Calibration Source

(9) Number of Licenses for All Types of Equipment that should Implement Radiation Medical Exposure Quality Assurance

Medical Equipment	Number of Licenses
Medical Linear Accelerator	160
Remote After-Loading Brachytherapy Equipment	36
Co-60 Teletherapy Machine	0
Gamma Knife	9
CyberKnife	5
Tomotherapy	19
Mammography X-ray Equipment (not include disabled equipment)	377
Computed Tomography Scanner (not include disabled equipment)	652
Total	1,258

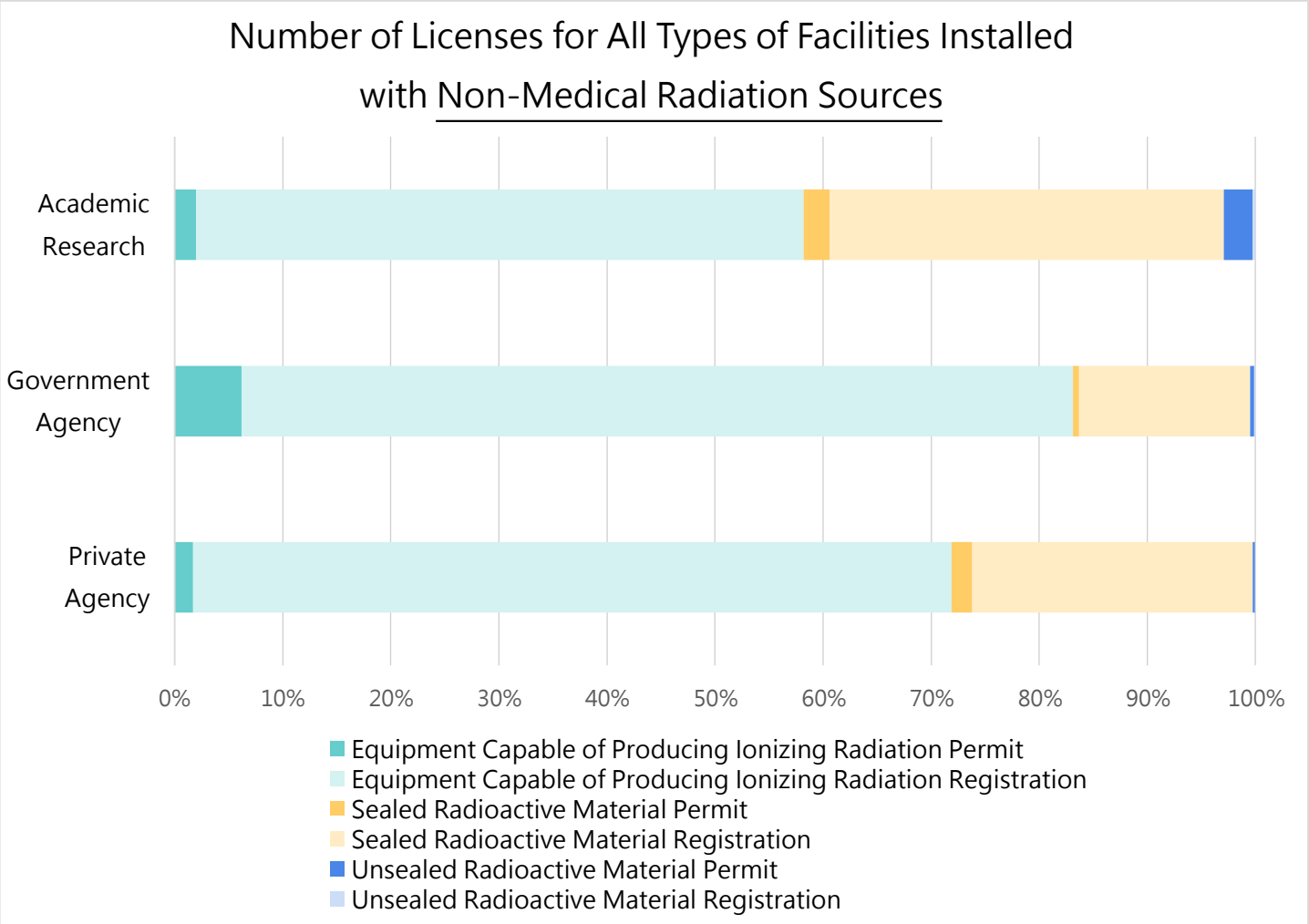
Number of Licenses for All Types of Equipment that should Implement Radiation Medical Exposure Quality Assurance



2. Radiation Sources Licenses (Non-Medical Use)

(1) Number of Licenses for All Types of Facilities Installed with Non-Medical Radiation Sources by type

Type / Facility	Equipment Capable of Producing Ionizing Radiation		Sealed Radioactive Material		Unsealed Radioactive Material		Total
	Permit	Registration	Permit	Registration	Permit	Registration	
Public Medical Institution	218	8,963	246	3,314	25	3	12,769
Private Medical Institution	65	811	6	167	4	1	1,054
Academic Research	17	484	21	314	23	2	861
Total	300	10,258	273	3,795	52	6	14,684



(2) Number of Licenses for All Types of Facilities Installed with Non-Medical Radiation Sources by county/city

Facility / County/City	Permit									Registration								
	Private Agency			Government Agency			Academic Research			Private Agency			Government Agency			Academic Research		
	Equip-ment	Sealed	Unseal-ed	Equipm-ent	Sealed	Unsea-led	Equipm-ent	Sealed	Unsea-led	Equip-ment	Sealed	Unsea-led	Equip-ment	Sealed	Unsea-led	Equip-ment	Sealed	Unsea-led
Keelung City	4	4	0	3	0	0	0	0	0	52	1	0	21	2	0	4	2	0
Taipei City	21	7	2	10	2	2	2	3	4	627	82	0	143	52	1	89	47	1
New Taipei City	8	7	9	6	3	1	0	0	0	1,293	274	0	33	38	0	8	0	0
Taoyuan City	37	17	3	16	0	0	7	13	7	1,939	551	2	303	28	0	58	90	0
Hsinchu(county and city)	8	8	2	1	0	0	5	4	0	941	386	0	8	2	0	105	43	0
Miaoli County	4	6	1	0	0	0	0	0	3	219	133	0	4	0	0	3	0	0
Taichung City	22	11	4	5	0	0	1	0	4	864	314	0	42	11	0	67	40	0
Changhua County	6	5	0	0	0	0	0	0	0	246	76	0	4	0	0	6	3	0
Nantou County	2	2	0	2	0	0	0	0	0	75	16	0	4	2	0	4	0	0
Yunlin County	4	31	0	0	0	0	2	0	0	176	216	0	5	0	0	11	2	0
Chiayi (county and city)	4	0	0	2	0	0	0	0	1	126	36	0	8	2	0	8	11	1
Tainan City	12	1	0	4	0	0	0	0	2	827	617	0	37	4	0	52	19	0
Kaohsiung City	77	142	3	7	1	1	0	1	1	1,346	416	0	103	14	0	35	23	0
Pingtung County	6	2	1	5	0	0	0	0	0	109	89	1	12	4	0	9	10	0
Yilan County	2	3	0	0	0	0	0	0	0	78	74	0	2	1	0	3	0	0
Hualien County	1	0	0	2	0	0	0	0	1	30	24	0	15	1	0	21	23	0
Taitung County	0	0	0	1	0	0	0	0	0	12	8	0	19	6	0	1	1	0
Penghu County	0	0	0	1	0	0	0	0	0	2	1	0	24	0	0	0	0	0

Facility / County/City	Permit									Registration								
	Private Agency			Government Agency			Academic Research			Private Agency			Government Agency			Academic Research		
	Equip-ment	Sealed	Unseal-ed	Equipm-ent	Sealed	Unsea-led	Equipm-ent	Sealed	Unsea-led	Equip-ment	Sealed	Unsea-led	Equip-ment	Sealed	Unsea-led	Equip-ment	Sealed	Unsea-led
Lienchiang County	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0
Kinmen County	0	0	0	0	0	0	0	0	0	1	0	0	16	0	0	0	0	0
Total	218	246	25	65	6	4	17	21	23	8,963	3,314	3	811	167	1	484	314	2

Remarks:

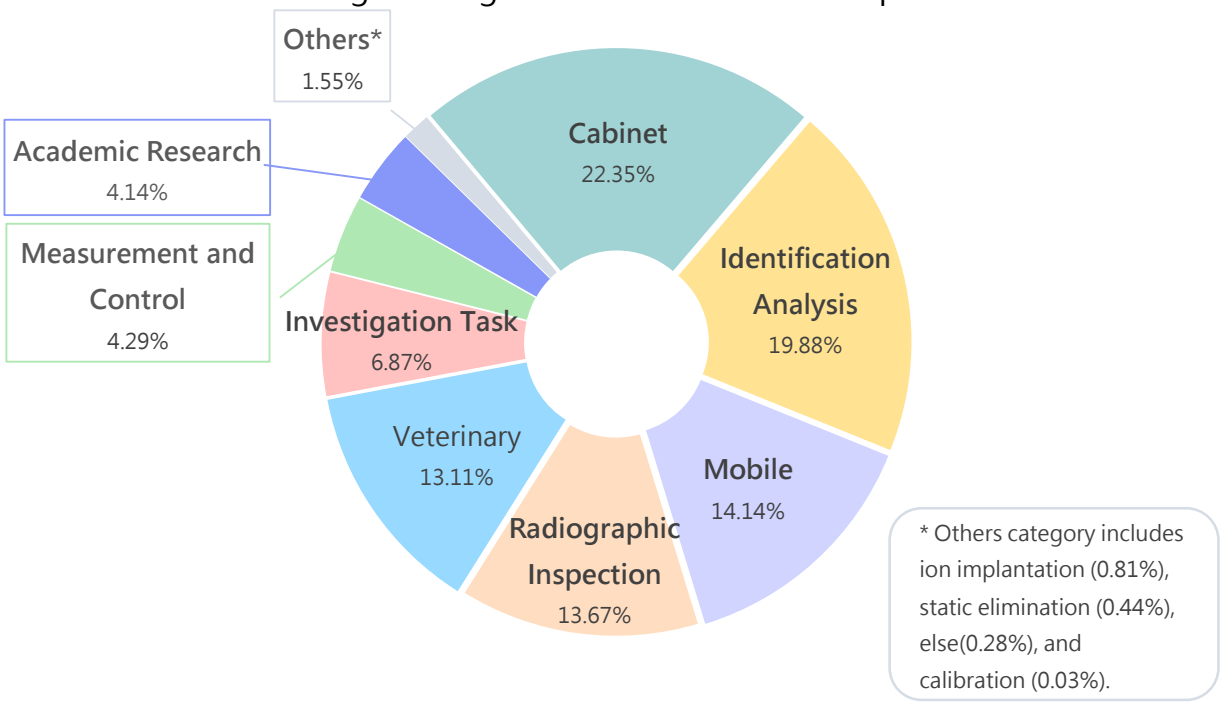
1. Equipment: Equipment capable of producing ionizing radiation.
2. Sealed: Sealed radioactive material.
3. Unsealed: Unsealed radioactive material.

(3) Number of Licenses for Non-Medical Equipment Capable of Producing Ionizing Radiation for Various Purposes

Equipment Usage	Number of Licenses
Identification Analysis	2,099
Radiographic Inspection	1,443
Veterinary	1,384
Academic Research	437
Investigation Task	725
Measurement and Control	453
Ion Implantation	85
Static Elimination	46
Calibration	3
Cabinet	2,360
Mobile	1,493
Others*	30
Total	10,558

* "Others" refers to the equipment held by the sales and manufacturing industry and is not classified.

Number of Licenses for Non-Medical Equipment Capable of Producing Ionizing Radiation for Various Purposes



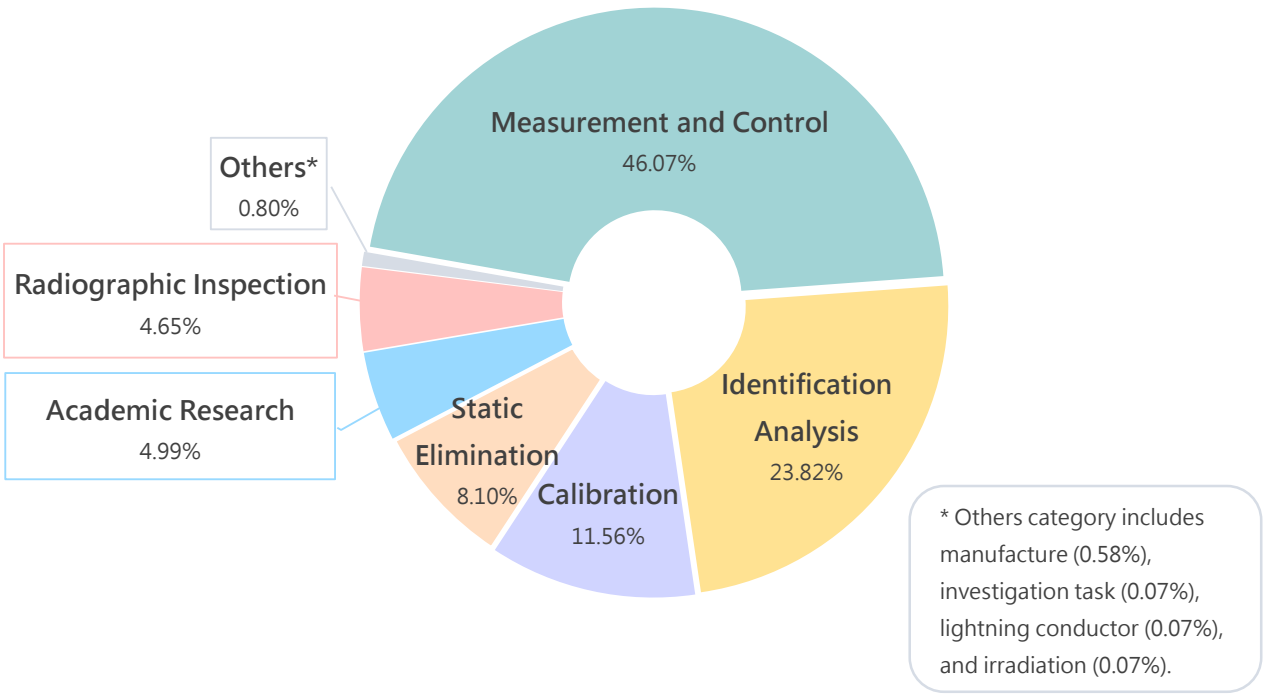
(4) Number of Licenses for Non-Medical Radioactive Materials for Various Purposes

Radioactive Material Usage	Number of Licenses
Measurement and Control	1,795
Identification Analysis	910
Academic Research	162
Calibration	319
Radiographic Inspection	183
Investigation Task	5
Static Elimination	293
Manufacture[1]	19
Lightning Conductor[2]	3
Irradiation[3]	6
Total	3,695

Remarks:

1. Manufacture usage includes packaging and manufacturing.
2. Lightning conductors use Am-241 sources.
3. Irradiation refers to the irradiation of agricultural products, medical products, etc.

Number of Licenses for Non-Medical Radioactive Materials for Various Purposes



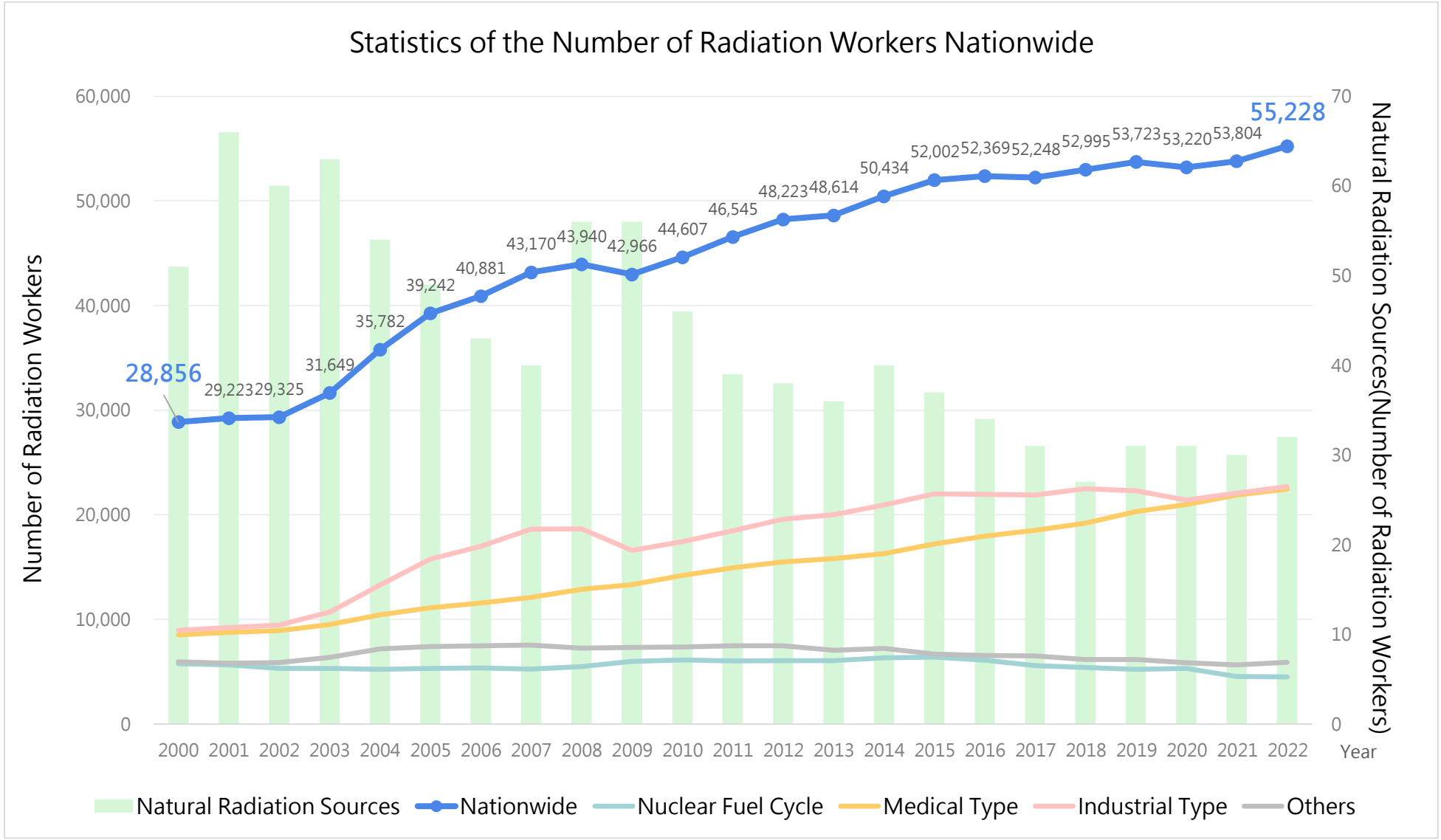
3. Personnel Dose

(1) Statistics of the Number of Radiation Workers Nationwide

Year	Nuclear Fuel Cycle	Medical Type	Industrial Type	Natural Radiation Sources[1]	Others[2]	Nationwide[3]
2000	5,731	8,510	8,960	51	5,925	28,856
2001	5,622	8,775	9,221	66	5,786	29,223
2002	5,296	8,914	9,468	60	5,857	29,325
2003	5,281	9,504	10,702	63	6,361	31,649
2004	5,189	10,425	13,272	54	7,167	35,782
2005	5,287	11,101	15,754	49	7,410	39,242
2006	5,325	11,561	16,966	43	7,472	40,881
2007	5,232	12,110	18,615	40	7,541	43,170
2008	5,473	12,873	18,639	56	7,221	43,940
2009	5,971	13,321	16,588	56	7,329	42,966
2010	6,093	14,207	17,435	46	7,360	44,607
2011	6,001	14,920	18,465	39	7,482	46,545
2012	6,026	15,482	19,576	38	7,473	48,225
2013	6,040	15,804	20,002	36	7,031	48,617
2014	6,313	16,272	20,919	40	7,199	50,437
2015	6,384	17,199	21,995	37	6,659	52,012
2016	6,084	17,958	21,951	34	6,540	52,369
2017	5,557	18,522	21,877	31	6,479	52,248
2018	5,383	19,199	22,479	27	6,137	52,995
2019	5,189	20,291	22,269	31	6,142	53,723
2020	5,286	20,970	21,406	31	5,832	53,220
2021	4,513	21,866	22,046	30	5,645	53,804
2022	4,497	22,439	22,695	32	5,870	55,228

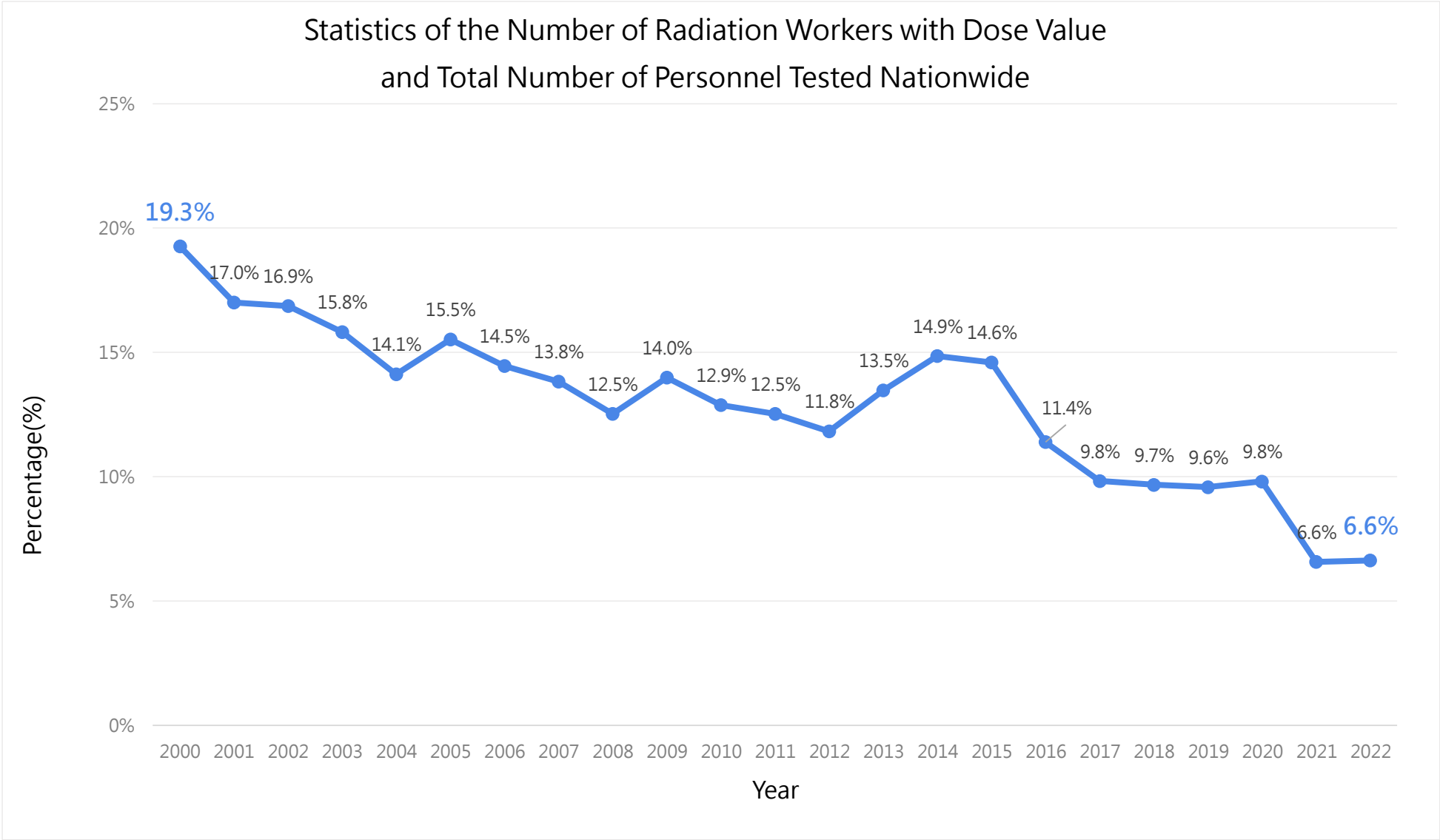
Remarks：

1. Natural radiation sources include civil aircraft, oil, gas, and mineral and ore processing.
2. Others category includes educational institutions, veterinarians and a few difficult to classify.
3. National dose badge usage statistics includes radiation workers and non-radiation workers as defined by law/regulations.
4. Because some workers are engaged in more than two types of radiation works, the total number of personnel tested nationwide will be less than the total number of various types of work.


Statistics of the Number of Radiation Workers Nationwide
Number of Radiation Workers
Natural Radiation Sources(Number of Radiation Workers)
60,000
50,000
40,000
30,000
20,000
10,000
0
70
60
50
40
30
20
10
0
28,856
29,223
29,325
31,649
35,782
39,242
40,881
43,170
43,940
42,966
44,607
46,545
48,223
48,614
50,434
52,002
52,369
52,248
52,995
53,723
53,220
53,804
55,228
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
Year
Natural Radiation Sources
Nationwide
Nuclear Fuel Cycle
Medical Type
Industrial Type
Others

(2) Statistics of the Number of Radiation Workers with Dose Value and Total Number of Personnel Tested Nationwide

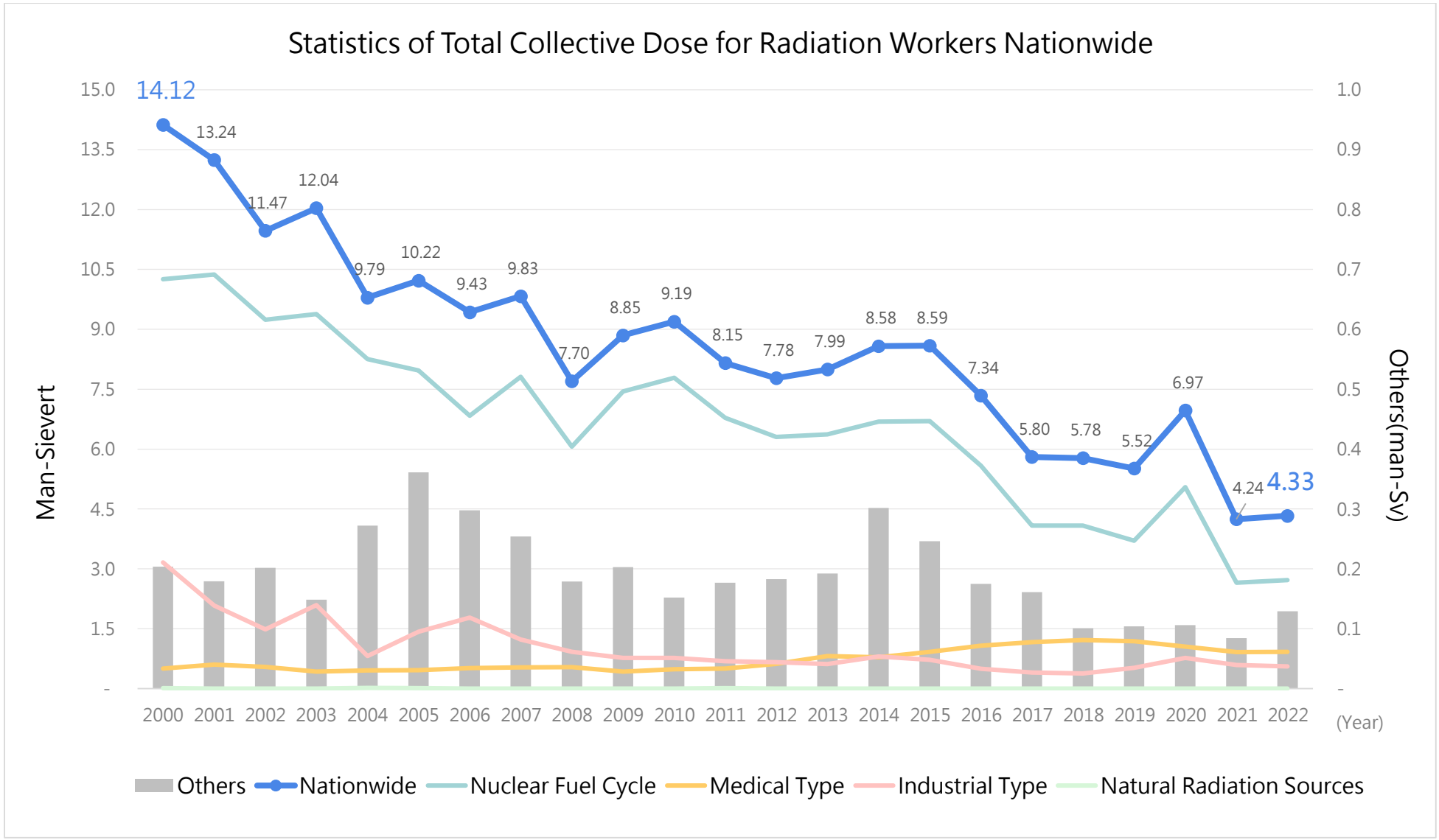
Year	Number of People with Dose Value	Total Number of Personnel Tested	Percentage
2000	5,559	28,856	19.3%
2001	4,970	29,223	17.0%
2002	4,943	29,325	16.9%
2003	5,006	31,649	15.8%
2004	5,052	35,782	14.1%
2005	6,088	39,242	15.5%
2006	5,908	40,881	14.5%
2007	5,969	43,170	13.8%
2008	5,504	43,940	12.5%
2009	6,008	42,966	14.0%
2010	5,745	44,607	12.9%
2011	5,831	46,545	12.5%
2012	5,704	48,223	11.8%
2013	6,551	48,614	13.5%
2014	7,490	50,434	14.9%
2015	7,589	52,002	14.6%
2016	5,966	52,369	11.4%
2017	5,132	52,248	9.8%
2018	5,127	52,995	9.7%
2019	5,148	53,723	9.6%
2020	5,220	53,220	9.8%
2021	3,537	53,804	6.6%
2022	3,661	55,228	6.6%


Statistics of the Number of Radiation Workers with Dose Value and Total Number of Personnel Tested Nationwide
Percentage(%)
25%
20%
15%
10%
5%
0%
19.3%
17.0%
16.9%
15.8%
14.1%
15.5%
14.5%
13.8%
12.5%
14.0%
12.9%
12.5%
11.8%
13.5%
14.9%
14.6%
11.4%
9.8%
9.7%
9.6%
9.8%
6.6%
6.6%
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
Year

(3) Statistics of Total Collective Dose for Radiation Workers Nationwide

Year	Nationwide	Nuclear Fuel Cycle (Nuclear Power Plant)	Medical Type	Industrial Type (Non-Medical)	Others (Research)	Natural Radiation Sources
2000	14.12	10.25	0.50	3.16	0.20	0.00
2001	13.24	10.37	0.61	2.08	0.18	-
2002	11.47	9.24	0.55	1.48	0.20	-
2003	12.04	9.38	0.42	2.09	0.15	0.00
2004	9.79	8.25	0.45	0.82	0.27	0.00
2005	10.22	7.97	0.46	1.42	0.36	0.00
2006	9.43	6.83	0.52	1.78	0.30	0.00
2007	9.83	7.81	0.53	1.23	0.25	0.00
2008	7.70	6.06	0.54	0.92	0.18	-
2009	8.85	7.45	0.43	0.77	0.20	-
2010	9.19	7.79	0.49	0.77	0.15	0.00
2011	8.15	6.79	0.50	0.68	0.18	0.00
2012	7.78	6.31	0.62	0.66	0.18	0.00
2013	7.99	6.37	0.81	0.61	0.19	-
2014	8.58	6.69	0.79	0.80	0.30	-
2015	8.59	6.70	0.92	0.72	0.25	-
2016	7.34	5.59	1.08	0.50	0.17	-
2017	5.80	4.08	1.16	0.40	0.16	-
2018	5.78	4.08	1.21	0.38	0.10	-
2019	5.52	3.70	1.19	0.52	0.10	0.00
2020	6.97	5.05	1.05	0.77	0.11	-
2021	4.24	2.65	0.92	0.59	0.08	-
2022	4.33	2.72	0.92	0.56	0.13	-

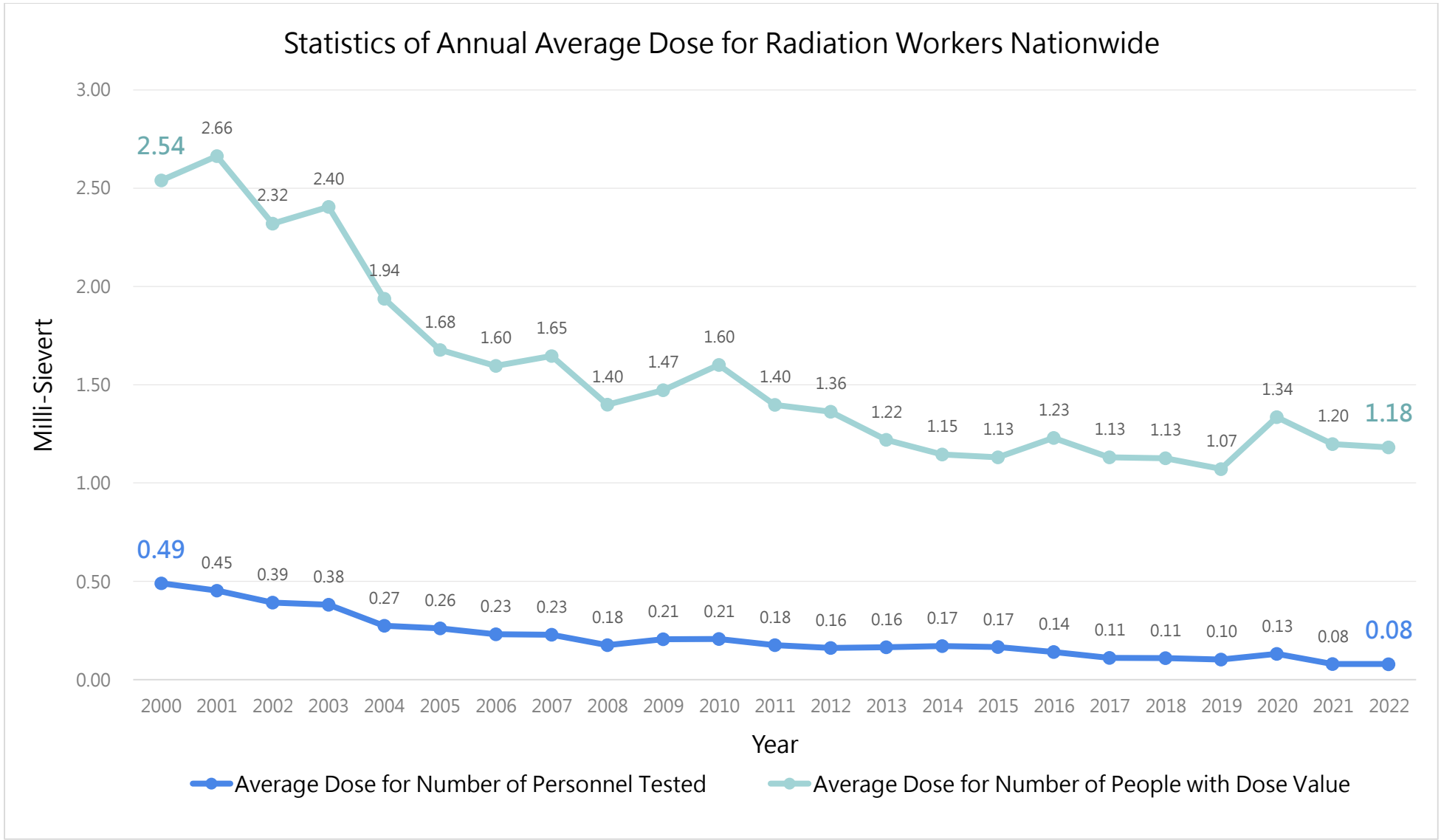
Unit：Man-Sievert (man-Sv)


Statistics of Total Collective Dose for Radiation Workers Nationwide
Man-Sievert
Others(man-Sv)
(Year)
14.12
13.24
11.47
12.04
9.79
10.22
9.43
9.83
7.70
8.85
9.19
8.15
7.78
7.99
8.58
8.59
7.34
5.80
5.78
5.52
6.97
4.24
4.33
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
-
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
-
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
Others
Nationwide
Nuclear Fuel Cycle
Medical Type
Industrial Type
Natural Radiation Sources

(4) Statistics of Annual Average Dose for Radiation Workers Nationwide

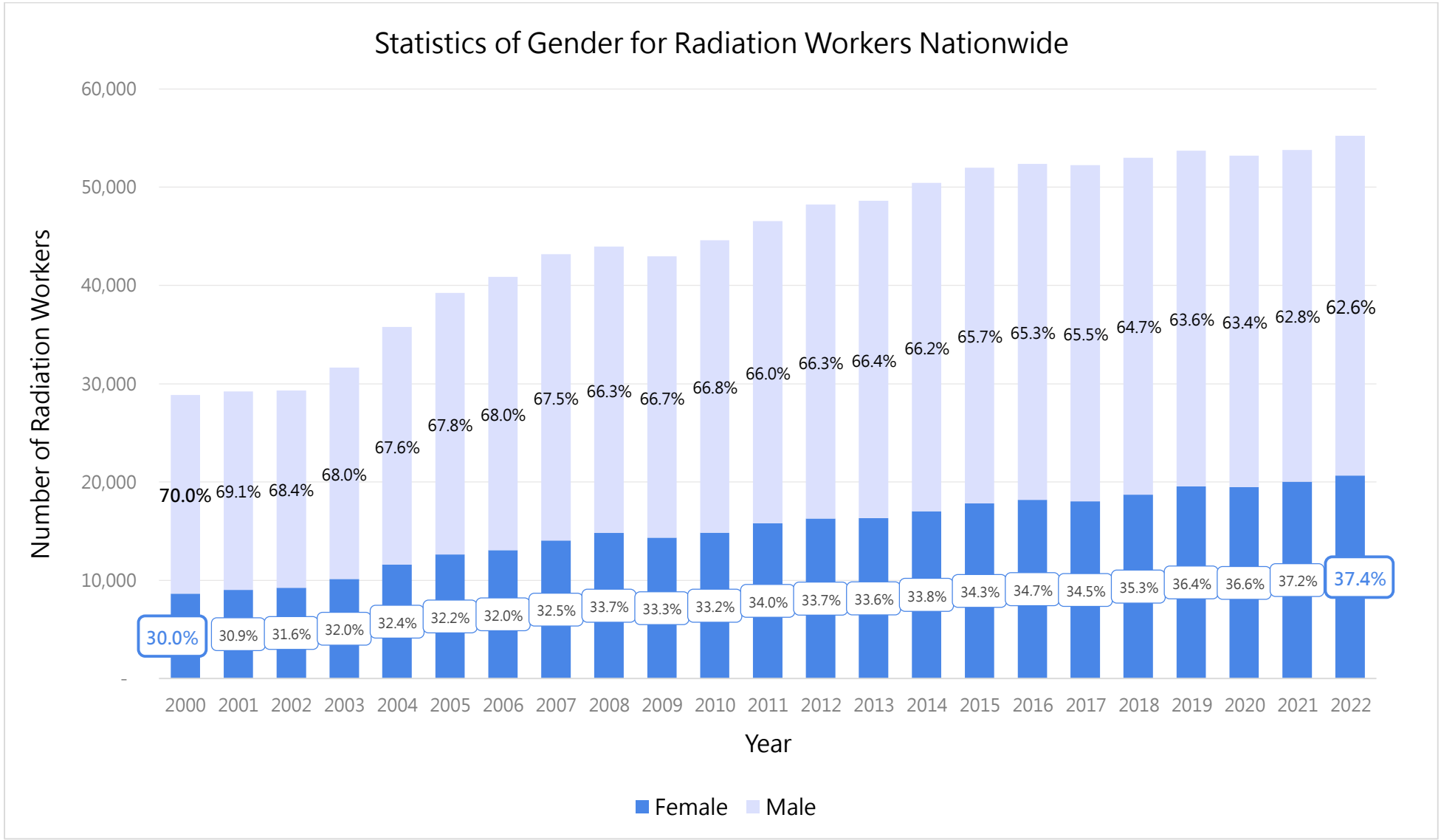
Year	Average Dose for Number of Personnel Tested	Average Dose for Number of People with Dose Value
2000	0.49	2.54
2001	0.45	2.66
2002	0.39	2.32
2003	0.38	2.40
2004	0.27	1.94
2005	0.26	1.68
2006	0.23	1.60
2007	0.23	1.65
2008	0.18	1.40
2009	0.21	1.47
2010	0.21	1.60
2011	0.18	1.40
2012	0.16	1.36
2013	0.16	1.22
2014	0.17	1.15
2015	0.17	1.13
2016	0.14	1.23
2017	0.11	1.13
2018	0.11	1.13
2019	0.10	1.07
2020	0.13	1.34
2021	0.08	1.20
2022	0.08	1.18

Unit：Milli-Sievert (mSv)


Statistics of Annual Average Dose for Radiation Workers Nationwide
Milli-Sievert
3.00
2.50
2.00
1.50
1.00
0.50
0.00
2.54
2.66
2.32
2.40
1.94
1.68
1.60
1.65
1.40
1.47
1.60
1.40
1.36
1.22
1.15
1.13
1.23
1.13
1.13
1.07
1.34
1.20
1.18
0.49
0.45
0.39
0.38
0.27
0.26
0.23
0.23
0.18
0.21
0.21
0.18
0.16
0.16
0.17
0.17
0.14
0.11
0.11
0.10
0.13
0.08
0.08
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
Year
Average Dose for Number of Personnel Tested
Average Dose for Number of People with Dose Value

(5) Statistics of Gender for Radiation Workers Nationwide

Year	Male	Female	Total	Male Ratio (%)	Female Ratio (%)
2000	20,201	8,655	28,856	70.0%	30.0%
2001	20,194	9,029	29,223	69.1%	30.9%
2002	20,069	9,256	29,325	68.4%	31.6%
2003	21,507	10,142	31,649	68.0%	32.0%
2004	24,194	11,588	35,782	67.6%	32.4%
2005	26,620	12,622	39,242	67.8%	32.2%
2006	27,816	13,065	40,881	68.0%	32.0%
2007	29,122	14,048	43,170	67.5%	32.5%
2008	29,112	14,828	43,940	66.3%	33.7%
2009	28,639	14,327	42,966	66.7%	33.3%
2010	29,778	14,829	44,607	66.8%	33.2%
2011	30,740	15,805	46,545	66.0%	34.0%
2012	31,948	16,275	48,223	66.3%	33.7%
2013	32,295	16,319	48,614	66.4%	33.6%
2014	33,396	17,038	50,434	66.2%	33.8%
2015	34,184	17,818	52,002	65.7%	34.3%
2016	34,178	18,191	52,369	65.3%	34.7%
2017	34,210	18,038	52,248	65.5%	34.5%
2018	34,283	18,712	52,995	64.7%	35.3%
2019	34,163	19,560	53,723	63.6%	36.4%
2020	33,750	19,470	53,220	63.4%	36.6%
2021	33,771	20,033	53,804	62.8%	37.2%
2022	34,574	20,654	55,228	62.6%	37.4%


Statistics of Gender for Radiation Workers Nationwide
Number of Radiation Workers
60,000
50,000
40,000
30,000
20,000
10,000
-
70.0% 69.1% 68.4% 68.0% 67.6% 67.8% 68.0% 67.5% 66.3% 66.7% 66.8% 66.0% 66.3% 66.4% 66.2% 65.7% 65.3% 65.5% 64.7% 63.6% 63.4% 62.8% 62.6%
30.0% 30.9% 31.6% 32.0% 32.4% 32.2% 32.0% 32.5% 33.7% 33.3% 33.2% 34.0% 33.7% 33.6% 33.8% 34.3% 34.7% 34.5% 35.3% 36.4% 36.6% 37.2% 37.4%
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
Year
Female
Male

(6) Statistics of the Number of Radiation Workers in Each Dose Interval Nationwide (Unit: person)

Dose Interval (mSv)	≦LLD	≦ 1	> 1 ≦ 2.5	> 2.5 ≦ 5	> 5 ≦ 7.5	> 7.5 ≦ 10	> 10 ≦ 15	> 15 ≦ 20	> 20 ≦ 25	> 25 ≦ 30	> 30 ≦ 35	> 35 ≦ 40	> 40 ≦ 45	> 45 ≦ 50	> 50 ≦ 100	> 100
2000	23,297	3,296	891	549	272	191	169	90	47	26	15	8	3	0	2	0
2001	24,253	2,774	891	539	251	161	187	86	36	24	17	0	3	0	1	0
2002	24,382	2,907	857	519	225	148	155	77	40	8	5	1	0	0	1	0
2003	26,643	3,001	801	520	228	157	135	84	43	21	7	7	2	0	0	0
2004	30,730	3,152	822	512	196	126	165	75	1	1	0	2	0	0	0	0
2005	33,154	4,018	935	528	245	143	159	52	3	1	2	1	1	0	0	0
2006	34,973	3,991	854	526	214	140	132	31	13	2	5	0	0	0	0	0
2007	37,201	3,922	909	586	221	126	156	43	3	2	1	0	0	0	0	0
2008	38,436	3,644	948	503	186	118	98	6	1	0	0	0	0	0	0	0
2009	36,958	3,968	941	593	254	145	99	8	0	0	0	0	0	0	0	0
2010	38,862	3,652	961	614	238	138	121	21	0	0	0	0	0	0	0	0
2011	40,714	3,884	977	507	238	134	81	10	0	0	0	0	0	0	0	0
2012	42,519	3,758	1,030	531	201	103	68	12	1	0	0	0	0	0	0	0
2013	42,063	4,601	1,008	556	196	93	77	19	0	1	0	0	0	0	0	0
2014	42,944	5,431	1,072	542	246	101	87	11	0	0	0	0	0	0	0	0
2015	44,413	5,413	1,188	569	220	111	81	7	0	0	0	0	0	0	0	0
2016	46,403	4,200	950	477	159	87	80	13	0	0	0	0	0	0	0	0
2017	47,116	3,716	756	394	136	75	50	5	0	0	0	0	0	0	0	0
2018	47,868	3,680	840	362	117	60	52	14	2	0	0	0	0	0	0	0
2019	48,575	3,713	823	364	139	60	41	8	0	0	0	0	0	0	0	0
2020	48,000	3,668	808	398	124	79	108	29	3	2	1	0	0	0	0	0
2021	50,267	2,369	719	290	83	40	32	4	0	0	0	0	0	0	0	0
2022	51,567	2,470	718	297	97	53	25	1	0	0	0	0	0	0	0	0

LLD：Lower limit of detection

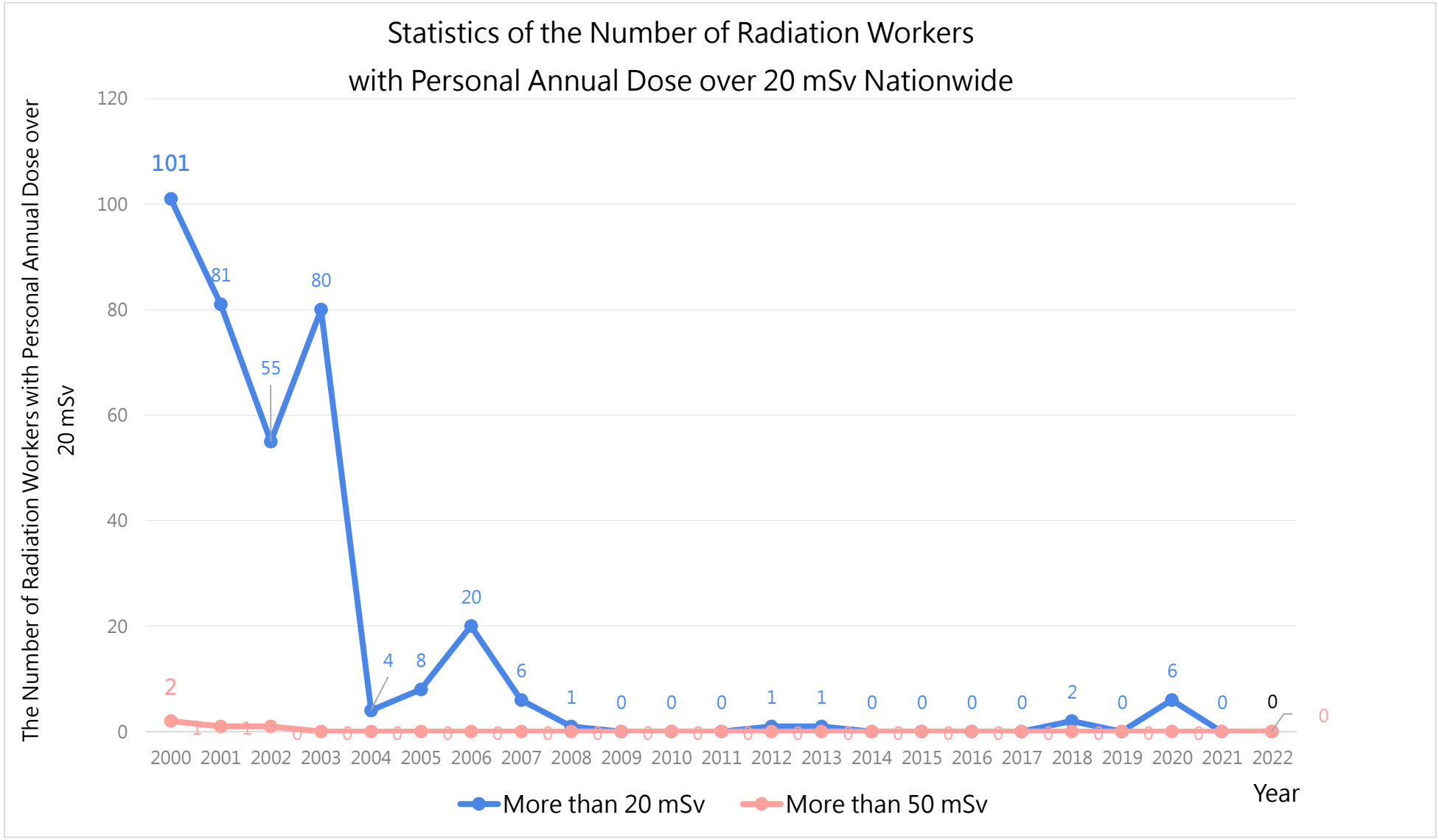
(7) Statistics of Relative Percentage of Radiation Workers in Each Dose Interval Nationwide (unit: %)

Dose Interval (mSv)	≦LLD	≦ 1	> 1 ≦ 2.5	> 2.5 ≦ 5	> 5 ≦ 7.5	> 7.5 ≦ 10	> 10 ≦ 15	> 15 ≦ 20	> 20 ≦ 25	> 25 ≦ 30	> 30 ≦ 35	> 35 ≦ 40	> 40 ≦ 45	> 45 ≦ 50	> 50 ≦ 100	> 100	Percentage of People with Dose Value
2000	80.7	11.4	3.1	1.9	0.9	0.7	0.6	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	19.3%
2001	83.0	9.5	3.1	1.8	0.9	0.6	0.6	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	17.0%
2002	83.1	9.9	2.9	1.8	0.8	0.5	0.5	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.9%
2003	84.2	9.5	2.5	1.6	0.7	0.5	0.4	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	15.8%
2004	85.9	8.8	2.3	1.4	0.6	0.4	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.1%
2005	84.5	10.2	2.4	1.4	0.6	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.5%
2006	85.6	9.8	2.1	1.3	0.5	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.5%
2007	86.2	9.1	2.1	1.4	0.5	0.3	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.8%
2008	87.5	8.3	2.2	1.1	0.4	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5%
2009	86.0	9.2	2.2	1.4	0.6	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0%
2010	87.1	8.2	2.2	1.4	0.5	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.9%
2011	87.5	8.3	2.1	1.1	0.5	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5%
2012	88.2	7.8	2.1	1.1	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.8%
2013	86.5	9.5	2.1	1.1	0.4	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.5%
2014	85.2	10.8	2.1	1.1	0.5	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.9%
2015	85.4	10.4	2.3	1.1	0.4	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.6%
2016	88.6	8.0	1.8	0.9	0.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.4%
2017	90.2	7.1	1.5	0.8	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.8%
2018	90.3	6.9	1.6	0.7	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.7%
2019	90.4	6.9	1.5	0.7	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6%
2020	90.2	6.9	1.5	0.8	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.8%
2021	93.4	4.4	1.3	0.5	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6%
2022	93.4	4.5	1.3	0.5	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6%

LLD：Lower limit of detection

(8) Statistics of the Number of Radiation Workers with Personal Annual Dose over 20 mSv Nationwide

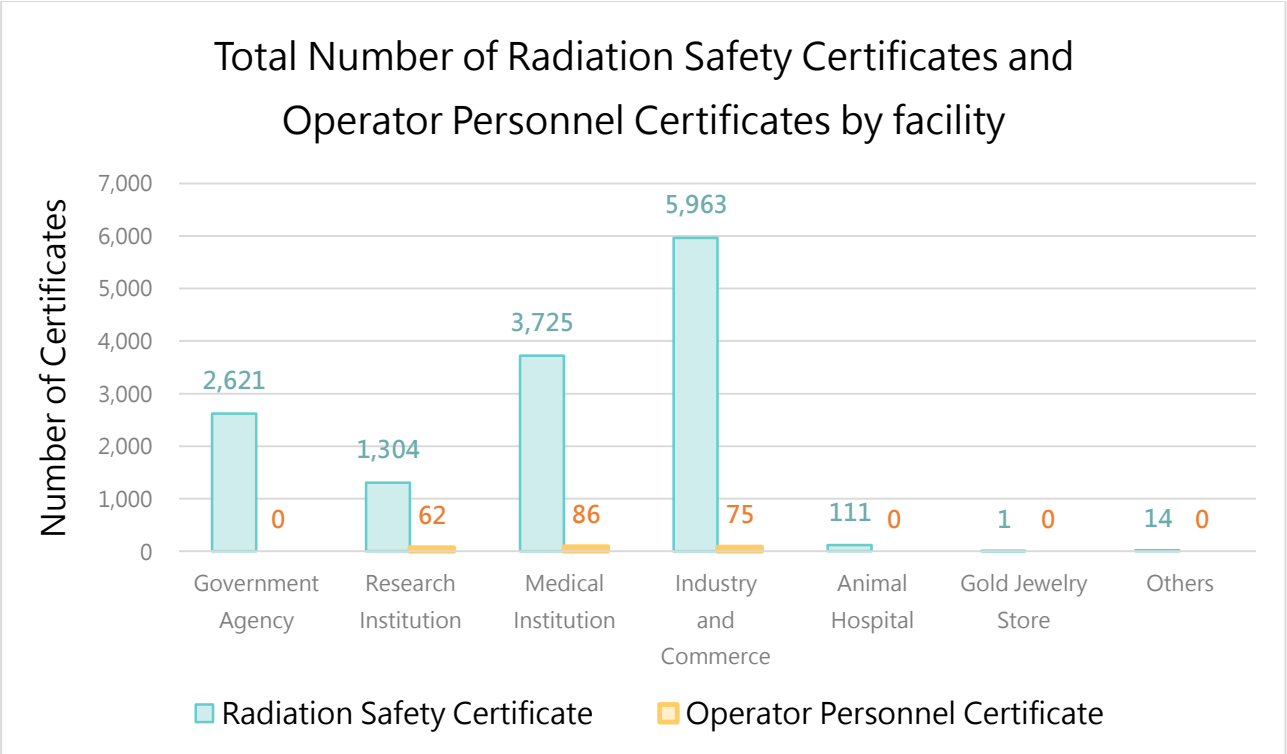
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
More than 20 mSv	101	81	55	80	4	8	20	6	1	0	0	0	1	1	0	0	0	0	2	0	6	0	0
More than 50 mSv	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



4. Personnel with Certificates (Radiation Safety Certificates, Operator Personnel, Radiation Protection Personnel) and Radiation Protection Business with Certificates

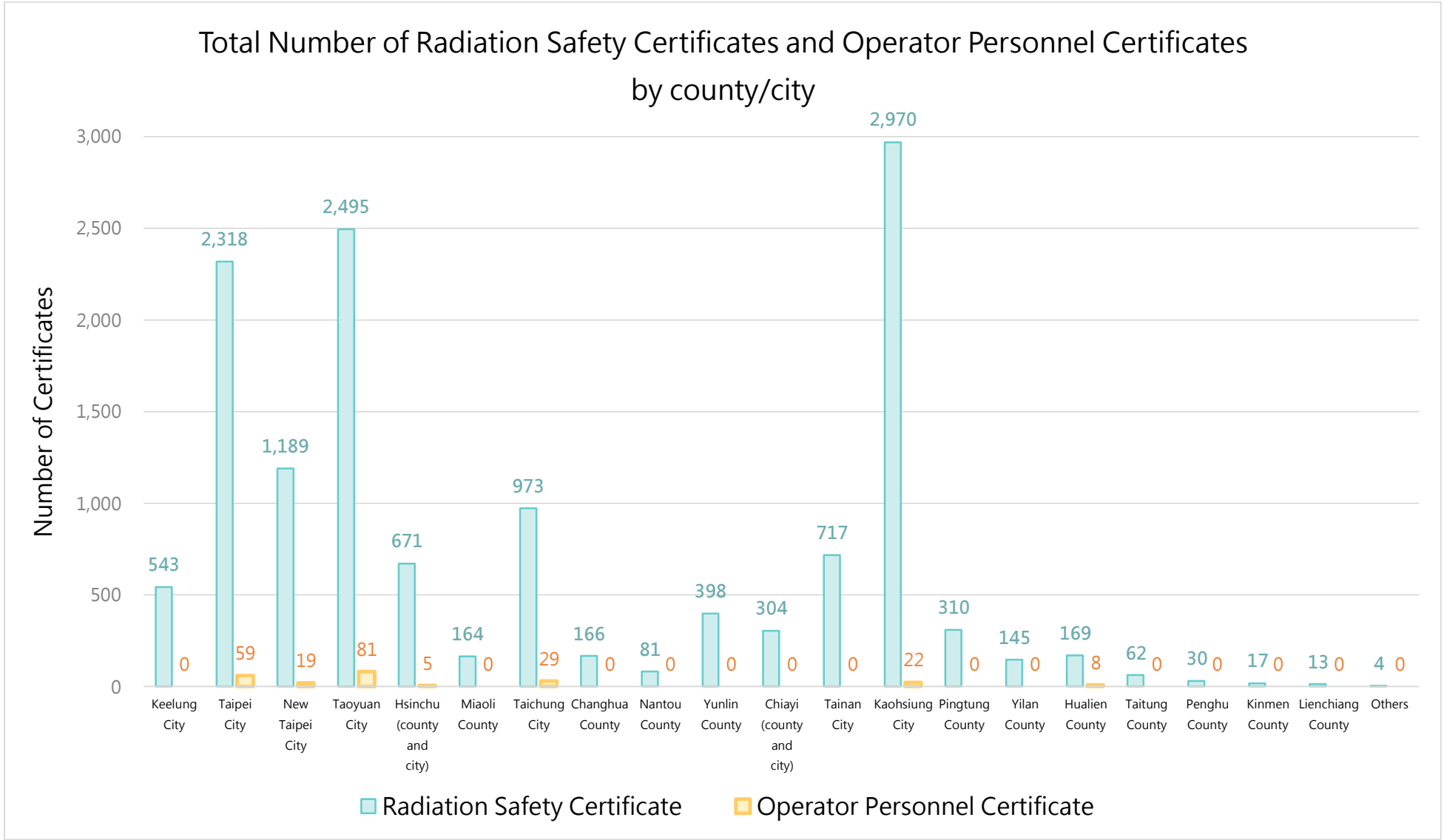
(1) Total Number of Radiation Safety Certificates and Operator Personnel Certificates by facility

Facility / Certificate Type	Government Agency	Research Institution	Medical Institution	Industry And Commerce	Animal Hospital	Gold Jewelry Store	Others (Including unemployed people)	Total
Radiation Safety Certificate	2,621	1,304	3,725	5,963	111	1	14	13,739
Operator Personnel Certificate	0	62	86	75	0	0	0	223
Total	2,621	1,366	3,811	6,038	111	1	14	13,962



(2) Total Number of Radiation Safety Certificates and Operator Personnel Certificates by county/city

Certificate type / County/City	Radiation Safety Certificate	Operator Personnel Certificate	Total
Keelung City	543	0	543
Taipei City	2,318	59	2,377
New Taipei City	1,189	19	1,208
Taoyuan City	2,495	81	2,576
Hsinchu (county and city)	671	5	676
Miaoli County	164	0	164
Taichung City	973	29	1,002
Changhua County	166	0	166
Nantou County	81	0	81
Yunlin County	398	0	398
Chiayi (county and city)	304	0	304
Tainan City	717	0	717
Kaohsiung City	2,970	22	2,992
Pingtung County	310	0	310
Yilan County	145	0	145
Hualien County	169	8	177
Taitung County	62	0	62
Penghu County	30	0	30
Kinmen County	17	0	17
Lienchiang County	13	0	13
Others	4	0	4
Total	13,739	223	13,962

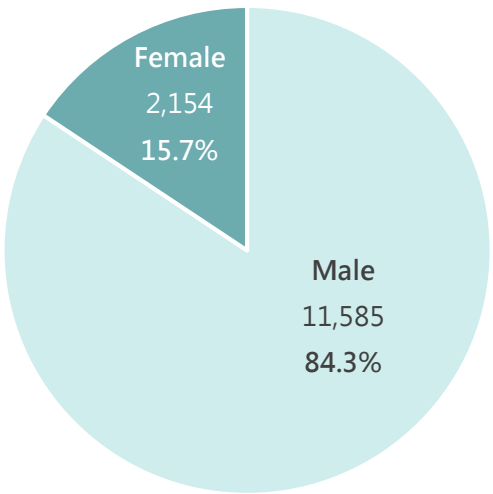

Total Number of Radiation Safety Certificates and Operator Personnel Certificates by county/city
Number of Certificates
3,000
2,500
2,000
1,500
1,000
500
0
543
0
2,318
59
1,189
19
2,495
81
671
5
164
0
973
29
166
0
81
0
398
0
304
0
717
0
2,970
22
310
0
145
0
169
8
62
0
30
0
17
0
13
0
4
0
Keelung City
Taipei City
New Taipei City
Taoyuan City
Hsinchu (county and city)
Miaoli County
Taichung City
Changhua County
Nantou County
Yunlin County
Chiayi (county and city)
Tainan City
Kaohsiung City
Pingtung County
Yilan County
Hualien County
Taitung County
Penghu County
Kinmen County
Lienchiang County
Others
Radiation Safety Certificate
Operator Personnel Certificate

(3) Total Number of Radiation Safety Certificates and Operator Personnel Certificates by gender

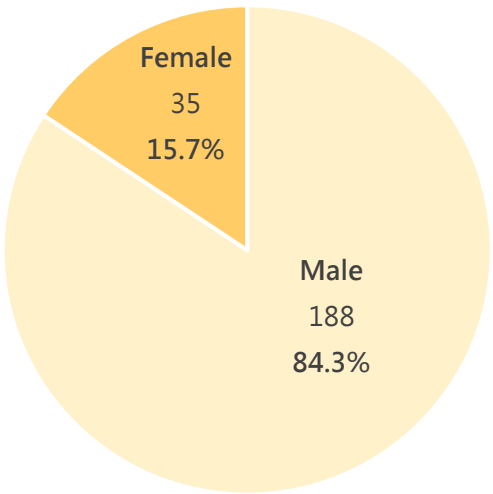
Gender / Certificate Type	Male	Female	Total	Male Ratio	Female Ratio
Radiation Safety Certificate	11,585	2,154	13,739	84.3%	15.7%
Operator Personnel Certificate	188	35	223	84.3%	15.7%
Total	11,773	2,189	13,962	84.3%	15.7%

Total Number of Radiation Safety Certificates and Operator Personnel Certificates by gender

Radiation Safety Certificate

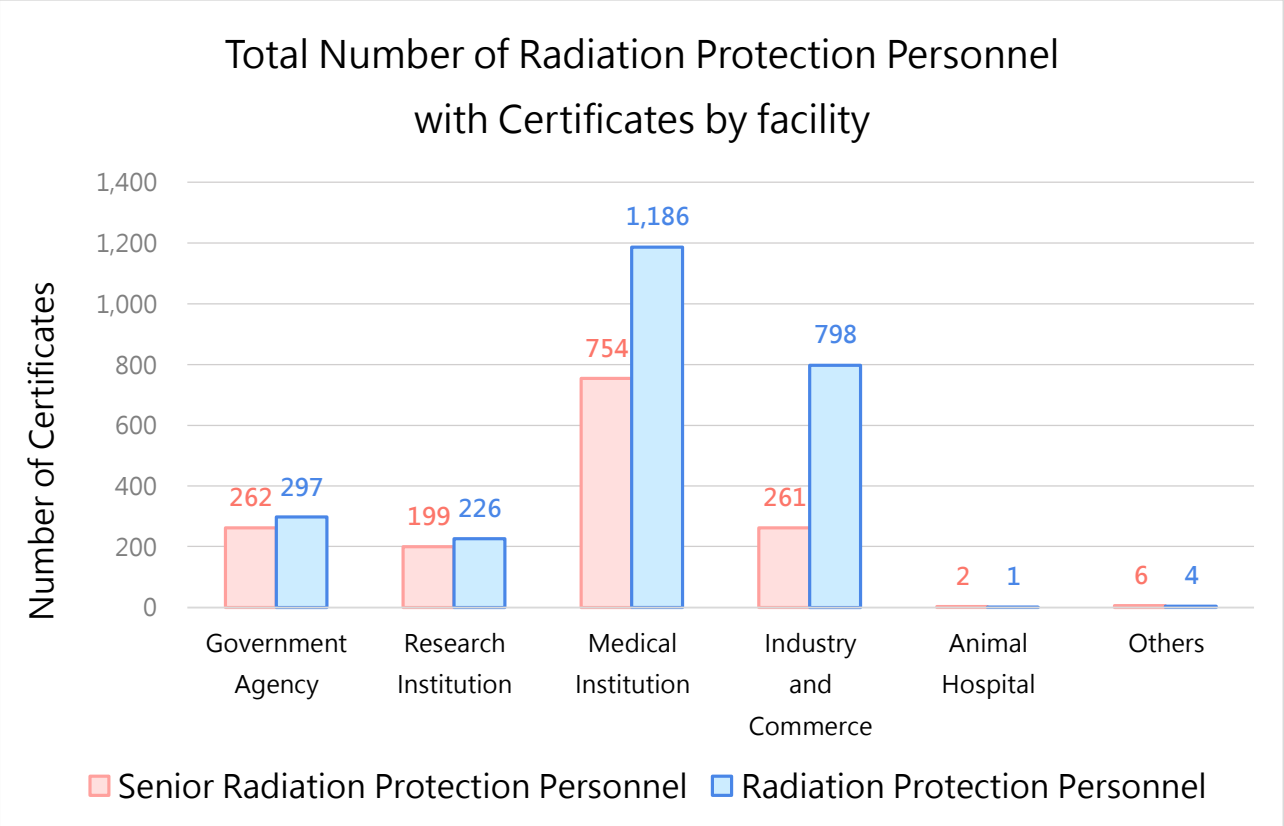


Operator Personnel Certificate



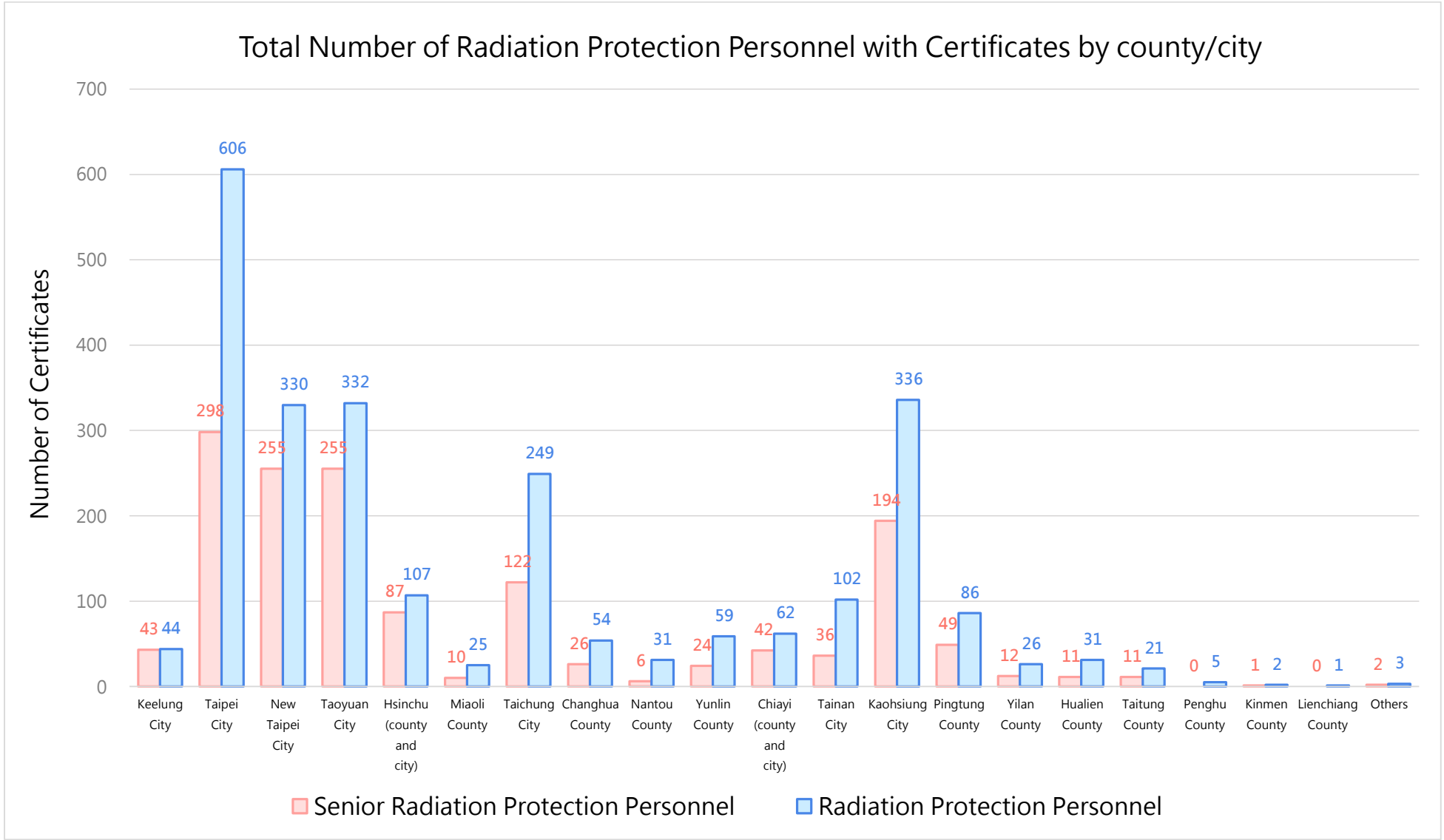
(4) Total Number of Radiation Protection Personnel with Certificates by facility

Facility / Certificate Type	Government Agency	Research Institution	Medical Institution	Industry and Commerce	Animal Hospital	Others (Including unemployed people)	Total
Senior Radiation Protection Personnel	262	199	754	261	2	6	1,484
Radiation Protection Personnel	297	226	1,186	798	1	4	2,512
Total	559	425	1,940	1,059	3	10	3,996



(5) Total Number of Radiation Protection Personnel with Certificates by county/city

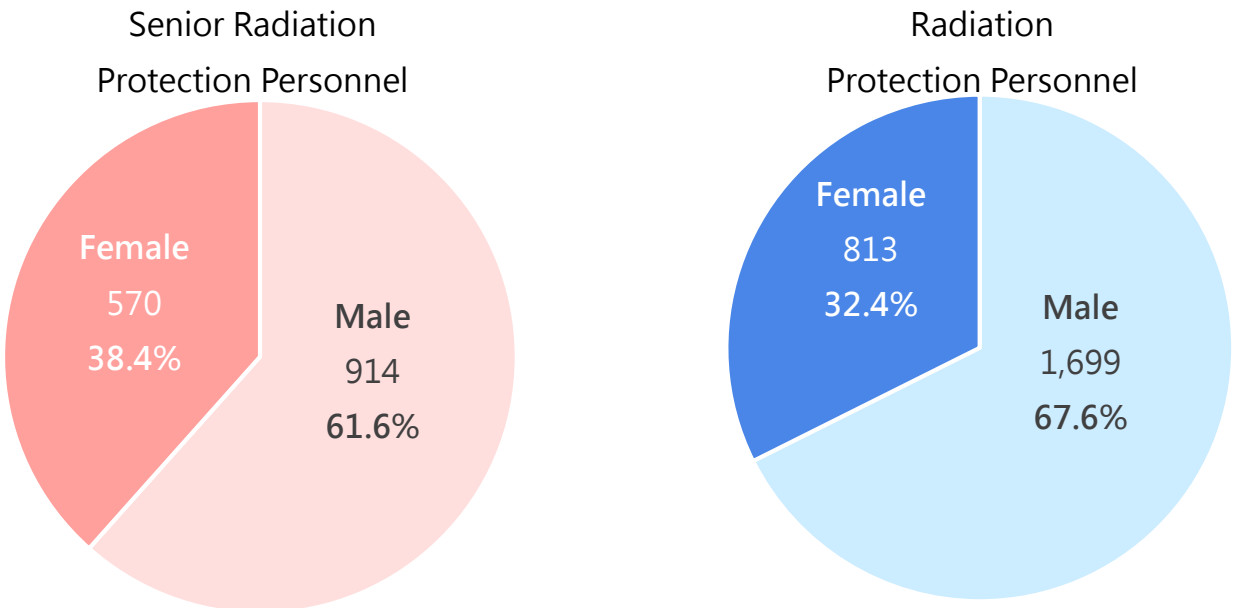
Certificate Type / County/City	Senior Radiation Protection Personnel	Radiation Protection Personnel	Total
Keelung City	43	44	87
Taipei City	298	606	904
New Taipei City	255	330	585
Taoyuan City	255	332	587
Hsinchu (county and city)	87	107	194
Miaoli County	10	25	35
Taichung City	122	249	371
Changhua County	26	54	80
Nantou County	6	31	37
Yunlin County	24	59	83
Chiayi (county and city)	42	62	104
Tainan City	36	102	138
Kaohsiung City	194	336	530
Pingtung County	49	86	135
Yilan County	12	26	38
Hualien County	11	31	42
Taitung County	11	21	32
Penghu County	0	5	5
Kinmen County	1	2	3
Lienchiang County	0	1	1
Others	2	3	5
Total	1,484	2,512	3,996


Total Number of Radiation Protection Personnel with Certificates by county/city
Number of Certificates
700
600
500
400
300
200
100
0
43 44
298 606
255 330
255 332
87 107
10 25
122 249
26 54
6 31
24 59
42 62
36 102
194 336
49 86
12 26
11 31
11 21
0 5
1 2
0 1
2 3
Keelung City
Taipei City
New Taipei City
Taoyuan City
Hsinchu (county and city)
Miaoli County
Taichung City
Changhua County
Nantou County
Yunlin County
Chiayi (county and city)
Tainan City
Kaohsiung City
Pingtung County
Yilan County
Hualien County
Taitung County
Penghu County
Kinmen County
Lienchiang County
Others
Senior Radiation Protection Personnel
Radiation Protection Personnel

(6) Total Number of Radiation Protection Personnel with Certificates by gender

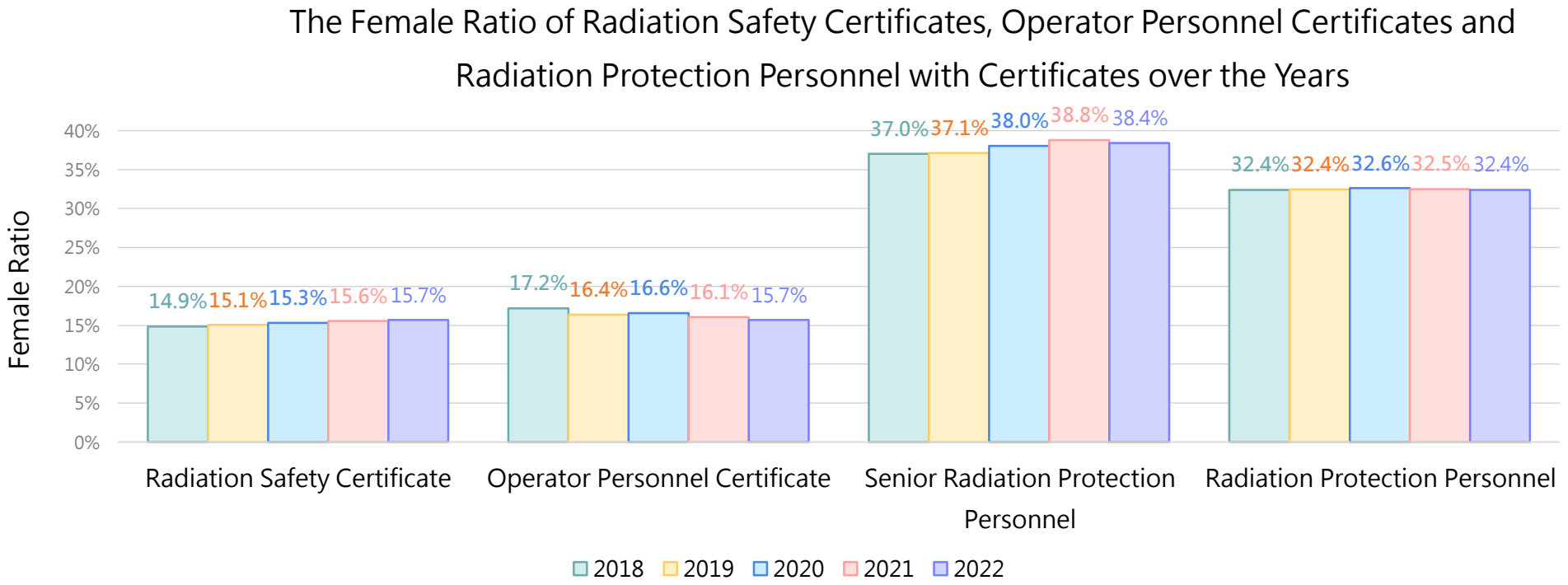
Gender / Certificate Type	Male	Female	Total	Male Ratio	Female Ratio
Senior Radiation Protection Personnel	914	570	1,484	61.6%	38.4%
Radiation Protection Personnel	1,699	813	2,512	67.6%	32.4%
Total	2,613	1,383	3,996	65.4%	34.6%

Total Number of Radiation Protection Personnel with Certificates by gender



(7) The Female Ratio of Radiation Safety Certificates, Operator Personnel Certificates and Radiation Protection Personnel with Certificates over the Years

	Radiation Safety Certificate			Operator Personnel Certificate			Senior Radiation Protection Personnel			Radiation Protection Personnel		
Year	Male	Female	Female Ratio	Male	Female	Female Ratio	Male	Female	Female Ratio	Male	Female	Female Ratio
2018	11,200	1,956	14.9%	130	27	17.2%	816	480	37.0%	1,667	799	32.4%
2019	11,279	2,000	15.1%	148	29	16.4%	850	502	37.1%	1,676	805	32.4%
2020	11,395	2,061	15.3%	151	30	16.6%	868	533	38.0%	1,669	808	32.6%
2021	11,496	2,120	15.6%	167	32	16.1%	884	560	38.8%	1,674	806	32.5%
2022	11,585	2,154	15.7%	188	35	15.7%	914	570	38.4%	1,699	813	32.4%

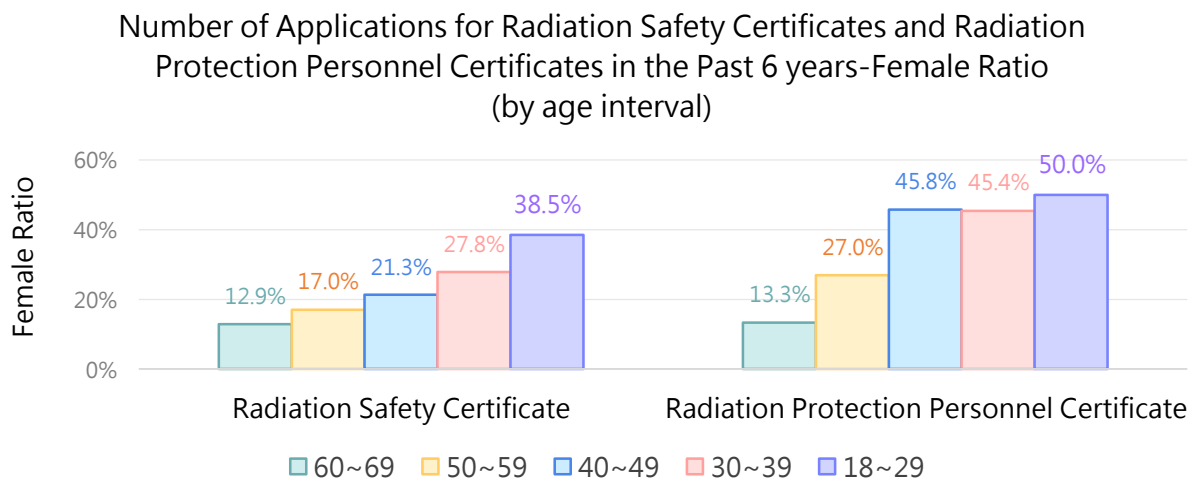


(8) Number of Applications for Radiation Safety Certificates and Radiation Protection Personnel Certificates in 2022

	Year	Female	Male	Total	Female Ratio	Male Ratio
Radiation Safety Certificate	2022	949	3,363	**4,312**	22.0%	78.0%
Radiation Protection Personnel Certificate	2022	850	1,484	**2,334**	36.4%	63.6%

(9) Number of Applications for Radiation Safety Certificates and Radiation Protection Personnel Certificates by age interval and gender in 2022

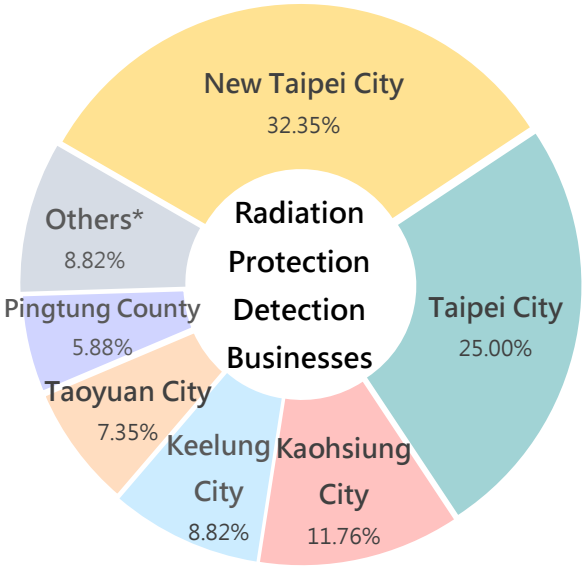
	Age Interval	Female	Male	Total	Female Ratio	Male Ratio
Radiation Safety Certificate	80~88	0	5	5	0.0%	100.0%
	70~79	0	23	23	0.0%	100.0%
	60~69	62	420	482	12.9%	87.1%
	50~59	177	863	1,040	17.0%	83.0%
	40~49	301	1,112	1,413	21.3%	78.7%
	30~39	288	747	1,035	27.8%	72.2%
	18~29	121	193	314	38.5%	61.5%
	合計	949	3,363	4,312	22.0%	78.0%
Radiation Protection Personnel Certificate	80~88	0	4	4	0.0%	100.0%
	70~79	1	25	26	3.8%	96.2%
	60~69	43	280	323	13.3%	86.7%
	50~59	148	401	549	27.0%	73.0%
	40~49	320	379	699	45.8%	54.2%
	30~39	280	337	617	45.4%	54.6%
	18~29	58	58	116	50.0%	50.0%
	合計	850	1,484	2,334	36.4%	63.6%



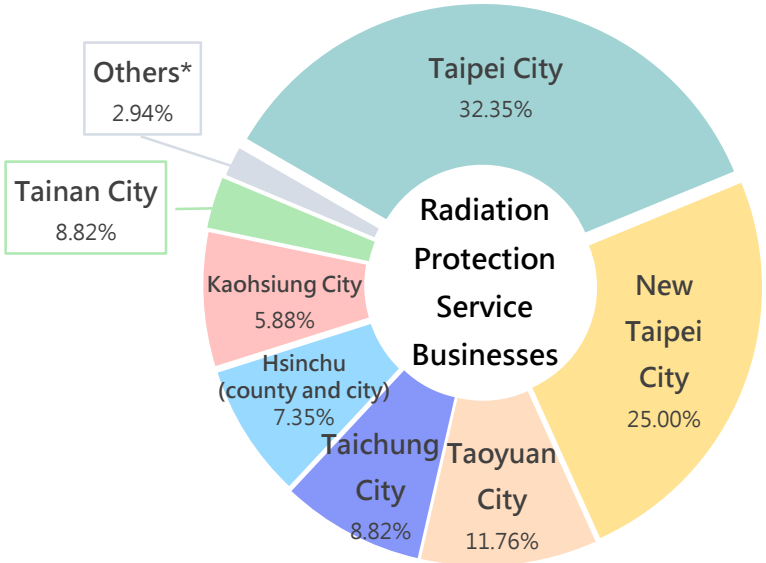
(10)Total Number of Radiation Protection Business with Certificates by business category and county/city

Business category / County/City	Radiation Protection Detection Businesses	Radiation Protection Service Businesses	Institutions of Radiation Protection Training Affairs	Total
Keelung City	6	1	1	8
Taipei City	17	161	1	179
New Taipei City	22	111	5	138
Taoyuan City	5	47	3	55
Hsinchu (county and city)	2	37	5	44
Miaoli County	0	1	0	1
Taichung City	2	38	2	42
Changhua County	1	2	1	4
Nantou County	0	0	0	0
Yunlin County	0	0	0	0
Chiayi (county and city)	0	2	0	2
Tainan City	1	14	2	17
Kaohsiung City	8	37	3	48
Pingtung County	4	2	0	6
Yilan County	0	0	1	1
Hualien County	0	0	0	0
Taitung County	0	0	0	0
Penghu County	0	1	0	1
Kinmen County	0	0	0	0
Lienchiang County	0	0	0	0
Total	68	454	24	546

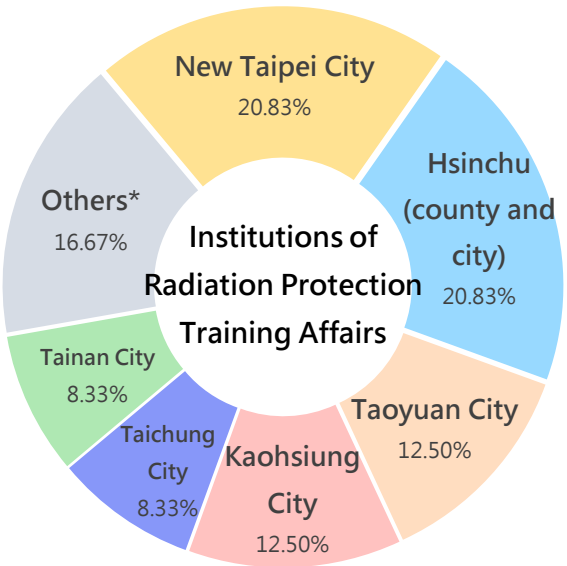
Total Number of Radiation Protection Business with Certificates by business category and county/city



* Others county/city includes Taichung City (2.94%), Hsinchu county and city (2.94%), Tainan City (1.47%), and Changhua



* Others county/city includes Changhua County (0.44%), Chiayi county and city (0.44%), Pingtung County (0.44%), Keelung City (0.22%), Miaoli County (0.22%), and Penghu County (0.22%).



* Others county/city includes Keelung City (4.17%), Taipei City (4.17%), Changhua County (4.17%), and Yilan County (4.17%).

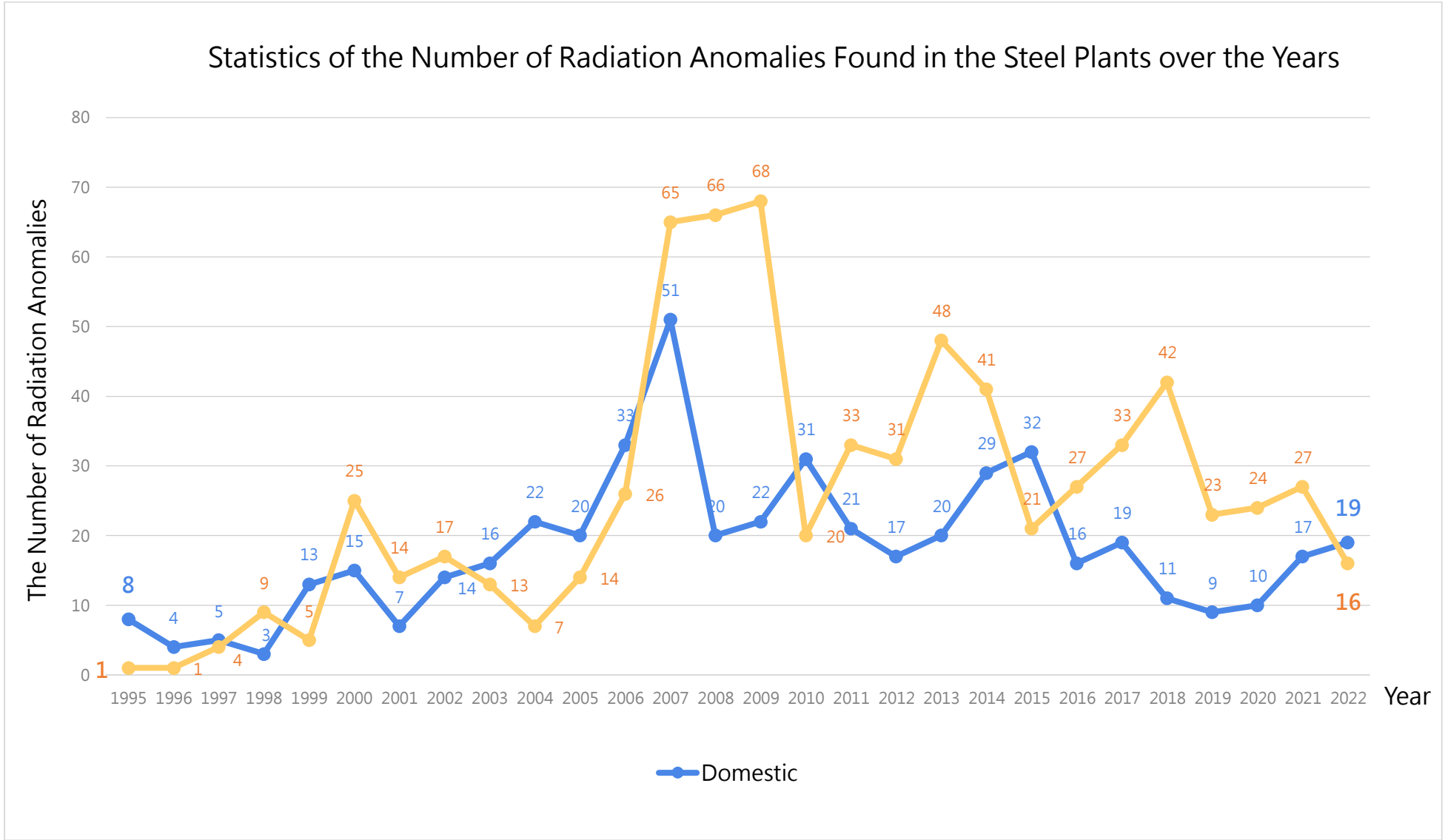
5. Radiation Anomalies Found in the Steel Plants over the Years

(1) Statistics of the Number of Radiation Anomalies Found in the Steel Plants over the Years

Year / Source	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Domestic	8	4	5	3	13	15	7	14	16	22	20
Foreign	1	1	4	9	5	25	14	17	13	7	14
Total	9	5	9	12	18	40	21	31	29	29	34

Year / Source	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Domestic	33	51	20	22	31	21	17	20	29	32	16
Foreign	26	65	66	68	20	33	31	48	41	21	27
Total	59	116	86	90	51	54	48	68	70	53	43

Year / Source	2017	2018	2019	2020	2021	2022	Total
Domestic	19	11	9	10	17	19	504
Foreign	33	42	23	24	27	16	721
Total	52	53	32	34	44	35	1,225

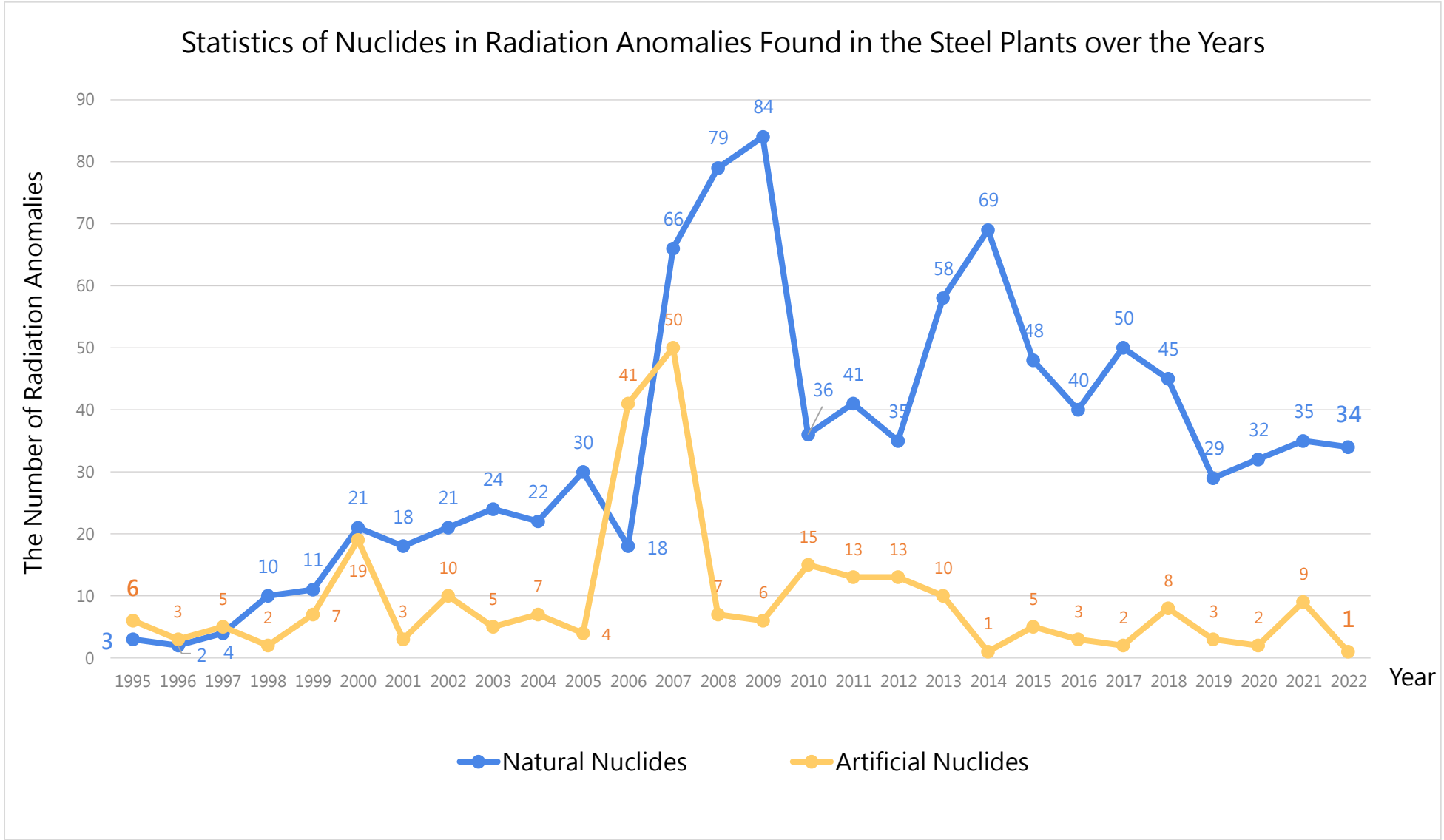

Statistics of the Number of Radiation Anomalies Found in the Steel Plants over the Years
The Number of Radiation Anomalies
80
70
60
50
40
30
20
10
0
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
Year
8 4 5 3 13 15 7 14 16 22 20 33 51 20 22 31 21 17 20 29 32 16 19 11 9 10 17 19
1 1 4 9 5 25 14 17 13 7 14 26 65 66 68 20 33 31 48 41 21 27 33 42 23 24 27 16
Domestic

(2) Statistics of Nuclides in Radiation Anomalies Found in the Steel Plants over the Years

Year / Nuclides	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Natural Nuclides	3	2	4	10	11	21	18	21	24	22	30
Artificial Nuclides	6	3	5	2	7	19	3	10	5	7	4
Total	9	5	9	12	18	40	21	31	29	29	34

Year / Nuclides	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Natural Nuclides	18	66	79	84	36	41	35	58	69	48	40
Artificial Nuclides	41	50	7	6	15	13	13	10	1	5	3
Total	59	116	86	90	51	54	48	68	70	53	43

Year / Nuclides	2017	2018	2019	2020	2021	2022	Total
Natural Nuclides	50	45	29	32	35	34	965
Artificial Nuclides	2	8	3	2	9	1	260
Total	52	53	32	34	44	35	1,225


Statistics of Nuclides in Radiation Anomalies Found in the Steel Plants over the Years
The Number of Radiation Anomalies
Year
Natural Nuclides
Artificial Nuclides
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
3 2 4 10 11 21 18 21 24 22 30 18 66 79 84 36 41 35 58 69 48 40 50 45 29 32 35 34
6 3 5 2 7 19 3 10 5 7 4 41 50 7 6 15 13 13 10 1 5 3 2 8 3 2 9 1

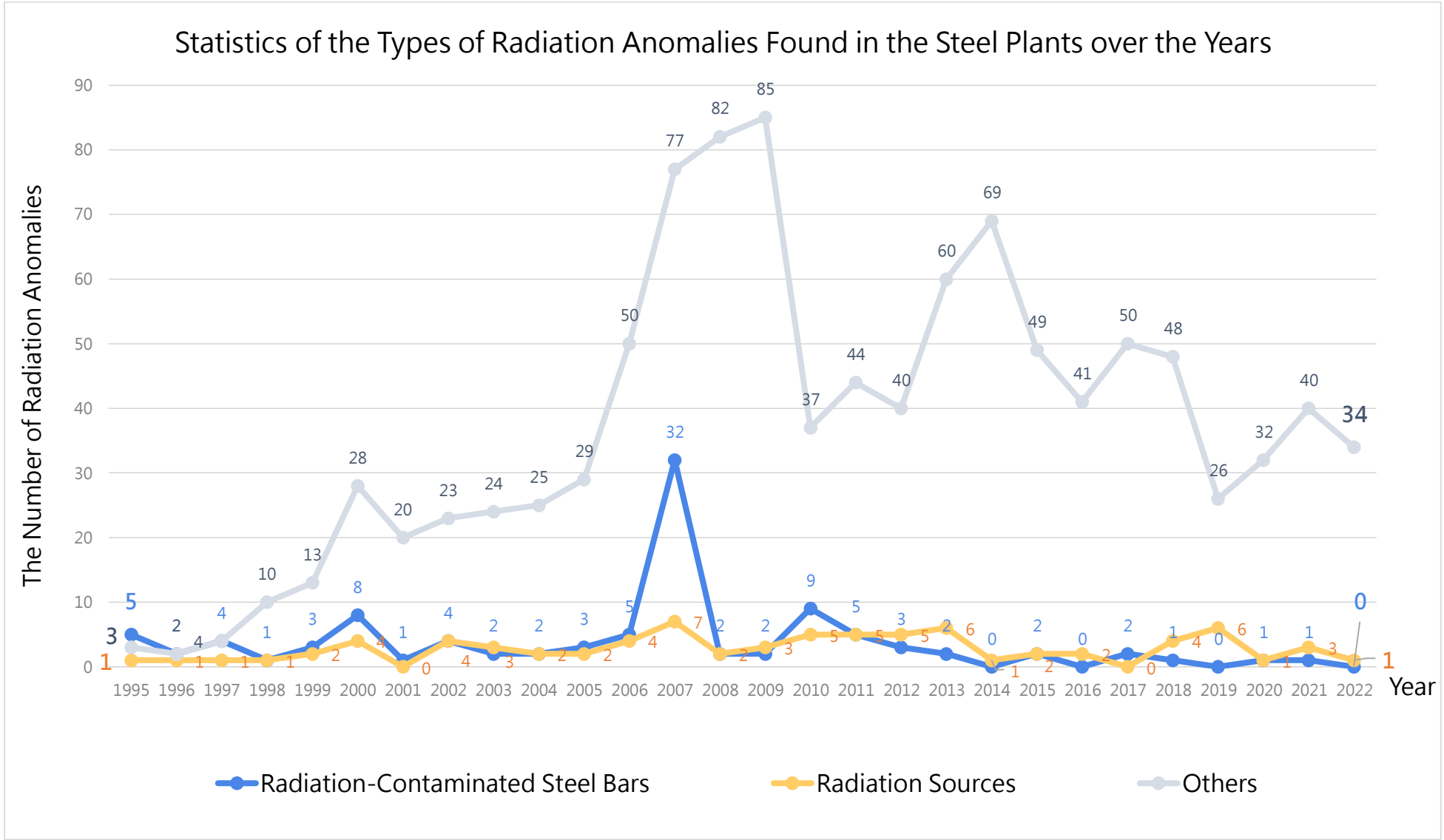
(3) Statistics of the Types of Radiation Anomalies Found in the Steel Plants over the Years

Year / Types of Radiation Anomalies	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Radiation Contaminated Steel Bars	5	2	4	1	3	8	1	4	2	2	3
Radiation Sources	1	1	1	1	2	4	0	4	3	2	2
Others*	3	2	4	10	13	28	20	23	24	25	29
Total	9	5	9	12	18	40	21	31	29	29	34

Year / Types of Radiation Anomalies	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Radiation Contaminated Steel Bars	5	32	2	2	9	5	3	2	0	2	0
Radiation Sources	4	7	2	3	5	5	5	6	1	2	2
Others*	50	77	82	85	37	44	40	60	69	49	41
Total	59	116	86	90	51	54	48	68	70	53	43

Year / Types of Radiation Anomalies	2017	2018	2019	2020	2021	2022	Total
Radiation Contaminated Steel Bars	2	1	0	1	1	0	102
Radiation Sources	0	4	6	1	3	1	78
Others*	50	48	26	32	40	34	1,045
Total	52	53	32	34	44	35	1,225

* "Others" refers to those that are difficult to classify, and most are naturally occurring radioactive materials.


Statistics of the Types of Radiation Anomalies Found in the Steel Plants over the Years
The Number of Radiation Anomalies
Year
Radiation-Contaminated Steel Bars
Radiation Sources
Others