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PART II

Statutory Notifications (S. R. O.)

GOVERNMENT OF PAKISTAN

PAKISTAN NUCLEAR REGULATORY AUTHORITY

NOTIFICATION

Islamabad, the 15th August, 2018

S. R. O. 1235(I)/2018.—In exercise of the powers conferred by Section 16(2)(a) read with Section 56 of the Pakistan Nuclear Regulatory Authority Ordinance, 2001 (III of 2001), the Pakistan Nuclear Regulatory Authority is pleased to make and promulgate the following regulations:—

1. Short Title, Extent, Applicability and Commencement.—(1) These regulations may be called the "Regulations on Security of Radioactive Sources - (PAK/926)".

(2) These regulations extend to the whole of Pakistan.

(3) These regulations shall be applicable for the security of radioactive sources.

(4) These regulations shall come into force at once.

2. Definitions.— In these regulations, unless there is anything repugnant in the subject or context,

(a) "*Authority*" means the Pakistan Nuclear Regulatory Authority established under Section 3 of Pakistan Nuclear Regulatory Authority Ordinance, 2001;

(b) *"background checks"* means a process which include confirmation of identity, financial/criminal record, moral conduct, motivation, verification of references, and employment history to determine the integrity, character and reliability of an individual;

(c) "*D Value*" means the activity of a radioactive source above which it is considered to be a dangerous source;

(d) *"delay"* means a function of security system, occurring between detection and response, designed to increase adversary's penetration time towards the radioactive source location(s);

(e) "*detection*" means a function of security system that begins with sensing a potentially malicious or otherwise unauthorized act and that is completed with the assessment of the cause of the alarm;

(f) "*licensee*" means the holder of a current license issued under Section 19 of the PNRA Ordinance, 2001;

(g) "*operating personnel*" means individual workers engaged in the operation of a licensed radiation facility;

(h) "*physical protection plan*" means a document prepared by the licensee and required to be reviewed by the Authority that presents a detailed description of the security arrangements in place at a facility;

(i) "*radioactive source*" (also called as sealed radioactive source) means radioactive material that is permanently sealed in a capsule or closely bonded, in a solid form;

(j) "*response personnel*" means persons, on-site or off-site, who are appropriately equipped and trained to counter an attempted unauthorized removal of radioactive source(s) or an act of sabotage;

(k) "*sabotage*" means a deliberate act directed against a radioactive source in use, storage or transport that could directly or indirectly endanger the health and safety of personnel, the public or the environment by exposure to radiation or release of radioactive material;

(l) "*secured area*" means designated area containing radioactive source to which access is limited to authorized personnel only and controlled for security purposes;

(m) "*security*" means measures to prevent unauthorized access or damage to, and loss, theft or unauthorized transfer of, radioactive sources;

(n) "*security culture*" means the assembly of characteristics, attitudes and behaviors of individuals, organization and institutions that serve as a means to support and enhance the security;

(o) "*security elements*" means an organization/establishment having its role in the security of radiation facilities;

(p) "*security event*" means an event that has potential or actual implications for security that must be addressed;

(q) "*security level*" means protection level for security of radioactive sources, based on graded approach, for determination of security system specifications with respect to corresponding goal;

(r) "*security management*" means procedures, policies, records, plans and adequate resources (human and financial) for the security of radioactive sources;

(s) "*security personnel*" means an authorized and security cleared person who is responsible for security relating to patrolling, monitoring, assessing or escorting any individuals or transport or controlling access and providing initial response;

(t) "*security system*" means an integrated set of security measures;

(u) "*sensitive information*" means information, in whatever form, including software, the unauthorized disclosure, modification, alteration, destruction, or denial of use of which could compromise security;

(v) "*source location*" means a position of radioactive source inside the secured area;

(w) "*storage*" means the holding of radioactive sources in a facility that provides for their containment with the intention of retrieval;

(x) "*threat*" means an individual or group of individuals with intention and capability to commit a malicious act;

(y) "*transport*" means carriage of radioactive sources by any means of transportation, beginning with the departure from a facility of the shipper and ending with the arrival at a facility of the receiver;

(z) "*unauthorized removal*" means theft or other unlawful taking of radioactive sources; and

(aa) "*unsealed radioactive source*" means a radioactive source that does not meet the definition of a sealed radioactive source.

3. Scope.—These regulations establish regulatory requirements for the security of radioactive sources during manufacture, use, storage and transport.

4. Interpretation.—The decision of the Chairman PNRA regarding interpretation of any word or phrase of these regulations shall be final and binding.

5. Oversight Mechanism.—The licensee shall conduct assessment/evaluation of the security system on periodic basis to ensure the effectiveness of the security system and reports of these assessments/evaluations shall be submitted to the Authority. Regulatory oversight may be conducted by the Authority through inspections and verifications in coordination with relevant national competent authorities.

6. Categorization of Radioactive Sources and their Corresponding Security Level(s).—The licensee shall categorize the radioactive sources for which he is responsible and determine their corresponding security level, based on the criteria given in Schedule-I of these regulations.

GENERAL PROVISIONS

7. General Responsibilities.—(1) The licensee shall have the prime responsibility for ensuring the security of radioactive sources, for which he is licensed, in compliance with

the requirements of these regulations, conditions of the license, or any additional requirements imposed by the Authority from time to time.

(2) The licensee shall establish the safety and security interface to ensure that they do not adversely affect each other and that, to the degree possible, they are mutually supportive.

(3) The licensee shall ensure that only authorized personnel shall be permitted to fulfill required assignments and tasks.

(4) The licensee shall cooperate and coordinate with relevant organizations having their role in response to contingencies related to security of radioactive sources.

(5) The licensee shall ensure that the installed security systems and components are appropriate and fulfill their intended functions.

(6) The licensee shall ensure that a dynamic and effective security culture exists at all levels of management and relevant staff.

(7) The licensee shall ensure that the radioactive sources under their responsibility to be kept secure and not transferred unless the receiver possesses a valid license or authorization from the Authority.

(8) The licensee shall ensure identification, classification and protection of security sensitive information including physical protection plan and related records against unauthorized disclosure.

(9) The licensee shall conduct vulnerability assessment and implement additional security measures, if required.

8. Inventory and Records.—(1) The licensee shall develop, maintain and update the register of sealed radioactive sources for which he is responsible and submit the inventory to the Authority on quarterly basis for Category 1 and biannually for remaining categories of sources.

(2) The licensee shall establish, maintain and update records of receipt, transfer, transportation, disposal, physical verification etc. of radioactive sources.

(3) The licensee shall establish, maintain and update inventory of all the components of installed security system, where applicable.

9. Maintenance and Testing.—(1) The licensee shall ensure that security systems and components are maintained in operable condition. In case the security system(s) is taken out of service, the licensee shall provide equivalent level of compensatory measures till such time.

(2) The licensee shall develop and implement plans and procedures for maintenance and testing of security systems.

(3) The licensee shall establish and maintain all records related to maintenance and testing of installed security systems and components.

10. Event Reporting.—(1) Whenever an event involving the loss of control of,

damage to, unauthorized transfer/access to, actual or attempted theft or sabotage of a radioactive source has occurred, the licensees shall:

(a) Take immediate remedial actions and inform local law enforcement agencies;

(b) Within twenty four (24) hours, notify to the Authority;

(c) Within seventy two (72) hours, submit a preliminary report to the Authority;

(d) Within sixty (60) days, submit a detailed report to the Authority on the causes of the event, its circumstances and consequences, and on the corrective actions taken or to be taken.

(2) In case of any specific threat to the security of radioactive sources, the licensee shall immediately take measures as specified in Regulation - 17 of these regulations and inform the Authority.

SECURITY MEASURES FOR RADIOACTIVE SOURCES IN MANUFACTURE, USE AND STORAGE

Explanation: The security measures prescribed in Regulations 11 to 14 of these regulations, against unauthorized removal of radioactive sources also minimize the likelihood of a successful act of sabotage.

11. Security Measures for Radioactive Sources in Category 1 (Security Level A).—In order to prevent the unauthorized removal of radioactive sources, the licensee shall ensure:

(1) Detection;

(a) Immediate detection of any unauthorized access to the secured area by the use of electronic intrusion detection system. In case, intrusion detection system is intentionally bypassed by the operating personnel, continuous surveillance shall be ensured;

(b) Immediate detection of any attempted unauthorized removal of the sources, by the use of electronic tamper detection device;

(c) Immediate assessment of detection by the use of CCTV or by operating and/or security personnel, as applicable;

(d) Immediate communication to response personnel through rapid, dependable and diverse means of communication;

(e) Presence of radioactive sources through physical verification by fortnightly check(s).

(2) Delay;

Sufficient delay, for response personnel to interrupt the unauthorized removal, through a system of at least two layers of barriers.

(3) Response;

Immediate response to the assessed alarm with sufficient resources and capabilities to interrupt and neutralize the adversary in accordance with the approved physical protection plan.

(4) Access Control;

Provision of access control to the radioactive source location through identification and verification that effectively restricts access to authorized persons only.

12. Security Measures for Radioactive Sources in Category 2 (Security Level B).—In order to minimize the likelihood of unauthorized removal of radioactive sources, the licensee shall ensure:

(1) Detection;

(a) Immediate detection of any unauthorized access to the secured area by the use of electronic intrusion detection system or by operating personnel. In case, intrusion detection system is intentionally bypassed by the operating personnel, continuous surveillance shall be ensured;

(b) Detection of any attempted unauthorized removal of radioactive sources through tamper detection or periodic checks by operating and/or security personnel, as applicable;

(c) Immediate assessment of detection of unauthorized access/attempted unauthorized removal by the use of CCTV or by operating and/or security personnel, as applicable;

(d) Immediate communication to response personnel through rapid and reliable means of communication;

(e) Presence of radioactive sources through physical verification by fortnightly check(s).

(2) Delay;

Sufficient delay, for response personnel to interrupt the unauthorized removal, through a system of two layers of barriers.

(3) Response;

Initiation of immediate response action(s) to interrupt the adversary in accordance with the approved physical protection plan.

(4) Access Control;

Provision of access control to the radioactive source location through identification that effectively restricts access to authorized persons only.

13. Security Measures for Radioactive Sources in Category 3 (Security Level C).—In order to reduce the likelihood of unauthorized removal of radioactive sources, the licensee shall ensure:

(1) Detection;

(a) Detection of unauthorized removal of the sources through tamper detection device or daily check(s) by operating and/or security personnel, as applicable;

(b) Immediate assessment of detection by operating and/or security personnel, as applicable;

(c) Presence of radioactive sources through physical verification on monthly basis.

(2) Delay;

Delay through single barrier or surveillance by security personnel.

(3) Response;

Implementation of appropriate response action(s) in accordance with the approved physical protection plan.

(4) Access Control;

Provision of access control to the radioactive source location through identification that effectively restricts access to authorized persons only.

14. Security Measures for Radioactive Sources in Category 4 and 5 (Security Level D).—(1) The licensee shall ensure presence of radioactive sources through physical verification on quarterly basis.

(2) The licensee shall ensure:

(a) The confidentiality of security-sensitive information; and

(b) The reliability of personnel having access to radioactive sources.

15. Security Management for Radioactive Sources in Security Level A, B and C.—The licensee shall:

(1) Ensure that the security related responsibilities and clear lines of authority of each individual are clearly identified and each individual is suitably trained and qualified.

(2) Develop and implement procedure for access of authorized persons to radioactive source location and sensitive information.

(3) Ensure trustworthiness and reliability, through background checks, of all personnel authorized for unescorted access to the source location and sensitive information.

(4) Ensure that necessary cyber security measures are taken and information concerning the security and movement of sources is protected and handled securely and disseminated on a ‘need to know’ basis.

(5) Submit a physical protection plan for radioactive sources to the Authority for its approval, prepared in consultation with the concerned security elements, in accordance with the format and content specified by the Authority. The physical protection plan shall be tested and evaluated at intervals as agreed by the Authority and shall be reviewed and revised, if needed. Any change(s) in the physical protection plan shall be submitted for prior approval to

the Authority.

(6) Identify, prepare and maintain necessary procedures for implementation of the physical protection plan.

16. Additional Security Measures for Mobile and Portable Radioactive Sources when Used in the Field.—The licensee shall ensure:

(1) Immediate detection, effective delay and timely response, in case of unauthorized access to or removal of the radioactive sources, by operating and/or security personnel.

(2) Availability of two persons, each equipped with an independent communication device, to communicate with the response personnel.

(3) Presence of radioactive sources through physical check(s) after every use in the field.

17. Measures against Increased Security Threat.—(1) If there is an increased security threat targeting a radioactive source, as notified by the Authority or through reliable resources, the licensee shall take following additional security measures:

(a) Returning the radioactive source to its secured storage location if it is in use;

(b) Ensure 24-hour surveillance through guard(s); and

(c) Review physical protection plan and corresponding procedures to ensure security system's credibility.

(2) Additional security measures shall be continued until such time, the licensee determines, that the specific threat no longer exists.

SECURITY MEASURES DURING TRANSPORT OF RADIOACTIVE SOURCES

18. General Requirements for Radioactive Sources in Category 1, 2 and 3 (Security Level A, B and C).—(1) The licensee shall ensure that the responsibilities of all persons involved in the transport of radioactive sources are clearly defined.

(2) The licensee shall provide information to the Authority prior to the transportation of radioactive sources.

(3) The licensee shall ensure the integrity of the lock and seal during transportation.

(4) The licensee shall designate a contact person, traveling with the vehicle carrying radioactive sources, equipped with diverse communication means.

(5) In case of any adverse conditions during transportation, the licensee shall restrict movement of the vehicle carrying radioactive sources and inform the Authority and law enforcement agencies accordingly.

(6) The licensee shall ensure that the vehicle carrying radioactive sources is never left unattended during transport.

(7) The licensee shall ensure that security related procedures are available and necessary instructions are communicated to the relevant personnel involved in the transport.

(8) The licensee shall protect information related to transport of radioactive sources and shall disseminate such information only on a 'need to know' basis.

19. Additional Requirements for Radioactive Sources in Category 2 (Security level-B).—In addition to the requirements in Regulation - 18 of these regulations, the following requirements apply to the transportation of radioactive sources in Category 2:

(1) The licensee shall submit physical protection plan for transport of radioactive sources to the Authority for its approval, prepared in consultation with concerned security elements, in accordance with the format and content as specified by the Authority.

(2) For frequently transported radioactive sources, the licensee shall submit the physical protection plan for transport of radioactive sources once and shall provide route information to the Authority prior to each transportation of radioactive source.

(3) The licensee shall establish credible liaison with the law enforcement agencies, in coordination with the security elements, during transportation.

20. Additional Requirements for Radioactive Sources in Category 1 (Security level-A).—In addition to the requirements in Regulation 18 & 19 of these regulations, the following requirements apply to the transportation of radioactive sources in Category 1:

(1) The licensee shall prepare physical protection plan for transport for each transportation of radioactive source, in consultation with concerned security elements, in accordance with the format and content as specified by the Authority and submit to the Authority for approval. The physical protection plan for transport shall be tested and evaluated before transportation of radioactive sources and shall be reviewed and revised, if needed. Any change(s) in the physical protection plan for transport shall be submitted to the Authority for prior approval.

(2) The licensee shall ensure that the vehicle carrying radioactive sources is escorted by security personnel.

(3) The licensee shall ensure tracking of the vehicle carrying radioactive sources to confirm its location.

(4) The licensee shall ensure that all persons engaged in the transportation of radioactive sources are trustworthy.

21. Requirements for Radioactive Sources in Category 4 and 5 (Security Level D).— (1) The licensee shall ensure that the radioactive sources are secured during transport.

(2) The licensee shall ensure that radioactive sources are handled only by the authorized persons during transport.

22. Non Compliance.—All the cases of non compliance(s) with any of the requirements of these regulations shall be dealt under the provisions of Pakistan Nuclear Regulatory Authority Enforcement Regulations - (PAK/950).

23. Repeal.— Regulation No. 20 of Regulations on Radiation Protection (PAK/904) issued vide S.R.O. 837(I)/2004 dated 05 October, 2004 is hereby repealed.

Schedule – I

CRITERIA FOR CATEGORIZATION OF RADIOACTIVE SOURCES

(i) For sealed radioactive sources:

Category	Practices[(a)]	A/D[(b)(c)]	Security Level
1	Irradiators, Teletherapy	A/D ≥ 1000	A
2	Industrial radiography, High/medium dose rate Brachytherapy	1000>A/D≥10	B
3	Fixed industrial gauges that incorporate high activity sources, Well logging gauges	10>A/D≥1	C
4	Low dose rate (LDR) Brachytherapy, Industrial gauges that incorporate low activity sources, Bone densitometers, Static eliminators	1>A/D≥0.01	D
5	LDR Brachytherapy eye plaques and permanent implant sources, X-ray fluorescence devices containing sources, Electron capture devices, Mossbauer spectrometry, check sources.	0.01>A/D and A > exempt	

(a) Overriding priority for the categorization of radioactive sources shall be given to their use in a certain practice.

(b) In case of radioactive source is not listed in column 2 of the above table, then A/D ratio shall be used for their categorization. Where A = Activity of a radionuclide and D = D value for radionuclide n. (A list of D values of various radionuclides is specified in Table-1).

(c) Furthermore, for the radioactive sources during manufacture and storage, their A/D value shall only be considered for categorization.

(ii) For unsealed radioactive sources:

The unsealed radioactive sources shall be categorized based on their A/D ratio.

(iii) In case, same type of radioactive sources are placed together, the summed activity of the radionuclide shall be divided by their corresponding D value.

$$Aggregate\frac{A}{D} = \frac{\sum A_n}{D}$$

where:

A = Activity of a source n of same radionuclide

D = D value of radionuclide n

(iv) In case, various type of radioactive sources are placed together, the sum of the ratios A/D shall be used in determining the category, in accordance with the formula:

$$Aggregate\frac{A}{D} = \sum_n \frac{\sum_i A_{i,n}}{Dn}$$

where:

$A_{i,n}$ = Activity of each individual source *i* of radionuclide *n*

Dn = D value of radionuclide *n*

TABLE - 1

RADIONUCLIDES AND THEIR D VALUES

Radionuclide	Symbol	D Value (TBq)	Radionuclide	Symbol	D Value (TBq)
Americium 241	Am 241	0.06	Americium 241/Beryllium	Am-241/Be	0.06
Americium 243	Am 243	0.2	Antimony 124	Sb-124	0.04
Antimony 125	Sb-125	0.2	Argon 41	Ar-41	0.05
Arsenic 76	As-76	0.2	Astatine 211	At-211	0.5
Barium 133	Ba-133	0.2	Barium 137m	Ba-137m	10
Beryllium 7	Be-7	1	Bismuth 210	Bi-210	8
Bromine 76	Br-76	0.03	Bromine 77	Br-77	0.2
Bromine 82	Br-82	0.03	Cadmium 109	Cd-109	20
Calcium 45	Ca-45	100	Californium 252	Cf-252	0.02
Carbon 11	C-11	0.06	Carbon 14	C-14	50
Cerium 141	Ce-141	1	Cerium 144	Ce-144	0.9
Cesium 134	Cs-134	0.04	Cesium 137	Cs-137	0.1
Chlorine 36	Cl-36	20	Chromium 51	Cr-51	2
Cobalt 55	Co-55	0.03	Cobalt 56	Co-56	0.02
Cobalt 57	Co-57	0.7	Cobalt 58	Co-58	0.07
Cobalt 60	Co-60	0.03	Copper 61	Cu-61	10
Copper 64	Cu-64	0.3	Copper 67	Cu-67	0.7
Curium 242	Cm-242	0.04	Curium 243	Cm-243	0.2
Curium 244	Cm-244	0.05	Erbium 171	Er-171	0.2
Europium 154	Eu-154	0.06	Europium 152	Eu-152	0.06
Fluorine	F-18	0.06	Gadolinium 148	Gd-148	0.4
Gadolinium 153	Gd-153	1	Gallium 67	Ga-67	0.5
Gallium 68	Ga-68	0.07	Germanium 68	Ge-68	0.07
Gold 198	Au-198	0.2	Holmium 66	Ho-166	2
Indium 111	In-111	0.2	Indium 113m	In-113m	0.3
Iodine 120	I-120	10	Iodine 123	I-123	0.5
Iodine 124	I-124	0.06	Iodine 125	I-125	0.2
Iodine 131	I-131	0.2	Iridium 192	Ir-192	0.08
Iron 52	Fe-52	0.02	Iron 55	Fe-55	800
Iron 59	Fe-59	0.06	Krypton 79	Kr-79	1

Radionuclide	Symbol	D Value (TBq)	Radionuclide	Symbol	D Value (TBq)
Krypton 81	Kr-81	30	Krypton 85	Kr-85	30
Lanthanum 140	La-140	0.03	Lead 210	Pb-210	0.3
Manganese 52	Mn-52	0.02	Manganese 54	Mn-54	0.08
Manganese 56	Mn-56	0.04	Mercury 203	Hg-203	0.3
Molybdenum 99	Mo-99	0.3	Neptunium 237	Np-237	0.07
Nickel 59	Ni-59	1000	Nickel 63	Ni-63	60
Nitrogen 13	N-13	0.06	Oxygen 15	O-15	0.06
Palladium 103	Pd-103	90	Phosphorus 32	P-32	10
Phosphorus 33	P-33	200	Plutonium 238	Pu-238	0.06
Plutonium 239	Pu-239	0.06	Plutonium 239/ Beryllium	Pu-239/Be	0.06
Plutonium 240	Pu-240	0.06	Plutonium 241	Pu-241	3
Plutonium 242	Pu-242	0.07	Polonium 210	Po-210	0.06
Potassium 42	k-42	0.2	Promethium 147	Pm-147	40
Protactinium 231	Pa-231	0.06	Radium 224	Ra-224	0.05
Radium 226	Ra-226	0.04	Radium 228	Ra-228	0.03
Rhenium 186	Re-186	4	Rhenium 188	Re-188	1
Rubidium 81	Rb-81	0.1	Rubidium 81m	Rb-81m	10
Rubidium 82	Rb-82	10	Rubidium 82m	Rb-82m	10
Rubidium 84	Rb-84	0.07	Rubidium 86	Rb-86	0.7
Ruthenium 103	Ru-103	0.1	Ruthenium 106	Ru-106	0.3
Samarium 151	Sm-151	500	Samarium 153	Sm-153	2
Scandium 46	Sc-46	0.03	Scandium 47	Sc-47	0.7
Selenium 75	Se-75	0.2	Silver 110m	Ag-110m	0.02
Sodium 22	Na-22	0.03	Sodium 24	Na-24	0.02
Strontium 83	Sr-83	1	Strontium 89	Sr-89	20
Strontium 90	Sr-90	1	Tantalum 182	Ta-182	0.06
Technetium 94	Tc-94	1	Technetium 99m	Tc-99m	0.7
Thallium 201	Tl-201	1	Thallium 204	Tl-204	20
Thorium 228	Th-228	0.04	Thorium 229	Th-299	0.01
Thorium 230	Th-230	0.07	Thulium 170	Tm-170	20
Tin 113	Sn-113	0.3	Tin 117m	Sn-117m	0.5
Tin 119m	Sn-119m	0.1	Tin 121	Sn-121	20
Tin 121m	Sn-121m	70	Tin 125	Sn-125	0.1

Radionuclide	Symbol	D Value (TBq)	Radionuclide	Symbol	D Value (TBq)
Tritium	H-3	2000	Vanadium 48	V-48	0.02
Xenon 133	Xe-133	3	Ytterbium 169	Yb-169	0.3
Ytterbium 175	Yb-175	2	Yttrium 86	Y-86	1
Yttrium 88	Y-88	0.03	Yttrium 90	Y-90	5
Zinc 62	Zn-62	1	Zinc 65	Zn-65	0.1
Zirconium 89	Zr-89	1	Zirconium 95	Zr-95	0.04

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