

**“Regulations on Radioactive Waste Management
PAK/915”**

**PART-II
Statutory Notification (S.R.O)
Government of Pakistan
PAKISTAN NUCLEAR REGULATORY AUTHORITY**

**Notification
Islamabad, the 14th December, 2004
Amended on March 8, 2010**

S.R.O. 765 (I)/2005. — In exercise of the powers conferred by 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 and commencement. — (1) These regulations may be called the Regulations on Radioactive Waste Management – PAK/915.

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

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

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

- (a) "clearance" means the removal of radioactive materials or radioactive objects within licensed/authorized practices from any further regulatory control by the regulatory body.
- (b) "clearance level" means a value, established by a regulatory body and expressed in terms of activity concentration and/or total activity, at or below which a source of radiation may be released from regulatory control.
- (c) "closure" means administrative and technical actions directed at a repository at the end of its operating lifetime.
- (d) "conditioning" means those operations that produce a waste package suitable for handling, transport, storage and/or disposal.
- (e) "critical group" means a group of members of the public which is reasonably homogeneous with respect to its exposure for a given radiation source and given exposure pathway and is typical of individuals receiving the highest effective dose or equivalent dose (as applicable) by the given exposure pathway from the given source.
- (f) "decommissioning" means administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility. This does not apply to a repository or to certain nuclear facilities used for mining and milling of radioactive materials, for which closure is used.
- (g) "discharge" means a planned and controlled release of (usually gaseous

or liquid) radioactive material to the environment.

- (h) "disposal" means emplacement of waste in an appropriate facility without the intention of retrieval.
- (i) "dose constraint" means a prospective restriction on the individual dose delivered by a source, which serves as an upper bound on the dose in optimization of protection and safety for the source.
- (j) "exemption level" means a value, established by the Authority and expressed in terms of activity concentration and/or total activity, at or below which a source of radiation may be granted exemption from regulatory control without further consideration.

- (k) "licensee" means the holder of a current license.
- (l) "long lived waste" means radioactive waste that contains significant levels of radionuclides with half-lives usually greater than thirty (30) years.
- (m) "monitoring" means the continuous or periodic measurement of radiological and other parameters or determination of the status of a system.
- (n) "nuclear facility" means a facility and its associated land, buildings and equipment in which radioactive materials are produced, processed, used, handled, stored or disposed of on such a scale that consideration of safety is required.
- (o) "Ordinance" means the Pakistan Nuclear Regulatory Authority Ordinance, 2001 (III of 2001).
- (p) "practice" means any human activity that introduces additional sources of exposure or exposure pathways or extends exposure to additional people or modifies the network of exposure pathways from existing sources, so as to increase the exposure or the likelihood of exposure of people or the number of people exposed.
- (q) "pretreatment" means any or all of the operations prior to waste treatment, such as collection, segregation, chemical adjustment and

decontamination.

- (r) "radioactive waste" means waste that contains, or is contaminated with, radionuclides at concentrations or activities greater than clearance levels as established by the Authority.
- (s) "radioactive waste management" means all activities, administrative and operational, that are involved in the handling, pretreatment, treatment, conditioning, transport, storage and disposal of radioactive waste.
- (t) "repository" means a nuclear facility where waste is emplaced for disposal.
- (u) "segregation" means an activity where waste or materials (radioactive and exempt) are separated or are kept separate according to radiological, chemical and/or physical properties which will facilitate waste handling and/or processing.
- (v) "source" means anything that may cause radiation exposure such as by emitting ionizing radiation or by releasing radioactive substances or materials and which can be treated as a single entity for protection and safety purposes.
- (w) "storage" means the holding of spent fuel or of radioactive waste in a facility that provides for its containment, with the intention of retrieval.
- (x) "treatment" means operations intended to benefit safety and/or economy by changing the characteristics of the waste.
- (y) "waste acceptance requirements" means quantitative or qualitative criteria specified by the Authority, or specified by an operator and approved by the Authority, for radioactive waste to be accepted by the operator of a repository for disposal, or by the operator of a storage facility for storage.
- (z) "waste form" means the waste in its physical and chemical form after treatment and/or conditioning (resulting in a solid product) prior to packaging. The waste form is a component of the waste package.
- (aa) "waste inventory" means quantity, radionuclides, activity and waste form characteristics of wastes for which an operator is responsible.
- (bb) "waste package" means the product of conditioning that includes the

waste form and any container(s) and internal barriers (e.g. absorbing materials and liners), prepared in accordance with the requirements for handling, transport, storage and/or disposal.

- (cc) "waste processing" means any operation that changes the characteristics of a waste, including pretreatment, treatment and conditioning.

3. Scope.— These regulations shall apply to all aspects of radioactive waste management, including collection, segregation, characterisation, classification, treatment, conditioning, storage and disposal, where the waste arises from the operation and decommissioning of nuclear installations, the application of radionuclides in industry, medicine, agriculture, research and education, the processing of raw materials that contain naturally occurring radionuclides and the cleanup of contaminated sites.

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

5. General responsibilities.— The licensee shall be responsible for the safe management of the radioactive waste and its security and shall take all necessary steps towards achieving this aim, including:

- (a) keep the generation of both the activity and volume of radioactive waste to the minimum practicable by suitable design, operation and decommissioning of its facilities;
- (b) ensure that radioactive waste is managed by appropriate classification, segregation, treatment, conditioning, storage and disposal, and maintain records of such activities including inventory of radioactive waste;
- (c) ensure that disposal of radioactive waste is not unnecessarily delayed; and
- (d) report to the Authority the required information at such intervals as may be specified in the licence.

6. Designation/Employment of Radioactive Waste Management Officer. — (1) ~~The licensee shall designate/employ a technically competent~~

~~individual as a Radioactive Waste Management Officer, when so required by the Authority. The Radioactive Waste Management Officer shall fulfill the basic qualification criteria established by the Authority for the accomplishment of the requirements of these regulations.~~

**“The licensee shall designate/employ a Radioactive Waste Management Officer, when so required by the Authority, for the accomplishment of these regulations. The Radioactive Waste Management Officer shall meet the basic qualification criteria given in Annex-IV of these regulations”*

(2) Under normal circumstances, the Radioactive Waste Management Officer and Radiation Protection Officer shall not be the same individual unless not so required by the Authority.

7. Radioactive waste classification.— Radioactive waste shall be classified according to the activity concentration and half-lives of the radionuclides, as given in Annex I.

8. Radioactive waste management programme. — (1) Each licensee generating radioactive waste shall prepare and submit its radioactive waste management programme to the Authority. This programme shall be reviewed and updated by the licensee as and when required by the Authority.

(2) The licensee shall manage radioactive waste in accordance with the radioactive waste management programme approved by the Authority.

9. Control of radioactive waste generation. — Licensees shall ensure that steps are taken to keep generation of radioactive waste, its environmental impact and cost to the minimum practicable by:

- (a) avoiding the use of unnecessarily hazardous/toxic materials;
- (b) minimizing the activity of waste by using the minimum quantity of radioactive material needed;
- (c) using short lived radionuclides where possible;
- (d) minimizing the amount of waste by preventing unnecessary contamination of materials; and

* [Amended vide S.R.O. 156\(I\)/2010 dated March 8, 2010.](#)

- (e) maintaining consistency with the management strategy and systems.

10. Radioactive waste processing.— (1) Radioactive waste shall be processed in such a way that the resulting waste, packaged or unpackaged, can be safely stored and retrieved from the storage facility for disposal. Considerations relating to safe storage shall include possible reactions within the waste form and between the waste and the waste container, and the compatibility of the waste package with the storage environment.

(2) All waste considered radioactive shall be collected. Decisions with respect to segregation, decontamination and chemical adjustment shall be based upon appropriate consideration of the characteristics of the waste and of the requirements imposed by subsequent steps in the programme for radioactive waste management (treatment, conditioning, transport, storage and disposal).

(3) Licensees shall ensure that waste is segregated at the point of origin in such manner and form as may be directed by the Authority.

(4) Licensees shall ensure that the treatment and conditioning of radioactive waste is carried out in accordance with the waste acceptance requirements.

(5) Waste packages shall be designed and produced such that radionuclides are confined under both normal conditions and the accident conditions assumed to occur in handling, storage, transport and disposal.

11. Discharge or release of radioactive substances to the environment.— (1) The licensee shall not discharge, or dispose of, radioactive waste to the environment without first obtaining an authorization from the Authority as required under section-22 of the Ordinance.

- (2) Before obtaining such authorization, the licensee shall, as appropriate:
 - (a) determine the characteristics and activity of the material to be discharged, and the potential points and methods of discharge;
 - (b) determine by an appropriate pre-operational study all significant exposure pathways by which discharged radionuclides can deliver public exposure;
 - (c) assess the doses to the critical groups due to the planned discharges;

- (d) estimate dose constraint in relation to the discharges of radioactive substances to the environment and determine discharge limits on the basis of the estimated dose constraint; and
- (e) submit this information to the Authority for approval.

(3) The licensee shall ensure that radioactive substances are not discharged/released to the environment unless:

- (a) such discharge is within the limits authorized by the Authority and is carried out in a controlled fashion using authorized methods; or
- (b) the public exposure committed by the discharges is below the exemption criteria as specified in PAK/904.

(4) The licensee, during the operation, shall:

- (a) keep all radioactive discharges as far below the authorized limits as is reasonably achievable;
- (b) monitor and record the discharges of radionuclides with sufficient detail and accuracy to demonstrate compliance with the authorized discharge limits and to permit estimation of the exposure of critical group of population;
- (c) report discharges to the Authority on yearly basis or such shorter intervals as may be specified by the Authority; and
- (d) report promptly, not later than forty eight (48) hours, to the Authority any discharge exceeding the authorized limits.

(5) Whether activity is released within the clearance levels established by the Authority or radioactive waste is discharged under licence, the licensee shall consider the non-radiological hazards of the released waste and shall comply with the requirements of any other regulations concerning those hazards.

12. Clearance of radioactive waste from regulatory control. — (1) The licensee shall seek permission from the Authority for the clearance of waste from regulatory control. For this purpose information regarding the origin, characteristics and accumulation rate of the waste and the methods to be used for the determination of its radionuclide contents shall be submitted to the Authority.

(2) The clearance levels shall be as specified in Annex II or as determined on the basis of the criteria given in Annex II.

(3) Clearance shall not be pertinent to waste that is volatile or flammable or is in a form that can easily cause radiation exposure.

13. Recycle and reuse of radioactive materials.— (1) Reuse and recycling of materials shall be applied to the extent possible to keep the generation of radioactive waste to the minimum practicable.

- (2) The licensee using radioactive material shall not:
- (a) dismantle any sealed source without prior approval of the Authority;
 - (b) transfer the material without confirmation that the organization to which it is to be transferred has the necessary authorization to hold/use/recycle that material.

14. Transport of radioactive waste. — The licensee shall ensure that radioactive waste is prepared for transport to a storage or disposal site. For this purpose it shall be regarded as a radioactive source for transport in accordance with all applicable regulations.

15. Radioactive waste storage facility.— (1) The radioactive waste storage area shall be clearly demarcated and have controlled access.

(2) The radioactive waste storage facility shall be designed in such a way that the waste can be retrieved whenever required.

(3) The storage facility shall be designed on the basis of the assumed conditions for its normal operation and assumed incidents or accidents. It shall be designed and constructed for the likely period of storage, preferably with passive safety features, with the potential for degradation taken into account. Provisions shall be made for regular monitoring, inspection and maintenance of the waste and the storage facility to ensure continued integrity. The adequacy of the storage capacity shall be periodically reviewed, with account taken of the predicted waste arising and the expected life of the storage facility.

16. Radioactive waste repository.— Radioactive waste repositories shall be licensed with the Authority. The licensee shall have overall responsibility for its safety and shall carry out safety assessments and the activities needed for siting, design, construction, operation and closure, as well as any measures needed in the

post-closure phase. The operator of the repository shall impose the necessary acceptance requirements, approved by the Authority, on waste to be received from generators of the waste. The operator of the repository shall conduct, or otherwise commission, research and development to the extent necessary to ensure safety and security of the repository.

17. Acceptance criteria for radioactive waste storage or disposal.—

Radioactive waste destined for storage or disposal shall be processed to meet the acceptance criteria for storage or disposal at a repository established with the approval of the Authority. These criteria shall define the radiological, mechanical, physical, chemical and biological properties of the waste and of any package for that repository.

18. Storage or disposal of radioactive waste.— (1) When the radioactive waste is not suitable for discharge or release to the environment or for clearance within a reasonable time, the holder of the waste shall:

- (a) store such waste in its storage area/facility or otherwise shall sent the waste to the designated waste storage facility with the intimation to the Authority and ensure that the criteria for acceptance of the waste at designated storage facility are met; or
- (b) seek permission from the Authority for disposal of such waste and ensure that the criteria for acceptance of the waste at any disposal facility are met.

(2) Radioactive waste shall be stored in such a way as to protect human health and the environment and in particular shall not be stored in the vicinity of corrosive, explosive or easily flammable materials.

19. Management of sealed radioactive sources.— The licensee shall follow the instructions regarding the management of sealed radioactive sources as specified in Annex III.

20. Decommissioning.— The licensee shall ensure that appropriate means are available to manage the waste arising from the activities of decommissioning safely and securely.

21. Quality assurance.— The licensee shall submit a quality assurance programme to the Authority for approval as part of the licence application covering all safety aspects of the radioactive waste management.

22. Physical protection.— The licensee shall ensure that all necessary means are taken to prevent unauthorised persons gaining access to the radioactive waste.

23. Records and reports.—(1) The licensee shall submit up-to-date inventory of radioactive waste, on yearly basis or such shorter intervals as may be specified by the Authority, in his possession in such form and contain such details as the Authority may require.

(2) The licensee shall submit to the Authority an annual report providing the following details:

- (a) radioactive waste disposed of;
- (b) cleared materials released to the environment;
- (c) waste discharged to the environment;
- (d) spent radioactive sources returned to supplier; and
- (e) such other details as the Authority may require;

(3) If any radioactive waste has been lost, stolen or is missing, the licensee shall inform promptly and submit preliminary report within forty eight (48) hours and within sixty (60) days submit a written report to the Authority on the matter and the actions which have been taken.

(4) If radioactive material has been released to the environment above the clearance criteria established by the Authority or if waste has been discharged above the limits of licence issued by the Authority, the licensee shall inform promptly but not later than forty eight (48) hours and submit preliminary report to the Authority and within sixty (60) days submit a written report on the matter and the actions taken.

24. Repeal.— Regulations 60 and 61 of Pakistan Nuclear Safety & Radiation Protection Regulations, 1990 are hereby repealed.

ANNEX I

CLASSIFICATION OF RADIOACTIVE WASTE

No.	Class	Description
1.	Cleared Material/Waste	Material/waste containing levels of radionuclides at concentration less than the clearance levels established by the Authority.

No.	Class	Description
2.	Low Level (Short lived)/Decay Waste	Low level radioactive waste containing short lived radionuclides only (e.g. with half lives less than 100 days) that will decay to clearance levels within three years after the time of its generation.
3.	Low and Intermediate Level Short Lived Waste (LILW-SL)	Waste which will not decay to clearance levels within three (3) years and contains beta/gamma emitting radionuclides with half-lives less than thirty (30) years and/or alpha emitting radionuclides with an activity less than 400 Bq/g and a total activity less than 4000 Bq in each waste package.
4.	Low and Intermediate Level Long Waste (LILW-LL)	Radioactive waste containing radionuclides with Lived concentrations above those for LILW-SL, but which does not generate heat at above 2kW/m ³ of waste.
5.	High Level Waste (HLW)	Radioactive waste containing long lived radionuclides concentration above those for LILW-SL but which generate heat at above 2kW/m ³ .

ANNEX II

CLEARANCE LEVELS AND CLEARANCE CRITERIA

CLEARANCE LEVELS

TABLE I

(This Table reproduces ANNEX I of PAK/904)

EXEMPTION LEVELS: EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (ROUNDED)

Nuclide	Activity		Nuclide	Activity	
	Concentration (Bq/g)	Activity (Bq)		Concentration (Bq/g)	Activity (Bq)
H-3	1 E+06	1 E+09	P-33	1 E+05	1 E+08
Be-7	1 E+03	1 E+07	S-35	1 E+05	1 E+08
C-14	1 E+04	1 E+07	Cl-36	1 E+04	1 E+06
O-15	1 E+02	1 E+09	Cl-38	1 E+01	1 E+05
F-18	1 E+01	1 E+06	Ar-37	1 E+06	1 E+08
Na-22	1 E+01	1 E+06	Ar-41	1 E+02	1 E+09
Na-24	1 E+01	1 E+05	K-40	1 E+02	1 E+06
Si-31	1 E+03	1 E+06	K-42	1 E+02	1 E+06
P-32	1 E+03	1 E+05	K-43	1 E+01	1 E+06

Nuclide	Activity Concentration (Bq/g)	Activity (Bq)
Ca-45	1 E+04	1 E+07
Ca-47	1 E+01	1 E+06
Sc-46	1 E+01	1 E+06
Sc-47	1 E+02	1 E+06
Sc-48	1 E+01	1 E+05
V-48	1 E+01	1 E+05
Cr-51	1 E+03	1 E+07
Mn-51	1 E+01	1 E+05
Mn-52	1 E+01	1 E+05
Mn-52m	1 E+01	1 E+05
Mn-53	1 E+04	1 E+09
Mn-54	1 E+01	1 E+06
Mn-56	1 E+01	1 E+05
Fe-52	1 E+01	1 E+06
Fe-55	1 E+04	1 E+06
Fe-59	1 E+01	1 E+06
Co-55	1 E+01	1 E+06
Co-56	1 E+01	1 E+05
Co-57	1 E+02	1 E+06
Co-58	1 E+01	1 E+06
Co-58m	1 E+04	1 E+07
Co-60	1 E+01	1 E+05
Co-60m	1 E+03	1 E+06
Co-61	1 E+02	1 E+06
Co-62m	1 E+01	1 E+05
Ni-59	1 E+04	1 E+08
Ni-63	1 E+05	1 E+08
Ni-65	1 E+01	1 E+06
Cu-64	1 E+02	1 E+06
Zn-65	1 E+01	1 E+06
Zn-69	1 E+04	1 E+06
Zn-69m	1 E+02	1 E+06
Ga-72	1 E+01	1 E+05
Ge-71	1 E+04	1 E+08
As-73	1 E+03	1 E+07
As-74	1 E+01	1 E+06
As-76	1 E+02	1 E+05
As-77	1 E+03	1 E+06
Se-75	1 E+02	1 E+06
Br-82	1 E+01	1 E+06
Kr-74	1 E+02	1 E+09

Nuclide	Activity Concentration (Bq/g)	Activity (Bq)
Kr-76	1 E+02	1 E+09
Kr-77	1 E+02	1 E+09
Kr-79	1 E+03	1 E+05
Kr-81	1 E+04	1 E+07
Kr-83m	1 E+05	1 E+12
Kr-85	1 E+05	1 E+04
Kr-85m	1 E+03	1 E+10
Kr-87	1 E+02	1 E+09
Kr-88	1 E+02	1 E+09
Rb-86	1 E+02	1 E+05
Sr-85	1 E+02	1 E+06
Sr-85m	1 E+02	1 E+07
Sr-87m	1 E+02	1 E+06
Sr-89	1 E+03	1 E+06
Sr-90*	1 E+02	1 E+04
Sr-91	1 E+01	1 E+05
Sr-92	1 E+01	1 E+06
Y-90	1 E+03	1 E+05
Y-91	1 E+03	1 E+06
Y-91m	1 E+02	1 E+06
Y-92	1 E+02	1 E+05
Y-93	1 E+02	1 E+05
Zr-93*	1 E+03	1 E+07
Zr-95	1 E+01	1 E+06
Zr-97*	1 E+01	1 E+05
Nb-93m	1 E+04	1 E+07
Nb-94	1 E+01	1 E+06
Nb-95	1 E+01	1 E+06
Nb-97	1 E+01	1 E+06
Nb-98	1 E+01	1 E+05
Mo-90	1 E+01	1 E+06
Mo-93	1 E+03	1 E+08
Mo-99	1 E+02	1 E+06
Mo-101	1 E+01	1 E+06
Tc-96	1 E+01	1 E+06
Tc-96m	1 E+03	1 E+07
Tc-97	1 E+03	1 E+08
Tc-97m	1 E+03	1 E+07
Tc-99	1 E+04	1 E+07
Tc-99m	1 E+02	1 E+07
Ru-97	1 E+02	1 E+07
Ru-103	1 E+02	1 E+06

Nuclide	Activity Concentration (Bq/g)	Activity (Bq)
Ru-105	1 E+01	1 E+06
Ru-106*	1 E+02	1 E+05
Rh-103m	1 E+04	1 E+08
Rh-105	1 E+02	1 E+07
Pd-103	1 E+03	1 E+08
Pd-109	1 E+03	1 E+06
Ag-105	1 E+02	1 E+06
Ag-110m	1 E+01	1 E+06
Ag-111	1 E+03	1 E+06
Cd-109	1 E+04	1 E+06
Cd-115	1 E+02	1 E+06
Cd-115m	1 E+03	1 E+06
In-111	1 E+02	1 E+06
In-113m	1 E+02	1 E+06
In-114m	1 E+02	1 E+06
In-115m	1 E+02	1 E+06
Sn-113	1 E+03	1 E+07
Sn-125	1 E+02	1 E+05
Sb-122	1 E+02	1 E+04
Sb-124	1 E+01	1 E+06
Sb-125	1 E+02	1 E+06
Te-123m	1 E+02	1 E+07
Te-125m	1 E+03	1 E+07
Te-127	1 E+03	1 E+06
Te-127m	1 E+03	1 E+07
Te-129	1 E+02	1 E+06
Te-129m	1 E+03	1 E+06
Te-131	1 E+02	1 E+05
Te-131m	1 E+01	1 E+06
Te-132	1 E+02	1 E+07
Te-133	1 E+01	1 E+05
Te-133m	1 E+01	1 E+05
Te-134	1 E+01	1 E+06
I-123	1 E+02	1 E+07
I-125	1 E+03	1 E+06
I-126	1 E+02	1 E+06
I-129	1 E+02	1 E+05
I-130	1 E+01	1 E+06
I-131	1 E+02	1 E+06
I-132	1 E+01	1 E+05
I-133	1 E+01	1 E+06
I-134	1 E+01	1 E+05

Nuclide	Activity Concentration (Bq/g)	Activity (Bq)
I-135	1 E+01	1 E+06
Xe131m	1 E+04	1 E+04
Xe-133	1 E+03	1 E+04
Xe-135	1 E+03	1 E+10
Cs-129	1 E+02	1 E+05
Cs-131	1 E+03	1 E+06
Cs-132	1 E+01	1 E+05
Cs-134m	1 E+03	1 E+05
Cs-134	1 E+01	1 E+04
Cs-135	1 E+04	1 E+07
Cs-136	1 E+01	1 E+05
Cs-137*	1 E+01	1 E+04
Cs-138	1 E+01	1 E+04
Ba-131	1 E+02	1 E+06
Ba-140*	1 E+01	1 E+05
La-140	1 E+01	1 E+05
Ce-139	1 E+02	1 E+06
Ce-141	1 E+02	1 E+07
Ce-143	1 E+02	1 E+06
Ce-144*	1 E+02	1 E+05
Pr-142	1 E+02	1 E+05
Pr-143	1 E+04	1 E+06
Nd-147	1 E+02	1 E+06
Nd-149	1 E+02	1 E+06
Pm-147	1 E+04	1 E+07
Pm-149	1 E+03	1 E+06
Sm-151	1 E+04	1 E+08
Sm-153	1 E+02	1 E+06
Eu-152	1 E+01	1 E+06
Eu-152m	1 E+02	1 E+06
Eu-154	1 E+01	1 E+06
Eu-155	1 E+02	1 E+07
Gd-153	1 E+02	1 E+07
Gd-159	1 E+03	1 E+06
Tb-160	1 E+01	1 E+06
Dy-165	1 E+03	1 E+06
Dy-166	1 E+03	1 E+06
Ho-166	1 E+03	1 E+05
Er-169	1 E+04	1 E+07
Er-171	1 E+02	1 E+06
Tm-170	1 E+03	1 E+06
Tm-171	1 E+04	1 E+08

Nuclide	Activity	
	Concentration (Bq/g)	Activity (Bq)
Yb-175	1 E+03	1 E+07
Lu-177	1 E+03	1 E+07
Hf-181	1 E+01	1 E+06
Ta-182	1 E+01	1 E+04
W-181	1 E+03	1 E+07
W-185	1 E+04	1 E+07
W-187	1 E+02	1 E+06
Re-186	1 E+03	1 E+06
Re-188	1 E+02	1 E+05
Os-185	1 E+01	1 E+06
Os-191	1 E+02	1 E+07
Os-191m	1 E+03	1 E+07
Os-193	1 E+02	1 E+06
Ir-190	1 E+01	1 E+06
Ir-192	1 E+01	1 E+04
Ir-194	1 E+02	1 E+05
Pt-191	1 E+02	1 E+06
Pt-193m	1 E+03	1 E+07
Pt-197	1 E+03	1 E+06
Pt-197m	1 E+02	1 E+06
Au-198	1 E+02	1 E+06
Au-199	1 E+02	1 E+06
Hg-197	1 E+02	1 E+07
Hg-197m	1 E+02	1 E+06
Hg-203	1 E+02	1 E+05
Tl-200	1 E+01	1 E+06
Tl-201	1 E+02	1 E+06
Tl-202	1 E+02	1 E+06
Tl-204	1 E+04	1 E+04
Pb-203	1 E+02	1 E+06
Pb-210*	1 E+01	1 E+04
Pb-212*	1 E+01	1 E+05
Bi-206	1 E+01	1 E+05
Bi-207	1 E+01	1 E+06
Bi-210	1 E+03	1 E+06
Bi-212*	1 E+01	1 E+05
Po-203	1 E+01	1 E+06
Po-205	1 E+01	1 E+06
Po-207	1 E+01	1 E+06
Po-210	1 E+01	1 E+04
At-211	1 E+03	1 E+07
Rn-220*	1 E+04	1 E+07

Nuclide	Activity	
	Concentration (Bq/g)	Activity (Bq)
Rn-222*	1 E+01	1 E+08
Ra-223*	1 E+02	1 E+05
Ra-224*	1 E+01	1 E+05
Ra-225	1 E+02	1 E+05
Ra-226*	1 E+01	1 E+04
Ra-227	1 E+02	1 E+06
Ra-228*	1 E+01	1 E+05
Ac-228	1 E+01	1 E+06
Th-226*	1 E+03	1 E+07
Th-227	1 E+01	1 E+04
Th-228*	1 E+00	1 E+04
Th-229*	1 E+00	1 E+03
Th-230	1 E+00	1 E+04
Th-231	1 E+03	1 E+07
Th-nat (incl.Th-232)	1 E+00	1 E+03
Th-234*	1 E+03	1 E+05
Pa-230	1 E+01	1 E+06
Pa-231	1 E+00	1 E+03
Pa-233	1 E+02	1 E+07
U-230*	1 E+01	1 E+05
U-231	1 E+02	1 E+07
U-232*	1 E+00	1 E+03
U-233	1 E+01	1 E+04
U-234	1 E+01	1 E+04
U-235*	1 E+01	1 E+04
U-236	1 E+01	1 E+04
U-237	1 E+02	1 E+06
U-238*	1 E+01	1 E+04
U-nat	1 E+00	1 E+03
U-239	1 E+02	1 E+06
U-240	1 E+03	1 E+07
U-240*	1 E+01	1 E+06
Np-237*	1 E+00	1 E+03
Np-239	1 E+02	1 E+07
Np-240	1 E+01	1 E+06
Pu-234	1 E+02	1 E+07
Pu-235	1 E+02	1 E+07
Pu-236	1 E+01	1 E+04
Pu-237	1 E+03	1 E+07
Pu-238	1 E+00	1 E+04
Pu-239	1 E+00	1 E+04

Nuclide	Activity	
	Concentration (Bq/g)	Activity (Bq)
Pu-240	1 E+00	1 E+03
Pu-241	1 E+02	1 E+05
Pu-242	1 E+00	1 E+04
Pu-243	1 E+03	1 E+07
Pu-244	1 E+00	1 E+04
Am-241	1 E+00	1 E+04
Am-242	1 E+03	1 E+06
Am-242m*	1 E+00	1 E+04
Am-243*	1 E+00	1 E+03
Cm-242	1 E+02	1 E+05
Cm-243	1 E+00	1 E+04
Cm-244	1 E+01	1 E+04
Cm-245	1 E+00	1 E+03
Cm-246	1 E+00	1 E+03
Cm-247	1 E+00	1 E+04
Cm-248	1 E+00	1 E+03
Bk-249	1 E+03	1 E+06
Cf-246	1 E+03	1 E+06
Cf-248	1 E+01	1 E+04
Cf-249	1 E+00	1 E+03
Cf-250	1 E+01	1 E+04
Cf-251	1 E+00	1 E+03
Cf-252	1 E+01	1 E+04
Cf-253	1 E+02	1 E+05
Cf-254	1 E+00	1 E+03
Es-253	1 E+02	1 E+05
Es-254	1 E+01	1 E+04
Es-254m	1 E+02	1 E+06
Fm-254	1 E+04	1 E+07
Fm-255	1 E+03	1 E+06

* Parent nuclides and their progeny included in secular equilibrium are listed in the following:

Sr-80	Rb-80
Sr-90	Y-90
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Ag-108m	Ag-108
Cs-137	Ba-137m
Ba-140	La-140
Ce-134	La-134
Ce-144	Pr-144
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0.36), Po-212 (0.64)
Bi-212	Tl-208 (0.36), Po-212 (0.64)
Rn-220	Po-216
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208(0.36), Po-212(0.64)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
Th-nat	Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
U-235	Th-231
U-238	Th-234, Pa-234m
U-nat	Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
U-240	Np-240m
Np-237	Pa-233
Am-242m	Am-242
Am-243	Np-239

CLEARANCE CRITERIA.

Clearance criteria shall be the same as specified in clause 1 of regulation 7 of PAK/904 which is as follows:

“7. Exemptions.— (1) Practices and sources within practices may be cleared from the requirements of these regulations if the Authority is satisfied that the sources meet the exemption criteria:

- (a) the effective dose expected to be incurred by any member of the public due to the exempted practice or source is of the order of 10 μ Sv or less in a year,
- (b) either the collective effective dose committed by one year of performance of the practice is no more than about 1 man.Sv or an assessment for the optimization of protection shows that exemption is the optimum option.

or the exemption levels specified in Annex I or other exemption levels specified by the Authority on the basis of these exemption criteria.”

ANNEX III

MANAGEMENT OF SEALED RADIOACTIVE SOURCES

A. Management of sealed radioactive sources procured by the users/importers

III.1 Sealed radioactive sources containing long lived radionuclides (half-life >1 year with initial activity of 100 GBq or more) shall not be purchased without the undertaking from the manufacturer/supplier to accept the return of the source(s) when:

- (a) no longer useful for the intended purpose (i.e., spent sources) or
- (b) not useful for another purpose or
- (c) not useful to another user in the country for another purpose.

III.2 This condition shall be included as part of the purchase contract without which no objection certificate for import will not be granted by the Authority. The user/importer is required to provide copies of the purchase contract, shipping and

other related documents to the Authority when applying for no objection certificate for import/export of the sealed radioactive sources.

B. Management of spent sealed sources

III.3 Spent sealed sources, maintained in the inventory of the users for disposal and those not covered under 'A' above, shall be transported within Pakistan only under prior intimation to the Authority. The responsibility for the sources will remain that of the user/licensee until such time as the source(s) passes into the custody of waste storage facility designated by the Authority.

Annex-IV

***Basic Qualification Criteria for
Radioactive Waste Management Officer (RWMO)**

Under clause 6(1) of PAK/915, following are the basic qualification Criteria for RWMO:

(1) A graduate in engineering or masters in basic science with a minimum experience of three (03) years related to radioactive waste management.

or

A graduate in engineering or masters in basic science having a six (06) month post graduate diploma/ certificate in an area related to radiation safety with minimum experience of two (02) years related to radioactive waste management.

or

Masters in Nuclear Engineering or Nuclear Power Engineering or Medical Physics with minimum experience of one (01) year related to radioactive waste management.

(2) In addition to the above mentioned qualification requirements, RWMO shall be:

- (a) well aware of the regulatory requirements, principles, procedures and practices for radioactive waste management and control of radioactive discharges,
- (b) well aware of the testing and maintenance requirements for waste management system components, etc.
- (c) capable of performing his role in emergency situations.

Pakistan Nuclear Regulatory Authority

* [Annex-IV added vides S.R.O. 156\(I\)/2010 dated March 8, 2010.](#)