REGISTERED No. M - 302
L.- 7646

The Gazette of Pakistan

EXTRAORDINARY

PUBLISHED BY AUTHORITY

ISLAMABAD, FRIDAY, JULY 12, 2019

PART II

Statutory Notification (S. R. O.)

GOVERNMENT OF PAKISTAN

PAKISTAN NUCLEAR REGULATORY AUTHORITY

NOTIFICATION

Islamabad, the 20th April, 2019

S.R.O. 807(I)/2019.—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 Radioactive Waste Management - (PAK/915) (Rev.1)".

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

(3) These regulations shall be applicable for the management of radioactive waste.

(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 the Ordinance;

(b) *"borehole disposal"* means disposal in a facility consisting of an array of boreholes, or a single borehole, which may be between a few tens of meters up to a few hundreds of meters deep. Such a borehole disposal facility is designed for the disposal of only relatively small volumes of waste, in particular disused sealed radioactive sources;

(c) *"clearance"* means the removal of radioactive materials or radioactive objects within licensed or authorized practices from any further regulatory control by the Authority;

(d) *"clearance level"* means a value, established by the Authority and expressed in terms of activity concentration, at or below which a source of radiation may be released from regulatory control;

(e) *"closure"* means administrative and technical actions directed at a disposal facility at the end of its operating lifetime;

(f) *"conditioning"* means those operations that produce a waste package suitable for handling, transport, storage and disposal;

(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) *"disposal facility"* means an engineered facility where radioactive waste is emplaced for disposal;

(j) *"disused sealed radioactive source - (DSRS)"* means a radioactive source, comprising radioactive material that is permanently sealed in a capsule or closely bonded and in a solid form, excluding reactor fuel elements, that is no longer used, and is not intended to be used, for the purpose for which an authorization was granted;

(k) *"dose constraint"* means a prospective and source related value of individual dose that is used in planned exposure situations as a parameter for the optimization of protection and safety for the source, and that serves as a boundary in defining the range of options in optimization;

(l) *"facilities"* means nuclear facilities, irradiation installations, some mining and raw material processing facilities such as uranium mines, radioactive waste management facilities, and any other places where radioactive material is produced, processed, used, handled, stored or disposed of or where radiation generators are installed;

(m) *"geological disposal facility"* means a facility for radioactive waste disposal located underground, usually several hundred meters or more below the surface, in a stable geological formation to provide long term isolation of radionuclides from the biosphere;

(n) *"institutional control"* means control of a radioactive waste site by an authority or institution designated under the laws of a state. This control may be active (monitoring, surveillance, remedial work) or passive (land use control) and may be a factor in the design of a facility;

(o) *"landfill disposal"* means disposal in a facility similar to a conventional landfill facility for industrial refuse but which may incorporate measures to cover the waste. Such a facility may be designated as a disposal facility for very low level radioactive waste with low concentrations or quantities of radioactive content;

(p) *"licensee"* means the holder of a valid license issued by the Authority;

(q) *"monitoring"* means the measurement of dose, dose rate or activity related to the assessment or control of exposure to radiation or radioactive substances, and the interpretation of the results;

(r) *"near surface disposal facility"* means a facility for radioactive waste disposal located at or within a few tens of meters of the earth's surface;

(s) *"NORM waste"* means naturally occurring radioactive material for which no further use is foreseen;

(t) *"Ordinance"* means the Pakistan Nuclear Regulatory Authority Ordinance, 2001 (III of 2001);

(u) *"predisposal"* means any waste management steps carried out prior to disposal, such as pretreatment, treatment, conditioning, storage and transport activities;

(v) *"pretreatment"* means any or all of the operations prior to waste treatment, such as collection, segregation, chemical adjustment and decontamination;

(w) *"radioactive waste"* means waste, generated irrespective of its origin, that contains, or is contaminated with, radionuclides at activity concentrations greater than the levels as established by the Authority in Regulations on Radiation Protection – (PAK/904), and may also be called as waste;

(x) *"radioactive waste management"* means all administrative and operational activities involved in the handling, pretreatment, treatment, conditioning, transport, storage and disposal of radioactive waste;

(y) *"recycling"* means the process of converting waste materials into new products;

(z) *"representative person"* means an individual receiving a dose that is representative of the doses to the more highly exposed individuals in the population;

(aa) *"reuse"* means the use of an item again after it has been used before;

(bb) *"risk constraint"* means a source related value that provides a basic level of protection for the individuals most at risk from a source;

(cc) *''sealed radioactive source - (SRS)''* means a radioactive source in which the radioactive material is; (a) permanently sealed in a capsule, or (b) closely bonded and in a solid form;

(dd) *"segregation"* means an activity where types of waste or material, either radioactive or exempt, are separated or kept separate on the basis of radiological, chemical and physical properties, to facilitate waste handling and processing;

(ee) *"storage"* means the holding of radioactive sources, radioactive material, spent fuel or radioactive waste in a facility that provides for their containment, with the intention of retrieval;

(ff) *"supplier"* means any person or organization to whom a registrant or licensee delegates duties, totally or partially, in relation to the design, manufacture, production or construction of a source. The term supplier includes designers, manufacturers, producers, constructors, assemblers, installers, distributors, sellers, importers or exporters of a source;

(gg) *"treatment"* means operations intended to benefit safety and economy by changing the characteristics of the waste;

(hh) *"unrestricted use"* means the use of an area or material without any radiological based restrictions;

(ii) *"waste acceptance criteria - (WAC)"* means quantitative or qualitative criteria specified by a licensee of waste management facility and approved by the Authority, for the waste form and waste package to be accepted by the licensee of a waste management facility;

(jj) *"waste characterization"* means determination of the physical, mechanical, chemical, radiological and biological properties of radioactive waste to establish the need for further adjustment, treatment or conditioning, or its suitability for further handling, processing, storage or disposal;

(kk) *"waste form"* means the waste in its physical and chemical form after treatment and conditioning resulting in a solid product prior to packaging;

(ll) *"waste inventory"* means quantity, radionuclides, activity and waste form characteristics of wastes for which a licensee is responsible; and

(mm) *"waste package"* means the product of conditioning that includes the waste form and any container and internal barrier e.g. absorbing materials and liners as prepared in accordance with the requirements for handling, transport, storage and disposal.

3. **Scope.**—These regulations shall cover the following:

(1) The management of all types of radioactive waste including Disused Sealed Radioactive Sources (DSRS) and orphan sources.

(2) The radioactive waste management facilities such as storage facility, pre-disposal facility, all types of disposal facilities such as landfill disposal, near surface disposal, geological disposal, borehole disposal, etc. and activities that are involved in the management of radioactive waste.

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

5. **General Responsibilities.**—(1) The licensee shall have the prime responsibility for the safe management of its entire radioactive waste including DSRS.

(2) The licensee shall:

(a) Ensure that radioactive waste is managed by appropriate segregation, characterization, classification, treatment, conditioning, storage and disposal;

(b) Use best available technologies and techniques at various steps in the management of radioactive waste;

(c) Store and dispose radioactive waste and DSRS only at authorized facility; and ensure that disposal of radioactive waste and DSRS is not unnecessarily delayed;

(d) Establish and maintain a mechanism to provide and ensure adequate financial resources needed to implement the requirements of these regulations, where so required by the Authority; and

(e) Ensure that personnel involved in the radioactive waste management activities are trained, qualified and competent.

6. **Radiation Protection.**—The licensee shall follow the requirements of radiation protection as specified in Regulations on Radiation Protection – (PAK/904) while managing the radioactive waste.

7. **Physical Protection and Security.**—(1) The licensee shall ensure that all necessary measures are taken to ensure physical protection and security of radioactive waste and DSRS according to the requirements of Regulations on Physical Protection of Nuclear Materials and Nuclear Installations – (PAK/925) and Regulations on Security of Radioactive Sources – (PAK/926) respectively.

(2) The measures shall be implemented to ensure an integrated approach to safety and nuclear security measures in the management of radioactive waste.

8. **Emergency Preparedness.**—The licensee shall establish and maintain emergency preparedness and response plans commensurate with the hazards associated with the radioactive waste facilities and activities, and shall follow applicable PNRA Regulations.

9. **Management System.**—The licensee shall develop and implement a comprehensive management system to provide assurance of quality to all safety related activities, systems and components throughout the life time of a facility which may affect safe management of radioactive waste.

10. **Safety Culture.**—The licensee shall establish and maintain a strong safety culture by means of an effective management system and a demonstrated commitment to safety on the part of senior management.

11. **Interdependences.**—(1) The licensee shall take into account interdependences among all steps in the predisposal management of radioactive waste as well as the impact of the anticipated disposal option.

(2) All activities from the generation of radioactive waste up to its disposal, including its processing shall be considered as part of a larger entity, and the management elements of each step shall be selected so as to be compatible with those of the other steps.

12. **Designation of Radioactive Waste Management Officer.**—The licensee shall designate a Radioactive Waste Management Officer (RWMO) for the implementation of these regulations, when so required by the Authority, who is under the administrative control of a person responsible for safety. The RWMO shall meet the basic qualification criteria given in Schedule I of these regulations.

13. **Radioactive Waste Management Program.**—The licensee shall manage its radioactive waste in accordance with the radioactive waste management program (RWMP) approved by the Authority.

14. **Control of Radioactive Waste Generation.**—(1) The licensee shall keep radioactive waste generation to the minimum, arising from the operation of its facility or carrying out any activity, to the extent practicable.

(2) The licensee shall carefully plan siting, design, construction, commissioning, operation, shutdown and decommissioning of facilities in which radioactive waste is generated to keep the volume and the radioactive content of the waste arising to the minimum practicable.

(3) Measures to control the generation of radioactive waste, in terms of both volume and radioactivity content, shall be considered before the construction of a facility, beginning with the design phase, and throughout the lifetime of the facility.

(4) The licensee shall adopt prudent management practices to ensure unnecessary generation of radioactive waste arising from its activities.

15. **Reuse and Recycling of Radioactive Waste and DSRS.**—(1) The reuse and recycling of radioactive waste and DSRS shall be subject to approval by the Authority after safety assessment.

(2) The reuse and recycling of radioactive waste and DSRS shall be applied to the extent possible to keep the generation of radioactive waste to the minimum level practicable.

16. **Characterization and Classification of Radioactive Waste.**—(1) The licensee, at the various steps in the management of radioactive waste, shall:

(a) Characterize the radioactive waste in terms of its physical, mechanical, chemical, radiological and biological properties; and

(b) Classify the radioactive waste according to the activity concentration and half-lives of the radionuclides keeping in view the perspective of its future disposal as given in Schedule II and submit the classification scheme to the Authority for approval.

17. **Processing of Radioactive Waste.**—(1) Radioactive material for which no further use is foreseen, and with characteristics that make it unsuitable for authorized discharge, authorized use or clearance from regulatory control, shall be processed and stored as radioactive waste. The processing of radioactive waste shall be based on appropriate consideration of the characteristics of the waste and of the demands imposed by different steps in its management including pretreatment, treatment, conditioning, transport, storage and disposal.

(2) Radioactive waste shall be processed in such a way, that safety is appropriately ensured during normal operation, that measures are taken to prevent the occurrence of incidents or accidents, and that provisions are made to mitigate the consequences if accidents occur. The licensee shall ensure that processing of radioactive waste is consistent with the type of waste, the possible need for its storage, the anticipated disposal option, and the limits, conditions and controls.

(3) The licensee shall ensure that radioactive waste is segregated at the point of origin and that the treatment and conditioning of radioactive waste is carried out in accordance with the waste acceptance requirements.

(4) Radioactive waste shall be processed in such a way that the resulting waste form can be safely stored and retrieved from the storage facility whenever required.

(5) The licensee shall establish provisions for identifying, assessing and dealing with radioactive waste or waste packages that do not meet process specifications and requirements for its safe handling, transport, storage and disposal.

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

(7) Consideration shall be given to the consequences of dealing with any secondary waste both radioactive and non-radioactive that may be created during processing.

18. **Discharge or Release of Radioactive Effluents to the Environment.**—(1) The applicant requiring license under PNRA regulations shall obtain an authorization from the Authority to discharge or release radioactive effluents to the environment.

(2) The applicant or licensee shall submit following information to the Authority along with the application for obtaining authorization:

(a) The characteristics and activity of the material to be discharged, and the possible points and methods of discharge;

(b) All significant exposure pathways by which discharged radionuclides can cause public exposure by performing an appropriate pre-operational study;

(c) Assessment of the doses to the representative person due to the planned discharges;

(d) The radiological environmental impacts assessments;

(e) Estimate dose constraint in relation to the discharges of radioactive waste to the environment by taking into account the operation of other facility at the site if any; and

(f) Determine discharge limits on the basis of the estimated dose constraint at the design stage of the facility.

(3) The licensee shall ensure that radioactive effluents are not discharged or 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 applicable PNRA regulations.

(4) The licensee shall review and modify their discharge control measures with the approval of the Authority, as appropriate, by taking into account:

(a) Operating experience;

(b) Installation or establishment of any new facility or activity that may result in the increase of radiation exposure to the public; and

(c) Any change in exposure pathways or in the characteristics of the representative person that could affect the assessment of doses due to the discharges.

(5) The licensee shall ensure that operational limits and conditions relating to public exposure are established. These operational limits and conditions shall:

(a) Be used by the licensees as the criteria for demonstration of compliance after the commencement of operation of a facility;

(b) Correspond to doses below the dose limits with account taken of the results of optimization of protection and safety;

(c) Reflect good practice in the operation of similar facilities or activities;

(d) Allow for operational flexibility; and

(e) Take into account the results of the prospective assessment for radiological environmental impacts.

(6) In case the nuclear facility could cause public exposure outside the country, the licensee shall:

(a) Ensure that the assessment for radiological impacts includes those impacts outside the country; and

(b) Establish requirements for the control of discharges to the extent possible.

(7) The licensee 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 representative person of population;

(c) Report discharges to the Authority on yearly basis and such shorter intervals as may be specified in the license; and

(d) Notify to the Authority any event of discharges exceeding the authorized limits within forty eight (48) hours. The detailed event report shall be submitted within sixty (60) days containing:

(i) The description of the event that lead to release of radioactive material;

(ii) The probable cause of the event;

(iii) The measures taken to restore the normal operational conditions and to mitigate the consequences of radioactive releases and to avoid repetition of similar events in future;

(iv) The amount of concentration and activity of the released radioactive materials;

(v) The time and total duration of discharge; and

(vi) Estimated doses to the workers and public as a result of discharge.

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

19. **Clearance of Radioactive Waste from Regulatory Control.**—(1) The licensee shall seek permission from the Authority for the clearance of its radioactive waste and DSRS from further regulatory control.

(2) In case of DSRS, the licensee shall submit source certificate, current activity, and the technique used to determine the activity of the source to obtain clearance.

(3) In case of radioactive waste, the licensee shall submit information regarding the origin, characteristics in terms of its physical, mechanical, chemical, radiological and biological properties and the methodology used for the determination of its radionuclide content for the purpose of clearance.

(4) Clearance shall be granted on the basis of criteria specified in Regulations PAK/904.

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

(6) The licensee shall ensure that clearance of radioactive waste including DSRS is not unnecessarily delayed.

(7) All DSRS, cleared by the Authority, shall be managed as per Regulation 23 of these regulations.

(8) Other national regulations shall be applicable while disposing of the radioactive waste cleared from the Authority.

20. **Transfer of Radioactive Waste and DSRS.**—(1) The licensee shall not transfer radioactive waste and DSRS without:

(a) Prior approval of the Authority; and

(b) Confirmation that the person to which it is to be transferred has the necessary authorization to hold, use, recycle or manage that radioactive waste and DSRS.

(2) The licensee shall provide necessary information, so required by the Authority, prior to the transfer of radioactive waste and DSRS.

21. **Transport of Radioactive Waste.**—The licensee shall follow the requirements of the Regulations for the Safe Transport of Radioactive Material - (PAK/916) in case of transportation of radioactive waste and DSRS from its facility to another location.

22. **Waste Acceptance Criteria for Storage or Disposal.**—(1) The Waste Acceptance Criteria (WAC) shall be developed by the operator of the storage and disposal facility that specify the radiological, mechanical, physical, chemical and biological characteristics of waste packages and unpackaged waste that are to be processed, stored or disposed of at designated radioactive waste storage or disposal facility. WAC shall be subject to the approval of the Authority.

(2) Waste acceptance requirements and criteria for a given disposal facility shall ensure the safe handling of waste packages and unpackaged waste in conditions of normal operation and anticipated operational occurrences. It shall also ensure the fulfillment of the safety functions for the waste form and waste packaging with regard to safety in the long term.

(3) Modeling and testing of the behavior of waste forms shall be undertaken to ensure the physical and chemical stability of the different waste packages and unpackaged waste under the conditions expected in the disposal facility, and to ensure their adequate performance in the event of anticipated operational occurrences or accidents.

(4) Radioactive waste intended for disposal shall be characterized to provide sufficient information to ensure compliance with the WAC. Arrangements shall be put in place to verify that the waste and waste packages received for disposal comply with the WAC and, if not, to confirm that corrective measures are taken by the generator of the radioactive waste or the operator of the disposal facility. Quality control of waste packages shall be undertaken and achieved mainly on the basis of records, reconditioning testing e.g. of containers and control of the conditioning process. Post conditioning testing and the need for corrective measures shall be limited as far as practicable.

23. **Management of Disused Sealed Radioactive Sources.**—(1) DSRS or devices incorporating radioactive sources shall be considered as waste when there is no further use declared by the licensee. The licensee shall inform the Authority about the declaration of DSRS as waste.

(2) The licensee shall acquire all relevant technical information from the supplier and manufacturer of radioactive sources or devices incorporating radioactive sources to permit their safe and secure management.

(3) The licensee shall follow the instructions regarding the management of DSRS as specified in Schedule III.

(4) The return of the DSRS, if applicable, to the supplier shall be with the permission of the Authority.

(5) The licensee shall not dismantle any DSRS without prior approval of the Authority.

24. **Storage 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 radioactive waste shall store such waste in its storage area or otherwise shall send the radioactive waste to the designated radioactive waste storage facility with the prior approval of the Authority and ensure that the criteria for acceptance of the waste at designated radioactive waste storage and disposal facility are met.

(2) The radioactive waste storage area shall be clearly demarcated and have controlled access.

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

(4) The radioactive waste storage facility shall be designed in such a way that the waste can be retrieved whenever required. Measures for achieving this aim shall include the appropriate design and construction of openings, passages and handling systems and the incorporation of appropriate stacking systems or spacing for waste packages.

(5) The storage facility shall be designed on the basis of type of radioactive waste, its characteristics and associated hazards, radioactive waste inventory and also 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. Consideration shall be given to the dynamic and static loads resulting from the handling and stacking of the waste packages. The wall thickness of the containers, their filled weight and the stacking orientation shall be taken into account at the design stage.

(6) Provisions shall be made for the regular monitoring, inspection and maintenance of the radioactive waste and of the storage facility to ensure their continued integrity.

(7) The adequacy of the storage capacity shall be periodically reviewed, with account taken of the predicted radioactive waste arising, both from normal operation and from possible incidents, of the expected lifetime of the storage facility and of the availability of disposal options.

(8) The licensee shall ensure that each container containing radioactive waste bears a durable, clearly visible label bearing the radiation symbol which is legible for the whole period of storage.

(9) When it is proposed to store the radioactive waste for a long period of time, consideration shall be given to the protection of present and future generations.

(10) The licensee shall undertake regular verification of status of waste in storage.

(11) The need for remote handling shall be considered in cases where the waste package is a source of radiation at high dose rates, where there is a risk that radioactive aerosols or gases could be released to the working environment, or where the waste might pose a significant non-radiological hazard e.g. chemical toxicity.

(12) Arrangements for monitoring the radiological conditions in the waste storage facility shall be provided. Such arrangements for monitoring may include, as necessary, measurements of radiation dose rates, concentrations of airborne radioactive material, levels of both fixed and loose surface contamination and neutron flux rates.

(13) Storage facilities shall be operated in accordance with a set of operational limits and conditions to identify the safe boundaries of operation. Operational limits and conditions for the storage of radioactive waste shall include, as appropriate:

(a) Specifications for waste packages such as waste form, radionuclide content and container characteristics consistent with the WAC for the storage facility;

(b) Requirements for safety systems, e.g. requirements for ventilation, heat removal, tank agitation and radiation monitoring, including requirements for the availability of these features in normal and abnormal conditions;

(c) Periodic testing of equipment, especially backup systems that need to be available in emergency conditions;

(d) Maximum radiation dose rates, especially on container surfaces;

(e) Maximum levels of surface contamination for containers;

(f) Requirements for training and qualification of personnel and minimum staffing levels; and

(g) Limits on the cumulative radionuclide inventory.

25. **Pre-disposal Radioactive Waste Management Facility (PRWMF).**—(1) PRWMF shall be located and designed so as to ensure safety for the expected operating lifetime under both normal and possible accident conditions, and for their decommissioning. The need for operational maintenance, testing, examination and inspection shall be addressed from the conceptual design stage onward.

(2) All operations and activities important to safety shall subject to documented limits, conditions and controls, and shall be carried out by trained, qualified and competent personnel.

26. **Disposal of Radioactive Waste.**—(1) The licensee shall ensure that the provision of the main safety functions remain functional both in normal evolution of the disposal system and design failure of the disposal system.

(2) The safety objective shall be to site, design, construct, operate and close a disposal facility so that protection after its closure is optimized, social and economic factors being taken into account. A reasonable assurance shall be provided that doses and risks to members of the public in the long term shall not exceed the dose constraints or risk constraints that were used as design criteria. The dose criteria shall be as follows:

(a) To comply with the dose limit for member of the public, a disposal facility shall be so designed that the calculated dose or risk to the representative person who might be exposed in the future as a result of possible natural

processes affecting the disposal facility does not exceed a dose constraint of 0.3 mSv in a year or a risk constraint of the order of 10^{-5} per year;

(b) In relation to the effects of inadvertent human intrusion after closure if such intrusion is expected to lead to an annual dose of less than 1 mSv to those living around the site, then efforts to reduce the probability of intrusion or to limit its consequences are not warranted;

(c) If human intrusion was expected to lead to a possible annual dose of more than 20 mSv to those living around the site, then alternative options for radioactive waste disposal shall be considered, for example, disposal of the radioactive waste below the surface, or separation of the radionuclide content giving rise to the higher dose; and

(d) If annual doses in the range 1–20 mSv are indicated, then reasonable efforts shall be made at the stage of development of the facility to reduce the probability of intrusion or to limit its consequences by means of optimization of the facility's design.

(3) The disposal facility shall be sited, designed and operated to provide features that are aimed at isolation of the radioactive waste from people and from the accessible biosphere. The features shall aim to provide isolation for several hundreds of years for short lived waste and at least several thousand years for intermediate and high level waste. Consideration shall be given to both natural evolution of the disposal system and events causing disturbance of the facility.

(4) The site for a disposal facility shall be characterized at a level of detail sufficient to support a general understanding of both the characteristics of the site and how the site will evolve over time. This shall include its present condition, it's probable natural evolution and possible natural events, and also human plans and actions in the vicinity that may affect the safety of the facility over the period of interest. It shall also include a specific understanding of the impact on safety of features, events and processes associated with the site and the facility.

(5) The licensee shall evaluate the site and shall design, construct, operate and close the disposal facility in such a way that safety is ensured by passive means to the fullest extent possible and the need for actions to be taken, after closure of the facility, is minimized.

(6) The host environment shall be selected, the engineered barriers of the disposal facility shall be designed and the facility shall be operated to ensure that safety is provided by means of multiple safety functions. Containment and isolation of the waste shall be provided by means of a number of physical barriers of the disposal system. The performance of these physical barriers shall be achieved by means of diverse physical and chemical processes together with various operational controls. The capability of the individual barriers and controls together with that of the overall disposal system shall be demonstrated. The overall performance of the disposal system shall not be unduly dependent on a single safety function.

(7) The engineered barriers, including the waste form and packaging, shall be designed, and the host environment shall be selected, so as to provide containment of the radionuclides associated with the waste. Containment shall be provided until radioactive decay has significantly reduced the hazard posed by the waste. In addition, in case of heat generating waste, containment shall be provided while the waste is still producing heat energy in amounts that could adversely affect the performance of the disposal system.

(8) The disposal facility and its engineered barriers shall be designed to contain the waste with its associated hazard, to be physically and chemically compatible with the host geological formation and surface environment, and to provide safety features after closure that complement those features afforded by the host environment.

(9) The licensee shall retain all the information relevant to the disposal facility and shall retain the inspection records that demonstrate compliance with regulatory requirements. Such information and records shall be retained, at least up until the time when the information is shown to be superseded, or until responsibility for the disposal facility is passed on to another organization.

(10) Waste packages and unpackaged waste accepted for emplacement in a disposal facility shall conform to criteria that are fully consistent with, the design of the disposal facility in operation and after closure.

(11) A program of monitoring shall be carried out prior to, and during, the construction and operation of a disposal facility and after its closure. This program shall be designed to collect and update information necessary for the purpose of protection and safety. Information shall be obtained to confirm the conditions necessary for the safety of the workers and members of the public and protection of the environment during the period of operation of the facility. Monitoring shall also be carried out to confirm the absence of any condition that could affect the safety of the facility after closure.

(12) Plans shall be prepared for the period after closure to address institutional control and the arrangements for maintaining the availability of information on the disposal facility. These plans shall be consistent with passive safety features and shall form part of the safety analysis report on which authorization to close the facility is granted.

27. **Modification.**—The licensee shall not implement any modification in Structures, Systems, and Components (SSCs) and in the licensing documents without prior approval of the Authority. The record of any such modification shall be maintained.

28. **Management of NORM Waste.**—(1) NORM Waste containing naturally occurring radionuclides with the activity concentration greater than those specified in Schedule IV shall subject to the requirements of these regulations.

(2) In case the NORM waste contains activity concentrations higher than the specified values, prior approval of the Authority shall be required for the disposal of such NORM waste. Disposal methods for NORM waste shall be safe and practical that provides adequate protection to both human health and the environment. Such methods shall be designed to prevent contamination of natural resources such as underground water, soil, etc.

(3) Purposeful dilution to render NORM exempt shall not be performed.

(4) No person shall release NORM residue for unrestricted use unless it has activity concentration less than specified in Schedule IV or the activity concentration does not exceed specific values derived so as to meet a dose criterion of the order of 1 mSv in a year, which is commensurate with typical doses due to natural background levels of radiation.

(5) Records of disposal, including manifests, shall be maintained and made available as and when required by the Authority.

29. **Records and Reports.**—(1) The licensee shall maintain up-to-date inventory of radioactive waste and DSRS, 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 including inventory and all other details relevant to the safe management of radioactive waste and DSRS.

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

30. **Repeal.—** The "Regulations on Radioactive Waste Management - (PAK/915)" notified vide S.R.O. 765(I)/2005 dated 3rd August, 2005 and its corresponding amendment notified vide S.R.O. 156(I)/2010 dated 8th March, 2010 are hereby repealed.

Schedule I

Basic Qualification Criteria for Radioactive Waste Management Officer (RWMO)

Under Regulation 12 of these regulations, following are the basic qualification criteria for RWMO:

(1) A graduate in engineering or masters in basic science or bachelor in basic science four (04) years with a minimum experience of three (03) years in radioactive waste management.

OR

Masters in Nuclear Engineering or Nuclear Power Engineering or Medical Physics or Radiation Physics with minimum experience of two (02) years in radioactive waste management.

(2) In addition to the above mentioned qualification criteria, 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 the emergency situations;

(d) Well aware of the radioactive waste packaging requirements;

(e) Well aware with the reporting of incidents significant to safety and physical protection to the Authority related to waste management in accordance with the relevant national regulations; and

(f) Possessing good interpersonal and communication skills.

Schedule II

Classification of Radioactive Waste

(1) Exempt Waste (EW) - Waste that meets the criteria for clearance, exemption or exclusion from regulatory control for radiation protection purposes.

(2) Very Short Lived Waste (VSLW) - Waste that can be stored for decay over a limited period of up to a few years and subsequently cleared from regulatory control according to arrangements approved by the Authority for uncontrolled disposal, use or discharge. VSLW includes waste primarily containing radionuclides with very short half-lives often used for research and medical purposes.

(3) Very Low Level Waste (VLLW) - Waste that does not necessarily meet the criteria of EW, but which does not need a high level of containment and isolation and, therefore, is suitable for disposal in near surface landfill type facilities with limited regulatory control. Such landfill type facilities may also contain other hazardous waste. Typical waste in this class includes soil and rubble with low levels of activity concentration. Concentrations of longer lived radionuclides in VLLW are generally very limited.

(4) Low Level Waste (LLW) - Waste that is above clearance levels, but with limited amounts of long lived radionuclides. Such waste requires robust isolation and containment for periods of up to a few hundred years and is suitable for disposal in engineered near surface facilities. This class covers a very broad range of waste. LLW may include short lived radionuclides at higher levels of activity concentration and long lived radionuclides, but only at relatively low levels of activity concentration.

(5) Intermediate Level Waste (ILW) - Waste that, because of its content, particularly of long lived radionuclides, requires a greater degree of containment and isolation than that provided by near surface disposal. However, ILW needs no provision or only limited provision for heat dissipation during its storage and disposal. ILW may contain long lived radionuclides, in particular alpha emitting radionuclides, which will not decay to a level of activity concentration acceptable for near surface disposal during the time for which institutional controls can be relied upon. Therefore, waste in this class requires disposal at greater depths, in the order of tens of meters to a few hundred meters.

(6) High Level Waste (HLW) - Waste with levels of activity concentration high enough to generate significant quantities of heat by the radioactive decay process or waste with large amounts of long lived radionuclides that need to be considered in the design of a disposal facility for such waste. Disposal in deep, stable geological formations usually several hundred meters or more below the surface is the generally recognized option for disposal of HLW.

Schedule III

Management of Disused Sealed Radioactive Source (DSRS)

(1) Sealed radioactive sources containing radionuclides (half - life > 1 year and with initial activity of 100 GBq or more) shall not be purchased without the undertaking from the manufacturer or supplier to accept the return of the sources. The source shall be returned, when the source is:

(a) No longer useful for the intended purpose; or

(b) Not useful to another user in the country for another purpose.

This condition shall be included as part of the purchase contract without which No Objection Certificate (NOC) for import will not be granted by the Authority. The user or importer is required to provide copies of the purchase contract, shipping and other related documents to the Authority when applying for NOC for import of the sealed radioactive sources.

(2) For sources not covered under clause (1) above, the responsibility for DSRS shall remain that of the licensee until such time as the source passes into the custody of radioactive waste storage or disposal facility designated by the Authority. Designated radioactive waste storage or disposal facility shall be responsible to manage the DSRS received as waste. In addition, DSRS shall be managed in accordance with the national policy related to safe management of radioactive waste.

(3) Licensee shall inform the Authority at the time of acquiring NOC for import of source about the following:

(a) Time frame of returning the DSRS to the supplier in case of clause (1) of Schedule III;

(b) Time frame of handing over the DSRS to the designated radioactive waste storage or disposal facility in case of clause (2) of Schedule III.

Schedule IV

Levels for Exemption/Clearance of Radionuclide of Natural Origin

Radionuclide	**Activity Concentration (Bq/g)**
K-40	10
Each radionuclide in the uranium decay chain or the thorium decay chain	1

MOHAMMAD SALEEM ZAFAR,
Member (Corporate).