

THE NATIONAL COMMISSION FOR NUCLEAR ACTIVITIES CONTROL

Regulation on safety requirements for natural sources

Chapter 1. General Provisions

Section 1

Scope and objective

Art. 1. This regulation sets out the requirements concerning the protection of workers, members of the public and the environment against the risks arising from natural radiation sources, in accordance with the provisions of Article 91 b and c of the CNCAN Presidential Order no. 14/2000 for the approval of the Fundamental Norms on Radiological Safety published in the Official Journal of Romania Part I no. 404 and 404 bis of 29 august 2000, hereinafter referred to as NSR-01.

Art. 2. (1) This regulation shall apply to planned exposure situations associated with industrial and scientific activities involving natural radiation sources the presence of which leads to a significant increase in the exposure of workers or of members of the public, which cannot be disregarded from the radiation protection point of view.

(2) With regard to the industrial and scientific activities mentioned in para (1), this regulation shall apply to the total life-cycle of the industrial or scientific activity including:

- a. Design
- b. Construction and commissioning
- c. Operation including maintenance and residue management
- d. Decommissioning and closure, including remediation of contaminated areas
- e. Ongoing institutional control after termination of regulatory control, where applicable.

(3) Industrial and scientific activities mentioned in para (1) include in particular:

- a. Activities specified in Annex 1–a involving operations with, and storage of, materials that contain naturally occurring radionuclides
- b. Activities associated with accumulations of residues which contain naturally occurring radionuclides, specified in Annex 1-b.

(4) This regulation shall also apply to existing exposure situations involving natural radiation sources, including legacy sites for which remedial actions may need to be considered.

Art. 3. This regulation shall not apply to industrial and scientific activities involving the use of natural radionuclides for their fissile or fertile properties, which are covered by specific regulations issued by CNCAN.

Section 2

Definitions and Terms

Art. 4. Within the scope of application of this regulation, besides the terms defined in the Law 111/1996 on the safe deployment, regulation, licensing and control of nuclear activities, republished, with subsequent amendments and completions, and in NSR-01, the other terms, definitions and abbreviations used are defined in Annex 2 which is an integral part of this regulation.

Chapter 2. Application of the basic principles of radiation protection

Section 1

Justification, optimization and dose limitation

Art. 5. (1) No practice or remedial action shall be undertaken unless it is justified.

(2) Protection and safety in authorized practices and in remedial actions shall be optimized.

(3) In authorized practices the undertaking shall ensure that the dose limits specified in NSR-01 are not exceeded.

Section 2

Graded approach

Art. 6. The application of the system of radiological protection and safety in authorized practices and in remedial actions shall be commensurate with the radiation risks associated with the exposure situation.

Art. 7. The application of the requirements of this regulation in authorized practices shall be commensurate with the characteristics of the practice or the source within the practice, and with the likelihood and magnitude of exposures.

Chapter 3 Planned exposure situations

Section 1

Determination of radionuclide activity concentrations

Art. 8. An undertaking carrying out or intending to carry out any of the industrial or scientific activities specified in Art. 2(3) shall submit to CNCAN the information listed in Annex 3.

Art 9. (1) The undertaking referred to in Art.8 shall determine the activity concentrations of radionuclides in the uranium and thorium decay chains in all materials that:

- are associated with that activity;
- have potentially elevated activity concentrations of these radionuclides
- give rise to a gamma dose rate exceeding 0.3 μ Sv/h at a distance of 1 m from the source.

(2) The radionuclides for which activity concentrations shall be determined are specified in Annex 4.

Art. 10. The undertaking referred to in Art.8 shall submit to CNCAN the results of the activity concentration measurements mentioned in Art.9.

Art. 11. If the activity concentration of each radionuclide measured in terms of Art. 9 is less than 1 Bq/g, the industrial or scientific activity concerned shall not be considered as a practice and shall not be subject to the relevant requirements for planned exposure situations set out in this regulation.

Art. 12. If any of the activity concentrations measured in terms of Art. 9 exceeds 1 Bq/g, the industrial or scientific activity concerned shall be considered a practice and shall be subject to the relevant requirements for planned exposure situations set out in this Chapter.

Art. 13. In workplaces where there is a possibility of elevated concentrations of radon in air which cannot be disregarded from a radiation point of view, the activity concentrations of radon in air shall be measured to determine whether radon needs to be controlled in terms of the requirements for existing exposure situations, as set out in Section 5 of Chapter 4 of this regulation.

Art.14. The activity concentration measurements specified in Art.9 and Art.12 shall be carried out using measurement procedures and devices approved by CNCAN.

Section 2

Prior Radiological Evaluation

Art. 15. (1) The undertaking carrying out any practice identified in terms of Art. 12 shall evaluate the radiation exposure of workers and members of the public.

(2) The assessment of effective doses received by workers shall take into account all activities in the practice. Special consideration should be given to maintenance and repair activities and residue management activities that may result in doses that are higher than those resulting from normal operations.

(3) Where doses are estimated to exceed 1 millisievert per year, the nature of the work and the duration of the exposure shall be documented.

(4) Where the undertaking does not possess the required level of radiation protection expertise to carry out the evaluation referred to in para (1), a radiation protection expert shall be identified and consulted to assist with the evaluation.

Art. 16. (1) The dose assessment shall be carried out based on the principles set out in Annex 5.

(2) For new practices, the effective dose shall be assessed using the available information on the materials involved and the anticipated exposure situations, complemented where possible by reliable measurements and experience from similar operating practices.

(3) In the case of practices already in operation, the effective dose shall be assessed on the basis of annual exposure times and measurements of exposure levels.

(4) In the case of practices already in operation, the dose assessment shall be based on sampling and analysis of materials in greater detail than in Art. 9, depending on the specific nature of the facilities and materials involved and where this is considered necessary for obtaining a reliable dose assessment.

(5) The sampling procedure shall be endorsed by a radiation protection expert.

(6) The analysis of materials shall be performed by a laboratory certified by CNCAN.

(7) CNCAN may require additional sampling and analyses in order to substantiate the dose assessment.

Art. 17. (1) The undertaking carrying out any practice identified in terms of Art. 12 shall compile a report containing the results of the prior radiological evaluation referred to in Art. 15 and shall submit that report to CNCAN.

(2) The report mentioned in para (1) shall contain the information listed in Annex 6.

(3) Where the evaluation has been carried out in consultation with a radiation protection expert, the report shall be endorsed by that expert.

(4) For practices already in operation, the report referred to in para (1) shall be submitted to CNCAN in accordance with Art. 80.

Art. 18. After evaluating the report submitted in terms of Art. 17, CNCAN shall decide on the need for registration or licensing.

Art. 19. If there is a change in conditions with significant dose implications or if the decommissioning of the practice is anticipated, a further radiological evaluation is required.

Section 3

Notification

Art. 20. (1) The information submitted to CNCAN in terms of Art.8, Art.10 and Art.17 shall be regarded as a formal notification to CNCAN of the relevant activities specified in Art. 2(3).

(2) CNCAN may decide that notification alone is sufficient provided that the exposures expected to be associated with the industrial and scientific activity are unlikely to exceed a small fraction of the relevant limits, and that the likelihood and magnitude of potential exposures and any other potential detrimental consequences are negligible, in which case no further action is required.

Art. 21. If there is a change in conditions with significant dose implications or if the decommissioning of the practice is anticipated, further notification is necessary.

Art. 22. Notwithstanding the provisions of Art. 80, any undertaking intending to permanently cease an industrial or scientific activity that has been notified in terms of Art. 20 shall notify CNCAN in writing, where possible at least 3 months before the cessation of such activity.

Section 4

Exemption

Art. 23. (1) Where the findings of the prior radiological evaluation developed according to Section 2 show that the doses to workers and members of the public do not exceed 1 mSv/a, the practice is exempt from the requirement for authorization.

(2) If doses exceeding 1 mSv/a are associated only with maintenance and repair activities or with residue management activities, authorization shall be required only for those particular activities, except where notification alone is sufficient in terms of Art. 20 para (2). All other activities shall qualify for exemption.

Section 5

General requirements for practices requiring authorization

Art. 24. If the doses assessed according to Section 2 exceed 1 millisievert per year but do not exceed 6 millisievert per year, the undertaking shall apply to CNCAN for a registration.

Art. 25. (1) If the doses assessed according to Section 2 exceed 6 millisieverts per year, the undertaking shall apply to CNCAN for a licence.

(2) The application for a licence shall contain the information listed in Annex 7.

Art. 26. No new industrial or scientific activity which meets the dose criteria mentioned in art.24 or art.25 may be carried out until a registration or licence, as applicable, has been issued by CNCAN.

Art. 27. In an authorized practice, the undertaking shall be responsible for all aspects of safety, radiation protection and protection of the environment. The responsibility shall not be delegated.

Art. 28. The undertaking shall grant CNCAN access to all necessary information and documents that CNCAN needs for the fulfilment of their duties.

Art. 29. (1) The undertaking in an authorized practice shall set up and maintain a system of protection against the risks associated with exposure to ionizing radiation

- a. at all workplaces with relevant natural radiation sources and
- b. from residues

that may cause a significant increase in the exposure of workers or members of the public.

(2) The system of protection referred to in para (1) shall include at least the following measures:

- a. The conduct of dose investigations.
- b. The control of doses to workers and the public.
- c. The control of materials with enhanced natural radioactivity and the control of the spread of contamination.
- d. The assignment of a radiation protection expert according to Art. 30.

Art. 30. (1) The undertaking shall ensure that a radiation protection expert is identified and consulted as necessary on compliance with the applicable legal provisions on exposure and radiation protection of workers, of environment and members of the public.

(2) The radiation protection expert shall be in possession of a permit for working in the fields “Unsealed sources” and/or “Raw nuclear material”.

(3) The duties of the radiation protection expert shall be as specified in Annex 5 of CNCAN Presidential Order no. 202/2002 for the approval of the Norms on the issue of permits for practicing nuclear activities and on the designation of accredited experts in radiation protection, published in the Official Journal of Romania, Part I, no. 936 and 936 bis of 20 December 2002, hereinafter referred to as NSR-07.

(4) In the case of conventional health and safety and of environmental protection associated with workplaces, the undertaking shall ensure that the radiation protection expert cooperates with the appointed competent occupational safety expert, occupational health expert and/or environmental expert, as appropriate.

Art. 31. (1) Specific obligations of the undertaking under a registration are the following:

- a. Monitoring of the relevant workplaces and assessing the doses received by workers
- b. Where applicable, monitoring environmental radiation in accordance with NSR-22 in order to confirm that the off-site radiological impact is controlled in accordance with NSR-01
- c. Reporting of the results of the monitoring and associated dose assessment referred to in a) and b), with a frequency stipulated in the registration certificate issued by CNCAN.

(2) In order to ensure that the day-to-day obligations under the registration are met, the undertaking may use its own staff members, suitably qualified and each possessing a radiation working permit as specified in NSR-07.

Art. 32. (1) Specific obligations of the undertaking under a licence are the following:

- a. Submit to CNCAN, and periodically update, a safety assessment, in accordance with Annex 8.
- b. Monitoring of the relevant workplaces and assessing doses received by workers
- c. Where applicable, monitoring environmental radiation according to NSR-22 in order to confirm that the off-site radiological impact is controlled in accordance with NSR-01
- d. Reporting of the results of the monitoring and associated dose assessment referred to in a) and b), with a frequency stipulated in the licence
- e. Individual radiation monitoring for workers expected to receive doses exceeding 6mSv/a;
- f. Appointment of a person responsible for radiation safety

(2) For meeting its obligations under para (1), the undertaking may use its own staff members provided that they are suitably qualified and that each staff member possesses a radiation working permit as specified in NSR-07.

Section 6

Protection of workers

Art. 33. (1) The radiation protection of workers shall be in accordance with the relevant provisions of NSR-01.

(2) For workers receiving a radiation exposure that results in a dose exceeding 1 mSv/a, the applicable requirements of NSR-01 shall be applied.

(3) The undertaking shall inform the workers of their exposure situation and their obligations and training requirements according to Art. 49 and 50 of NSR-01.

Section 7

Management of residues

General requirements

Art. 34. (1) The undertaking carrying out a practice referred to in Art. 2(3) letter b) shall determine the radionuclide concentration in the generated residues, , at least once during operation and each time when there are changes in operational activities with significant implications for gamma dose, as well as before decommissioning, or as otherwise required by CNCAN,. The determination shall be carried out in accordance with Annex 4 and shall be endorsed by a radiation protection expert.

(2) Residues with radionuclide activity concentrations of 1 Bq/g or less can be regarded as non-radioactive and can be handled without any radiation protection measures.

(3) Residues for which any radionuclide activity concentration exceeds 1Bq/g are controlled residues and shall be handled taking radiation protection measures.

(4) If it is intended to discharge residues via the water or air pathways, the provisions of Art. 50 shall be applied.

Art. 35. Radioactive materials excavated from contaminated sites are residues according Annex I-b lit. j).

Controlled residues

Art. 36. The undertaking shall identify those activities associated with the management of controlled residues, shall implement protective measures for workers and members of the public against the radiological risks and, if not already in possession of an authorization that covers such activities, shall apply to CNCAN for authorisation.

Art. 37. The undertaking shall ensure the optimization of the exposures of workers and members of the public during the handling of controlled residues being managed in the practice or remediation, in accordance with Art. 5(2).

Art. 38. The undertaking shall implement measures for minimisation of the quantity of controlled residues requiring management as waste.

Art. 39. The disposal of controlled residues as waste shall be in accordance with relevant requirements for disposal of radioactive waste as set out in the specific regulation issued by CNCAN.

Art. 40. (1) The undertaking may store the controlled residues on the site of the practice pending recycling, use or disposal provided that:

- a. Measures for radiation protection of the workers according to Art. 33 are implemented,
- b. Measures for securing against loss, theft and unauthorised access are implemented;
- c. The storage meets the relevant requirements of Art. 59 as well as the relevant requirements on the storage of mineral waste, where such requirements are applicable.

(2) CNCAN may, as part of the conditions of authorization of the storage referred to in para (1), limit the amount and duration of interim storage of controlled residues and may impose special protection and safety measures.

Reporting

Art. 41. (1) The undertaking shall report to CNCAN the results of the characterization carried out in accordance with Art. 34(1).

(2) The required information is listed in Annex 3. The endorsement of the radiation protection expert shall be attached.

(3) For new practices, without prejudice to Art. 80, the reporting shall be done within 6 months after commencement of an activity involving the generation of controlled residues.

(4) If an activity involving the generation of controlled residues is to cease permanently, CNCAN shall be informed in writing by the undertaking, where possible at least 3 months before the cessation of the activity.

Use or recycling of residues

Art. 42. (1) In accordance with Art. 38, the undertaking shall give priority to recycling residues or using them as by-products, rather than disposing of them as waste.

(2) Recycling or use as a by-product of the controlled residue shall not result in a significant increase of radiation exposure of members of the public.

(3) In complying with para (2), consideration shall be given to mixing of the residue with low activity material or non-radioactive material.

Art. 43. (1) For the purpose of demonstrating compliance with Art. 42(2), the undertaking shall carry out a safety assessment in accordance with Annex 8, which shall include, where appropriate, external exposure, internal exposure to airborne dust and radon, and the contamination of surface water, ground water and the food chain due to leaching of radionuclides. Where appropriate, the safety assessment shall include an assessment of risks far into the future.

(2) For contaminated scrap metal, the recycling or use as a by-product shall also be subject to the applicable requirements of CNCAN Presidential Order no. 89/2010 for the approval of the Regulation on radiological monitoring of scrap metal during collecting, trading and processing.

Art. 44. (1) The recycling of a controlled residue or its use as a by-product according to Art. 42 shall be subject to approval by CNCAN.

(2) The undertaking shall submit to CNCAN in support of the application a report compiled by a radiation protection expert that provides:

- a. a detailed description of an optimization process in which the benefits and detriments of various options for recycling or use as a by-product are considered and the results of that optimization process are set out
- b. a written technical description of the optimum option for recycling or use as a by-product resulting from the optimization process mentioned in let. a, including a full description of any treatment carried out on the residue for this purpose
- c. the safety assessment mentioned in Art. 43(1) endorsed by the radiation protection expert mentioned in let. a for the optimum option described in let. b
- d. a written declaration of the compliance with applicable regulations.

(3) In cases covered by Art. 38 of Law no. 111/1996, republished, with further amendments and completions, the approval of the Ministry of Public Health shall be submitted to CNCAN in support of the application referred to in para (2).

Clearance of radioactive materials and equipment

Art. 45. The clearance of residues, including materials and equipment generated during the operational and decommissioning stages of an authorized practice shall be subject to approval by CNCAN.

Art. 46. Any residue referred to in Art. 45 may be cleared provided that:

a. the radiological impacts of the released materials or equipment are sufficiently low as not to warrant regulatory control

or

b. the continuation of regulatory control of the materials would not provide any net benefit in terms of the reduction of doses or of health effects.

Art. 47. A residue may be cleared without further consideration provided that the undertaking demonstrates by an assessment carried out in accordance with Annex 5 that the dose limit for members of the public established according to Art. 25 of NSR-01 will not be exceeded for any individual exposed to the released material, taking into account all significant exposure pathways.

Art. 48. Notwithstanding Art. 47, a residue may be cleared without further consideration if the activity concentration of each radionuclide in the uranium and thorium decay chains defined in Annex 4 for the material concerned is less than 1 Bq/g.

Art. 49. (1) The undertaking carrying out an authorized practice shall implement monitoring activities for controlling the clearance of materials and equipment.

(2) Verification of compliance of control measures mentioned in para (1) shall be performed by a radiation protection expert and approved by CNCAN.

Discharge of effluents

Art. 50. (1) The undertaking carrying out any practice mentioned in Annex 1 shall implement control measures for the discharge of natural radionuclides by surface water pathways and air pathways in order to ensure that the dose constraint of 0.3 millisievert per year for members of the public is not exceeded.

(2) Compliance with the dose constraint shall be verified by a radiation protection expert.

(3) If a dose constraint is exceeded, this shall be reported to CNCAN.

Control of other materials

Art. 51. If any industrial or scientific activity not covered by annex 1-a, or any residue not covered by Annex 1-b, is identified as causing an exposure of members of the public which cannot be disregarded from the radiation protection point of view, CNCAN may extend the scope of this regulation to such an activity or residue and notify the undertaking about this fact.

Import, export, transfer and intracommunity transfer of residues

Art. 52. In the case of import and intracommunity transfer into Romania of a material classified as residue according to Annex 1-b, the party responsible for the import or the intracommunity transfer shall assume the role of the undertaking in terms of Art. 27 and shall be subject to the relevant requirements of Sections 1, 2 and 3 of this Chapter.

Art. 53. In the case of export and intracommunity transfer from Romania of a material classified as residue according to Annex 1-b, the party responsible for the export or the intracommunity transfer shall obtain, and submit to CNCAN, confirmation by the competent authority responsible for residue management in the destination country and in each transit country that the residue will be accepted in those countries.

Art. 54. The import, export, transfer and intracommunity transfer of a controlled residue shall be authorized according to the Law no. 111/1996, republished, with subsequent amendments and completions.

Section 9

Decommissioning, closure and associated remediation activities

Decommissioning and closure

Art. 55. (1) At the end of the life cycle of any activity mentioned in Art. 2, the undertaking shall conduct the necessary decommissioning and closure activities, including any associated remediation.

(2) The actions taken during decommissioning and closure shall be such as to ensure the long term protection of members of the public and the environment, and, in particular, to ensure that doses to members of the public after termination of regulatory control will not exceed the dose limit for members of the public mentioned in Art. 25 and 26 of NSR-01.

(3) If necessary, compliance with the dose limit for members of the public after termination of regulatory control shall be achieved by means of ongoing institutional controls in accordance with Chapter V.

(4) Decommissioning and closure activities shall be planned in advance as an essential part of the life cycle of activities.

(5) The undertaking intending to carry out decommissioning and closure activities associated with an authorized practice shall apply to CNCAN for a separate registration certificate or licence, as applicable in terms of art. 24 and art.25.

Art. 56. (1) The undertaking shall establish, implement and regularly update the decommissioning and closure plan of the facility.

(2) The decommissioning plan and closure plan shall:

a. Be developed as early as possible in the life cycle, if possible at the onset of the initial registration or licensing process;

- b. Document all steps in the decommissioning and closure process;
- c. Define the end points of the decommissioning and closure process, using appropriate criteria;
- d. Demonstrate the feasibility and safety of decommissioning and closure
- e. Identify the classes of the waste generated during decommissioning and estimate the quantities involved;
- f. Describe the strategy for management of all radioactive residues, including any radioactive waste generated;
- g. Establish the costs associated with decommissioning and closure including the costs of the management of radioactive residues including any radioactive waste generated and the costs of institutional control where applicable;
- h. Address environmental protection issues.

Art. 57. The undertaking shall establish a financial guarantee during the operations to ensure that there is always adequate funding available for decommissioning, closure and, where applicable, institutional control, even if the operations are terminated prematurely.

Art. 58. The radioactive residues created by decommissioning and closure shall be managed in accordance with Section 8.

Art. 59. If large amounts of residues are to remain deposited at the site, these deposits shall be treated as waste disposal facilities and shall be properly constructed, closed and, where applicable, subject to ongoing institutional control, to ensure long term protection of the public and the environment.

Remediation conducted as part of decommissioning and closure

Art. 60. (1) The undertaking shall identify, plan, implement and verify the effectiveness of remedial actions to reduce exposure of the members of the public and, where appropriate, to allow the removal of restrictions on the use of or access to the site.

(2) Remedial actions giving rise to doses exceeding 1 mSv/a shall be justified as part of the overall justification of the practice as required in Art. 5(1).

(3) The remediation activities referred to in para (2) shall be subject to authorization by CNCAN, in the form of registration or licensing, as appropriate.

Art. 61. (1) In support of remediation activities, the undertaking shall develop and submit to CNCAN for approval a remediation plan as well as the associated safety assessment report developed according to Annex 8.

(2) The remediation plan shall include at least the actions specified in Annex 9.

Art. 62. The undertaking shall:

- a. Conduct the remediation work, including the management of the radioactive residues arising, in accordance with the remedial action plan.
- b. Take responsibility for all aspects of protection and safety, including the conduct of the safety assessment and the protection of occupationally exposed remediation workers in accordance with the relevant provisions of NSR-01.
- c. Monitor the area regularly during the remediation so as to verify levels of contamination, to verify compliance with the requirements for radioactive waste management, and to enable any unexpected levels of radiation to be detected and the remedial action plan to be modified accordingly, subject to approval by CNCAN.
- d. Perform a radiological survey after completion of remedial actions to demonstrate that the end point conditions, as established in the remedial action plan, have been met.

Art. 63. The undertaking shall prepare and submit to CNCAN a final remediation report in support of the application for release of the area from regulatory control as outlined in Annex 10.

Art. 64. The undertaking shall, where possible, identify and implement certain preventive and/or small scale remedial actions throughout the operational phase of the facility in order to reduce public exposure and minimize current liabilities, as well as to reduce long term costs and the number of larger and longer term remediation activities required during the decommissioning phase. Examples of this approach are given in Annex 11.

Termination of regulatory control

Art. 65. (1) On completion of the decommissioning and closure process, including remediation of contaminated areas, the undertaking shall conduct a final radiological survey of the site, to confirm that the agreed remediation end state has been reached and all other decommissioning and closure activities have been effective in meeting the specified objectives.

(2) The undertaking shall prepare and submit to CNCAN for approval a final characterisation report as part of the documentation in support of the application for release from regulatory control of the facility and site.

(3) On approval of the application referred to in para (2), CNCAN shall issue a certificate formally granting release from regulatory control and setting out any necessary requirements for institutional control in accordance with Chapter 5.

Chapter 4 Existing exposure situations

Section 1

General requirements

Art. 66. The following exposures to natural radiation sources shall be regarded as existing exposure situations for which CNCAN has responsibility or joint responsibility with other authorities:

- a. Exposures due to contamination of areas at legacy sites as a result of past activities that were not carried out in accordance with this regulation
- b. Exposures due to radionuclides in food, animal feed, agricultural fertilizer and construction materials
- c. Exposures to radon and its decay progeny in workplaces.

Section 2

Reference levels

Art. 67. (1) CNCAN shall determine reference levels for existing exposure situations on the basis of the feasibility of controlling the situation and experience in managing similar situations in the past.

(2) For exposure to radionuclides in commodities such as food, animal feed, fertilizers and construction material, the reference level should generally not exceed a value of about 1 millisievert per year.

(3) The reference level for ^{222}Rn in workplaces shall be set at a value that does not exceed an annual average activity concentration in air of 300 Bq/m³.

(4) CNCAN shall periodically review the reference levels to ensure that they remain appropriate in the light of prevailing circumstances.

Section 3

Identification of the need for remedial action and assignment of responsibilities

Art. 68. CNCAN, in consultation with other competent authorities, as appropriate, and the owners, shall prioritize those existing exposure situations for which remedial actions should be considered, taking into account all available information on the relevant existing exposure situations and the applicable reference levels.

Art. 69. For those existing exposure situations prioritised for remediation in terms of Art. 68, CNCAN, in consultation with other competent authorities as appropriate, shall assign responsibilities for the development and implementation of remediation plans and for the identification of adequate sources of funding of the remediation work.

Section 4

Remediation of contaminated areas

Art. 70. The party responsible for developing remediation plans in terms of Art. 69 shall develop a remediation plan for each contaminated area to be remediated in accordance with Annex 9 and in consultation with all interested parties including:

- a. CNCAN and other competent authorities as appropriate
- b. the party that was responsible for causing the contamination, if such party can be identified, is still in existence and can be located
- c. the owners, tenants and users of the contaminated site
- d. local government, municipal authorities and local communities
- e. relevant non-governmental organizations such as environmental groups.

Art. 71. (1) The remediation plan shall be developed taking into account all relevant factors such as

- a. the characteristics of the exposed population and the associated health risks
- b. the reduction in health risks expected to be achieved by the remediation
- c. the environmental impacts
- d. socioeconomic considerations
- e. the need for minimizing the amount of radioactive waste generated
- f. the need for minimizing the extent of post-remediation institutional control such as restrictions on access to or use of the remediated site
- g. the amount of funding likely to be available
- h. the availability of suitable remediation techniques and equipment.

(2) The remedial actions set out in the remediation plan shall be

- a. justified, in that they provide a positive net benefit
- b. optimized, in that the form, scale and duration of the remedial actions are such as to provide the greatest net benefit.

Art. 72. The party responsible for developing the remediation plan shall submit the plan to CNCAN for approval before any remediation work is carried out.

Art. 73. (1) If the party causing the contamination can be identified, is still in existence and can be located, that party shall be liable for the cost of the remediation work.

(2) If the party that was responsible for causing the contamination cannot be identified, is no longer in existence, cannot be located or is unable to bear the cost of the remediation work, the party to responsible in terms of Art. 69 for identifying adequate sources of funding shall attempt

to negotiate the provision of the necessary funding through voluntary and cooperative action by engaging with other competent authorities, as appropriate, and with other potential contributors such as

- a. the party responsible for causing the contamination, if it is still in existence and can be located
- b. the owners, tenants and users of the contaminated site and of nearby property
- c. local government, municipal authorities and local communities
- d. potential developers of the site after remediation
- e. liability insurance companies.

(3) If adequate funding for the remediation of a site cannot be guaranteed, CNCAN shall not approve the implementation of the remediation plan.

Art. 74. Any undertaking intending to carry out the remediation work shall comply with the relevant requirements for planned exposure situations set out in Chapter 3 of this regulation, including those associated with radiation protection, notification, determination of activity concentrations, prior radiological evaluation, authorization, protection of workers and management of residues.

Section 5

Exposure to radon in workplaces

Art. 75. (1) The undertaking shall ensure that the activity concentrations of ^{222}Rn in workplaces are as low as reasonably achievable below the reference level established in terms of Art. 67(3).

(2) The undertaking shall implement measures for optimization of the radiation protection.

Art. 76. In situations where the activity concentration of ^{222}Rn remains above the reference level established according with art. 67(3), despite all reasonable efforts by the employer to reduce it, the relevant requirements for occupational exposure in planned exposure situations, as stated in Chapter 3 of this regulation, including dose limitation requirements, shall apply.

Art. 77. For workplaces where the exposure to other radionuclides in the uranium or thorium decay chain is already controlled, the relevant requirements for occupational exposure in planned exposure situations, as stated in Chapter 3 of this regulation, including dose limitation requirements, shall apply.

Chapter 5

Institutional control of ongoing exposure to residual radioactive material

Art. 78. (1) Any institutional control measures identified in the remediation plan, such as monitoring, surveillance and restrictions on the use of or access to the remediated area, shall be reviewed, amended as necessary and then specified in the certificate issued by CNCAN as mentioned in Art. 65(3).

(2) CNCAN shall provide a duplicate of the certificate mentioned in para (1) to the competent authority responsible for ongoing institutional control, shall coordinate the transfer of responsibility for radiological safety at the site with that authority and shall notify the local authorities accordingly.

(3) At the time of transfer of responsibility for radiological safety at the site to the competent authority responsible for the implementation of institutional control, CNCAN shall establish arrangements with that authority for periodic review of the conditions at the site and the possible amendment or removal of institutional control measures.

Art. 79. If there are no restrictions on access to or use of the remediated area, the end state of the area shall be considered to constitute the background conditions for any new facilities and activities or for habitation of the area.

Chapter 6

Transitory and final provisions

Art. 80. For a practice that is already in operation at the time of entry into force of this regulation, the undertaking concerned shall achieve compliance with this regulation within 12 (24) months of the date of entry into force.

Art. 81. The Annexes 1 to 11 are integral part of this regulation as follows:

Annex 1: List of industrial and scientific activities and residues

Annex 1-a. List of industrial and scientific activities

- a) Industrial production and processing of niobium, tantalum or rare earth ores
- b) Production of thorium compounds and thoriated products
- c) Industrial use of materials containing thorium or uranium, which was added for other purposes than to use its fissile, fusible or fertile properties (Uranium glass or so-called "canary" glass, thoriated lenses, welding rods, gas lamp mantles, Th-Mg alloys, etc.)
- d) Industrial use of minerals with enhanced natural uranium or thorium content, such as abrasives, refractories
- e) Production of TiO₂ pigments from minerals such as ilmenite and rutile
- f) Processing of phosphate ores such as thermal phosphorus production, production of phosphoric acid, production of phosphate fertilizers
- g) Milling, micronization of zircon sands
- h) Industrial and commercial activities for maintenance, decommissioning and remediation of installations with residues according to Annex I-b

Annex 1-b. List of residues

- a) Sludge, scales, incrustations and other materials contaminated with them such as sediments and soils from the oil and gas industry; the production, processing, storage and distribution of water in regions with enhanced natural radioactive background; radon baths and spas; geothermal plants and spas; and treatment and discharge of mine effluents
- b) Sludge, sands, precipitates and incrustations from the chemical or hydrometallurgical processing of bauxite, ilmenite, rutile, phosphate ores, rare earth ores or other raw materials with enhanced natural radioactivity
- c) Waste rock, tailings, contaminated installations and equipment, dust, and sands from mining of ores or minerals with enhanced natural radioactivity
- d) Slag and residues from pyrometallurgical processing of niobium, iron, copper, zinc, tin, lead, aluminium as well as processing of phosphate rock
- e) Filter dust from exhaust gas filtration of sintering and pyrometallurgy of niobium, iron, copper, zinc, tin, lead, aluminium and phosphorus production

- f) Filter dust from exhaust gas filtration of sintering or firing of zircon and ceramics tiles
- g) Rubble from the decommissioning or remediation of industrial installations with refractories
- h) Ashes from thermal power station using coal, wood or peat.
- i) Solid materials from the industrial use or trade of thoriated products or other materials with high natural uranium or thorium content
- j) Piles, stacks, dumps or sediments as well as excavated soil or demolition rubble and scrap metal from former practices belonging to one of the above mentioned processes, if removed for decommissioning, site remediation or use of the materials.

Materials, which are re-used in the same facility from where they originate, are not considered residues.

Annex 2: Definitions and Terms

Activity (A) - The number of radioactive nuclides, which are disintegrating in an interval of time. The measurement unit of activity A is Becquerel.

Background radiation - Radiation:

- a. due to natural radionuclides contained in the human body and unincorporated as result of a practice
- b. cosmic radiation at the ground level
- c. present at or near the surface of the Earth due to natural radionuclides from the unperturbed geological environment.

Closure - The administrative and technical actions directed at a repository at the end of its operating lifetime — e.g. covering of the disposed waste in a near surface repository — and the termination and completion of activities in any associated structures.

Controlled residue - Residues with both activity and activity concentration exceeding the criteria set forth in Annex III-a (4). The treatment of such residues requires control in order to ensure the radiation protection for members of the public.

Decommissioning - The administrative and technical actions taken at the end of the operating lifetime of a facility to retire the facility from service and allow the removal of some or all of the regulatory controls. Decommissioning may include the dismantling and decontamination of structures and equipment, the remediation of contaminated areas to reduce the levels of residual radionuclides, and the construction of waste repositories on site.

Existing exposure situation - A situation of exposure that already exists when a decision on the need for control needs to be taken. Existing exposure situations include situations of exposure to natural background radiation.

Exposure pathways - The pathways through which the radioactive material reaches, or can irradiate, the human body.

Exposure - The irradiation process of a person.

Increase of radiation exposure - Exposure of a person from a natural radiation source amenable to control above background radiation.

Institutional control - control of a site containing residual radioactive material 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 (e.g. near surface repository).

Legacy site - a site developed in the past without appropriate regulatory oversight for which the party responsible cannot be found or is financially unable to carry out the required management or remediation measures within an acceptable time frame.

Undertaking - Any natural or legal person, which is responsible for activities involving natural radiation sources within the framework of this regulation.

Material - Substance other than of food, feed, agricultural fertilizer, drinking water and soil amendments, construction material and existing residues in the environment that contains no significant amounts of radionuclides other than naturally occurring radionuclides and is designated by the regulatory body as being subject to regulatory control because of its radioactivity.

Natural radiation source - Radiation sources of natural origin (terrestrial or cosmic)

Natural radionuclides - Radioactive elements of natural origin

Optimization - The process of determining what level of protection and safety would result in the magnitude of individual doses, the number of individuals (workers and members of the public) subject to exposure and the likelihood of exposure being “as low as reasonably achievable, economic and social factors being taken into account” (ALARA).

Planned exposure situation - A situation of exposure that arises from the planned operation of a source or from a planned activity that results in an exposure due to a source. Since provision for protection and safety can be made before embarking on the activity concerned, the associated exposures and their likelihood of occurrence can be restricted from the outset. The primary means of controlling exposure in planned exposure situations is by good design of facilities, equipment and operating procedures, and by training. In planned exposure situations, exposure at some level can be expected to occur.

Practice - Any human activity that introduces additional sources of exposure or additional exposure pathways, 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.

Radiation protection expert - A person having the necessary knowledge and training needed to carry out the physical, technical or radiochemical tests which allow the doses evaluation and/or for give advice in order to ensure an effective protection of individuals and the correct use of protective equipment and whose capacity to act as an expert in this sense is recognized by CNCAN. This recognition consists of issuing of exercising permit, in accordance with the specific regulations issued by CNCAN.

Remedial action - The removal of a source or the reduction of its magnitude (in terms of activity or amount) for the purposes of preventing or reducing exposures that might otherwise occur.

Remediation - Any measures that may be carried out to reduce the radiation exposure due to contamination of land areas through actions applied to the contaminant itself (the source) or to the exposure pathways to humans.

Residue - Material arising from practices specified in Annex I-b which the holder discards or intends or is required to discard . Residues are also materials that arose in past practices which are removed from the site if the owner company still exists.

Safety assessment - Assessment of all aspects of a practice that are relevant to protection and safety.

Significant increase of radiation exposure - Increase of the radiation exposure exceeding a certain level, so that the exposure cannot be disregarded from the radiation protection point of view. Within the framework of these norms the increase of radiation exposures below 0.3 millisievert per year is not considered as a significant increase.

Treatment of residues

- Treatment means the recovery or disposal. Any operation involving residues after removal from an operator's premises where they have originally occurred, other than collection and transport;

- Recovery includes the re-use by which products or components that have become waste are used again for the same purpose for which they were conceived and the recycling by which materials are transformed into new products, materials or substances whether for the original or other purposes.;

- Disposal means the final deposition of materials at a licensed waste disposal site;

- Operations involving residues on an operator's premises where they have originally occurred are activities according to Art. 2 (1) and are not considered as treatment of residues in the framework of these norms.

Annex 3: Basic Information to be reported to CNCAN in terms of Art.8

1. GENERAL INFORMATION

- Name and headquarters address of the undertaking according to Art. 8
- Name and position of legal representative
- Name(s) of responsible site manager(s) (if different from representative above)
- Addresses and cadastral details of workplaces
- Name, address and CNCAN approval number of radiation protection expert
- Types of practice according to Annex 1-a
- Types of residue according to Annex 1-b

2. SITE SPECIFIC INFORMATION ON WORKPLACES

- Number of workplaces at each location
- Materials of potential radiological concern at each location and the amounts handled annually:
 - [a] Niobium, tantalum or rare earth ores?
 - [b] Thorium compounds and thoriated products?
 - [c] Materials containing thorium or uranium?
 - [d] Minerals with enhanced natural uranium or thorium content?
 - [e] Ilmenite, rutile?
 - [f] Phosphate ores, materials processed for thermal phosphorus production or production of phosphoric acid, phosphate fertilizers?
 - [g] Zirconium sands?
 - [h] Residues according to Annex 1-b?
 - [i] Others, to be specified.
- Industrial or scientific activities carried out with the identified materials and the associated annual worker exposure times
- Description of identified materials; amounts handled annually; methods of recycling, by-product use or disposal; gamma dose rate at 1 m distance from the source
- Activity concentrations of radionuclides in the identified materials, as specified in Annex4, provided that such materials give rise to a gamma dose rate exceeding 0.3 $\mu\text{Sv/h}$ at a

distance of 1 meter; date and location of sampling; details and CNCAN accreditation number of analysis laboratory

- Any other relevant information

Annex 4: Radionuclide activity concentrations to be determined

Material	Radionuclides
Monazite sand, residue from rare earths extraction	232Th, 228Ra
Scale and sludge from rare earths extraction	228Ra, 226Ra, 228Th
Niobium/tantalum concentrate, slag from thorium/tantalum extraction	238U, 232Th
Furnace dust from niobium/tantalum extraction	210Pb, 210Po
Other residues from niobium/tantalum extraction	238U, 232Th, 226Ra
Uranium containing products	238U
Thorium concentrate, thorium containing products	232Th, 228Ra
Zircon sand, zircon refractories, fused zirconia	238U, 232Th
Furnace dust from zirconia production	210Pb, 210Po
Titanium dioxide feedstocks	232U, 232Th
Scale from titanium dioxide pigment production	226Ra, 228Ra
Phosphate rock, phosphoric acid, phosphate fertilizer	238U
Phosphogypsum, scale from phosphoric acid production	226Ra
Furnace dust from thermal phosphorus production	210Pb
Slag from thermal phosphorus production	238U
Produced water from oil and gas production	228Ra, 226Ra, 224Ra
Scale and sludge from oil and gas production	226Ra, 228Ra, 224Ra, 210Pb
Non-uranium metal ores	238U, 232Th
Scale and furnace dust from smelting of metals	210Pb, 210Po
Sludge from smelting of metals	210Pb
Slag from smelting of metals	238U, 232Th, 226Ra
Bauxite	232Th
Red mud from processing of bauxite	238U, 232Th
Bottom ash from coal fired power generation	238U, 226Ra
Flyash from coal fired power generation	210Pb, 210Po
Scale from coal fired power generation	226Ra, 210Pb
Scale from mines with radium rich fissure water	226Ra, 228Ra
Mine waste rock and tailings	238U, 232Th, 226Ra, 228Ra
Water treatment sludge	226Ra

Annex 5: Principles for Dose Assessment

Doses received by workers

To determine the representative range of doses received by workers, exposure levels (e.g. gamma dose rates, airborne dust activity concentrations) and corresponding exposure periods should be determined wherever workers may be exposed to material with elevated radionuclide concentrations, with particular attention paid to workplaces associated with:

- Routine operations involving material with highly elevated radionuclide concentrations, even in small amounts and in shielded locations;
- Routine operations involving bulk quantities of material, even if the radionuclide concentrations are only moderately elevated;
- Routine operations involving high airborne dust concentrations;
- Non-routine operations such as periodic maintenance and repair activities involving closer contact with material than during normal operations.

The following principles shall be applied:

- (1) For each area, the dose calculation should include the following types of exposure:
 - a. External exposure;
 - b. Internal exposure by inhalation and, where appropriate, ingestion of dust;
 - c. Where necessary in terms of Chapter 4 of this regulation, internal exposure from the inhalation of radon progeny.
- (2) The radiation exposure should be calculated based on realistic exposure pathways and exposure assumptions without taking into consideration any special radiation protection measures.
- (3) Doses due to external exposure should be estimated by summing the products of the dose rates and the annual exposure period (for both routine and non-routine activities).
- (4) Doses due to the inhalation of airborne dust should be calculated from the dust activity concentration in air (activity per unit volume of air) and the annual exposure period. The dust activity concentration in air may be measured directly or may be calculated from measurements of dust mass concentration in air and the activity per unit mass of dust.. If dust concentrations are not available, conservative concentration values of 1 mg/m³ (outdoors) and 10 mg/m³ (indoors) should be used. If a sufficient number of appropriately taken dust samples have been analysed, a

representative activity per unit mass derived from the measurements should be used. Otherwise, the measurement with the maximum activity per unit mass should be used.

- (5) For the rate of inhalation, 1.2 m³/h should be used as the default value.
- (6) Internal exposure by ingestion of materials should be included only if there are special conditions that may result in significant exposure by this pathway. If no specific ingestion rates have been determined, a rate of 20 g/a or 10 mg/h should be used.
- (7) The internal exposure from inhalation and ingestion should be calculated using the dose coefficients of Annex 4, Table 4-C1 of NSR-01.
- (8) Where, in terms of Chapter 4 section 5 of this regulation, exposure to radon progeny has to be included in the dose calculation, this should be determined using the measured radon concentration and the annual exposure period.

Doses received by members of the public

In the case of residues, including discharges, that may give rise to members of the public off site, the calculation of the doses received by members of the public should take into consideration all exposure situations that may result from the intended discharge, disposal or recycling of the residue, or from its use as a by-product.

In the case of disposal of residues at landfills or underground repositories, the calculation of doses received by members of the public should take into consideration all exposure situations that may be associated the intended disposal route, including exposures resulting from the pre-treatment, storage and deposition of the residue.

In the calculation of doses received by members of the public, internal exposure by ingestion of material or food, including drinking water, should be included if the site specific conditions indicate a significant exposure by these pathways.

Doses due to internal exposure should be calculated using the dose coefficients of Annex 4, Tables 4-A and 4-B of NSR-01 or other justified dose coefficients accepted by CNCAN and using the following default values for the rate of inhalation:

Age	Rate of inhalation
<1 a	0.12 m ³ /h
1 - 2 a	0.22 m ³ /h
2 - 7 a	0.36 m ³ /h
7 - 12 a	0.64 m ³ /h
12 -17 a	0.84 m ³ /h
> 17 a	0.93 m ³ /h

Annex 6: Results of prior radiological evaluation

Information on measurements of exposure rate

- Measuring devices including type/make, lower limit of determination as specified in the data sheet, quality certificates (calibration record as issued by manufacturer or service provider with date of latest calibration)
- Measurements of gamma dose rate in $\mu\text{Sv/h}$ at a distance of 1 m from the source at specified locations
- Measurements of dust activity concentration in mBq/m^3 , or dust mass concentration in mg/m^3 at specified locations
- Measurement of radon concentration in Bq/m^3 (2 m above ground) at specified locations
- Date of investigation
- Name of the person who carried out the measurements

Information on dose assessment

- Selection of relevant exposure pathways for workplaces and off-site environment
- Description of exposure scenarios
- Description of reasons for use of specified parameters
- Dose calculation for workers
- Assessment of the potential exposures of the public
- Author of the report and date

Annex 7: Content of a licence application

- a) The radiation monitoring and dose assessment programme for the relevant workplaces
- b) <where applicable> The environmental radiation monitoring programme according to NSR-22 in order to confirm that the off-site radiological impact is in compliance with NSR-01
- c) A plan for characterisation of the site;
- d) <where applicable>An environmental impact assessment report;
- e) The proposed measures to be taken for protection and safety, including an occupational safety and radiation protection programme;
- f) The proposed project management structure and qualifications of personnel to be engaged in implementing the <practice or remediation, as appropriate>;
- g) A training programme to ensure the <practice or remediation, as appropriate> can be safely implemented;
- h) A plan for assuring that the necessary resources, financial, manpower, and equipment, will be available when required;
- i) <only for practices>A preliminary decommissioning plan;
- j) A public information programme;
- k) A programme for the management of controlled residues;
- l) A quality assurance programme;
- m) Copies of bank documents confirming that the fees and tariffs for licensing have been paid.

Annex 8: The components of the safety assessment process

- (1) Specification of the assessment context;
 - a) Assessment philosophy
 - Estimation of worker dose during work in the practice or remediation
 - Use of the graded approach to assessment
 - Type of public exposure assessment, deterministic or probabilistic
 - Type of model used, simple or complex
 - Type of assumptions for input parameters, conservative or realistic
 - The treatment of uncertainties
 - b) Regulatory framework
 - Radiological safety criteria for workers and the public
 - Must impacts on non-human biota be determined?
 - Definition of receptors
 - Consideration of non-radioactive hazardous substances
 - c) Assessment time frame
 - The time frame of the operating practice or remedial action for worker and public dose assessment
 - The time frame of the public dose assessment following decommissioning and/or remediation must be indicated and justified. Since the lifetimes of naturally-occurring radionuclides are very long and the uncertainties in the result of any assessment increase with time, a time frame of 200 years is generally considered acceptable. In certain cases, however, CNCAN may require that the modelling should be carried out until the peak of the dose occurs, however, usually not longer than 1000 years
- (2) Description of the practice or site to be remediated;
 - a) The practice, especially activities involving the handling or contact with NORM must be described, the number of workers, and the times spent in each activity and location, any off-site emissions expected
 - b) In the case of remediation of a decommissioned or legacy site, the site to be remediated, its location, any structures and noteworthy features, types of contaminated material must be described

- c) The characteristics and spatial distribution of contaminated material, both radioactive and non-radioactive hazardous
- d) The magnitude and distribution of radiation fields
- e) Any existing barriers or control systems to contain the contaminated material
- f) The hydrological, hydrogeological, meteorological, etc. properties of the site and surroundings to identify and quantify the various pathways to the public
- g) The characteristics and habits of the receptors, land use, etc.
- (3) Description of remedial options for sites requiring remediation
 - a) For each remedial option
 - Types of activities, number of workers, time spent
 - Off-site emissions during the remediation
 - (4) Development and justification of scenarios;
 - a) Identification and quantification of hazards and initiating events during the practice or remediation
 - b) Types of initiating events for operational upsets and accidents should be identified
 - c) Screening of hazards, during normal operations, maintenance activities, and accidents
 - For workers, this can include the magnitude of radiation fields and exposure times, the risk of internal exposure from dust and radon
 - For the public, the concentrations of contaminants, the risk and consequences of airborne and waterborne contaminants, the proximity and risk from external radiation can be considered
 - d) All relevant scenarios arising from operations or accident situations in which the screened hazards could be realized should be identified
 - e) All relevant scenarios in which exposure to members of the public are possible should be identified and screened
- (5) Formulation and implementation of models;
 - a) Development of a conceptual model for the operating practice or the site to be remediated
 - b) Development of a mathematical model
 - c) Use of a computer model, either simple, or complex, if required
 - d) Choice of the appropriate model(s) for the appropriate phase of the assessment
 - e) Input data requirements

- (6) Performing simulations and analysing the results, including sensitivity and uncertainty analyses;
 - a) Graded approach
 - A graded approach shall be used in determining the scope and level of detail of the safety assessment carried out for any particular facility or activity, consistent with the magnitude of the possible radiation risks arising from the facility or activity
 - In the screening of hazards and or remedial options, the scope and level of detail of the assessment should be sufficient to determine the difference in risks
 - b) Assembly of required input data and parameters
 - c) Screening of hazards
 - Simulations may be necessary for screening hazards that are not readily quantifiable
 - d) Optimization of remedial options
 - An iterative process between remedial option selection and assessment of the option is a vital part of the optimization process
 - e) Assessment of the practice or the preferred remedial option
 - In the final assessment, the graded approach must be considered consistent with the magnitude of the possible radiation risks and available input data
 - f) Perform sensitivity and uncertainty analyses on parameters and calculated doses
- (7) Comparison against assessment criteria; and
- (8) Review and modification of the assessment if necessary (iteration).

Annex 9: Actions to be included in a remediation plan

The remediation plan addresses all crucial aspects of the remediation and closure process, including the management of radioactive waste arising from the remedial work, on-site and off-site safety, environmental monitoring, the need for an environmental impact assessment, stakeholder engagement and post-remediation management. The remediation plan takes into account all components of the site and all significant sources of risk. A remedial action plan should include at least the following actions:

- a. Initial site evaluation and prioritization;
- b. Engagement of stakeholders such as CNCAN, other relevant authorities, the general public and other interested parties;
- c. Site characterization, including a description and boundaries of the site to be remediated, any buildings or structures remaining, the contaminants of concern (radiological and chemical), and an assessment of the risks to members of the public;
- d. Project management structure and qualifications of implementing personnel;
- e. A training programme to ensure the safe implementation of the remediation;
- f. Establishment of the remediation objectives, including desired future uses of the site and any structures to be left intact, and safety principles;
- g. Development and description of remediation options;
- h. Selection of the optimum remediation option;
- i. Conducting a safety assessment and an environmental impact assessment for the proposed activities (for each option initially for input into the optimization and for the optimum option in greater detail) and for the end state after release of the site;
- j. Development of a detailed remediation implementation plan that includes:
 - A description of the proposed remediation activities and the equipment, resources, schedule, and timescales for their implementation;
 - Site security measures/access control during remediation;
 - Control measures to minimize air emissions and control surface water;
 - A specification of the remediation end points and the associated remediation criteria that have to be met;
 - A description of the measures taken for the protection of workers and the public;

- A description of monitoring activities during remediation, as well as on completion of remediation to demonstrate that the end point criteria have been met;
 - A description of the management system applied to the remediation process, including quality assurance and record keeping;
 - Contingency plan for unforeseen contaminant releases and, where appropriate, an emergency response plan;
- k. Developing cost estimates for the specified activities and identifying the sources of the necessary funding;
- l. Implementation of the remediation activities;
- m. Management of radioactive residues arising from the remediation;
- n. Post-remediation monitoring and evaluation.

Annex 10: List of contents of a remedial action completion report

A report should be produced following completion of all remediation activities. This remedial action completion report should include at least the following:

- a. Statement of remediation criteria
 - o This section contains the objectives of the remediation and the criteria developed to ensure the objectives have been met. A statement indicating that all criteria have been satisfied must be made here.
- b. End-state of remediated site
 - o In this section, compliance with the criteria is demonstrated using the results of verification monitoring. In addition, the final physical state of the site is described, including any remaining structures.
- c. Summary of worker and public doses during remediation
 - o This section includes a summary of the worker dose monitoring programme and the results of monitoring of off-site emissions and estimates of the doses to workers and the public during the remediation.
- d. Future use of site
 - o In this section, the future use of the site that is considered at the time is presented, including the future use of any remaining structure. Any necessary restrictions on future use of the site are also summarized here.
- e. CNCAN sign-off, any conditions
 - o This section presents CNCAN agreement that the conditions of the authorization governing the remediation project have been met. This could be on condition that some minor outstanding actions, given in f. are completed.
 - o It also contains any conditions given by CNCAN on the final release of the site for its intended use or conditions that must be satisfied prior to its release from regulatory control. This would include any post-remediation monitoring and surveillance requirements and any periodic maintenance requirements.
 - o In this section, the mechanisms for institutional control, if necessary, would also be presented.
- f. Actions to meet any remaining conditions
 - o In this section, any additional remedial actions required for the release of the site from regulatory control would be outlined.
 - o The post-remediation monitoring and surveillance programme would be described.

- o The periodic maintenance programme would be described.

Annex 11: Preventive actions and small scale remedial actions that should be considered during the operation of a facility

Preventive actions and small scale remedial actions include:

- a. Engaging with the public living nearby in terms of their interaction with the site, through education programmes and public meetings, in order to increase public awareness of the physical and radiological hazards associated with the facility;
- b. Discouraging public access to the site, for instance by the installation of fencing and warning signs;
- c. Directly remediating contaminated areas of the site, for instance by:
 - Regrading of waste rock piles and stabilizing them with soil covers;
 - Covering contaminated areas with clean material such as soil or waste rock;
 - Removing contaminated material and equipment from the site and salvaging anything that is economically valuable;
 - Addressing groundwater contamination at an early stage, when its impact on the environment is still limited;
- d. Characterizing and segregating all residues adequately so that clean material and contaminated material are not unnecessarily mixed;
- e. Diverting clean water away from sources of contamination and recycling wastewater back to the process circuit or using it for dust suppression, in order to minimize the volume of water that will become contaminated (and thus the costs of eventually dealing with it);
- f. Characterizing minewater in order to understand the levels of potential contamination and neutralizing acidic water as soon as practicable;
- g. Using early remediation as an opportunity for trying out new remediation techniques and for implementing and monitoring innovative approaches to remediation well in advance of the final site decommissioning activities.
- h. Restricting access to areas of higher radiation in which personnel are required only for infrequent activities, e.g. maintenance.