Action: SPESS Step 11 – Second review of the draft safety standard by the SSC(s).
Incorporating NUSSC Members Comments made at NUSSC 34.
Incorporating WASSC 34 comment (i.e. ENISS comment #10 on V5)
Awaiting confirmation from NUSSC Chair on incorporation of ENISS comments.

ADDENDUM TO NS-R-5

APPENDIX IV – REPROCESSING FACILITIES

APPENDIX V – FUEL CYCLE RESEARCH & DEVELOPMENT FACILITIES

DRAFT SAFETY REQUIREMENTS DS439

The general text in NS-R-5 “Safety of Nuclear Fuel Cycle Facilities”, provides safety requirements that are applicable to all fuel cycle facilities, to be applied in a graded way, whilst the appendices in NS-R-5 provide supplementary safety requirements that are specific to a facility.

This draft, comprising NS-R-5 Appendices IV & V, is therefore to be read inconjunction with NS-R-5, as these appendices will be added to NS-R-5.

Appendix IV

REQUIREMENTS SPECIFIC TO REPROCESSING FACILITIES

The following requirements are specific to reprocessing facilities using liquid-liquid extraction processes (e.g. PUREX processes) on an industrial scale. Reprocessing facilities are involved in the treatment of spent fuel from nuclear power plants and from research reactors to recover fissile material (uranium and plutonium) for the manufacturing of fresh fuel, e.g. MOX fuel for light water reactors or fuel for fast breeder reactors. The processes covered here are: the shearing, decladding and dissolution of spent fuel; all the chemical cycles of separation and purification (including removal of solvents from aqueous solutions, treatment and reconditioning of solvents, and recovery of acids); the concentration of fission products and plutonium and uranium nitrates; the conversion of plutonium nitrate and uranium nitrate to oxides; the storage of these products and the interim storage of waste from the process stream (e.g. the storage of solutions of fission products in vessels).

In reprocessing facilities, the full range of radioactive materials and risks that may be encountered in the nuclear fuel cycle are present.

This appendix does not cover out-of-core reprocessing processes, such as those that are carried out in cask unloading facilities, spent fuel storage facilities and waste conditioning facilities, e.g. facilities for vitrification of high level waste or for immobilization of radioactive sludge. Safety requirements for waste conditioning facilities are provided in Ref. [2][1].

SITING

IV.1. In the siting of new reprocessing facilities on complex and large site areas, which may contain a number of facilities, account shall be taken of the potential for interactions with existing facilities, irrespective of their status, i.e. under construction, under commissioning, in operation, shutdown or being decommissioned. Requirements for site evaluation for nuclear installations are established in Ref. [17].

DESIGN

SAFETY FUNCTIONS

[1] Reference [2] of the main text is IAEA Safety Standards Series No. WS-R-2. This has now been superseded by Predisposal Management of Radioactive Waste, IAEA Safety Standards Series No. GSR Part 5, IAEA, Vienna (2009).

IV.2. The facility shall be designed to prevent a criticality accident and the accidental release of hazardous materials. The design shall keep radiation exposures from normal operations and accident conditions as low as reasonably achievable.

ENGINEERING DESIGN

IV.3. The design shall take into account feedback from operating experience at similar facilities and relevant operating experience at other industrial facilities.

Cooling

IV.4. Cooling systems, including any support features, shall have adequate capacity, availability and reliability to remove heat from radioactive decay or, if necessary, due to chemical reactions.

IV.5. Cooling systems, including any support features, for removing heat due to chemical reactions shall have adequate capacity, availability and reliability to prevent an uncontrolled increase in temperature, e.g. from a fire during the dissolution of metal spent fuel in nitric acid.

IV.6. Cooling systems shall be designed to minimize the risk from coolant leaking into areas where this could cause a criticality hazard.

Sampling and analysis

IV.7. Appropriate means shall be provided for measuring the parameters that are relevant to the safety of the reprocessing facility, both:

- In normal operation to ensure that all processes are being conducted within the operating limits and conditions and to monitor their environmental impact;
- For detecting and managing accident conditions, such as criticality.

IV.8. Provision shall be made for monitoring radioactive effluents and effluents with possible contamination, prior to and during their discharge from the facility to the environment.

CRITICALITY PREVENTION

IV.9. Criticality safety shall be ensured by means of preventive measures.

IV.10. Preference shall be given to achieving criticality safety by engineering design, to the extent practicable, rather than by administrative measures.

IV.11. As part of the overall safety assessment of the facility, a criticality safety assessment shall be performed prior to the commencement of any activity involving fissile material. The wide range of possible forms of fissile material and their associated process conditions shall be taken into account in the assessment. Safety criteria and safety margins shall be developed to ensure sub-criticality on the basis of the neutron multiplication factor, k_{eff}, and/or on the basis of control parameters, such as geometry, mass, concentration, density, enrichment or moderation.

IV.12. A reference composition for the fissile material (reference fissile medium) shall be defined. The criticality safety assessment performed using such a reference shall be a conservative bounding case for the actual composition of the fissile material being handled or processed, e.g. on the basis of its mass, volume and isotopic composition. It shall be ensured by means of the assessment that processes are conducted within the operating limits and conditions.

IV.13. A reference flow sheet shall be defined. This shall specify compositions and flow rates for active feed material and reagent feed material. Faults relating to incorrect reagent flows or compositions having the potential to impact criticality safety shall be assessed.

IV.14. Particular consideration shall be given to those system interfaces[2] for which there is a change in the state of the fissile material[3] or in the criticality control mode. Particular consideration shall also be given to the transfer of fissile material from equipment with a safe geometry to equipment with geometry not meeting the safety criteria.

IV.15. If the design of the reprocessing facility takes into account burn-up credit, its use shall be appropriately justified in the criticality safety assessment.

IV.16. In the criticality safety assessment, account shall be taken of the potential for mis-direction, accumulation, overflow and spills of fissile material (e.g. mis-transfer due to human error) or for carry-over of fissile material (e.g. from evaporators). Consideration shall be given to the potential for leaks to evaporate leading to an increase in concentrations, particularly if there is a potential for fissile material to leak onto a hot surface.

IV.17. In the criticality safety assessment, the choice of fire extinguishing media (e.g. water or powder), and the safety of their use shall be addressed.

IV.18. In the criticality safety assessment, account shall be taken of the effects of corrosion, erosion and vibration in systems exposed to oscillations, e.g. leaks and changes in geometry. When criticality control of fissile liquid is achieved by geometry; loss of containment shall be anticipated by, for example, the use of criticality safe drip trays or detection of liquid level.

IV.19. In the criticality safety assessment, consideration shall be given to the potential for internal and external flooding and other internal and external hazards that may compromise measures for criticality prevention.

IV.20. In the criticality safety assessment, the potential use of neutron poisons, such as gadolinium or boron shall be addressed, in normal operation (e.g. to increase the safe mass of fissile material in a dissolver), during deviations from normal operation (e.g. dilutions of soluble neutron poisons below a specified limit of concentration) and in accident conditions.

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[2] System interfaces may occur in the course of transfer of fissile material between different locations, e.g. between different processes, process vessels, sub-facilities or rooms.

[3] The state of the fissile material includes, for example, its physical and chemical forms and concentration.

CONFINEMENT OF RADIOACTIVE MATERIAL

IV.21. Containment shall be the primary method for confinement against the spreading of contamination. Confinement shall be provided by two complementary containment systems — static (e.g. physical barrier) and dynamic (e.g. ventilation). The containment systems shall be designed:

- To prevent unacceptable dispersion of airborne contamination within the facility;
- To keep the levels of airborne contamination within the facility below authorized limits and as low as reasonably achievable.

IV.22 The static containment shall have at least one static barrier between radioactive materials and operating areas (workers) and at least one second static barrier between operating areas and the environment.

Kommentar [DDJ1]: This added paragraph needs confirmation of acceptance by NUSSC. Final NUSSC conclusion will be provided at the CSS meeting

Kommentar [JG2]: ENISS comment #10 on Version 5 approved at the RASSC33/WASSC34 meeting.

IV.23. The dynamic containment shall be designed to create a pressure differential to induce airflow toward areas that are more contaminated. The static containment shall be designed such that its effectiveness is maintained as far as achievable in case of loss of dynamic confinement.

IV.24. In the design, account shall be taken of the performance criteria for the ventilation system, including the pressure difference between zones, the types of filter to be used, the differential pressure across filters and the appropriate flow velocity for operational states.

IV.25. The efficiency of filters, including improper installation resulting in efficiency loss, and factors potentially damaging the filters (e.g. their resistance to high humidity, chemicals, high temperatures and high pressure of the exhaust gases, and fire conditions), and the build-up of materials, shall be taken into consideration. The ventilation system design, including filters, shall facilitate testing.

Occupational protection

IV.26. In normal operation, internal exposure shall be minimized by design and shall be as low as reasonably achievable.

IV.27. Consideration shall be given to the potential for radiation exposure from leakage or mis-direction of radioactive material.

IV.28. The design and layout of plant equipment shall include provisions to minimize exposure arising from maintenance, inspection and testing activities, as far as reasonably practicable. Specific attention shall be paid on design of equipment installed in hot cells, e.g. high active units.

IV.29. Within the design of the facility, consideration shall be given to further increasing shielding designed to address external exposure, where practical, in order to reduce the consequences of a criticality accident.

IV.30. The design and layout of shielding shall take account of its potential for degradation.

Protection of the public and environmental protection

IV.31. Systems shall be provided at the reprocessing facility for the treatment of liquid and gaseous radioactive effluents to keep their amounts below the authorized limits for discharges and as low as reasonably achievable.

IV.32. In the design of the reprocessing facility, it shall be ensured that aerial and liquid radioactive effluents from the reprocessing facility site are collected, appropriately treated (e.g. filtered) and confirmed to be within authorized limits prior to their discharge, through appropriate means, to the environment.

POSTULATED INITIATING EVENTS

Internal initiating events

Fire and explosion

IV.33. The risk of fire, explosion and excess internal pressure due to the following shall be considered and appropriate safety measures shall be implemented:

- The use of explosive gases, flammable liquids and chemical substances such as hydrogen or hydrogen peroxide, nitric acid, tributyl phosphate (TBP) and its diluents and hydrazine nitrate;
- The generation of hydrogen by radiolysis in aqueous or organic solutions and solids;
- The formation of explosive or flammable products by chemical reactions, e.g. nitrated organic substances (red oils);
- Pyrophoric materials, e.g. small particles of zircaloy.

IV.34. In areas with potentially explosive atmospheres, the electrical network and equipment shall be adequately protected.

IV.35. A detection and alarm system and/or suppression system shall be installed that is commensurate with the risks of fires and explosions.

IV.36. In order to prevent the propagation of a fire through ventilation ducts and to maintain the integrity of firewalls, ventilation systems shall be equipped with fire dampers at appropriate locations.

Equipment failure

IV.37. In the design of a reprocessing facility, plant equipment for use in a radiological and nuclear environment shall be suitably assessed for its adequate performance or potential failure. Measures for the industrial safety of non-nuclear-designed equipment installed in glove boxes or hot cells (e.g. mechanical guards, fuses, seals, insulation) shall be adapted to the environment if necessary.

Leaks

IV.38. Provisions to prevent, detect and collect leaks arising from corrosion, erosion and vibration in systems exposed to oscillations shall be implemented. Consideration shall be given to equipment containing acid solutions, especially when such solutions are at high temperatures.

Flooding

IV.39. Reprocessing facilities shall be designed to prevent leakage of contaminated liquid to the environment in the event of internal flooding.

Loss of support systems

IV.40. In the design of a reprocessing facility, the potential for a long term loss of support system support features, such as cooling and energy supplies, that are required by a safety system shall be considered and the impact of such a loss on safety shall be assessed.

IV.41. The design of the electrical power supply to a reprocessing facility shall ensure its adequate availability, sustainability[4] and reliability. In the event of a loss of normal power, even for a significant period, e.g. several days, an emergency electrical supply shall be provided to the relevant items important to safety, which will depend on the operational status of the reprocessing facility (e.g. normal operation, shutdown, maintenance or clean-out of the facility). The restoration of the electrical power supply shall be planned and shall be exercised to ensure its adequate and timely deployment following such a loss of normal power.

Load drops

IV.42. In the design of a reprocessing facility, the possibility of load drops shall be considered and their impact on safety shall be assessed.

Missiles

IV.43. In the design of a reprocessing facility, the possibility of missiles generated by rotating components shall be considered and their impact on safety shall be assessed.

External Initiating Events

Earthquake

IV.44. Considering seismic hazards, an adequately conservative ground motion shall be selected to ensure:

- The stability of buildings and transfer canals between buildings and to assure the ultimate barrier of confinement in case of an earthquake,

[4] Sustainability, in this context, means having the capability to perform its required function for an extended period of time, such that a safe state can be reached or alternative provisions can be put in place.

taking into consideration the consequences to the workers, the public, and the environment;

- Relevant SSCs availability during and after the earthquake.

IV.45. Provisions (e.g. instrumentation, support systems and procedures) shall be provided for the post-earthquake monitoring of the status and safety functions of the reprocessing facility.

Extreme weather conditions

IV.46. Extreme weather conditions shall be taken into account in the design of items important to safety (including their location), in particular for cooling systems for the removal of decay heat in the storage of high level waste.

INSTRUMENTATION AND CONTROL SYSTEMS

Instrumentation

IV.47. Adequate means shall be provided for measuring process parameters that are relevant to the safety of the reprocessing facility, both:

- In normal operation, to ensure that all processes are being conducted within the operating limits and conditions and to provide indication of significant deviations in processes;
- For detecting and managing accident conditions, such as criticality or adverse effects due to external hazards such as an earthquake or flooding (e.g. fire, release of hazardous materials, loss of support systems).

IV.48. When used, safety automated control systems shall be designed to be highly reliable, consistent with their role in the safety of the facility.

RADIOACTIVE WASTE AND EFFLUENT MANAGEMENT

IV.49. The design of the reprocessing facility shall enable safe management of radioactive waste and effluents arising from operational states, maintenance and periodic clean-out of the facility. Due consideration shall be given to the various natures, compositions and activity levels of the waste generated in the facility.

IV.50. The design of reprocessing facilities shall endeavour, as far as reasonably practicable, to ensure that all wastes anticipated to be produced during the life cycle of the facility have designated disposal routes. Where these routes do not exist at the design stage of the reprocessing facility, provisions shall be made to facilitate envisioned future options.

COMMISSIONING

COMMISSIONING PROGRAMME[5]

IV.51. Particular consideration shall be given to ensuring that no commissioning tests are performed that might place the facility in an unanalysed or unsafe condition. Each safety function shall be verified as fully as practicable before the proceeding to a stage in which that function becomes necessary.

IV.52. The ability to test and maintain the reprocessing facility's structures, systems and components after operation commences shall be addressed in the commissioning programme, especially for hot cells and remote equipment.

COMMISSIONING STAGES

Inactive commissioning

IV.53. Inactive commissioning (or 'cold processing') includes all commissioning and inspection activities with and without the use of non-active solutions, before the introduction of radioactive material.

IV.54. The following activities shall, as a minimum, be performed[6]:

- Confirmation of the performance of shielding and confinement systems, including confirmation of the weld quality of the static containment;
- Confirmation, where practicable, of the performance of criticality control measures;
- Demonstration of the availability of criticality detection and alarm systems;
- Demonstration of the performance of emergency shutdown systems;
- Demonstration of the availability of the emergency power supply;
- Demonstration of the availability of any other support systems, e.g. compressed air supply and cooling.

Active commissioning

IV.55. By the end of active commissioning (or 'hot processing'), all the safety requirements for active operations shall be met. Any exceptions shall be justified in the safety case for commissioning.

IV.56. During commissioning, operational limits and normal values for safety significant parameters shall be confirmed as well as acceptable variation values due to facility transients and other small perturbations.

[5] Owing to the large size of commercial reprocessing facilities, handover from construction to commissioning is often carried out in phases.
[6] In some States some of the activities are performed at the construction stage, in accordance with national requirements.

Commissioning report

IV.57. The commissioning report shall identify any updates required to the safety case and any changes made to safety measures or work practices during commissioning.

OPERATION

IV.58. Spent fuel acceptance criteria and a feed programme[7] shall be prepared and assessed to ensure that the requirements established in the operating licence and in the safety assessment are met throughout the reprocessing processes, and to ensure that there is no unacceptable impact on products from the reprocessing facility, on the waste generated or on discharges.

MANAGEMENT SYSTEM

IV.59. In accordance with the complexity of the design of the reprocessing facility and its hazard potential, the operating organization shall establish and maintain the quality of the interfaces and communication channels between different groups of personnel within the reprocessing facility and between the reprocessing facility and other facilities both on the site and off the site.

Receipt of radioactive material

IV.60. Procedures shall be developed to ensure that radioactive material received at the facility is appropriately characterized and acceptable before it is stored at or used within the facility.

FACILITY OPERATION

IV.61. The feed programme shall be supported by appropriate fuel data, prior to committing to dissolution of the fuel, to confirm that the characteristics of the fuel meet the safety requirements for the feed programme.

IV.62. For each reprocessing campaign, the values of control parameters shall be determined on the basis of the actual characteristics of the fuel and fuel solution to be reprocessed in the actual feed programme for that campaign, and as required by the safety assessment.

Operational documentation

[7] The feed programme is the planned sequence of fuel feeding to the head-end facility and the dissolver.

IV.63. Operating instructions and procedures shall include the action(s) to be taken in the event that the operational limits and conditions are exceeded, to ensure that corrective action is taken to prevent the exceeding of a safety limit.

IV.64. Particular attention shall be paid to the arrangements for the efficient and accurate transfer of information and records between shift teams (shift handovers) and between shift teams and day teams.

Specific provisions

IV.65. The operating organization shall take actions to minimize the risks associated with maintenance during shutdown (inter-campaign periods).

CRITICALITY PREVENTION

IV.66. Relevant personnel shall be trained in the general principles of criticality control, including the requirements of the emergency response plan.

IV.67. A sufficient number of qualified criticality staff, knowledgeable about the criticality aspects of the design, operation and hazards of the facility shall be appointed at the reprocessing site to support criticality safety.

IV.68. Procedures for the transfer or movement of fissile material during operational states (including maintenance) shall be defined and submitted for review by criticality staff that are, to the extent necessary, independent of the operations management.

IV.69. Fissile material, in particular waste and residues that have not been monitored for fissile content, shall not be collected or placed in containers unless these have been specifically designed and approved for that purpose.

IV.70. Prior to changing the location of process equipment, their process connections or neutron reflectors, the criticality assessment shall be updated to determine whether such a change is acceptable.

IV.71. Specific provisions shall be provided to reduce the risk of accumulation of organic phase in tanks that handle aqueous solutions containing fissile material and to detect such accumulations where necessary.

IV.72. All transfers of fissile material, including waste and residues, shall be performed in accordance with the criticality safety requirements of both the sending area/facility and the receiving area/facility and shall be made subject to certification by the sending area/facility and acceptance by the receiving area/facility prior to sending.

IV.73. The potential for the inadvertent addition of water, weak acids or neutralizing chemicals (often used for decontamination) to fissile solutions, which can cause precipitation or a change in the flow sheet conditions (e.g. failure of the extraction process) with a criticality risk, shall be minimized. Such liquid feed lines shall be isolated or shall be made subject to appropriate administrative controls.

IV.74. Depending on the risk arising from accumulations of fissile material, including waste and residues, a surveillance programme shall be developed and implemented to ensure that uncontrolled accumulations of fissile material are detected and further accumulation is prevented.

IV.75. Adequate arrangements for responding to a criticality accident shall be established and maintained. These arrangements shall include the development of an emergency plan, definition of responsibilities and provision of equipment, and shall include emergency operating procedures.

IV.76. Non-fissile chemical reagents[8] that are important to process chemistry shall be assessed. If addition of either the wrong composition or the wrong quantity of a chemical reagent could pose a criticality hazard, then this shall be controlled.

RADIATION PROTECTION

IV.77. Appropriate equipment, either stationary or mobile, shall be provided at the reprocessing facility to ensure that there is adequate radiation monitoring in operational states and, as far as is practicable, in accident conditions.

Control of internal and external exposure

IV.78. During operation (including maintenance operations), the prevention of internal and external exposure shall be controlled by both physical and administrative means, in order to limit the need to use personnel protective equipment as far as reasonably practicable.

MANAGEMENT OF FIRE, CHEMICAL AND INDUSTRIAL SAFETY

IV.79. The potential for fire or explosion and the control of ignition sources and potential combustible materials, including hazardous and toxic process chemicals, shall be considered, including during maintenance operations.

MANAGEMENT OF RADIOACTIVE WASTE

IV.80. Waste pre-treatment, treatment, and storage shall be organized in accordance with pre-established criteria and the national waste classification scheme and shall take into consideration both on-site storage capacity and disposal options (see Ref. [2]).

IV.81. High level waste shall be stored in facilities that maintain a suitably reliable heat removal function in addition to adequate confinement and shielding.

IV.82. Where a decision is made to store radioactive waste pending the provision of disposal routes, all the available information characterizing the waste shall be held in secure and recoverable archives (this applies to the full range of design, technical and operational records).

[8] Reagents in this context can include acid, solvent, water and any other chemical that may be added to the process.

DECOMMISSIONING

IV.83. In applying decommissioning actions, including the dismantling of equipment that was used to process fissile material (e.g. vessels, gloveboxes), procedures shall be implemented to ensure that criticality control is maintained.

IV.84. Criticality safety shall be ensured for the temporary storage of waste from decommissioning that is contaminated with fissile material.

Appendix V

REQUIREMENTS SPECIFIC TO FUEL CYCLE RESEACH AND DEVELOPMENT FACILITIES

The following requirements are specific to fuel cycle research and development facilities[9] at laboratories and to facilities at pilot and demonstration scales that receive, handle, process, examine and store a large variety of radioactive materials with very different physical characteristics (e.g. uranium, thorium, plutonium), other actinides (e.g. americium, neptunium, curium), separated isotopes (fissile and non-fissile), fission products, activated materials and irradiated fuel. Furthermore, a wide range of other materials are used in such facilities, for example graphite, boron, gadolinium, hafnium, zirconium, aluminium, heavy water and various metal alloys.

Fuel cycle research and development facilities can be used to investigate various fuel manufacturing techniques, reprocessing and waste handling techniques and processes, as well as to investigate material properties of fuel before and after irradiation in the reactor, and to develop equipment, the use of which is envisaged later at an industrial scale.

The following are safety issues that are specific to fuel cycle research and development facilities:

- The manipulation of small amounts of radioactive material;
- The diversity of the experiments carried out and the associated safety assessment, which might cover several different experiments;
- The manipulation of unusual radionuclides, such as 'exotic' actinides, with associated risks;
- Organizational and human factors, as operations are mainly manual and require cooperation between operating personnel of the facility and personnel responsible for research and development.

DESIGN

SAFETY FUNCTIONS

V.1. The facility shall be designed to prevent a criticality accident and the accidental release of hazardous materials. The design shall keep radiation exposures from normal operation and accident conditions as low as reasonably achievable.

ENGINEERING DESIGN

[9] Fuel cycle research and development facilities are generally characterized by a need for a large degree of flexibility in their operations and processes, but they typically have low inventories of fissile materials and can include both hands-on and remote handling operations.

V.2. The design shall, as far as reasonably practicable, prevent hazardous concentrations of gases and other explosive or flammable materials.

V.3. Consideration shall be given in the design to the possible need for clean-up or recovery of radioactive material following an incident.

CRITICALITY PREVENTION

V.4. Criticality safety shall be ensured by means of preventive measures.

V.5. Preference shall be given to achieving criticality safety by engineering design, to the extent practicable, rather than by administrative measures.

V.6. In the criticality safety assessment, the choice of fire extinguishing media (e.g. water, inert gas or powder) and the safety of their use shall be addressed.

CONFINEMENT OF RADIOACTIVE MATERIAL

V.7. Containment shall be the primary method for ensuring confinement against the spreading of contamination. Containment shall be provided by two complementary containment systems — static (e.g. physical barriers) and dynamic (e.g. ventilation). In view of the large range of potential radiological hazards present in fuel cycle research and development facilities, a graded approach shall be used in the design of the containment systems with respect to the nature and number of barriers and their performance, in accordance with the potential severity of the radiological consequences of their failure.

PROTECTION AGAINST EXPOSURE TO RADIATION

V.8. The activities carried out in fuel cycle research and development facilities generally rely on analytical data from samples. Sampling devices, sample transfer methods, sample storage and the analytical laboratories shall be designed to keep exposures as low as reasonably achievable.

POSTULATED INTIATING EVENTS

Internal initiating events

Fires and explosion

V.9. A detection and/or suppression system shall be installed that is commensurate with the risks of fires.

V.10. In areas with potentially explosive atmospheres, the electrical network and equipment shall be adequately protected.

OPERATION

MANAGEMENT SYSTEM

Receipt of radioactive material

V.11. The operating organization shall develop procedures to ensure that radioactive material received at the facility is appropriately characterized and is acceptable before it is allowed to be stored or used within the facility.

Qualification and training of personnel

V.12. Operators and researchers shall be qualified and trained to handle radioactive material and to conduct tests and experiments.

V.13. Specific training and drills for personnel and external fire and rescue staff shall be organized by the operating organization. The operating organization and operators shall recognize that an inappropriate response to a fire or explosion at the facility could increase the consequences of the event (e.g. radiological hazards including criticality, chemical hazards).

CRITICALITY PREVENTION

V.14. As criticality hazards may be encountered in research and development activities involving fissile material, including maintenance work, a criticality safety assessment shall be performed. If fissile material has to be removed from equipment, only approved containers shall be used.

V.15. Any wastes and residues arising from experiments, pilot processes or sampling, decontamination, or maintenance activities that involve fissile material shall be collected in containers with a favourable geometry and shall be recorded and stored in dedicated criticality safe areas.

V.16. Consideration shall be given to the unintentional mixing of chemicals which could increase criticality risk, e.g. dilution of acid causing precipitation of fissile material.

EMERGENCY PLANNING AND PREPAREDNESS

V.17. An emergency plan shall be prepared and shall be focused on the following aspects for immediate response:

- Fire and explosion;
- Criticality accidents;

- The release of hazardous materials, both radioactive material and chemicals;
- Loss of services, e.g. electrical power supply and coolants.

V.18. In dealing with a fire or a release of hazardous materials (e.g. UF_6), the actions taken or the medium used to respond to the emergency shall not create a criticality hazard or add to the chemical hazard.

DECOMMISIONING

V.19. Special procedures shall be implemented to ensure that criticality control is maintained in dismantling equipment whose criticality is controlled by geometry.

V.20. Criticality safety shall be ensured for the temporary storage of waste contaminated with fissile material, including plutonium that is generated from decommissioning, including the dismantling of gloveboxes and their contents.

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