

DOCUMENT PREPARATION PROFILE

1. IDENTIFICATION

Category: Safety Guide
Status: In preparation
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Proposed Title: Safety of Reprocessing Facilities
Review Committee(s): NUSSC, RASSC, WASSC
Technical Officer: Nocture, P.
Comments on status:

2. INTRODUCTION

The Fifth Meeting of the Advisory Commission on Safety Standards (ACSS) identified the need for specific safety standards covering 'other fuel cycle facilities.' The subsequent IAEA Consultants Meeting on Status of Regulations for Fuel Cycle Facilities in Member States held on 4 to 8 October 1999 provided recommendations. Based on these recommendations, the ACSS suggested at its Sixth meeting in November 1999 that the guidance developed should be 'facility related rather than theme or subject related'.

A Technical Committee Meeting was held on 8 to 12 May 2000 on Status of Regulations for Fuel Cycle Facilities in Member States, which suggested that the Secretariat proceed with the development of a Requirements document and several supporting Guides for the safety of non-reactor nuclear facilities. These facilities are: MOX fuel fabrication; Uranium fuel fabrication; Reprocessing; Conversion and Enrichment.

The Commission on Safety Standards (CSS) generally endorsed this approach during its Meetings in 2000 and requested the Secretariat to start the development of the Requirements document and Guides for the various facilities in the order as written above.

The proposed Guide will apply to facilities which use the PUREX process for the reprocessing of spent fuel from NPPs (metallic or oxide fuel, including MOX and fast breeders fuel) and research reactors. It will cover the safety issues of the installations for the mechanical treatment and the dissolution of the irradiated fuel, the chemical cycles of separations and purification, the plutonium and uranium conversions in oxides (including into MOX powder) and the storage of the products. It will cover also the interim waste storage from the process stream, prior conditioning (e.g. fission products solutions in vessels).

This safety Guide will not cover the installation out of the core reprocessing process, like cask unloading facilities, spent fuel storage facilities and radioactive wasteconditioning facilities like e.g. facilities for vitrification of high active liquid waste or for bituminisation of radioactive sludge.

3. INTERFACES

While the NUSSC will co-ordinate the document preparation, development and review, the RASSC and the WASSC should participate in the development and review process.

This Standard will have interfaces with the following:

- Objectives and Principles of Nuclear, Radiation, Radioactive Waste and Transport Safety (Safety Fundamentals) [DS 298 - In preparation]
- Preparedness and Response for a Nuclear or Radiological Emergency (Safety Requirements), GS-R-2
- Legal & Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (Safety Requirements), GS-R-1
- Safety of Fuel Cycle Facilities (Safety Requirements), [DS316, in preparation]
- Safety Requirements: Management Systems [DS 338, in preparation]
- International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series 115
- Regulations for the Safe Transport of Radioactive Material – 1996 Edition (safety Requirements), Safety Standards Series No. TS-R-1
- Predisposal Management of Radioactive Waste including Decommissioning (Safety Requirements), WS-R-2
- Predisposal Management of Low and Intermediate Level Radioactive Waste (Safety Guide), WS-G-2.5
- Decommissioning of Nuclear Fuel Cycle Facilities (Safety Guide), WS-G-2.4
- Safety Assessment for Predisposal Waste Management (Safety Guide) [DS 284 – In preparation]
- Management Systems for the Treatment, Handling and Storage of Radioactive Waste (Safety Guide). [DS336, in preparation]

4. CONTENT

The intended Table of Contents is as follows:

INTRODUCTION

- Background: Main process facilities of a PUREX reprocessing site and hazards of nuclear origin (dispersion of radioactive materials, external exposure, criticality, risks connected with release of heat and risks connected with radiolysis). Nature (dispersible forms. and inventory of radioactive material (fission products and Pu) subjected to physical and chemical reactions. Design and operating characteristics (containment, ventilation systems with off gas purification, shielding, remotely controlled equipment, intensive use of automation...)
- Scope: safety issues in the core PUREX process facilities for the reprocessing of NPPs (e.g. Magnox, GCR, LWR, AGR, FBR) and research reactors spent fuel, head-end mechanical treatment (shearing) and dissolution, chemical cycles of separations and purification,

conversion of Pu and U nitrate in oxides (including MOX powder) and storage of these products. Out of scope: cask unloading facilities, spent fuel storage facilities and radioactive waste conditioning facilities.

- Structure: similar to the other Safety Guides, in line with the Safety Requirements for FCFs for FCFs

GENERAL SAFETY

- Main risks from which man and the environment need to be protected
- Defense in depth implementation

SITING

Features of the site, which affect dispersion of radioactive releases

Proximity of the public and sensibility of the environment

Ability of services to the site

External hazards (natural and man-made)

Ability to receive external emergency support and supplies

Siting related instrumentation (seismic sensors, cooling water reservoirs level monitoring, sea coast erosion) according to internal and external hazards

DESIGN

General

- Safety functions
 - Containment against dispersion of radioactive material and chemical hazards;
 - Protection of workers and of the environment
 - Cooling (evacuation of decay heat)
 - Prevention of radiolysis explosive products (H₂, red oils, HN₃)
 - Protection against external irradiation
 - Prevention of criticality
- Design basis accidents and safety analysis
For each process facility, e.g.:
 - Earthquake
 - Fire (loaded extractors, Pu glove boxes, organic waste storage vessel...)
 - Explosion (Pu evaporator, FP evaporator),
 - Criticality accident
- Specific engineering design safety provisions:
 - Prevention of dispersion of radioactive material
 - First and second containment systems (static/ventilation)
 - Areas classifications/monitoring
 - Redundancy/diversity
 - Prevention of external irradiation:
 - Shielding/remote operation
 - Areas classifications/monitoring
 - Prevention of criticality: double contingency

Hazards of nuclear origins

- Dispersion of radioactive material
 - Loss of static containment (corrosion, irradiation) for liquids/ gases/powders;

- Loss of ventilation
- External exposure
- Criticality
- Risk from decay heat
- Risk from radiolysis

Non-nuclear hazards of internal origin

- Fire (cladding material - Mg, Zr - or from U metal; TBP/dodecane);
- Internal explosion (Red oil/nitric acid reaction; HN3, hydrogen)
- Dropped loads/ collision
- Mechanical failure/corrosion
- Internal flooding
- Use of chemical products (toxicity, corrosion)
- Use of pressurized equipment
- Loss of process media, of fluids (e.g. coolant for HA tanks),
- Loss of support systems (e.g. electrical power), failure of I&C systems

Non-nuclear hazards of external origin

- Earthquake
- Accidental aircraft crash hazards
- External fire and explosion (industrial environment and transport routes)
- Extreme weather conditions

Instrumentation and control (I&C)

Process control; criticality alarm systems; fire detection and fighting systems; radiation and contamination monitoring systems; control of effluents discharge:

- During normal operation
- For anticipated operational occurrences
- For design basis accident conditions

Human factor considerations

Safety analysis

- during operational states
- for design basis accidents

Waste management

CONSTRUCTION

- Specific importance of QA programme
- “design change” procedure
- Verification of shielding efficiency

COMMISSIONING

Commissioning programme, procedures and reports

OPERATION (INCLUDING MODIFICATIONS AND MAINTENANCE)

- Characteristics of reprocessing facilities to be taken into account for the implementation of the Safety requirements (DS316)
- Management including organization, qualification and training of personnel
- Plant operation

- Maintenance and periodic testing
- Modification control
- Criticality control
- Radiation protection (control of external and internal doses)
- Conventional safety management
- Waste and effluents management Emergency preparedness

DECOMMISSIONING

5. PRODUCTION

Approval for development:

- | | |
|--|-----------|
| (1) Submission of DPP to NUSSC | Sept.2004 |
| (2) Discussion and Approval of DPP in NUSSC - WASSC/RASSC Meetings | 2005 |
| (3) Discussion and Approval of DPP in CSS Meeting | June 2006 |

Development:

- | | |
|-------------------------------------|---------------------------------|
| CS (3 CS foreseen) | From 4 th quarter 06 |
| First Draft to NUSSC, WASSC/RASSC | October 2007 |
| (4) Member States comments | 2008 |
| (5) Approval by NUSSC, WASSC, RASSC | October 08 |
| (7) Approval by CSS | |