



International Guidelines for Nuclear Safety • Operations • Third Party Liability at Nuclear Power Plants

PUBLISHED ON BEHALF OF THE NUCLEAR POOLS FORUM

Revision 001, March 2015

**International Guidelines for
Nuclear Safety • Operations • Third-Party Liability
at Nuclear Power Plants**

Published on behalf of the Nuclear Pools' Forum
Rev 001, March 2015

Introductory Note

These revised Guidelines have been developed by a working group representing nuclear insurers. Due to the importance of achieving and maintaining the highest possible level of nuclear safety for insurance purposes at Nuclear Power Stations, they have been approved by the Engineering Sub Committee of the General Purposes Committee on behalf of the Nuclear Pools' Forum.

Belgium	Syndicat Belge d'Assurances Nucléaires (SYBAN) Square de Meeûs 29 B-1000 Brussels e-mail: secretariat@syban.be
Brazil	CBRN – Brazilian Pool for the Insurance of Nuclear Risks IRB Brasil Resseguros S.A. Av. Marechal Câmara 171 - Castelo Rio de Janeiro. RJ – Brasil - CEP 20-020-901 e-mail: cnabuco@irb-brasilre.com
Bulgaria	Bulgarian National Insurance Nuclear Pool Energy Ins. Co. Ltd 33 Kn.Al.Dondukov Blvd. 1000 Sofia e-mail: nucl.pool@energy.bg
Canada	Nuclear Insurance Association of Canada 401 Bay St., Suite 1600 Toronto, Ontario, Canada M5H 2Y4 e-mail: Murphy@niac.biz ; colleen@niac.biz
China	China Nuclear Insurance Pool China Re Building No. 11 Jin Rong Avenue, Xicheng District Beijing 100033 e-mail: zuohq@chinare.com.cn

Croatia	Croatian Nuclear Pool Radnička cesta 40-5 HR - 10000 ZAGREB HRVATSKA/CROATIA E-mail: hrnukpool@hrnukpool.hr
Czech Republic	Czech Nuclear Insurance Pool c/o Ceska Pojistovna a.s. Na Pankráci 1720 5C/123 140 00 Praha 4 Czech Republic e-mail: mposad@cpoj.cz
France	ASSURATOME Tour Franklin, Défense 8 92042 Paris La Défense Cedex e-mail: contact@assuratome.fr
Germany	Deutsche Kernreaktor-Versicherungsgemeinschaft (DKVG) Aachener Str. 75 D-50931 Cologne e-mail: Annette.Kaiser@dkvg.eu
Hungary	Hungarian Nuclear Insurance Pool C/o: Allianz Hungária Zrt. 1087 Budapest Könyves K.krt. 48-52 e-mail: attila.4.olah@allianz.hu
Japan	The Japan Atomic Energy Insurance Pool Non-Life Insurance Building Annex 9 7, Kanda-Awajicho 2-Chome, Chiyoda-Ku, Tokyo, 101-8335 e-mail: rito@jaeip.gr.jp
Korea	The Korea Atomic Energy Insurance Pool 80, Susong-Dong, Chongno-Gu Seoul 110-733 C/o. Korean Reinsurance Company C.P.O. Box 1438, Seoul (London Liaison Office) International House 1st St. Katherine's Way, London E1W 1UN e-mail: offrisk@koreanre.co.kr

Mexico	Atomic Mexican Pool Reaseguradora Patria, S.A. Periférico Sur No. 2771 Col. San Jerónimo Lidice La Magdalena Contreras México D.F. Mexico e-mail: fmartinez@poolamx.com.mx
Netherlands	BV Bureau van de Nederlandse Pool voor Verzekering van Atoomrisico's Visitors' Address Handelskade 49 2288 BA Rijswijk ZH The Netherlands Postal Address Postbus 1074 2280 CB Rijswijk ZH The Netherlands e-mail: niek.bos@assurpools.nl
Romania	Romanian Pool for the Insurance of Atomic Risks c/o Generali Asigurari S.A. Str Ghe. Polizu 58 – 60 Sector 1 Bucharest 011062 e-mail: emil.boldus@generali.ro
Russia	Russian Nuclear Insurance Pool 9/8 Building 2, 3 rd Floor Maly Gnezdnikovsky per., Moscow, Russian Federation, 125009 e-mail: info@ranipool.ru
Slovakia	Slovak Nuclear Insurance Pool Allianz-Slovenská poisťovňa, a.s. Dostojevského rad 4 815 74 Bratislava 1 Slovak Republic e-mail: beata.petriskova@allianzsp.sk
Slovenia	Nuclear Insurance and Reinsurance Pool (Nuclear Pool) Miklosiceva 19 SL-1000 Ljubljana e-mail: danilo.antoncic@triglav.si
South Africa	South African Pool for the Insurance of Nuclear Risks c/o The South African Insurance Association PO Box 5098, Weltevreden Park, 1709 South Africa e-mail: info@sainsurance.co.za, charles@saia.co.za

Spain	Espanuclear Aseguradores de Riesgos Nucleares, A.I.E. Sagasta, 18– 4o derecha 28004 Madrid e-mail: espanuclear@espanuclear.com
Sweden	Nordic Nuclear Insurers Birger Jarlsgatan 57B S-11396 Stockholm e-mail: georg.pyk@atompool.com
Switzerland	Swiss Pool for the Insurance of Nuclear Risks Mythenquai 50/60 CH-8022 Zurich e-mail: Alain_Quere@swissre.com
Taiwan	Nuclear Energy Insurance Pool of the Republic of China 15F, 88, Nanking East Road, Sec. 2 Taipei, 104 e-mail: neiproc@mail.cki.com.tw
Ukraine	Nuclear Insurance Pool Vul. M. Raskovoy, 11-a Office 204 Kiev 02660 e-mail: unip@nbi.com.ua
United Kingdom	Nuclear Risk Insurers Limited 18 St. Swithin's Lane, London EC4N 8AD, UK e-mail: enquiries@nuclear-risk.com
United States	American Nuclear Insurers (ANI) 95 Glastonbury Blvd., Suite 300 Glastonbury, Connecticut 06033 4453 e-mail: EngInfo@AmNuclns.com

Table of Contents

Introduction.....	1
Section 1. Nuclear Safety.....	2
1.1 Barriers	2
1.1.1 Fuel	2
1.1.2 Leak Tightness (Vessel, Primary Circuit) including In-Service Inspection	3
1.1.3 Containment Integrity	3
1.2 Safety Concept and Accident Mitigation	4
1.2.1 Probabilistic Safety Assessment (PSA).....	4
1.2.2 Protection Systems	5
1.2.3 Internal Hazards.....	5
1.2.4 External Hazards	6
1.3 Nuclear Safety Oversight	6
1.3.1 Oversight.....	6
1.3.2 Performance Indicators for Nuclear Safety	6
1.4 Nuclear Safety Culture.....	7
1.4.1 Management Systems	7
1.4.2 Corrective Action Programme	7
1.4.3 Continuous Learning.....	7
Section 2. Operations	8
2.1 Operating Performance	8
2.1.1 Performance Indicators	8
2.1.2 INES and Reportable Events	8
2.2 Organisation, Administration & Staffing	9
2.2.1 Organisational Structure.....	9
2.2.2 Human Resources and Training	9
2.3 Operational Areas.....	10
2.3.1 Shift Operations.....	10
2.3.2 Maintenance.....	10
2.3.3 Chemistry.....	10
2.3.4 Outage Safety Management.....	10
2.3.5 Fuel Route Operations.....	11
2.3.6 Radwaste Operations	11

2.4	Engineering and Technical Support	11
2.4.1	Design Authority	11
2.4.2	Configuration Management	12
2.4.3	Records Management	12
2.5	Programmes	12
2.5.1	Modernisation	12
2.5.2	Periodic Safety Review	12
2.5.3	Ageing Management and Plant Life Management (PLiM)	13
2.5.4	PLEX	13
2.5.5	Decommissioning.....	13
2.5.6	Beyond Design Basis Accident Response.....	14
2.6	Physical Plant	14
2.6.1	Housekeeping and Material Condition.....	14
2.6.2	System Health.....	15
2.6.3	Foreign Material Exclusion (FME).....	15
2.6.4	Physical Security and Vetting.....	15
2.6.5	Cyber Security.....	16
2.7	New Build.....	16
2.7.1	New Design / Prototype Plant	16
2.7.2	Commissioning Arrangements	17
2.7.3	Operational Readiness.....	17
Section 3.	Third Party Liability	18
3.1	Emergency Preparedness	18
3.1.1	Emergency Preparedness Facilities	18
3.1.2	Drills and Training.....	18
3.1.3	Emergency Plan	19
3.1.4	Severe Accident Management.....	19
3.2	Radiological Environmental Monitoring.....	19
3.2.1	Dose Model.....	19
3.2.2	Performance	20
3.2.3	Post Accident Radiological Monitoring.....	20
3.2.4	Programme Verification	20
3.2.5	Site Groundwater Monitoring	20

3.3	Radiological Effluent Monitoring.....	20
3.3.1	Performance Indicators	20
3.3.2	Effluent Controls.....	21
3.3.3	Unplanned and Unmonitored Releases.....	21
3.4	Radiological Protection.....	21
3.4.1	Dose Management	21
3.4.2	Radioactive Contamination Controls.....	22
3.4.3	Radiological Programmes	22
3.5	Legal and Licensing	22
3.5.1	Legal Basis.....	22
3.5.2	Regulatory.....	22
3.5.3	Licensing and Licence Conditions	23
3.5.4	Claims.....	23
3.6	Local Environment and Amenity	23
3.6.1	Population Centres	23
3.6.2	Off-Site Property.....	23
Section 4.	References	24

Introduction

The International Nuclear Insurance Pools have developed a series of International Engineering Survey Guidelines to achieve quality risk surveys and to inform our insured about nuclear insurers' expectations. In 2010, a Guideline was produced to address Nuclear Safety, Operations and Third Party Liability (NSO TPL) topics that the Pools have traditionally incorporated in insurance surveys where third party liability insurance is in place.

This is the first revision of the NSO TPL Guidelines. The objective of the revision was to build on the original document, to address some areas that were not covered and to capture any improvements identified through use of the Guidelines.

The format is such that each section suggests, in bullet point format, the key issues to be addressed during a survey. This is backed by a section of References to International Standards, criteria and other documents. This approach has been carried forward from the first issue of this document, and supports consistent high quality insurance surveys without repeating the large body of work that is presently contained in current Standards and Criteria.

Separate Appendices to this revision provide further explanatory information for Insurance Pools Surveyors.

Disclaimers of Liability

The members of the Nuclear Pools' Forum make no claims, promises, guarantees or warranties as to the accuracy, completeness or adequacy of any information published in the ***International Guidelines for Nuclear Safety • Operations • Third-Party Liability at Nuclear Power Plants***.

The members of the Nuclear Pools' Forum disclaim liability for any personal injury, damage to property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on the ***International Guidelines for Nuclear Safety • Operations • Third-Party Liability at Nuclear Power Plants***.

Anyone using the ***International Guidelines for Nuclear Safety • Operations • Third-Party Liability at Nuclear Power Plants*** should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstance.

Reproduction

Reproduction in whole or in part permitted with indication of source: *International Guidelines for Nuclear Safety • Operations • Third-Party Liability at Nuclear Power Plants*, Published on behalf of the Nuclear Pools' Forum.

Cover Photograph: Beznau Nuclear Power Plant, courtesy of Axpo.

Section 1. Nuclear Safety

Objective: The objective of Section I is to assess the Nuclear Safety arrangements of the facility. This includes consideration of the quality of barriers, which can be physical, procedural or organisational, that are designed to reduce the risks from the nuclear hazard during both operations and accident conditions.

1.1 Barriers

1.1.1 Fuel

- Fuel assemblies usage and lead test assemblies
- Enrichments and burn-up rates
- On-line leakage monitoring
- Fuel leakage history, causes and corrective actions
- Formal decision protocol and procedures concerning response to fuel failures
- Fuel performance anomalies and corrective actions
- Fuel inspections for new fuel and at refuelling outages
- Spent fuel storage
- WANO Fuel Reliability Index

1.1.2 Leak Tightness (Vessel, Primary Circuit) including In-Service Inspection

- Leak Detection technology applied
- Primary System leakage history and trends
- Technologies applied to the monitoring of primary system leakage
- Action thresholds such as Technical Specifications and administrative limits
- Monitoring of Thermal Ageing
- Monitoring and evaluation of reactor vessel fracture toughness
- Materials issues (eg Alloy 600/Inconel stress corrosion cracking)
- Non-destructive examination and physical plant inspections

For UK AGR plant, primary circuit integrity including gas circulator seals, and hot gas release may be considered here.

Secondary circuit integrity and safety devices for overpressure protection (primary and secondary circuits) are covered within the Machinery Breakdown guidelines.)

1.1.3 Containment Integrity

- Containment Integrated Leakage Rate Testing (ILRT) and Local Leak Rate Testing (LLRT) results and trends, distribution of results, test frequency
- Structural Integrity test results
- Containment stress and tension monitoring
- Containment material condition (i.e. corrosion)
- Monitoring of physical parameters
- Corrective Actions
- Action thresholds such as Technical Specifications and administrative limits

For UK AGR plant, the pre-stressed concrete pressure vessel may be considered here; for CANDU multi unit sites the vacuum building and for RBMK/VVER 440 the bubbler towers/condensers.

1.2 Safety Concept and Accident Mitigation

1.2.1 Probabilistic Safety Assessment (PSA)

- Scope of PSA analysis; operating reactor; shutdown reactor
- Range of initiating events included in the analysis (internal events, external events, fire initiating events)
- PSA Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) Values (or equivalent eg Dose Band 5 release frequency in UK)
- Cut set(s) for most limiting CDF and LERF scenarios
- Ranking of accident scenarios and system influences
- Top Operator actions and timescales
- Development of Level I, Level II and Level III PSA
- Plant operational CDF profile
- PSA usage (safety monitor, prioritise modifications, work control, etc.)
- Administrative approval protocol for CDF values (Plant Configuration Changes and PSA Thresholds)
- Safety improvements suggested by PSA
- Quality Assurance and validation
- PSA and plant configuration control

1.2.2 Protection Systems

- Design basis and margins
- Reactor shutdown and holddown systems
- Core cooling requirements
- Reactor protection systems
- Power supplies – emergency generation, short break ad UPS
- Other required lines of protection
- Physical separation of redundant trains of emergency equipment
- Segregation of diverse trains of protection equipment
- Ultimate Heat Sink
- Protection of spent fuel storage
- Development of strategies for beyond design basis events including Fukushima response

1.2.3 Internal Hazards

- Fire
- Steam release
- Hot and cold gas release
- Missile impact including turbine disintegration
- Dropped loads
- Internal Flooding
- Toxic gas release
- Vehicular impact
- RFI

1.2.4 External Hazards

- Return frequencies specified
- Seismic
- Wind/tornado/typhoon/hurricane loading
- External flooding
- Extreme ambient temperatures
- Aircraft impact
- Industrial hazards
- Lightning
- Marine/bio fouling

1.3 Nuclear Safety Oversight

1.3.1 Oversight

- Independent Nuclear Oversight process and programmes
- Organisation and committees

Note: Further discussion of related ‘oversight’ activities Corrective Action Programmes, Self Assessment, Third Party Assessments, Human Performance and Error Prevention, Use of OPEX are covered within the Nuclear Safety Culture section [IGNSO 1.4](#), below.

1.3.2 Performance Indicators for Nuclear Safety

- Safety system availability and key performance indicators
- System health assessments
- Safety system reviews

Note: Operational Performance and Third Party Indicators are covered within [IGNSO 2.1.1](#).

1.4 Nuclear Safety Culture

If a separate Nuclear Safety Culture stream is not included in the survey, the following key topics and strategic issues may be considered:

1.4.1 Management Systems

- Organisation for Nuclear Safety Culture
- Quality Assurance and Transition to Integrated Management Systems
- Grading and documentation
- Management commitment
- Process Implementation
- Assessment
- Cumulative Impact

1.4.2 Corrective Action Programme

- Corrective action programme
- Evaluation
- Resolution
- Trending

1.4.3 Continuous Learning

- Self assessment and Benchmarking
- Third Party Assessment
- Error Prevention and Human Performance
- Use of OPEX

Section 2. Operations

Objective: The objective of Section 2 is to assess the quality of management systems, operations and programmes that are important to favourable plant performance and minimizing risks.

2.1 Operating Performance

2.1.1 Performance Indicators

- WANO & internal indicators
- Performance indicator system for physical equipment and programme performance
- Oversight & accountability
- Corrective actions applied to unfavourable performance indicators or trends
- Goals
- New Build indicators

Note: Performance Indicators for nuclear safety are covered within [IGNSO 1.3.2](#).

2.1.2 INES and Reportable Events

- INES Events
- Regulatory reportable events
- Corrective Actions
- For New Build - high level events during construction, erection and commissioning stage

2.2 Organisation, Administration & Staffing

The importance of organisational arrangements to Nuclear Safety Culture are also discussed within the Nuclear Safety Culture Guidelines.

2.2.1 Organisational Structure

- Shareholding structure
- Organisational structure
- Senior management responsibilities
- Department/ Division/ Branch responsibilities
- Robustness when organisational changes are made

2.2.2 Human Resources and Training

- Staffing sufficiency (number, age, educational background) and Qualification
- Identification of job and task training need
- Performance metrics and criteria
- Availability of Training Programmes
- Simulator and Training Facilities, simulator scope and usage
- Training records
- Succession management

Note: Continuous Learning including Human Performance (HU) training are discussed within the Nuclear Safety Culture Guidelines under section 1.3.

2.3 Operational Areas

2.3.1 Shift Operations

- Conduct of Operations
- Communication, including Shift Handover Protocol
- Surveillance and equipment status
- Qualification and experience for key positions (shift supervisor, safety engineers etc.), Licensing
- New Build and commissioning involvement for new operators

Note: Operator training is covered in section IGNSO 2.2.2.

2.3.2 Maintenance

- Maintenance Performance
- Defects
- Backlogs

2.3.3 Chemistry

- Chemistry programmes
- Primary / Secondary Circuit Chemistry
- Chemical parameters for protection
- Reactivity control
- Irradiated Pond Chemistry

Chemistry Program is also covered within the Machinery Breakdown guidelines.

2.3.4 Outage Safety Management

- Risks during outages
- Post outage evaluations
- Forced Outage

2.3.5 Fuel Route Operations

- Spent fuel storage facilities
- Hazards during fuel handling and refuelling
- PSA studies of fuel route operations
- Lifting and handling operations
- Nuclear Cranes

2.3.6 Radwaste Operations

- Arrangements for receipt, assay, sorting, volume reduction and packaging of waste
- Solid and liquid radwaste treatment methods
- Performance metrics
- Storage Facilities
- Material condition
- ALARA Implementation

2.4 Engineering and Technical Support

2.4.1 Design Authority

- Design Authority organisation
- Significant Design Modifications including Tech Spec changes
- Engineering standards
- Fleet size considerations

2.4.2 Configuration Management

- Organisation
- Implementation of configuration management
- Temporary modification management
- Systematic document review
- Performance indicators and trends

2.4.3 Records Management

- Formalised Retention Program
- Facilities & Technology (including Change Management)

2.5 Programmes

2.5.1 Modernisation

- Modernisation Schedule
- Scope and purpose
- PSA updates

2.5.2 Periodic Safety Review

- Regulatory requirements
- Scope and results

2.5.3 Ageing Management and Plant Life Management (PLiM)

- Ageing management organisation, policy and resources
- Critical component screening criteria
- Evaluation of potential degradation
- Management effectiveness of replaceable Structures, Systems and Components (SSCs)
- Detection and mitigation
- Safety margin
- Data
- Alignment with life extension

2.5.4 Plant Life Extension (PLEX)

- Organisation, policy and procedure
- Safety review
- Critical Structures, Systems and Components (SSCs)
- Irreplaceable components
- Progress and milestones
- Licensing condition
- Operational readiness before restart
- Alignment with modernisation, ageing and PLiM programmes

2.5.5 Decommissioning

- Policies and strategies
- Programme and Milestones
- Waste handling and treatment
- Safety analysis and protection systems

2.5.6 Beyond Design Basis Accident Response

- Beyond design basis accidents study
- Cliff edges
- Improvement methods and results

2.6 Physical Plant

2.6.1 Housekeeping and Material Condition

- Facility Tour Observations
- Leaks
- Labelling
- Operator aids
- Equipment Deficiencies
- Housekeeping
- New build:
 - Work observation to see if the procedures are fully in action
 - Equipment preservation on completion of finishing testing / commissioning
 - Extra fire loads in safety areas
 - Clean control measures are in place
 - Common SSCs shared by operational units and construction units
 - Potential risks from erection work in construction units to adjacent or neighbouring operational units

2.6.2 System Health

- System based approach to plant management
- Adaptive maintenance programmes and equipment reliability eg AP913
- Scoping and identification of systems
- Monitoring of system health
- Component Engineers
- Corrective Actions

2.6.3 Foreign Material Exclusion (FME)

- Formal policies & procedures
- Accountability & ownership
- Sensitive FME areas (Fuel area, RPV, primary circuit, I&C system)
- New Build - Openings during commissioning

FME is also covered within the Machinery Breakdown guidelines.

2.6.4 Physical Security and Vetting

- Physical barriers
- Supervision of barriers
- Control of personnel, visitors and contractors
- Control of goods in to and out from the plant
- Entrance and exit control of person
- Security screening of persons
- Guards and watchmen service
- Supervision and maintenance of security systems
- Support from authorities
- Security during outages
- Exceptions and Waivers
- New Build

2.6.5 Cyber Security

- Security for software and computer systems
- Reliability and/or protection arrangements for programmable electronic systems, SCADA, PLCs and Distributed Control Systems
- Backfitting to replace obsolete control and protection systems
- Diversity of software based control systems
- Graded approach to security
- Data Security

2.7 New Build

2.7.1 New Design / Prototype Plant

- Details of new or improved concepts, systems or components compared to existing proven designs
- Validation of new or improved concepts, systems or components
- Testing of safety system settings
- Reliability and availability claims for equipment with first use in nuclear environment
- Reservation or revalidation of re-construction NPPs
- Suppliers of major plant components

2.7.2 Commissioning Arrangements

- Organisational arrangements (eg between operator, construction organisation, contractor)
- Commissioning programme and schedule
- Involvement of NPP staff in commissioning
- Safety management
- Treatment of reservations
- Handover protocol
- OPEX from other plants / vendors
- Key performance indicators

2.7.3 Operational Readiness

- Construction Milestone
- Interface among construction company, owner and operator
- Safety management
- Operational technical support from out sources
- Main design changes during construction period
- Handover strategy and criteria
- Handover completion schedule and rate

Section 3. Third Party Liability

Objective: The objective of Section 3 is to assess the quality of selected activities and programmes that have demonstrated importance to Third Party Liability (TPL) risks.

3.1 Emergency Preparedness

3.1.1 Emergency Preparedness Facilities

- Short and long term emergency response command centres
- Alternative control rooms and indication centres
- Provision of emergency shelters for personnel
- Design and material condition of emergency response facilities
- Fire and rescue facilities and tactical damage mitigation facilities
- Public notification (eg. sirens)

3.1.2 Drills and Training

- Drill schedules
- Involvement of outside organisations
- Periodic proficiency training for individuals and groups
- Formal training and periodic proficiency drills for Emergency Plan sub-sections.
- Main Control Room evacuation and use of Emergency Shutdown facilities
- Post-drill critiques and corrective actions

3.1.3 Emergency Plan

- Clear definition of authorities and responsibilities
- Organisational interfaces
- Clear decision points and criteria necessary to support a graded approach to the emergency response
- Establishment of a formal Emergency Response Organisation (ERO) team and back-up team.
- Formal ERO activation protocol
- Notification to Nuclear Insurers

3.1.4 Severe Accident Management

- Severe Accident Management programme
- Tactical damage mitigation facilities installed in support of Severe Accident Management
- Resilience of communication facilities
- Off-site control and command facilities
- Japanese earthquake response actions

3.2 Radiological Environmental Monitoring

3.2.1 Dose Model

- Critical dose pathway (considering release pathway, isotope, environmental pathway, receptor and organ, direct radiation)
- Environmental based dose model
- Periodic review and update of dose model
- Cover for liability arising from Authorised Discharges

3.2.2 Performance

- Radiological isotopes identified in the environment greater than the Lower Level of Detection (LLD)
- Trending and comparison of environmental monitoring results eg against pre-operational Values
- Performance indicators eg sample collection, equipment operability

3.2.3 Post Accident Radiological Monitoring

- Remote environmental monitoring networks
- Centralisation of data
- Modelling of fall-out patterns

3.2.4 Programme Verification

- Independent certification or verification of environmental monitoring programmes
- Quality Assurance programme
- Periodic independent third-party verification of laboratory results

3.2.5 Site Groundwater Monitoring

- Current hydrology study
- Representative sample wells
- Corrective Actions to address identified active leakage
- Remediation
- Proximity of public drinking water sources to NPP

3.3 Radiological Effluent Monitoring

3.3.1 Performance Indicators

- Performance indicators for radiological effluents
- Monitoring of failure or unavailability of monitoring equipment

3.3.2 Effluent Controls

- Airborne and waterborne effluents
- Identify release points
- Airborne (gaseous) – monitored stacks, discharges, vents
- Waterborne (liquid)
- Monitoring systems for release points
- Modelling of release points for which monitoring is not practicable
- Protocol for the authorisation and conduct of radiological effluent releases (including interlocks)
- Protective measures eg final delay tank, bunding of tanks, discharge valve interlocks, double isolating valves, single failure studies etc

3.3.3 Unplanned and Unmonitored Releases

- All reportable events of unplanned or unmonitored effluent releases

3.4 Radiological Protection

3.4.1 Dose Management

- Internal & external dosimetry
- Measures taken to maintain personnel doses ALARA
- Dose anomalies
- Work management in radiological areas
- Signposting
- Performance Indicators

3.4.2 Radioactive Contamination Controls

- Control of plant contaminated spaces
- Cases of personnel contamination and corrective actions
- Control of contaminated materials and objects
- Plant access and egress monitoring

3.4.3 Radiological Programmes

- Organisation, qualifications & responsibilities
- Policies & procedures
- Radiological surveillance
- Records management
- Data analysis

3.5 Legal and Licensing

3.5.1 Legal Basis

- National law, legislative acts and administrative decrees etc. which form the legal basis for operation of the NPP
- Legislation relating to cross boundary consequences of nuclear accidents – ratification of new conventions
- Other legal requirements such as environmental and industrial legal obligations
- Recognition of International Treaties

3.5.2 Regulatory

- Description of the main Nuclear Regulatory Authority
- Independence of the Nuclear Regulatory Authority
- Peer review of the regulatory process
- Regulatory inspections and enforcement actions
- Regulatory activity by other bodies such as environmental and industrial authorities

3.5.3 Licensing and Licence Conditions

- Term of NPP License
- Periodic Regulatory Reviews
- License restrictions and conditions
- NPP's licensed commitments
- Reportable events and improvement notices

3.5.4 Claims

- Claims activity
- Occurrence of events that may be claim related
- Legal environment

3.6 Local Environment and Amenity

3.6.1 Population Centres

- Proximity and size of population centres to NPP
- Local economic level

3.6.2 Off-Site Property

- Proximity of high-value off-site property to NPP
- Local tourist attractions, parks etc
- Local agriculture

Section 4. References

A list of all IAEA valid safety standards is available at:

[IAEA list of all valid safety standards 2015](#)

The status of IAEA safety standards is at:

[Status of Safety Standards 2015](#)

Superseded publications and obsolete publications in the IAEA Safety Standards and Safety Series are listed at:

[IAEA superseded safety standards Nov 2014](#)

Section 1 Nuclear Safety

1.1 Barriers

1. [Analysis of Differences in Fuel Safety Criteria for WWER and Western PWR Nuclear Power Plants; IAEA TECDOC Series No. 1381](#)
2. [Design of the Reactor Core for Nuclear Power Plants Safety Guide; IAEA Safety Standards Series No. NS-G-1.12](#)
3. [Appendix A to 10CFR Part 50--General Design Criteria for Nuclear Power Plants](#)
4. [Basic Safety Principles for Nuclear Power Plants; 75-INSAG-3 Rev. 1](#)
5. [WENRA Reactor Safety Levels, January 2008](#) and [November 2013](#)
6. ANI/MAELU Technical Risk Information Notice 97-2
7. [Regulations for the Safe Transport of Radioactive Materials IAEA SSR-6](#)
8. [Core Management and Fuel Handling for Research Reactors Safety Guide IAEA Safety Standards Series No. NS-G-4.3](#)
9. [Core Management and Fuel Handling for Nuclear Power Plants Safety Guide IAEA Safety Standards Series No. NS-G-2.5](#)
10. [NEA/CSNI/R\(2014\)10 Leaking Fuel Impacts and Practices, July 2014](#)
11. [Assessment and Management of Ageing of Major Nuclear power Plant Components Important to Safety Primary Piping in PWRs; IAEA TECDOC Series No. 1361](#)
12. [Periodic Safety Review of Nuclear Power Plants Safety Guide IAEA Safety Standards Series No. NS-G-2.10](#)
13. Chapter 3 of [International Guidelines for Machinery Breakdown at Nuclear Power Plants](#)

14. [Design of the Reactor Coolant System and Associated Systems in Nuclear Power Plants Safety Guide IAEA Safety Standards Series No. NS-G-1.9](#)
15. [Design of Reactor Containment Systems in Nuclear Power Plant IAEA NS-G-1.10](#)
16. [Performance based Containment Leak-test Programme; US NRC Regulatory Guide 1.163](#)

1.2 Safety Concept and Accident Mitigation

- 1 [WENRA Reactor Safety Levels, January 2008 and November 2013](#)
- 2 [Defence in Depth in Nuclear Safety INSAG-10 \(1996\)](#)
- 3 [Management of Operational Safety in Nuclear Power Plant INSAG-13 \(1999\)](#)
- 4 [Design of Emergency Power Systems for Nuclear Power Plants Safety Guide IAEA Safety Standards Series No. NS-G-1.8](#)
- 5 [Instrumentation and Control Systems Important to Safety in Nuclear Power Plants Safety Guide IAEA Safety Standards Series No. NS-G-1.3.](#)
- 6 [Software for Computer Based Systems Important to Safety in Nuclear Power Plants IAEA Safety Guide NS-G-1.1](#)
- 7 [Operational Safety Performance Indicators for Nuclear Power Plants IAEA TECDOC Series No. 1141](#)
- 8 [External Events Excluding Earthquakes in the Design of Nuclear Power Plants IAEA NS-G-1.5](#)
- 9 [Seismic Design and Qualification for Nuclear Power Plants IAEA NS-G-1.6](#)

1.3 Nuclear Safety Oversight

1. [Operational Safety Performance Indicators for Nuclear Power Plants IAEA TECDOC Series No. 1141](#)

1.4 Nuclear Safety Culture

1. [WANO Principles PL 2013-01 – Traits of a Healthy Nuclear Safety Culture](#)
2. [INPO 12-012 Traits of a Healthy Nuclear Safety Culture](#)
3. [IAEA SCART Guidelines: Reference report for IAEA Safety Culture Assessment Review Team \(SCART\)](#)
4. [IAEA Safety Requirements GS-R-3 The Management System for Facilities and Activities](#)
5. [IAEA Safety Guide GS-G-3.1 Application of the Management System for Facilities and Activities](#)
6. [IAEA Safety Guide NS-G-3.5 The Management System for Nuclear Installations](#)
7. [IAEA Safety Reports Series No. 69 Management System Standards: Comparison between IAEA GS-R-3 and ISO 9001:2008](#)

8. International Organisation for Standardisation Quality Management Systems- Requirements, ISO 9001:2008
9. [IAEA TECDOC 1057 Experience in the use of Systematic Approach to Training for Nuclear Power Plant Personnel](#)
10. [IAEA TECDOC 1204 A Systematic Approach to Human Performance at Nuclear Power plants: Training Solutions](#)
11. [IAEA NG-T-2.7 Managing Human Performance in Improve Nuclear Facility Operation](#)
12. [IAEA TECDOC 1329 Safety Culture in Nuclear Installations](#)
13. [IAEA TECDOC 1458 Effective corrective actions to enhance operational safety of nuclear installations](#)
14. [IAEA TECDOC 1580 Best Practices in the Utilization and Dissemination of Operating Experience at Nuclear Power Plants](#)
15. [IAEA INSAG 4 Safety Culture](#)
16. [IAEA INSAG 12 Basic Safety Principles for Nuclear Power Plants](#)
17. [IAEA INSAG 15 Key Practical Issues in Strengthening Safety Culture](#)

Section 2 Operations

2.1 Operating Performance

1. [IAEA Safety Guide NS-G-2.14 Conduct of Operations at Nuclear Power Plants](#)
2. [WENRA Reactor Safety Levels, January 2008](#) and [November 2013](#)

2.2 Organisation, Administration & Staffing

1. [IAEA Safety Guide NS-G-2.4 The Operating Organisation for Nuclear Power Plants](#)
2. [IAEA Safety Guide NS-G-2.8 Recruitment, Qualification and Training of Personnel for Nuclear Power Plants](#)
3. [Use of Control Room Simulators for training of nuclear power plant personnel IAEA TECDOC 1411](#)
4. [Application of simulation techniques for accident management training in nuclear power plants IAEA TECDOC 1352](#)
5. [Severe Accident Management Operator Training and Instrumentation Capabilities NEA/CSNI/R\(2001\)11](#)
6. [WENRA Reactor Safety Levels, January 2008](#) and [November 2013](#)

2.3 Operational Areas

1. [IAEA Safety Guide NS-G-2.14 Conduct of Operations at Nuclear Power Plants](#)
2. [IAEA Safety Guide NS-G-2.15 Severe Accident Management Programmes for NPP](#)
3. [WENRA Reactor Safety Levels, January 2008](#) and [November 2013](#)
4. [International Guidelines for Machinery Breakdown prevention at Nuclear Power Plants](#)
5. [Chemistry Programme for Water Cooled Nuclear Power Plant IAEA Specific Safety Guide SSG-13](#)
6. [IAEA TECDOC 1315 Nuclear power plant outage optimisation strategy](#)
7. [Safety of Nuclear Fuel Cycle Facilities Safety Requirements IAEA Safety Standards Series No. NS-R-5 \(not power plants\)](#)
8. [Design of Fuel Handling and Storage Systems in Nuclear Power Plants Safety Guide Safety Standards Series No. NS-G-1.4](#)
9. [Core Management and Fuel Handling for Nuclear Power Plants Safety Guide IAEA Safety Standards Series No. NS-G-2.5](#)
10. [IAEA Safety Standards Series No. WS-G-6.1 Storage of Radioactive Waste Safety Guide](#)
11. [IAEA NW-G-1.1 Policies and Strategies for Radioactive Waste Management](#)
12. [IAEA NW-O Radioactive Waste Management Objectives](#)
13. [IAEA WMDB-ST-4 Radioactive Waste Management – Status and Trends Issue 4 2005](#)

2.4 Engineering and Technical Support

1. [IAEA-TECDOC-1078 Technical support for nuclear power operations](#)
2. [IAEA Safety Standard SSR 2/1 Safety of Nuclear Power Plants: Design](#)
3. [Maintaining the Design Integrity of Nuclear Installations throughout their Operating Life INSAG-19](#)
4. [Design Change Management in Regulation of Nuclear Fleets WNA Report](#)
5. [IAEA Safety Report Series No.65 Application of Configuration Management in Nuclear Power Plants](#)
6. [IAEA Safety Guide NS-G-2.3 Modifications to Nuclear Power Plants](#)
7. [WENRA Reactor Safety Levels, January 2008](#) and [November 2013](#)

2.5 Programmes

1. [IAEA-TECDOC-1389 Managing modernization of nuclear power plant I&C systems](#)
2. [IAEA-EBP-WWER-14 Safety Issues and their ranking for Small Series WWER 1000 Nuclear Power Plants](#)
3. [IAEA Safety Guide NS-G-2.10 Periodic Safety Review of Nuclear Power Plants](#)
4. [IAEA Safety Guide NS-G-2.12 Ageing Management for Nuclear Power Plants](#)
5. [IAEA NW-G-2.1 Policies and Strategies for the Decommissioning of Nuclear and Radiological Facilities](#)
6. [IAEA Safety Guide NS-G-2.15 Severe Accident Management Programmes for NPP](#)
7. [WENRA Reactor Safety Levels, January 2008](#) and [November 2013](#)

2.6 Physical Plant

1. [IAEA Safety Guide NS-G-2.14 Conduct of Operations at Nuclear Power Plants](#)
2. [WENRA Reactor Safety Levels, January 2008](#) and [November 2013](#)

2.7 New Build

1. [IAEA Safety Guide NS-G-2.14 Conduct of Operations at Nuclear Power Plants](#)
2. [IAEA Safety Guide NS-G-2.9 Commissioning for Nuclear Power Plants](#) (Superseded)
3. [IAEA SSG-28 Commissioning for Nuclear Power Plants](#)
4. [IAEA NG-T-2.2 Commissioning of Nuclear Power Plants: Training and Human Resources Considerations](#)
5. [IAEA Safety Report Series No.74 Safety Culture in Pre-operational Phases of Nuclear Power Plant Projects](#)
6. [WENRA Reactor Safety Levels, January 2008](#) and [November 2013](#)

Section 3 Third Party Liability

3.1 Emergency Preparedness

1. [IAEA Safety Guide GS-G-2.1 Arrangements for Preparedness for a Nuclear or Radiological Emergency](#)
2. [IAEA Safety Guide NS-G-2.15 Severe Accident Management Programmes for NPPs](#)
3. [IAEA Safety Standards Series No GS-R-2 Preparedness and Response for a Nuclear or Radiological Emergency Safety Requirements](#)
4. [WENRA Reactor Safety Levels, January 2008](#) and [November 2013](#)

3.2 Radiological Environmental Monitoring

1. [ICRP, 2007. The 2007 Recommendations of the International Commission on Radiological Protection. ICRP Publication 103.](#)
2. [EC Radiation Protection 129. Guidance on the realistic assessment of radiation doses to members of the public due to the operation of nuclear installations under normal conditions.](#)

3.3 Radiological Effluent Monitoring

None identified.

3.4 Radiological Protection

1. [ICRP, 2007. The 2007 Recommendations of the International Commission on Radiological Protection. ICRP Publication 103.](#)
2. [UK Industry Radiological Protection Co-ordination Group \(IRPCG\) Personal Dosimetry Management – Good Practice Guide](#)
3. [IAEA Safety Standards Series No GS-R Part 3 Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards](#)
4. [IAEA Safety Standards Series No. NS-G-1.13 Radiation Protection Aspects of Design for Nuclear Power Plants Safety Guide](#)
5. [IAEA Safety Standards Series No. NS-G-2.7 Radiation Protection and Radioactive Waste Management in the Operation of Nuclear Power Plants](#)
6. [OECD, 2009. Work Management to Optimise Occupational Radiological Protection at Nuclear Power Plants](#)

3.5 Legal and Licensing

1. [IAEA Safety Standards Series No. GS-G-1.4 Documentation for Use in Regulating Nuclear Facilities Safety Guide](#)
2. [IAEA Special Safety Guide SSG-12 Licensing Process for Nuclear Installations](#)
3. [IAEA Handbook on Nuclear Law 2003](#)
4. [IAEA Safety Standards Series No GS-R Part 1 Government, Legal and Regulatory Framework for Safety](#)

Note: IAEA GS-R-1 Legal and Governmental Infrastructure for Nuclear Radiation, Radioactive Waste, and Transport Safety has been superseded by IAEA GS-R Part 1.

3.6 Local Environment and Amenity

None identified.