Training Course on the IAEA Safety Standards Overview

SSR-2/2 (Rev. 1)

Safety of Nuclear Power Plants: Commissioning and Operation

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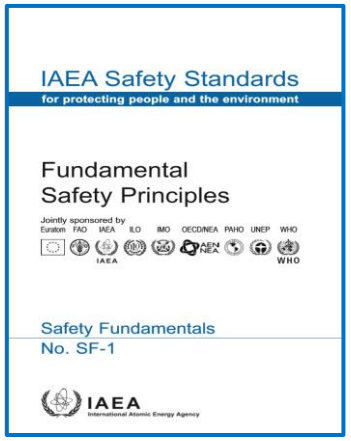
Learning Objectives

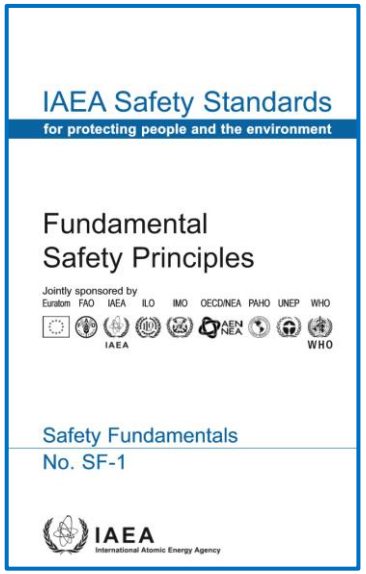
This presentation will enable participants to understand:

- The content of SSR-2/2 (Rev.1) Safety of Nuclear Power Plants: Commissioning and Operation
- The link of SSR-2/2 (Rev.1) to Fundamental Safety Principles
- The extent of Safety Guides supporting SSR-2/2 (Rev.1)
- Purpose of Operational Safety Review Team (OSART) review missions



Safety Fundamentals: Safety Objective and Principles

Principle 1: Responsibility for safety
Principle 3: Leadership and management for safety
Principle 5: Optimization of protection
Principle 6: Limitation of risks to individuals
Principle 7: Protection of present and future generations
Principle 8: Prevention of accidents
Principle 9: Emergency preparedness and response



Principle 2 relates to the role of government
Principle 4 relates to justification of facilities
Principle 10 relates to existing or unregulated radiation risks

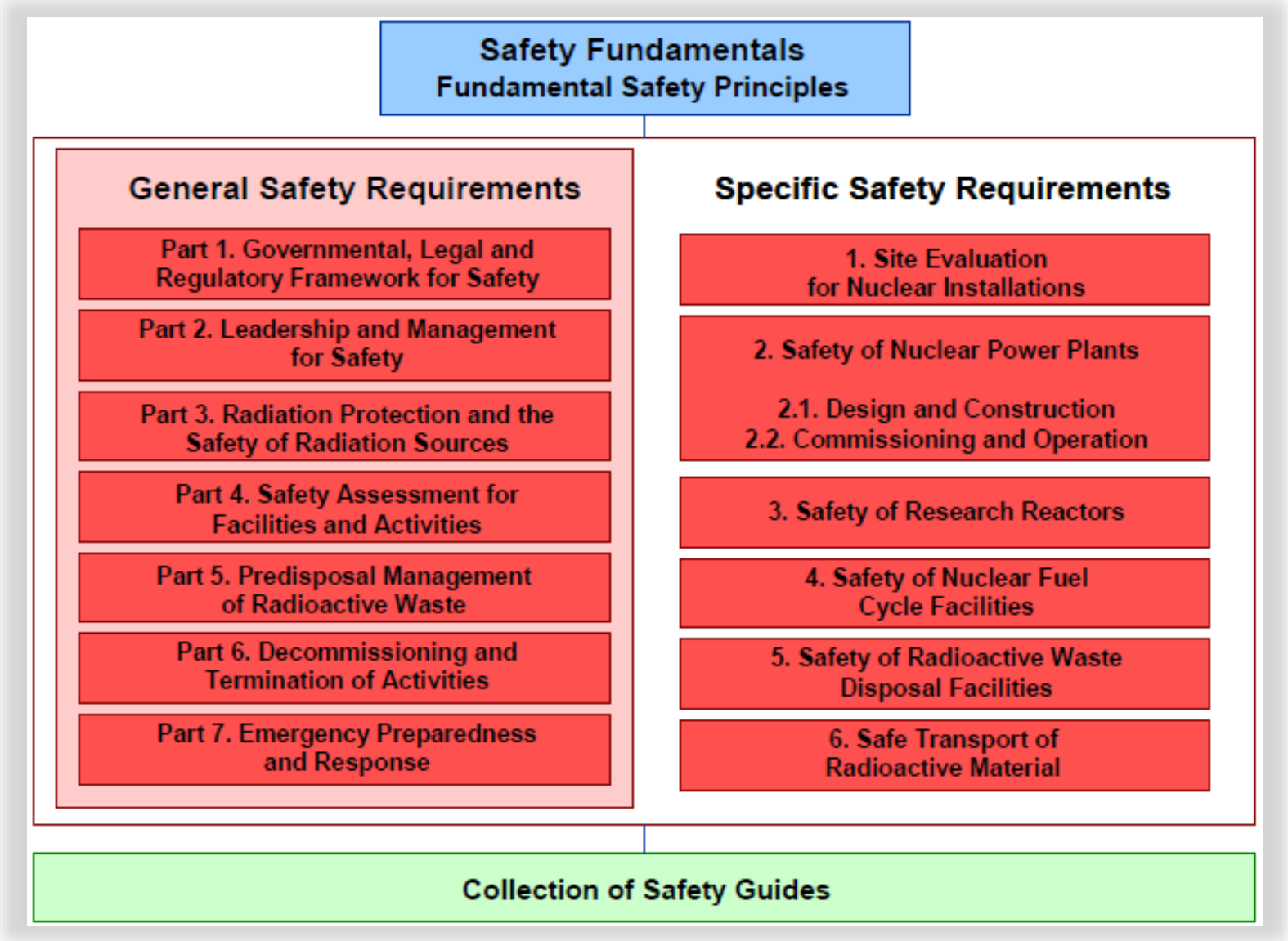
SSR-2/2 (Rev.1)

- Issued in 2016; it superseded previous version from 2011 and NS-R-2: Safety of Nuclear Power Plants: Operation issued in 2000
- Takes into account lessons drawn from experience in events that have occurred, including Fukushima-Daiichi accident
- Guidance on how to meet the requirements is provided in a collection of supporting Safety Guides

Scope of SSR-2/2 (Rev.1)

- Safe commissioning and operation of NPPs including maintenance and modifications
- Safe operation of NPPs up to the removal of nuclear fuel from the plant
- Preparation for decommissioning
- Normal operation and anticipated operational occurrences as well as accident conditions are taken into account

Comprehensive Collection of Safety Requirements



Overview of SSR-2/2 (Rev. 1) Requirements

1-4	Management and Organizational Structure of the Operating Organization
5-16	Management of Operational Safety
17-24	Operational Safety Programmes
25	Plant Commissioning
26-30	Plant Operations
31-32	Maintenance, Testing, Surveillance and Inspections
33	Preparation for Decommissioning

Management and Organizational Structure of the Operating Organization / 1

This section has four requirements

1. Responsibilities of the operating organization
2. Management system
3. Structure and functions of the operating organization
4. Staffing of the operating organization

Management and Organizational Structure of the Operating Organization / 2

Key messages

- ✓Prime responsibility rests with an operating organization; responsibility for supervising of all suppliers included
- ✓Design integrity assured; formally designated entity with responsibility for integrity of the plant design throughout the lifetime
- ✓Liaison with regulatory body and relevant authorities established
- ✓Procedure for reporting events to the regulatory body
- ✓The structure of the operating organization is specified so that all roles critical for safe operation are specified and described
- ✓A long-term staffing plan aligned to the long-term objectives of the operating organization

Question

Req. 2 Management system

Management system shall include:

3.2 (f) Design integrity, which includes maintaining a formally designated entity that has overall responsibility for the continuing integrity of the plant design throughout its lifetime and managing the interfaces and lines of communication with the responsible designers and equipment suppliers contributing to this continuing integrity.

How do you understand the purpose of “design authority”?

Question

Req. 4 Staffing

Distractions to control room operators shall be minimized. To avoid overburdening control room operators and to allow them to focus on their responsibilities for safety, activities shall be scheduled to reduce simultaneous activities as far as possible.

Is this requirement followed in your organization and how?

Management of operational safety / 1

This section has twelve requirements

5. Safety policy
6. Operational limits and conditions
7. Qualification and training of personnel
8. Performance of safety related activities
9. Monitoring and review of safety performance
10. Control of plant configuration
11. Management of modifications
12. Periodic safety review
13. Equipment qualification
14. Ageing management
15. Records and reports
16. Programme for long term operation

Management of operational safety / 2

Key messages:

- ✓ Safety policy giving safety the utmost priority; commitment to perform periodic safety reviews, commitment to enhancements in operational safety
- ✓ The operational limits and conditions reflect provisions made in the final design as described in the safety analysis report; review and revision; appropriate surveillance programme to ensure compliance; deviations documented and reported; no intentional exceed
- ✓ Suitable training programme for the training of personnel before their assignment to safety related duties; systematic approach to training; operating experience incorporated; adequate training facilities including a representative simulator
- ✓ All activities important to safety carried out in accordance with written procedures; acceptable margins ensured; experiments only with adequate justification + specific safety review and procedure

Management of operational safety / 3

Key messages:

- ✓ An adequate audit and review system established to improve safety performance; self-assessment is an integral part; suitable performance indicators used; corrective actions taken
- ✓ Controls implemented to handle changes in plant configuration resulting from maintenance work, testing, repair, operational limits and conditions and plant refurbishment, from modifications due to ageing of components, technical developments,…
- ✓ Modification control assured; temporary modifications limited in time and number; training related to modifications
- ✓ Safety reviews such as periodic safety reviews etc. conducted at regular intervals; findings of safety reviews reported to the regulatory body
- ✓ Probabilistic safety assessment can be used to complement deterministic safety assessment
- ✓ Concepts and the scope and process of equipment qualification is established

Management of operational safety / 4

Key messages:

- ✓ Systematic approach to ageing management
- ✓ System for control of records and reports established
- ✓ Programme for long term operation established

Question

Req. 10 Control of plant configuration

The operating organization shall establish and implement a system for plant configuration management to ensure consistency between design requirements, physical configuration and plant documentation.

What are the challenges related to this requirement?

Operational safety programmes / 1

This section has eight requirements

17. Consideration of nuclear security in safety programmes
18. Emergency preparedness
19. Accident management programme
20. Radiation protection
21. Management of radioactive waste
22. Fire safety
23. Non-radiation-related safety
24. Feedback of operating experience

Operational safety programmes / 2

Key messages:

- ✓Safety and security are viewed as complementary; safety and security measures are implemented not compromising each other
- ✓The operating organization develops an emergency plan and establishes response structure; contributes to the development of off-site emergency procedures; coordination with bodies having responsibility in an emergency; testing and validation of emergency plan in exercise before fuel loading; emergency trainings, exercises and drills at suitable intervals
- ✓An accident management programme covers the preparatory measures, procedures and guidelines and equipment necessary for preventing the progression of accidents and for mitigating their consequences; multi-unit NPP site considered; contingency measures like alternative supply of cooling water and electrical power; technical and administrative measures, training
- ✓Radiation protection programme ensures that doses are kept below authorized limits and ALARA; assessment of occupational exposure of all plant personnel including suppliers

Operational safety programmes / 3

Key messages:

- ✓The program for the management of radioactive waste includes characterization, classification, processing, transport., storage and disposal of radioactive waste; the volume and activity of radioactive discharges to the environment reported periodically to regulatory body
- ✓Adequate management for fire safety, preventing fires, detecting and extinguishing quickly; fire hazard analysis; special attention to cases with risk of release of radioactive materials in a fire
- ✓Non-radiation-related hazards are kept as low as reasonably achievable
- ✓Operating experience programme established in a systematic way; investigation of events with safety implications; direct and root causes; used in training; corrective actions taken; maintain liaison with support organizations (manufacturers, research organizations, designers)

Question

Req. 22 Fire safety

The operating organization shall be responsible for ensuring that appropriate procedures, equipment and staff are in place for effectively coordinating and cooperating with all firefighting services involved. Periodic joint fire drills and exercises shall be conducted to assess the effectiveness of the fire response capability.

How it works in your plant?

Plant commissioning / 2

This section has only one requirement

25. Commissioning programme

Plant commissioning / 2

Main messages:

- ✓Commissioning programme covers full range of plant conditions; commissioning stages, test objectives and acceptance criteria are specified
- ✓Demonstration that the plant can be safely operated in accordance with the operational limits and conditions; validation of operating and maintenance procedures
- ✓Initial fuel loading authorization only after all relevant pre-operational tests have been performed and results have been accepted by the operating organization and the regulatory body
- ✓Importance of interfaces and the communication; authorities and responsibilities clearly specified
- ✓Process to address non-conformances established

Question

Req. 25 Commissioning programme

The operating organization shall be responsible for ensuring that construction activities are of appropriate quality and that completion data on commissioning activities and comprehensive baseline data, documentation or information are provided.

What tools/means are used to ensure an appropriate quality of construction by operating organization?

Plant operations / 1

This section has five requirements

26. Operating procedures
27. Operation control rooms and control equipment
28. Material conditions and housekeeping
29. Chemistry programme
30. Core management and fuel handling

Plant operations / 2

Main messages:

- ✓Operating procedures developed for normal operation, anticipated operational occurrences and design basis accidents; guidelines or procedures also for accidents more severe than the design basis accidents; event-based approach and symptom-based approach are used
- ✓Operation control rooms and control equipment are maintained in a suitable conditions; clear communication between main control room and additional/local control rooms; supplementary control room in the proper state of operational readiness; alarms considered as an important feature, prioritized
- ✓Material conditions and housekeeping in a high standard; exclusion programme for foreign objects in place; identification and labelling of safety and safety related equipment

Plant operations / 3

Main messages:

- ✓Chemistry programme in place during the commissioning; chemistry monitoring, data acquisition systems, laboratory analyses; use of chemicals under close control
- ✓Only fuel appropriately manufactured is loaded into the core, specifications and procedures for the procurement, verification, receipt, accounting and control, loading, utilization, relocation, unloading and testing of fuel and core components; safe reactivity management programme established, core monitoring programme established
- ✓Radiochemistry data indicating fuel cladding integrity are systematically monitored
- ✓Packaging, carriage and transport of unirradiated and irradiated fuel in accordance with national and international regulations

Maintenance, Testing, Surveillance and Inspections / 1

This section has two requirements

31. Maintenance, testing, surveillance and inspection programmes
32. Outage management

Maintenance, Testing, Surveillance and Inspections / 2

Main messages:

- ✓Maintenance, testing, surveillance and inspection programmes established; predictive, preventive and corrective maintenance; procedures for all maintenance developed; data on maintenance, testing, surveillance and inspection recorded, stored, analyzed; frequency of maintenance determined; comprehensive work planning and control established; coordination between different maintenance groups
- ✓Arrangements to procure, receive, control, store and issue materials, spare parts and components; adequate storage conditions
- ✓Outage management established, special attention is given to maintaining the plant configuration in accordance with operational limits and conditions; interfaces between different groups are defined
- ✓Optimization of radiation protection, optimizing non-radiation-related safety, waste reduction and control of chemical hazards essential

Question

Req. 32 Outage management

A comprehensive review shall be performed after each outage to draw lessons to be learned.

How is it done in your plant? What lessons learned are typical ones?

Preparation for decommissioning / 1

This section has only one requirement

33. Preparation for decommissioning

Preparation for decommissioning / 2

Key messages:

- ✓Preparation of decommissioning plan; keep it up to date throughout the lifetime of the plant
- ✓Human resources programme developed
- ✓In case of multiple unit plant, all common systems and equipment remain fully available to support safe operation of all generating units

Question

Req. 33 Preparation for decommissioning

A human resources programme shall be developed for ensuring that sufficient motivated and qualified personnel are available for the safe operation of the plant up to final shutdown,…

Have you an experience with challenges related to this life-cycle stage?

Safety Guides for Commissioning and Operation of NPPs

Protection Against Internal and External Hazards in the Operation of NPPs	SSG-77
Operational Limits & Conditions and Operating Procedures for NPPs	SSG-70
Modifications to NPPs	SSG-71
The Operating Organization for NPPs	SSG-72
Core Management and Fuel Handling for NPPs	SSG-73
Maintenance, Testing, Surveillance and Inspection in NPPs	SSG-74
Predisposal Management of Radioactive Waste from NPPs and RRs	SSG-40
Recruitment, Qualification and Training of Personnel for NPPs	SSG-75
Ageing Management and Development of a Programme for Long Term Operation of NPPs	SSG-48
Evaluation of Seismic Safety for Existing Nuclear Installation	SSG-89
Conduct of Operations at NPPs	SSG-76
Accident Management Programmes for NPPs	SSG-54
Chemistry Programme for Water Cooled NPPs	SSG-13
Periodic Safety Review for NPPs	SSG-25
Commissioning for NPPs	SSG-28
Operating Experience Feedback for Nuclear Installations	SSG-50

This is a just a subset of all the related guides

Guide in red is under revision

Application of the Safety Standards

- The IAEA Safety Review Services help Member States to review alignment with the IAEA Safety Standards

- There are many IAEA safety review services: the one most closely related to Commissioning and Operation of NPPs is OSART: Operational Safety Review Team.

OSART Objectives

- Improve host plant operational safety
- Objectively assess status of key operational safety areas
- Exchange information and experiences

OSART Methodology

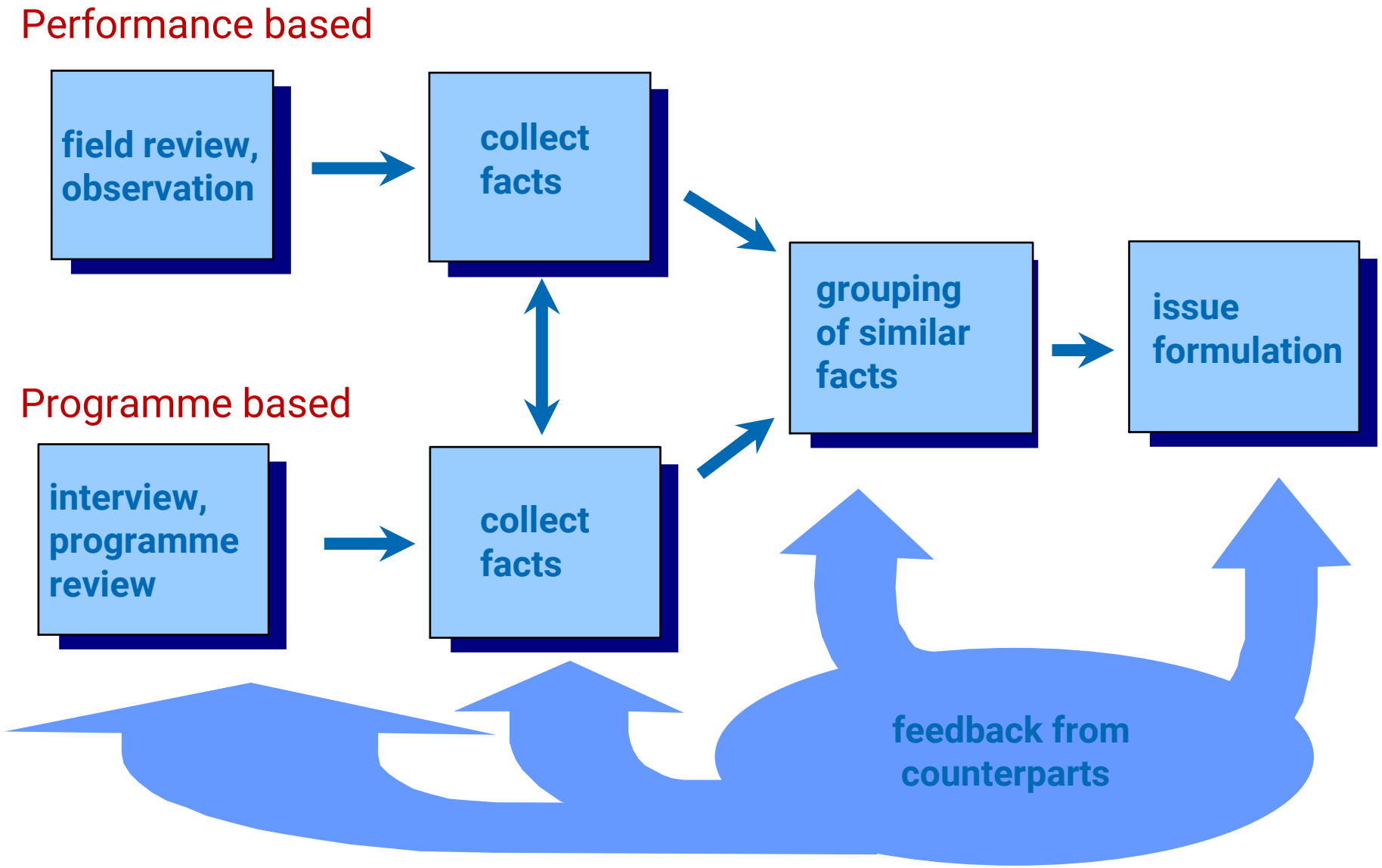
OSART: Assessment Objectives

- Objectively assess status of key operational safety areas against IAEA Safety Standards
- Improve operational safety
- Exchange information and experiences between hosts, reviewers and industry

What OSART does not assess

- Overall design adequacy
- Performance against national regulatory requirements
- The overall safety of a plant
- The operational safety performance of a plant in comparison with other plants

OSART Methodology



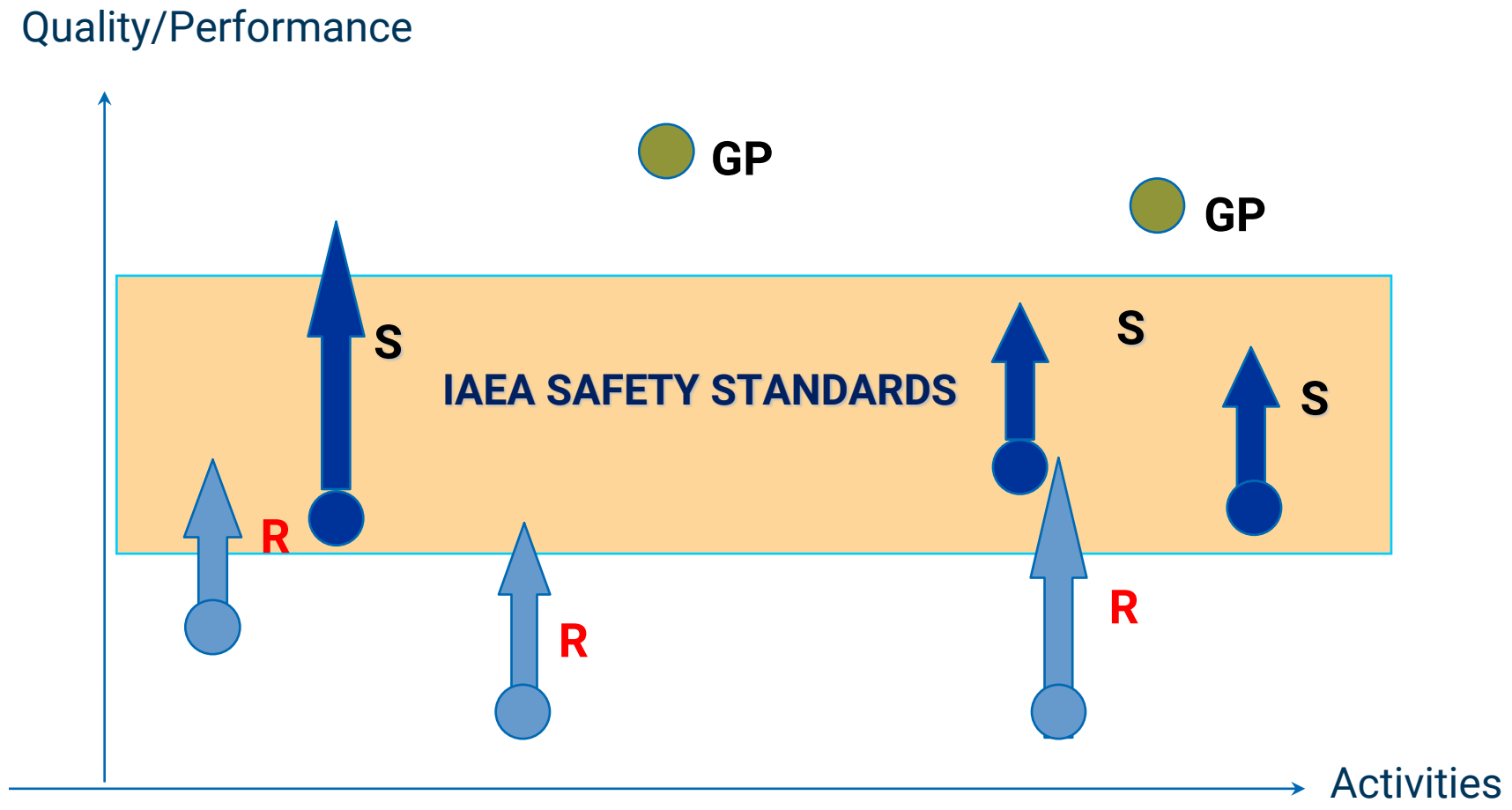
OSART Methodology

Performance (Field) Review

Reviewers look for:

- ✓Effective application of policies, programmes and procedures by supervisors and workers
- ✓Attitudes and performance of supervisors and workers
- ✓Material condition of systems, structures and components
- ✓Housekeeping and cleanliness

OSART Methodology



R: Recommendation S: Suggestion GP: Good Practice, Good Performance

Thank you!

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