



The Abdus Salam
**International Centre
for Theoretical Physics**



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Joint ICTP-IAEA School on Nuclear Energy Management

15 July - 3 August, 2013

Lecture Notes

D. Delattre
IAEA, Vienna, Austria

**The ICTP/IAEA School of Nuclear Energy
Management School, Trieste, 18 July 2013**

The IAEA Safety Review Services

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IAEA

International Atomic Energy Agency

Content

- OSART
- IRRS
- INIR
- SALTO
- PROSPER
- SEDO
- DESAR
- SEED
- INSARR
- The IAEA safety review missions are voluntary and are invited by Member States

IAEA Support Framework



OSART

OPERATIONAL SAFETY REVIEW TEAM

Operational Safety Review Team (OSART)

ABOUT OSART



- Provides advice and assistance to Member States in enhancing operational safety of operating NPPs, and also approaching operation, commissioning or in earlier stages of construction (Pre-OSART).
- Can be focused to review only a few specific areas or a specific issue (i.e., Expert missions).
- Follow-up visits are standard and are conducted between 12 to 18 months following the OSART mission.

OSART Overall Concept

TIME	ACTIVITY	RESOURCES
12 months before mission	PREPARATORY MEETING, SEMINAR	2 IAEA staff 3 days
	MISSION	2-4 IAEA staff Up to 12 external experts 2.5 weeks
about 18 months after mission	FOLLOW-UP VISIT	2 IAEA staff 1-3 external experts 1 week



OSART PROGRAMME - Structure and Scope

1MOA	Management, Organization and Administration
2TQ	Training and qualification
3OPS	Operations (2 reviewers)
4MA	Maintenance
5TS	Technical support
6OE	Operating Experience
7RP	Radiation protection
8CH	Chemistry
9EPP	Emergency planning and preparedness
14AM	Accident Management

Safety culture review is included in all areas or separate module.

Optional areas: Corporate, Commissioning, PSA application, LTO, Transition to decommissioning

OSART attributes

- Objectivity of judgement guaranteed by using IAEA Safety Standards as reference criteria to decide whether a recommendation or suggestion should be made or not;
- Well qualified experts with management experience and the potential of world-wide selection; diverse experience of team members representing not only NPPs but also regulatory bodies and technical support organizations.

OSART attributes

- Customized scope of the review by offering optional review areas (corporate review, commissioning, risk informed decision making, long term operation, transition to decommissioning).
- Transparency of the review process through host plant peer and daily communications between team leader and plant manager.
- Derestricted nature of the report allows the regulatory body, politicians, non-governmental organizations and the public to view and consider the results as independent expert assessment.

OSART

Western Europe	58
Central Europe	27
Eastern Europe	33
Asia	30
North America	15
South America	8
Africa	4

175

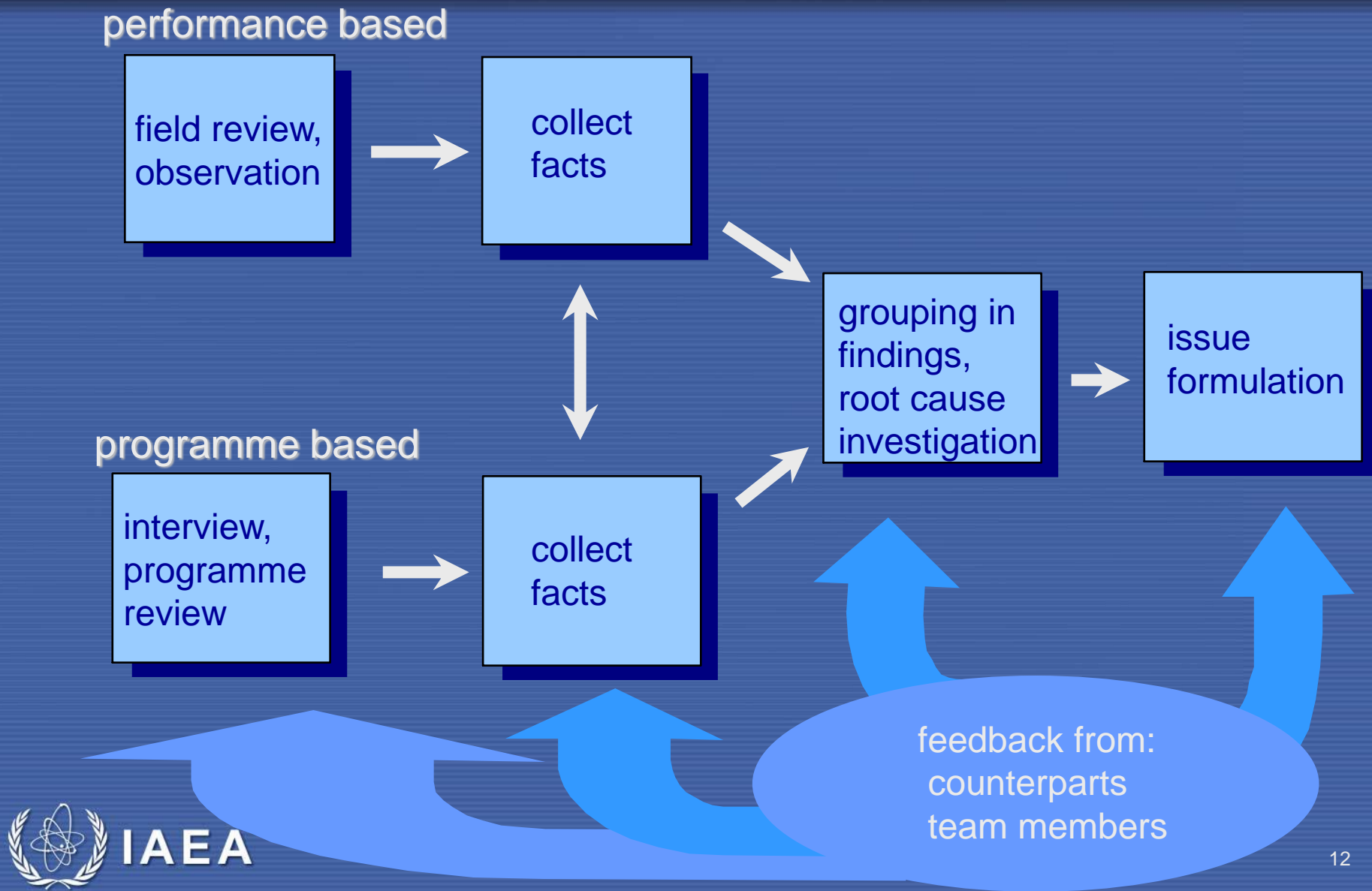


Top customers of OSART mission

Country (number of operating NPPs)	Numbers of OSART missions hosted
France (19)	24
Ukraine (4)	14
China (6)	11
Czech Republic (2)	10
Brazil (1)	7
Bulgaria (1)	7
Russia (10)	7
Sweden (3)	7
USA (63)	7



Identifying, developing and reporting Issues



OSART PROGRAMME - Follow-up Visit

Timing

About 18 months after the OSART mission

Purpose

Determine status of actions taken in response to mission findings

Assist the host power plant in achieving maximum benefit from OSART response actions

Review areas of Corporate OSART

- Corporate management
- Independent nuclear oversight
- Corporate support to provide human resources
- Communication
- Corporate support in technical functions
 - e.g. Operating experience, Chemistry, Fuel management etc. (depending on the functions of the corporate organization and the request)

Follow-up Visit - Methodology

Plant prepares responses for each recommendation and suggestion

Plant responses are sent in advance to each member of follow-up team by IAEA

During the visit, team members:

- discuss responses, issue by issue and item by item
- verify responses
- make comments on appropriateness
- make judgments on degree of progress
- report their views orally and in writing

Future OSART missions 2014

- Taishan, China 2nd Q
- Borssele, Netherlands 1–18 September
- Flamanville, France 6–23 October
- Kola, Russia 11–27 November
- Olkiluoto 3, Finland ?
- Bushehr, Iran 4th Q
- Clinton, USA 4Q
- EDF Corporate 24 Nov.-5 Dec.

Future OSART missions 2015

- Dampierre, France
- Angra 3, Brazil April 2015
- Novovoronezh, Russia 3rd Q

Future OSART missions 2016-2023

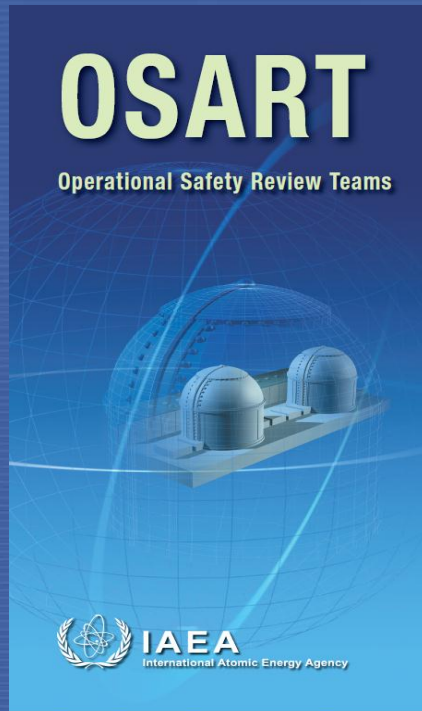
- Flamanville 3, France 2016
- Leningrad, Russia 2017
- Barakah, UAE 2017
- Kalinin, Russia 2019
- Beloyarsk, Russia 2021
- Novovoronezh II, Russia 2023

Key messages

- OSART is the oldest world-wide peer review service
- OSART is recognised and recommended for use by
 - the General Conference
 - the Review Meeting of the Convention on Nuclear Safety
 - the Ministerial Conference of 2011
- OSART reports become publicly available
- OSART will continue to be an excellent IAEA service
- OSART must be driven from the heart of TLs

Materials available on OSART website

OSART brochure



http://www-ns.iaea.org/downloads/ni/s-reviews/osart/osart_brochure.pdf



OSART Good Practices OSART Guidelines on the web



<http://www-ns.iaea.org/reviews/good-practices.asp?s=2&l=8>



<http://www-ns.iaea.org/downloads/ni/s-reviews/osart/OSART%20GLN.pdf>

OSMIR Database

- OSART Mission Results Database
- Contains results from 113 OSART missions and 87 follow-up visits from 1991 (Continually being updated)
- 2890 Recommendations,
- 2091 Suggestions
- 1101 Good Practices
- Available on the IAEA website (only for registered users)

MISSIONS AND FOLLOW-UP VISITS

xxxx NPP, XXX

PWR 1330 MW

dd-dd mm, yyyy
dd-dd mm, yyyy

CHEMISTRY

Organization and Functions

Issue:

The lack of policies, procedures and programmes in chemistry is inconsistent with good industry practice and is resulting in some inferior practices. The following are examples where there were no established policies or procedures:

- Programme for lifetime control for chemicals standards.
- Programme to control the use of chemical reagents, e.g. inflammable solvents and toxic chemicals.
- Programme for quality control of chemical analysis, which includes trend analysis results and statistics treatment.
- Administrative procedure to control storage of chemicals reagents in the different laboratories.

Some examples of weaknesses associated with the lack of policies, procedures and programmes that were observed in the field are as follows:

- There were unnecessary quantities of flammable solvents, like toluene and benzene stored in the cold laboratory Unit 1 & 2.
- There was no administrative procedure to control toxic chemicals, which were stored in the cold laboratory Units 1 & 2.
- No administrative control is applied in the cold laboratories of Units 1 & 2 and Units 3 & 4 for chemicals segregation.

Lack of chemistry policies, programmes and procedures could lead to incorrect analysis and results that could lead to violation of chemicals limits or challenge plant personal safety.

Recommendation:

The plant should establish quality control policies, procedures and programmes consistent with good industry practice. These include: lifetime control for chemicals standards, control the use and storage of chemicals reagents and quality control of chemical analysis.

Plant response:

The bringing together of all laboratories within one department called the Measurements Performance and Environment



Vandellós II NPP

OSART Mission

(September 21st – October 8th 2009)

Advance Information Package

Volume I



IAEA



IRRS

INTEGRATED REGULATORY REVIEW SERVICE

Integrated Regulatory Review Service (IRRS)

ABOUT IRRS



- Compares national regulatory practices with IAEA safety standards and equivalent good practices elsewhere in the world for a requesting Member State.
- Provides opportunities for both the Regulator and the IAEA to learn about different approaches to the organization and practices of national nuclear regulatory bodies.
- Provides feedback to the IAEA on the application of IAEA safety standards and contributes to the harmonization of regulatory approaches among Member States.
- Follow-up missions encouraged to be conducted two years from the first IRRS mission.



IRRS MODULES

1. Responsibilities and functions of the government
2. Global nuclear safety regime
3. Responsibilities and functions of the regulatory body
4. Management system of the regulatory body

Core regulatory processes

5. Authorization
6. Review and Assessment
7. Inspection
8. Enforcement
9. Regulations and Guides

Core regulatory processes

Facilities and activities

Radiation sources
Research reactors
Nuclear power plants
Fuel cycle facilities
Waste facilities
Decommissioning

Facilities and activities

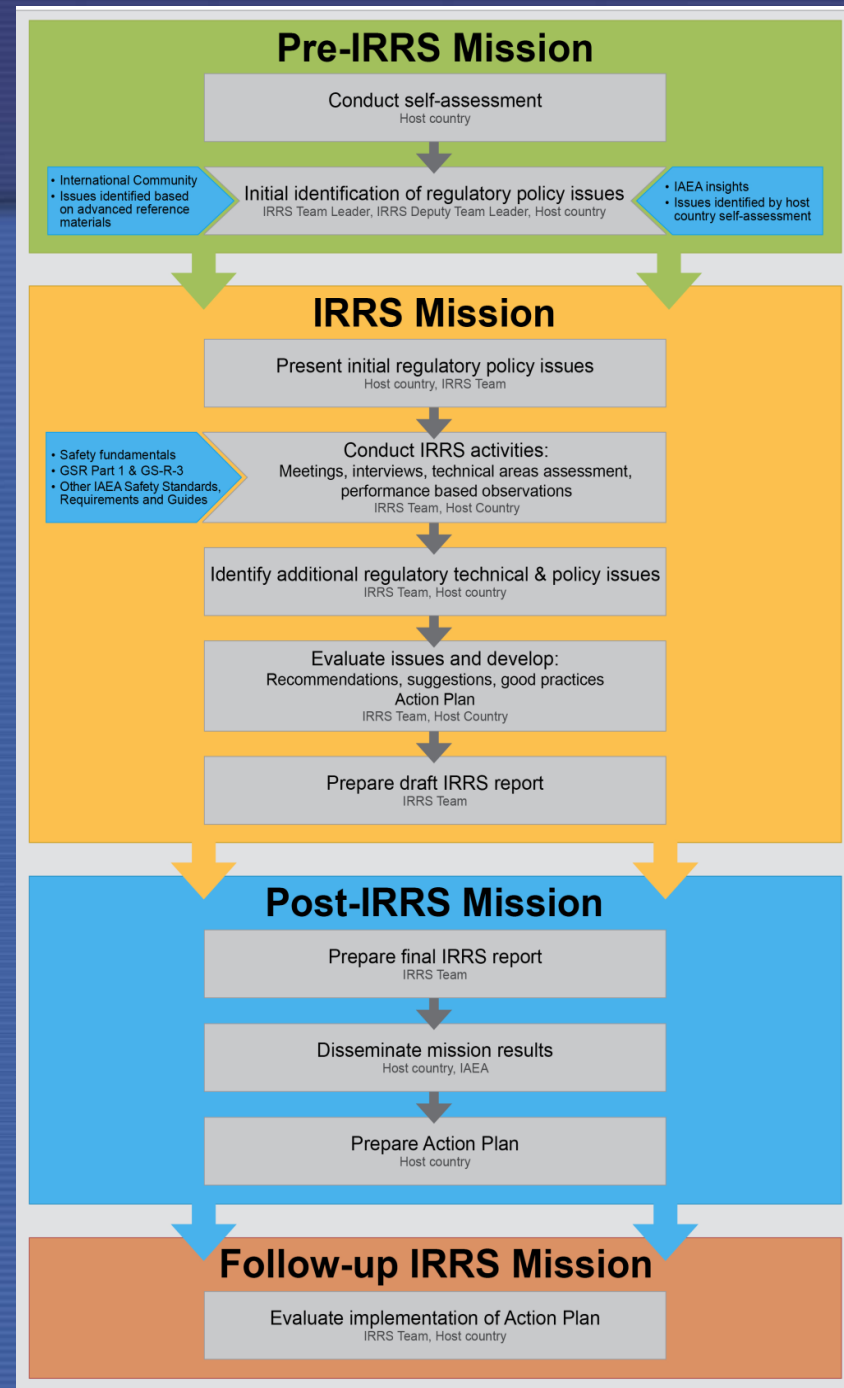
10. Emergency preparedness and response
11. Thematic areas
12. Interfaces with nuclear security

Policy Issues

Tailored module for countries embarking on nuclear power

IRRS Process

- Prep-meeting about 6 months before
- First mission: 10 days
- Report finalization about 3 months
- Follow-up missions after 2-3 years, about 7 days



IRRS

- Modular review by **international experts (15-20)**
- Duration of mission **2 weeks**
- **Mission report** provides recommendations, suggestions, good practices for regulatory framework for nuclear and radiation safety, and emergency preparedness

	Niger				UAE	
	Mexico	Germany			Canada (f)	
	Mauritius	Ukraine	Russia		Switzerland	
	Cameroon	Sierra Leone	UK (part 2)		Australia (f)	
	Kenya	Namibia	Vietnam		Slovenia	
	Uganda	Madagascar	Lebanon	Ukraine (fu)	Germany (f)	Finland
France	Gabon	Botswana	Canada	USA	Korea	Greece
UK	Australia	Spain	Peru	China	Spain (f)	Slovakia
Romania	Japan	Cote d'Ivoire	France (f)	Iran	Romania	Sweden
2006	2007	2008	2009	2010	2011	2012
3	9	8	7	4	9	4



IAEA

Present and future missions

Y	Country	Type	Scope	Status	Date
2013	Bulgaria	initial	full	invited	8 – 19 April
	Poland	initial	t.b.d.	invited	15 – 26 April
	UK	follow-up	extended	invited	30 Sept. – 11 Oct.
	Russian Fed.	follow-up	extended	invited	11 – 19 November
	Czech R.	initial	full	invited	18 – 29 November
	Belgium	initial	full	invited	2 - 13 December
2014	US	follow-up	reduced	invited	February
	Armenia	initial	t.b.d.	invited	t.b.d.
	Pakistan	initial	t.b.d.	invited	t.b.d.
	Indonesia	initial	t.b.d.	invited	9 – 21 March
	Jordan	initial	t.b.d.	discussed	April/June 2014
	Kazakhstan	initial	reduced	invited	May
	Vietnam	follow-up	reduced	invited	28 Sept. – 8 Oct.
	France	initial	full	invited	17 – 28 November
	Netherlands	initial	full	invited	2 – 15 November
	Romania	follow-up	full	invited	t.b.d.
	Korea	follow-up	full	invited	t.b.d.
	Slovenia	follow-up	full	invited	t.b.d.
	Slovakia	follow-up	full	invited	t.b.d.
	Japan	initial	t.b.d.	invited	t.b.d.
	Bangladesh	initial	t.b.d.	discussed	t.b.d.
	Chile	initial	t.b.d.	invited	t.b.d.
2015	Malta	initial	<u>t.b.d.</u>	invited	Q1
	Hungary	initial	full	invited	t.b.d.
	Italy	initial	t.b.d.	invited	t.b.d.
	Estonia	initial	t.b.d.	invited	t.b.d.
	Ireland	initial	t.b.d.	invited	t.b.d.
	Malaysia	initial	<u>t.b.d.</u>	invited	<u>t.b.d.</u>
	Croatia	initial	<u>t.b.d.</u>	invited	<u>t.b.d.</u>
	Finland	follow-up	t.b.d.	invited	t.b.d.
	Belgium	follow-up	t.b.d.	invited	t.b.d.
	Switzerland	follow-up	<u>t.b.d.</u>	discussed	<u>t.b.d.</u>

IRRS Guidelines



- Recently revised (slight changes)
- Published in May 2013
- A series of **Targeted Consultancies** was held for collecting experience and advice for a thorough revision
- Novel edition is compiled based on the consultancies starting next year

Conclusions

- **IRRS is an effective means** of reviewing compliance of RB status and activities with IAEA SS
- **Regular invitation** of IRRS missions by all IAEA MS is highly recommended
- The **IRRS process** is mature and effective – yet it is under **continuous development**
- **Lessons learned** from past missions are analysed and used for further development
- Mission **effectiveness and efficiency** is analysed
- Participation of MS representatives in **IRRS expert training** is encouraged

INIR

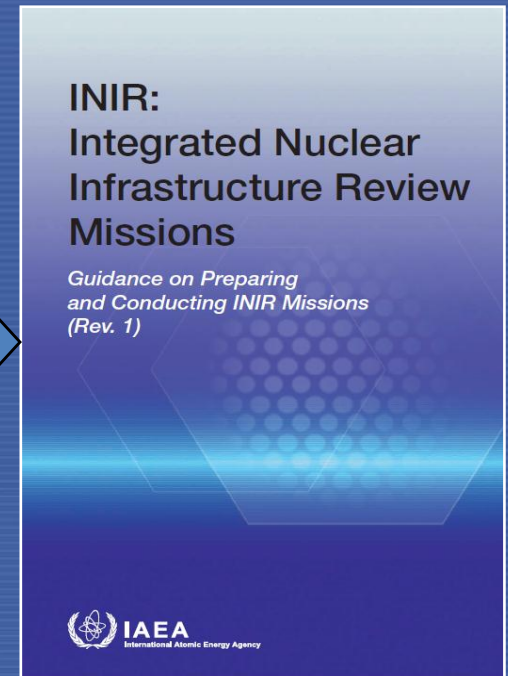
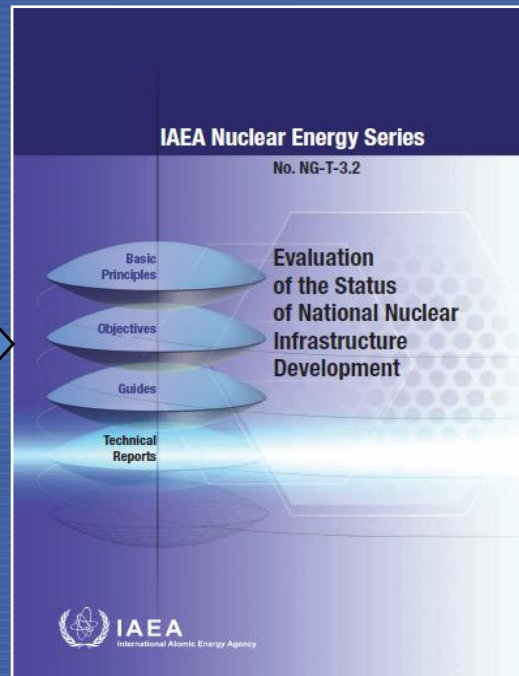
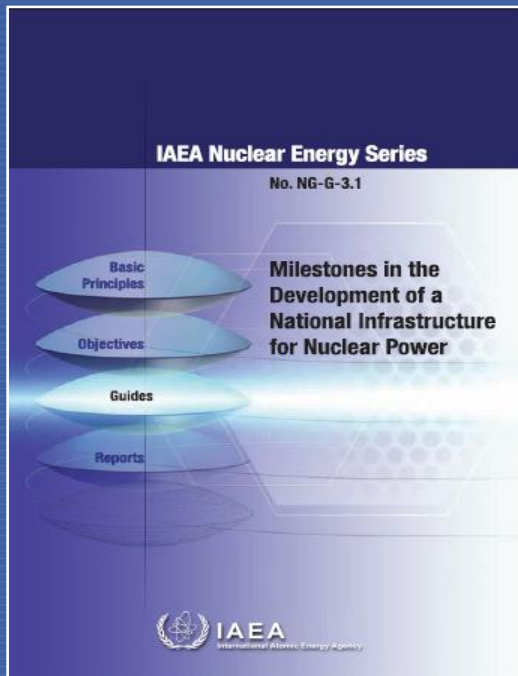
INTEGRATED NUCLEAR INFRASTRUCTURE REVIEW

Objective of the mission

- Assist a MS to develop necessary infrastructure for introduction of nuclear power to the country
- Evaluate the status of national infrastructure for nuclear power
- Identify gaps (areas where further work is needed to reach the Milestone)
- Make recommendations and suggestions to make progress

Basis of evaluation

Milestones / Evaluation / Guidance on INIR Missions



Addendum

Infrastructure Issues covered by INIR

- 
1. National position
 2. Nuclear safety
 3. Management
 4. Funding and financing
 5. Legislative framework
 6. Safeguards
 7. Regulatory framework
 8. Radiation protection
 9. Electrical grid
 10. Human resources development
 11. Stakeholder involvement
 12. Site and supporting facilities
 13. Environmental protection
 14. Emergency planning
 15. Security and physical protection
 16. Nuclear fuel cycle
 17. Radioactive waste
 18. Industrial involvement
 19. Procurement

Steps to an INIR mission

- Official request from the country
- Member State prepares Self-Evaluation report
- IAEA assembles team, reviews SER and supporting documents
- Training Package
- Pre-INIR (logistics, clarification, additional information, ToR)
- Preparatory meeting
- INIR mission conducted
- Final report delivered

Conducted and scheduled INIR Missions

1	Jordan	2009
2	Indonesia	2009
3	Vietnam	2009
4	Thailand	2010
5	UAE	2011
6	Bangladesh	2011
7	Jordan (follow-up)	2012
8	Belarus	2012
9	Vietnam	2012
10	South Africa	2013
11	Poland	2013
12	Turkey	2013



INIR Mission Statistics

	Jordan	Indonesia	Vietnam	Thailand	UAE	Bangladesh	Belarus	Vietnam
Phase	1&2	1	1	1	2	1&2	1&2	2
Experts	9(1)	6(2)	8(2)	7(1)	12(3)	10(3)	12(5)	12(3)
Working days	3	5	5	6	7	8	11	10
Recomm.	17	14	12	11	1	50	15	42
Suggest.	6	17	22	16	16	20	22	14
Good Practice	-	-	-	6	14	2	10	2

Common Challenges identified by INIR Missions

- Legislative framework
- Coordination, especially between the project promoter and the regulatory body
- Management, including project management and management systems
- National workforce planning and HRD
- Effectiveness of the regulatory body
- Infrastructure developing at slower pace than NPP project

Conclusions

- INIR Mission is well received by Member States
- INIR Mission has high visibility.
- INIR final report is delivered to a highest level in the country responsible for a nuclear power programme.
- Key factors of the mission success:
 - Strong team leadership
 - The IAEA and external experts
 - Intensive preparation
 - Good contact with a counterpart and coordination inside the country
- INIR coordination with other reviews.

OTHER SAFETY REVIEW SERVICES

SALTO –Safe Long Term Operation

- To assess the current status of the plant's programmes for long term operation and ageing management
- To identify existing or potential issues in respect of safe long term operation
- To propose measures to address issues identified using IAEA Safety Standards as basis
- To facilitate exchange of experience



Standard SALTO Peer Review scope

- **A - Organisation and functions, licensing basis, scoping and screening;**
- **B - Preconditions for LTO- Maintenance, ISI, EQ, Surveillance ;**
- **C - Ageing management programmes and related safety analyses involving time limited ageing assumptions for mechanical components;**
- **D - Ageing management programmes and related safety analyses involving time limited ageing assumptions for electrical and I&C components;**
- **E - Ageing management programmes and related safety analyses involving time limited ageing assumptions for civil structures :**
- **F - Human resources, competence and knowledge management for LTO.**

SALTO missions conducted/planned 2005 - 2013

18 SALTO missions:

Western Europe	3
Central Europe	8
Eastern Europe	1
Asia	4
North America	0
South America	1
Africa	1



PROSPER

Peer Review

of the effectiveness of the

Operating Safety

Performance Experience

Review

process

AREAS COVERED

1. Strategy and organization.
2. Event / deviation reporting and tracking.
3. Screening of reports for significance.
4. Assessment, Investigation, Analysis
5. Trend and trending review.
6. External operating experience review.

AREAS COVERED

7. Corrective action setting, prioritization tracking and accountability.
8. Immediate review of events with significant plant impact.
9. Utilization and dissemination of operational experience information.
10. Programme results and monitoring of effectiveness.

Safety Evaluation of Fuel Cycle Facilities During Operation SEDO

Fuel Cycle Facilities included in SEDO:

- Conversion & Enrichment Facilities
- Fuel Fabrication Facilities
- Spent Fuel Storage Facilities
- Reprocessing & associated Waste Treatment Facilities
- Fuel Cycle R&D Facilities

IAEA OPERATIONAL SAFETY REVIEW SERVICES - SEDO

Review Areas included in SEDO:

1. Management, organization and administration (MOA)
2. Training and qualification (TQ)
3. Operation (OP)
4. Maintenance and periodic tests (MPT)
5. Modifications (MOD)
6. Other technical support (TS)
7. Criticality safety (CS)
8. Radiation protection (RP)
9. Waste management (WM)
10. Fire, chemical and industrial safety management (FCIS)
11. Emergency planning and preparedness (EPP)
12. Effluent management and environment protection (EMEP)



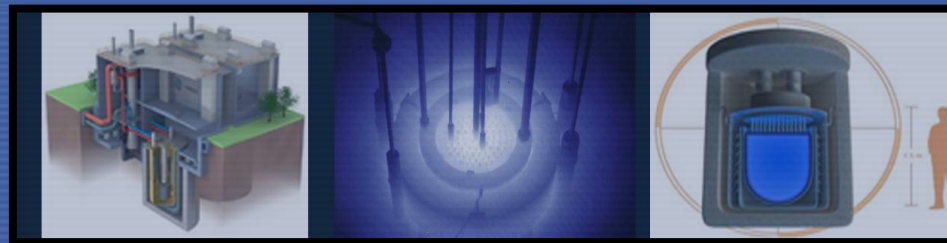
IAEA

Design and Safety Assessment Review Service (DSARS)

ABOUT DSARS



- DSARS assess plant design safety in comparison to IAEA safety standards for a requesting Member State; it is tailored to meet specific needs
- DSARS is organized in modules and can assist countries in the following areas:
 - ✓ Review of design safety supporting design evaluation of plant licensing
 - ✓ Review of safety analysis, both deterministic and probabilistic through out the plant life time
 - ✓ Review of safety analysis applications
 - ✓ Review of the severe accident management programme
 - ✓ Various safety aspects addressed in periodic safety review



DSARS

- Modular review by **IAEA Experts** and **Member State chosen Experts**
- DSARS integrates **modules** for **key technical safety assessment** areas
- **Final report** — summarizes strengths and weakness of design features, documentation quality, defence in depth, safety margins and so on

DSR — Design Safety Review

GRSR — Generic Reactor Design Safety Reviews

IPSART — International Probabilistic Safety Assessment Review Team

RAMP — Review of Accident Management Programme and Emergency Operating Procedures

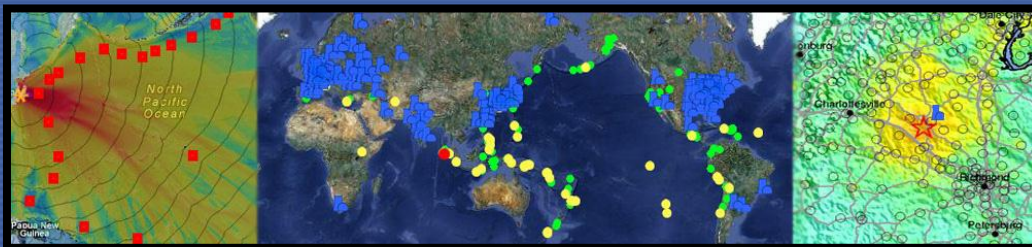
PSR — Periodic Safety Review

Site and External Events Design (SEED)

ABOUT SEED



- Service designed to assist the Member States through the different stages of the site selection, site assessment and design of structures, systems and components against the site specific external and internal hazards;
- Provides independent review of adherence to IAEA guidance on appropriateness of screening criteria uses in ranking sites;
- Provides multidisciplinary review of site requirements for construction of a nuclear installation;
- Provides the Member States with an independent review of safety margin assessment against external hazards for both single and multi-unit sites.
- Follow up missions as requested.



SEED

- Duration of mission **1 to 2 weeks**
- **IAEA staff (2) and external experts**
- **Mission report** provides recommendations, suggestions, good practices for the site evaluation and the designed safety of the nuclear installation against the demands of the external hazards both natural and human induced and internal hazards.

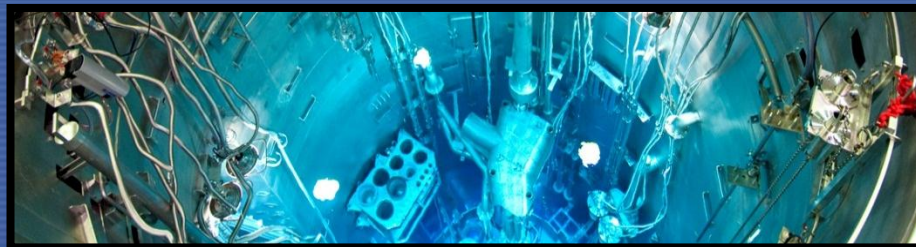


Integrated Safety Assessment of Research Reactors (INSARR)

ABOUT INSARR



- Review of the safety of research reactors against IAEA Safety Standards and provides recommendations for safety improvements
- Key review areas include design, safety analysis, operational limits and conditions, regulatory supervision, reactor operation and maintenance, ageing management, radiation protection and waste management, and experiments and modifications.
- The host organization may request a full-scope INSARR or a review of a specific area(s).
- Follow-up missions are encouraged and conducted with 12 to 18 months from the first INSARR mission.





SEDO

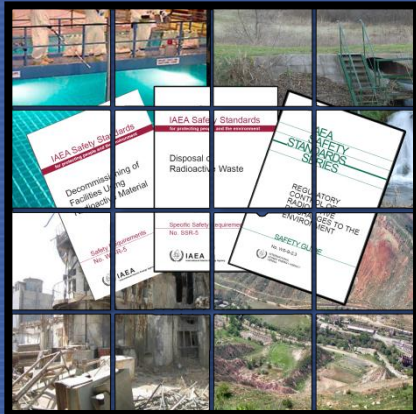
INSARR

- Duration of mission **1 to 2 weeks**
- **IAEA staff (2) and external experts**
- **Mission report** provides recommendations, suggestions, good practices



IAEA

Additional IAEA Services



EPREV
Review

— Emergency Preparedness

EduTA — Education and Training Appraisal

ORPAS — Occupational Radiation
Protection Advisory Service

RPoPAS — Radiation Protection of Patients
Advisory Service

TranSAS — Transport Safety Appraisal Service



How do IAEA Peer Review Missions Improve Nuclear Safety?

- By enhancing Member State capacity to evaluate reactor safety and conduct comprehensive and complete safety self-assessment
- By supporting regulators and operators in the development and application of advanced nuclear safety capacity in line with IAEA Safety Standards
- By implementing recommendations derived from these missions to effect needed nuclear safety improvements

Thank you!

