



International Atomic Energy Agency

TENTH EUROPEAN TRIGA USERS CONFERENCE

Atominstitut, Vienna, Austria, September 14 - 16, 1988

SAFETY INSPECTIONS TO TRIGA REACTORS

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1. INTRODUCTION

There are about 27 TRIGA reactors in 20 countries throughout the world outside the USA. Of these about 12 TRIGA's are under the Agency sponsored projects (see Table 1), whereby the Agency is entitled to examine the operational and radiological safety aspects of Agency assisted projects. To meet these needs the IAEA announced in 1972 the availability of safety advisory missions to research reactors, including TRIGA reactors.

In the most comprehensive form of safety mission, a team of experts assesses all areas affecting the ultimate safety of a particular research reactor. These missions are conducted regularly, about once each four years. Each mission comprises IAEA staff and if necessary external consultants.

This operational safety advisory programme was created to provide useful assistance and advice from an international perspective to research reactor operators and regulators on how to enhance operational safety and radiation protection on their reactors.

Safety missions cover not only the operational safety of reactors themselves, but also the safety of associated experimental loops, isotope laboratories and other experimental facilities.

Safety missions are also performed on request in other Member States which are interested in receiving impartial advice and assistance in order to enhance the safety of research reactors.

2. OBJECTIVES OF THE MISSION

The objectives of a safety mission are to conduct a comprehensive integrated safety assessment of the research reactor facility and to compare the safety of the reactor with the Agency's safety standards.

The evaluation is also aimed at facilitating an exchange of knowledge and experience between the experts and reactor personnel.

Safety missions are intended not to be a regulatory-type inspection that checks compliance with national requirements, but to achieve enhanced operational safety through application of effective practices used at other facilities around the world.

3. AREAS OF THE INSPECTION

3.1. General

The mission checks whether the safety at the reactor is subject to review by a regulatory organisation independent of the operating organisation and noting the frequency of regular inspections and any non-compliance observed by the inspectors. It checks whether a reactor safety committee, or an equivalent advisory group, exists to review safety problems arising in reactor operations and in planning of experiments.

The mission also checks whether the Safety Analysis Report (SAR) is up to date including accident analysis and whether the SAR addresses current deterministic and probabilistic methodologies for safety assessment.

3.2. Nuclear Safety

The nuclear safety review is mainly based on the requirements of the "Safe Operation of Research Reactor and Critical Assemblies" as it appears in the Agency's Safety Series No 35, 1984 edition.

The review examines the following areas :

3.2.1. Safety specifications

The mission checks whether there are approved safety specifications, including limits and conditions for the conduct of operations and experiments, and corrective actions in case of violation of the safety limits.

3.2.2. Periodic Testing and Inspection

The mission checks the surveillance test intervals established for the different reactor systems, the availability of written procedures for testing and inspection and the compliance of test results with safety specifications.

3.2.3. Management

The mission verifies the organisational structure of the Research Centre and Reactor Department for clearly defined duties and responsibilities in implementing and controlling facility activities. Particular attention is paid to training and retraining programmes, staff size, qualification and licencing of the operators, programmes for reactor utilization, quality assurance for operation, physical security and housekeeping.

3.2.4. Operating instructions

During the inspection the mission checks whether all normal and emergency operating procedures required for guiding the operating personnel are in place, the personnel are trained and retrained in these procedures, and a system has been established for regular review of all procedures and for the communication of any revisions to the operating personnel and other holders of the document.

3.2.5. Records and Reports

The mission checks whether all essential records on design and operation related to safety are being maintained.

3.2.6. Maintenance

The mission checks primarily the preventive maintenance programme for the reactor, the organisation of maintenance, the equipment available, and the procedures and documentation for maintenance. It also checks whether a system of work permits and approval after the maintenance is completed exists.

3.2.7. Experiments and modification

The mission checks the assurance of safety in routine experiments and irradiations and the safety review process for new experiments or modification in the reactor systems.

3.2.8. Physical security

The mission checks whether a physical security plan exists for the facility and whether it has been approved by the regulatory body.

3.2.9. Quality Assurance Programme for Operation

The mission checks whether the operating organisation has a quality assurance programme duly reviewed and approved by the regulatory body that will govern the quality at all safety related items during the operations. Does the quality assurance programme cover periodic testing and inspection of components and equipment at a determined frequency.

3.2.10. Conduct of Operations

The mission conducts a walk-through of the facility and asks questions of reactor personnel on matters relating to the reactor systems and the safety of reactor operation. The mission checks :

- a) Housekeeping in the facility
- b) Operational status of components and equipment important to safety
- c) Leak tightness of containment/confinement
- d) Proper demarcation of high radiation areas, e.g. experimental facilities, spent fuel storage, etc.
- e) Following up the approved procedures by the operators and accomplishment of the required checklists and forms.
- f) Function and calibration of instruments and systems.
- g) Knowledge of operating limits of the reactor and, of its operational characteristics by the operators.
- h) Reactor incidents and abnormal occurrences with safety significances which may have occurred.
- i) Number of unplanned scrams per year (for the last three years)
- j) Future plans for the reactor facility (conversion, increase in power level)

- 3.3. Radiation Protection
The mission examines the following areas :
- 3.3.1. Roles and responsibilities of management, the line organisation and the authority of the radiation protection staff with regard to the operating personnel.
- 3.3.2. Staff selection, training and qualification.
- 3.3.3. Occupational radiation control, including equipment, facilities and procedures for external and internal dose control, and surveillance activities including dosimetry and monitoring activities.
- 3.3.4. Public radiation control, including equipment, facilities and procedures for control and monitoring of liquid gaseous and solid waste discharged into environment and environmental monitoring.
- 3.3.5. Emergency planning and preparedness at on-site and off-site organizations responsible for responding to nuclear accidents and radiological emergencies.

4. PERFORMANCE OF THE MISSION

The members of a mission study information provided in advance by the research reactor organisation to familiarize themselves with the reactor, its main design features, operating characteristics, and the organisation of the reactor operation. This information is contained in a questionnaire which is filled out by the reactor operator.

At the reactor site members of the mission :

- examine the safety documentation of the facility,
- review the operational status of the reactor, and observe, if possible, a reactor start-up and shutdown,
- discuss technical details with the responsible personnel.

At the conclusion the mission's principal findings and recommendations are discussed with the senior management of the operating organisation and representatives of the regulatory authority.

IAEA safety inspections to TRIGA reactors are shown in Table 2.

5. REPORTING POLICY

After examining in depth the operational safety and the radiation protection aspects of the reactor operation the mission orally convey their findings and recommendations to the relevant authorities (operating organisation and regulatory body) during the final meeting. Shortly afterwards, a final mission report with conclusions is submitted through official channels to the Member State concerned. Further distribution of the report is at the discretion of the requesting Member State.

6. SOME CONCLUSIONS FROM INSPECTIONS

The results of the inspections have shown that in some countries there are problems with radiation protection practices and nuclear safety.

Very often the Safety Analysis Report is not updated, regulatory supervision needs clarification and improvement, maintenance procedures should be more formalised and records and reports are not maintained properly. In many cases population density around the facility has increased affecting the validity of the original safety analysis.

7. RELATED IAEA PUBLICATIONS

1. IAEA Safety Series No 35
State Operation of Research Reactors and Critical Assemblies
(1984 Edition)
2. IAEA Safety Series No 9
Basis Safety Standards for Radiation Protection (1982
Edition)
3. IAEA Safety Series 74
Safety in Decommissioning of Research Reactors (1986 Edition)
4. IAEA TECDOC - 348
Earthquake Resistant Design of Nuclear Facilities with
Limited Radioactive Inventory (1985 Edition)
5. IAEA TECDOC-400
Probabilistic Safety Assessment for Research Reactors (1987
Edition)
6. IAEA TECDOC-403
Siting of Research Reactors (1987 Edition)
7. IAEA TECDOC-448
Analysis and Upgrade of Instrumentation and Control Systems
for the Modernisation of Research Reactors (1988 Edition)

Table 1.

TRIGA REACTORS UNDER THE AGENCY SPONSORED PROJECTS

	TRIGA MODEL	MAXIMUM RATING, kW(t)	
		STADY STAFF	PULSING
Bangladesh	Mark II	3.000	852.000
Indonesia	Mark II	250	250.000
Malaysia	Mark II	1.000	1.360.000
Mexico	Mark III	1.000	2.000.000
Philippines	Conversion	3.000	650.000
Romania	Mark II	14.000	22.000.000
Tailand	Mark III	1.000	1.200.000
Turkey	Mark II	250	1.200.000
Vietnam	Reconstructed	500	-
Yugoslavia	Mark II	250	-
Zaire	Mark II	1.000	1.600.000

Table 2

RECORDS OF IAEA SAFETY INSPECTIONS TO TRIGA REACTORS

	<u>Dates of Safety Mission Visit</u>															
	<u>72</u>	<u>73</u>	<u>74</u>	<u>75</u>	<u>76</u>	<u>77</u>	<u>78</u>	<u>79</u>	<u>80</u>	<u>81</u>	<u>82</u>	<u>83</u>	<u>84</u>	<u>85</u>	<u>86</u>	<u>87</u>
Bangladesh																
Finland					x					x						x
Indonesia	x		x				x	x			x				x	
Malaysia							x					x			x	
Mexico		x				x				x					x	
Philippines	x		x			x					x					
Romania											x					
Thailand			x				x				x					x
Turkey					x									x		
Vietnam														x		
Yugoslavia					x										x	
Zaire								x					x			