



# DEVELOPMENT OF A WEB-BASED INFORMATION SYSTEM FOR BENCHMARKING OF SAFETY ASSESSMENT APPROACHES FOR RESEARCH REACTORS



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July 2005

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**DEVELOPMENT OF A WEB-BASED INFORMATION SYSTEM FOR  
BENCHMARKING OF SAFETY ASSESSMENT APPROACHES  
FOR RESEARCH REACTORS**

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EUR21738EN  
July 2005

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# 1. Objective

The objective of this report is to describe the development of a methodology and corresponding web-based tool for mapping and cross-comparing the safety approaches in European and other research reactor (RR) facilities in order to detect the principal similarities and differences.

As an example, the performance of a Probabilistic Safety Assessment (PSA) for RRs is mapped, as follows: is PSA performed at all? (Yes/No); if so, is PSA mandatory or just recommended? (Yes/No); what is the scope of PSA?, its objective? and practical use? (set of more detailed questions), etc.

In this way, information on different types of safety verification practices and requirements for RRs from Europe, Argentina, Australia, Canada, South Africa and the USA has been collected in a systematic way and included in the web-based JRC benchmarking tool DARES (DAtabase for REsearch Reactor Safety).

This systematic mapping by using DARES in parallel to an international Working Group, consisting of different types of stakeholders (operators, authorities) could be the starting point towards harmonisation of RR safety verification on an international level. In addition, the availability of a user-friendly Information System on the Internet such as DARES containing this information is considered a useful mechanism to exchange international experiences and practices in the area among qualified users.

## 2. Background

There is general agreement nowadays that the traditional deterministic approach to (nuclear) safety should be complemented by probabilistic approaches. Consequently, considerable resources have been invested worldwide in developing PSAs for Nuclear Power Plants (NPPs) as well as for RRs. Over the last two decades, PSA methods significantly matured, therefore an appropriate use of PSA results for risk informed decision making should be expected. Use of probabilistic risk insights can result in both improved safety and reduction of unnecessary regulatory requirements.

Why to harmonise safety assessment approaches? - International Conventions or European Union (EU) Directives define generic objectives, but leave technical methods / criteria usually to Member States. When implementing a Convention or Directive into national law, EU Member States are free to adopt specific measures to pursue its mandatory overall objectives and to judge how this is practically ensured. Thus, a diversity of specific technical approaches is kept on the national level. Examples are the specific safety assessment methods and criteria based on the specific safety culture of a Member State. However, due to the need to make estimated risk levels comparable and communicate safety and risk in a consistent way to stakeholders (authorities, public, etc.), there is a need for some level of international harmonisation.

Regarding harmonisation of safety assessment approaches for NPPs, at worldwide (IAEA) level, there is a reporting requirement on the NPPs' "safety status" under the 1994 IAEA Convention on Nuclear Safety. Country reports based on a specific reporting format have to be submitted and the collection of completed information templates will ultimately result in an IAEA Information System for comparing international practices.

On an EU level, the first draft EU Directive on safety of nuclear facilities was issued in November 2002, including a system of independent verification. The main concern of Member States was the question about the added value of such a Directive versus the IAEA Convention. A revised proposal was issued in September 2004 and the issue is still under discussion.

On EU national level, Member States' institutions became pro-active under WENRA, the Western European Nuclear Regulators Association. WENRA was created in 1999 by all European NPP regulators to develop a common approach to nuclear safety, to provide an independent capability to examine nuclear safety and to exchange experience and discuss significant safety issues.

WENRA defined the following areas for harmonisation of (power) reactor safety:

- Safety Management
- Design
- Operations
- Safety verification
- Emergency preparedness

For each of these *safety areas*, several *safety issues* have been defined, e.g. the following four issues for the safety area "Safety management":

- Safety policy
- Operating organisation
- Quality management system
- Training and authorisation of plant staff

As final step, each safety issue is complemented by a set of *reference levels* against which the fulfilment of a safety issue is "measured". For the safety issue "safety policy" these reference levels are:

- A written safety policy shall be issued by the licensee
- The safety policy shall be clear about giving safety first priority in all plant activities
- The safety policy shall include a commitment to continuously develop safety
- The safety policy shall be communicated to all staff in such a way that the policy is understood and applied
- The safety policy shall be communicated to all subcontractors, in such a way that the policy is understood and applied in their on-site activities
- The safety policy shall require a strategy for implementing the safety policy and monitoring safety performance
- The safety policy shall require safety objectives and targets clearly formulated in such a way that they can be easily monitored and followed up by the plant management
- The adequacy and implementation status of the safety policy shall be evaluated by the licensee on a regular bases, more frequent than the safety reviews

In a systematic way, WENRA members performed a (voluntary) self-benchmarking of its safety practices against these reference levels on a national level. Ultimately, by comparison and adjustment of deviations on a national level, this should result in a (voluntary) safety harmonisation. The results of this WENRA exercise have not yet been published.

### What about RRs?

Although RRs are not included in the 1994 IAEA Convention on Nuclear Safety, the topic of safety of RRs was considered important enough on an international level to issue the 2004 IAEA Code of Conduct on the Safety of Research Reactors.<sup>1</sup> In contrast to the Convention, the Code of Conduct includes recommendations for actions rather than formal obligations.

With a view to the WENRA practice, the question is: Does pro-activeness here pay-off for RR operators? If yes, a technical support tool for some sort of self-harmonisation, e.g. by the RR operators, would be the development of a database on RR safety assessment principles.

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<sup>1</sup> [http://www-ns.iaea.org/downloads/ni/code-rr/code\\_conduct\\_March04.pdf](http://www-ns.iaea.org/downloads/ni/code-rr/code_conduct_March04.pdf)

### 3. Work performed

As starting point, internationally available information on safety of RRs was screened by the European Commission's Joint Research Centre (JRC). Apart from the IAEA Code of Conduct and some quite specific and partly outdated IAEA activities, e.g. in the area of developing PSA modelling data for RRs, only an IAEA database on basic technical and operational information on RRs could be identified<sup>2</sup>. Another web-based Information System with information about nuclear research facilities exists on the JRC's ODIN website.<sup>3</sup> However, this NuCoC Database does not include any information on safety issues for the facilities listed.

The JRC project on development of a web-based Information System for benchmarking of safety assessment approaches for RRs was started in 2003 as an academic exercise between the JRC and the Atominstitut Vienna. A proposal for a Joint RROG<sup>4</sup>-JRC project on this topic was made at the October 2003 European Atomic Energy Society (EAES) Working Group Meeting in Bratislava<sup>5</sup>. This proposal included already the definition of the mapping of safety approaches exercise and a first proposal on the contents of a questionnaire concerning current safety verification approaches and requirements at RR facilities.

Until January 2004 this questionnaire was developed in further detail by the Atominstitut Vienna and JRC, and sent out to about 50 operators of RR facilities worldwide<sup>6</sup>. It shall be mentioned that the structure and type of questions included in the Questionnaire are based on the WENRA benchmarking for power reactors, duly modified in order to consider RR specificities. Until the end of 2004, 29 responses were received from all over the world.

Until March 2005, the responses were carefully analysed and summarised in a table. This summary was then distributed to the information providers for their approval.

During April 2005, an adequate information system structure as well as query tools were developed by JRC in order to enable qualified users to detect in an easily understandable way the main differences and similarities of safety approaches in different RR facilities. The resulting JRC Information System offers the possibility to exchange experience in the area among interested parties and could thus represent a starting point for future harmonization of RR safety principles.

This Information System, called DARES (DAtabase for REsearch Reactor Safety), is installed on the JRC's ODIN website (<http://odin.jrc.nl>). To ensure that the data are treated in a confidential way, access to DARES is restricted by means of passwords. Passwords can be given to interested users by contacting the database administrator: [christian.kirchsteiger@jrc.nl](mailto:christian.kirchsteiger@jrc.nl)

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<sup>2</sup> [www.iaea.org/worldatom/rrdb/](http://www.iaea.org/worldatom/rrdb/)

<sup>3</sup> <http://odin.jrc.nl> --> NuCoC DB

<sup>4</sup> Research Reactor Operators Group (RROG), the European group of RR operators.

<sup>5</sup> Christian Kirchsteiger (European Commission - DG JRC), Ludo Veuchelen (SCK-CEN Mol), Helmuth Böck (Atominstitut Vienna), Benchmarking of Safety Approaches for Research Reactors - Proposal for a Joint RROG-JRC Project, EAES Working Group Meeting 2003, Bratislava, 23-24 October 2003.

<sup>6</sup> See Annex I for the original letter and questionnaire.



As information basis for DARES, the 29 electronical or written answers to the first questionnaire were used. In Annex I of this report, this original questionnaire and the accompanying letter can be found. Annex II includes the original text of all responses as they have been received by the authors. As mentioned above, these 29 answers include a single response for all the RRs from the USA, a single response for a certain French RR which is supposed to be taken for all French RRs, and one response from Romania which actually represents a response for two "RRs" (i.e. for a double core facility). The Romanian responses are counted as one response, but for two RRs. In addition, there are two responses for the same RR from South Africa - the first one dated February 2004, the second one dated December 2004. All these responses were used as data sources for the DARES database. In order to correct and update this information, another table was sent out with an overview of the collected information. Responses from four RRs were received and included in DARES. Besides these information sources, the above-mentioned IAEA database for RRs was used as source to allocate official RR codes to the entries.

A detailed description of how to use DARES and how to interpret its evaluation results can be found in Annex III. This Annex includes a description of the user interface, the way how to make a selection for different groups of RRs to be compared against each other and a description of how the comparison results are presented and can be interpreted.

## 4. Next steps

Having finalised the data collection and database development, systematic evaluations of the contents of the DARES database will now be performed in order to detect similarities and main differences among different types of RRs or RRs of the same types located in different countries or used in different ways. A publication of corresponding results is planned for late 2005.



Further, based on discussion with IAEA, it is planned to directly use the IAEA Code of Conduct as a reference document in preparing a new (and final) questionnaire to be submitted to the members of the RROG. The responses to the questionnaire would be analysed and reported using the techniques that JRC has already developed, with a view towards mapping and cross comparing the safety approaches in European RR facilities to detect the principal similarities and differences. This work would also provide an assessment of the extent of application of the guidance in the Code of Conduct.

As this work would help promote the use of the IAEA Code of Conduct and provide useful information on the status of RR safety in Europe, a close cooperation with the IAEA is sought. This could be done by embedding the JRC activity in a possible future IAEA Working Group or IAEA Coordinated Research Project on the subject of monitoring of implementation of the Code.

However, as the Code also includes guidance for the State and for the regulatory body, this would require extension of the current user group of DARES (RR operators only) to include also these stakeholders. Discussions with IAEA in this respect are ongoing.

# Annex I

## ***Original questionnaire, sent out in January 2004, including the accompanying letter***

Dear Research Reactor Colleague,

within an EC project a survey on PSA activities on research reactor facilities will be performed. In this framework, we submit the following questionnaire and we ask you or one of your co-workers kindly to answer the relevant questions for your facility as complete as possible. We would appreciate if you return this questionnaire by February 15<sup>th</sup>, 2004 electronically to [boeck@ati.ac.at](mailto:boeck@ati.ac.at). The results will be published in a summary form and you will receive a copy. Prior to publication a draft version will be sent to you for your comments and approval. If you want certain parts of your inputs to be kept confidential please indicate it in your questionnaire. We thank you in advance for your cooperation, if you have any questions please contact me directly,

very sincerely yours

Helmuth Boeck

Vienna, 20.1.2004

### **A) Research Reactor Identification Information**

Reactor name :  
IAEA Code :  
Type (TRIGA, MTR, etc. ):  
Thermal power :

### **B) Addresses of**

#### **1) Facility**

Physical address:

Contact person:

Weblink :

#### **2) Operating organisation**

Physical address :

Contact person:

Weblink :

#### **3) Regulator**

Physical address :

Contact person:

Weblink :

### C) Periodic safety review performed for your research reactor facility

**1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)**

Does your facility have a formally issued SAR?

What was date of last revision?

Is your SAR currently undergoing a revision?

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely:

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

Does your facility have an external regulatory body?

Does your facility have a written requirement specifying a change control/safety review process?

Does your facility have a safety review committee (SRC)?

Does SRC meet routinely, or as required? Are minutes and decisions published?

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Have any external safety reviews been performed in last XX years?

If yes, state scope.

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

### C) Periodic safety review performed for your research reactor facility (cont.)

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

**4) Confidentiality status of the periodic safety review report(s)**

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

**4) Confidentiality status of the PSA report(s)**

# Annex II

## Questionnaire answers

### 1. Argentina – RA-3:

#### A) Research Reactor Identification Information

Reactor name : RA-3  
IAEA Code :  
Type (TRIGA, MTR, etc. ): MTR  
(Plate type fuel elements)  
Thermal power : 10 MW

#### B) Addresses of

##### 1) Facility

Physical address: RA-3 Reactor  
Centro Atómico Ezeiza  
Presbítero Juan González y Aragón 15  
Buenos Aires – CP: B1802AYA  
Contact person: Lic Jorge Quintana (Reactor Head)  
Weblink : ----

##### 2) Operating organisation

Physical address : Comisión Nacional de Energía  
Atómica – Avda del Libertador 8250 – CP 1429  
Buenos Aires – Argentina  
Contact person: Lic Jorge Quintana (Reactor Head)  
Weblink : [www.cnea.gov.ar](http://www.cnea.gov.ar)

##### 3) Regulator

Physical address : Autoridad Regulatoria Nuclear  
Avda del Libertador 8250 – CP 1429  
Buenos Aires – Argentina  
Contact person: Ing. Carlos Perrin  
Weblink : [www.arn.gov.ar](http://www.arn.gov.ar)

#### C) Periodic safety review performed for your research reactor facility

**1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)**  
Does your facility have a formally issued SAR? Yes.

What was date of last revision? November 2003  
Is your SAR currently undergoing a revision? No.

Does your SAR follow the IAEA 35-G1 format guidelines ? Yes

Closely:  
Somewhat: X  
Not at all:

Does your SAR have a formal acceptance letter from the regulator? Yes.

Does your facility have an external regulatory body? Yes.

Does your facility have a written requirement specifying a change control/safety review process?

We suggest that the facility should be asked about this item.

Does your facility have a safety review committee (SRC)? Yes.

Does SRC meet routinely, or as required? Are minutes and decisions published? As required. No.

Does your facility have to request approval for some specified types of changes to an external regulatory authority? Yes.

Have any external safety reviews been performed in last XX years?

If yes, state scope.

We suggest that the facility should be asked about this item.

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

We suggest that the facility should be asked about this item.

### **C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

We suggest that the facility should be asked about this item.

**4) Confidentiality status of the periodic safety review report(s)**

We suggest that the facility should be asked about this item.

### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

- Design changes carried out at the installation were taken into account.
- New deterministic studies were considered (thermal-hydraulics, neutronic and radioactive inventory calculations included)
- The list of initiating events considered in previous reviews was updated taking into account bibliography and operating experience.
- Frequency of initiating events was updated.
- The event tree diagram was modified including results obtained through deterministic calculations available, and eliminating excessively conservative

hypotheses.

- Doses incurred by the critical group were estimated for the radioactive inventory calculated for the equilibrium core at 10 MW and compliance with Argentinean Standards was verified.

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

We suggest that the facility should be asked about this item.

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

We suggest that the facility should be asked about this item.

**4) Confidentiality status of the PSA report(s)**

We suggest that the facility should be asked about this item.



## 2. Australia – HIFAR:

### A) Research Reactor Identification Information

Reactor name :	HIFAR (High Flux Australian Reactor)
IAEA Code :	AU-0001
Type (TRIGA, MTR, etc. ):	Materials Test Reactor, Tank Type, DIDO class
Thermal power :	10MW

### B) Addresses of

#### 1) Facility

Physical address:	ANSTO, New Illawara Road, Menai, NSW 2234, AUSTRALIA.
Contact person:	Greg Storr
Weblink :	<a href="http://www.ansto.gov.au">http://www.ansto.gov.au</a>

#### 2) Operating organisation

Physical address :	ANSTO (Australian Nuclear Science and Technology Organisation).
Contact person:	Greg Storr
Weblink :	<a href="http://www.ansto.gov.au">http://www.ansto.gov.au</a>

#### 3) Regulator

Physical address :	ARPANSA (Australian Radiation Protection and Nuclear Safety Agency).
Contact person:	To be advised later
Weblink :	<a href="http://www.arpansa.gov.au">http://www.arpansa.gov.au</a>

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?

Yes. It is referred to as the HIFAR Safety Document (HSD).

What was date of last revision? . December 2002.

Is your SAR currently undergoing a revision? No.

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely: No

Somewhat: See comments below.

Not at all: See comments below.

The original HIFAR Safety Document was prepared in 1972 (now exists as a historical document). A major update was carried out over the period 1996-2000 and the current version (being followed) was completed in 2002. The original structure of the 1972 document was retained. However the HSD

includes most, if not all, the detailed information called for in the IAEA 35-G1 guidelines although the structure of the document does not follow the guidelines.

Does your SAR have a formal acceptance letter from the regulator?

Yes, the regulatory body (ARPANSA) approves the SAR formally through formal acceptance letter (s).

As part of compliance of one of the Standard Licence Conditions (issued by the regulator), the SAR is required to be approved by the regulator.

Does your facility have an external regulatory body? Yes (ARPANSA).

Does your facility have a written requirement specifying a change control/safety review process? Yes.

Does your facility have a safety review committee (SRC)? Yes.

A local safety committee, named "Reactor Assessment Committee" (RAC) exists to provide advice, remaining independent of the reactor management. Another committee, named the "Safety Assessment Committee" (SAC) that reports to the ANSTO Executive Director also reviews and makes recommendations on submissions requiring ARPANSA approval.

Does SRC meet routinely, or as required? Are minutes and decisions published?

Yes, the RAC meets routinely approximately once in an operating program (35 days) and/or more frequently to address issues, if need arises. The RAC issues written minutes of its meetings containing recommendations, if any.

Does your facility have to request approval for some specified types of changes to an external regulatory authority? Yes, in cases of changes having significant implications for safety, as identified in appropriate procedures.

Have any external safety reviews been performed in last 10 years?

If yes, state scope.

The Probabilistic Safety Assessment (PSA) and the Remaining Life Study (RLS) on HIFAR were completed in 1997 and the final PSA report was issued in January 1998. The work was undertaken by a US-based company with extensive experience in such studies. The assessment considered a range of postulated external and internal events, to assess the level of safety of the HIFAR plant.

The RLS study evaluated the important passive components of HIFAR that are not normally considered to be replaceable. The RLS provided important insights into the importance of aging mechanisms as well as mitigative actions taken by ANSTO on the safety of HIFAR.

The HIFAR PSA and Remaining Life Study were recommended by an external Reactor Review Committee in their advice to the Government at the

conclusion of their review in 1993, as probabilistic risk assessments to ascertain the remaining life of HIFAR and to address any concerns among some sections of the public about the safety of the reactor.

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

Traditionally, there has not been a practice of regular periodic updating of the HSD. Updating has been carried out whenever there has been a need due to changes in the reactor plant, introduction of new fuel types, changes in the organisational or regulatory framework or to incorporate results of latest safety studies, as applicable. Similarly, safety reviews, such as HIFAR PSA and RLS were performed in the past have been for specific purposes as discussed above.

**C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

The methodologies adopted for different types of safety reviews conducted over the past 10 years are outlined below.

Updating of HIFAR Safety document (1996-2002) – Deterministic Safety Analysis/Review (An internal safety review by ANSTO).

HIFAR PSA Level 1 plus (1998) – Probabilistic Safety Assessment; Software used: PLG's proprietary software RISKMAN. (An external review by Consultants - PLG Ltd for Australian Government)

**4) Confidentiality status of the periodic safety review report(s)**

The safety review reports, such as the HSD and the HIFAR PSA/RLS are not open public documents. Their circulation is limited. However, the results of the safety studies may be used at relevant forums, as appropriate.

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

PSA Level 1 plus

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

The HIFAR PSA was completed in 1998. Some of its analyses have been modified and updated to reflect subsequent modifications to the HIFAR plant and revised results reported to the regulatory body ARPANSA for specific cases, but no complete revisions of the PSA have been made.

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

Uses of HIFAR PSA:

- Fulfilled a condition recommended by an external review committee appointed by the Australian Government, to assess the future of the existing reactor, which has reached near the end of its service life.
- Serves as part of HIFAR safety case, i.e. supplements deterministic safety analysis (HSD), as one of the licensing-basis documents.
- Used to support arguments made in submissions for regulatory approval of plant modifications.

Note: HIFAR PSA has not been used for any risk-informed decision making on reactor operations.

**4) Confidentiality status of the PSA report(s)**

As discussed in Item 4 above.

### 3. Austria – TRIGA Mark II Vienna:

#### A) Research Reactor Identification Information

Reactor name :	TRIGA Mark II Vienna
IAEA Code :	AT-0002
Type (TRIGA, MTR, etc. ):	TRIGA
Thermal power :	250 kW, 250 MW Pulsing

#### B) Addresses of

##### 1) Facility

Physical address:	Atominstitut Szt Dionaltee 2 1020 Vienna Austria
Contact person:	H.Boeck <a href="mailto:boeck@ati.ac.at">boeck@ati.ac.at</a> M.Villa: <a href="mailto:mvilla@ati.ac.at">mvilla@ati.ac.at</a>
Weblink :	<a href="http://www.ati.ac.at">www.ati.ac.at</a>

##### 2) Operating organisation

Physical address :	Vienna Institut of Technology Karlspaltz 13 1040 Vienna
Contact person:	Prof.Dr.H.Rauch <a href="mailto:rauch@ati.ac.at">rauch@ati.ac.at</a>
Weblink :	<a href="http://www.ati.ac.at">www.ati.ac.at</a>

##### 3) Regulator

Physical address :	Bundesministerium für Bildung ,Wissenschaft und Kultur Minoritenplatz 5 1014 Vienna
Contact person:	Min.Rat Dr.Iris Hornig
Weblink :	<a href="http://www.bmbwk.gv.at">www.bmbwk.gv.at</a>

#### C) Periodic safety review performed for your research reactor facility

##### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR? yes

What was date of last revision? 1996

Is your SAR currently undergoing a revision? yes

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely: yes

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator? yes

Does your facility have an external regulatory body? yes

Does your facility have a written requirement specifying a change control/safety review process?

yes

Does your facility have a safety review committee (SRC)?

yes

Does SRC meet routinely, or as required? Are minutes and decisions published?

Meets as required, minutes not published

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

yes

Have any external safety reviews been performed in last XX years?

If yes, state scope.

Yes ,every year there is formal review by external experts and the regulatory body

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

The periodic formal review covers all safety related systems and components, radiation protection system, personnel- and environmental monitoring system. All documents are reviewed and if necessary revised

### **C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

In regular intervals PSA is carried out , especially if new data are available. Recently a survey on TRIGA data failure rates was performed.

**4) Confidentiality status of the periodic safety review report(s)**

Non- confidential

### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

PSA level 1 was performed in the past several times, human errors are not included, some small scale level 2 was also carried out.

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

PSA is updated when new data are available

### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

Only internal use, regulatory body and licensing procedures d not take advantage of these studies

**4) Confidentiality status of the PSA report(s)**

Not confidential

## 4. Belgium – BR2:

### A) Research Reactor Identification Information

Reactor name :	BR2
IAEA Code :	BE0002
Type (TRIGA, MTR, etc. ):	MTR
Thermal power :	100 MW

### B) Addresses of

#### 1) Facility

Physical address:	SCK-CEN Boeretang 200 2400 Mol Belgium
Contact person:	P. Gubel Tel: +32.14.33.2400 Fax: +32.14.32.05.13 <a href="mailto:pgubel@sckcen.be">pgubel@sckcen.be</a>
Weblink :	<a href="http://www.sckcen.be">www.sckcen.be</a>

#### 2) Operating organisation

Physical address :	SCK-CEN Boeretang 200 2400 Mol
Contact person:	P. Gubel
Weblink :	<a href="http://www.sckcen.be">www.sckcen.be</a>

#### 3) Regulator

Physical address :	FANC/AFNC Rue Ravenstein 36 1000 Brussels Belgium
Contact person:	J.P. Samain Director-general Tel: + 32 2 2892111 Fax: +32 2 2892112
Weblink :	<a href="http://www.fanc.fgov.be">www.fanc.fgov.be</a>

#### 4) Inspection Agency

Physical address :	AVN Rue Walcourt 148 1070 Brussels Belgium
Contact person:	Michel Sonck Tel: +32 2 5280133 Fax: +32 2 5280101 <a href="mailto:msk@avn.be">msk@avn.be</a>
Weblink	<a href="http://www.avn.be">www.avn.be</a>



### C) Periodic safety review performed for your research reactor facility

**1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)**

Does your facility have a formally issued SAR?

yes

What was date of last revision?

2001

Is your SAR currently undergoing a revision?

Next revision 2006

Does your SAR follow the IAEA 35-G1 format guidelines ?

All items mentioned in IAEA 35-G1 are treated, although the format is totally different.

Does your SAR have a formal acceptance letter from the regulator?

yes

Does your facility have an external regulatory body?

Yes

Does your facility have a written requirement specifying a change control/safety review process?

yes

Does your facility have a safety review committee (SRC)?

yes

Does SRC meet routinely, or as required? Are minutes and decisions published?

Yes

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

yes

Have any external safety reviews been performed in last XX years?

If yes, state scope.

INSARR in 1999

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

A review of the safety aspects is requested in the licence every 5 years. The content of the review is first discussed with the authorities. The inspection agency AVN makes a formal report on the revision which is sent to the authorities

### C) Periodic safety review performed for your research reactor facility (cont.)

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer**

**codes used etc.)**

The safety reviews are normally made using deterministic methods.

A PSA model was made during the first half of the nineties. The results were used for the major revision of 1996.

Last years the model was extended using fault trees in order to include the influence of support systems.

**4) Confidentiality status of the periodic safety review report(s)**

Confidential

Available for AVN en FANC/AFCN

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

Level 1 PSA with some attention to level 2 aspects.

The PSA deals only with the operational mode of the reactor.

Human error is taken into account.

External events are not treated in the PSA.

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

The PSA is reviewed in detail by AVN.

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

Licensing

**4) Confidentiality status of the PSA report(s)**

Confidential.

Available for AVN (review)

Available for FANC/AFCN on request.

## 5.-9. Canada

Helmuth,

Here is some data for 5 SLOWPOKE reactors for your survey. This was supplied by Greg Kennedy of Ecole Polytechnique, Montreal, who is familiar with all the reactors. I think you met Greg in Santiago?

Regards,

Dave

.....

Data for 5 SLOWPOKE reactors:

### Reactor 1

#### A) Research Reactor Identification Information

Reactor name: Ecole Polytechnique de Montreal, SLOWPOKE -2

IAEA Code: CA-0009

Type: SLOWPOKE-2, LEU fuelled.

Thermal Power: 20 kW(th)

#### B) Addresses of:

##### 1. Facility

Physical address:  
Ecole Polytechnique de Montreal  
2900 Edouard-Montpetit  
Montreal, Quebec  
Canada H3T 1J4

Contact person: Mr. Gregory Kennedy

Weblink: [www2.polymtl.ca/nucl/index-Fr.html](http://www2.polymtl.ca/nucl/index-Fr.html)

##### 2. Operating organization, Ecole Polytechnique de Montreal

Physical address:

Ecole Polytechnique de Montreal  
2900 Edouard-Montpetit  
Montreal, Quebec  
Canada H3T 1J4

Contact person: Mr. Robert Papineau, directeur general

Weblink: [www.polymtl.ca](http://www.polymtl.ca)

### 3. Regulator

Physical address:  
Canadian Nuclear Safety Commission  
280 Slater Street  
P.O. Box 1046, Station B  
Ottawa, Ontario

Contact person: Mr. Lawrence Colligan

Weblink: [www.nuclearsafety.gc.ca](http://www.nuclearsafety.gc.ca)

### C) Periodic safety review performed for your research reactor facility

1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

no periodic safety review

Does your facility have a formally issued SAR? What was date of last revision?

Yes, March 1998

Is your SAR currently undergoing a revision?

No.

Does your SAR follow the IAEA 35-G1 format guidelines?

Yes, quite closely.

Does your SAR have a formal acceptance letter from the regulator?

No.

Does your facility have a written requirement specifying a change control/safety review process?

No.

Does your facility have an external regulatory body?

Yes.

Does your facility have a safety review committee (SRC)?

Yes, the reactor safety review is part of the Institute safety review, but is not entirely dedicated to reactor review.

Does SRC meet routinely, or as required? Are minutes and decisions published?

Meets once per year; minutes or decisions are not published.

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes. The reactor license specifies the reactor facility should be operated and the design maintained, as described in a number of documents, including the SAR. Prior authority from the CNSC is required to change these documents.

Have any external safety reviews been performed in last 5 years? If yes, state scope.

Yes. The CNSC did a review of the facility in 2003, with public hearings, before issuing the new license. The license is for 10 years.

2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organization, qualification of staff etc.)

No.

3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)

no

4) Confidentiality status of the periodic safety review report(s).

no

D) Probabilistic Safety Assessment (PSA) performed for your RR facility

1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)

no

2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)

no

3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)

no

4) Confidentiality status of the PSA report(s)

no

## Reactor 2

A) Research Reactor Identification Information

Reactor name: Royal Military College, SLOWPOKE -2

IAEA Code: CA-0014

Type: SLOWPOKE-2, LEU fuelled.

Thermal Power: 20 kW(th)

B) Addresses of:

1. Facility

Physical address:  
Royal Military College of Canada  
P.O. Box 17000 Station Forces  
Kingston, Ontario  
Canada K7K 5B4

Contact person:  
Ms. Kathy Nielsen

Weblink:

2. Operating organization, Royal Military College of Canada

Physical address:  
Royal Military College of Canada  
P.O. Box 17000 Station Forces  
Kingston, Ontario  
Canada K7K 5B4

Contact person:  
Mr. Les G.I. Bennett

Weblink:

3. Regulator

Physical address:  
Canadian Nuclear Safety Commission  
280 Slater Street  
P.O. Box 1046, Station B  
Ottawa, Ontario

Contact person: Ms. Lisa Lang

Weblink: [www.nuclearsafety.gc.ca](http://www.nuclearsafety.gc.ca)

C) Periodic safety review performed for your research reactor facility

1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

no periodic safety review, review performed for new digital reactor control system

Does your facility have a formally issued SAR? What was date of last revision?

Yes 1985

Is your SAR currently undergoing a revision?

No

Does your SAR follow the IAEA 35-G1 format guidelines?

No

No

Does your facility have a written requirement specifying a change control/safety review process?

No.

Does your facility have an external regulatory body?

Yes.

Does your facility have a safety review committee (SRC)?

Yes.

Does SRC meet routinely, or as required? Are minutes and decisions published?

-

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes, approval was required for a new digital reactor control system for example. The reactor license specifies the reactor facility should be operated and the design maintained, as described in a number of documents, including the SAR. Prior authority from the CNSC is required to change these documents.

Have any external safety reviews been performed in last 5 years? If yes, state scope.

Yes. The CNSC did a review of the facility in 2003, with public hearings,

before issuing the new license. The license is for 10 years.

2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organization, qualification of staff etc.)

No.

3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)

No.

4) Confidentiality status of the periodic safety review report(s).

No.

D) Probabilistic Safety Assessment (PSA) performed for your RR facility

1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)

no

2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)

no

3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)

no

4) Confidentiality status of the PSA report(s)

no

### **Reactor 3**

A) Research Reactor Identification Information

Reactor name: Dalhousie University, SLOWPOKE -2

IAEA Code: CA-0010

Type: SLOWPOKE-2, HEU fuelled.

Thermal Power: 20 kW(th)

B) Addresses of:

1. Facility

Physical address:



Dalhousie University  
Life Sciences Building  
Halifax, Nova Scotia  
Canada B3H 4J1

Contact person:  
Mr. Amares Chatt

Weblink: [www.dal.ca/~chatt/](http://www.dal.ca/~chatt/)

2. Operating organization, Dalhousie University

Physical address:  
Dalhousie University  
Life Sciences Building  
Halifax, Nova Scotia  
Canada B3H4J1

Contact person:  
Mr. Amares Chatt

Weblink: [www.dal.ca](http://www.dal.ca)

3. Regulator

Physical address:  
Canadian Nuclear Safety Commission  
280 Slater Street  
P.O. Box 1046, Station B  
Ottawa, Ontario

Contact person: Ms. Lisa Lang

Weblink: [www.nuclearsafety.gc.ca](http://www.nuclearsafety.gc.ca)

C) Periodic safety review performed for your research reactor facility

1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

No periodic safety review.

Does your facility have a formally issued SAR? What was date of last revision?

Yes, 1975 generic SLOWPOKE-2 SAR, not site specific.

Is your SAR currently undergoing a revision?

No.

Does your SAR follow the IAEA 35-G1 format guidelines ?

No.

Does your SAR have a formal acceptance letter from the regulator?

No.

Does your facility have a written requirement specifying a change control/safety review process?

No.

Does your facility have an external regulatory body?

Yes.

Does your facility have a safety review committee (SRC)?

No.

Does SRC meet routinely, or as required? Are minutes and decisions published?

No.

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes, The reactor license specifies the reactor facility should be operated and the design maintained, as described in a number of documents, including the SAR. Prior authority from the CNSC is required to change these documents.

Have any external safety reviews been performed in last 5 years? If yes, state scope.

Yes. The CNSC did a review of the facility in 2003, with public hearings, before issuing the new license. The license is for 10 years.

2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organization, qualification of staff etc.)

No

3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)

No.

4) Confidentiality status of the periodic safety review report(s).

No.

D) Probabilistic Safety Assessment (PSA) performed for your RR facility

1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)

No.

2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)

No.

3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)

No.

4) Confidentiality status of the PSA report(s)

No.

#### **Reactor 4**

##### A) Research Reactor Identification Information

Reactor name: University of Alberta, SLOWPOKE -2

IAEA Code: CA-0011

Type: SLOWPOKE-2, HEU fuelled.

Thermal Power: 20 kW(th)

##### B) Addresses of:

###### 1. Facility

Physical address:  
Dentistry/Pharmacy Building  
University of Alberta  
Edmonton, Alberta  
Canada T6L 1C7

Contact person: Mr. John Duke

Weblink:

###### 2. Operating organization, University of Alberta

Physical address:  
University of Alberta  
Edmonton, Alberta  
Canada T6L 1C7

Contact person: Mr. John Duke

Weblink:

3. Regulator

Physical address:  
Canadian Nuclear Safety Commission  
280 Slater Street  
P.O. Box 1046, Station B  
Ottawa, Ontario

Contact person: Ms. Lisa Lang

Weblink: [www.nuclearsafety.gc.ca](http://www.nuclearsafety.gc.ca)

C) Periodic safety review performed for your research reactor facility

1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

No periodic safety review.

Does your facility have a formally issued SAR? What was date of last revision?

Yes, 1975 generic SLOWPOKE-2 SAR, not site specific.

Is your SAR currently undergoing a revision?

No.

Does your SAR follow the IAEA 35-G1 format guidelines ?

No.

Does your SAR have a formal acceptance letter from the regulator?

No

Does your facility have a written requirement specifying a change control/safety review process?

No.

Does your facility have an external regulatory body?

Yes.

Does your facility have a safety review committee (SRC)?

No.

Does SRC meet routinely, or as required? Are minutes and decisions published?

No.

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes, The reactor license specifies the reactor facility should be operated and the design maintained, as described in a number of documents, including the SAR. Prior authority from the CNSC is required to change these documents.

Have any external safety reviews been performed in last 5 years? If yes, state scope.

Yes. The CNSC did a review of the facility in 2003, with public hearings, before issuing the new license. The license is for 10 years.

2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organization, qualification of staff etc.)  
No.

3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)  
No.

4) Confidentiality status of the periodic safety review report(s).  
no

D) Probabilistic Safety Assessment (PSA) performed for your RR facility

1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)  
no

2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)  
no

3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)  
no

4) Confidentiality status of the PSA report(s)  
no

## **Reactor 5**

A) Research Reactor Identification Information

Reactor name: Saskatchewan Research Council, SLOWPOKE -2

IAEA Code: CA-0012

Type: SLOWPOKE-2, HEU fuelled.

Thermal Power: 20 kW(th)

B) Addresses of:

1. Facility

Physical address:  
Saskatchewan Research Council  
SRC Analytical Laboratories  
422 Downey Road  
Saskatoon, SK. S7N 4N1

Contact person:  
Mr. Jeff Zimmer

Weblink:

2. Operating organization, Saskatchewan Research Council

Physical address:  
422 Downey Road  
Saskatoon, Saskatchewan  
Canada S7N 4N1

Contact person:  
Mr. Michael Weekes

Weblink:

3. Regulator

Physical address:  
Canadian Nuclear Safety Commission  
280 Slater Street  
P.O. Box 1046, Station B  
Ottawa, Ontario

Contact person: Ms. Lisa Lang

Weblink: [www.nuclearsafety.gc.ca](http://www.nuclearsafety.gc.ca)

C) Periodic safety review performed for your research reactor facility

1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your

reactor etc.)

No periodic safety review.

Does your facility have a formally issued SAR? What was date of last revision?

Yes, 1975 generic SLOWPOKE-2 SAR, not site specific.

Is your SAR currently undergoing a revision?

No.

Does your SAR follow the IAEA 35-G1 format guidelines ?

No.

Does your SAR have a formal acceptance letter from the regulator?

No.

Does your facility have a written requirement specifying a change control/safety review process?

No.

Does your facility have an external regulatory body?

Yes.

Does your facility have a safety review committee (SRC)?

Yes.

Does SRC meet routinely, or as required? Are minutes and decisions published?

-

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes. The reactor license specifies the reactor facility should be operated and the design maintained, as described in a number of documents, including the SAR. Prior authority from the CNSC is required to change these documents.

Have any external safety reviews been performed in last 5 years? If yes, state scope.

Yes. The CNSC did a review of the facility in 2003, with public hearings, before issuing the new license. The license is for 10 years.

2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organization, qualification of staff etc.)

No.

3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)

No

4) Confidentiality status of the periodic safety review report(s).

No.

D) Probabilistic Safety Assessment (PSA) performed for your RR facility

1) Scope and content: (i.e. PSA level, inclusion of all operational modes, ext.)

2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)

No.

3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)

No.

4) Confidentiality status of the PSA report(s)

No.



## 10. Czech Republic – LVR-15:

### A) Research Reactor Identification Information

Reactor name : LVR-15  
IAEA Code :  
Type (TRIGA, MTR, etc. ): Tank type  
Thermal power : 10 MW

### B) Addresses of

#### 1) Facility

Physical address: Nuclear Research Institute plc  
250 68 Rež  
Czech Republic

Contact person: Jan Kysela, director  
Reactor Services Division  
+420 266173528

Weblink : [kys@ujv.cz](mailto:kys@ujv.cz)

#### 2) Operating organisation

Physical address : Nuclear Research Institute plc  
250 68 Rež  
Czech Republic

Contact person: Vladimír Brož  
Reactor operation department  
+420 266172384

Weblink : [brv@ujv.cz](mailto:brv@ujv.cz)

#### 3) Regulator

Physical address : State Office for Nuclear Safety  
Senovážné náměstí 9  
110 00 Praha 1

Contact person: Karel Bohm  
Deputy for nuclear safety  
+420 221624313

Weblink :

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?

Yes.

What was date of last revision?

11/2003

Is your SAR currently undergoing a revision?

Yes. In this year we prepare the revision of SAR according the recommendations of INSARR mission.

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely: Yes.

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

Yes. The regulatory body evaluates SAR during the licence process for the operation of the reactor LVR-15.

Does your facility have an external regulatory body?

Yes, State Office for Nuclear Safety. (SONS)

Does your facility have a written requirement specifying a change control/safety review process?

Yes.

Does your facility have a safety review committee (SRC)?

Yes, SRC of Institute and SRC of Reactor service Division.

Does SRC meet routinely, or as required? Are minutes and decisions published?

Both SRC meet every 3 month and when occur the abnormal or emergency situations.

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes, according the Atomic Law (Number 18/1997), §9 we have to request approval of SONS for every change with influence of nuclear safety, radiation protection, security system and emergency preparedness.

Have any external safety reviews been performed in last XX years?

If yes, state scope.

Yes, INSARR mission in 12/2003.

**2) Scope and content: (i.e. frequency of updating, recent operation experience changes in organisation, qualification of staff etc.)**

The safety review we perform

- For the licensing process,
- According the Atomic Law for the changes facility or new experiments with influence on nuclear safety or radiation protection,
- On the basic of operation experience,
- By the changing of legislation, new decrees.

In the last years we did the updating of the SAR in 2002, 2003.

In 2003 reactor LVR-15 received operation licence to 2014.

The reactor staff is regularly trained. The legal background for the training activities the Atomic Low and Decree 146/1997, the latter was amended by Decree 315/2003. The Decrees clearly define the education and training requirements regarding

nuclear safety and radiation protection. Four job categories are stated for nuclear safety, namely: senior operator, operator, control physicist and physicist responsible for critical experiments (physical start-up). For radiation protection two categories are defined: chief health physicist and health physicist. Senior operator should have high school degree, two years of initial practice, a special education course at the reactor and one-year practice as operator, while technicians should have five-year initial and additional two-year practice as operator.

The thematic for the preparation consists of: mathematics, theory of the reactor, construction of the reactor, nuclear safety, OLC and practice as required. In 2003 the Regulatory Body authorized the Institute to conduct the education and training for nuclear safety and approved the new teaching manuals replacing the previous ones. The Regulatory Body strictly defined the way of examinations and also published new booklets containing the teaching material and questions too for the examinations.

The theoretical examination is followed by an eight week long practical one. The licence is valid for 2-6 years, the duration is defined by the examining committee depending on the performance of the examinee. Re-examination is organized twice a year. Radiation protection personnel are trained outside (the Institute has accreditation) but the way of the examination is the same.

Loop and rig operators, mechanicals and electricians are trained and examined in-house. Meetings are held every month not only for training purposes but also for open discussion and for evaluation of the previous month operation.

We had no changes in organisation in last five years.

### **C) Periodic safety review performed for your research reactor facility (cont.)**

#### **3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

The deterministic and probabilistic assessments are both used in SAR. Computer codes are subject of certification by regulatory body.

#### **4) Confidentiality status of the periodic safety review report(s)**

SAR and other documents are open.

### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

#### **1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

PSA study level 1 issued in 1996.

The main initial events were evaluated in the PSA

- Leakage in the first circuit or reactor vessel,
- Input of reactivity to active core,
- Air crash,
- Blockade of the water flow through fuel elements,
- LOCA of the experimental water loop in active core,
- Loss of the heat transport from the first cooling circuit,
- Human factor,
- Etc.

Separately, in the other report, the risks of external events were evaluated

- Earthquake,
- Explosions,
- Meteorology,
- Fire.

The results were used in Chapter 16 SAR.

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

Revision of PSA is planned in near future.

#### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

We used PSA

- For licensing, the results of PSA were included in SAR,
- For modifications, a new signal for shut down reactor will be install.

**4) Confidentiality status of the PSA report(s)**

No.

## 11. Finland – FiR 1:

### A) Research Reactor Identification Information

Reactor name :	FiR 1
IAEA Code :	FI-0001
Type (TRIGA, MTR, etc. ):	Triga
Thermal power :	250 kW

### B) Addresses of

#### 1) Facility

Physical address:	VTT Processes Visiting address: Otakaari 3 A, Espoo P.O.Box 1608, FIN-02044 VTT Finland
Contact person:	Seppo Salmenhaara seppo.salmenhaara@vtt.fi
Weblink :	www.vtt.fi

#### 2) Operating organisation: the same as the Facility

Physical address :

Contact person:

Weblink :

#### 3) Regulator

Physical address :	Radiation and Nuclear Safety Authority Visiting address: Laippatie 4, 00880 Helsinki P.O. Box 14, FIN-00881 Helsinki Finland
Contact person:	Olli Vilkamo olli.vilkamo@stuk.fi
Weblink :	www.stuk.fi

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?

Yes

What was date of last revision?

11.5.1999

Is your SAR currently undergoing a revision?

No

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely:

Somewhat: OK  
Not at all:

Does your SAR have a formal acceptance letter from the regulator?  
Yes

Does your facility have an external regulatory body?  
Yes

Does your facility have a written requirement specifying a change control/safety review process?  
General requirements for all nuclear facilities

Does your facility have a safety review committee (SRC)?  
Yes

Does SRC meet routinely, or as required? Are minutes and decisions published?  
As required. Published only inside the facility personnel.

Does your facility have to request approval for some specified types of changes to an external regulatory authority?  
Yes

Have any external safety reviews been performed in last XX years?  
If yes, state scope.  
Yes, inspections made by the authority, annually, biannually etc. depending on the scope

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

Annually: Operation of the reactor  
Radiation protection and radioactive wastes

Biannually: Training of the personnel (qualification of the operators and shift supervisors every third year)  
Instrumentation  
Nuclear fuel  
Preparedness and fire protection  
Physical protection

**C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

Deterministic

**4) Confidentiality status of the periodic safety review report(s)**

Mainly for official use only

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

No

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

-

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

No

**4) Confidentiality status of the PSA report(s)**

-

## 12. France – High Flux Reactor of ILL:

*Dear Mr. Boeck,*

*You'll find a rapid and uncompleted answer to your questions.  
Sincerely yours.*

*Hervé GUYON*

### Information :

*ILL is an independant institute, it doesn't belong CEA.*

*Safety representant of CEA may be*

*- DSQS – Mr Charles JOLY  
and/or - DPSN – Mr MERCIER in Saclay center*

### **A) Research Reactor Identification Information**

Reactor name : High Flux Reactor of ILL (Institut Laue Langevin)

IAEA Code :

Type (TRIGA, MTR, etc. ): Neutron Source MTR

Thermal power : 57 MW nucl.

### **B) Addresses of**

#### **1) Facility**

Physical address: 6 rue Jules Horowitz BP 156  
38042 GRENOBLE Cedex 9 France

Contact person: GUYON Hervé (guyon@ill.fr)

Weblink : <http://www.ill.fr>

#### **2) Operating organisation**

Physical address : The same as facility

Contact person:

Weblink :

#### **3) Regulator**

Physical address :

**DGSNR**

Direction Générale de la Sûreté Nucléaire et de  
la Radioprotection

FONTENAY AUX ROSES

Contact person:

Weblink : <http://www.asn.gouv.fr>



## C) Periodic safety review performed for your research reactor facility

**1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)**

Does your facility have a formally issued SAR?

Yes, every ten years.

What was date of last revision?

May 2002.

Is your SAR currently undergoing a revision?

Yes.

Does your SAR follow the IAEA 35-G1 format guidelines ?

~~Closely:~~

Somewhat: French rules – regulator = DGSNR

~~Not at all:~~

Does your SAR have a formal acceptance letter from the regulator?

Yes.

Does your facility have an external regulatory body?

No.

Does your facility have a written requirement specifying a change control/safety review process? Yes, through the CIS (Commission Interne de Sécurité) above all for experimental modification. For reactor modification, ILL needs a formal authorisation or at least to make an information.

Does your facility have a safety review committee (SRC)?

For experimental application : CIS

For reactor application : If necessary creation of Expert Advisory Committee (EAC)

Does SRC meet routinely, or as required? Are minutes and decisions published?

CIS : 1 /year

EAC : 3 times/2 last years } as required

***Minutes and decisions are internally published and consultable by the safety authority***

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes when "Elements Important for Safety" (as defined in the Safety Report) are concerned

Have any external safety reviews been performed in last XX years?

If yes, state scope.

3 externals reviews have been performed in the last 2 years, with external experts. The topic was "sismic reinforcements".

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

- Sismic reinforcements
- Separation of the three neutronic control systems
- New safety filling circuit
- Improved ventilation filtration

**C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

Almost exclusively deterministic assessments.

Classical qualified codes (mechanical – thermal – neutronic...applications)

**4) Confidentiality status of the periodic safety review report(s)**

Internal safety review reports are consultable by the Safety Regulator.

External review reports may be consulted after requirement.

Safety analysis made by the safety regulator are its property.

Inspection report are consultable on the web <http://www.asn.gouv.fr> as well as incident report

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

PSA is marginally used:

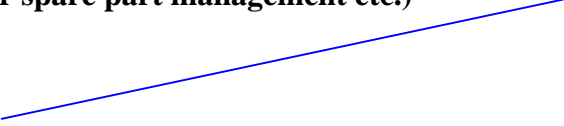
- Probability less than  $10^{-6}$  → only impact evaluation and description of protection in depth
- Probability less than  $10^{-7}$  → excluded events

Tacit Policy ← Criticity = probability and impact is used to prioritise the stakes and eventually modifications

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**



**4) Confidentiality status of the PSA report(s)**



## 13. Germany – BER II:

### A) Research Reactor Identification Information

Reactor name :	BER II ( <u>B</u> erliner- <u>E</u> xperimentier- <u>R</u> eaktor)
IAEA Code :	DE-0031
Type (TRIGA, MTR, etc. ):	MTR-Type
Thermal power :	10MW

### B) Addresses of

#### 1) Facility

Physical address:	Hahn-Meitner-Institut Berlin GmbH Glienicke Strasse 100 D-14109 Berlin
Contact person:	Prof. Dr. Michael Steiner Scientific Director
Weblink :	<a href="http://www.hmi.de">www.hmi.de</a>

#### 2) Operating organisation

Physical address :	Hahn-Meitner-Institut Berlin GmbH Reactor Department
Contact person:	Dr. Herbert Krohn Head of the Reactor Department
Weblink :	<a href="http://www.hmi.de">www.hmi.de</a>

#### 3) Regulator

Physical address :	Senatsverwaltung für Stadtentwicklung Brückenstr. 6 D-10179 Berlin
Contact person:	Dr. Karl-Heinz Steinmetz
Weblink :	<a href="http://www.stadtentwicklung.berlin.de">www.stadtentwicklung.berlin.de</a>

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?

After 10 years of operating the upgraded BER II, the compilation of a SAR was started in 2002 and will be finished in the II. Quarter 2004.

What was date of last revision? -

Is your SAR currently undergoing a revision? -

Does your SAR follow the IAEA 35-G1 format guidelines ? No, it does not.

Closely:

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator? Not yet, because

the report is in process.

Does your facility have an external regulatory body? Yes, see page 1 (3).

Does your facility have a written requirement specifying a change control/safety review process? No, it has not.

Does your facility have a safety review committee (SRC)? Yes, it has.  
It is the IRSK ( Internal Reactor Safety Committee).

Does SRC meet routinely, or as required? Are minutes and decisions published?  
The IRSK is meeting routinely once a year with the regulatory body. If it is required the IRSK will be called up additionally. As a result of a meeting an internal protocol will be distributed.

Does your facility have to request approval for some specified types of changes to an external regulatory authority? Yes, quiet often, depending on the safety importance.

Have any external safety reviews been performed in last XX years? No, they have not.  
If yes, state scope.

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

The normal operation time of BER II is three weeks with one week of maintenance, updating and periodic inspections. The organisation of the reactor department has not changed in the last years. The level of the high qualification of the reactor staff will be guaranteed by performing of special lessons related to the BER II in regular intervals.

All tasks of maintenance, updating and periodic inspection are done responsible by the reactor staff and by support of the technical supervision company (TÜV) and of external specialists.

**C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

Deterministic assessment every 10 years.

**4) Confidentiality status of the periodic safety review report(s)**

The status is confidential. We have the intention to publish the report after an approval of our regulatory body.

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

Not applicable

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

Not applicable

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

Not applicable

**4) Confidentiality status of the PSA report(s)**

Not applicable

## 14. Germany – FRJ-2:

### A) Research Reactor Identification Information

Reactor name :	FRJ-2
IAEA Code :	DE-0006
Type (TRIGA, MTR, etc. ):	MTR
Thermal power :	23 MW

### B) Addresses of

#### 1) Facility

Physical address:	Forschungszentrum Jülich 52425 Jülich, Germany
Contact person:	Dr. R. Nabbi
Weblink :	<a href="http://www.fz-juelich.de/zfr">www.fz-juelich.de/zfr</a>

#### 2) Operating organisation

Physical address :	Forschungszentrum Jülich 52425 Jülich, Germany
Contact person:	Dr. R. Nabbi
Weblink :	<a href="http://www.fz-juelich.de/zfr">www.fz-juelich.de/zfr</a>

#### 3) Regulator

Physical address :	Ministerium für Verkehr, Energie und Landesplanung des Landes Nordrhein-Westfalen 41090 Düsseldorf, Germany
Contact person:	Mr. P. Ceyrowski Ministerium für Verkehr, Energie und Landesplanung des Landes Nordrhein- Westfalen, Referat IV 8 41090 Düsseldorf, Germany
Weblink :	

### C) Periodic safety review performed for your research reactor facility

**1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)**

Does your facility have a formally issued SAR?

**Yes**

What was date of last revision?

**December 2003, the updating SAR has been completed. Its approval and acceptance by the licensing authority is expected in near future**

Is your SAR currently undergoing a revision?

**Yes**

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely: *Yes*

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

*The approval is in progress*

Does your facility have an external regulatory body?

**Yes**

Does your facility have a written requirement specifying a change control/safety review process?

**Yes**

Does your facility have a safety review committee (SRC)?

**Yes**

Does SRC meet routinely, or as required? Are minutes and decisions published?

**Required, minutes are internally published**

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

**Yes**

Have any external safety reviews been performed in last 10 years?

If yes, state scope.

Yes, review of the safety documents and SAR including the core conversion analysis

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

- *Modification of the operating manual*
- *Arrangements for periodic qualification of the staff*
- *Establishing a section for communication with the regulatory body*
- *Establishing a procedure for power control and fuel element temperature control*

### **C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer**



codes used etc.)

- *Methods for determination of exact power distribution*
- *Sophisticated computer codes for operation control(MCNP)*
- *Experiment Control and measurement of shutdown reactivity*

4) Confidentiality status of the periodic safety review report(s)

**Internal level**

#### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)

**PSA level 1 Determination of failure frequency including all operational states and modes, external events, human error**

*PSA level 2 Determination of Consequences including the enviromental impact*

2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)

*It was the first comprehensive and structured PSA for FRJ-2 under the consideration of all previos and recent experiences and informations. The study could benefit from the corresponding PSA performed for the DIDO-type reactors of the same design*

#### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)

*PSA was initiated to enhance:*

- *the passive safety behavior of the reactor*
- *the reliability of the safety and protection system*

As a consequence of the PSA, some modifications were performed to enhance the safety potential:

- *Installation of a feed and bleed system for after-heat removal*
- *Separation of the purification loop and primary cooling system*
- *Installation of a redundant power supply for the protection system*
- *Modification of the auxiallary cooling system*
- *Inclusion of the 2<sup>nd</sup> shutdown system for reactor scram*

4) Confidentiality status of the PSA report(s)

**Confidential and not for publication**

## 15. Germany – FRM-II:

### A) Research Reactor Identification Information

Reactor name :	Forschungsreaktor München II (FRM-II)
IAEA Code :	WFR2
Type (TRIGA, MTR, etc. ):	Compact Core High Flux Reactor
Thermal power :	20 MW

### B) Addresses of

#### 1) Facility

Physical address:	ZWE FRM-II Lichtenbergstrasse 1 85748 Garching/Germany
Contact person:	Prof. Dr. Klaus Schreckenbach Technical Director
Weblink :	<a href="http://www.frm2.tum.de">www.frm2.tum.de</a>

#### 2) Operating organisation

Physical address :	Technische Universität München Arcisstrasse 21 80333 München/Germany
Contact person:	Dr. Ludwig Kronthaler Kanzler der TU München
Weblink :	<a href="http://www.tum.de">www.tum.de</a>

#### 3) Regulator

Physical address :	Bayer. Staatsministerium für Umwelt, Gesundheit und Verbraucherschutz (StMUGV) Rosenkavalierplatz 2 91925 München/Germany
Contact person:	Dr. Hans Kühlewind Ministerialrat
Weblink :	<a href="http://www.stmugv.bayern.de">www.stmugv.bayern.de</a>

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective (i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?

The “Sicherheitsbericht” (safety report) for the FRM-II has been issued in October 1993. It is part of the documents being prepared during the licensing procedure. The safety report is a basic document during the licensing procedure. All safety related questions are treated in much more detail in the facility documentation.

What was date of last revision?

There is no revision of the “Sicherheitsbericht”. The facility documentation is revised permanently.

Is your SAR currently undergoing a revision?

No, it is not.

Does your SAR follow the IAEA 35-G1 format guidelines?

The safety report (Sicherheitsbericht) for the FRM-II has been issued in October 1993, i.e before the publication of IAEA 35-G1. It is based on the German Atomrechtliche Verfahrensverordnung (AtVfV).

Does your SAR have a formal acceptance letter from the regulator?

The safety report has been accepted in the framework of the first partial license of the FRM-II.

Does your facility have an external regulatory body?

Yes, Bayerisches Staatsministerium für Umwelt, Gesundheit und Verbraucherschutz

Does your facility have a written requirement specifying a change control/safety review process?

Yes, it has

Does your facility have a safety review committee (SRC)?

No

Does SRC meet routinely, or as required? Are minutes and decisions published?

Not applicable

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes. Details are specified in operators manual (Betriebshandbuch).

Have any external safety reviews been performed in last XX years?

If yes, state scope.

Yes, all safety related questions have been addressed during the licensing procedure before the nuclear startup. The license has been awarded in May 2003

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

Approximately every 10 years a periodic safety analysis report has to be carried out. The first analysis has to be presented 10 years after the begin of the routine operation

The report has to cover an analysis of the safety status of the facility, a probabilistic safety analysis and an analysis of the physical protection.

The requirements for the analysis are defined by the German authorities in written form (Bund/Länder Behördenleitfäden).

### C) Periodic safety review performed for your research reactor facility (cont.)

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

- safety status report
- probabilistic safety analysis
- analysis of the physical protection measures

**4) Confidentiality status of the periodic safety review report(s)**

The first periodic safety report is due approximately in 2014. The status of confidentiality is therefore not yet known.

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

The scope and content of the PSA are defined by the German authorities in written form (Bund/Länder Behördenleitfäden).

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

There are no previous PSA to date. According to the license of the FRM-II an update of the PSA has to be done every 10 years.

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

The PSA is necessary every 10 years in order to keep the license.

Apart from the PSA essential modifications need to be licensed separately . The management of non-essential modifications is determined in the operators manual (Betriebshandbuch).

**4) Confidentiality status of the PSA report(s)**

The status of confidentiality of the PSA reports is not yet known.

## 16. Germany – TRIGA Mainz:

### A) Research Reactor Identification Information

Reactor name : **TRIGA Mainz**  
IAEA Code : **WUMZ**  
Type (TRIGA, MTR, etc. ): **TRIGA**  
Thermal power : **100 kW**

### B) Addresses of

#### 1) Facility

Physical address: **Johannes-Gutenberg Universität  
Institut für Kernchemie  
Fritz-Strassmann-Weg 2  
D-55128 Mainz**

Contact person: **Dr. Norbert Trautmann**

Weblink : [www.kernchemie.uni-mainz.de](http://www.kernchemie.uni-mainz.de)

#### 2) Operating organisation ® see 1)

Physical address :

Contact person:

Weblink :

#### 3) Regulator

Physical address : **Ministerium für Umwelt und Forsten  
Kaiser-Friedrich-Str. 1  
D-55021 Mainz**

Contact person: **Min.-Rat Wolfhard Meier**

Weblink : [www.muf.rlp.de](http://www.muf.rlp.de)

### C) Periodic safety review performed for your research reactor facility

**1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)**

Does your facility have a formally issued SAR? **yes**

What was date of last revision? **1995**

Is your SAR currently undergoing a revision? **no**

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely:

**Somewhat: X**

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

**yes, acceptance is part of the licensing process**

Does your facility have an external regulatory body? **yes**

Does your facility have a written requirement specifying a change control/safety review process? **no**

Does your facility have a safety review committee (SRC)? **no**

Does SRC meet routinely, or as required? Are minutes and decisions published?

Does your facility have to request approval for some specified types of changes to an external regulatory authority? **yes**

Have any external safety reviews been performed in last XX years? **no**  
If yes, state scope.

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

**No frequent SAR update. Last update in 1995 due to refurbishment of reactor cooling circuits**

#### **C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

**Only deterministic methods used for safety analysis in SAR**

**4) Confidentiality status of the periodic safety review report(s)**

**SAR is not published**

#### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

**See part c)**

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

**See part c)**

#### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

**See part c)**

**4) Confidentiality status of the PSA report(s)**

**See part c)**

## 17. Greece – GRR-1:

### A) Research Reactor Identification Information

Reactor name :	GRR-1
IAEA Code :	WGR1-10-GRR1
Type (TRIGA, MTR, etc. ):	MTR
Thermal power :	5 MW

### B) Addresses of

#### 1) Facility

Physical address:	N.C.S.R. “Demokritos” 27, Neapoleos Str., 15341 Aghia Paraskevi GREECE
Contact person:	Mrs A. Daniel
Weblink :	

#### 2) Operating organisation

Physical address :	Institute of Nuclear Technology – Radiation Protection 27, Neapoleos Str., 15341 Aghia Paraskevi GREECE
Contact person:	Dr N. Catsaros
Weblink :	

#### 3) Regulator

Physical address :	Greek Atomic Energy Commission 27, Neapoleos Str., 15341 Aghia Paraskevi GREECE
Contact person:	Prof. Th. Matikas
Weblink :	

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?

YES

What was date of last revision?

2000

Is your SAR currently undergoing a revision?

YES

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely:

Somewhat: X



Not at all:

Does your SAR have a formal acceptance letter from the regulator?

NO

Does your facility have an external regulatory body?

YES

Does your facility have a written requirement specifying a change control/safety review process?

NO

Does your facility have a safety review committee (SRC)?

YES

Does SRC meet routinely, or as required? Are minutes and decisions published?

SRC meets as required. Minutes are not published.

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

YES

Have any external safety reviews been performed in last XX years?  
If yes, state scope.

YES, IAEA INSARR mission, Nov. 2001, follow-up June 2004.

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

### **C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

Both deterministic and probabilistic computer codes used in accident analysis: code PARET (coupled thermal-hydraulic and kinetics).

Computer codes used in the PSA: code RISKSPECTRUM (Boolean reduction of the accident sequences).

**4) Confidentiality status of the periodic safety review report(s)**

None

### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external**

**events, human error etc)**

PSA Level 1.

Operational status: nominal full-power (5 MWth), reduced power operation, startup operation, subcritical reactor.

External events have not been considered.

Failures due to human error have been considered.

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

There was no previous PSA. This was the first time that a PSA has been performed.

#### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

For modification, namely during the conversion from HEU to LEU.

**4) Confidentiality status of the PSA report(s)**

None. Published in the open literature.

## 18. Hungary - BRR:

### A) Research Reactor Identification Information

Reactor name :	Budapest Research Reactor (BRR)
IAEA Code :	
Type (TRIGA, MTR, etc. ):	Tank type
Thermal power :	10 MW

### B) Addresses of

#### 1) Facility

Physical address:	KFKI AEKI, Reactor Department Konkoly Thege Str. 29-33 H-1121 Budapest, HUNGARY
Contact person:	Sandor TOZSER
Weblink :	<a href="http://www.kfki.hu/brr">http://www.kfki.hu/brr</a>

#### 2) Operating organisation

Physical address :	KFKI Atomic Energy Research Institute Konkoly Thege Str. 29-33 H-1121 Budapest, HUNGARY
Contact person:	Istvan VIDOVSZKY
Weblink :	<a href="http://www.kfki.hu/~aekihp">http://www.kfki.hu/~aekihp</a>

#### 3) Regulator

Physical address :	Hungarian Atomic Energy Authority Fenyves A. Str. 4. H-1036 Budapest, HUNGARY
Contact person:	Ivan LUX
Weblink :	<a href="http://www.haea.gov.hu">http://www.haea.gov.hu</a>

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?

YES

What was date of last revision?

31.12.2003

Is your SAR currently undergoing a revision?

It has just been finished (30.01.2004)

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely: YES

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

YES

Does your facility have an external regulatory body?

YES

Does your facility have a written requirement specifying a change control/safety review process?

YES

Does your facility have a safety review committee (SRC)?

(YES)

Internal committee, headed by the director of the institute.

Does SRC meet routinely, or as required? Are minutes and decisions published?

YES: As required, no minutes and decisions published.

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

YES

Have any external safety reviews been performed in last XX years?

If yes, state scope.

1993, IAEA INSAR

PSR, 2003, carried out by the KFKI-AEKI (licence holder)

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

PSR: every 10 years

SAR: actualisation every calendar year

Operation staff: examination every 3 years

### C) Periodic safety review performed for your research reactor facility (cont.)

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

No PSA, otherwise the same analyses as for the power plant, the same computer codes, certainly modified for the different conditions.

**4) Confidentiality status of the periodic safety review report(s)**

Confidential.

### D) Probabilistic Safety Assessment (PSA) performed for your RR facility

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

No PSA.

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

Not relevant.

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

Not relevant.

**4) Confidentiality status of the PSA report(s)**

Not relevant.

## 19. Italy – L.E.N.A.:

### A) Research Reactor Identification Information

Reactor name :  
IAEA Code : I – WLEP  
Type (TRIGA, MTR, etc. ): TRIGA Mark II  
Thermal power : 250 kW

### B) Addresses of

- 1) Facility**  
Laboratorio Energia Nucleare Applicata  
(L.E.N.A.) - University of Pavia  
Physical address: Via Aselli, 41  
27100 Pavia  
Italy  
Contact person: Dr. Andrea Borio di Tigliole  
Director  
Weblink : [http://www.unipv.it/weblena/sito\\_lena/index.htm](http://www.unipv.it/weblena/sito_lena/index.htm)
- 2) Operating organisation**  
Physical address : University of Pavia  
C.so Strada Nuova, 65  
27100 Pavia  
Italy  
Contact person: Dr. Andrea Borio di Tigliole  
L.E.N.A. Director  
Tel. +39 (0)382 507300  
Weblink : [http://www.unipv.it/weblena/sito\\_lena/index.htm](http://www.unipv.it/weblena/sito_lena/index.htm)
- 3) Regulator**  
Physical address : A.P.A.T.  
Via V. Brancati, 48  
00144 ROMA  
Contact person:  
Weblink :

### C) Periodic safety review performed for your research reactor facility

**1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)**

Does your facility have a formally issued SAR?

Yes

What was date of last revision?

It was issued in 1965. It has been revised since then many times but new versions were not formally approved by the Regulatory Authority.

Is your SAR currently undergoing a revision?

Yes

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely: yes

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

Yes

Does your facility have an external regulatory body?

Yes

Does your facility have a written requirement specifying a change control/safety review process?

Yes

Does your facility have a safety review committee (SRC)?

Yes

Does SRC meet routinely, or as required? Are minutes and decisions published?

The SRC meet as required. Minutes and decisions are registered.

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes

Have any external safety reviews been performed in last XX years?

If yes, state scope.

Yes. Before and after the realisation of an experiment with a big impact on the plant

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

Change of the air filtering and conditioning system.

Upgrade of other systems of the plant and change of some spare parts.

Changes in the organisation of the staff.

### **C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

The methodology is deterministic.

**4) Confidentiality status of the periodic safety review report(s)**

### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

-

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events**

implemented? etc.)

-

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

-

**4) Confidentiality status of the PSA report(s)**

-



## 20. Italy – RC-1:

### A) Research Reactor Identification Information

Reactor name :	RC-1
IAEA Code :	WTRG
Type (TRIGA, MTR, etc. ):	Triga
Thermal power :	1 Mw

### B) Addresses of

#### 1) Facility

Physical address:	ENEA C.R. Casaccia – Via Anguillarese,301 - 00060 S.Maria di Galeria – Rome - Italy
Contact person:	Dott. Armando Festinesi
Weblink :	

#### 2) Operating organisation

Physical address :	ENEA C.R. Frascati, via Enrico Fermi, 45 00044 FRASCATI
Contact person:	Dott. Alberto Renieri
Weblink :	

#### 3) Regulator

Physical address :	APAT Agenzia per la Protezione dell'Ambiente e per i Servizi Tecnici Via Vitaliano Brancati, 48 00144 ROME - Italy
Contact person:	
Weblink :	

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?

YES

What was date of last revision?

1987

Is your SAR currently undergoing a revision?

NO

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely:

Somewhat: x

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

YES

Does your facility have an external regulatory body?

YES

Does your facility have a written requirement specifying a change control/safety review process?

NO

Does your facility have a safety review committee (SRC)?

YES

Does SRC meet routinely, or as required? Are minutes and decisions published?  
As required. Yes, records are published.

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

YES

Have any external safety reviews been performed in last XX years?

If yes, state scope.

YES – Improvement due Italian laws revision.

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

The safety report is updated consequently APAT request or Italian laws modifications. It is also updated when relevant plant modifications are planned. Staff is qualified by examination that are prescribed in the 1450/70 Italian law.

### **C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

Deterministic. Monte Carlo codes are often used. Also some particular codes developed by ENEA/APAT are used to evaluate environmental releases.

**4) Confidentiality status of the periodic safety review report(s)**

The safety review reports are known by ENEA, Regulatory Body, Industrial Ministry.

### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

N.A.

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

N.A.

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

N.A.

**4) Confidentiality status of the PSA report(s)**

N.A.

## 21. Netherlands – HOR:

### A) Research Reactor Identification Information

Reactor name : HOR  
IAEA Code : NL-0002  
Type (TRIGA, MTR, etc.): MTR-pool  
Thermal power : 2 MW cont., 3 MW max.

### B) Addresses of

#### 1) Facility

Physical address:  
DELFT UNIV. OF TECHNOLOGY  
INTERFACULTY REACTOR INSTIT.  
MEKELWEG 15, NL-2629 JB, DELFT  
Contact person:  
Prof. A.H.M. Verkooijen, Director  
Weblink : [www.iri.tudelft.nl](http://www.iri.tudelft.nl)

#### 2) Operating organisation

Physical address :  
Identical to above.  
Contact person:  
Weblink :

#### 3) Regulator

Physical address :  
MINISTRY OF HOUSING, LAND-USE  
PLANNING AND THE ENVIRONMENT,  
NUCLEAR SAFETY DEPARTMENT  
P.O. Box 16191  
NL 2500 BD DEN HAAG  
THE NETHERLANDS  
Contact person:  
Dr. P.J.W.M. Müskens  
Weblink :

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective (i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?

Yes

What was date of last revision?

July 1995

Is your SAR currently undergoing a revision?

No. In the Dutch situation, revision of the SAR is directly coupled to a formal licence procedure. In the present situation, the licence is granted with no time limits. The underlying material, e.g. safety documentation, analysis and reviews have to be kept up-to-date. The SAR is a formal document, which describes in general terms on a public information basis the facility and the risks and hazards associated with its operation.

Does your SAR follow the IAEA 35-G1 format guidelines?

Closely: Yes, to the extent possible; A probabilistic approach is used only on a minor scale for risk assessment in connection with external events, and for the radiological consequences/risk assessment of accidents.

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

Yes.

Does your facility have an external regulatory body?

Yes.

Does your facility have a written requirement specifying a change control/safety review process?

Yes, requirements laid down in the licence.

Does your facility have a safety review committee (SRC)?

Yes, internal Reactor Safety Committee, in advisory role to the Director.

Does SRC meet routinely, or as required? Are minutes and decisions published?

Yes, routinely each quarter, and ad-hoc. Written records of minutes and "decisions" are made.

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes, graded approach depending on the safety class/implications following written procedures.

Have any external safety reviews been performed in last XX years?

If yes, state scope.

Yes, Major audit and review by Dutch authorities in 1988; QA-audit in 1998; formal INSARR in 2000 and follow-up mission in 2002.

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

### C) Periodic safety review performed for your research reactor facility (cont.)

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

Deterministic.

**4) Confidentiality status of the periodic safety review report(s)**

INSARR Report can be obtained through IAEA; Self-assessment report (In Dutch) can be made available on request (has been handed over also to IAEA for information purposes).

### D) Probabilistic Safety Assessment (PSA) performed for your RR facility

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

Not applicable.

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

Not applicable.

### D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

PSA techniques have been used occasionally for judging different options for plant modifications.

**4) Confidentiality status of the PSA report(s)**

There is no material available or suitable for external use.

## 22. Norway – JEEP II:

### A) Research Reactor Identification Information

Reactor name :	JEEP II
IAEA Code :	NO-0002
Type (TRIGA, MTR, etc. ):	Tank
Thermal power :	2MW

### B) Addresses of

#### 1) Facility

Physical address:	Institute for Energy Technology P.O.Box 40 N-2027 Kjeller Norway
Contact person:	Jon Per Rambæk
Weblink :	<a href="http://www.ife.no">www.ife.no</a>

#### 2) Operating organisation

Physical address :	Institute for Energy Technology P.O.Box 40 N-2027 Kjeller Norway
Contact person:	
Weblink :	<a href="http://www.ife.no">www.ife.no</a>

#### 3) Regulator

Physical address :	Norwegian Radiation Protection Authority (NRPA)
Contact person:	
Weblink :	<a href="http://www.nrpa.no">www.nrpa.no</a>

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR? **Yes**

What was date of last revision? **April 2003**

Is your SAR currently undergoing a revision? **No**

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely: **Yes**

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator? **Yes**

Does your facility have an external regulatory body? **Yes**

Does your facility have a written requirement specifying a change control/safety

review process? **Yes**

Does your facility have a safety review committee (SRC)? **Yes**

Does SRC meet routinely, or as required? Are minutes and decisions published?  
**The SRC meets as required. Minutes are not published.**

Does your facility have to request approval for some specified types of changes to an external regulatory authority? **Yes**

Have any external safety reviews been performed in last XX years?  
If yes, state scope. **NRPA November 2003**

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

#### **C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

**NA**

**4) Confidentiality status of the periodic safety review report(s)**

**Open, except physical protection issues**

#### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

**NA**

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

**NA**

#### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

**NA**

**4) Confidentiality status of the PSA report(s)**

**NA**



## 23. Poland – MARIA:

### A) Research Reactor Identification Information

Reactor name : **MARIA**

IAEA Code : **PL-0004**

Type (TRIGA, MTR, etc. ): Pool type (Russian design)

Thermal power : *max. 30 MW*

### B) Addresses of

#### 1) Facility

Physical address: *Institute of Atomic Energy  
PL-05-400 Otwock-Swierk, POLAND*

Contact person: *Grzegorz Krzysztozek*

Weblink : [www.iea.cyf.gov.pl/reaktor.html](http://www.iea.cyf.gov.pl/reaktor.html)

#### 2) Operating organisation

Physical address : *Institute of Atomic Energy  
PL-05-400 Otwock-Swierk, POLAND*

Contact person: *Krzysztof Wieteska*

Weblink : [www.iea.cyf.gov.pl](http://www.iea.cyf.gov.pl)

#### 3) Regulator

Physical address : *National Atomic Energy Agency  
Krucza 36; PL-00-522 Warszawa, POLAND*

Contact person: *Jerzy Wiktor Niewodniczanski*

Weblink : [www.paa.gov.pl](http://www.paa.gov.pl)

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?

*Yes*

What was date of last revision?

*2004*

Is your SAR currently undergoing a revision?

*No*

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely: *Yes*

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

*Yes*

Does your facility have an external regulatory body?

*Yes*

Does your facility have a written requirement specifying a change control/safety review process?

*No*

Does your facility have a safety review committee (SRC)?

*Yes*

Does SRC meet routinely, or as required? Are minutes and decisions published?

*Meetings on request.*

*Written minutes of the official SRC meetings comprise the comments, recommendations and decisions*

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

*Yes*

Have any external safety reviews been performed in last XX years?

If yes, state scope.

*Yes, INSARR (PRE-, NORMAL and FOLLOW-UP) missions*

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

*Typical frequency: 2÷5 years comprising:*

- modifications including changes of fuel;*
- recent incidents and operation experience;*
- changes in organisation;*
- introduction of the new state regulations (e.g. Atomic Law).*

### **C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

*Deterministic based on:*

- Computer codes:*
  - a. neutronic – transport, diffusion and Monte Carlo;*
  - b. thermal-hydraulic – own designed due to the complexity of the cooling system;*
  - c. radioactivity dispersion and radiological hazard within the object – own designed codes;*
  - d. environmental dispersion of radioactivity – standard codes;*
- Safety oriented experiments (loss of coolant simulation, critical heat flux phenomena, natural convection conditions etc.)*

**4) Confidentiality status of the periodic safety review report(s)**

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

**No PSA performed**

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

**No**

**4) Confidentiality status of the PSA report(s)**

## 24. Portugal - RPI:

### A) Research Reactor Identification Information

Reactor name :	RPI (Reactor Português de Investigação)
IAEA Code :	RPI
Type (TRIGA, MTR, etc. ):	MTR
Thermal power :	1 MW

### B) Addresses of

#### 1) Facility

Physical address:	Reactor Instituto Tecnológico e Nuclear Estrada Nacional 10 2686-953 Sacavém
Contact person:	Dr. José Marques Reactor Manager
Weblink :	<a href="http://www.itn.mces.pt">www.itn.mces.pt</a>

#### 2) Operating organisation

Physical address :	Instituto Tecnológico e Nuclear Estrada Nacional 10 2686-953 Sacavém
Contact person:	Prof. Júlio Montalvão e Silva President of Directive Board of ITN
Weblink :	<a href="http://www.itn.mces.pt">www.itn.mces.pt</a>

#### 3) Regulator

Physical address :	(Safety Review Committee for RPI) Comissão de Segurança do RPI Instituto Tecnológico e Nuclear Estrada Nacional 10 2686-953 Sacavém
Contact person:	Prof. Júlio Montalvão e Silva President of Directive Board of ITN  Prof. Carlos Varandas President of Safety Review Committee
Weblink :	(none)

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?

Yes

What was date of last revision?

1997

Is your SAR currently undergoing a revision?

Yes

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely: Yes

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

No

Does your facility have an external regulatory body?

The facility has a Safety Review Committee (Comissão de Segurança, in Portuguese), independent from the reactor management. Its members are nominated by the Minister for Science and Higher Education on proposal by the President of ITN and include specialists external to ITN. The nominations are published in the Official Journal (Diário da República). The Safety Review Committee reports directly to the President of the Directive Board of ITN, who reports directly to the Government.

Does your facility have a written requirement specifying a change control/safety review process?

There are written requirements specifying the safety review process for any changes in safety related equipment, I&C, core configurations, etc., as well as for any new experiments.

Does your facility have a safety review committee (SRC)?

Yes.

Does SRC meet routinely, or as required? Are minutes and decisions published?

Meets on a monthly basis. Minutes and decisions are not published but can be consulted by any member of the public.

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

In Portugal some competences are attributed *inter alia* to the General Directorate for Health, to the General Directorate for Energy and to the Environment Institute. Approval from these bodies may be required.

Have any external safety reviews been performed in last XX years?

If yes, state scope.

IAEA's INSARR Mission, June 1992.

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

No significant changes were made in the reactor itself since the last formal revision of the SAR in 1997. Only minor equipment changes (e.g., replacement of obsolete paper recorders by equivalent ones).

Operating Limits and Conditions, issued also in 1997, is currently under revision, also

to adapt it to recent IAEA recommendations.

Physical Protection was not included in 1997's SAR. Access control via magnetic cards and video was introduced in 1999. Since 9/11 significant improvements were introduced with the assistance of US DOE. Physical Protection documents are kept in a separate, confidential, document.

#### **C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

Deterministic.

**4) Confidentiality status of the periodic safety review report(s)**

Same as for any decisions of the Safety Review Committee.

#### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

PSA never performed.

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

#### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

**4) Confidentiality status of the PSA report(s)**

## 25.-26. Romania – TRIGA SSR, TRIGA ACPR:

### A) Research Reactor Identification Information

Reactor name: TRIGA SSR  
TRIGA ACPR  
IAEA Code: RO-0002  
RO-0004  
Type (TRIGA, MTR, etc.): TRIGA  
Thermal power: SSR: 14 MW  
ACPR: up to 500 KW

### B) Addresses of

#### 1) Facility

Physical address: Institute for Nuclear Research  
Str. Campului, nr1  
Pitesti

Contact person: Dr. M. Ciocanescu

Weblink: [ciocanescum@lycos.com](mailto:ciocanescum@lycos.com)

#### 2) Operating organization

Physical address: Institute for Nuclear Research  
Str. Campului, nr1  
Pitesti

Contact person: Dr. M. Preda

Weblink: [marin.preda@scn.ro](mailto:marin.preda@scn.ro)

#### 3) Regulator

Physical address: Nuclear Commission for Nuclear Control Activities  
Bucharest

Contact person: Dr. Lucian Biro

Weblink: [lucian.biro@cncan.ro](mailto:lucian.biro@cncan.ro)

### C) Periodic safety review performed for your research reactor facility

1) Objective (i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR:

Yes.

What was date of last revision?

The last revision was in 2000, after INSAR mission.

Is your SAR currently undergoing a revision?  
Yes.

Does your SAR follow the IAEA 35-G1 format guidelines?  
Closely:  
Somewhat: Yes.  
Not at all:

Does your SAR have a formal acceptance letter from the regulator?  
Yes, authorization for continuous operation.

Does your facility have an external regulatory body?  
Yes, Nuclear Commission for Nuclear Control Activities.

Does your facility have a written requirement specifying a change control/safety review process?

Yes, safety documentation for re-authorization following periodic safety review for the TRIGA reactor.

Does your facility have a safety review committee (SRC)?  
Yes, the name of the SRC is CASN – Committee for Nuclear Safety Analysis.

Does SRC meet routinely, or as required? Are minutes and decisions published?  
As required. Minutes are kept at reactor archive, and are available for consultation.

Does your facility have to request approval for some specified types of changes to an external regulatory authority?  
Yes, the changes are made according to Regulatory Body approvals.

Have any external safety reviews been performed in the last 20 years?  
If yes, state scope.

The external safety reviews have been performed in the last 20 years, and the scope is safe operation, emergency preparation, modification i.e. reactor can commission to LEU. (Regulatory supervision and INSAR mission).

2) Scope and content: (i.e. frequency of updating, recent operation experience, Changes in organization, qualification of staff etc.)

- The conversion of reactor core having end point use of LEU type fuel (final stage 2006).
- Strategy for reactor system upgrading and performance improvement. A strategy of international collaboration can be appointed through improvement of reactor performance.
- Development of activity area taking into account internal and international requirements (economy, medicine, agriculture).
- Re-organization according to activities on short period.
- Qualification of staff through periodic re-authorization of operator personnel (every two years).



- All the activities are procedured being implemented in the Quality Management System.

### **C) Periodic safety review performed for your research facility (cont.)**

#### **3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

Up to now: Deterministic assessments using WIMS, 3DDT, PARET computer codes.

Planned: Probabilistic assessments, Level 1 PSA, computer codes: PSAMAN romanian computer code.

#### **4) Confidentiality status of the periodic safety review report(s)**

- Safety review reports made by Regulatory Body are confidential until implementation.
- INSAR mission reports follows the IAEA regulation concerning the confidentiality.

### **D) Probabilistic safety Assessment (PSA) performed for your RR facility**

1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)

PSA Level 1, covers internal initiating events, human errors and common cause failures with reactor at nominal power. Further, PSA phase will include external initiating events.

2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)

The previous PSA is regularly updated, the events are inherent, being implemented in personnel training program.

### **D) Probabilistic safety Assessment (PSA) performed for your RR facility**

3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)

The results of PSA study for TRIGA SSR 14 MW will be used for licensing, in the development of Test/ Maintenance Programs, improvements of Operating and Emergency Procedures, Aging Phenomena.

#### **4) Confidentiality status of PSA report(s)**

The PSA report is included in Yearly Operation Report for the reactor, having the same confidentiality.

## 27a. South Africa – SAFARI-1, Version 1:

### A) Research Reactor Identification Information

Reactor name :	SAFARI-1
IAEA Code :	ZA-0001
Type (TRIGA, MTR, etc. ):	Tank in Pool
Thermal power :	20 MW

### B) Addresses of

#### 1) Facility

Physical address:	Pelindaba, Pretoria, South Africa
Contact person:	Dr CSB Piani PO Box 582 Pretoria 0001 South Africa
Weblink :	Necsa.co.za

#### 2) Operating organisation

Physical address :	Necsa (South African Nuclear Energy Corporation) PO Box 582 Pretoria 0001 South Africa
Contact person:	Dr CSB Piani Senior Manager: SAFARI-1 Research Reactor
Weblink :	Email: <a href="mailto:csbpiani@necsa.co.za">csbpiani@necsa.co.za</a>

#### 3) Regulator

Physical address :	NNR (National Nuclear Regulator) PO Box 7106 Centurion 0046 Pretoria South Africa
Contact person:	Ms L Zondo (CEO: NNR)
Weblink :	NNR.co.za

### C) Periodic safety review performed for your research reactor facility

**1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)**

SAFARI-1 is continuously undergoing replacement of equipment, process for control (eg. I&C systems) as well as experimental and commercial installations. A formal ISI plan is being implemented and refurbishment for life extension is ongoing.

Does your facility have a formally issued SAR?

Yes

What was date of last revision?

November 2003

Is your SAR currently undergoing a revision?

Yes – mainly refinements according to Regulator request for document clarity.

Does your SAR follow the IAEA 35-G1 format guidelines?

Closely: Yes

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

Yes – with limitations (but not with expiry date)

Does your facility have an external regulatory body?

Yes

Does your facility have a written requirement specifying a change control/safety review process?

Yes

Does your facility have a safety review committee (SRC)?

Yes – 3 levels of review (Reactor Safety Committee / Safety Evaluation Committee and then the NNR - regulator).

Does SRC meet routinely, or as required? Are minutes and decisions published?

Quarterly and *ad hoc*

Yes – regulator is represented on this committee and minutes formally issued to all attendees and relevant persons

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes for selectively significant changes

Have any external safety reviews been performed in last XX years?

If yes, state scope.

No

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

SAFARI-1 is ISO 9001 and ISO 14001 certified – continuous updating of documentation including SAR etc. to meet dynamics of maintaining certifications and safe operations.

Operational experience: 24h x7d x 3 weeks – followed by 60-70 hr shutdown reload / maintenance ~ i.e. ~310 operational days/a @ ~18.7 MW average power level.

Applications: Isotope (<sup>99</sup>Mo, <sup>131</sup>I, etc.), Si-NTD, Irradiation services and experimental beam port facilities (Radiography, Diffraction, SANS being designed for installation

2005)

Facility includes fuel / control rod and isotope target plate manufacture (Total ~110 persons)

Staff: Mainly scientists/engineers/technicians.

Reactor operators – 12 years basic schooling with Science and Mathematics and ~ 6 years intensive in-house training and certification.

#### **C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

Recent licence (Nov 2003) includes full PSA evaluation

**4) Confidentiality status of the periodic safety review report(s)**

The PSA is included in the SAR and is regarded as Confidential – selective extractions could be made available to approved parties.

#### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

Fully inclusive of operations and human error on environmental and public safety incidence

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

The November 2003 version is an improved (revised) version of a previously antiquated Risk Assessment and includes all the recent experimental and process implications to-date.

#### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

The PSA was generated for licensing purposes only. All significant projects requiring modifications to the Licence eh. Fuel change, will require full reanalysis of the safety case with related transient accounting and revision of the applicable PSA.

**4) Confidentiality status of the PSA report(s)**

Confidential documents, but requests for information extracts could be negotiated.

## 27b. South Africa – SAFARI-1, Version 2:

### A) Research Reactor Identification Information

Reactor name :	SAFARI-1
IAEA Code :	ZA
Type (TRIGA, MTR, etc. ):	MTR
Thermal power :	20 MW (30 MW pending)

### B) Addresses of

#### 1) Facility

Physical address:	Pelindaba. Pretoria. South Africa.
Contact person:	Dr. Charles PIANI Senior Manager: SAFARI-1 P.O.Box 582 Pretoria 0001 South Africa
Weblink :	<a href="mailto:CSBPIANI@NECSA.CO.ZA">CSBPIANI@NECSA.CO.ZA</a>

#### 2) Operating organisation

Physical address :	As above (NECSA)
Contact person:	
Weblink :	~ NECSA.CO.ZA

#### 3) Regulator

Physical address :	NATIONAL NUCLEAR REGULATOR
Contact person:	
Weblink :	

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?

yes

What was date of last revision?

2003

Is your SAR currently undergoing a revision?

Continuous review

Does your SAR follow the IAEA 35-G1 format guidelines?

Closely: yes

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

yes

Does your facility have an external regulatory body?

yes

Does your facility have a written requirement specifying a change control/safety review process?

yes

Does your facility have a safety review committee (SRC)?

Yes

Level 1: Reactor Safety Committee (RSC)

Level 2: Safety Evaluation Committee (SEC)

Does SRC meet routinely, or as required? Are minutes and decisions published?

RSC: routinely (1/4) and ad hoc as needed (RSC + SEC)

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

yes

Have any external safety reviews been performed in last XX years?

If yes, state scope.

PSA, PRA, HAZOP – all significant modifications, e.g. replacement of primary pumps

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

- SAFARI-1 safety analysis report (SAR)
- Based on IAEA 35-GI -> 21 chapters
- Accepted (conditional – by regulator) Nov. 2003
- Continuous review/revision (dynamic SAR improvement program)
- Submission being prepared for 2 test (LEU silicide) elements
- Handled by: thermal hydraulic/ thermodynamic, nuclear physics, risk assessment specialists

**C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

PSA based on Hazard Analysis

- computer code (not sure of name)
- Hazard Analysis (plant management: evaluation)

**4) Confidentiality status of the periodic safety review report(s)**

Safety Analysis Report

- full report (21 chapters) – confidential to restricted
- currently preparing summary (~ 1 year) – expected “no confidentiality”

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

Full PSA based on Hazard Analysis (FMEA)

- includes all accident + potential risk (plant + human)

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

- subject to ISO 9001 and internal Quality Management System (QMS)
- evaluated/updated according to significance of change
- currently evaluating impact of insertion of 2-4 LEU (Si) test elements

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

- licensing (as per significant modifications)
- reporting – based on risk determined eg. (In-Service-Inspection)

**4) Confidentiality status of the PSA report(s)**

- confidential (but can be dismissed – for controlled distribution)

## 28. United Kingdom - CONSORT

### A) Research Reactor Identification Information

Reactor name :	Imperial College / CONSORT
IAEA Code :	GB0031
Type (TRIGA, MTR, etc. ):	MTR
Thermal power :	100kW

### B) Addresses of

#### 1) Facility

Physical address:	Imperial College Reactor Centre Imperial College London Silwood Park campus Buckhurst Road Ascot, Berks SL5 7TE, UK
Contact person:	Simon Franklin
Weblink :	<a href="http://www.imperial-consultants.co.uk/reactor.html">http://www.imperial-consultants.co.uk/reactor.html</a>

#### 2) Operating organisation

Physical address :	As above
Contact person:	
Weblink :	

#### 3) Regulator

Physical address :	Nuclear Installations Inspectorate St Peter's House Stanley Precinct Bootle Merseyside L20 3LZ
Contact person:	Chris Kemp
Weblink :	<a href="http://www.hse.gov.uk/nsd">www.hse.gov.uk/nsd</a>

### C) Periodic safety review performed for your research reactor facility

**1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)**

Does your facility have a formally issued SAR? Yes

What was date of last revision? 2002

Is your SAR currently undergoing a revision? Improvements identified in close-out

Does your SAR follow the IAEA 35-G1 format guidelines ?

Closely: Yes

Somewhat:

Not at all:

Does your SAR have a formal acceptance letter from the regulator?

Yes – see website for regulator



Does your facility have an external regulatory body?

Yes

Does your facility have a written requirement specifying a change control/safety review process?

Yes

Does your facility have a safety review committee (SRC)?

Yes

Does SRC meet routinely, or as required? Are minutes and decisions published? 6 monthly. Minutes are circulated amongst attending and regulators

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes

Have any external safety reviews been performed in last XX years?

If yes, state scope.

Only by regulator

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

10 yearly

Full 20 chapters, adherence to NII safety assessment principles, op ex, organisational changes, responsibility and adequacy of supervision.

### **C) Periodic safety review performed for your research reactor facility (cont.)**

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

Both. PARET, RISKSPECTRUM

**4) Confidentiality status of the periodic safety review report(s)**

Private documents

### **D) Probabilistic Safety Assessment (PSA) performed for your RR facility**

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

Level 1 PSA, **inclusion of all operational modes, external events, human error etc)**

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

An independent power station standard PSA using event trees and linked fault trees was requested over an above the internal human factors bounding case based upon event trees

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

Licensing only at present

**4) Confidentiality status of the PSA report(s)**

Conf

## 29. USA

### A) Research Reactor Identification Information

Reactor name :  
IAEA Code :  
Type (TRIGA, MTR, etc. ):  
Thermal power :

### B) Addresses of

#### 1) Facility

Physical address:  
Contact person:  
Weblink :

#### 2) Operating organisation

Physical address :  
Contact person:  
Weblink :

#### 3) Regulator

Physical address :                   USNRC  
  US O-12-G-13  
  Washington, DC 20555  
Contact person:                   Alexander Adams Jr.  
  
Weblink :                               [www.nrc.gov](http://www.nrc.gov)

### C) Periodic safety review performed for your research reactor facility

#### 1) Objective ( i.e. do you consider recent changes in safety related equipment, I&C systems or other, do you include new experiments at your reactor etc.)

Does your facility have a formally issued SAR?  
yes

What was date of last revision?  
n.a.

Is your SAR currently undergoing a revision?  
n.a.

Does your SAR follow the IAEA 35-G1 format guidelines?  
Closely:  
Somewhat: X follows NUREG - 1537  
Not at all:

Does your SAR have a formal acceptance letter from the regulator?  
yes

Does your facility have an external regulatory body?

yes

Does your facility have a written requirement specifying a change control/safety review process?

yes

Does your facility have a safety review committee (SRC)?

yes

Does SRC meet routinely, or as required? Are minutes and decisions published?

yes

Does your facility have to request approval for some specified types of changes to an external regulatory authority?

Yes, 10 CFR 50.59

Have any external safety reviews been performed in last XX years?

If yes, state scope.

Some licensees have requirement, but not all. NRC believes external reviews are good to have

**2) Scope and content: (i.e. frequency of updating, recent operation experience, changes in organisation, qualification of staff etc.)**

There is no regulatory requirement to update SAR. Safety significant changes are captured by changes to technical specifications and changes to the facility, procedures, and tests – experiments that require a 10 CFR 50.59 review. SARs are completely updated for renewal every 20 years

### C) Periodic safety review performed for your research reactor facility (cont.)

**3) Methodology: (i.e. deterministic and/or probabilistic assessments, computer codes used etc.)**

deterministic

**4) Confidentiality status of the periodic safety review report(s)**

Mostly public. However NRC is reviewing what types of information should be non-public.

### D) Probabilistic Safety Assessment (PSA) performed for your RR facility

**1) Scope and content: (i.e. PSA level, inclusion of all operational modes, external events, human error etc)**

None for regulatory purposes

Some licensees have done some PRA-PSA work to train students. NRC has not seen this work.

**2) Quality of PSA: (i.e. are previous PSA regularly updated?, recent events implemented? etc.)**

**D) Probabilistic Safety Assessment (PSA) performed for your RR facility (cont.)**

**3) Use or application of the PSA at your facility: (i.e. for licensing, for modifications, for spare part management etc.)**

**4) Confidentiality status of the PSA report(s)**

# Annex III

## **Specifications for the Research Reactor Safety Database**

This document is meant to give an introduction in how to use the research reactor database DARES. It tries to help to enter information or simplify the access to evaluations of reactor comparisons.

### **1. choose action**

The first step when reaching the main site of the database, is to choose from a number of offered actions:

- **Create new RR record, modify or delete RR record:**  
“If you want to modify or enter data, please contact the [database coordinator](#).  
A downloadable file for new research reactor entries or for changes to existing ones is available from [here](#).”
- Help file: “If you need information on how to use the database, [click here](#).”
- **Enter Database:**  
“Click [here](#) in order to select and view research reactor safety requirements and safety practices.”
- energyrisks – homepage

If there are any problems or questions arising concerning the database or in database administrative matters, contact the database coordinator. For any technical matters, contact the ODIN administrator. Both email addresses are available at the main page.

### **2. create new record**

The first possibility here is not directly available, but leads to an **Export File** (e.g. Excel), where the new/updated data can be entered or changed. This file is then sent to a central database administrator, who has access to the database to do the task. The deletion of a research reactor record can be requested through sending an email to the person responsible for the coordination of the database.

The export file to be filled out by the person wanting to include a new reactor or change old data, includes the following data as **basic information**:

1. Country
2. Facility name
3. Facility number (IAEA code)
4. Last update of data

5. Reactor type
6. Reactor category (use)
7. Thermal power
8. Construction Date
9. Criticality Date

Following these entries then the questions about the **safety information** (see 6. system hierarchy) are to be filled out. After completing these data sheet the new record can be saved through sending an email with this data sheet to the database coordinator.

As this is supposed to be a “living” database it is always possible for new reactors to be included, for new characteristics, categories and questions to be added or to change and update old information.

### 3. group selection

After having chosen “Enter Database”, the next step is to define the characteristic of the groups of reactors for the comparison. In this, a selection of characteristics from these **categories** is needed:

1. Country
2. Type of reactor
3. Purpose
4. Criticality Date
5. Construction Date
6. Thermal Power

There is no need to select one of the **characteristics** in each category, but it is also possible to leave the selection for all possibilities of one category.

It is important to say, that even before the first selection is made, the choice of features is always limited to those that are available. This means, that e.g. there might not be any Argonaut reactor in the Database, thus it also cannot be chosen in the category of research reactor types.

Also after choosing a certain characteristic, is it possible to see, that after pushing the “confirm” button, in the other categories the selections are narrowed down to the ones that are available for that selection.

For **country** either a single country can be chosen from a list of all countries or all EU member countries together can be selected. Otherwise a specific number also can be selected through pressing Control+Alt and then mark the chosen countries.

As **type of reactor** it is possible now to choose from:

1. MTR TYPE
2. TRIGA TYPE
3. Slowpoke-2
4. Compact Core High Flux
5. Tank

6. Pool
7. Argonaut
8. MNSR
9. DIDO TYPE

Hereby it is necessary to select one reactor type and by clicking on the “Confirm” this selection is made. New entries can be added to this list.

The **purpose** can be either:

1. Universities (Training)
2. Research institutions
3. Industry
4. Multipurpose
5. Other

The data here was collected from two databases on the internet: from the RR database on the IAEA website, and from the NuCoC – available at the ODIN website. If a University research reactor is said to be used also for research, this reactor is found under the category of Multipurpose.

The range of the **thermal power level** can be chosen individually, which means that any power range can be entered into a box “from:” for the lowest power and “to:” for the highest power wanted. Again, it is only possible to select a power range that is really available.

The same approach is used for the **construction** and the **criticality dates** of the reactor.

When selecting one particular feature for a facility, the number of features in the other categories is reduced to those that are available for the first selected one. Besides, below the categories can always be seen the number of available reactors in the specific selection, that has been done.

#### 4. submit selection

After having chosen the characteristic of the group for the comparison, the next step is to submit this selection by pushing the “**Finish Group**” button, before being able to choose the characteristics for the **second group** of research reactors.

Each group can be deleted by its own by clicking on the button with the red cross. If “**Reset**” is selected, then all groups are deleted.

This site shows not only the characteristics of the groups through which they are created, but also the research reactors, with their information, that are included in each selection. These reactors – for easier viewing – can be sorted by each criterion via using the criteria name as link for this action.

The switch from viewing one group to the other group is possible through using the link “Group 1”, “Group2”, etc. depending on the number of chosen groups.



The codes used were taken from the IAEA research reactor database (<http://www.iaea.org/worldatom/rrdb/>).

After having finished and submitted the second selection, with the button “**compare**” it is finally possible to compare the data of the two research reactor groups.

## 5. results

To help the understanding of the comparison and to facilitate changes of the selection, the submitted selection of characteristics is shown above the final results.

These results are presented in two columns – one for each group -, each row representing the answer to an asked question for the research reactor facility or the group of research reactors.

The result of each question is, according to the data of each reactor or to the group of reactors, represented as checked for fulfilled, O for partly fulfilled, and X for not fulfilled. It can also be indicated accordingly if there is no information available about a reactor (n.i.), represented through a question mark.

	fulfilled	partly fulfilled	not fulfilled	no information
fulfilled	✓	O	O	✓
partly fulfilled	O	O	O	O
not fulfilled	O	O	X	X
no information	✓	O	X	n.i.

Table 1: combination of possible answers for two reactors forming one group

In case of comparing a group containing more than two reactors these following rules apply:

A question for a group is answered with

- fulfilled: only if this criterion is fulfilled for all reactors of that group
- partly fulfilled: if at least for one reactor this criterion is partly fulfilled
- not fulfilled: only if for all reactors of the group this is answered as not being fulfilled
- n.i.: as answer for a whole group, only if all of the answers have this result, otherwise this answer is not counted. For the diagram, also this as answer for the whole group is not counted.

In case the data is a subjective interpretation of the received information from the facilities, the letter or check in the cell opens a small yellow window for a little while, if moved unto with the arrow, with further information about this answer. If this is available, this is indicated through a gray background.

For further information, the questions themselves a new link to other pages with detailed information about the results to those questions and – if available – those comments, that have been indicated through a gray background.

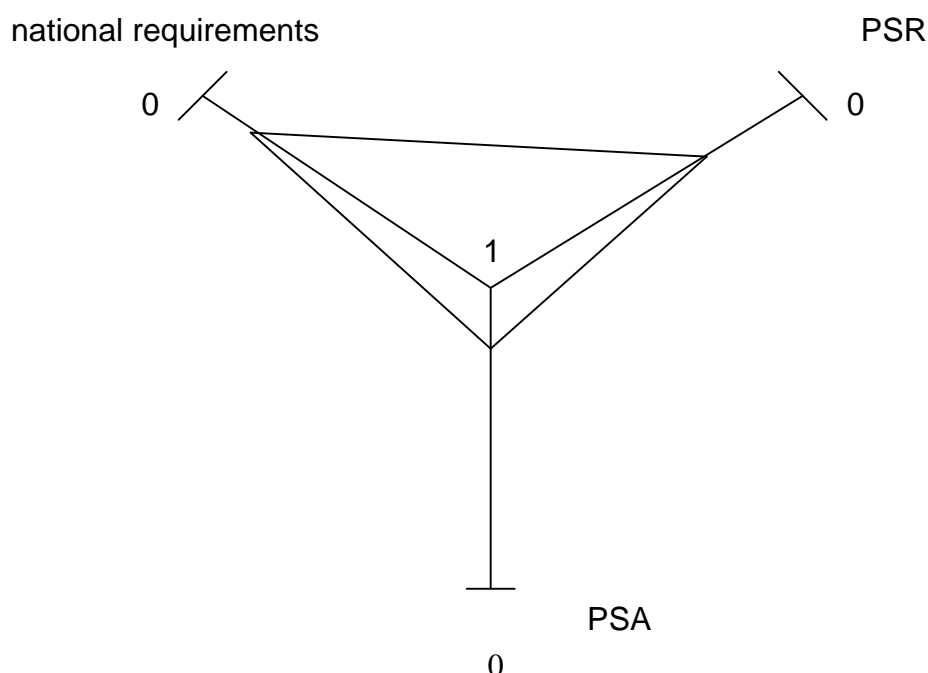
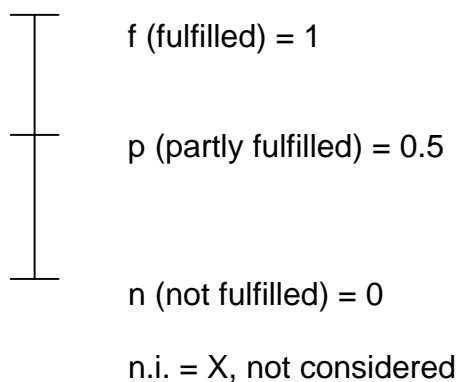
This way it can be easily seen how each reactor data contributes to the creation of data for the whole group.

At the same time it is also possible to hide or show part of the questions in chapters (2. national requirements, 3. Periodic Safety Review (PSR), 4. Probabilistic Safety Analysis (PSA)), or to show all answers of the research reactors of one group at a time.

## 6. evaluation of results

Besides the listing of the results for the two groups, the possibility is offered to draw a diagram. This is supposed to represent the level of compliance with the asked level of safety assessment.

The evaluation of the data and the switch from qualitative to quantitative data follows these rules:



The value for each of the three main chapters is calculated through detecting the average value of each of them.

The link to these diagrams is located beside the group name, and it opens up a new window.

The compliance of the research reactor group is determined through calculating the arithmetic mean value of the three axes. This value represents the degree of compliance between safety requirements and fulfilment of these requirements for the three safety areas National Requirements, Periodic Safety Review and Probabilistic Safety Assessment. This diagram shows the degree of compliance. The three axes of the diagram represent these three areas.

## 7. system hierarchy

2	national requirements
21	SAR
21	1 Does the facility have a formally issued SAR?
21	2 Is the SAR legally required?
21	3 Does the SAR follow the IAEA 35-G1 format guidelines?
21	4 Does the SAR have a formal acceptance letter from the regulator?
21	5 Is the SAR currently undergoing a revision?
22	SRC – Safety Review Committee
22	1 Does the facility have a safety review committee?
22	2 Does the SRC meet routinely, or as required?
22	3 Are the minutes and decisions made publicly available?
23	other
23	1 Does the facility have an external regulator body?
23	2 Does the facility have a written requirement specifying a change control/safety review process?
23	3 Does your facility have to request approval for some specified types of changes to an external regulatory authority?
23	4 Is the area around the research reactor facility classified in terms of “risk zones”?
3	PSR – Periodic Safety Review
31	Objective
31	1 Does the license holder have the prime responsibility for performing the review?
31	2 Does the review confirm the compliance of the research reactor facility with its licensing requirements and are any deviations resolved?
31	3 Does the review identify and evaluate the potential safety significance of those deviations from safety standards and best practices?
31	4 Are all reasonable practicable improvement measures taken by the licensee as a result of the review?
31	5 Is, as a result of a full scope review, an overall assessment of the safety of the research reactor facility provided, taking into account all identified strengths and shortcomings?
31	6 Is the PSR review confidential?
32	Scope of the PSR
32	1 Is the review made periodically?
32	2 Is the scope of the review clearly defined and justified?
32	3 Is the scope as comprehensive as reasonably practicable with regard to significant safety aspects of an operating research reactor?
32	4 Are the following areas covered by the review ?:
	- research reactor design as built compared to actual condition of systems, structures and components;
	- current safety analyses and their use;

- operating experience during the review period and experience feed-back;
- organizational structure;
- safety and quality management;
- staffing and qualification of staff;
- emergency preparedness;
- radiological impact on the environment

33 Methodology

- 33 1 Does the review use an up to date systematic and documented methodology, taking into account deterministic as well as probabilistic assessments?
- 33 2 Is each area reviewed and the findings compared to the licensing requirements as well as to current safety standards and practices? Do conclusions consider reasonable and practical improvements taking interactions and overlaps between the different safety issues into consideration?
- 33 3 If other information is used in the periodic safety review, is its contribution to the review explained and appropriate references given?

4 PSA

41 Scope and content of PSA

- 41 1 Is the PSA developed for levels 1 and 2?
- 41 2 Does PSA include all modes of operation, all relevant initiating events and hazards, including internal fire, internal flooding, severe weather conditions and seismic events?
- 41 3 Does PSA include all relevant dependencies (functional dependencies and other common cause failures)?
- 41 4 Does PSA contain uncertainty and/or sensitivity analyses?
- 41 5 Is the PSA based on a realistic modeling of the research reactor facility response, taking into account human performance in operating and accident procedures?
- 41 6 Are human errors analyzed and are the factors taken into account which can influence the performance of the operators in all facility states?

42 Quality of PSA

- 42 1 Is the PSA performed, documented and maintained according to the quality management system of the licensee?
- 42 2 Is the PSA performed using state-of-the-art methodology?
- 42 3 Is the PSA regularly updated?

43 Use of PSA

- 43 1 Is the PSA being used for safety management purposes, and is its role in the decision making process defined?
- 43 2 Is the PSA used to identify the need for modifications of systems and components of research reactors and its procedures, in order to reduce its risk?
- 43 3 Are insights from PSA used to develop safety significant training programs for the reactor operators?
- 43 4 Is the PSA being used to assess the overall risk from the research reactor facility to demonstrate that a balanced design has been achieved?
- 43 5 Is the PSA being used to assess the adequacy of system and component modifications, changes to technical specifications and procedures?
- 44 1 Are the PSA reports confidential?

**European Commission**

**EUR 21738 EN – DG JRC - Institute for Energy  
DEVELOPMENT OF A WEB-BASED INFORMATION SYSTEM  
FOR BENCHMARKING OF SAFETY ASSESSMENT  
APPROACHES FOR RESEARCH REACTORS**

**Authors:**

Christian Kirchsteiger

Hannelore Lauter

**Abstract**

A benchmarking of current safety assessment approaches (deterministic and probabilistic) has been performed for about 30 research reactor installations in Europe, the USA and South Africa. The results show significant discrepancies in practices for similar types of reactors, mainly due to different regulatory requirements.

The results are discussed with a view to identify future improvements on an international level, e.g. in the context of the recently published IAEA Code of Conduct on the Safety of Research Reactors and could form the basis of a future Working Group in the area, trying to find harmonisation areas, together with the European Research Reactor Operators Group (RROG).

The mission of the Joint Research Centre is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

