International Atomic Energy Agency

THE SAFETY ASSESSMENT EDUCATION AND TRAINING PROGRAMME (SAET)

Education and Training in the Area of Safety Assessment

SAFETY ASSESSMENT SECTION
DIVISION OF NUCLEAR INSTALLATIONS SAFETY
DEPARTMENT OF NUCLEAR SAFETY & SECURITY

Safety assessment competence
is the key to
making the right decisions
in design, licensing and operation.

SAFETY ASSESSMENT CAPACITY BUILDING

The IAEA is developing a complete and sustainable capacity and competency building programme in safety assessment knowledge and practical applications - SAET

SAET

The Safety Assessment Education and Training Programme (SAET) was established and launched in 2009 as a systematic programme for training of regulatory, technical support, and operational staff in the skills needed for informed decision-making and technical review of NP documentation.

Safety Assessment Education and Training (SAET) Programme

The SAET Programme Objective:

Support Member States in building and maintaining independent safety assessment competency and capacity

The SAET objective is accomplished through:

- **Identification of safety assessment knowledge requirements**
- **Training materials based on Safety Standards for instructor-led courses**
- **Training workshops and courses**
- **Use of web-based training tools**
- **International collaboration on safety assessment projects**

Safety Assessment Education and Training (SAET) Programme

The structure of the programme is built on two main pillars:

- **Essential Safety Assessment Knowledge**
- **Practical Applications**

The ***Main Elements*** of the Programme are:

I. **Fundamentals of Safety Assessment**

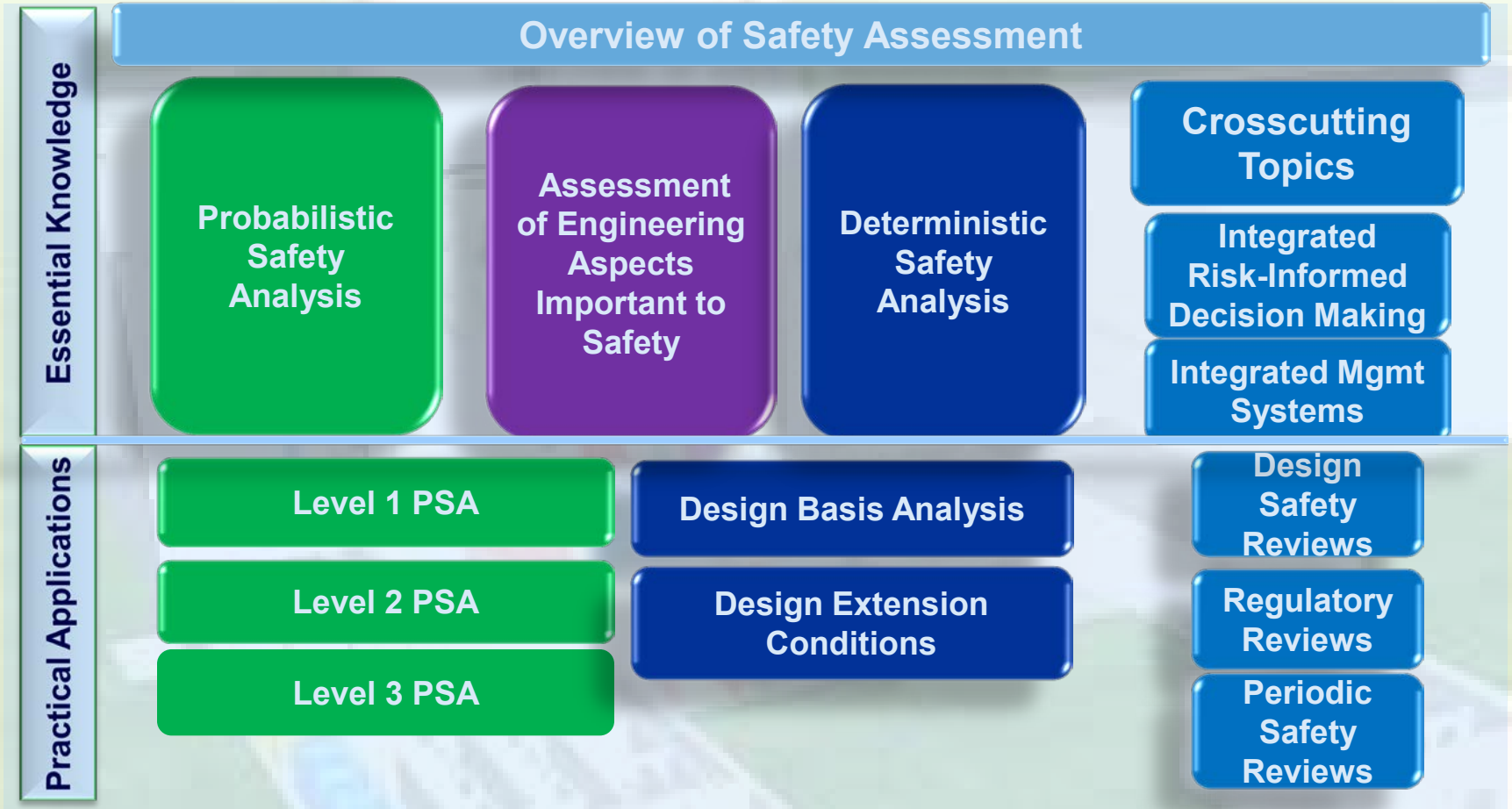
II. Assessment of Engineering Aspects Important to Safety

III. Deterministic Safety Assessment

IV. Probabilistic Safety Assessment

V. Cross-Cutting Topics

SAET SYLLABUS STRUCTURE



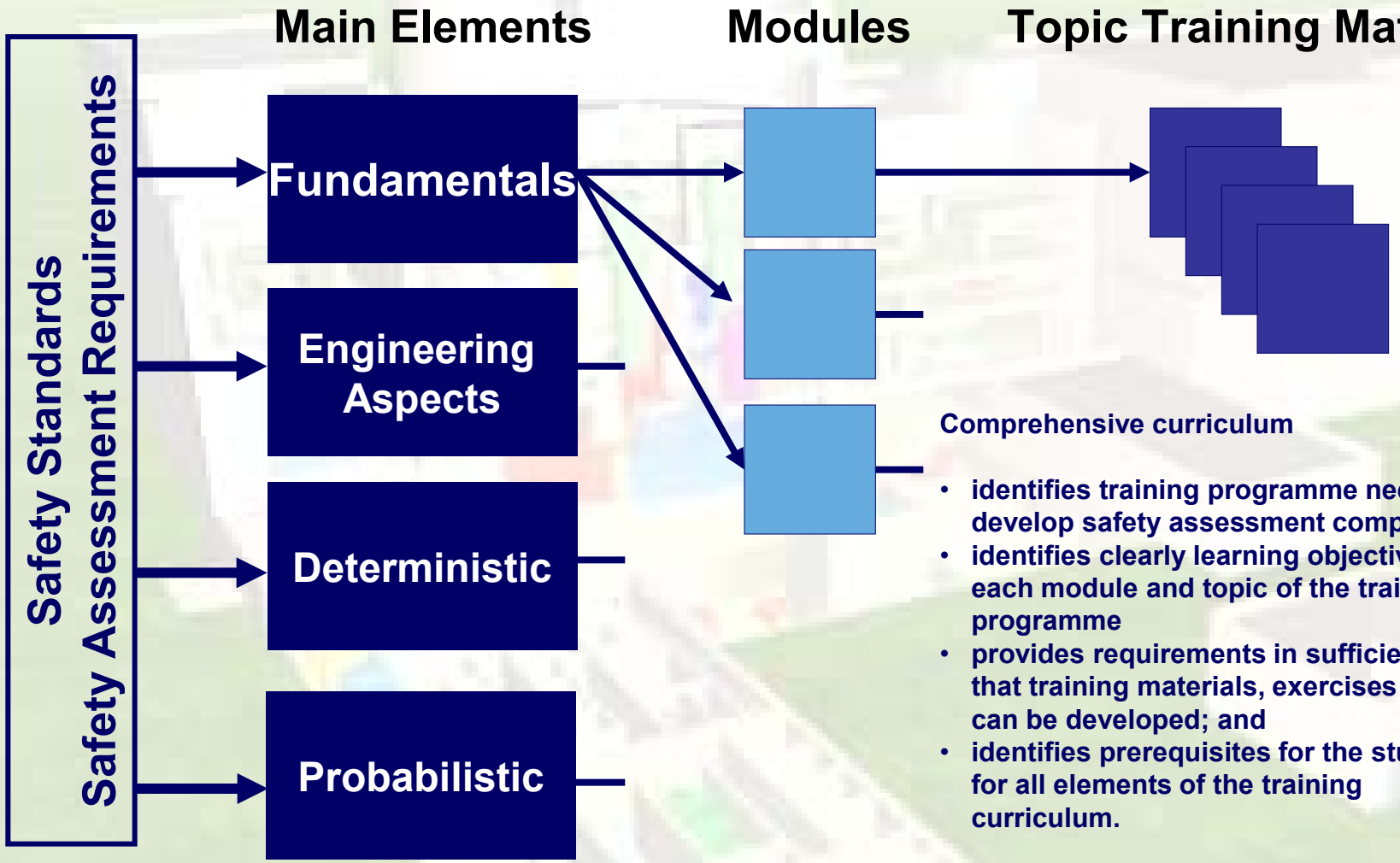
Safety Assessment Education and Training (SAET) Programme

- ***The SAET Syllabus Outline*** presents the structure of the training programme for bought pillars and for all Main Elements.

Each Main Element consists of a number of ***Modules***.

- ***The SAET Curriculum***
  - defines the ***learning objectives and the required content*** for the Modules
  - identifies the ***Topics*** to be addressed in each Module
  - defines the required format and content of the ***Topic Training Materials***
- ***The Topic Training Materials*** are being developed by the IAEA with support from international experts.

SAET Curriculum



Comprehensive curriculum

- identifies training programme needed to develop safety assessment competency
- identifies clearly learning objectives for each module and topic of the training programme
- provides requirements in sufficient detail that training materials, exercises , etc. can be developed; and
- identifies prerequisites for the students for all elements of the training curriculum.

SAET Essential Knowledge Programme

- **Develops understanding and comprehension of:**
  - The structure of IAEA Safety Standards
  - The design safety and safety assessment requirements
  - Fundamentals of engineering aspects important to safety, deterministic and probabilistic safety analyses, and practical applications like review of the Safety Analysis Report (SAR)
  - The concept of integrated risk informed decision making
  - Deterministic and probabilistic safety analysis methodology through practical applications and technical exercises

The content of this programme is based on IAEA Safety Standards

SAET Practical Applications Programme

- The SAET Practical Application (PA) Programme is designed for development of analytical skills in deterministic and probabilistic safety analyses.
- The SAET PA Programme provides:
  - Training materials
  - Access to specific computer codes
  - Specialized courses per request
- It facilitates international collaboration through safety analysis exercises and information exchange.

SAET Syllabus Outline
(work in progress)

MAIN ELEMENTS			
I. Fundamentals of Safety Assessment*	**II. Assessment of Engineering Aspects Important to Safety***	**III. Deterministic Safety Assessment***	**IV. Probabilistic Safety Assessment***
Essential Safety Assessment Knowledge			
MODULES	**MODULES**	**MODULES**	**MODULES**
A – Introduction to Safety Assessment 1. Fundamental Safety Principles and overview of IAEA Safety Standards 2. Safety Requirements: Safety Assessment GSR Part 4 and Design Safety SSR-2/1 3. Basic Safety Concepts 4. Scope of Safety Assessment ***Note:*** ***For additional training in nuclear safety fundamentals, please refer to the IAEA Basic Professional Training Course on Nuclear Safety (BPTC) at:*** ***http://www-ns.iaea.org/training/ni/fund-bpc.asp?s=100&l=105***	***A – Overview of Engineering Aspects*** 1. Implementation of defence in depth 2. Operational experience 3. Radiation protection 4. Classification of structures systems and components 5. Equipment qualification 6. Aging and wear-out mechanisms 7. Human factors in NPP design and operation 8. Protection against internal fire and explosions 9. Protection against internal hazards other than fire and explosions 10. Protection against earthquakes 11. Protection against external events excluding earthquakes	***A – Overview of Deterministic Safety Assessment (DSA)*** 1. Deterministic Safety Assessment 2. Scope of Deterministic Analysis 3. Overview of DSA Applications 4. Licensing Analyses 5. Development of EOPs and SAMGs 6. Safety Analyses in Support of Periodic Safety Reviews 7. Shut-down and Low Power Analyses 8. Analyses in Support of Modifications and Life Extension	***A – Probabilistic Safety Assessment (PSA)*** 1. Basic Risk Concepts and Techniques 2. General Objectives and Scope of PSA 3. Overview of Level 1, 2, and 3 PSAs 4. Level-1 PSA organization, management and tasks outline 5. Level 2 PSA Process - Major Tasks & Interfaces and Project Arrangements 6. Role of PSA concepts in Risk Informed Regulations 7. Safety Assessment and Verification with Level 1 PSAs 8. Overview of PSA Applications and Regulatory Use of PSAs 9. Living PSAs and Risk Monitors

Example of a SAET Curriculum Module

I. Fundamentals of Safety Assessment

Module A: Introduction to Safety Assessment

Background and Scope: Fundamental Safety Principles require assessment of safety for all facilities and activities that potentially give rise to radiation risks. The module provides the background and basic knowledge of requirements, processes and methods used in safety analyses. IAEA Safety Standards pertaining to safety analyses are discussed and interpreted.

Learning Objective: To understand background of safety analysis and to obtain general knowledge necessary for performance of efficient, focused and adequate safety analyses or to gain knowledge basis for review of safety analyses. This includes understanding of safety concepts and safety criteria, and familiarization with the role, the scope and the processes of safety analyses To become familiar with IAEA Safety Standards, especially Fundamental Safety Principles and Requirements for Safety Assessment.

Courses of this module of the SAET Programme provide for introductory and preparatory knowledge necessary for regulatory and TSO personnel engaged in safety analysis performance or reviews.

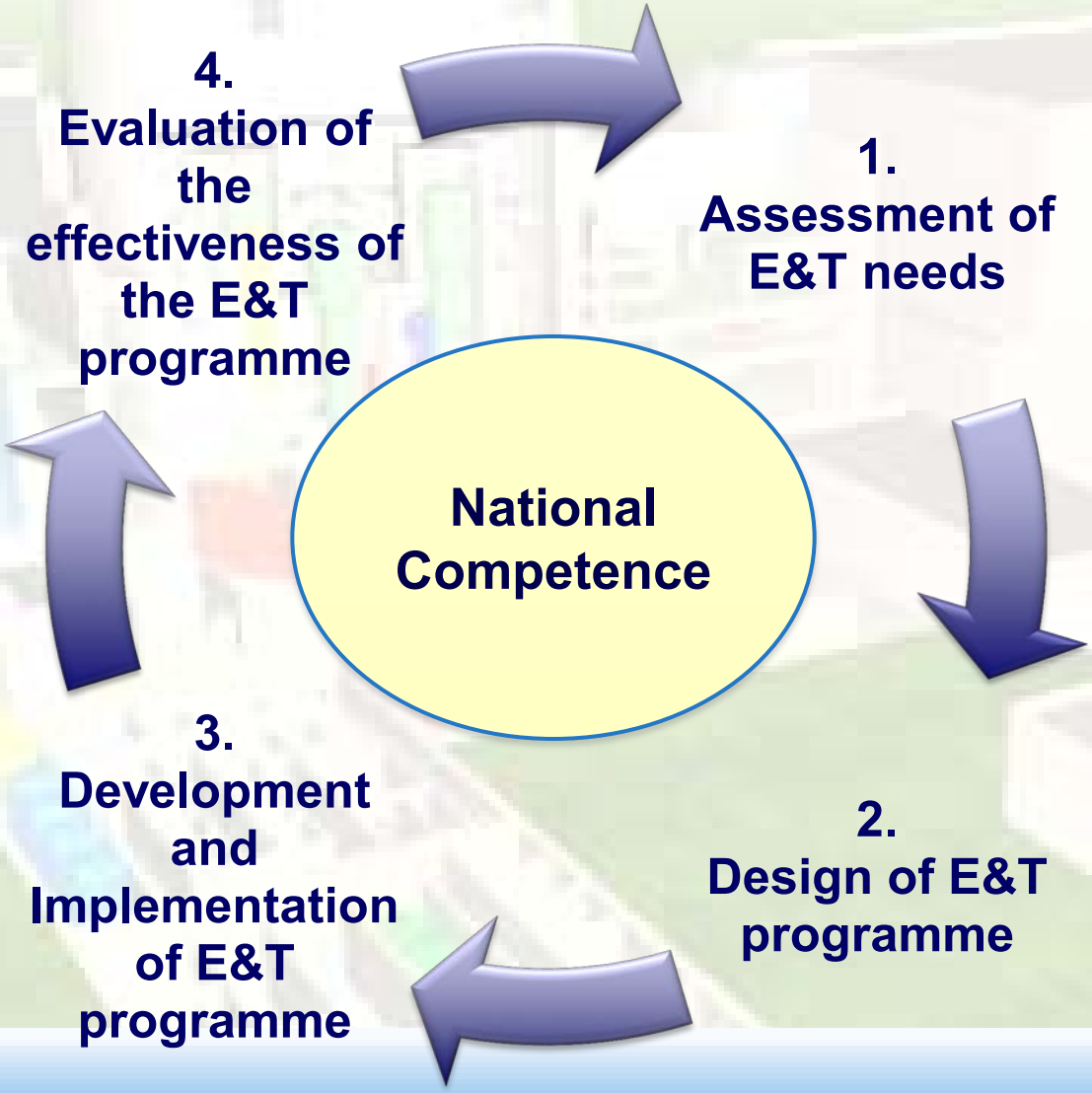
Applicable Principal Safety Standards: IAEA Safety Standards, Fundamental Safety Principles, Safety Fundamentals No. SF-1, International Atomic Energy Agency, Vienna 2006; IAEA Safety Standards Series, Safety of Nuclear Power Plants: Design, Requirements, No. NS-R-1, International Atomic Energy Agency, Vienna 2000; IAEA Safety Standards, Safety Assessment of Nuclear Facilities and Activities, Draft Requirements, DS348, International Atomic Energy Agency, Vienna 2007.

Content: This SAET Programme module consists of the following courses:

1. Fundamental Safety Principles and overview of IAEA Safety Standards
2. Safety Requirements: Safety Assessment GSR Part 4 and Design Safety SSR-2/1
3. Basic Safety Concepts
4. Scope of Safety Assessment

Requirements and Pre-requisites: Advanced nuclear or mechanical engineering degree.

Framework for building competences through education and training



The Safety Assessment Competency Evaluation Methodology

To assist Member States in evaluating their needs in the area of safety assessment a new methodology was developed in 2012 and is being piloted through the Peaceful Uses Initiative in 2013-14.

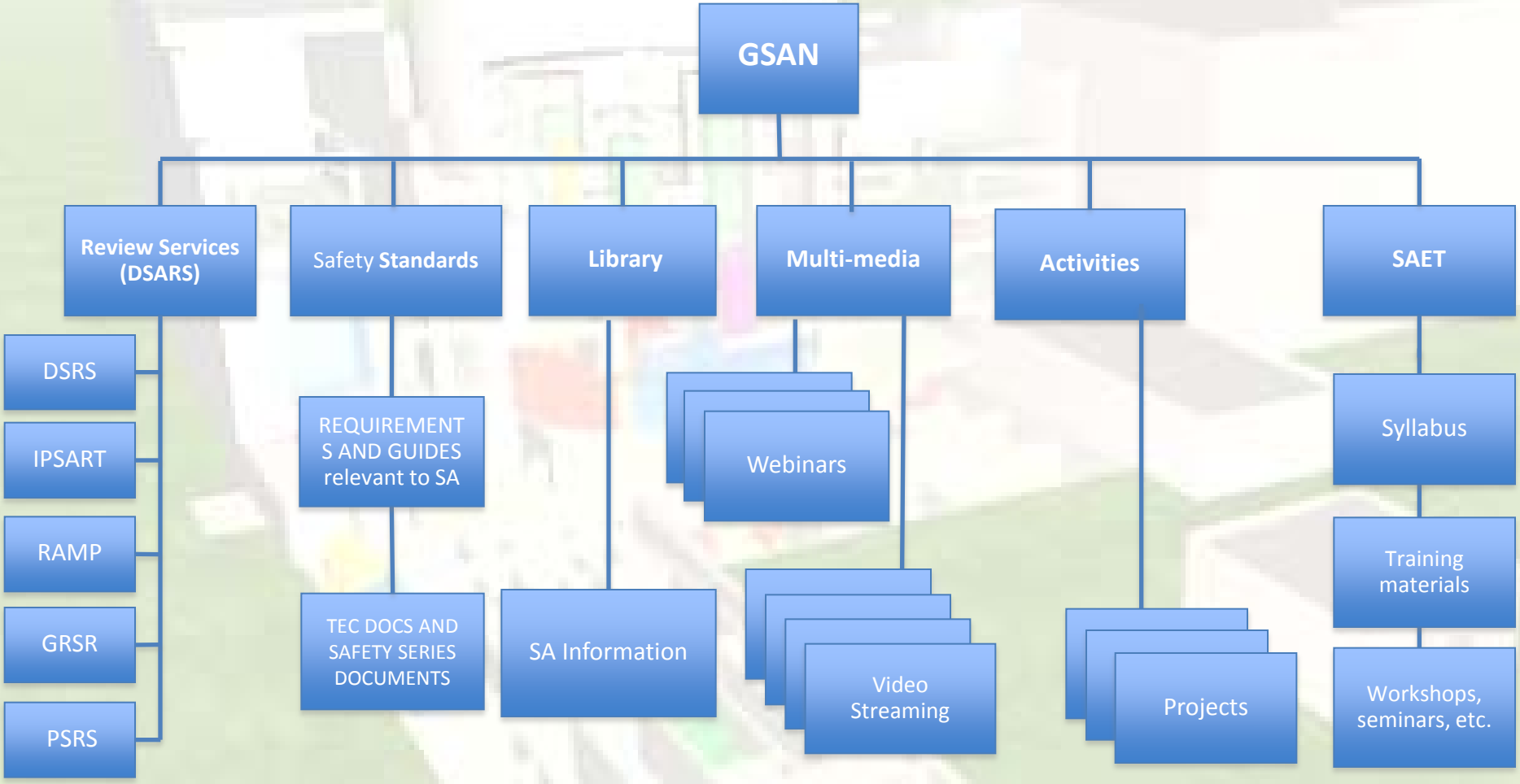
"Establishing the Competence Needs for Safety Assessment Within an Organization"

It is an integral part of the New DSARS Advisory for Newcomers: the Safety Assessment Advisory Programme (SAAP).

The Global Safety Assessment Network (GSAN)

A web-based platform for collaborative safety assessment project and training

Global Safety Assessment Network (GSAN) Structure



Progression of Education and Training for Embarking Countries following the SAET

1. Safety Assessment Advisory Programme

PHASE ONE

- **Introductory 5 day workshop with all NPP stakeholders including high level decision-makers, presenting requirements for safety assessment and assisting in preliminary needs assessment.**

PHASE TWO

- **More in-depth analysis of existing capacity and competence in the country at all levels using the Competency Evaluation Methodology**
- **Development of an E&T Programme based on the SAET Curriculum tailored to assessed and expressed needs in safety assessment training.**

2. Implementation of the SAET Programme

SELECTION OF STAKEHOLDER TRAINEES

- **Usually from regulator, prospective owner/operator/utility, research organization/prospective TSO, universities, etc.**

Progression of Education and Training for Embarking Countries following the SAET

2. Implementation of the SAET Programme (cont'd)

ORGANIZATION/COORDINATION OF WORKSHOPS

- Arrangements and scheduling with stakeholders
- Recruitment of team of senior safety assessment experts to ensure continuity of the programme (may include SAS staff members)

THEORETICAL AND PRACTICAL TRAINING

A. Essential Knowledge

- Initial Workshops on Fundamentals of Safety Assessment
- Progression of introduction to and fundamentals of Deterministic and Probabilistic Safety Assessment and essential principles and methods

B. Practical Applications

- Parallel introduction to practical skills development to increase understanding (often special trainee teams are selected with stakeholders for the two different methods)
  - DBA - RELAP5
  - Level 1 PSA - Risk Spectrum

Progression of Education and Training for Embarking Countries following the SAET

3. On-the-job training through Joint Projects

COLLABORATIVE APPROACH WITH STAKEHOLDERS

- Assistance in selection of appropriate analytical projects
- Guidance and advice on project conduct
- Evaluation of progress through joint steering committee
- Example: Conduct of Level 1 PSA of Malaysian Research Reactor

4. Mentoring and/or assistance with Fellowships

CONTINUED GUIDANCE AND ADVISORY FOR STAKEHOLDERS

- Assistance in selection of candidates for TC fellowship requests and liaison with TC on country fellowship needs in safety assessment
- Continued contact with stakeholders on safety assessment needs and conduct of projects and workshops

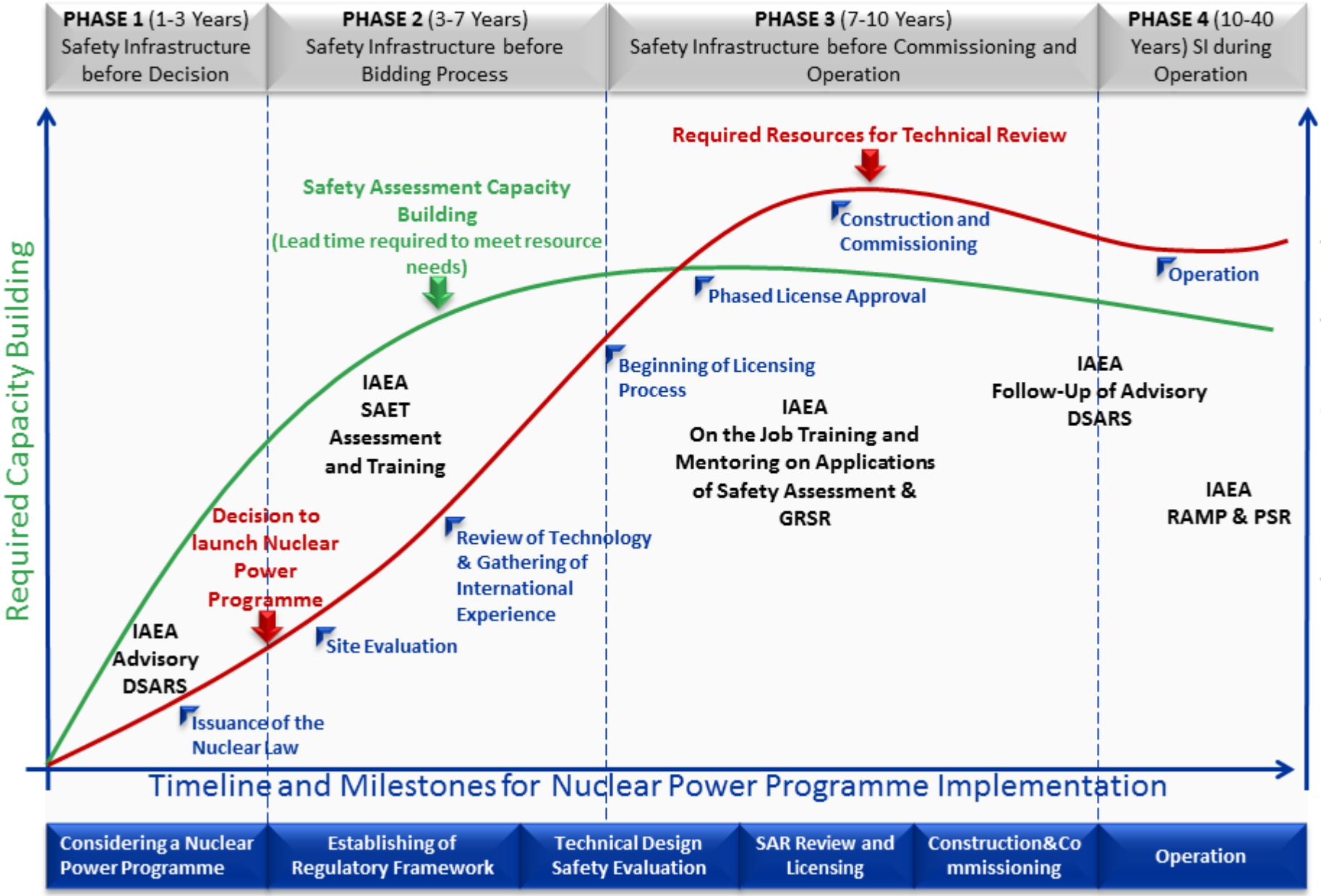
5. Evaluation, Planning and Sustainability

PLANNING NEXT STEPS WITH STAKEHOLDERS

- Provision of workshop materials and videos for continued training
- Access to GSAN
- Further evaluation and planning

Essential Safety Assessment Capacity building for Technical Review Requirements

For Regulatory Body (w. SSG-16 Phases)

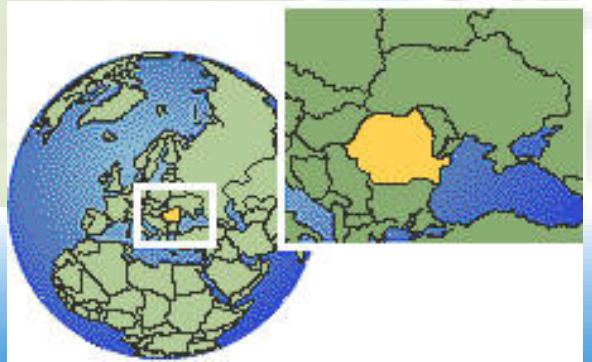


A HISTORY OF EDUCATION AND TRAINING ACTIVITIES:

Building Competences through Education and Training

II. The Norway Grants Programme for Romania and Bulgaria (Norwegian EBP funding) (completed) (2009-2011)

- A multi-topic programme containing projects in safety assessment as well as a variety of other areas (e.g. management systems, safety culture, emergency response)
- Further progress was made in delivering education and training through GSAN Support Activities
- Knowledge management for sustained training
- Needs of two different Member States addressed
- Results and methods included in IAEA Safety Assessment framework for all MS (Benefits back to IAEA)



A HISTORY OF EDUCATION AND TRAINING ACTIVITIES:

Building Competences through Education and Training

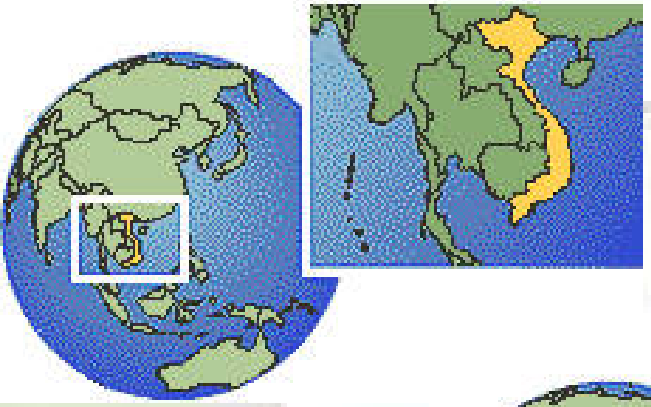
III. The Norwegian funded NOKEBP for Strengthening Nuclear Safety Assessment Competence (Norwegian EBP funding) – ongoing (2011-2016)

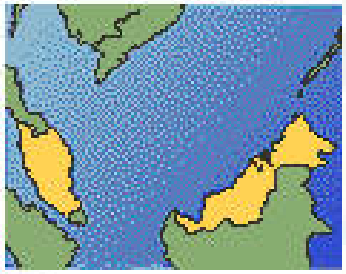
- **The aim of this Norwegian-funded pilot programme is:**
  - ✓ **to enhance independent, technically justified, safety decision making capacity at IAEA Member States launching nuclear energy programmes**
  - ✓ **to develop and implement safety assessment competency building features within the GSAN framework**

Benefits to Member States:

- Improved GSAN Knowledge Network for safety assessment information and capacity building
- Development of new SAET Modules
- Further progress in delivering education and training through GSAN Support Activities

COUNTRIES SELECTED FOR THE PILOT PROGRAMME





Two countries requiring a programme of development and representing different needs and stages of nuclear power programme development were selected.

Vietnam and Malaysia joined the Pilot Programme in 2010

A HISTORY OF EDUCATION AND TRAIING ACTIVITIES:

Building Competences through Education and Training

IV. EC Funded Programme for JNRC (Jordan) Introduction to Safety Assessment (2012-2016) – applying SAET

V. US GSAN – Practical Applications for Poland's Nuclear Research Institute (2011-2014)

VI. Peaceful Uses Initiative (PUI) – (SAAP Pilots 2013- 2014)

SUMMARY

- **The SAET Programme provides a systematic approach for training regulatory, operational and technical support staff in the skills needed for informed decision-making and technical review of NPP safety case documentation.**

- **The objective of the Programme is to support the IAEA Member States in developing the knowledge and skills necessary for making the right decisions in NPP design, licensing and operation.**

International Atomic Energy Agency

…Thank you