แบบ ICOP1

รายงานการไปราชการ ประชุม สัมมนา ศึกษา ฝึกอบรม ปฏิบัติการวิจัย ดูงาน ณ ต่างประเทศ และการปฏิบัติงานในองค์การระหว่างประเทศ

ส่วนที่๑ ข้อมูลทั่วไป

๑.๑ ชื่อ-สกุล.....นางสาวจารุณี ไกรแก้ว.....

๑.๒ ตำแหน่ง .....นักนิวเคลียร์เคมีชำนาญพิเศษ.....

๑.๓ สังกัด .....กองพัฒนาระบบและมาตรฐานกำกับดูแลความปลอดภัย.....

๑.๔ ชื่อเรื่อง/หลักสูตร

นำเสนอผลงานแบบบรรยาย *(ดังสำเนาบทคัดย่อ และบทความเรื่องเต็มแนบ)* เรื่อง "Management of Domestic Nuclear Information for NNFL Development" หรือ "การจัดการข้อมูลสารสนเทศนิวเคลียร์ภายในประเทศสำหรับการพัฒนาห้องสมุดการตรวจพิสูจน์เอกลักษณ์ทางนิวเคลียร์ (NNFL)" ในหัวข้อ "Safety and Security" หรือ "ความปลอดภัยและการรักษาความมั่นคงปลอดภัย" วันที่ 13 มีนาคม 2561

เพื่อ ☐ ศึกษา ☐ ฝึกอบรม ☐ ดูงาน
✓ ประชุม ☐ ปฏิบัติงานวิจัย ☐ ไปปฏิบัติงานในองค์การระหว่างประเทศ

แหล่งให้ทุน .....IAEA.....

สถานที่ (หน่วยงาน/ประเทศ) ...European Research Reactor Conference 2018..... ณ เมืองมิวนิค ประเทศเยอรมนี

ระหว่างวันที่ .....11-15 มีนาคม 2561.....

รวมระยะเวลาการรับทุน .....5 วัน.....

ส่วนที่ ๒ ข้อมูลที่ได้รับจากการศึกษา ฝึกอบรม ดูงาน ประชุม/สัมมนา ปฏิบัติการวิจัย และการไปปฏิบัติงาน ในองค์การระหว่างประเทศ (โปรดให้ข้อมูลในเชิงวิชาการ หากมีรายงานแยกต่างหาก)

๒.๑ วัตถุประสงค์

การแลกเปลี่ยนข้อมูลและประสบการณ์ในการทำงาน การดำเนินการ และการกำกับดูแลเครื่องปฏิกรณ์ปรมาณูวิจัย โดยเน้นการนำเสนอผลงานด้านการจัดการข้อมูลสารสนเทศนิวเคลียร์เพื่อการพัฒนาห้องสมุดการตรวจพิสูจน์เอกลักษณ์ทางนิวเคลียร์ เพื่อให้เป็นไปตามหลัก 3S คือ Safety Security และ Safeguards ตามหนึ่งในวัตถุประสงค์ของห้องปฏิบัติการการตรวจพิสูจน์เอกลักษณ์ทางนิวเคลียร์ ภายใต้โครงการ No.30 "Network of Excellence for Nuclear Forensics in South East Asia Region (2013-2014)" ซึ่งสนับสนุนโดย EU CBRN CoE

๒.๒ เนื้อหา (โดยย่อ)

การประชุม RRFM 2018 เป็นการประชุมวิชาการ ผู้เข้าร่วมประชุมร่วมนำเสนอผลงานทั้งภาคบรรยายและภาคโปสเตอร์ เริ่มประชุมวันที่ 11 มีนาคม 2561 และมีการบรรยาย นำเสนอผลงาน วันที่ 12-14 มีนาคม 2561 (*ดังสำเนาโปรแกรมและ powerpoint presentation แนบ*) และ เข้าร่วม Technical tour ทัศนศึกษาโรงไฟฟ้านิวเคลียร์ Isar วันที่ 15 มีนาคม 2561 (*ดังรายละเอียดแนบ*)

ประเด็นการประชุมเป็นการนำเสนอทั้งภาคบรรยายและโปสเตอร์ในหัวข้อต่อไปนี้

- วัฏจักรเชื้อเพลิงนิวเคลียร์ของเครื่องปฏิกรณ์ปรมาณูวิจัยตั้งแต่ front-end ถึง back-end
- เครื่องปฏิกรณ์วิจัยความดันต่ำ
- การใช้ประโยชน์เครื่องปฏิกรณ์ปรมาณูวิจัย
- กระบวนการนวัตกรรมในฟิสิกส์เครื่องปฏิกรณ์และเทอร์โมไฮโดรลิคส์
- โครงการใหม่ของเครื่องปฏิกรณ์ปรมาณูวิจัย
- การเดินเครื่อง การบำรุงรักษา และการจัดการยืดอายุการทำงาน
- การจัดการความปลอดภัยเครื่องปฏิกรณ์ปรมาณู
- การรักษาความมั่นคงปลอดภัยเครื่องปฏิกรณ์ปรมาณู
- การยกเลิกการดำเนินงาน การรื้อถอน เครื่องปฏิกรณ์ปรมาณูวิจัย และการจัดการกากกัมมันตรังสี

หัวข้อการประชุมที่เข้าฟัง (12-14 มีนาคม, 2561)

1. การบรรยายพิเศษ
2. การแข่งขันโปสเตอร์ของนักศึกษา
3. Innovative Methods I
4. Utilisation I
5. Research reactor fuel cycle III, IV
6. Safety and Security *(หมายเหตุ ได้นำเสนอผลงานแบบบรรยายใน Session นี้)*
7. Research reactor operation & maintenance and ageing management
8. Research reactor Safety
9. New Projects
10. New Project II

วันพฤหัสบดีที่ 15 มีนาคม 2561: *เยี่ยมชมโรงไฟฟ้านิวเคลียร์ Isar ทั้งวัน*

แนวทางการนำมาใช้ประโยชน์ต่อการดำเนินงานของตนเองและ ปส.

1) ใช้ในการพัฒนาการจัดการองค์ความรู้ทางนิวเคลียร์ในรูปฐานข้อมูลการตรวจพิสูจน์เอกลักษณ์ทางนิวเคลียร์ ซึ่งสนับสนุนงานห้องสมุดการตรวจพิสูจน์เอกลักษณ์ทางนิวเคลียร์อันเป็นหนึ่งในงานของ กพม. ตามแผนงานห้องปฏิบัติการการตรวจพิสูจน์เอกลักษณ์ทางนิวเคลียร์
2) ได้เรียนรู้ระบบความปลอดภัยและการรักษาความมั่นคงปลอดภัยจากสถานปฏิบัติการโรงไฟฟ้านิวเคลียร์ที่เข้าเยี่ยมชม รวมทั้งได้เรียนรู้การทำงานระบบต่างๆ ในโรงไฟฟ้านิวเคลียร์และการผลิตไฟฟ้า ซึ่งเสริมสร้างความรู้ความเข้าใจในการทำงานของสถานปฏิบัติการทางนิวเคลียร์ อันเกี่ยวเนื่องกับการจัดการองค์ความรู้ทางนิวเคลียร์ดังกล่าว
3) ผลงานบรรยายตีพิมพ์ใน Proceedings RRFM 2018 เป็นตัวชี้วัดที่ 8 จำนวนงานวิจัยที่ได้รับการดำเนินการตามแผนของ กพม. ปส.

๒.๓ ประโยชน์ที่ได้รับต่อตนเอง

✓ ต่อตนเอง .....ได้เรียนรู้เพิ่มเติมเกี่ยวกับเทคโนโลยีในการดำเนินการและการกำกับดูแลเครื่องปฏิกรณ์ปรมาณู จากผลงานของผู้เข้าร่วมประชุมอื่นๆ ทั้งภาคบรรยายและโปสเตอร์

✓ ต่อหน่วยงาน .....สอดคล้องกับงานในความรับผิดชอบและภารกิจของหน่วยงานตามแบบบันทึกข้อตกลงการปฏิบัติราชการของผู้รับทุน รอบที่ 1 (วันที่ 1 ตุลาคม 2560 ถึง วันที่ 30 มีนาคม 2561)

ส่วนที่ ๓ ปัญหา / อุปสรรค

ค่าลงทะเบียนได้รับการลดหย่อนเนื่องจากได้รับการสนับสนุนค่าใช้จ่ายจาก IAEA โรงแรมที่พักอยู่ในที่เดียวกันกับสถานที่ประชุม ซึ่งอยู่ในสิ่งแวดล้อมดี อยู่ในย่านที่พักอาศัย และศูนย์การค้า สามารถเลือกซื้ออาหารได้แตกต่างกันหลายประเทศ เจ้าหน้าที่ผู้เกี่ยวข้องในการจัดการประชุมได้อำนวยความสะดวกและช่วยเหลือเป็นอย่างดี ระหว่างการเข้าร่วมประชุม 11-15 มีนาคม 2561

อากาศเย็นอุณหภูมิต่ำประมาณ 0-10°C ฝนตกบางครั้ง ได้เป็นไข้เล็กน้อย แต่ไม่เป็นอุปสรรคในการเข้าร่วมประชุมและการเข้าร่วม Technical tour ยังโรงไฟฟ้านิวเคลียร์

ส่วนที่ ๔ ข้อคิดเห็นและข้อเสนอแนะ

คาดว่าจะนำความรู้และประสบการณ์ที่ได้รับ ประยุกต์ใช้ในงานการจัดทำฐานข้อมูลการตรวจพิสูจน์เอกลักษณ์ทางนิวเคลียร์ ในเนื้อหาที่เกี่ยวข้องกับวัฏจักรเชื้อเพลิงนิวเคลียร์

(ลงชื่อ).....

(นางสาวจารุณี ไกรแก้ว)

นักนิวเคลียร์เคมี ชพ.

วันที่ 21 มีนาคม 2561

21 มี.ค. 61

ส่วนที่ ๕ ความคิดเห็นของผู้บังคับบัญชา

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.....

(ลงชื่อ).....

(.....)

ตำแหน่ง.....

วันที่.....

แบบ ICOP2

แผนงานการนำความรู้จากการประชุม/อบรม ไปใช้ประโยชน์

โดย ....นางสาวจารุณี ไกรแก้ว นักนิวเคลียร์เคมี ชพ.

หน่วยงาน ...กองพัฒนาระบบและมาตรฐานกำกับดูแลความปลอดภัย

ชื่อเรื่อง/หลักสูตร

(ภาษาไทย) .....ความปลอดภัยและความมั่นคงปลอดภัยเครื่องปฏิกรณ์ปรมาณูวิจัย.....

(ภาษาอังกฤษ).....Research Reactor Safety and Security.....

สถานที่ (หน่วยงาน/ประเทศ)....European Research Reactor Conference 2018 ณ เมืองมิวนิค ประเทศเยอรมนี

องค์ความรู้ที่นำมาใช้ (นำเสนอผลงาน"Management of Domestic Nuclear Information for NNFL Development")

๑. หลักการตรวจพิสูจน์เอกลักษณ์ทางนิวเคลียร์โดยทั่วไป ในการตรวจพิสูจน์อุบัติเหตุและอุบัติการณ์ทางรังสี

๒. การจัดการคลังข้อมูลโดยเกี่ยวเนื่องกับระบบฐานข้อมูลใบอนุญาตวัสดุนิวเคลียร์และวัสดุกัมมันตรังสีของ สนง.ฯ

๓. การจัดวางระบบโครงสร้างและการออกแบบฐานข้อมูลการตรวจพิสูจน์เอกลักษณ์ทางนิวเคลียร์ตามหลักการ NNFL ของ IAEA

๔. การจัดการข้อมูลด้วยโปรแกรม Microsoft Access 2010 และ Microsoft Word 2010

แผนการใช้ประโยชน์

หัวข้อการนำความรู้ไปใช้	หน่วยงานที่เกี่ยวข้อง	งบประมาณที่คาดว่าจะใช้	ระยะเวลาดำเนินงาน	ผลลัพธ์/ผลสำเร็จของงาน
1. งานสนับสนุนทางเทคนิคด้านคลังข้อมูลของการตรวจพิสูจน์เอกลักษณ์ทางนิวเคลียร์	กพพ./กพม.	สามารถดำเนินการได้ภายในงบประมาณของหน่วยงานฯ เนื่องจากงานส่วนใหญ่เป็นงานด้านเอกสาร และการใช้โปรแกรมคอมพิวเตอร์	มีนาคม 2561-กันยายน 2561	1. อยู่ในรูปเอกสาร รายงาน แฟ้มงาน อิเลคทรอนิคส์ และฐานข้อมูล 2. สนับสนุนการดำเนินงานของ กพพ. ตามยุทธศาสตร์ที่ 1 ของ ปส. คือ การพัฒนาความพร้อมด้านการกำกับดูแลความปลอดภัยจากการใช้พลังงานนิวเคลียร์และรังสี และเป็นไปตามภารกิจ กพม. ตามกฎกระทรวงแบ่งส่วนราชการ สนง. ปส. พ.ศ.2561 ข้อ ค) ดำเนินการตรวจพิสูจน์เอกลักษณ์ทางนิวเคลียร์
2. การจัดการข้อมูลสารสนเทศนิวเคลียร์โดยใช้โปรแกรม Microsoft ซึ่งเป็นโปรแกรมที่ใช้กันอย่างแพร่หลายในปัจจุบัน				

ลงชื่อ.....

(.นางสาวจารุณี ไกรแก้ว)

นักนิวเคลียร์เคมี ชพ.

วันที่ 21 มีนาคม 2561

ลงชื่อ.....

(นายธงชัย สุดประเสริฐ.)

ผกพม.

ผู้บังคับบัญชา

วันที่ 22 มี.ค. 61

Management of Domestic Nuclear Information for NNFL Development

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ABSTRACT

The National Nuclear Forensics Laboratory of Thailand was established in 2013 by Office of Atoms for Peace (OAP) under the Project No.30, "Network of Excellence for Nuclear Forensics in South East Asia Region (2013-2014)", supported by EU CBRN CoE. It is expected to develop The National Nuclear Forensics Library (NNFL) and increase the capability of the nation to overcome illicit trafficking of domestic radioactive and nuclear materials.

The nuclear materials in only location outside facilities (LOF), from total 93 facilities, were created as database in 2016. It was input as one of the information in the present developing Nuclear Forensics Database prototype. The nuclear knowledge which are planned to include, are legislative work, IAEA documents, ISO details, Nuclear Forensics analytical reports, inspection reports, and other useful/concerning information. The templates of each nuclear material/radioactive material are in on-going modification following the structures and formats available for NNFL, related to IAEA concepts and requirements.

The success of this nuclear knowledge management (NKM) will reduce the time wasting for nuclear forensics assessments whether the sized material is or is not consistent with the given process or activity. The concerning illicit activities can also be deterred. These attempts will assist the National Nuclear and Radiological Emergency Plan, as well as the country nuclear security and physical protection, related to SG/NPT, for the peaceful use of atomic energy.

1. Introduction

1.1 Background [1, 2, 3, 4]

The State Policies and the roles of Office of Atoms for Peace (OAP) were declared currently in 2016 Nuclear Security Summit in Washington D.C., USA. Thailand Prime Minister issued national statement in the topic, "National Actions to Enhance Nuclear Security". His Excellency confirmed that it was a fundamental responsibility of the states to maintain effective security of nuclear and other radioactive materials as well as nuclear facilities under their control, including military ones. It was a priority to ensure nuclear security in all types of public and private facilities, where nuclear and radioactive materials are used, i.e. hospitals, factories, research laboratories, and nuclear waste disposal facilities.

For ASEAN, Thailand initiated the setting up of the ASEAN Network of Regulatory Bodies on Atomic Energy, or ASEANTOM, which was welcomed by the ASEAN Leaders in 2011 and has been functioning since 2012. It is a collaborative network of nuclear regulatory bodies and relevant agencies to share information, experiences, and best practices, as well as to discuss issues relevant to nuclear safety, security and safeguard. It is a confidence building measure within the region.

Since the 2014 Nuclear Security Summit, Thailand has strengthened nuclear security implementation and built up the global nuclear security architecture by strengthening Nuclear and Other Radioactive Material Security. OAP, as the national coordinating agency for all nuclear-related matters, takes part in two projects.

- The Project on Border Monitoring Activities in Thailand, which OAP has activities together with the European Commission Joint Research Centre (EC JRC), in collaboration with IAEA and the United States Department of Energy and National Nuclear Security Administration. The Project is aimed at strengthening national capability in countering illicit trafficking of nuclear and other radioactive materials, through capacity building of personnel and provision of equipment to the Thai authorities concerned, including Customs Department, Port Authority of Thailand, Airport Authority of Thailand, Thailand Post, Royal Thai Police, and Bureau of Immigration.

- OAP, together with Thailand Institute of Nuclear Technology (TINT), have also continued its collaboration efforts with EU CBRN projects, including the integrated national security system for nuclear and radioactive materials, Network of Excellence for Nuclear Forensics in Southeast Asia, and a course on Regional Human Resource Development for Nuclear Safety, Security and Safeguards Management under Chulalongkorn University's Masters Programme on nuclear non-proliferation.

All missions and activities are performed following 2nd strategy from "National Nuclear Energy Policies and Strategies, B.E. 2560-2569" and 5th strategy of "12nd National Economic and Social Development Plan". The national security is planned to develop related to international standards for sustainability related to OAP roadmaps to be the center of Regional Nuclear Safety Regulation. The effective nuclear and radiation systems are in ongoing development process for implementation of national security.

1.2 Objectives and Scopes [5, 6, 7, 8, 9]

a) Cataloguing characteristics and signatures of all nuclear and radioactive material holdings under regulatory control to provide their importance data, i.e. chemical and elemental compositions, isotopic ratio, together with associated traditional evidence for information of material origin and history.
b) Developing the prototype database of the National Nuclear Forensics Library (NNFL) in Thai-English, based on data related to nuclear materials and other radioactive materials, which are in OAP licensing systems, as well as the information access capability.
c) Management of nuclear knowledge information for defining the specific data that needs to be acquired for NNFL except information of nuclear and radioactive materials holdings, such as IAEA information, ISO, Nuclear Forensics Laboratory analytical reports, inspection reports, etc.
d) Transferring the technology and methodology developed to the responsible authorities after the establishment of the national framework of nuclear forensics in Thailand.

1.3 Legislative work and IAEA Roles

a) Domestic laws and enforcement [10, 11, 12, 13, 14, 15, 16, 17]

Before the national framework of nuclear forensics is established, it is necessary to have complete national security approach for the effective nuclear and radiation regulatory. One of the importance criteria is the legislation concerning for enforcement. It takes time for the whole processes to create these requirements and issue as the law, for example;

- Establish radiological crime scene control
- Implement nuclear forensics evidence collection plan and initiate chain of custody
- Collection, packaging, transit of evidence to the nuclear forensics laboratory

Some objectives of these requirements are: 1) Hazards risk assessment; 2) Reduce radiation hazards; 3) nuclear and radiological control; and 4) Preserve items of evidentiary value.

However, at present, there are some related legislative work applied for the regulatory of nuclear material and radioactive material.

Last year, 2016, the nuclear Energy Act, B.E. 2559(2016), in Thai, was issued on August 5, 2016, in Government gazette. There are the rule, regulation and requirements concerning nuclear materials, and radioactive materials, in Chapter IV (section 36-40) and Chapter III (Section 18-24), respectively.

For nuclear fuel, some requirements and regulation are described in Chapter V Nuclear Facility, Part 4 Commissioning and Operation, Section 63, as well as Chapter VII Spent Nuclear Fuel Section 87. Some requirement for Research Reactor Safety Analysis Report are storage and management of nuclear fuel, as in Regulation of the Atomic Energy Commission for Peace, "Research Reactor Safety Analysis Report", B.E. 2555.

More details and requirements of nuclear materials and radioactive materials (sealed source and unsealed source) can be obtained from other rules and regulations as Reference no. 13-17.

b) International instruments and IAEA [18, 19]

Thailand was the member of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) from December 7, 1972. Thailand signed and ratified Safeguards Agreement (SG) with International Atomic Energy Agency (IAEA) on May 16, 1974. Office of Atoms for Peace (OAP), as the national regulator, was the responsible group to co-operate with IAEA nuclear safeguards inspectors for annual nuclear materials inspection under SG. The main nuclear material (NM) is the spent fuel of 2 MW TINT nuclear research reactor and the others are some nuclear materials in a small amount of some locations outside facility (LOF).

From the Convention of the Physical Protection of Nuclear Material (CPPNM), states are required to protect NM on their territories and during international transport. However, States are not to undertake transport/transits unless NM is protected at the appropriate levels. However, Penalties are required under national law. At present, this CPPNM is ongoing process for cabinet approval to be concluded in national nuclear security plan.

As one of the United Nations members, Thailand has to follow "The resolution of United Nations Security Council 1540 (Non-Proliferation of Weapons of Mass Destruction)". It is necessary to set up the nuclear material regulatory system to control the manufacturing of nuclear, chemical, and biological weapons of mass destruction, as well as control of international transit and shipment.

From action plan for participating States in support of IAEA, in Nuclear Security Summit 2016, IAEA central roles are: 1) strengthening the international nuclear security architecture and 2) the leader in developing international nuclear security guidance. For nuclear forensics, IAEA assists the sustainability of the States' nuclear forensics capabilities, including through building upon the expertise of the Nuclear Forensics International Technical Working Group, i.e.

- Developing guidance documents
- Promoting international nuclear forensics cooperation
- Sharing experiences and knowledge, and
- Supporting the development of national nuclear material databases or national nuclear forensics libraries (NNFL).

2. OAP Experience on Radioactive and Nuclear Material Database

2.1 Conventional radioactive and nuclear material database [18, 20, 21]

At present, there are more than 1,000 radiation facilities where the radioactive materials are possessed and utilized. The domestic nuclear and radioactive material information, i.e. licensing, facility locations, quality/quantity, irradiation status, and etc., were collected and created as the database in OAP licensing systems. Their conventional database system is illustrated briefly in Figure 1.

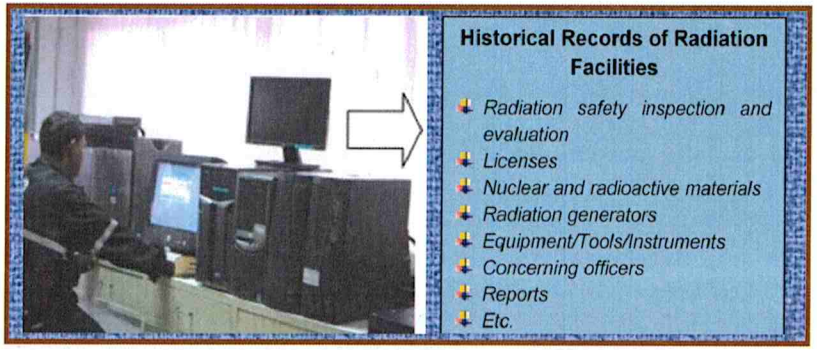

Fig 1 OAP Inspector at work with Radiation Safety and Security Evaluation

2.2 Microsoft Access 2010-LOF database developed in 2016 [18]

- In Thai fiscal year 2016, the author worked with nuclear material information management for accomplishment of domestic nuclear material database. The alternative Domestic NM database was created via Microsoft Access 2010 in Thai-English, as the following details.
  - The domestic nuclear materials information (i.e., licensing, facility locations, quality/quantity, irradiation status, and etc.) were selected and extracted from radioactive materials/sources/equipment database of Bureau of Radiation Safety Regulation (BRSR).
  - All information were identified, added more details/reports, etc. They were created and compiled in several Tables in the same file of Microsoft Access 2010.
  - Have a database available for the next fiscal years based on the starting fiscal year 2016 (2559 B.E.).
  - Have the options for the attachments of OAP inspection reports and some domestic/international legislative/technical information concerning LOF.
  - Can demonstrate and print out via Access 2010 in tables, reports, forms, and EXCEL 2010 spreadsheet.

3. Development of National Nuclear Forensics Library (NNFL) in Thailand

3.1 Nuclear Forensics Implementation [22, 23, 24, 25]

The National Nuclear Forensics Laboratory (Figure 2) was established in 2013 at OAP to enhance the national capability for combating illicit trafficking of nuclear and radioactive materials in Thailand. It was under the project no.30 of the CoE initiative entitled "Network of Excellence for Nuclear Forensics in South East Asia Region" and Thai Government budget.

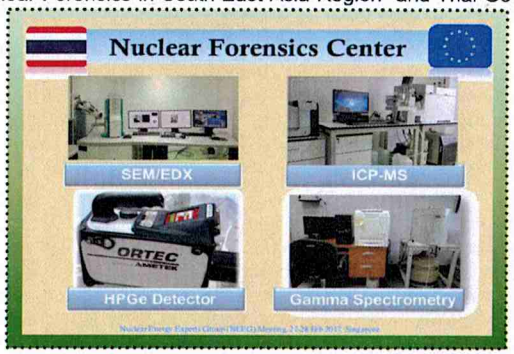

Fig 2 The Nuclear Forensics Laboratory at OAP

Nuclear forensics, as a key element of nuclear security, supports the investigations for criminal or unauthorized acts involving nuclear or radioactive materials. South East Asia is a region where the large amounts of good are transited but there are only few nuclear activities. To prevent illicit smuggling activities out of regulatory control, nuclear forensics should be applied to assist the States by providing information of immediate relevance to investigating authorizes.

The research and development of this laboratory is focused on signature analysis techniques to identify the production history and origin of these materials. The National Nuclear Forensics Library (NNFL) was also in their mission plan to establish, as well as its nuclear forensics database. Furthermore, the regional activities under ASEANTOM i.e. training courses/workshops by IAEA, EU, and US DOE, are helpful for higher competency of the specialists both in OAP and other concerning authorizations. Last year, December 20-23, 2017, there was a meeting on "Development of regulatory systems and standards for the competent authorizes", at Chiangmai, Thailand. One of the topics was "Global Initiative to Counter Nuclear Terrorism, Part I: Enhanced Nuclear Forensics Capabilities".

3.2 NNFL General Concepts [10, 26, 27, 28, 29]

Nuclear forensic science, referred to as "nuclear forensics", is a subset of forensic science. It is the examination of nuclear or other radioactive materials, or of evidence contaminated with radionuclides, for legal proceedings under international or national law related to nuclear security, as illustrated in Figure 3.

Nuclear forensics deals with the crimes involving nuclear or other radioactive materials. When these materials are seized, they will be sent to nuclear forensics laboratory for material characterization, i.e. chemical composition, physical characteristics, and isotope abundance. The nature and origin of the seized material, as well as any intent to use it, are identified. The preferred methodology is to compare the obtained results with those existing in nuclear forensics database, which is supposed to include in national nuclear forensics library (NNFL).

The NNFL gathers all information (measured or modeled) of nuclear and other radioactive material produced, used, stored, or transported within a nation. As a result, in the event of an actual investigation, materials data obtained with evidence is easily and quickly compared, traced, associated or even identified among materials data already cataloged. Each nation must decide what information is necessary to identify material consistent with those produced, used or transported within their borders.

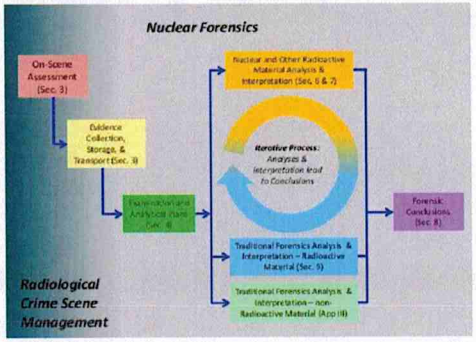

Fig 3 Model Action Plan in support of investigation of nuclear security event

Advantages of NNFL

- Critical for timely and informed nuclear forensics conclusions
- Assessing material history and possible origin for acceleration of material identification process

- Deter illicit activities involving nuclear material to enhance nuclear security
- Protects proprietary and national security information
- Builds international confidence

4. Methodology [6, 30, 31, 32]

4.1 NNFL Database structure and design

The database is a central and key component of any NNFL and provides a centralized structure for storing data and information that characterize nuclear and radioactive material holdings within a state. Because of less developed fuel cycles and small amount of materials in Thailand, a "flat file" database using a single table for data is useful and available. The relation between NNFL and the procedure, from nuclear security event though laboratory analysis, is shown simply as the example of Rokkasho (ROK) schemes in Figure 4, where the database is one part in NNFL.

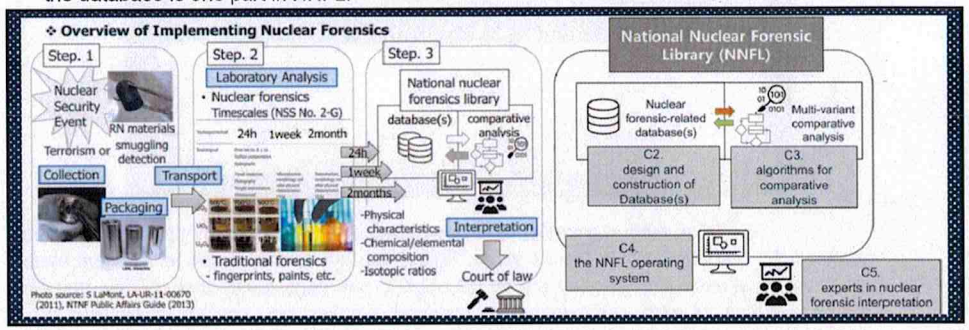

Fig 4 Implementing of nuclear forensics for nuclear security event investigation

To develop NNFL, the Nuclear Forensics Database prototype is planned to setup following these procedures.

- Data collection relating to OAP conventional radioactive and nuclear material database of licensing systems
- Storage functions using Microsoft Access 2010 software
- Proposed models for searching/comparative analysis, identification and reporting

The information on nuclear and other radioactive material in a NNFL is organized according to nuclear fuel cycle stages and types of radioactive sources, as an IAEA notional structure of NNFL in Figure 5. It consists of a material master index, domain expertise, and data and information summary in the library.

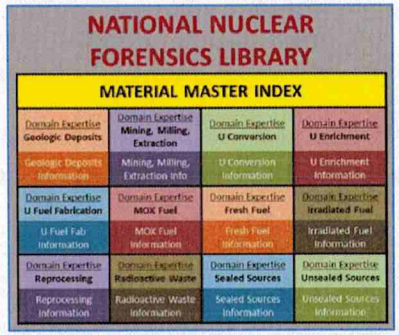

Fig 5 Notional structure of a national nuclear forensics library

The database software applied is Microsoft Access 2010 and Microsoft Word 2010, which are easier to use and are the popular programs for data/information management and processing. The architecture was designed as two main databases;

·) Additional nuclear forensics information (Figure 6), i.e. concerning articles, IAEA documents, ISO, legislative work, NM database 2559-2560 (2016-2017), nuclear forensics analytical summary report and templates

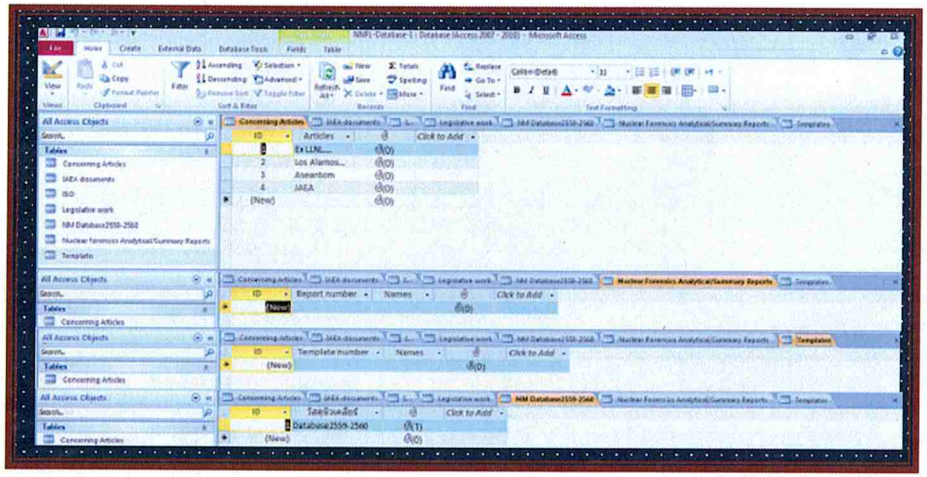

Fig 6 Database # 1: Additional nuclear forensics information

2) Nuclear and other radioactive materials related to OAP licensing systems (Figure 7) following an IAEA notional structure of NNFL (Figure 5). Because of only one nuclear facility in Thailand, the domain expertise, fresh and spent/irradiated nuclear fuel, can be recorded together as nuclear fuel element. The main rest are sealed and unsealed sources, which are ether nuclear or radioactive materials. The Access 2010-Information Form examples of "Nuclear fuel element" and "Sealed source" are illustrated as Figure 8.

There is no Uranium manufacturing plant in Thailand but there are some work concerning in geology. The radioactive waste management is in responsibility of Thailand Institute of Technology (Public Organization) or TINT. Most of their wastes come from radiation facilities, i.e. hospitals, factories, research laboratories, and etc.

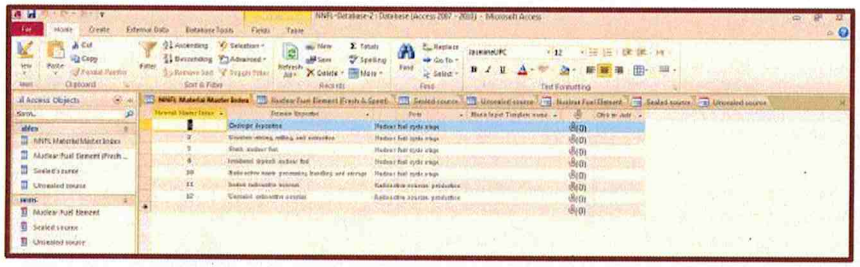

Fig 7 Database # 2: Nuclear and other radioactive materials information

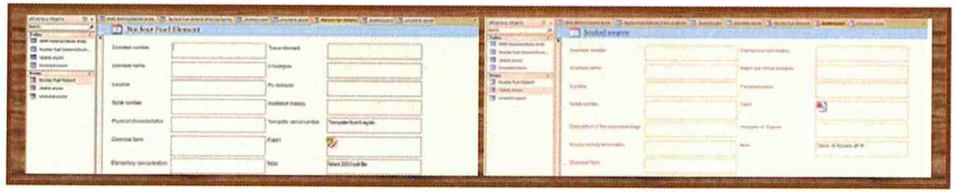

Fig 8 Examples of Access Form 2010 for "Nuclear fuel element" and "Sealed source"

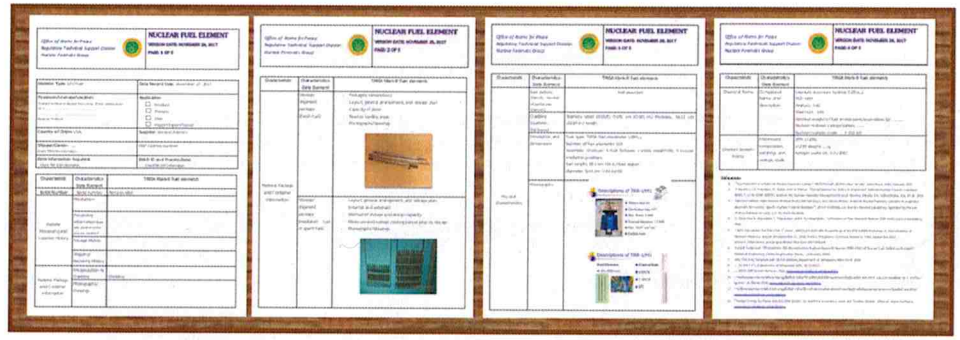

Fig 9 Example of Nuclear Fuel Element Detailed Template

The example of "Nuclear Fuel Element" template is presented as Figure 9. This template is created via Microsoft Word 2010 and is attached as the detail in Database # 2. Because there are a lot of sealed sources in one facility, in the same licensee number, the detail of each is collected together as another attached Access 2010 file (Figure 10).

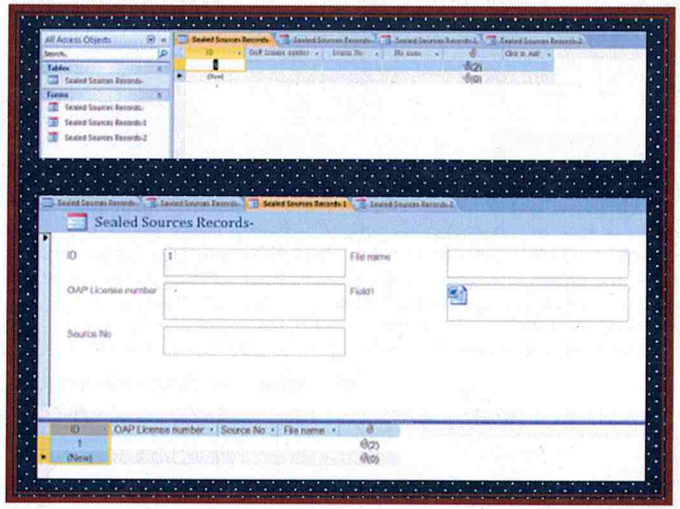

Fig 10 Example of Sealed source records database

This prototype database of NNFL was created from last May 2017 based on data/information related to nuclear materials and radioactive materials of OAP conventional licensing systems. Their architectures were developed as templates and Microsoft Access 2010 databases, which catalogues characteristics and signatures of all nuclear and radioactive materials holdings under regulatory control.

There is more work to continue for implementing nuclear forensics building capacities, i.e. data/information collection, access capability, and data interpretation and analysis, as the example of ROK NNFL-model in Figure 4. To support radiological crime scene control, some options are required, such as searching/comparative analysis, identification and reporting, for data interpretation and analysis following design and construction of databases.

5. Conclusions

The nuclear forensics science supports the investigations for criminal or unauthorized acts related to nuclear or radioactive materials to enhance the national nuclear security. There are some research and development in OAP nuclear forensics laboratory for signatures analysis to identify the production history and origin of these materials, following the ASEANTOM objective, the establishing NNFL and nuclear forensics database to increase the capability of the nation to overcome illicit trafficking of domestic nuclear and radioactive materials. It is also in the action plan of the national nuclear forensics laboratory of Thailand, which is assisted by EU CBRN CoE, under the project No. 30, "Network of Excellence for Nuclear Forensics in South East Asia Region (2013-2014)".

To complete NNFL, there is another work to support their establishment functions, for example, the legislative work for the cooperation and integration between the responsible competent authorities. This article illustrates the starting milestone of the NNFL development via alternative prototype database. It takes time to develop technology and methodology to transfer to the responsible competent authorities in the future for the success of national actions to enhance nuclear security. All planned work is aimed to strengthen nuclear security missions for confidence building of the nation, as well as for ASEAN region.

6. Acknowledgement

The author would like to thank for all sources of technical information, mostly obtained via internet search. Thanks for the cooperation from the concerned personnel of Office of Atoms for Peace for processing the author's IAEA travel grant application. The financial assistance from IAEA, for the author to participate and have oral presentation in RRFM 2018, is also appreciated.

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RRFM2018-A0128	Research Reactor Spent Fuel Treatment Processes and Licensing	Morlaes, I. (1); Valery, J.-F. (1); Talbi, A. (1); Vo Van, V. (1); Stachetti, L. (2) 1 - Orano, France 2 - Orano TN, France
RRFM2018-A0061	NEW DUAL-PURPOSE CASK CASTOR® MTR 3 FOR DISPOSAL OF SPENT FUEL FROM RESEARCH REACTORS	Synder, L. (1); Heß, C. (1); Graf, J. M. (1) 1 - GNS Gesellschaft für Nuklear Services mbH, Germany

Tu 13.50 – 15.50 Parallel Session: Safety and Security

Chair: J. Estrade, Institut Laue Langevin, France

RRFM2018-A0065	Kurchatov Institute's Critical Assemblies	Gagarinskiy, A. (1) 1 - Nastional Research Centre Kurchatov Institute, Russian Federation
RRFM2018-A0038	Management of Domestic Nuclear Information for NNFL Development	Kraikaew, J. (1); Changkrueng, K. (1); Srijittawa, L. (1); Phaukkachane, P. (1); Thong-in, S. (1); Mungpayaban, H. (1) 1 - Regulatory Technical Support Division, Office of Atoms for Peace, Thailand
RRFM2018-A0109	OVERVIEW OF THE IAEA COORDINATION RESEARCH PROJECT ON NUCLEAR SECURITY FOR RESEARCH REACTORS AND ASSOCIATED FACILITIES	Shull, D. (1) 1 - International Atomic Energy Agency, Austria
RRFM2018-A0153	IMPLEMENTATION OF FUNCTION RESTORATION GUIDELINES AT THE HFR IN PETTEN	Slootman, M. (1); Van Zanten, T. (1) 1 - NRG, Netherlands
RRFM2018-A0040	Graded Approach to Safety Regulation of Russian Nuclear Research Facilities: Present and Future	Sapozhnikov, A. (1) 1 - Federal Environmental, Industrial and Nuclear Supervision Service of Russia, Russian Federation
RRFM2018-A0042	VALIDATION OF THE HOR OSCAR4/MCNP MODEL FOR USE IN SAFTEY STUDIES	Winkelman, A. (1); Van der marck, S. (2) 1 - Technical University Delft, Netherlands 2 - Nuclear Research an Consultancy Group, Netherlands

Tu 15.50 – 16.20 Coffee break

This RRFM 2018 Coffee break is sponsored by

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Research Reactor Security

MANAGEMENT OF DOMESTIC NUCLEAR INFORMATION FOR NNFL DEVELOPMENT

European research reactor conference 2018
Munich, Germany
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IAEA 60 Years

MANAGEMENT OF DOMESTIC NUCLEAR INFORMATION FOR NNFL DEVELOPMENT

J. KRAIKAEW, K. Changkrueng, L. Srijittawa, P. Phaukkachane, S. Thong-in, and H. Mungpayaban

Regulatory Technical Support Division, Office of Atoms for Peace
Vibhavadee Rangsit Road, Bangkok 10900, Thailand

Corresponding author: jarunee.k@oap.go.th

Presented by Ms. Jarunee Kraikaew

Objectives and Scopes

- Cataloguing characteristics and signatures of all nuclear and radioactive material holdings under regulatory control
- Developing the prototype database of the National Nuclear Forensics Library (NNFL) in Thai-English following OAP licensing systems
- Management of nuclear knowledge information for defining the specific data, including IAEA information, ISO, nuclear forensics laboratory analytical reports, and etc.
- Transferring the technology and methodology developed to the responsible authorities

OAP conventional radioactive and nuclear material database

Historical Records of Radiation Facilities

- *Radiation safety inspection and evaluation*
- *Licenses*
- *Nuclear and radioactive materials*
- *Radiation generators*
- *Equipment/Tools/Instruments*
- *Concerning officers*
- *Reports*
- *Etc.*

Inspector at work with radiation safety and security evaluation via Database following OAP licensing systems

Microsoft Access 2010-LOF database developed in 2016

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- All information were identified, as well as adding more details and reports. They were complied as several tables in the same Access 2010 file.
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National Nuclear Forensics Library (NNFL)

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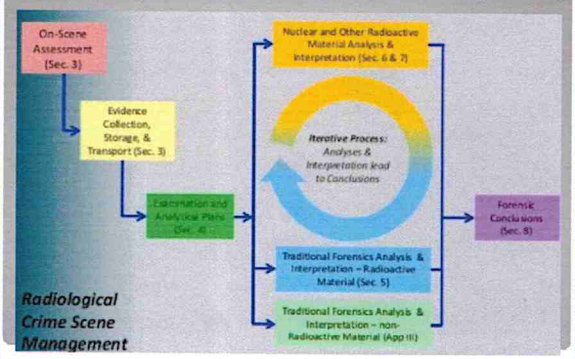
IAEA Model Action Plan for NS event investigation



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- Critical for timely and informed nuclear forensics conclusions
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- Deter illicit activities involving nuclear material to enhance nuclear security
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Development of National Nuclear Forensics Library (NNFL) in Thailand

Background

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- It is under the project no.30 of the CoE initiative, "Network of Excellence for Nuclear Forensics in South East Asia Region" and Thai government budget.

Development of National Nuclear Forensics Library (NNFL) in Thailand

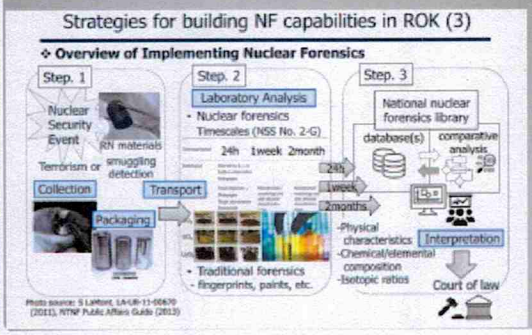
- The research and development of this laboratory focused on signature analysis techniques to identify the production history and origin of these materials.
- The human resources of OAP and concerning organizations are trained for higher competency under regional activities under ASEANTOM, i.e. training courses and workshops by IAEA, EU, and US DOE.

Development of National Nuclear Forensics Library (NNFL) in Thailand

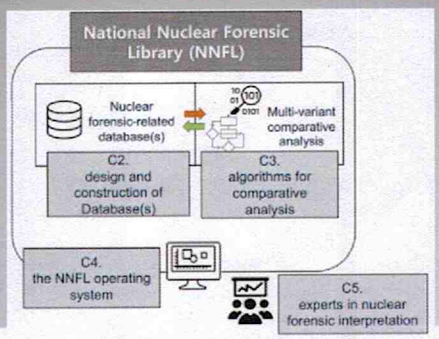
NNFL Database structure and design

- The database is a central and key component of any NNFL and provides a centralized structure for storing data and information that characterize nuclear and radioactive material holdings within a state.
- The relation between NNFL and the procedure, from nuclear security event though laboratory analysis, is illustrated as the example ROK diagram as the following slides.

NNFL Database structure and design



NNFL Database structure and design

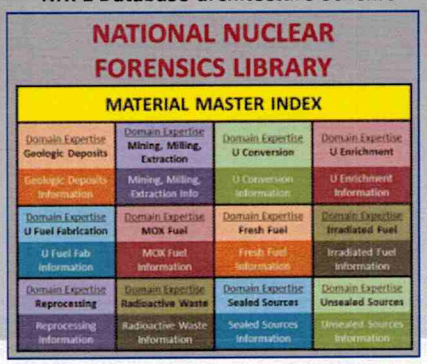


NNFL Database structure and design

Nuclear forensics database prototype setup procedure

- Data collection relating to OAP conventional radioactive and nuclear material database of licensing systems
- The architecture were developed as templates and databases cataloguing characteristics and signatures of these materials holdings under regulatory control
- Storage functions using Microsoft Access 2010 software
- Proposed models for searching/comparative analysis, identification and reporting

NNFL Database architecture scheme



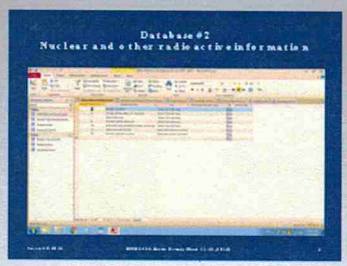
IAEA National structure of a national nuclear forensics library

NNFL Database structure and design

Database # 1 : Additional Nuclear Forensics Information

NNFL Database structure and design

Database # 2 : Nuclear and radioactive materials information



NNFL Database structure and design

NNFL Database structure and design

Conclusions

- More work to continue, such as data/information collection, access capability, and data interpretation and analysis etc.
- To complete NNFL, another work is necessary to perform, for example, the legislative work for the cooperation and integration between the responsible competent authorities
- All action plans is aimed to strengthen nuclear security actions for confidence building of the nation, as well as ASEAN region.

Acknowledgement

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- The cooperation from concerned OAP personnel to process financial assistance application to IAEA
- The financial support from IAEA for the author to attend RRFM 2018 and have a presentation

Thank you

Danke

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การศึกษาดูงานโรงไฟฟ้านิวเคลียร์ Isar ประเทศเยอรมนี

งานประชุม European Research Reactor Conference 2018

วันที่ 15 มีนาคม 2561

Operator: PreussenElektra GmbH

โรงไฟฟ้านิวเคลียร์ชุดแรก KKN Research reactor เป็น CO_2-cooled, D_2O-moderated pressure tube reactor มี electric gross output 106 MW ดำเนินการ (commissioning 17 ธันวาคม 1972) และได้หยุดเดินเครื่องต่อมา ด้วยเหตุผลเชิงพาณิชย์จากการประสบความสำเร็จของเครื่องปฏิกรณ์แบบ BWR และ PWR วันที่ 6 มิถุนายน 1986 ได้รับอนุมัติ license สำหรับการกำจัดและยกเลิกทั้งหมด (total elimination) วันที่ 17 สิงหาคม 1995 งานถอดโครงสร้าง disassembly เสร็จสมบูรณ์

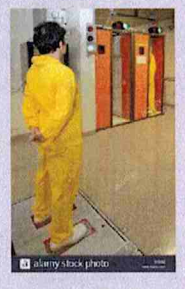
ปัจจุบันประกอบด้วย Nuclear Installation 3 ชุด ได้แก่

1. KKI Unit 1 (1972-2011) เป็น BWR (Boiling water reactor) มีความสามารถในการผลิตกระแสไฟฟ้า gross electricity capacity 912 MW ได้เลิกดำเนินการ (decommissioning) ปี ค.ศ. 2011 ได้รับ decommissioning and dismantling license ในเดือนมกราคม 2017 และอยู่ในระหว่างการรื้อถอนระดับปานกลาง (immediate)
2. KKI Unit 2 (1982-1988) เป็น PWR (Pressurized water reactor) มี Gross electricity capacity 1485 MW ดำเนินการ (commissioning) ปี 1988
3. On-site interim storage facility (SZL) ได้รับ license 22/09/2003 license masses of heavy metal (HM) 1,500 Mg ก่อสร้าง ปี 2004 และดำเนินการ 12/03/2007

หมายเหตุ

- 12% ของการจ่ายกระแสไฟฟ้าของ Barvarian
- มีการปรับปรุงเปลี่ยนแปลงกฎหมายปีที่แล้ว 2017 เพื่อจัดการกับโรงไฟฟ้านิวเคลียร์หลังหยุดดำเนินการ
- คาดว่า Isar 2 จะเลิกกิจการ (offline) ภายในปี 2022

การเข้าศึกษาดูงานภายใน ไม่ได้รับอนุญาตให้ถ่ายรูป และต้องตรวจวัดความเปรอะเปื้อนทางรังสีก่อนและหลัง รวมทั้งได้รับ dosimeter แต่ละคน ผู้เข้าร่วมประชุม RRFM 2018 ที่เยี่ยมชมทั้งหมด (รวมผู้รายงาน) มีจำนวน 12 คน ทั้งหมดต้องสวมชุดกันการเปรอะเปื้อนภายในตัว containment



Isar nuclear power plant

On the banks of the Isar, at a historical site fourteen kilometers downriver from Landshut, where Romans settled nearly 2,000 years ago, on the border between the municipalities of Essenbach and Niederaichbach in Landshut County, Southern Bavaria, lie blocks 1 and 2 of the Isar nuclear power station.

Isar 1 nuclear power plant

1971	Kernkraftwerk Isar GmbH (equally owned by Bayernwerk AG and Isar Amperwerke AG) awards the contract for construction of the nuclear power plant to Kraftwerk Union AG (KWU)
1972	Clearance under German nuclear law; construction work begins
1975	Pressure tests conducted on steel containment structure
1975/76	Turbo set and piping installed in machine room
1976	Second partial clearance under German nuclear law
1977	Third and fourth partial clearances under German nuclear law for reactor loading, nuclear commissioning, trial runs and first power generation phase
1979	Commercial commissioning
1983	World champion in boiling-water reactor capacity utilization
2000/01	Uninterrupted supply to the public grid for 519 days

Isar 2 nuclear power plant

1982	First partial clearance under German nuclear law; construction work begins (KWU); principals: Bayernwerk AG (40%), Isar-Amperwerke AG (25%), City of Munich (25%), Energieversorgung Ostbayern (10%)
1984	Second partial clearance under German nuclear law
1987	Third partial clearance under German nuclear law for reactor loading
1988	Fourth partial clearance under German nuclear law, trial runs, commercial commissioning
1994	World champion in gross annual output
1999-2004	World champion for five consecutive years

Fuel assembly container storage facility

2004	Construction of the fuel assembly container storage facility begins

Technical specifications

Isar 1 nuclear power plant

Owner	
E.ON Kernkraft GmbH	100%
Commercial commissioning	March 21, 1979
Total plant	
Net installed electric capacity	878 MW
Thermal reactor capacity	2,575 MW
Nuclear plant:	
Containment structure	
Inner diameter	27 m
Steel containment wall thickness	16 - 30 mm
Steel outer shell wall thickness	4 mm
Spacing between the two shells	70 mm
Reactor pressure vessel	
Inner diameter	5.85 m
Inner height	21 m
Cylindrical section wall thickness	approx. 148 mm
Weight including upper shell and cylindrical skirt	approx. 620 t
Reactor	
Feedwater temperature at reactor inlet	215 °C
Live steam temperature at reactor outlet	286 °C
Amount of live steam at reactor outlet	1,400 kg/s
Live steam pressure at reactor outlet	70 bar
Reactor core	
Fuel elements	592
Total amount of uranium	100 mt
Control rods	145
Coolant circulation pumps	
Pumps	8
Rating per pump	1,380 kg/s
Speed	1,825 rpm
Engine plant:	
Turbine	
Speed	1,500 rpm
Outer diameter of last turbine blade wheel	5.64 m
Steam pressure at HP turbine inlet	67 bar
Steam pressure at HP turbine outlet	11.9 bar
Generator	
Speed,	1,500 rpm
Apparent output	1,070 MVA
Coolant system	
Amount of primary coolant	42,000 kg/s
Primary coolant pumps	4
Flow rate per pump	14,000 kg/s

Isar 2 nuclear power plant

Owners	
E.ON Kernkraft GmbH	75%
Stadtwerke München	25%
Commercial commissioning	April 9, 1988
Total plant	
Net installed electric capacity	1,400 MW
Thermal reactor capacity	3,950 MW
Nuclear plant:	
Containment structure	
Inner diameter	56 m
Wall thickness	38 - 60 mm
Reactor pressure vessel	
Inner diameter	5 m
Cylindrical shell wall thickness	250 mm
Total height	12.01 m
Weight excluding built-in components	approx. 507 mt
Reactor	
Primary coolant circuits	4
Temperature at reactor inlet	293 °C
Temperature at reactor outlet	328 °C
Reactor core	
Fuel elements	193
Total weight of uranium in primary core	approx. 103 t
Control elements	61 packs
Steam generators	
Quantity	4
Height	21.5 m
Weight per generator	440 mt
Effective heating surface	approx. 5,400 sqm
Engine plant:	
Turbine	
Speed	1,500 rpm
Steam pressure at HP turbine inlet	64.3 bar
Steam pressure at HP turbine outlet	11.3 bar
Amount of saturated steam	2,200 kg/s
Generator	
Speed	1,500 rpm
Apparent output	1,640 MVA
Rated current	35 kA
Coolant system	
Condenser cooling surface	96,000 sqm
Amount of primary coolant	60,000 kg/s
Cooling tower	
Base diameter	approx. 145 m
Height	165 m
Upper diameter	approx. 86 m

เอกสารอ้างอิง

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