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International Workshop on Transparency Technology for Nonproliferation Cooperation in the Asia Pacific

- Applications of Remote Monitoring and Secure Communications for Regional Confidence Building -

Co-Sponsored by JAEA/NPSTC and the University of Tokyo GLOBAL-COE
20-22 February 2008, Tokyo, Japan

(Eds.) J. David Betsill and Yu HASHIMOTO

Nuclear Nonproliferation Science and Technology Center

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日本原子力研究開発機構

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（Eds.） J. David Betsill* and Yu HASHIMOTO

Nuclear Nonproliferation Science and Technology Center
Japan Atomic Energy Agency
Tokai-mura, Naka-gun, Ibaraki-ken

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The Japan Atomic Energy Agency (JAEA) sponsored an international workshop 20-22 February 2008 on "Transparency Technology for Nonproliferation Cooperation in the Asia Pacific – Applications of Remote Monitoring and Secure Communications for Regional Confidence Building." The Workshop focused on identifying appropriate roles and functions for Transparency in addressing nonproliferation concerns associated with the use of nuclear energy, particularly in the East Asia region.

Participants from several East Asia countries included representatives from nuclear energy research institutions, Ministries, facility operators, and non-governmental organizations. Regional participation from countries currently developing their nuclear energy infrastructure was also encouraged. Several promising students from the University of Tokyo and the Tokyo Institute of Technology, representing the next generation of nuclear energy experts, also participated in the meeting and added significant value and fresh viewpoints.

The participants agreed that transparency has many roles and definitions, and that its usefulness ranges for verification and compliance with the Nonproliferation Treaty (NPT) to building trust and confidence in the activities of the state and other regional nuclear energy stakeholders. In addition, they identified a need for further education among the professional community, public, operators, and regulators as a key factor in transparency effectiveness. Also, the education and cultivation of the next generation of nuclear energy experts was identified as crucial to the long-term success and acceptance of nuclear energy development. And finally, that the development, selection, and implementation of technology that is appropriate to the goals and participants of a transparency effort are unique to each situation and are key to the successful acceptance of cooperative transparency and regional confidence building.

* Sandia National Laboratories

At the conclusion of the Workshop it was importantly noted that small, incremental, approaches and steps, both technical and non-technical, are needed as the foundation upon which next steps toward increasing transparency, openness, and confidence building among all East Asia neighbors can be advanced.

Results from this Workshop will be incorporated into ongoing activities at the JAEA. In addition, the results of the Workshop will be used as a basis for planning future regional interactions and possible development of collaborative confidence building projects between participants.

Keywords: Remote Monitoring, Nuclear Transparency, Regional Nonproliferation

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アジア太平洋地域における核不拡散協力のための透明性技術に関するワークショップ

-地域での信頼醸成に向けたリモートモニタリングと安全性の高い通信の適用-

共催：日本原子力研究開発機構核不拡散科学技術センター、東京大学 GLOBAL-COE
2008 年 2 月 20-22 日、東京大学本郷キャンパス

日本原子力研究開発機構
核不拡散科学技術センター
（編） J. David Betsill*、橋本　裕

（2009 年 6 月 9 日受理）

日本原子力研究開発機構(JAEA)は、「アジア太平洋地域における核不拡散協力のための透明性技術-地域での信頼醸成に向けたリモートモニタリングと安全性の高い通信の適用-」に関する国際ワークショップを 2008 年 2 月 20-22 日に開催した。このワークショップでの議論の焦点は、原子力利用、特に東アジア地域での利用拡大に伴う核不拡散上の懸念に対する透明性の役割・機能を明確にすることであった。

東アジアの国からの参加者は、原子力研究機関、行政機関、事業者及び非政府機関(NGO) であった。次世代の原子力専門家になるであろう、東京大学及び東京工業大学の学生を数名参加し、その参加はこのワークショップに重要な価値と新鮮な観点を与えるものであった。

透明性には多くの役割や定義があり、その有用性は検認や核拡散防止条約（NPT）遵守から国や原子力関係者の活動に関する信頼醸成に及ぶことには参加者の合意が得られた。さらに、透明性を効果的にするための重要なファクターとして教育界、公衆、施設者及び規制当局の間で教育推進が必要であることが確認された。また、次世代の原子力専門家教育・育成が今後の長期における原子力開発の成功と受容にとって、極めて重要であることが確認された。また、目標に適したどのような技術を開発し、選択し、実施するのか、誰が透明性向上に努めるのかはそれぞれの状況によって異なるが、協力し合って透明性を向上することや地域での信頼性を醸成することが受け入れられるために重要であることは確認された。

ワークショップでの議論の結果として、東アジア地域全域における透明性・公開性及び信頼性醸成が向上する基礎として、 最初は少しずつそしてだんだん拡大していく取り組みや方法、技術面とそれ以外の面（概念・体制検討）双方からの取り組みの必要が重要なこととして認識された。

このワークショップの成果は JAEA において現在実施されている活動に反映されるとともに、参加者間における地域相互活動の立案や相互協力による信頼性醸成プロジェクト推進の基礎となるものと思われる。

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1. Workshop Summary

The "International Workshop on Transparency Technology for Nonproliferation Cooperation in the Asia Pacific – Applications of Remote Monitoring and Secure Communications for Regional Confidence Building" was co-sponsored by the Japan Atomic Energy Agency's Nonproliferation Science and Technology Center (NPSTC) and the University of Tokyo's GLOBAL-COE program. The Workshop was held at the University of Tokyo, 20-22 February 2008.

The Workshop was attended by a select, invited, group of approximately 60-70 nuclear energy professionals, experts, and students with professional interests in remote monitoring and transparency technology for use in cooperative nonproliferation and regional confidence building at nuclear energy facilities. The Workshop provided a unique opportunity and interactive venue where participants discussed and explored the intersection of transparency, technology, and regional confidence building. Invited attendees included government agencies and ministries, research laboratories, industry, facility operators, International Atomic Energy Agency (IAEA), non-governmental organizations (NGOs), and academia involved with Asia Pacific nuclear energy development. Representation included Indonesia, Vietnam, Republic of Korea, Australia, Japan, and the United States.

The focus of presentations, demonstrations, and group discussions were:

- Increasing regional confidence in traditional IAEA safeguards and the NPT regime using cooperative technology and confidence building activities as supplemental transparency measures.
- Transparency technology, remote monitoring, and secure communications methods supportive of nonproliferation commitments and goals that further the development and acceptance of peaceful nuclear energy in the Asia Pacific.
- Practical technical applications, issues, and problems associated with remote monitoring transparency when used as a voluntary confidence building measure that is complementary, and supplemental, to IAEA safeguards.
- Promoting nuclear energy university student participation and leadership in nuclear energy development and nonproliferation.

The Workshop built upon a series of past workshops sponsored by JAEA and its predecessor organizations. The Workshop focused on the topic of transparency in support of JAEA's ongoing regional nonproliferation activities. Over time, the JAEA has invested significantly in transparency efforts that support a broad set of nuclear energy interests in Japan, and also to complement traditional IAEA safeguards and national regulatory measures.

This Workshop was a new opportunity and a bit of an experiment, itself, in the organization and implementation of workshops at JAEA. The Workshop was unique in that it expanded greatly in scope and variety upon previous transparency workshop efforts – it sought a broad regional set of participants, actively sought the involvement of countries with emerging and developing nuclear energy programs in East Asia, included alternative viewpoints from other stakeholders such as NGOs and the public, and welcomed the next generation of nuclear energy experts currently matriculating through highly respected universities. The Workshop also used various techniques and methods to involve and encourage open interaction and frank discussions among the participants, and the generation of needs, ideas, and next steps for progress. These methods included traditional presentations and panel sessions, live demonstrations of technology and hardware, a design exercise for transparency monitoring systems, and ample time for sharing ideas through facilitated group discussions.

The Workshop was broken into several different focus areas and topics of discussion over the course of three days. One intention of this approach was to provide a variety of opportunities for participants to interact and engage on the topic of transparency, remote monitoring technologies, and applications to regional cooperation and confidence building for nonproliferation and nuclear energy development.

The Workshop began on the first day with an overview and presentation session. It was open to a broad audience. This session included summaries and examples of the uses and roles of transparency, views from

the IAEA and from non-governmental organizations on transparency, and presentations from representatives from Indonesia and Vietnam regarding the status and plans for nuclear energy under development in those countries. The afternoon session consisted of a panel discussion focused on the role and definitions of transparency, especially as applied to regional cooperation. The second day was devoted to technical sessions and demonstrations focusing on approaches to transparency and the role of technologies in transparency, especially those using remote monitoring and secure communications. On the final day, several senior and graduate students from the University of Tokyo and the Tokyo Institute of Technology made presentations and designs using technical approaches for nonproliferation transparency based on their exposure and learning during the workshop. The involvement of this group is very important since they are the next generation of nuclear energy experts. Interaction and involvement with the gathered group of international experts provided valuable guidance, encouragement, and advice for transparency design improvements for the students. The Workshop closed with a discussion among the participants which sought to narrowly define the types of nonproliferation challenges where cooperative nonproliferation transparency could play a role, appropriate technology and methods to meet those challenges, and possible next steps and activities for regional collaboration in this area.

Over the course of the Workshop, several important themes, discussion topics, and conclusions emerged, as highlighted in the following sections.

(1) Transparency has many Uses and Definitions

Much of the focus of the Workshop overview and plenary sessions entailed a discussion of the definition, value, and role of "Transparency." In fact, this theme remained current throughout the remainder of the Workshop. For some participants, transparency is largely seen as something that has a positive value in itself, regardless of the role it plays in achieving a specific end or outcome. For other participants, transparency is primarily viewed as an approach to engaging domestic stakeholders on various issues, such as safety. And for others, transparency is seen as specifically related to safeguards issues and compliance verification under the NPT.

(2) Developing the Concept of "Cooperative Nonproliferation Transparency"

Because transparency can mean so many different things to different people, and can take on different meanings in various situations, it was challenging to focus the Workshop discussion among such a group of diverse participants. However, that was one of the primary goals of the Workshop – to bring out and discuss the various roles and applications of transparency. Specifically, to explore, develop, and possibly reach a common understanding of "Cooperative Nonproliferation Transparency." In addition, to try to define the roles that cooperative transparency can play in addressing concerns about nuclear proliferation issues associated with host state diversion, and how can transparency applications be used to foster greater cooperation and confidence building among regional stakeholders.

Standardized IAEA methods, technologies, and hardware were duly acknowledged as the reliable, time-tested, cornerstone and benchmark of traditional Safeguards. The concept of cooperative transparency, therefore, can provide a complementary supplement to international Safeguards. Its value lies in developing and improving mutual trust regarding nonproliferation activities and allowing participating parties to reach independent conclusions regarding the perceived transparency and openness of regional partners.

To be effective, an important goal of cooperative transparency is to synergistically work in parallel with, and in full recognition of, the IAEA Safeguards process – not in competition with it. Therefore, cooperative nonproliferation transparency is envisioned as a voluntary approach by participating parties that increases confidence in the reviewed party's openness and willingness to comply with nonproliferation goals.

It was noted in the Workshop that in some cases, actions taken by a state or a nuclear facility operator to provide information and transparency intended for a domestic audience may also provide additional assurances about the peaceful use of nuclear facilities, in general, to a wider international audience.

However, this is not always the case. Therefore, to achieve a particular end, such as building confidence among regional neighbors that nuclear energy facilities are not being misused, the approach to cooperative nonproliferation transparency must be specifically tailored for each situation, set of participants, and outcomes sought.

(3) Regional Transparency Activities

The Workshop was designed to attract participants from the Asia Pacific region to explore the concept of cooperative transparency as used for nonproliferation within the region. Taking a broad view, several participants opined that institutionalized regional activities in the form of some type of a regional safeguards research consortium, such as recently proposed by the Australian Safeguards and Nonproliferation Office for an Asia Pacific Safeguards Association, or even a regional system of accounting along the lines of a "PACATOM" or "ASIATOM," for example, would have important regional transparency benefits. Although some of the typical arguments against such approaches were mentioned (for example, the Asia Pacific is not like Europe; or European institutions cannot simply be replicated and applied to Asia), there was a general sense of openness to this type of concept of a regional organization among the Workshop participants. A positive example of ongoing cooperation was offered by JAEA and KINAC participants who pointed to their long-term efforts to establish a bilateral data exchange program as an effort that might pave the way for broader, regional cooperation in the future.

(4) Transparency and Countries Developing Nuclear Energy

One of the important goals of the Workshop was to expand the transparency discussion and interactions to include countries that are currently developing their nuclear energy infrastructure, and to better understand and discuss the unique issues of their emerging nuclear energy development. Representatives from Indonesia and Vietnam participated and presented their efforts aimed at international transparency efforts, especially with regard to development of the legal infrastructure, and their sincere steps made toward compliance with the IAEA, NPT, and safeguards regime.

The representatives from Indonesia and Vietnam expressed that their countries were intentionally being transparent regarding their nuclear energy plans and obligations under the NPT. They also realistically recognized that they may have to prioritize the development of nuclear energy generation technology and first fulfill and implement existing regulations and obligations, including IAEA safeguards, before undertaking additional activities such as voluntary transparency measures. Some Workshop participants also wondered if additional "requirements" not currently developed or implemented, or the adoption of technology that subsequently becomes "common usage," might increase the financial burden on countries currently developing their nuclear energy capabilities, or even possibly delay or undermine the development of their nuclear energy programs.

However, all agreed that greater understanding, education, and regional cooperation were positive goals and would facilitate the overall successful development of safe and secure nuclear energy resources.

(5) Transparency and the IAEA

Throughout the Workshop, there was a great deal of discussion about the need for unspecified voluntary measures, such as cooperative transparency, to demonstrate compliance with nonproliferation obligations given the existing functions of the IAEA. Some argued that the IAEA safeguards system was itself a transparency measure. Others felt that the confidential nature of the relationship between states and the IAEA, however, meant that the safeguards system included bilateral sharing limitations and therefore was distinctly not transparent – depending on the perspective of the viewer. Some participants noted that a solid understanding of the roles and functions of the IAEA were crucial. A common understanding of transparency within the IAEA context is something the participants identified as an area where further collaboration and educational activities could add value.

However, even among those who had a solid understanding of the IAEA and felt confident in its ability to meet its mandate, there was a sense that regional tensions and past history or suspicions regarding possible motivations could justify additional efforts and measures to provide a higher level of assurance and instill greater confidence. Some participants noted that additional assurances could even help sustain and possibly increase the credibility of the IAEA and, possibly as an added benefit, reduce the overall, long-term burden on the Agency.

(6) Transparency – A Process and a Product

Many of the discussions about what information, data, etc. should be shared, and how it should be shared, were included in a high-level debate about "transparency." Some participants felt that in order for cooperative transparency to be valuable, there was specific information that needed to be shared (and, in some cases, specific ways for it to be shared). Others argued, importantly, that the very willingness of a state to share any information demonstrated some level of transparency or openness. Those holding this view also tended to lessen a strict need for authentication of shared information and data security, and also held that perhaps efforts to "formalize" transparency may tend to cross the line into areas normally reserved for formal obligations such as IAEA safeguards. This question of whether transparency was simply a *process*, or was a specifically identified *product*, remained an active topic throughout the Workshop. The group did agree that, in practice, cooperative transparency, especially in a regional sense, is *both a process and a product* dependent on the goals of the transparency effort. And, it can be both formal and/ or informal, depending on the mutual arrangement of the participants. Effective and pragmatic transparency, therefore, requires design and implementation on a case-by-case basis.

(7) Vulnerability of Transparency

The Workshop participants noted that there are some potential downsides to transparency. Most commonly mentioned were concerns that cooperative transparency efforts might create security vulnerabilities. In addition, some participants noted that all stakeholders, even the IAEA, were already overwhelmed by "an information tsunami" and that providing more information might be of little value in the absence of additional resources to properly review and evaluate that information.

In response to several suggestions for technical approaches to providing data, participants questioned how the recipient, and the provider, of the data should respond if the data suggested an anomaly. Therefore, incorporating procedures for dealing with questions and disputes was noted as an important aspect for cooperative nonproliferation transparency activities to ensure that they meet the goal of reducing tensions and suspicions, rather than exacerbating them.

(8) Transparency, Data Authentication, and Security

Discussions focusing on technical tools for acquiring and providing information for the purposes of cooperative transparency included a healthy debate about the importance of authenticating or securing the data being shared. Some participants argued that data that are not authenticated or secured would offer little value. That is, if the recipient could not trust the information being sent, the value of sharing the data or being "transparent," therefore, would be undermined. There may even be a risk that in the absence of such protections, data might be manipulated by malicious entities with the intent of actually increasing suspicions and tensions. Other participants, however, felt that authentication and data security only needed to be applied to the acquisition and transmission of IAEA safeguards information. In some cases, this argument seemed to stem from a sense that transparency could be a less-formal exercise than rigorous international safeguards. Still others offered a more practical explanation that authentication and data security were difficult and expensive, and perhaps unnecessary, for transparency as used solely for confidence building. One positive idea offered to help expedite the implementation of transparency measures was that initial cooperative efforts could use non-sensitive information, and therefore data security considerations could be temporarily set aside. Later, data security could be introduced as time and resources allowed, and on a case-by-case basis, as the level or sensitivity of information sharing is increased.

(9) The Effectiveness of Transparency

Several participants noted that implementing cooperative nonproliferation transparency measures could be an additional cost and burden on the operators of nuclear energy facilities. To justify this burden, those participants argued some attention must be paid to methods for evaluating the effectiveness of transparency measures. This emphasis on evaluation seemed to point toward more formal assessments of the role of transparency to ensure that there was something definitive to measure over time.

However, it was acknowledged by the participants that transparency in general, although difficult to measure in overall effectiveness, when used as a *process* is a positive approach toward developing regional understanding and acceptance of the development of peaceful nuclear energy. And, in practice, there may possibly be cost-saving benefits gained from the supplemental monitoring activities that could, in the long run, help lessen the overall burden on, and/ or show additional effectiveness of traditional IAEA safeguards information, *if* the information is complementary and supportive in nature.

(10) The Importance of Transparency Education

Reaching a common understanding through education among all Stakeholders and at all levels – public and professional communities, operators, regulators, and NGOs – regarding the importance and potential applications of transparency was identified as a crucial element in the overall successful acceptance, development, and maintenance of a country's nuclear energy policy and capability. The Workshop identified several areas that are key to current and future success on broad and specific issues, including understanding:

- the importance and safety of nuclear energy, in general
- transparency specifically as used within IAEA and the NPT
- the value of transparency as used for cooperation and confidence building
- transparency technology development, applications, and processes, and
- on-going educational needs of the public and professional communities.

Indeed, education and reaching common understandings are areas identified by the participants where further collaboration and activities could add significant value to cooperation and transparency, overall.

Also, the education of the next generation of nuclear energy experts was recognized as a critical need for the development of safe and peaceful nuclear energy. As a start, this type of education was actively encouraged throughout the Workshop by the interaction and involvement of the gathered group of experts who provided valuable guidance, encouragement, and advice for the future to the nuclear energy students from the University of Tokyo and the Tokyo Institute of Technology.

The nuclear energy students expressed their pleasure and appreciation for inclusion and active participation in the Workshop. For many, this was the first opportunity that they were able to participate as a "full member" of a professional meeting of experts, asked for their input and opinion, and able to express their ideas in an open forum. They reported that they gained useful knowledge and insights, not only regarding the technical aspects of the Workshop subject, but also valuable experience in the conduct and self-participation in such events.

In conclusion, a valuable lesson learned from the Workshop is the realization, emphasis, and need for adequate and appropriate education at all levels on an on-going basis as issues, events, and technologies unfold. Therefore, education regarding the IAEA, a state's nuclear energy plans, etc., is clearly as important for transparency as the technical approaches and methods that are used for monitoring and verification. When acceptance by the public and political processes are considered as ultimate goals, the informed and educated Stakeholders will have a large influence on the acceptance, or not, of the use peaceful nuclear energy.

(11) Reaching a Consensus on Transparency and Cooperation

During the final session of the Workshop, participants focused their discussions around a working summary that can serve as a foundation for future engagements on this topic. Participants noted that there were significant transparency benefits from regional discussions – a good example of which was demonstrated by the conduct and content of this Workshop. The emphasis of the summary session pointed to education regarding the IAEA, about a state's nuclear energy plans, etc. as being as important as the technical approaches for transparency monitoring. In fact, such education, along with needs assessments, precedes and leads the development and design of effective and appropriate technical tools and approaches for cooperative transparency.

Finally, cooperative nonproliferation transparency was recognized as *both a process and a product* dependent on the goals of the transparency effort. And, transparency approaches can be both formal and/ or informal, depending on the mutual arrangement of the participants to meet their needs and objectives. Effective cooperative transparency is designed and implemented on a case-by-case basis, and is most likely to be successful when implemented in small, incremental steps.

(12) Future Research Directions and Applications for Transparency and Cooperation

Asking the right questions – one key focus area of the Workshop's exploration of cooperative transparency – and assessing current and future needs can subsequently lead to new ideas and effective future research and applications. There were many needs identified and excellent ideas generated and discussed throughout the Workshop.

The predominance of the questions, suggestions, and comments revolved around the assessment of needs, stakeholder identification, cooperative transparency process development, and education. The specific technical solutions and ideas proposed by the participants were naturally fewer in number at this initial stage of the process. However, once the "drivers" (justifiable reasons) for pursuing transparency research are sufficiently identified, then subsequent ideas for technical solutions can be focused, refined, and proposed.

Many of the ideas for future transparency research and applications that were generated in the Workshop are summarized below. They are loosely organized and categorized into Drivers, Process, and Technical focus areas. However, many of the concepts have multiple aspects and could easily overlap into more than one category.

Drivers – Needs Assessment and Stakeholder Identification:

- What information, activities, and methods would be useful for enhancing regional trust and cooperation?
- Further work is needed to evaluate the needs of stakeholders before technology requirements can be identified.
- All relevant stakeholders need to be identified including, states, operators, IAEA, regulators, etc.
- Who is entitled to information access – Public, institutional, internal? And at what levels?
- Appropriate education is needed of the Public, and sometimes institutions, along with the next generation of experts as to the role and function of the IAEA, safeguards, traditional transparency, and cooperative transparency.
- Include future facilities and future fuel cycle in cooperative transparency development.

Process-Oriented Research and Applications:

- Analysis of policy regarding transparency for various countries and entities within the region – deepen mutual understanding at the international level.
- Enhance the effectiveness of traditional safeguards transparency through cooperative transparency activities.
- Investigate the prospects for synergy and cost-effectiveness of traditional, operational, and cooperative transparency technology and hardware.
- Mutual involvement in training, education, emergency response procedures.

- Develop evaluation methods for assessing effectiveness, measures of success, costs, and risks of cooperative transparency.
- Assess possible impacts of cooperative transparency on traditional safeguards transparency.
- Perform cost-benefit analyses – is there a possibility for a dual use of information and monitoring resources?
- Evaluate the effects of transparency on Operators – a benefit or a burden?
- Develop methods to explain the importance of cooperative transparency to government and other entities – the concept is not always easy to convey.
- How to deal with proprietary and safeguard confidential information?
- Perform a process analysis:
  - Do transparency mechanisms need to be formal and institutionalized (i.e., need a formal framework)?
  - Will more information about technical activities address concerns, or are concerns more political in nature?

Technical Research and Applications:

- Current technologies exist in different areas – evaluate new applications for existing technology or new approaches/ modifications for the use of existing technology. Are there technologies that are easy to implement at the present?
- Holistic synthesis and integration of various data streams from cameras, sensors, process monitoring, satellites, robots, and remote monitoring systems, etc. into easily understandable information.
- Develop methods and procedures for technical personnel exchanges and mutual inspections.
- Peer review of traditional and/or cooperative transparency data and information.
- Develop methods or technology to fulfill the needs of timeliness of information.
- Develop cooperative transparency “indicator data” that are adequate for building trust, confidence, and openness, but simultaneously protect and limit detailed or sensitive information release.
- Develop robotic, hardened “inspectors” to enter areas difficult of impossible for humans.
- Continuously improve data stream authentication and protection as hackers become more proficient.
- Develop realistic, operational test sites to evaluate and refine new technologies and methods in a representative setting. An on-site test center at an actual operational facility presents challenges regarding access, safety, and other factors unique to that facility. However, such settings provide a significant and invaluable opportunity to thoroughly test, evaluate, and refine new equipment and methods before introduction into full-scale usage.

2. Conclusions and Recommendations

The use of remote monitoring and cooperative transparency technologies for nonproliferation support the regional acceptance of nuclear energy and fuel cycle development. Interest by the regional community in non-traditional approaches that promote regional understanding, cooperation, and confidence building is an emerging trend. Cooperative nonproliferation transparency and technologies are complementary to, but do not replace a country's traditional approach to IAEA Safeguards.

The participants agreed that transparency has many roles and definitions, and that its usefulness ranges from verification and compliance with the NPT to building trust and confidence in the activities of the state and other regional nuclear energy players. The participants also agreed that transparency is not necessarily an easy topic to address, implement, and evaluate; but all acknowledged its inherent value in one or more ways.

Another conclusion is that the initial needs and goals of any transparency effort have to be established as the first step in a process between the various stakeholders involved in order to develop an effective transparency strategy, process, and resulting product. A key aspect of cooperative nonproliferation transparency includes activities to mutually agree upon the type of information or data that will be shared, how it will be collected, and who has access to that information, etc.

In addition, the need for education among the professional community, public, operators, and regulators is a key factor in transparency effectiveness and acceptance. Also, the education and cultivation of the next generation of nuclear energy experts are crucial to the long-term success of nuclear energy development. And finally, the development, selection, and implementation of technology that is appropriate to the goals and participants of a transparency effort are unique to each situation and are key to the successful acceptance of cooperative transparency and regional confidence building.

During the final group discussion of the Workshop it was importantly noted that small, incremental, technical *and* non-technical approaches and steps are needed as the foundation upon which next steps toward increasing, transparency, openness, and confidence building among all East Asia neighbors can be built. Therefore, the results and future direction developed from this Workshop will be incorporated into ongoing nonproliferation activities of the NPSTC at the JAEA.

In addition, the results of the Workshop will be used as a basis for planning future regional interactions and possible development of collaborative confidence building projects between participants. As observed on many occasions, most recently at this Transparency Workshop, the process for developing regional cooperation includes a series of small, incremental steps often performed in a face-to-face setting. These usually begin from simple ideas, issues, and engagements and lead over time to more complex and more sensitive ones.

A few examples of small, incremental next steps include activities and engagements such as conducting information exchanges regarding relevant technical subjects; organizing and leading joint, special sessions at international conferences; informal discussions of technology, hardware, software, and methods that might be used in a cooperative demonstration of information or data sharing; and performing small tests and demonstrations using artificial data or information to evaluate the technical methods and means of sharing that information.

As evidenced by this Workshop, transparency for nonproliferation and confidence building in a regional, or any other, setting is a complex subject that requires time, perseverance, and creativity to accomplish. The Workshop confirmed that there remains keen interest and opportunities in the transparency subject despite its many challenges. Therefore, the future remains open and bright for those willing to take up and continue this worthwhile challenge. The rewards are no less than facilitating the successful continuation, expansion, and improvement of safe, reliable, and peaceful nuclear energy production into the future for the Asia Pacific, and globally.


JAEA/NPSTC
CONERI
Nuclear Education and Research Initiative
Workshop on Transparency Technology
for Nonproliferation Cooperation in the Asia Pacific
UT, Tokyo, Japan, 20-22 February 2008

3. Focus on Transparency Overview

Dr. Yusuke Kuno, Moderator

- Introductions and Workshop Overview
- Invited Presentations on Nonproliferation and Transparency in the Asia Pacific
- Panel Discussion – "Transparency: Its Role, Type, Definitions, Measures, and Applications in Regional Cooperation"

20 February 2008: On Day 1, there were seven, focused, invited presentations in the morning session covering a variety of related subjects by speakers involved in nonproliferation and transparency in the Asia Pacific. These presentations served as an overview and description of the current situation regarding transparency and cooperation on nonproliferation in the region.

Panel discussions followed in the afternoon session. The panel participants addressed "Transparency: Its Role, Type, Definitions, and Measures and Applications in Regional Cooperation."

The panel session, along with the previous presentations, helped to stimulate many ideas regarding a variety of issues affecting regional cooperation, transparency, technology, and confidence building for nuclear energy development in the Asia Pacific.

Attendance on Day 1 included expert participants and a broad audience from government, academia, research, and interest groups who were invited to attend.

There was a reception in the evening were the participants were able to informally discuss the many ideas and issues brought up earlier in the day.



Mr. Masao Senzaki, Director of JAEA-NPSTC (left), and Professor Yoshiaki Oka, Leader of Global COE University of Tokyo (right), welcome participants during the Opening Session of the *International Workshop on Transparency Technology for Nonproliferation Cooperation in the Asia Pacific*.

3.1 Opening Remarks by Mr. Masao Senzaki

Masao Senzaki

Nuclear Nonproliferation Science and Technology Center
Japan Atomic Energy Agency

Good morning ladies and gentlemen. My name is Masao Senzaki and I am the Director of the Nuclear Nonproliferation Science and Technology Center at the Japan Atomic Energy Agency.

Let me start by welcoming all of the participants, researchers, technical specialists, and, transparency experts from around the world to participate in this "International Workshop on Transparency Technology for Nonproliferation Cooperation in the Asia Pacific – Applications of Remote Monitoring and Secure Communications for Regional Confidence Building" held here on the beautiful Sanjo-kaikan campus of Tokyo University. I think that you will agree that we are quite fortunate to be among such distinguished company, and also in the midst of the next generation of nuclear experts coming up through the higher education system, including the University of Tokyo GLOBAL-Center of Excellence, our co-sponsor of this Workshop.

In one way or another, you are all individuals with professional interests in remote monitoring and transparency technology for use in nonproliferation and regional confidence building at nuclear energy facilities, with an emphasis on the Asia Pacific. We are therefore, very happy that you have joined us at this Workshop on nonproliferation, technology, and cooperation.

Standardized IAEA methods, technologies, and hardware are rightfully acknowledged as the reliable, time-tested, cornerstone and benchmark of traditional Safeguards. At the same time, interest by the regional community in non-traditional approaches that help expand and promote regional understanding, cooperation, and confidence building are an emerging trend. Parties are also now considering looking more broadly at a wider set of potentially available information when forming their opinions about other regional entities. These approaches are complementary to, but do not replace, a country's traditional approach and application to IAEA Safeguards.

Over the next three days, you nonproliferation experts, along with the next generation of nuclear experts will together explore, discuss, create, and share ideas on transparency technology, remote monitoring, secure communications, and confidence building measures as applied to regional nonproliferation cooperation. You will also address the Stakeholder issues, problems, and practical technical applications associated with remote monitoring and transparency when used as a confidence building measure.

It is a complex, multidisciplinary subject, but I am confident that we will have very interesting and fruitful discussions over the next few days and I look forward to your great success, interesting results, and to the continuation of our relationship.

Thank you and good luck with this Workshop!

3.2 Opening Remarks by Professor Oka

Yoshiaki Oka

University of Tokyo
GLOBAL-Center of Excellence

My name is Professor Oka, the Leader of GLOBAL-COE (Center of Excellence) of the University of Tokyo. I warmly welcome you to the University of Tokyo. We are pleased to co-sponsor this important Workshop on Nonproliferation and Transparency Technology along with the JAEA/NPSTC and thank you for coming.

Mankind is having an increased effect on the environment through greenhouse gas emission; a very important and growing concern. Generally nuclear power is seen as a method for reducing greenhouse gas emission while still satisfying our modern society's high demand for energy.

We at Tokyo University are developing a well-rounded research and education program in response to a variety of world-wide nuclear utilization subjects such as protection of the global environment, supplying safe and stable nuclear energy, and applying radiation for healthy, productive, and prosperous lives.

The first systematic education on nuclear energy in the world is being performed here at the GLOBAL-COE, incorporating the social, liberal arts, and technical subjects as they relate to nuclear utilization. Such subjects include law and legislation, communication with the public, risk management, crisis control, nuclear nonproliferation, nuclear fundamentals, and nuclear applications. Research and education is being carried out in three areas: nuclear energy, radiation applications, and the social aspects of nuclear engineering which we call nuclear energy sociology.

Coexistence of nuclear nonproliferation and the peaceful use of nuclear energy is the most important problem in the nuclear energy utilization in the world. We promote this study by identifying the technological and systemic problems concerning nuclear nonproliferation and work towards solutions. We are producing Ph.D. students with the expertise necessary to serve in the future nuclear energy field. Therefore, we are very happy that you, a distinguished group of experts, has joined us this week. We look forward to hearing your ideas and to your interaction with the graduate students that we have among us – for they are the future generation of the nuclear energy world, and are eager to learn and improve upon the foundations that you have created.

As Senzaki-san has already mentioned, this workshop will focus on “transparency” for confidence-building in the areas of nuclear non-proliferation, which should be one of the key issues of nuclear energy sociology. We will have a half-day student session on the 3rd day, where I expect that young students will present very unique ideas to promote the regional transparency.

So, thank you and good luck with the Workshop. We look forward to hearing the positive results of your hard work!

Introduction

Yusuke Kuno

Nuclear Proliferation Science and Technology Centre (NPSTC) of
Japan Atomic Energy Agency (JAEA)
&
University of Tokyo

3.3 Workshop Introduction

Objectives of Workshop

- Discuss the various definitions and contexts used for transparency in regards to nonproliferation between interested parties.
- Explore the intersection of transparency, technology, and regional confidence building
- Discuss and promote development and applications of transparency technology
- Seek future common directions of technical application of transparency

- Support and encourage regional cooperation opportunities
- Develop a hypothetical regional transparency network for future application via a tabletop exercise, and addressing technical and pragmatic issues as they arise
- Promote University graduate student participation and leadership in nuclear energy and nonproliferation.

3.3 Workshop Introduction

Outline of Workshop

Day 1

- The participants and Panel 1 will discuss “Transparency: Its Role, Type, Definitions, Measures and Applications in Regional Cooperation.”

Day 2

- The focus is on Technology;
  Presentations, technical demonstrations, and expert group discussions. A small working group of about 20 technical Experts drawn from Day 1 will focus on the practical and technological issues and solutions for nonproliferation transparency.

Day 3

- Graduate students from the University of Tokyo, Tokyo Institute of Technology (and others) with experts will discuss application of their skills and ideas during a tabletop exercise to design a future, hypothetical regional transparency network for nuclear nonproliferation and confidence building.
- WS will conclude with final roundtable discussion to seek goals of development of transparency tools to promote regional cooperation for confidence building in Asia and Pacific.

3.3 Workshop Introduction

Today

Presentations:

Non-proliferation & Transparency in Asia Pacific

US-DOE, ROK-KINAC, BATAN-Indonesia, VAEC-Vietnam, ASNO-Australia, IAEA, CSIS

Panel Discussion:

Transparency : Its Role, Type, Definitions, Measures and Applications in Regional Cooperation

4. Presentation Session on

A Current Overview of Transparency and Regional Cooperation

Yusuke Kuno, Session Leader and Introduction

Yusuke Kuno: *Definition/Purpose of Transparency for Nuclear Non-Proliferation*

David Betsill: *Transparency and Openness* (for Dr. Stephan Bayer (left))
Wan Ki Yoon: *Technology Based "Built-in" Transparency Approach* (right)

4.1 Statement to Workshop Participants

John McClelland-Kerr

International Nuclear Safeguards and Engagement Program
Office of Global Security Engagement and Cooperation
U.S. DOE/NNSA

Abstract

Good morning. I am sorry that I am not able to be with you here today, but I wanted to congratulate the co-sponsors of this workshop, JAEA/NPST and the University of Tokyo Global-COE, for organizing such an important event.

Transparency is an important element of the nonproliferation regime. Transparency engenders trust, improves credibility with neighbors and international agencies, and establishes working relationships amongst technical experts. The International Nuclear Safeguards and Engagement Program in the Office of Global Security Engagement and Cooperation of the U.S. National Nuclear Security Administration is a strong supporter of transparency in the Asia Pacific region. Since 2003, we have funded activities in support of transparency data exchange between KAERI and JAEA. While these efforts have been fruitful, we also appreciate the legitimate sensitivities that every country has with respect to nuclear technology and operations. Previous regional transparency workshops have helped reduce these sensitivities, and opened new doors of cooperation. It is our hope that this workshop will build on these past successes and advance this important cause.

Please accept my best wishes for a productive and successful workshop.

Best Regards,

John McClelland-Kerr
International Nuclear Safeguards and Engagement Program
Office of Global Security Engagement and Cooperation
U.S. DOE/NNSA

4.2 Technology Based "Built-in" Transparency Approach

Wan Ki Yoon

Korea Institute of Nuclear Nonproliferation and Control

Abstract

Safeguards is a means to achieve nonproliferation. Especially integrated safeguards which is strengthened by the additional protocol and broader safeguards conclusion is considered effective. However its statutory nature of safeguards confidentiality does not allow sharing safeguards information. This creates asymmetry of information between the IAEA and states. Transparency is a vital element to achieve nonproliferation to overcome information monopoly. Balanced combination of safeguards which is a vertical obligatory relation between the IAEA and states, and transparency which is a horizontal voluntary cooperation among states, can contribute to nonproliferation.

Transparency can be achieved by information sharing among states. Traditional transparency mainly relies on human contact, such as visit and meeting. Advances in technology opened a way to make transparency possible in a remote manner. Technology based transparency approach or "TECATOM" has been discussed since mid 1990s. It has advantages such as higher degree of transparency, less intrusiveness and less political insensibility than those of traditional one. Technology based transparency is mainly based on digital surveillance and internet based secure transmission which were originally developed for safeguards applications. Technologies have been well understood and accepted through safeguards implementation and R/D activities in some countries concerned US, which allow them to attempt technology based transparency in some facilities as trial. JAEA and SNL are exchanging images, and KAERI/KINAC and INL/SNL are. Japan and Korea are working on arrangement to exchange technology based transparency information as trial.

Further development of component technologies will contribute to promotion of technology based transparency approach; however, its impacts do not look critical. Instead it would be necessary to apply technology based transparency in a comprehensive manner, which can raise overall transparency effectively. In this regards, application of built-in transparency features in an early design stages of facility is important. It is said that nuclear renaissance is coming. Especially in East Asia, much investment on nuclear facilities is planned to meet growing energy demands and to effectively deal with spent fuel matters. And through GIF, INPRO, GNEP, MNA, et al, various nuclear reactors and processes are being developed with emphasis on nonproliferation. To harmonize possible coming nuclear renaissance, the nuclear sector should pay more attention to transparency not to lose this valuable chance. In this context, technology based built-in approach can play a role in transparency enhancement and nuclear public relation.

JAEA Transparency Workshop

Technology Based "Built-in" Transparency Approach

February 20, 2008

Wan Ki Yoon

Korea Institute of Nuclear Nonproliferation and Control

KINAC

Outlines

- ❑ Transparency and Safeguards
- ❑ Regional Transparency
- ❑ Technology Based Transparency
- ❑ Technology Based "Built-in" Transparency
- ❑ Summary

KINAC

Transparency

- Goal

  Effort to promote trust, improve credibility and establish working relationships between countries, international agencies, other nuclear entities and the citizens through the sharing of information with respect to nuclear activities, both in the area of nuclear disarmament and the peaceful use of nuclear energy.

  Hori M., Hashimoto Y., Damico J., INMM Conf. 2002

- Activity

  Transparency is primarily related to providing information

  SAGSI

KINAC

Safeguards

- Purpose
  - To provide assurance about the exclusively peaceful use of nuclear material and facilities
- Objectives
  - Timely detection of diversion and deterrence through risk of early detection
- Task
  - To verify correctness and completeness of declarations made by States

Jill Cooley, Special Symposium for the IAEA 50 Anniversary

KINAC

Safeguards vs. Transparency

❑ Safeguards

- Openness to IAEA, Regional Control Regimes, National Control Authorities
- Statutory Obligations, Regulation
- Centralized and Vertical Relationship
- Governmental Approach
- Confidentiality
- Verification
- Professionals
- Single Level of Achievements – to meet criteria
- Highest Form of Transparency

KINAC

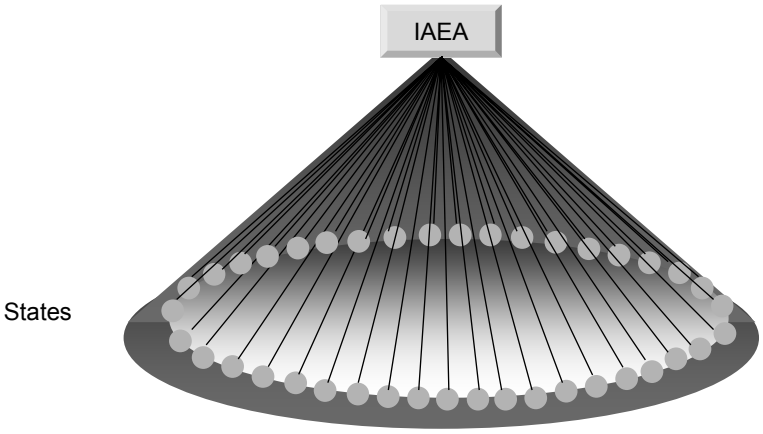
Safeguards vs. Transparency

❑ Transparency

- Transparency to States, International Agencies, Nuclear Entities, The Public
- Voluntary, Cooperation and Sharing
- Distributed and Horizontal (Equal) Relationship
- Governmental, Institutional and Civilian Approach
- Openness but Selective Confidentiality depending on Approach
- Confidence Building Measures
- Professionals and the Public
- Variety Degree of Achievements

KINAC

Nonproliferation Cone



KINAC

Information Asymmetry

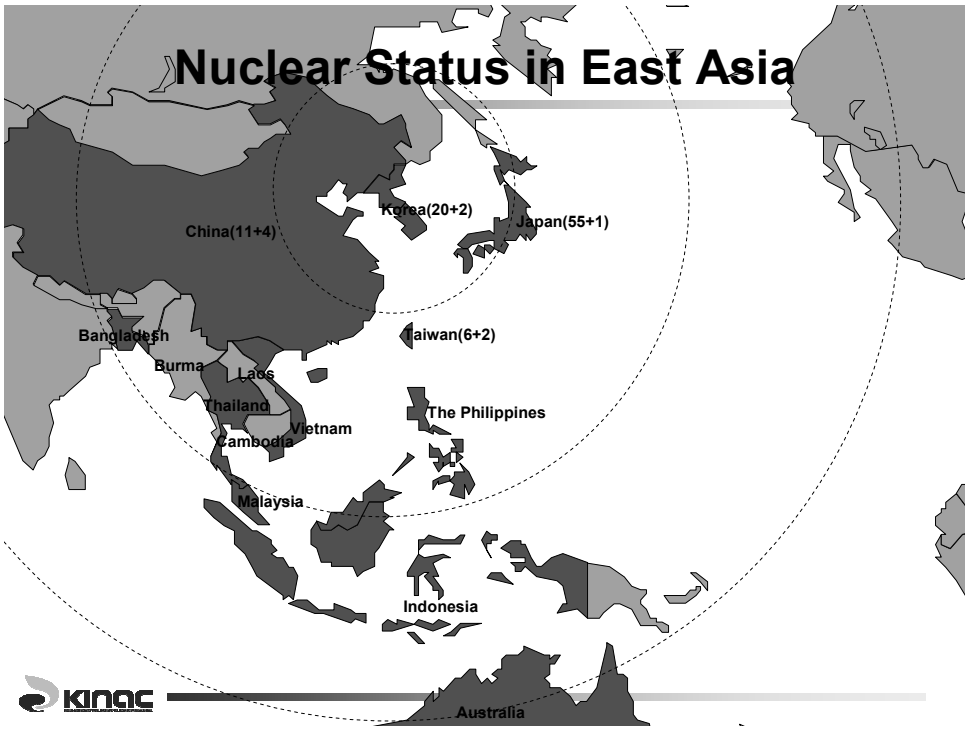
- IAEA Supremacy on Information Gathering
  - Comprehensive Safeguards
  - Additional Protocol
  - Open Source
  - State Evaluation and Drawing Broader Safeguards Conclusion
  - Integrated Safeguards
- Such information must remain unknown to other States, in keeping with IAEA's obligation to respect the confidentiality of State supplied information.
- Information Asymmetry between IAEA and States

KINAC

Regional Transparency

- Regional transparency are considered vital in preventing or reducing cross-border tensions and proliferation threats and promoting mutual concerns, arising from nuclear activities.
- Transparency can be achieved among states concerned through adopting a sustainable approach of voluntary information sharing.
- Regional transparency in the Asia-Pacific is in early stage.
- Transparency between regional states needs boost while safeguards is on the right track

KINAC



KINAC

Regional Cooperation Concepts in East Asia

- ASIATOM (Asian Atomic Energy Community)
- PACATOM (Pacific Atomic Energy Community)
- PACIFICATOM (Pacific Atomic Energy Community)
- EARC (East Asian Regional Compact for the Peaceful Use of Nuclear Energy)
- APOPUNE (Asia-Pacific Organization for the Peaceful Use of Nuclear Energy)
- ENTNEA (Enhancing Nuclear Transparency for Concept Building in Northeast Asia)
- ANREC (Asia Nonproliferation Research Center)
- TECATOM (Technical Atomic Energy Community in East Asia and the Pacific)
- APSA (Asia-Pacific Safeguards Association)

KINAC

Transparency in East Asia

- Heavy Reliance on Nuclear Energy, however, Little Progress in Structured Approach to Transparency.
- Politically, Culturally, Technically Different Backgrounds in Region
- Nuclear Disparity
- No Workability of Some Concepts

KINAC

Asia-Pacific Safeguards Association

- Australia Leads
- ESARDA (European Safeguards Research and Development Association) type
- Regional Association of Safeguards Professional
- First Meeting on June 26-27, Sydney
- Very Early Discussion Stage
- Issues : Scope, Activities, Structure, Funding

KINAC

Technology Based Transparency

- TECATOM : Technical Atomic Energy Community in East Asia
  - An Technology Based Regional Cooperation
  - Higher Level of Transparency
  - Low Intrusiveness
  - Continuous Transparent
  - Relatively Low Cost
- Technologies : Remote Monitoring, VPN and Mailbox.
  - Remote Monitoring transmits (Near) Real-time Images of Nuclear Activities
  - Mailbox provides Regular Declarations
  - IAEA Safeguards Verification Technology
    - Application of Relaxed Criteria based on Voluntary Provision
  - Experience of Korea, Japan and US

KINAC

Regional Efforts

- Korea, Japan and US have worked for last 10 years
- Very Slow Progress for Negotiations

- Korea-US Frame
  - Between KINAC & ACPF of KAERI, Korea and SNL & TREAT of INL, US
  - Remote Monitoring / Virtual Private Network

- Japan-US Frame
  - Between JAEA/JOYO, Japan and SNL, US
  - Remote Monitoring / Virtual Private Network

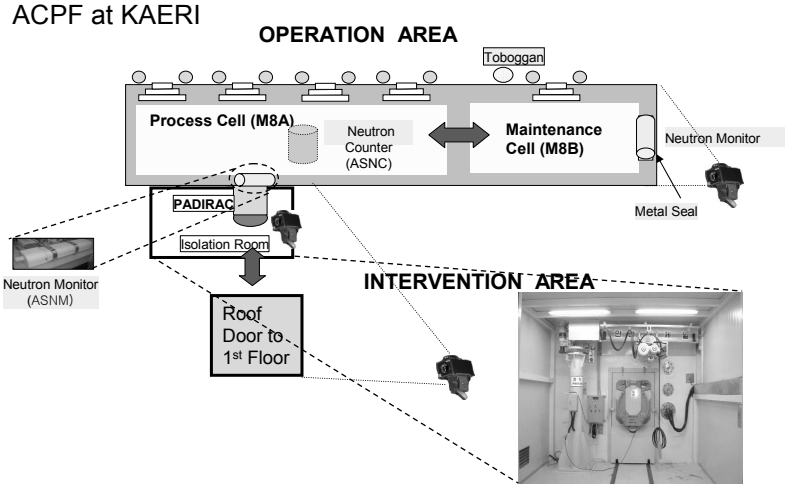
- Korea-Japan Frame
  - Between KINAC, ACPF of KAERI and JAEA, JOYO, Japan
  - Under Negotiation for Exchanging Camera Images

- IAEA Involvement as Observer

KINAC

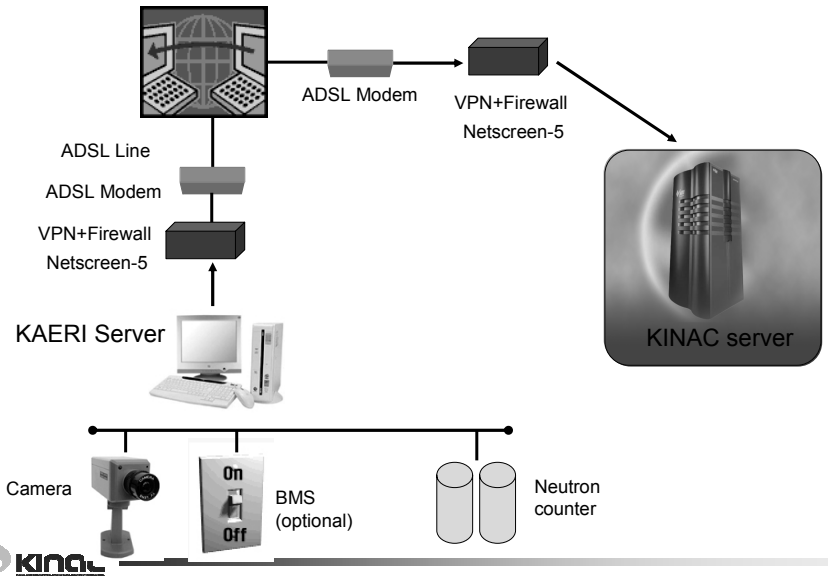
Korean Application

ACPF at KAERI

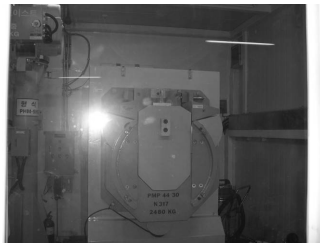


KINAC

Network Configuration

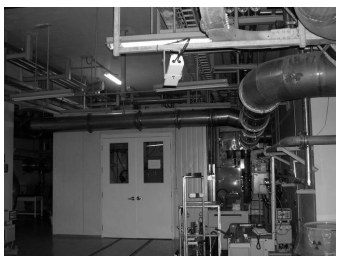


Camera Images



Isolation Room

Maintenance room



Door to 1st Floor

KINAC Servers

- Two servers are physically separated :
  IP separation, VPN separation

Safeguards RM Server

TECATOM Server

KINAC

Nuclear Renaissance

- ❑ High fossil energy price and CO_2 emission
- ❑ High expectation on nuclear energy and R/D
- ❑ GIF and INPRO
  - New reactors and processes under development
- ❑ GNEP, MNA, INFC
  - International fuel supply, spent fuel management
- ❑ Strong emphasis on nonproliferation and safeguards
  - Proliferation resistance and physical protection
- ❑ Need more supports from the public and other sectors
- ❑ Systematic approach of transparency to make the most of nuclear renaissance is essential – “built-in” approach

KINAC

What is Built-in

KINAC

Built-in Transparency Approach

- ❑ Comprehensive transparency approach to maximize rare chance of nuclear renaissance
- ❑ To develop transparency approach
- ❑ To design transparency features in conceptual stage
- ❑ To harmonize transparency with facilities
  - Inseparable elements
- ❑ To determine transparency openness level depending on target
  - The general public, NGOs, Professionals, States, International Organizations
- ❑ Joint approach with safeguards at design stage

KINAC

Summary

- ❑ Nuclear renaissance is a rare chance to nuclear sector.
- ❑ Regional transparency is vital to nuclear renaissance
- ❑ Major nuclear countries in the region should play a role in enhancement of transparency.
- ❑ Technology based transparency is an effective and consistent form to regional transparency.
- ❑ Built-in approach can make transparency comprehensive and competitive to get more support
- ❑ Joint approach in transparency and safeguards is synergic.

KINAC

4.3 Perspectives on Transparency and Nuclear Energy Development in Indonesia

HS Karyono

Badan Tensaga Nuklir Nasional, Indonesia

Abstract

The main objective of Nuclear Energy Program in Indonesia is the operation of first NPP in Java-Bali Grid System of a twin 1000 MWe each, respectively in the year 2016-2017 and 2023-2024, by using open cycle fuel management option. The construction is planned to be done in the year 2010-2011. It is supported by the preparation activities consist of 14 items that are divided by 8 and 6 items respectively as the government and owner of NPP responsibilities. The Presidential Decree that is required to establish a team for formulating the ownership and the relevant policy of NPP program, as the most important thing, is still being processed. With regard to that the public information and education / socialization are the most important activities to be prioritized presently.

Based on the National legal hierarchy, Basic principle of NST, Vision and Mission on NST, and Indonesian Status to the International Nuclear Agreements, Indonesia complies with the NPT and the IAEA safeguards system consists of the Comprehensive Safeguards Agreement and the Additional Protocols. Integrated Safeguards are being implemented as stated in the Statement of the Director General of IAEA to the forty seventh Regular Session of the IAEA General Conference, in Vienna 15 September 2003. The Conclusion of Integrated Safeguards was based on: (1) Correctness and Completeness of Safeguards Reports and Additional Protocol Declarations; (2) No diversion of NM uses (only for peaceful purposes); (3) No undeclared NM in the country; (4) No clandestine (undeclared) nuclear activities.

The principle criteria of perspective on transparency are: (1) in accordance with 4 rd paragraph of the Indonesian Constitution Preamble which stated to promote actively world peaceful purposes, the human right, anti colonialism, national independency and people welfare; (2) in harmony with the IAEA integrated safeguard system; (3) non-contradictory to the NPT and non-discriminatory; (4) sides with all peaceful purposes and against any human / mankind destruction. It is shown enough through her membership in IAEA, NPT (1978), BWC (1992), CWC (1998) and ratification of Comprehensive Safeguards and Additional Protocol; (5) supports the Treaty on the Southeast Asia Nuclear Weapon-Free Zone, and any international efforts for non-proliferation and disarmament based on core principle of multilateralism and lawful manner in the international laws; (6) supports the right of the parties to the treaty to undertake the R&D of the NST for peaceful purposes and to fulfill IAEA Integrated Safeguards Agreements and NPT; (7) developing countries parties to the treaty that have already implemented consequently the Integrated Safeguards should be given the international assurance to access the long-term NFCS for their NPP in timely manner.

Furthermore the transparency should be performed fairly in a common sense without any interference with sovereignty of each other. In relation to the nuclear fuel cycle services the optimum option of cooperation is the multilateral scheme under IAEA system, and/or a possible bilateral agreement under a mutual interdependency and non-discriminatory schemes that are acceptable for both sides that have already implemented consequently and consistently the Integrated Safeguards system.

Nuclear Fuel Cycle

Perspectives on Transparency from Emerging East Asia Nuclear Energy Countries

Presented by
KARYONO HS.

Workshop on Transparency Technology for Nonproliferation Cooperation in the Asia Pacific Tokyo, Japan 20-22 February 2008 Co-Sponsored by JAEA/NPSTC and the University of Tokyo GLOBAL-COE

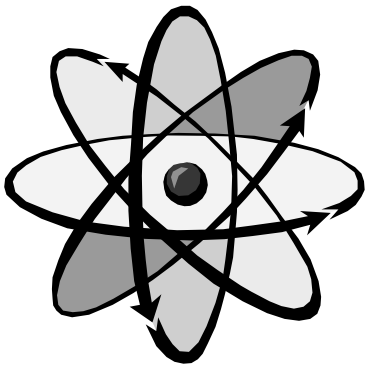
National legal hierarchy

- 1st level
  The 1945 Constitution of The Republic of Indonesia
- 2nd level
  Act Number 10 Year 1997 on Nuclear Energy
- 3rd level
  Government Regulation, such as Licensing of Nuclear Reactor, Nuclear Security and Emergency Preparedness.
- 4th level
  Guidance for the Application & Development of Nuclear Energy System in Indonesia

Nuclear Science and Technology Policy

BASIC PRINCIPLES

- NUCLEAR SCIENCE AND TECHNOLOGY FOR PEACEFUL USES ONLY
- SAFETY IS OUR PRIME CONSIDERATION
- DEMAND DRIVEN AND STAKEHOLDER SATISFACTION



NATIONAL NUCLEAR ENERGY AGENCY

VISION

Nuclear science and technology with reliable safety
to actuate and accelerate people's welfare

MISION

- R & D of nuclear science and technology with reliable safety for energy and non-energy industries,
- Dissemination of proven result of R & D in nuclear science and technology, and
- Quality management for user/ stakeholder satisfaction

NATIONAL NUCLEAR ENERGY AGENCY

Indonesian Status to the International Nuclear Agreements

No	INTERNATIONAL NUCLEAR TREATY AND CONVENTION	STATUS
1.	▪Non-Proliferation Treaty (NPT) ▪Safeguard Agreement with IAEA ▪Additional Protocol to Safeguards	▪Ratified : UU No.8 / 1978 ▪Signed (Valid) ▪Signed (Valid)
2.	Convention on Physical Protection of Nuclear Material and its Amendment	Ratified : President Decree No.49 / 1986
3.	Convention on Early Notification of a Nuclear Accident	Ratified : President Decree No.81 / 1993
4.	Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	Ratified : President Decree No.82 / 1993
5.	Treaty on the South East Asia Nuclear Weapon Free Zone	Ratified : UU No.9 / 1997
6.	Convention on Nuclear Safety	Ratified : President Decree No.106 / 2001
7.	Comprehensive Nuclear Test-Ban Treaty (CTBT)	In the process for Ratification
8.	Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management	Signed (1997)
9.	Protocol to Amend the Vienna Convention	Signed (1997)
10.	Supplementary Compensation for Nuclear Damage	Signed (1997)
11.	Bilateral Cooperation and Supply Agreement (s)	Signed (1997)

- Indonesia complies with the NPT and the IAEA safeguards system consists of the Comprehensive Safeguards Agreement and the Additional Protocols.
- It is shown in the Statement of the Director General of IAEA to the forty seventh Regular Session of the IAEA General Conference, in Vienna 15 September 2003:

  "..... We also continue to develop and improve our technological capability to detect undeclared nuclear materials and activities. At this point, ***Integrated Safeguards*** *are being implemented in three States: Australia,* ***Indonesia*** *and Norway....."*

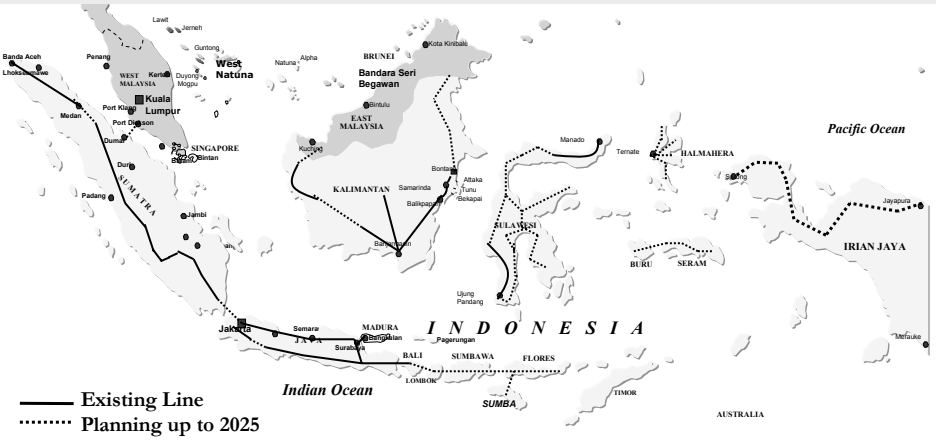
Conclusion of Integrated Safeguards was based on:

- Correctness and Completeness of Safeguards Reports and Additional Protocol Declarations
- No diversion of NM uses (only for peaceful purposes)
- No undeclared NM in the country
- No clandestine (undeclared) nuclear activities

Main Objectives of Nuclear Energy Program

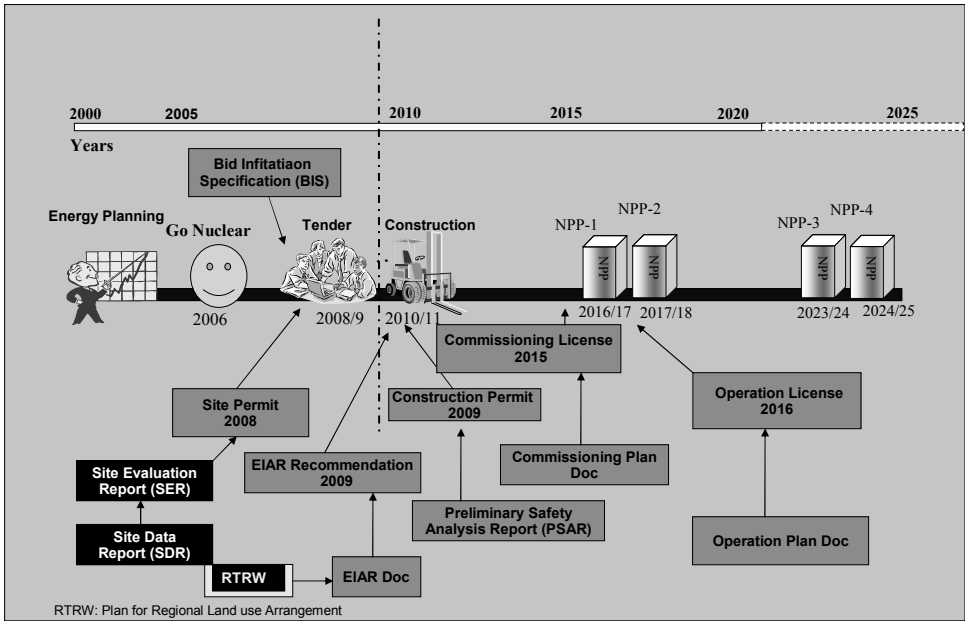
Operation of first NPP in Java-Bali Grid System in the year 2016-2017

NPP option for Java-Madura-Bali Grid System of National Transmission Network



NATIONAL NUCLEAR ENERGY AGENCY

Tentative Schedule for NPP



Policy *Option* on NFCS

- Uranium Processing and Conversion Services
  - Purchase from diversified producer countries
  - Produce domestically according to the optimum amount of the U deposit in the country
- Uranium Enrichment Services
  - Purchase from diversified producer countries
- Nuclear Fuel Fabrication Services
  - First loading from diversified producer countries
  - Leasing and / or longterm contract
  - Step wisely produced domestically based on economic justification
- Spent Fuel Storage Services
  - Store in the plant
  - Away from reactor, centralized facility
- Radioactive Wastes Services
  - Processed and managed in the plant (centralized facility)

NATIONAL NUCLEAR ENERGY AGENCY

High Level Radioactive Waste Management Options

- Option 1 - Open Cycle : Interim Storage step to Final Disposal
- Option 2 - Re-exporting the Spent Nuclear Fuels through the International Cooperation

NATIONAL NUCLEAR ENERGY AGENCY

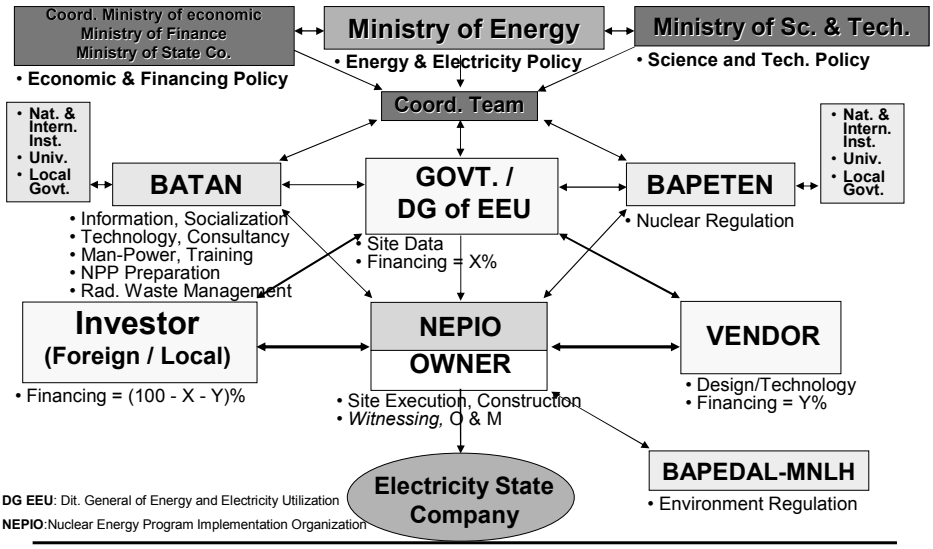
Government, Owner, and Utilities Activities*

- The latest study for National energy planning with nuclear option 2001-2002
- Socialization/public information, education, and community development 2003-2017
- Government decision and consultation with Parliament 2004 - 2008
- Up-dating of the site related data for site permit 2004-2008
- Nuclear site permit 2009
- Preparation of the regulation and licensing 2004-2008
- ***Ownership establishment, utility of the plant 2008-2009***
- Preparation of UCD, BIS and PSAR draft 2006-2008
- Bidding, negotiation and contractual process 2009-2010
- Engineering and design 2011-2013
- Licensing process for sitting, construction, commissioning and commercial operation (including "AMDAL/EIAR") 2009-2016
- Procurement of materials and services 2010-2018
- Construction 2011/12-2017/18
- Commissioning and commercial operation 2017/18-2019

* Based on Nuclear Act No 10 Year 1997 ❖ By Government ❖ By Owner, Utilities

NATIONAL NUCLEAR ENERGY AGENCY

NPP Organization Scheme (preliminary tentative option)



NATIONAL NUCLEAR ENERGY AGENCY

A Presidential Decree is required to establish a team for formulating the ownership of NPP and the relevant policy

The National Nuclear Energy Agency as a R & D institute has the task to prepare all relevant and important aspects to the NPP program such as site location, public information and education/ socialization, etc. as the government incentive

The principle criteria of the perspective on transparency

- in accordance with 4rd Paragraph of the Indonesian Constitution Preamble which stated *to promote actively world peaceful purposes, the human right, anti colonialism, national independency and people welfare*
- in harmony with the IAEA system: multilateral, and integrated safeguard system consisted of comprehensive safeguard agreement and additional protocol
- non-contradictory to the NPT and non-discriminatory

- sides with all peaceful purposes and against any human /mankind destruction. It is shown enough through her membership in IAEA, NPT (1978), BWC (1992), CWC (1998) and ratification of Comprehensive Safeguards and Additional Protocol.
- supports the Treaty on the Southeast Asia Nuclear Weapon-Free Zone, and any international efforts for non-proliferation and disarmament based on core principle of multilateralism and lawful manner in the international laws.

- supports the right of the parties to the treaty to undertake the R & D of the NST for peaceful purposes and to fulfill IAEA Integrated Safeguards Agreements and NPT.
- developing countries parties to the treaty that have already implemented consequently the *Integrated Safeguards* should be given the international assurance to access the long-term NFCS for their NPP in timely manner.

The main challenges of transparency

- how to implement fully and universally the transparency by all parties having different level of technology
- how to perform a common sense without any discriminatory and/or interference with *sovereignty of* each other
- how to implement fairly the Three Pillars of the NPT: Non-proliferation, Disarmament, and Peaceful Uses of Nuclear Energy (PUNE)

- in relation to the NFCS, in the normal condition the demand of the NFCS could be easily provided from both foreign market as well as from domestic self capabilities of certain countries.
- Base on the techno-economical justification, the development of a domestic NFCS facility will be only feasible when many NPPs with a big enough capacity have been already operating since long term period. For this reason, it would be more optimum to fulfil their demand from the foreign suppliers with a conducive condition for both sides.

The optimum cooperation might be performed through alternatives option

- to establish a favorable conditions of cooperation that acceptable for both the supplier states and the nuclear emerging states
- a possible bilateral agreement between fuel supplier and user countries under a mutual interdependency scheme of a MOU of both sides
- an option for establishment of a multinational nuclear fuel cycle facilities in the region, that is substantially stated in The Director General of IAEA's Expert Group report

NATIONAL NUCLEAR ENERGY AGENCY

Conclusion

- The Presidential Decree that is required to establish the ownership of NPP and the relevant policy is being processed. Public information and education/ socialization are still the most crucial activities to be prioritized presently
- Indonesia complies with the NPT and the IAEA integrated safeguards, and transparency for nonproliferation. The transparency should be performed fairly in a common sense without any discriminatory and/or interference with sovereignty of each other
- The optimum option of cooperation in the nuclear fuel cycle services is the multilateral scheme under IAEA system, and / or a possible bilateral agreement under a mutual interdependency and non-discriminatory schemes that are acceptable for both sides, fuel supplier and recipient countries that have already implemented consequently the Integrated Safeguards system

NATIONAL NUCLEAR ENERGY AGENCY

THANK YOU VERY MUCH

NATIONAL NUCLEAR ENERGY AGENCY

4.4 Strengthening Nonproliferation Transparency and Building Regional Cooperation in the Asia Pacific

LE Doan Phac

Vietnam Atomic Energy Commission

Abstract

Viet Nam is launching a comprehensive nuclear program, including nuclear infrastructure development, enhancement of capabilities on research, development and application of nuclear energy, especially, introduction of nuclear power into the country with the target that the first nuclear power plan will be put into commercial operation in 2020 with capacity of from 1,000 MW -2,000 MW and the total nuclear power capacity will be increased to 10,000 MW by the year 2030.

Viet Nam attaches great importance to the nuclear nonproliferation in promoting the research, development and peaceful, safe, and secure uses of nuclear energy.

From becoming a Member State of the IAEA in 1978, Viet Nam always fulfills its commitments and obligations in nonproliferation transparency and considers it as a factor ensuring the successful implementation of nuclear development program in Viet Nam.

1. Vietnam Atomic Energy Commission (VAEC)

In Viet Nam, the Ministry of Science and Technology (MOST) is a State Management Body on the fields of nuclear energy and radiation protection & nuclear safety. MOST has two organizations: Vietnam Atomic Energy Commission (VAEC), and Viet Nam Agency for Radiation and Nuclear Safety & Control (VARANSAC), which assist Minister of the MOST to carry out the functions and duties on State management.

The VAEC's Main Functions and Duties

1) Conduct fundamental and applied research on nuclear science and engineering, nuclear reactor technology, nuclear fuel and material, radiation protection and nuclear safety, and radioactive waste management technology in service of economic development of the country;

2) Develop technology, production and technical services in atomic energy and related fields in service of social and economic development;

3) Study and formulate directions, strategies, planning and plans for atomic energy development in Viet Nam, participate in the formulation of law projects and regulatory documents in relation to atomic energy, and in the implementation of nuclear policies approved by the Government;

4) Perform international co-operation in the field of atomic energy, and participate in the implementation of international treaties pledged by Viet Nam;

5) Provide technical support to the State management body on radiation protection and nuclear safety in the appraisal of radiation protection and nuclear safety, carry out radioactive environment monitoring, calibrate radiation and nuclear facilities, develop technical infrastructure in the preparedness and response to radiological and nuclear incidents and accidents; and

6) Participate in the planning and training of scientific and technical professionals in the field of atomic energy.

The VAEC's Organization:

Under the VAEC, there are following subsidiary bodies:

1) Da Lat Nuclear Research Institute (DNRI);
2) Institute for Nuclear Science and Technology (INST) in Ha Noi;
3) Institute for Technology of Radioactive and Rare Elements (ITRRE) in Ha Noi;
4) Center for Nuclear Techniques in Ho Chi Minh City (CNT);
5) Research and Development Center for Radiation Technology (VINAGAMMA) in Ho Chi Minh City;
6) Center for Application of Nuclear Techniques in Industry (CANTI) in Da Lat;
7) Ha Noi Irradiation Center (HIC); and
8) Technology Application and Development Company (NEAD) in Ha Noi.

2. Safeguards Implementation at VAEC

At present, under the Safeguards Agreement, VAEC has to declare to the IAEA the following:

1) Nuclear Research Reactor at DNRI. The reactor is IVV-9 type with solid heterogeneous, swimming pool, fuel 36% and 19.75% enriched uranium, light water moderated, light water cooled, graphite and beryllium reflected.

   Every year, the IAEA safeguards inspectors conduct a routine inspection (one time per year) at DNRI to review DNRR's reports and declarations and to conduct on-site inspection. Up to date, they have not taken any environmental sample. The reports (DIQs, ICRs, MBRs, PILs) are submitted to the IAEA in papers and electronic files.

2) Location Outside Facility (LOF): declarations to the IAEA some nuclear materials at Institute for Nuclear Science and Technology (INST) and Institute for Technology of Radioactive and Rare Elements (ITRRE).

In addition to fulfillment of its safeguards obligations, VAEC has been conducting activities of a Technical Support Organization (TSO), participating in the formulation of atomic energy law, and in the studies on the nuclear policies, including nonproliferation.

3. VAEC's International Cooperation in Nonproliferation and Nuclear Security

Cooperation with IAEA

Before November 2007, VAEC is the Viet Nam's national contact point for safeguards implementation. At present, this task was transferred to VARANSAC.

Under the assistance of the IAEA, VAEC hosted many workshops, seminars, and training course in safeguards, AP, CTBT, some conventions, nuclear safety and security, and nuclear law.

HEU to LEU fuel Conversion for DNRR

In September 2007, under the contracts with IAEA, USA and Russian Federation, Viet Nam has successfully accomplished a part fuel conversion of DNRR from HEU to LEU, in which 35 WWR-M2 HEU fuel assemblies (36%) have been returned to the RF and replaced by 36 WWR-M2 LEU fuel assemblies (19.7%) manufactured and supplied by the Russian TVEL Company.

Cooperation with USDOE/NNSA under framework of Sister Laboratory Program

August 2007, on behalf of MOST, VAEC signed "Arrangement between the Department of Energy of the United States of America and the Ministry of Science and Technology of the Socialist Republic of Viet Nam for Information Exchange and Cooperation in the Peaceful Uses of Nuclear Energy."

This Arrangement is concluded within the framework of USDOE/NNSA Sister Laboratory Program, which mission is to promote peaceful application of nuclear technology with developing member nations of the Treaty on Nonproliferation of Nuclear Weapons (NPT).

At present VAEC and International Nuclear Safeguards and Engagement Program (INSEP) managed by the Global Security Engagement and Cooperation Office (DOE/NNSA/NA-242) are planning to implement four (4) Action Sheets in the following fields:

- Technical assistance in radiation protection and health physics;
- Technical assistance in research reactor operations and utilization;
- Technical assistance in environmental radiological surveillance; and
- Technical assistance in low- and intermediate- level radioactive waste management.

Cooperation with USDOE/NNSA in Upgrading DNRR Physical Protection System (PPS)

From 2006, VAEC and USDOE/NNSA agreed to implement a USDOE/NNSA granted project on upgrading DNRR Physical Protection System. Under the project, the NNSA provides DNRR with experts, training and equipment aimed at enhancing the DNRR security.

Cooperation with Japanese Organizations

VAEC has close cooperation with many nuclear related organizations of Japan, such as Japan Atomic Industrial Forum (JAIF), Japan Atomic Energy Agency (JAEA), Nuclear Safety Research Association (NRSA), Japan Electric Power Information Center (JEPIC), Japan Nuclear Energy Safety Organization (JNES), Toshiba, Hitachi, Mitsubishi Heavy Industry (MHI)...

Regarding nuclear regulatory laws and Treaties, VAEC has conducted a cooperation program with JEPIC during period 2001-2005, and from 2006 to now, a new cooperation program with JNES has been being implementing.

Cooperation with France

VAEC signed with French Atomic Energy Commission (CEA) "The Cooperation Agreement on the Peaceful Application of Nuclear Technology" and Institute for Radiological Protection and Nuclear safety (IRSN) "Agreement for Cooperation in Radiation Protection and Nuclear Safety". The cooperative activities have been being carried out in many fields, including nuclear regulatory law and international instruments.

In addition, MOST/VARANSAC has been conducting many cooperative activities with the IAEA, USA, Japan, Australia, and France in the fields of nuclear securities and nonproliferation.

4. Strengthening Nonproliferation Transparency and Building Regional Cooperation in the Asia Pacific

On the 3rd January 2006, the Prime Minister of Viet Nam approved the Strategy for Peaceful Uses of Atomic Energy up to 2020. The strategy determines the objectives and tasks of atomic energy development in Viet Nam on both non-power and power applications.

The Strategy affirms that:

- Viet Nam's consistent policy on the use of atomic energy is for peaceful purposes and socio-economic development.

- The performing of international cooperation in the field of atomic energy aims to build international community confidence, to implementation of all international treaties and agreements that Viet Nam are signatories, and to actively study for accession to the other nuclear treaties and conventions...

Draft Atomic Energy Law, which was submitted to the National Assembly on November 2007 and will be enacted at the National Assembly Session on May 2008, includes the provisions on:

- Implementation of laws and international treaties (provision 4);

- Activities in the atomic energy fields in Viet Nam are conducted for peaceful purposes and served socio-economic development (provision 6);

- Safeguards and nuclear inspection activities (provision 96).

As a Party to the NPT, Viet Nam recognizes the need and importance of fulfillment of international nonproliferation obligation as well as safeguards agreement with the IAEA. As suggested in the IAEA publication *Milestone in the Development of a National Infrastructure for Nuclear Power (IAEA Nuclear Energy Series No.NG-G-3.1)*, Viet Nam is considering the implementation of the following factors:

- Cooperation between the State, facility operator and IAEA in safeguards implementation;
- Adequacy of the SSAC in relation to IAEA requirements for accounting for and control of nuclear material;
- Capacity of the IAEA to independently verify the completeness and correctness of Viet Nam's declaration, which has been reported in accordance with its safeguards agreement.

Viet Nam already signed the Treaty on the Non-Proliferation of Nuclear Weapons (1982), the Nuclear Safeguards Agreement (1989), the South East Asian Nuclear-Weapon-Free-Zone Treaty (1996).

Recently, Viet Nam ratified the Comprehensive Nuclear Test Ban Treaty (on 25 February 2006), wrote the Director General to express its supports for the Code of Conduct on the Safety and Security of Radioactive Sources, and supplementary Guidance on the Import and Export of Radioactive Sources, and is actively in the process of formulation and issuance of necessary regulations in order to be able to follow the Code and the Guidance, and signed with the IAEA the Additional Protocol (on 15 August 2007).

In order to meet nonproliferation requirements for nuclear power development Viet Nam needs to develop legal, technical infrastructure and manpower and to enhance international cooperation with the IAEA and other countries, especially, the countries in the region.

Under the NPT regime, in addition to the application of traditional safeguards approaches, Viet Nam supports the efforts in developing non-traditional approaches that promote regional understanding, cooperation, and confidence building. As its part, VAEC is ready to participate in activities and expert groups to explore, discuss, create, and share ideas on transparency technology, remote monitoring, secure communications, and confidence building measures (CBMs) as applied to regional nonproliferation cooperation.

Workshop on Transparency Technology for Nonproliferation Cooperation in the Asia Pacific

University of Tokyo, Japan, 20-22 February 2008

Strengthening Nonproliferation Transparency and Building Regional Cooperation in the Asia Pacific

Mr. LE Doan Phac
Director of International Cooperation
Vietnam Atomic Energy Commission (VAEC)

Contents

1. General Information.
2. Safeguards Implementation at VAEC.
3. VAEC's International Cooperation in Nonproliferation and Nuclear Security.
4. Strengthening Nonproliferation Transparency and Building Regional Cooperation.

1. General Information

Nuclear Related Organizations

- Ministry of Science and Technology
- Ministry of Industry and Trade (including subsidiary bodies: Electricity of Vietnam (EVN) and Institute of Energy (IE)) is assigned to conduct Pre-FS and FS for NPP Construction in Viet Nam;
- Ministry of Health, Ministry of Agriculture and Rural Development: application of nuclear techniques and radiation
- Ministry of Natural Resources and Environment: management and control of environmental radioactivity;
- Ministry of Education and Training: manpower preparation;
- Ministry of Defence and Ministry of Public Security: ensure defence and security of nuclear facilities, materials and nuclear power plants in futures, nuclear emergency preparedness...
- Ministry of foreign Affairs, Ministry of Justice: foreign policies, treaties,...
- Vietnam Academy of Science and Technology: Fundamental and applied researches on nuclear energy.

Ministry of Science and Technology (MOST)

- The Ministry of Science and Technology (MOST) is a State Management Body on the fields of nuclear energy and radiation protection & nuclear safety.
- Under the MOST are *Vietnam Atomic Energy Commission (VAEC);* and *Vietnam Agency for Radiation and Nuclear Safety & Control (VARANSAC).*
- In addition, there are *64 Department of Science and Technology (DOST)* in the 64 cities and provinces. DOTs are responsible for provincial management activities on radiation protection and reports regularly to MOST via VARANSAC.

Functions and Duties of the VAEC

- Conduct fundamental and applied research on nuclear science and engineering, nuclear reactor technology, nuclear fuel and material, radiation protection and nuclear safety, and radioactive waste management technology in service of economic development of the country;
- Develop technology, production and technical services in atomic energy and related fields in service of social and economic development;
- ***Study and formulate directions, strategies, planning and plans for atomic energy development in Viet Nam, participate in the formulation of law projects and regulatory documents in relation to atomic energy, and in the implementation of nuclear policies approved by the Government;***

Functions and Duties of the VAEC (Cont'd)

- ***Perform international cooperation in the filed of atomic energy, and participate in the implementation of international treaties pledged by Viet Nam;***
- Provide technical support to the State management body on radiation protection and nuclear safety in the appraisal of radiation protection and nuclear safety, carry out radioactive environment monitoring, calibrate radiation facilities and dosimeters, develop technical infrastructures in the preparedness and response to radiological and nuclear incidents and accidents; and
- Participate in the planning and training of scientific and technical professionals in the field of atomic energy.

VAEC Subsidiary Bodies

1. Da Lat Nuclear Research Institute (DNRI);
2. Institute for Nuclear Science and Technology (INST) in Ha Noi;
3. Institute for Technology of Radioactive and Rare Elements (ITRRE) in Ha Noi;
4. Center for Nuclear Technique (CNT) in Ho Chi Minh City;
5. Research and Development Center for Radiation Technology (VINAGAMMA) in Ho Chi Minh City ;
6. Center for Application of Nuclear Techniques in Industry (CANTI) in Da Lat;
7. Ha Noi Irradiation Center (HIC); and
8. Technology Application and Development Company (NEAD) in Ha Noi.

2. Safeguards Implementation at VAEC

Safeguards Implementation VAEC

- Nuclear Research Reactor at DNRI: the reactor is IVV-9 type with solid heterogeneous, swimming pool, fuel 36% and 19.75% enriched uranium, light water moderated, light water cooled, graphite and beryllium reflected. Every year, the IAEA safeguards inspectors conduct a routine inspection (one time per year) at DNRI to review DNRR's reports and declarations and to conduct on-site inspection. Up to date, the IAEA inspectors have not ever conducted taking any environmental sample. The reports (DIQs, ICRs, MBRs, PILs) are submitted to the IAEA in papers and electronic files.
- Location Outside Facility (LOF): declarations to the IAEA some nuclear materials at Institute for Nuclear Science and Technology (INST) and Institute for Technology of Radioactive and Rare Elements (ITRRE).

3. VAEC's International Cooperation in Nonproliferation and Nuclear Security

VAEC's International Cooperation in Nonproliferation and Nuclear Security

Cooperation with IAEA

- Before November 2007, VAEC is the national contact point for safeguards implementation. At present, this task was transferred to VARANSAC. Under the assistance of the IAEA, VAEC hosted many workshops, seminars, and training course in safeguards, AP, CTBT, some conventions, nuclear safety and security, and nuclear law.

HEU to LEU fuel Conversion for DNRR

- In September 2007, under the contracts with IAEA, USA and RF, Viet Nam has successfully accomplished a part fuel conversion of DNRR from HEU to LEU, in which 35 WWR-M2 HEU fuel assemblies (36%) have been returned to the RF and replaced by 36 WWR-M2 LEU fuel assemblies (19.7%) manufactured and supplied by the Russian TVEL Company

VAEC's International Cooperation in Nonproliferation and Nuclear Security (cont'd)

Cooperation with USDOE / NNSA under Framework of Sister Laboratory Program

- August 2007, on behalf of MOST, VAEC signed "Arrangement between the Department of Energy of the United States of America and the Ministry of Science and Technology of the Socialist Republic of Viet Nam for Information Exchange and Cooperation in the Peaceful Uses of Nuclear Energy".
- This Arrangement is concluded within the framework of USDOE/NNSA Sister Laboratory Program, which mission is to promote peaceful application of nuclear technology with developing member nations of the Treaty on Nonproliferation of Nuclear Weapons (NPT).

VAEC's International Cooperation in Nonproliferation and Nuclear Security (cont'd)

- At present VAEC and International Nuclear Safeguards and Engagement Program (INSEP) managed by the Global Security Engagement and Cooperation Office (DOE/NNSA/NA-242) are planning to implement four (4) Action Sheets in the following fields: Radiation protection and health physic, Research reactor operations and utilization, Environmental radiological surveillance, Low and intermediate level radioactive waste management.

Cooperation with USDOE / NNSA in Upgrading DNRR Physical Protection System (PPS)

- From 2006, VAEC and USDOE/NNSA agreed to implement a USDOE/NNSA granted project on upgrading DNRR Physical Protection System. Under the project, the NNSA provides experts, training and equipment aimed at enhancing the DNRR security.

VAEC's International Cooperation in Nonproliferation and Nuclear Security (cont'd)

Cooperation with Japanese Organizations

- VAEC has close cooperation with many nuclear related organizations of Japan, such as Japan Atomic Industrial Forum (JAIF), Japan Atomic Energy Agency (JAEA), Nuclear Safety Research Association (NRSA), Japan Electric Power Information Center (JEPIC), Japan Nuclear Energy Safety Organization (JNES), Toshiba, Hitachi, Mitsubishi Heavy Industry (MHI)...
- Regarding nuclear regulatory laws and treaties, VAEC has conducted a cooperation program with JEPIC during period 2001-2005, and from 2006 to now, an another cooperation program with JNES has been being implemented.

VAEC's International Cooperation in Nonproliferation and Nuclear Security (cont'd)

Cooperation with France

- VAEC signed with French Atomic Energy Commission (CEA) "*The Cooperation Agreement on the Peaceful Application of Nuclear Technology*" and Institute for Radiological Protection and Nuclear Safety (IRSN) "*Agreement for Cooperation in Radiation Protection and Nuclear Safety*".
- The cooperative activities have been being carried out in many fields, including nuclear regulatory law and international instruments.
- In addition, **MOST / VARANSAC** has been conducting many cooperative activities with the IAEA, USA, Japan, Australia, and France in the fields of nuclear securities and nonproliferation.

4. Strengthening Nonproliferation Transparency and Building Regional Cooperation

Strengthening Nonproliferation Transparency and Building Regional Cooperation

- On the 3rd January 2006, the Prime Minister of Viet Nam approved the **"Strategy for Peaceful Uses of Atomic Energy up to 2020"**, which determines the objectives and tasks of atomic energy development in Viet Nam on both non-power and power applications. The Strategy affirms that:

  - Viet Nam's consistent policy on the use of atomic energy is for peaceful purposes and socio-economic development.

  - The performing of international cooperation in the field of atomic energy aims to build international community confidence, to implementation of all international treaties and agreements that Viet Nam are signatories, and to actively study for accession to the other nuclear treaties and conventions...

Strengthening Nonproliferation Transparency and Building Regional Cooperation (cont'd)

- Draft Atomic Energy Law, which was submitted to the National Assembly on November 2007 and will be enacted at the National Assembly Session on May 2008, regulates the peaceful uses of atomic energy; implementation of international nuclear treaties, including safeguards.
- Viet Nam is launching a comprehensive nuclear program, including nuclear infrastructure development, enhancement of capabilities on research, development and application of nuclear energy. In order meet national electricity demand, the first nuclear power plan will be put into commercial operation in 2020 with capacity of from 1,000 MW -2,000 MW and the total nuclear power capacity is expected increasing to 10,000 MW by 2030.

Strengthening Nonproliferation Transparency and Building Regional Cooperation (cont'd)

- Recognizing the need and importance of fulfillment of international nonproliferation obligation as well as safeguards agreement with the IAEA and referring to suggestion in the IAEA publication: ***Milestone in the Development of a National Infrastructure for Nuclear Power***, Viet Nam is considering the implementation of the following factors:

  - Cooperation between the State, facility operator and IAEA in safeguards implementation;

  - Adequacy of the SSAC in relation to IAEA requirements for accounting for and control of nuclear material;

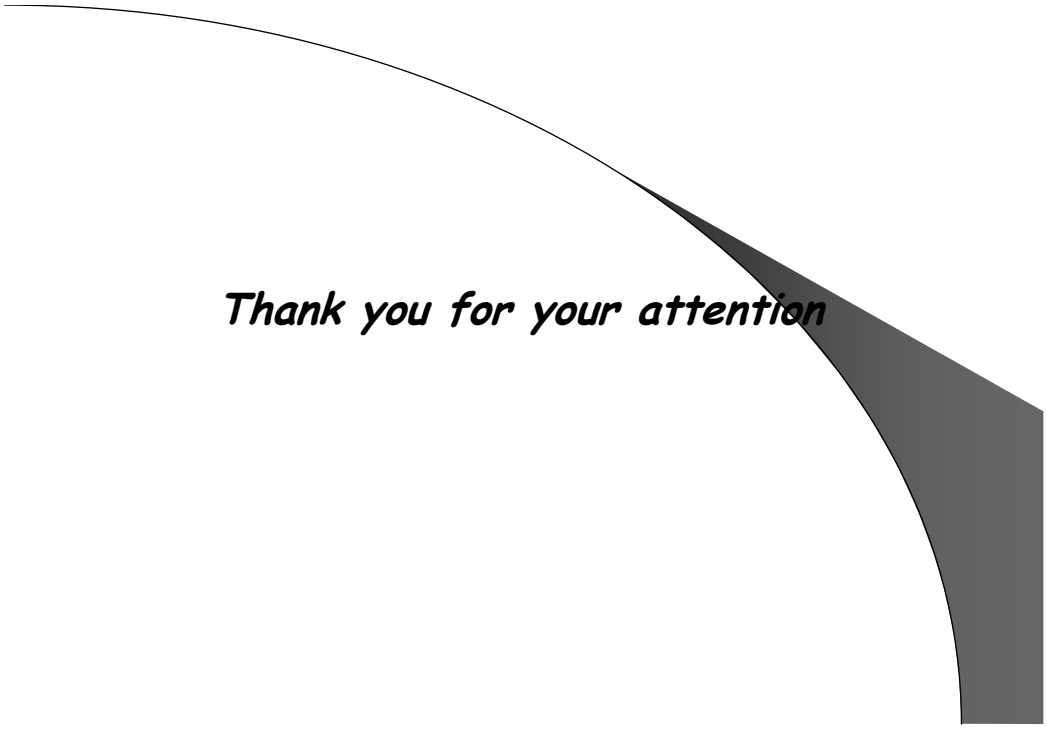
  - Capacity of the IAEA to independently verify the completeness and correctness of Viet Nam's declaration, which has been reported in accordance with its safeguards agreement.

Strengthening Nonproliferation Transparency and Building Regional Cooperation (cont'd)

- Viet Nam already signed the Treaty on the Non-Proliferation of Nuclear Weapons (1982), the Nuclear Safeguards Agreement (1989), the South East Asian Nuclear Weapon Free Zone Treaty (1996).
- 25 February 2006, Viet Nam ratified the Comprehensive Nuclear Test Ban Treaty (CTBT).
- August 2006, the MOST Minister wrote to the IAEA Director General its supports for the Code of Conduct on the Safety and Security of Radioactive Sources, and supplementary Guidance on the Import and Export of Radioactive Sources, and is in the process of formulation and issuance of necessary regulations in order to be able to follow the Code and the Guidance.
- 15 August 2007, Vietnam signed with the IAEA the Additional Protocol.

Strengthening Nonproliferation Transparency and Building Regional Cooperation (cont'd)

- In order to meet nonproliferation requirements for nuclear power development, Viet Nam needs to develop legal, technical infrastructure and manpower and to enhance international cooperation with the IAEA and other countries, especially, the countries in the region.
- Under the NPT regime, in addition to the application of traditional safeguards approaches, Viet Nam supports the efforts in developing non-traditional approaches that promote regional understanding, cooperation, and confidence building.
- As its part, VAEC is ready to participate in activities and expert groups to explore, discuss, create, and share ideas on transparency technology, remote monitoring, secure communications, and confidence building measures (CBMs) as applied to regional nonproliferation cooperation.


Thank you for your attention

4.5 Transparency and Openness

Stephan Bayer

Australian Safeguards and Non-Proliferation Office

(as delivered by Dr. David Betsill, JAEA)

Abstract

From the Conclusions page of Dr. Bayer's presentation:

"Openness and transparency is becoming an increasingly important factor to maintain, and at times, restore confidence in State compliance with regard to nuclear activities.

All States and the IAEA will face the challenge to move beyond strict legal compliance, toward agreed international norms of openness and transparency while maintaining sovereignty and efficiency in the application safeguards."

Australian Government
Australian Safeguards and Non-Proliferation Office

Transparency and Openness

Presented by David Betsill, JAEA

Dr Stephan Bayer
Australian Safeguards and Non-Proliferation Office
Transparency Technology Workshop on Nonproliferation Cooperation
in the Asia Pacific 20-22 February 2008 Tokyo

Acknowledgements

Transparency and Openness: Roles and Limitations in the Nuclear Verification System, James Larrimore, Myron Kratzer, John Carlson, and Bruce Moran, JNMM, Volume XXXV No. 1

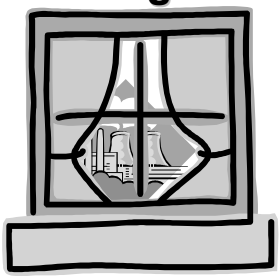
Developments in the International Safeguards System and the Implications for National Nuclear Programs, John Carlson, Seminar on the Role of International Legal Framework on Nuclear Peaceful Uses in Supporting the Indonesian Power Plant Program, Bali, 6 June 2007

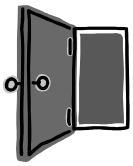
Background

- Nuclear Energy gaining increased interest worldwide
- Must ensure any expansion does not lead to further proliferation
- Non-proliferation regime comprises much more than traditional nuclear safeguards
- Move from correctness of declared activities to also gain confidence in completeness of declared activities
- Requires Cooperation, Openness and Transparency

Transparency and Openness in Safeguards

Transparency = the **availability** of **information** that a state that allows others to see more clearly State activities and capabilities





Openness = the **provision** of information and **access** (to the IAEA)

Openness is a subset of Transparency

Why Transparency and Openness (O&T)

- The Additional Protocol is the contemporary standard for NPT safeguards
- IAEA must draw conclusions on the absence of undeclared activities
  - Cannot rely only on predicable and mechanistic procedures
  - Safeguards conclusions necessarily become more qualitative
  - O&T assumes greater importance
- O&T helps restore confidence
- The legal minimum is not enough

Limitations

- An assessment by others. A Perceived virtue
- Cannot achieve transparency simply by proclaiming it
- Transparency ≠ completeness and accuracy.
  - Must take into account all modern states maintain elaborate systems to protect information important to national security
- Transparency is **not a substitute** for **compliance** with the **explicit obligations** of safeguards agreements.

Transparency and the IAEA

- Used by IAEA to draw safeguards conclusions about a state. Look at:
  - Compliance with its safeguards obligations
  - Cooperation with the agency
  - Consistency of all-source information with State Declarations
  - Challenge to develop sufficiently rigorous method to test transparency
- Also…
  - The IAEA could display more transparency by informing states in considerable detail of the measures that the agency has implemented in arriving at its findings.

Transparency and States

- States make a broader assessment of transparency from:
  - information it obtains independently
  - reports by the agency
  - open sources of information
  - confidence-building measures

Confidence Building Measures

Include:

- Voluntary actions by a state and additional openness of the state to the agency
- Actions by a state that go beyond the obligations of safeguards and non-proliferation agreements.
- Are welcome and potentially important when a restoration of confidence is necessary
- But should not undermine obligations
- Cant take backward then forward steps

Potential Mechanisms

- Wider publication of state's nuclear programs
- Collaborative research
- Privatisation, globalisation of nuclear activities
- Multilateral fuel cycle centres
- Conduct collaborative safeguards activities regionally or bilaterally
  - Eg ABACC

Who for?

All States can undertake transparency and openness activities:

- NWS/ Voluntary offers
  - Joint research activities
  - Voluntary reporting scheme
- Additional Protocol States
  - Publish IAEA inspection activities
  - Illicit transfers of sensitive nuclear technology
- SQP States
  - Conclude expanded SQP agreements
  - Conclude Additional Protocol

Conclusion

Openness and transparency is becoming an increasingly important factor to maintain, and at times, restore confidence in State compliance with regard to nuclear activities.

All States and the IAEA will face the challenge to move beyond strict legal compliance, toward agreed international norms of openness and transparency while maintaining sovereignty and efficiency in the application safeguards

4.6 IAEA Perspectives and the Use of Transparency in Nonproliferation

M. Zendel

International Atomic Energy Agency, Vienna

Abstract

The International Atomic Energy Agency (IAEA) and its safeguards system were established 50 years ago to promote the peaceful use of nuclear energy and other peaceful applications of nuclear science. The safeguards system has been strengthened over time to provide increased assurance to the international community of the exclusively peaceful use of States' nuclear material and activities. With the implementation of integrated safeguards (IS), the system has shifted from a pure verification emphasis to that of an 'information driven' regime. The search for indications of undeclared nuclear material and activities in a State has also become a priority safeguards task. The resolution of inconsistencies associated with certain nuclear activities in a State might require additional transparency measures beyond the legally binding requirements of a particular safeguards agreement.

The IAEA will need state-of-the-art technology and sufficient human resources to sustain its independent safeguards conclusions on the completeness and correctness of States' nuclear programmes. The level of safeguards efforts will need to increase in coming years due to emerging new safeguards agreements (e.g. in India), possible disarmament monitoring and the evidenced renaissance in nuclear power generation. The safeguarding of new facilities for fuel supply and spent fuel management associated with additional reactors will represent a significant challenge for the IAEA within its present budgetary resources. Savings from the implementation of IS will partly compensate for this increase, although new approaches will be needed to further balance these resource requirements without weakening the safeguards regime. Remote monitoring approaches are the most promising means of reducing inspection efforts while improving the timeliness of results. The number of remote and unattended monitoring systems is expected to increase significantly to support the verification of nuclear material and activities.

The IAEA safeguards system will remain as the international benchmark for transparency in nuclear non proliferation.

Keywords: Non-Proliferation, IAEA, integrated safeguards, remote monitoring, transparency.

Introduction

International cooperation and confidence building at bilateral, regional and global levels is required to prevent the spread of nuclear weapons. The international safeguards system operated by the IAEA is the central instrument in this undertaking. Founded some 50 years ago it has since then successfully contributed to limiting the number of nuclear weapon states. IAEA safeguards implementation has demonstrated to and on behalf of States that nuclear non-proliferation commitments are being respected or has sounded the alarm to the international community when States were in breach of their obligations.

The IAEA provides assurance that nuclear material under safeguards is not diverted from peaceful use. With the introduction of the Model Additional Protocol (AP) the IAEA has gained broader access to information and locations. Where these expanded capabilities are realized, the IAEA can draw safeguards conclusions concerning both the non-diversion of declared nuclear material and about the absence of undeclared nuclear material and activities for a State as a whole. Therefore the IAEA safeguards system can be considered as the international benchmark for transparency in nuclear non proliferation.

Perspectives

Recently the IAEA started a review of its future role and will provide a report, reviewing how the IAEA can be best prepared to fulfil Member States needs in a rapidly changing world beyond the year 2020. In the area of non-proliferation, the IAEA expects that the 1968 Treaty on the Non-Proliferation of Nuclear Weapons (NPT) will remain the essential cornerstone of its safeguards framework for providing global transparency in the peaceful use of nuclear energy and applications.

Application of integrated safeguards

A universally accepted verification standard for non-nuclear weapon States is warranted that combines safeguards measures from the comprehensive safeguards agreement (CSA) [1] and the additional protocol (AP) [2]. For the majority of States, the IAEA will have evaluated and maintained knowledge on the correctness and completeness of their nuclear programmes ("broader conclusion") allowing the implementation of integrated safeguards (IS) on a wide basis. The implementation of IS further shifts the safeguards system from a pure verification emphasis to that of an 'information driven' regime. The evaluation of Safeguards (SG) goal attainment for the IS scheme is not based on individual facilities but rather taking into account the State as a whole and making full use of all available safeguards measures.

IS can only be applied after the IAEA has obtained a complete picture of a State's peaceful nuclear activities by drawing and maintaining its broader conclusion regarding the completeness and correctness of a State's nuclear material and activities. In many cases, IS implementation involves unannounced inspections and complementary access (CA). Instruments for these specific types of verification activities often need to be made available to inspectors at very short notice. Such equipment must be multipurpose, easy to operate and portable in order to allow the inspector to readily perform numerous tasks within the short time span of each particular verification activity, including searching for indicators of undeclared nuclear materials and activities.

Safeguards information evaluation process

The IAEA is faced with an enormously high volume and complexity of safeguards related information. The sources of such information could be State supplied (e.g. nuclear material accountancy, design information, declarations), from in-field verification activities (inspection results, CAs), open sources (e.g. available databases, research publications, news, internet) or other sources (e.g. commercial satellite imagery, other information provided by Member States on a voluntary basis). State-of-the-art technology in data evaluation is needed to filter and evaluate the information before it can be assessed in order to provide a coherent picture of the State's nuclear programme. This process includes the planning of future safeguards activities (e.g. complementary access) to maintain and verify the continued validity of past and new information or to resolve ambiguities in the evaluated data. There will be an increasing need for qualified staff at IAEA Headquarters to sustain this comprehensive information evaluation process. Further increases can also be expected due to an expansion of remote monitoring and satellite imagery applications.

Enhancing IAEA detection capabilities

Confirming the absence of undeclared nuclear material and clandestine nuclear activities will play a primary role in providing an independent safeguards conclusion on the completeness and correctness of a State's nuclear programme. Detecting possible indicators of undeclared activities relies greatly on information collection and analysis. The IAEA needs to strengthen its existing detection capabilities to follow up on inconsistencies raised by information analysis. That requires adequate technologies, and at present the IAEA continues developing the capability to detect nuclear activities (e.g. reprocessing or enrichment) from a distance. CA activities may also require detection devices to search for non-traditional elements/isotopes (such as americium, neptunium, beryllium, and tritium) that could indicate the presence of a clandestine nuclear weapons programme.

Modern nuclear facilities are increasingly automated with the aims of decreasing both personnel exposure and production costs. As a consequence of automation, direct access to nuclear material may be limited for both the operator and the IAEA inspectorate. New technological standards in

terms of networking and the integration of unattended verification and C/S systems have been developed to cover the complete processes and storage areas of such facilities. The combination of surveillance data with synchronized NDA data is a very powerful tool to monitor nuclear processes while isolated C/S or NDA data have less value. A high level of standardization and integration of C/S and NDA equipment can reduce implementation costs significantly as less maintenance and training is required. The main drawback of these automated systems is their predictability. Especially under an IS regime with reduced inspector presence, credible short notice random inspections or unannounced inspection should supplement the inspection scheme to maintain the effectiveness of the overall approach. The combination of unannounced inspections with unattended monitoring and surveillance systems with remote data transmission has already been implemented successfully, in particular for the verification of spent fuel transfers. It has resulted in significant savings and reduced burden to the operator.

New approaches for safeguarding enrichment plants also call for unattended in-line NDA equipment to be developed to monitor flow and/or enrichment levels, i.e. to confirm that the plant operates as declared. Analytical tools for use at enrichment sites are under development, e.g. on-site analytical capabilities for UF_6 measurements using tunable diode laser spectroscopy, to partly replace the need for destructive analysis (DA) and thereby improve timeliness and reduce inspection resources.

Environmental sampling (ES) has an unmatched sensitivity to detect declared and undeclared nuclear activities in the past and present. It is one of the IAEA's strongest verification tools which need to be maintained and expanded. However, ES is very costly and only limited numbers of samples can be analyzed in a timely manner. Laser induced breakdown spectroscopy and optical stimulated luminescence (OSL) have been proposed as methods to supplement ES and the IAEA has initiated respective feasibility studies.

Design Information Verification

The early provision of design information is important for the IAEA to plan its verification activities and to prepare facility specific safeguards instrumentation. Subsequent design information verification is another important measure to confirm that facilities are used as declared by an operator and to detect the presence of undeclared design features and hidden facilities which could indicate undeclared nuclear activities or the diversion of nuclear material. The 3D laser range finder is capable of confirming within an accuracy of millimetres that no structural changes have occurred since the previous scanning and, of highlighting changes that may have occurred, in particular to maintain continuity of knowledge of the interiors of hot cells and especially on various piping arrangements.

Among several geophysical methods, ground penetrating radar has been selected as an appropriate technology to be further developed for the detection of hidden objects and structures.

Human resources

The collection, processing and evaluation of large amounts of complex safeguards data will not only require state-of-the-art technology but also well trained staff, especially in the fields of environmental sampling, satellite imagery and information analysis. Inspectors need to expand their knowledge beyond the traditional scientific background and to co-ordinate with multi-disciplinary teams involving other specialized skills such as reactor core simulations, DA result evaluation, satellite imaging, and open source analysis. Such teamwork is essential for the formulation of a soundly-based safeguards conclusion regarding the correctness and completeness of a State's peaceful nuclear programme.

Nuclear renaissance and additional safeguards tasks

The level of safeguards verification efforts will increase in the coming years due to new safeguards agreements (e.g. India), possible disarmament monitoring and the renaissance in nuclear power generation. Many States worldwide have indicated their intention to build new nuclear power plants.

Some States will become 'nuclear' for the first time requiring IAEA efforts to assist in building up effective State Systems of Accounting for and Control of nuclear material (SSAC). The safeguarding of facilities for the supply of fuel and spent fuel management associated with additional reactors will be a challenge for the IAEA within its present budgetary resources. Savings from the implementation of IS will partly compensate for this increased demand, but new approaches are needed in order to further balance the resource requirements without weakening the safeguards regime.

Transparency in non-proliferation

The goal of transparency in the nuclear field is to build, maintain or increase confidence among States regarding the peaceful use of nuclear energy. Today, the IAEA's safeguards system is *the* central component in the non-proliferation regime providing transparency and confidence on the peaceful applications of nuclear energy to the international community. The IAEA's safeguards system is an impartial and non discriminatory system and is capable of ensuring States' compliance with safeguards agreements. Therefore, measures which strengthen the efficiency and effectiveness of the present safeguards system will automatically contribute to enhanced transparency in the nuclear field.

Transparency measures and safeguards measures

Transparency is achieved through a set of measures (transparency measures), usually including the provision of information, notifications and access concerning a State's nuclear programme. When a verification standard based on both the CSA and AP is in force, States are obliged to accept and implement these measures in order to be in full compliance with their safeguards agreements. In this case, transparency measures are transformed into obligatory safeguards measures. States where no CSA and/or AP are in force, are called upon to voluntarily provide transparency through such measures in order to achieve a similar level of transparency. If there is an insufficient level of transparency in a State's nuclear programme, the IAEA will not be able to provide a credible assurance regarding the peaceful nature of such a programme. This is best demonstrated by the call on the Islamic Republic of Iran to implement additional transparency measures to enable the IAEA to verify the scope and nature of its enrichment programme.

Enhancing State systems of accounting for and control of nuclear material (SSAC)

Even with the most sophisticated verification system, the IAEA cannot fulfil its mission without cooperation with the SSAC. The enhancement of national or regional SSACs significantly increases support to the IAEA in its verification endeavours. Article 7 of the CSA stipulates that the Agency, in its verification, shall take due account of the technical effectiveness of the State's system. An effective, technically competent and independent SSAC is a valuable partner during joint inspections. Supranational or Regional Systems for Accounting and Control (RSAC) have the advantage of providing maximum transparency among its members in the nuclear field due to the ability of nationals of one country to verify implementation of safeguards in another, possibly a neighbouring country. The European Commission RSAC (formerly EURATOM) and the Brazilian-Argentine Agency for the Accounting and Control of Nuclear Materials (ABACC) are good examples of well functioning RSACs.

Additional measures

The application of additional measures, such as the specific regime of unannounced inspections at the Rokkasho reprocessing plant for collecting various operating parameters at other strategic points, becomes increasingly important in large facilities where quantitative safeguards goals are difficult to realize exclusively through conventional nuclear material accountancy. Again, the level of cooperation and willingness of a State to implement additional measures requested and properly justified by the IAEA will demonstrate its commitment to full transparency in its nuclear activities.

Additional information provided by a State gets indirectly confirmed by the IAEA. This might also increase transparency for its own citizens. Presently, a limited group of countries provides

information about their plutonium holdings to the IAEA on an annual basis. Japan for example announces annually its plans for the utilization of plutonium (before reprocessing) including names of the owners, respective amounts, and the purposes of its utilization as well as where, when and for how long the plutonium will be used.

Some limitations in the existing legal framework have already been identified which could hamper the process of assessing a State's nuclear programme (e.g. deficiencies in import/export control information on sensitive nuclear items with proliferation potential). Such limitations need to be addressed within a periodic review of possible additional measures which could further enhance effectiveness and efficiency of the safeguards system.

Remote verification and monitoring

Remote verification and monitoring systems can provide a high level of transparency without being unduly intrusive to the operator. Remote monitoring systems provide the means of electronically sending data collected with sealing systems, unattended monitoring systems and optical surveillance systems to off-site locations such as IAEA Headquarters or to an IAEA regional office. Such systems are increasingly being used to perform the remote verification of nuclear material flows in facilities. These systems have the ability to transmit 'state of health' (SoH) and authenticated verification data from the field in a cost effective manner. Remote monitoring approaches are most promising to reduce inspection efforts while gaining timeliness in results. Cost-effectiveness is achieved primarily by reducing the frequency of inspection visits and shortening inspections as a result of a lesser requirement for sealing, surveillance and NDA activities, which in some cases are completely eliminated. Other advantages of remote monitoring include the early identification of equipment failures and consequent ability to prepare for corrective actions before embarking upon inspections. In many instances, corrective actions required to a remote monitoring system can be handled remotely without the need to send technicians to the field. Furthermore, sealing, surveillance and NDA data can be reviewed at any time within a clean office environment.

The IAEA has recently established a Remote Monitoring Data Centre (RMDC) which is the backbone of the data transmission network and provides field data directly to the inspectorate at Headquarters for evaluation. The RMDC currently receives over 2Gb of data per day from 140 systems in 16 countries. It is equipped with terrestrial based communications, using the latest VPN (Virtual Private Network) technology, and transfers data with highly specialized software written in-house. SoH data is transferred and parsed every night to control equipment operation. The RMDC provides a central location which inspectors and technicians can visit in order to check, modify, or troubleshoot their systems remotely. Major facilities will be added to the global remote monitoring network in 2008, significantly increasing the overall number of systems and volume of data transferred. Satellite communication channels, currently in test phase, are also expected to be added in 2008. Possible additional future applications might also include secure video conferencing between Headquarters and facilities or with inspectors in the field, as well as encrypted and authenticated transmission of inspector reports to achieve more timely verification data.

Illicit Trafficking

The IAEA continues to enhance and develop equipment to counter the illicit trafficking of nuclear materials, capitalizing upon existing synergies between safeguards equipment and instruments used to detect radiation at borders, terminals and other places.

Such NDA systems must provide quick and accurate analyses in order to cope with an often enormous throughput of goods and people. The integration of nuclear and other radioactive material monitoring systems with monitoring systems for other hazardous and sensitive materials (e.g. explosives) would minimize the intrusiveness of control measures. In order to reduce the number of unwarranted follow-up measures and to avoid possibly unnecessary evacuation measures, the number of false alarms should be minimized. Active detection methods for shielded nuclear materials (e.g. prompt gamma activation analysis) are being considered for possible development. In addition to fixed installed portal monitors, the IAEA is seeking to further improve its portable

equipment to enable the swift detection of any radioactive material, including possible radiological dispersion devices.

Disarmament

Irreversible reductions in nuclear arsenals require great transparency. The IAEA has the capability to assist the international community in verifying nuclear disarmament efforts. As an example, the IAEA has verified the downblending of HEU hexafluoride from nuclear material declared excess to defence needs. The IAEA has been able to draw independent conclusions that HEU has in fact been blended down to a form that is not readily usable for weapons purposes. The IAEA can build upon this experience to verify future disposition of excess HEU. Under a Trilateral Initiative with the Russian Federation and United States, the IAEA is supporting steps to verify weapons-origin and other fissile materials that these two countries have released from their defense programmes.

Specific technology is needed to verify nuclear materials declared as excess by nuclear weapon States. The challenge is to provide verification tools to draw adequate safeguards conclusions without disclosing and knowing the characteristics of the disposed nuclear material. Such an example is the Attribute Verification system with an information barrier for plutonium with classified characteristics utilizing neutron multiplicity counting and high resolution gamma spectrometry under the Trilateral Initiative. Such experience within the IAEA safeguards system could also be applied to the verification of nuclear disarmament activities under the proposed Fissile Material Cut-off Treaty.

Conclusions

The IAEA safeguards system will remain a cornerstone of global efforts to prevent the spread of nuclear weapons. The IAEA is preparing itself to meet future challenges in a rapidly changing world. Resource savings from the implementation of integrated safeguards will be used to partly compensate for the additional effort involved in safeguarding an increasing number of nuclear power plants, together with their associated nuclear infrastructure. Additional resources will most likely be required if the IAEA is called upon to verify various disarmament steps. The use of remote verification and monitoring will play a major role in reducing future inspection effort. Emerging challenges related to the verification and detection of both declared und undeclared nuclear material and activities demand the ongoing adaptation of existing instrumentation and the development of new equipment. Transparency in all aspects of States' nuclear programmes is expected to provide the basis for global cooperation, confidence and readiness to expand the peaceful use of nuclear energy and nuclear applications. In this respect the IAEA safeguards system can be seen as *the* international benchmark for transparency in nuclear non proliferation.

References

[1] INFCIRC/153 (corrected), The Structure and Content of Agreements between the Agency and States required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons.
[2] INFCIRC/540 (corrected), Model Protocol Additional to the Agreement(s) between States(s) and the International Atomic Energy Agency for the Application of Safeguards.

IAEA Perspectives and the Use of Transparency in Nonproliferation

M. Zendel
Division of Technical Support
Department of Safeguards

IAEA
Atoms for Peace: The First Half Century
1957–2007

Introduction

IAEA safeguards implementation has demonstrated to and on behalf of States that nuclear non-proliferation commitments are being respected or has sounded alarm to the international community when States were in breach of their obligations.

Introduction

IAEA safeguards system

- Provides assurance that nuclear material under safeguards is not diverted from peaceful use.
- Safeguards conclusions concerning both the non-diversion of declared nuclear material and about the absence of undeclared nuclear material and activities for a State as a whole.
- Can be considered as the international benchmark for transparency in nuclear non proliferation.

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Perspectives

How the IAEA can be best prepared to fulfil Member States needs in a rapidly changing world beyond the year 2020?

- NPT will remain the essential cornerstone of its safeguards framework for providing global transparency in the peaceful use of nuclear energy and applications.

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Perspectives

Integrated Safeguards (IS)

- Combines safeguards measures from the comprehensive safeguards agreement (CSA) and the Additional Protocol (AP).
- Assesses correctness and completeness of nuclear programmes (“broader conclusion”)
- Shifts from a pure verification emphasis to that of an ‘information driven’ regime.
- Accounts the State as a whole and making full use of all available safeguards measures

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Perspectives

Integrated Safeguards (IS)

- IAEA has obtained a complete picture of a State’s peaceful nuclear activities.
- Involves unannounced inspections and complementary access (CA) visits.
- Requires equipment to be multipurpose, easy to operate and portable.
- Searches for indicators of undeclared nuclear materials and activities.

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Perspectives

Safeguards information evaluation process

- Enormously high volume and complexity of safeguards related information.
- Information sources
  - State supplied (e.g. nuclear material accountancy, design information, declarations).
  - Inspections (verification results, CAs).
  - Open sources (e.g. available databases, research publications, news, internet).
  - Other sources (e.g. commercial satellite imagery, other information provided on a voluntary basis).

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Perspectives

Safeguards information evaluation process

- State-of-the-art technology in data evaluation to filter and evaluate the information.
- Provides a coherent picture of the State's nuclear programme.
- Planning of future safeguards activities (e.g. CA).
- Qualified staff at IAEA Headquarters needed to sustain this comprehensive information evaluation process.
- Further HQ staff increases due to an expansion of remote monitoring and satellite imagery applications.

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Perspectives

Enhancing IAEA detection capabilities

- Detection of undeclared nuclear material and clandestine nuclear activities.
  - Detect nuclear activities (e.g. reprocessing or enrichment) from a distance.
  - Search for non-traditional elements/isotopes (such as americium, neptunium, beryllium, and tritium) that could indicate the presence of a clandestine nuclear weapons programme.

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Perspectives

Safeguarding modern nuclear facilities

- Increasingly automated.
- Limited access for both the operator and the IAEA inspectorate.
- Networking with the integration of unattended verification and C/S systems.
- Standardization and integration of C/S and NDA reduce implementation costs.

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Perspectives

Spent fuel verifications

- Spent fuel inventories are rapidly increasing.
- Most spent fuel is transferred to intermediate or long term dry storages.
- Transfer verification is resource intensive.
- Develop and implement unattended verification and monitoring systems to reduce inspection efforts.
- Safeguards measures for the final disposal of spent fuel are still under consideration.

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Perspectives

Safeguarding enrichment plants

- New approaches call for unattended in-line NDA equipment to monitor flow and/or enrichment levels.
- On-site analysis for UF6 measurements by tunable diode laser spectroscopy (TDLS).
  - Reduces destructive analysis (DA) including costs.
  - Improves timeliness.

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Perspectives

Environmental Sampling (ES)

- Unmatched sensitivity to detect declared and undeclared past and present nuclear activities.
- One of the IAEA's strongest verification tools which need to be maintained and expanded.
- Problems with cost and timeliness.
- Laser induced breakdown spectroscopy (LIBS) and optical stimulated luminescence (OSL) as alternative methods to supplement ES.

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Perspectives

Design Information Verification

- Early provision of design information is important
- Design information verification (DIV) to confirm
  - facilities are used as declared.
  - no undeclared design features and hidden facilities.
- 3D laser range finder for structural changes and CoK (e.g. interiors of hot cells, piping arrangements).
- Ground penetrating radar (GPR) to be further developed for the detection of hidden objects and structures.

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Perspectives

Human resources

- Well trained inspectors to collect, process and evaluate large amounts of complex safeguards data.
- Expand knowledge beyond traditional scientific background, e.g. weapon indicators.
- Build multi-disciplinary teams with specialized skills (e.g. reactor core simulations, DA evaluation, open source analysis).
- Work in a team to formulate of a soundly-based safeguards conclusion.

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Perspectives

Nuclear renaissance and additional SG tasks

- Additional facilities for the fuel supply and spent fuel management.
- Some states will become ‘nuclear’ for the first time requiring IAEA efforts to assist in building up an effective SSAC.
- New safeguards agreements (e.g. India).
- Possible disarmament monitoring.
- Savings from the implementation of IS will partly compensate for this increased demand.

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Transparency in Nonproliferation

IAEA's safeguards system is *the* central component in the non-proliferation regime providing transparency and international confidence in the nuclear field to its Member States.

- Build, maintain or increase confidence among States regarding the peaceful use of nuclear energy.
- Impartial and non discriminatory system.
- Ensures its members' compliance with safeguards agreements.
- Strengthen efficiency and effectiveness of present safeguards system to enhance transparency.

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Transparency in Nonproliferation

Transparency measures and safeguards measures

- Transparency measures include provision of information, notifications and access.
- Transparency measures are transformed into obligatory safeguards measures for States where CSA and AP is in force.
- Other States should voluntarily provide transparency measures to achieve a similar level of transparency.
- Insufficient level of transparency: no positive assurance regarding the peaceful nature of nuclear programme (e.g. Islamic Rep. of Iran).

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Transparency in Nonproliferation

Enhancing State systems of accounting for and control of nuclear material (SSAC)

- IAEA cannot fulfil its mission without cooperation by SSAC.
- The enhancement of national or regional SSACs support of the IAEA in its verification endeavours.
- IAEA shall take due account of the technical effectiveness of the State's system (Article 7).
- RSAC (EURATOM, ABACC) provide maximum transparency among its members, e.g. nationals of one country inspects another, possibly neighbouring country.

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Transparency in Nonproliferation

Additional measures

- When quantitative safeguards goals are difficult to realize.
- Increasing transparency for its citizen, e.g. annual plans for Pu utilization, stocks etc.
- Overcoming limitations in the existing legal framework (e.g. deficiencies in import/export control information on sensitive nuclear items with proliferation potential).

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Transparency in Nonproliferation

Remote verification and monitoring

- Provide a high level of transparency without being unduly intrusive to the operator.
- Sending data collected with sealing systems, unattended monitoring systems (UMS) and optical surveillance systems to IAEA Headquarters or to an IAEA regional office.
- Remote verification of nuclear material flows in facilities.

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Transparency in Nonproliferation

Remote verification and monitoring

- Reduce inspection efforts while gaining timeliness in results.
- Less frequent inspections.
- Early identification of equipment failures.
- Corrective actions can be handled remotely without the need to send technicians to the field.
- Sealing, surveillance and NDA data can be reviewed at any time within a clean office environment.

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Transparency in Nonproliferation

IAEA Remote Monitoring Data Centre (RMDC)

- Established September 2007.
- Backbone of the data transmission network.
- Terrestrial based communications, using the latest VPN technology.
- Transfers data with highly specialized software written in-house.
- 2Gb of data per day from 140 systems in 16 countries.
- Major facilities will be added to the global remote monitoring network in 2008.
- Satellite communication channels, expected in 2008.

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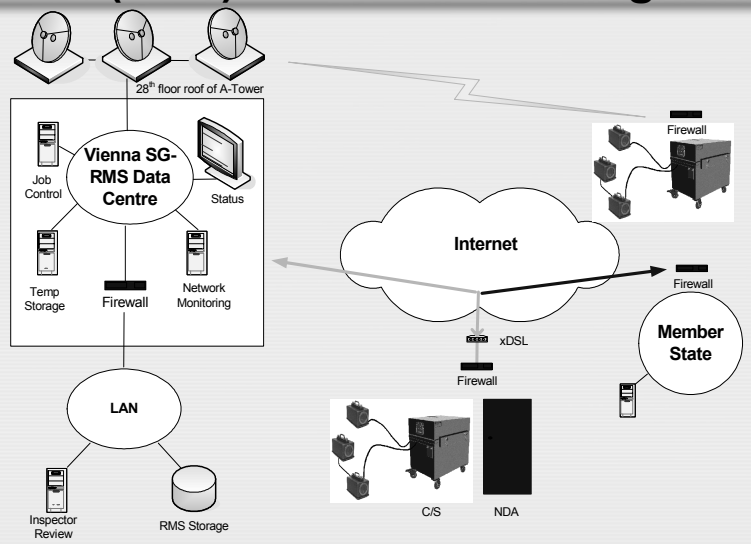
RM over Virtual Private Network (VPN) with Data Sharing



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Transparency in Nonproliferation

Illicit Trafficking

- Use synergies in equipment development.
- NDA systems must provide
  - Quick and accurate analyses cope with large throughput of goods and people.
  - Integration of nuclear and other radioactive material monitoring with other monitoring systems (e.g. explosives).
  - Low number of false alarms to avoid possibly unnecessary evacuation measures.
- Improve portable equipment to detect any radioactive material, including possible radiological dispersion devices.

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Transparency in Nonproliferation

Disarmament

- Irreversible reductions in nuclear arsenals require great transparency.
- Down blending of HEU hexafluoride from NM declared excess to defence needs.
  - Draw independent conclusions that HEU has in fact been blended down and is not readily usable for weapons purposes.
  - Verify future disposition of excess HEU.
- Trilateral Initiative with the Russian Federation and United States, the IAEA.
  - Information barrier for plutonium with classified characteristics.
  - Neutron multiplicity counting and high resolution Gamma spectrometry.
- Applicable to verify proposed Fissile Material Cut-off Treaty.

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Conclusions

- The IAEA safeguards system will remain a cornerstone of global efforts to prevent the spread of nuclear weapons.
- The IAEA is preparing itself to meet future challenges in a rapidly changing world.
  - Global application of integrated safeguards to compensate for an increased nuclear infrastructure.
  - Enhanced equipment for verification and detection of both declared und undeclared nuclear material and activities.
  - Ready to verify various disarmament steps.
  - Increased use of remote verification and monitoring.

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Conclusions

Transparency in all aspects of States' nuclear programmes is expected to provide the basis for global cooperation, confidence and readiness to expand the peaceful use of nuclear energy and nuclear applications.

*In this respect the IAEA safeguards system can be seen as **the** international benchmark for transparency in nuclear non proliferation.*

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4.7 Transparency in East Asia and the Pacific Rim: A Nongovernmental Organization's Perspective

Brad Glosserman

Pacific Forum Center for Strategic and International Studies, USA

Abstract

Working through the Council for Security Cooperation in the Asia Pacific (CSCAP), the Pacific Forum CSIS established a Nuclear Energy Experts Group (NEEG) to promote transparency in the use of nuclear energy and build confidence among nations of the Asia Pacific region. Founded in 1993 by a network of like-minded institutes, CSCAP is the premier track-two security organization in the Asia Pacific. The NEEG was founded in 1998 and designed to identify and articulate and then help to address or alleviate nuclear energy related regional concerns; to identify and help institute information collection and dissemination and a series of confidence building measures aimed at reducing nuclear energy-related concerns and set the stage for more formalized multilateral cooperation; and assess the feasibility and define the likely parameters of an institutionalized regional regime aimed at promoting greater safety, security, and transparency in nuclear energy production and research operations.

The NEEG was a subgroup of a Confidence and Security Building Measures International Study Group that explored confidence building more generally. NEEG members included nuclear industry experts from all Asia Pacific nuclear energy producers, as well as countries with research reactor programs and countries that were considering the nuclear option. The NEEG emerged out of concern among analysts and policy makers that countries in the region were not aware of all the issues associated with nuclear energy, in particular those of the back end of the fuel cycle such as waste storage and disposal. Originally, the environmental impact of accumulated fuel and waste was a primary concern, but in the aftermath of the terror attacks of Sept. 11, 2001, increasing attention was devoted to security of those materials (as well as of facilities more generally and transportation of radioactive materials throughout the fuel cycle). Environmental groups, power producers and national regulators appreciated the value of realtime data on emissions. Political analysts worried that the development of nuclear energy programs would increase suspicions about long-term intentions – whether civilian programs were in fact peacefully oriented and would not be diverted to military purposes. Here, the concerned constituencies were industry groups, foreign ministries and analysts working on political and security affairs. Technology researchers also appreciated the opportunity to address regional audiences and demonstrate the value of their work.

Working closely with the Cooperative Monitoring Center of the Sandia National Laboratories, the Pacific Forum CSIS attempted to demonstrate the merits of transparency on four levels: monitoring of radiation in the environment, operational safety of reactors, transportation security, and storage and disposal of spent fuel. Through discussions and visits to nuclear energy and related facilities, NEEG participants gained insight into the workings of the nuclear fuel cycle as well as programs of CSCAP member states. There is no substitute for the opportunity to examine and explore a nuclear facility firsthand. Chinese scientists marveled about Japanese transparency after our visit to the Rokkasho facility.

Transparency efforts built confidence in three distinct audiences: among national publics (through monitoring efforts, in particular the Nuclear Transparency website, which provides extensive data on radiation levels in the environment surrounding nuclear reactors), among nuclear industries and regulators (by demonstrating technologies of transparency and the potential benefits), and among political and technological elites (by demonstrating the intentions of neighboring or regional states nuclear energy programs). Real-time monitoring was seen as a way of allaying public concerns about the safety of those facilities, and technology demonstrations would facilitate the spread of proven means of increasing security.

The NEEG made clear the value of nongovernmental efforts to promote transparency. Being "nongovernmental" – even if funding was provided by government sources -- distanced the forum and the discussions from government policy. It created an appearance of greater neutrality, which is in fact accurate. While the Pacific Forum CSIS and CMC worked with US government sponsors, the NEEG had no explicit agenda other than to promote transparency. Moreover, agendas were flexible and able to accommodate issues that a government forum would not have been able to include. Since CSCAP members participate in their private capacities, discussion is free-flowing and less scripted – even though some participants may be government officials. Indeed, the presence of those officials is another confidence building measure. Moreover, their presence validated the work of the NEEG itself, proving that the sponsors took the NEEG seriously, showed the hosts had access to decision makers and that other members should be equally serious about their participation. Participants also gained a stake in the process because they were able to speak more authoritatively when they returned home. Since individuals are present in their private capacities, CSCAP meetings include participants from both North and South Korea, as well as China and Taiwan. Plainly, a nongovernmental forum like CSCAP offers unique opportunities for inclusiveness.

The NEEG experience provides several lessons for NGOs and transparency. First, it is vital that the host organization be a credible partner. No one – at least not busy and important role players – is prepared to participate in such exercises if they are perceived to be a waste of time. Sponsors and participants expect to have informed opinion around the table. That means conveying the views of your own organization/government as well as those of relevant players elsewhere in the world.

Second, the NEEG succeeded because we had the trust of our sponsoring organizations. Even though our views were not in always in alignment – nor should they have been as we were, after all, a nongovernmental organization – sponsors had to understand why the NEEG was run as it was and that official concerns would be addressed. No sponsor is going to underwrite a program that does not address its own concerns and interests.

Third, and related to that, success in such efforts requires an understanding of all stakeholder concerns. Even if the NEEG organizers did not share those priorities, we had to address them and ensure that agendas reflected those concerns. No one will participate – meaningfully – in a program that ignores them or their interests. That does not mean adopting them whole scale, but it does require compromises. This is especially important when addressing transparency issues which expose participants to a level of scrutiny to which they are not accustomed. (After all, transparency is about building trust, which means revealing hitherto obscured data.)

For the NEEG, this also required an understanding of the broader political context in which security, nuclear energy, and confidence building discussions take place. A cross-section of experts was required – technical expertise regarding the fuel cycle was as important as an understanding of the strategic and political context of the Asia Pacific region. There could be no meaningful understanding of one without the other. For example, no discussion of Japan's nuclear energy program is possible without understanding the historic grievances that raise suspicions about Japanese intentions.

Finally, given strategic sensitivities and political realities, the NEEG demonstrated the value of exploiting existing platforms for discussion. Even though the Pacific Forum had the contacts to develop an NEEG on its own, CSCAP was the best vehicle for this process, as participating organizations had already agreed to the ground rules and were prepared to engage under its umbrella on security-related discussions. Given the subsequent downturn in cross-Strait relations and the North Korean nuclear crisis, it would have been impossible to get all the parties together in one forum. But as CSCAP had a history of engagement and agreed rules of engagement, it was largely insulated from perturbations in the geopolitical space.

Sadly, the NEEG has fallen into abeyance. A reassessment by key partners of their roles and desired levels of support has meant that the group has not met for several years. However, CSCAP continues its work on confidence building and those discussions continue to skirt issues for which the NEEG could prove useful: countering the proliferation of weapons of mass destruction as well as energy

security policies. We have used the NEEG model to develop another experts group that focuses on export controls and applies the same procedure and rationale to work on that issue.

The growing interest in nuclear energy in East Asia suggests that the NEEG may yet be revived. The Pacific Forum CSIS remains committed to the NEEG and is prepared to resume its operations when the right circumstances arise.

The NEEG, with its mix of technical, analytical and human interaction provided clear evidence of the value of cooperative efforts to promote regional understanding. The literal “meeting of the minds” that occurred when participants met at NEEG conferences demonstrated that members were grappling with the same types of problems, and that they had experiences they could share. This recognition of common concerns and outlooks was a vital confidence building measure in itself – apart from the actual problem solving that followed.

Transparency in East Asia and the Pacific Rim: A Nongovernmental Organization's Perspective

Brad Glosserman

Pacific Forum Center for Strategic and International Studies, USA

Presentation

Mr. Glosserman's presentation was delivered oral, lecture style without the use of PowerPoint slides so that the audience could focus on his words, experience, and message. Please see Mr. Glosserman's abstract for a synopsis of his presentation and comments.

5. Panel Session on

Transparency: Its Role, Type, Definitions, Measures, and Applications in Regional Cooperation

Masato Hori, Moderator
George Baldwin, Secretary

With a Introduction by Dr. Yusuke Kuno

Panelists and Workshop participants openly discuss issues, roles, definitions, usefulness, and the future of cooperative regional transparency applications during the Panel session.

5.1 Concept of Transparency for Nuclear Non-Proliferation – Discussion on Current & Future Direction

Yusuke Kuno

Nuclear Engineering and Management
The University of Tokyo

Abstract

The definition of nuclear "transparency" varies depending upon the field where the term is used and within context of its usage. It may be defined as a cooperative process of providing information to all interested parties so that they can independently assess the safety, security and legitimate management of nuclear materials.

Once terminology of "transparency" is specified to nuclear non-proliferation, it is limitedly used in a few cases such as Safeguards, a complementary measure to Safeguards, and a measure to increase confidence among participated parties to comply with non-proliferation goals. It should assure that materials located within their respective region of interest are adequately accounted for and used only for legitimate purposes.

This short presentation will review some past remarkable discussions on definition, purpose, technology implementation, and risk of the transparency, and suggest future direction of activities in transparency, so as to facilitate the following panel discussion.

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Definition/Purpose of Transparency for Nuclear Non-Proliferation

- For Discussion on Future Direction -

Yusuke Kuno
Japan Atomic Energy Agency
The University of Tokyo

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What is Nuclear Transparency?

(Definition)

- Best defined a cooperative process of providing information to all interested parties so that they can independently assess the safety, security and legitimate management of nuclear materials (as used in context of peaceful use of nuclear energy) C.Harmon, J.Olsen et al: Cooperative Monitoring Centre (CMC) at SNL: (SAN02000-2400C)
- Provide sufficient and appropriate information to participating parties so that they increase confidence in the reviewed party's openness and willingness to comply with non-proliferation goals. JAEA NPSTC Web. 2007-8
- The availability of information that allows others to see more clearly State activities and capabilities S.Bayer, ASNO, Nucl. Energy Non-proliferation WS III, 2007

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Purpose of Transparency

[General Terms]

- Implementation of transparency technologies can be effective method of communicating with the local communities in order to share information and provide them with assurance that nuclear facilities are being operated in a safe and environmentally friendly manner. C.Harmon, J.Olsen et al: Cooperative Monitoring Centre (CMC) at SNL: (SAN02000-2400C)

[Nuclear Non-proliferation]

- To assure that materials located within their respective region of interest are adequately accounted for and used only for legitimate purposes. (SAN02000-2400C)
- Increase and enhance confidence and cooperation with other parties regarding their non-proliferation intentions, in parallel with IAEA Safeguards. JAEA NPSTC Web. 2007-8
- Transparency (and Openness) helps to restore confidence S.Bayer, ASNO, Nucl. Energy Non-proliferation WS III, 2007
- "Transparency" is used by IAEA to draw Safeguards conclusions. ibid

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Types of Transparency

Type A: Provision of detailed/reliable plant information with special device

- State-to-State (bi and/or multi)
- Operator- State (SSAC) / Inspector
- Operator-Operator (between different countries)

Type B: Provision of open source information

- State-to-State (bi and/or multi)
- Operator-Local Gov
- Operator-Public
- Others

Type C?

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Limitations

- Not for completeness and accuracy S.Bayer, ASNO, Nucl. Energy Non-proliferation WS III, 2007
- Not a substitute for compliance with explicit obligation of Safeguards ibid
- Not with authentication, since plant operational information should be shared JAEA
  (Other opinion: Tamper-indicating equipment Y.Hwang KAERI & D.Saltiel SNL)
- Voluntary actions beyond obligation by State but cannot achieve transparency simply by proclaiming it ibid

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General Risk of Transparency

- Misinterpretation e.g. due to little baseline information and insufficient technical context
- Credibility issue due to timeliness e.g. by near real time raw monitoring data vs screened/annotated data
- Provision of operational information could be used for disruption of facility operations.

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Understanding

- IAEA is formally verify State's nuclear activities and draw Safeguards conclusions.
  (Formally well-functioned to ensure State's neither diversion nor undeclared activity/materials for NNWS with CSA+AP)
  Sometimes IAEA-SG may not make them feel sufficient for confidence-building among countries, particularly in a timely manner.
- Therefore "Transparency" should be a measure to voluntarily increase/ enhance confidence by a State directly to other countries that have concern about the State.
- Voluntary basis but should be reliable (not easily falsified, but does not have to be authenticated), secured, and not costly.
- It could also complementarily be used for IAEA as provision of plant operational information.

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Transparency Technology Implementation

2 major categories;

(1) Access actual data from monitoring operational and environmental associated with operators at a particular nuclear facility.

(2) Ensure public access to information related to the decision making process associated with nuclear facilities.

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Transparency Technology Implementation (cont'd)

Particularly for (1), transparency tool may have to be designed bilateral and/or multilateral exchange with cost-effective and secured devices, wireless communications/network, virtual private network to be standardized. E.g., internet based system with encryption.

No additional (costly) sensors/monitors for Plant to Plant-owned ones should not be required.

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Discussion on Future Transparency Technology

- Discussion 1: operator-owned information acquired by operator's equipment (no authentication) can be used for "transparency" for confidence building?
- Discussion 2: what information is necessary
  Should the other partners need possible diversion -risk informed by the system?---probably no.
- Establish transparency technology / demonstrate and use
- Application for IAEA SG as a complementary tool to provide plant operational information in a timely manner?
- Develop transparency ideas/tools to enable public access

5.2 Panel Session Discussion Notes

Transparency: Its Role, Type, Definitions, Measures, and Applications in Regional Cooperation

Masato Hori, Moderator
George Baldwin, Secretary

Panelists

Dr. Yusuke Kuno, JAEA/NPSTC
Dr. Wan-Ki Yoon, KINAC, ROK
Dr. HS Karyono, BATAN, Indonesia
Dr. Doan Phac Le, VAEC, Vietnam
Dr. Manfred Zendel, IAEA
Mr. Brad Glosserman, CSIS/PacForum
Dr. Jor-Shan Choi, U. of Tokyo
Mr. David Saltiel, SNL

Theme 1. Definition of transparency for regional cooperation

- What is "transparency" in the peaceful use of nuclear energy?
- What is the need and purpose?
- What is the role in nuclear nonproliferation?

Theme 2. Types and measures for transparency

- Types (State-State, Operator-State/Inspector, Operator-Operator, between different countries)
- Measures (exchange of general information, exchange of detail/ reliable plant information, other)
- Framework (legal binding, voluntary, guideline)

Theme 3. Limitations and general risk of transparency

- Not for completeness and accuracy
- Authentication and verification
- Misinterpretation
- Disruption of facility operation
- Impact on nuclear security

Theme 4. Transparency technology and future direction of transparency for regional cooperation

- What is useful technology?
- What are cost effective and secure tools to exchange information?
- What is the future direction of transparency research?

The following is an edited summary of the Panelists' comments, in the approximate order spoken, and without attribution to the speaker.

Theme 1. Definition of transparency for regional cooperation

- What is transparency? Something more than IAEA Safeguards is needed.
- We are using different meanings of transparency. For example, is transparency equal to what is needed to achieve IAEA Safeguards; or, is transparency a subset of IAEA Safeguards? But, if transparency is actually bigger; safeguards is instead a subset of transparency.
- A single definition may not be a good goal. The definition may differ in different contexts. Is there something insufficient in what we currently do? What is the question that we are asking?
- We should limit the workshop's focus on transparency to that dealing with nonproliferation, which excludes safety, for example. What can we do to enhance the current system, without going off into other areas?
- Transparency is still about how information is made available and conveyed. But it is not verification, so it is different from IAEA Safeguards.
- Should we make two definitions? Transparency between states; and transparency in Safeguards?
- Information absent the political framework is not meaningful. "Define the context" is absolutely correct. Political decision demands the broader interpretation.
- IAEA Safeguards conclusion is independent, but it is not sufficient to convince states. If it is insufficient, then why is it insufficient?
- IAEA is not anonymous; it is the arm of the member states.
- IAEA provides confidence, but not transparency.
- IAEA publishes the Safeguards Implementation Report (SIR) and an annual report, but there are other reports too.
- This workshop is about *regional* transparency; so it is important to draw the distinction. We should separate Asian transparency from Agency transparency.
- Safeguards provides confidence, but for the present, not for the future. [gave example of the DPRK withdrawal.]
- That's a very important point! IAEA is a snapshot in time rather than understanding of a trend.
- Future Safeguards is an information-driven process; inspections are only part of it; provision of open-source information and other tools are addressing exactly what was said.
- The IAEA is for global, this workshop is for regional. Transparency is important. Commitment to a Safeguards agreement is very important, but other factors are important (such as safety).
- Corporate entities may have difficulty making information transparently available.
- The discussion at this workshop is more for cooperation. Not just technical, but also country policy. Transparency in cooperation is voluntary. Transparency should be multilateral. It should maintain and not interfere with sovereignty. What kind of information should be shared in this cooperation is important.
- Consider the Euratom inspection system model for sharing. Politically, it is not possible. A practical one is the Australia proposal for a regional association of Safeguards professionals.
- ABACC, for example, doesn't exist because the IAEA is not sufficient, but instead ABACC addresses transparency between the two countries (Argentina and Brazil).
- The issue of transparency for Japan has nothing to do with technical matters. ABACC is an apt example. The answer is "transparency" in the broader sense. A challenge: the ROK is concerned about what Japan's intentions are; and Japan has similar concerns about the ROK. These are not technical! How to introduce these transparency measures? What is needed is a regional model, grown from this region.

- Nonproliferation transparency to answer that is not simply more technical information about a facility. ABACC facilitated Brazil and Argentina's accession to NPT, but why does ABACC still exist? We need to articulate a problem – not one that exists, necessarily, but a problem that we don't want in the future. A greater provision of information limits one's options to do things. If the IAEA/NPT is the cornerstone, then we need to make sure that confidence is maintained, for example, by ensuring IAEA has the necessary resources. A greater provision of information may highlight a problem, and then what to do about that?

Theme 2. Types and measures for transparency

- We've gone to the second theme for the panel…
- ABACC is Safeguards, like Euratom, based on an agreement, state-to-state. So it's different.
- This workshop is state-to-state.
- Is a non-governmental organization the right forum? Transparency is an integral part of ABACC, nuclear weapon free zones, and other arrangements. What is transparency for? Transparency an integral part of a cooperative arrangement.
- Experience with the European Safeguards Research and Development Association (ESARDA): it brings together operators, the inspectorate, research community, and others where they can talk "business." The Australian proposal would likewise be beneficial.
- ESARDA also has participants from outside the European Union.
- The MNA approach (Australia) idea proposed by IAEA director general.
- All stakeholders should be involved, like ESARDA.
- Moving back onto measures: what kinds of measures should be shared?
- We can't answer the question until we know what the problem is.
- New countries (e.g., Vietnam, Indonesia, Thailand). There's also DPRK.
- Differentiate Safeguards and transparency: Safeguards starts from distrust. Transparency comes from trust; therefore we must try to supply as much as possible.
- We still need the framework, but that may be more than what we can accomplish, but we still could begin our thinking along these lines.
- Is this a framework for nonproliferation, or for broader security concerns?
- An insurance system is needed. Safety: do we enhance, or do we increase the liabilities [cited example of U.S. Price-Anderson Act] e.g., in the case of an accident? If China works with Japan, Korea with China, Japan with Korea, we've come a long way.
- Safeguards inspectors – we already do that!
- Six Party Talks is already an example, a process of building a framework. First need to acknowledge that there is a problem (five years ago no one admitted nonproliferation was a problem). How precisely will the DPRK solution fit into the nuclear nonproliferation regime?
- Is transparency a process, or a product? Does it matter what information is shared?

Theme 3. Limitation and general risk of transparency

- Authenticated information would be a double-punch of the IAEA approach; and costly. Information has to be reliable, but we can't authenticate it.
- If hackers get in to our websites, can we afford to work with unauthenticated data?
- If authenticated, we can't correct mistakes easily.
- The P-5 (U.S., U.K., France, Russia and China) and others (Japan, Germany, Belgium, Switzerland…) declare inventories of separated plutonium ("Section 549"). The IAEA's role was observational. Had to keep the declarations confidential.
- So we've provided information… what is the standard of whether we're pleased with it? We should not ask transparency to carry more weight than it can bear.
- Does the plutonium declaration to the agency provide enough transparency? Is it better than nothing? Or does it raise more questions?
- For the stakeholder involvement process, what are the concerns that the states in this region care about? What is the kind of information that is really important? An honest, frank discussion is needed.

- We are talking three things related to transparency: 1) IAEA 2) informational sharing among countries, and 3) domestic things within a country. We are focusing here on the second case.
- Transparency has been introduced long ago, but we still have discussion here. What is the difficulty? What can we do to move forward?

Theme 4. Transparency technology and future direction of transparency for regional cooperation

- Provide *more* information than what is required by IAEA is transparency.
- Of the information provided, safeguards information is the highest level.
- More credibility to information received from the counterpart (directly), rather than the newspaper (indirectly).
- We need to put the problems on the table. That's why we haven't had progress. Nuclear nonproliferation is everyone's problem. It is a changing international environment.
- Transparency without people has no meaning. We have to educate the people. Education and transparency should be addressed.
- The Institute of Nuclear Materials Management (INMM)/ESARDA workshop has one theme dealing with education.
- Generational transition (in the region) is profound. CSIS PacForum is engaging the younger people in this area. The University of Tokyo should make greater efforts for outreach.
- We should use the momentum of the Six Party Talks to push the effort for transparency cooperation forward. We have "stars in the sky."
- The last time in Sydney [at the ASNO meeting], it did not go well. [Referring to why we are still having difficulty getting ahead with transparency]. Even though participants were not officially representing their governments, they were still from the government, and it was very difficult.
- The Additional Protocol greatly introduced transparency, but still many states have not signed on.
- Ratifying the Additional Protocol is a form of transparency. But what does it mean if a state has not yet ratified? Transparency must have other benefits. It is costly, so it needs to have other benefits. How can we design them to meet multiple goals?

Summary Comments by Panelists

- Definition of transparency depends on the situation and parties involved: a case-by-case situation.
- One definition is Safeguards; it has transparency as an integral part.
- A more international and political approach is needed for cooperative transparency.
- A Framework should be practical and cost effective.

6. Focus on Transparency Technology

Dr. Mitsutoshi Suzuki, Moderator

- Transparency Technology Presentations
- Technical Demonstrations
- Interactive Working Group Discussions on "Issues and Technologies to Achieve Transparency Cooperation"

21 February: On Day 2, the focus was on Transparency Technology. Presentations, technical demonstrations, and expert group discussions took place throughout the day.

A small, interactive working group of about 20 technical experts were drawn from Day 1, along with interested observers and university students, to focus on the practical and technological issues and solutions for nonproliferation transparency.

There were a combination of nine invited presentations and demonstrations from this working group.

A facilitated discussion on "Issues and Technologies to Achieve Transparency Cooperation" addressed many issues and motivations for pursuing cooperative transparency and concluded the day's sessions by the working group.

The notes and working group discussions from the Day 2 sessions are combined and included in the "Workshop Summary Notes and Combined Group Discussions from Days 2 & 3 – Issues and Technologies to Achieve Transparency Cooperation" found in the "Focus on Transparency Future" section presented later in this report.

Dr. Jor-Shan Choi leading Technology Focus Discussion Group (left).
Technology Demonstrations of Regional Transparency Internet Portal and
HDIS Unattended Camera System (right).

6.1 Overview of Transparency Measures & Methods

Ms. Kazuko Hamada

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Nuclear Nonproliferation Science and Technology Center
Japan Atomic Energy Agency

Abstract

The perceived need for energy security, together with concerns about global warming, is driving many states to consider the peaceful use of nuclear energy as a potential solution, the trend apparently signaling the coming of a nuclear renaissance worldwide. This trend appears to be particularly salient in Asia, in comparison with other areas.

This nuclear renaissance, however, inevitably hints at increasing nuclear proliferation concerns, fueling fears about the security of nuclear material and creating suspicions about its use. These fears are intensified with evidence of nuclear build-up in North Korea, continuing uncertainties about Iran's nuclear program, and the emerging threat of nuclear terrorism. This means that the prospect of increasing nuclear energy use inevitably necessitates supplementary efforts, in addition to obligations to the Treaty on the Nonproliferation of Nuclear Weapons (NPT), in order to ensure nuclear security and a peaceful intention behind nuclear energy programs.

By providing tools to demonstrate secure, peaceful nuclear energy development, nuclear transparency measures could help build confidence in the idea that its increased use is not contributing to nuclear proliferation. These measures could be creative and evolving mechanisms in which potential participants can select acceptable levels of transparency and benefit from them accordingly, and they may begin with a minimum commitment and develop to achieve more transparency in a gradual fashion. These measures could also foster a cooperative tradition that would address rising concerns over nuclear trafficking and terrorism, which require regional coordination to combat. Thus, nuclear energy transparency is a suitable step for regions with political tensions and lack of cooperative tradition to begin with, to ensure nuclear nonproliferation commitment while promoting peaceful use of nuclear energy.

However, the fact that only moderate progress has been made in implementing transparency measures suggests a lack of political appreciation of this concept. Thus, this presentation describes various forms of potential transparency measures to expand the possibilities of the transparency concept and explore areas in which this concept might be applicable. Considering the political situation and the related trend of nuclear energy in Asia, special emphasis is placed on the evolving nature of transparency measures. The presentation also clarifies some challenges involving transparency projects, and suggests possible ways to address these challenges.

Overview of Transparency Measures & Methods

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Policy Research Office
Nuclear Non-proliferation
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JAPAN ATOMIC ENERGY AGENCY (JAEA)

Overview of Transparency Measures & Methods: Introduction

- **Focuses:**
  - The Nonproliferation Aspect
  - The Asia-Pacific Region
- **The Asia-Pacific Region as a Loosely Defined Framework**
- **Definition Used for this Presentation**
  - "A cooperative mechanism, in which concerned parties show their willingness to provide information related to peaceful nuclear programs and cooperate in increasing transparency in order for other concerned parties to assess the security and legitimate management of nuclear material." [1]

  [1] Harmon C. D., Olsen J.N., and Passell H. D., et al. (2000), Nuclear facility transparency: definitions and concepts. Int. Seminar on the US-Japan Energy Seminar. Washington D.C., 4-6 Oct.
- **Discussion-opener: Potential Applications of Transparency to the Region**

Overview of Transparency Measures & Methods: Organization of this Presentation

◆ **Outline**

I. General Transparency Features

II. Various Types of Transparency Procedures

III. Challenges to Transparency Efforts and Possible Solutions?

IV. Potential Applications of Nuclear Transparency to the Asia-Pacific Region

V. Concluding Remarks

Overview of Transparency Measures & Methods: I. Transparency Features in General 1/2

◆ **Stakeholders**

- Any actor or a group of actors who are concerned about nuclear material diversion

◆ **Transparency & Verification** [1]

- Transparency: a *passive* process to reduce opaqueness
- Verification: an *active* step to substantiate certain claims
- Not necessarily needs verification for confidence-building purposes

[1] Klerk, P. de. (2001), Transparency, confidence-building and verification and the peaceful use of nuclear energy. Int. Topical Workshop on Proliferation-Resistance in Innovative Reactors and Fuel Cycles. Como, 2-6 July.

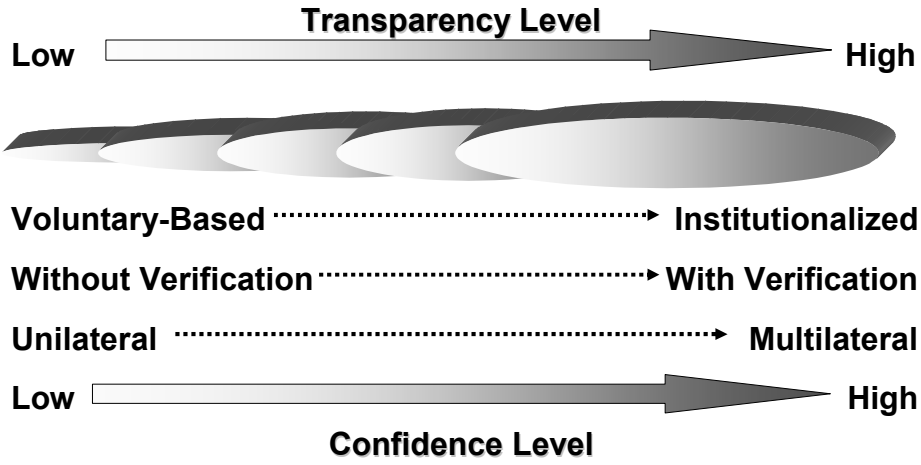
◆ **Evolving Transparency Measures**

□ Creative & Evolving Processes

- Various forms, tools, and Levels of credibility

Overview of Transparency Measures & Methods:
I. Transparency Features in General 2/2

Evolving Transparency Measures: Examples (1)



Overview of Transparency Measures & Methods:
II. Various Types of Transparency Procedures 1/8

- **Common Features**
  - Unilateral, Bilateral, and Multilateral
  - Without verification, or With verification
  - Noninstitutionalized, or Institutionalized
  - ✓ ***Various levels of formality, reciprocity, and credibility***
- **Various Types**
  1) Declaration Measures
  2) Notification Measures
  3) Communication Measures
  4) Document / Data Sharing Measures
  5) Access Measures
  6) Monitoring Measures

Overview of Transparency Measures & Methods:
II. Various Types of Transparency Procedures 2/8

□ Declaration Measures

- National policies for nuclear energy & Strategies for the nuclear fuel cycle
- Reports on one's plutonium holdings
  - *Guidelines for the Management of Plutonium* (INFCIRC/549)

□ Notification Measures

- Announcements on refueling schedules
- Pre-notifications of spent fuel reprocessing

Overview of Transparency Measures & Methods:
II. Various Types of Transparency Procedures 3/8

□ Communication Measures

- Fora & Seminars
  - *The Asian Export Control Seminar*
  - *Asian Senior-level Talks on Non-Proliferation (ASTOP)*
- Direct Lines between Nuclear Authorities

□ Document / Data Sharing Measures

- The power generation records of nuclear reactors
- The history of all movements of nuclear material
- Establishing a multilateral center for processing and distributing nuclear-related information

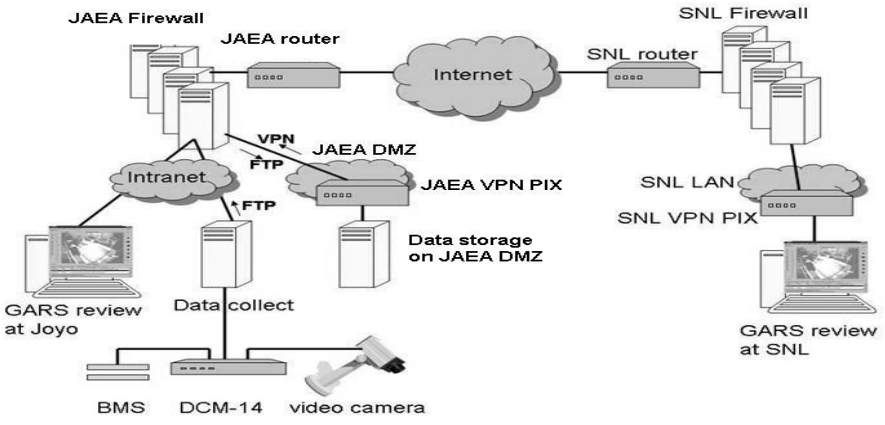
Overview of Transparency Measures & Methods:
II. Various Types of Transparency Procedures 4/8

- **Access Measures**
  - Exchanges of experts at material handling facilities
  - Opportunities for peer review to improve control performance
- **Monitoring Measures**
  - Radiation Monitoring
  - Video Monitoring
  - Remote Monitoring

Overview of Transparency Measures & Methods:
II. Various Types of Transparency Procedures 7/8

The Example of the Remote Monitoring System

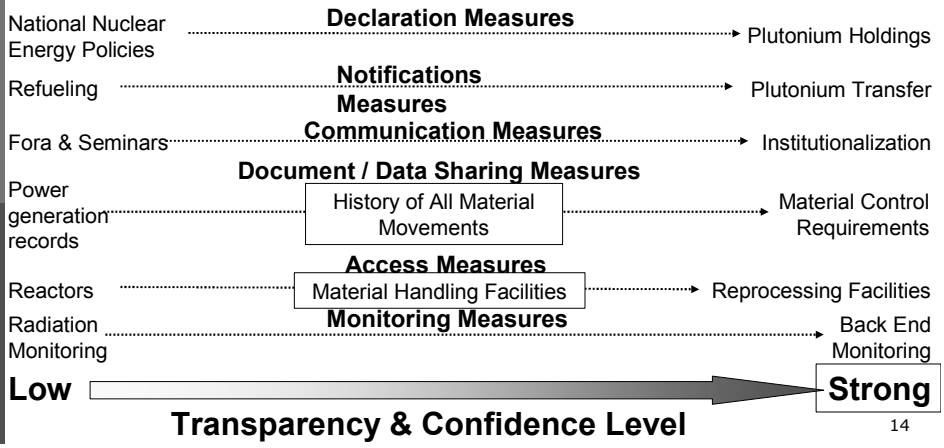
The Experimental Fast Reactor Joyo



Source: John N. Olsen, "REGIONAL COOPERATION IN REMOTE MONITORING FOR NUCLEAR NON-PROLIFERATION AND TRANSPARENCY," presented at INMM 25.

Overview of Transparency Measures & Methods:
II. Various Types of Transparency Procedures 8/8

Evolving Transparency Measures: Examples (2)



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Overview of Transparency Measures & Methods:
III. Challenges to Transparency Efforts & Possible Solutions? 1/3

- **Determinants of Nuclear Authority's Attitude Towards Nuclear Transparency**
  - **1)Political Calculation or Intention**
  - **2)Type of Political Regimes, Democracy**
  - **3)Government / Public Attitude**
  - **4)Propensity, Institutional or Cultural**
  - **5)Rationality: Cost Effectiveness & Trust**

Overview of Transparency Measures & Methods:
III. Challenges to Transparency Efforts & Possible Solutions? 2/3

Rationality of Transparency Efforts

- Security Concerns
- Political Risks
- Economic Risks
- Direct Economic Costs
- *Possible Ways to Address these Concerns & Risks*
  - Vulnerability Analyses
  - Restrictive Measures: encryption & authentication codes
  - Emphasis on Voluntary Cooperation:
  - Fundability & Sustainability

Overview of Transparency Measures & Methods:
III. Challenges to Transparency Efforts & Possible Solutions? 3/3

- Political Benefits of Cooperation
  - Methods to demonstrate the assumed good intentions to serve for one's nuclear energy programs
- Technological Benefits of Cooperation
  - Enabling to find technical solutions to effectively address nuclear proliferation threats
- Cost-Benefit Analysis to Determine the Rationality
  - Needs to articulate the potential benefits
  - Cost-benefit analyses in a broader context
    - National & regional security
    - Alternative scenario: Increasing nuclear energy use, remaining political tensions, no measures are taken

Overview of Transparency Measures & Methods: IV. Potential Applications of Nuclear Transparency to the Asia-Pacific Region 1/2

Regional Features in Nuclear Energy Use & Transparency

- **Expanding NE Use & Increasing Vulnerabilities to Nuclear Proliferation**
  - The prospect of increasing NE use in Asia
    - 73 to 151 gigawatts; 20% to 35% (2003—2030)[1].
  - Nuclear proliferation concerns: Traditional & Untraditional
    - Traditional: ①The diversion of nuclear material from declared facilities; ② Undeclared nuclear activities
    - Untraditional: ①Non-state actors as proliferators; ②Nuclear black markets as tools for proliferation

[1] Energy Information Administration (EIA), *The International Energy Annual 2003*

- **Political Insecurity in the Region**

➢ **Needs nuclear energy transparency**
  - — to reduce uncertainties or misperceptions over NE use
  - — to create a climate favorable to regional cooperation

Overview of Transparency Measures & Methods: IV. Potential Applications of Nuclear Transparency to the Asia-Pacific Region 2/2

Potential Applications of Nuclear Energy Transparency

- Developed nuclear programs vs. Underdeveloped ones
  - Direct economic costs: Additional financial burdens
  - Political concerns: Perceived controls on nuclear policies
  - Economic risks: Strategically sensitive technology, Competitiveness of the NE industry
- NWSs vs. NNWSs in the Region
  - NWS: Security concerns, Political risks
  - NNWS: No more inequality, obligations, and constraints

➢ **Important to accommodate perceived concerns by preserving the creativity of transparency measures**

➢ **Need to be not obligated, but voluntary motivated**

✓ **Suitable step in the region without cooperative tradition**

Overview of Transparency Measures & Methods: V. Concluding Remarks

◆ Concluding Remarks

- Transparency as a Creative & Evolving Process Suitable for Regions with Political Insecurity
- Cost-Benefit Analysis in a Broad Context
- Accommodate Perceived Risks and Concerns
- Expanding NE Use & Increasing Vulnerabilities to Nuclear Proliferation
- Transparency as a Suitable Step for the Region

Overview of Transparency Measures & Methods

Thank you for your attention

Kazuko Hamada
JAPAN ATOMIC ENERGY AGENCY (JAEA)

6.2 Assessing and Addressing Increased Stakeholder and Operator Information Needs to Support the Safe, Secure, and Peaceful Expansion of Nuclear Energy

Mr. David H. Saltiel

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Abstract

The democratization of the dialogue about how to meet growing energy needs is pushing energy producers to respond to a host of new demands and expectations from a diverse group of nuclear energy stakeholders including the public, environmental groups, financial investors, national regulators, international inspectors, and neighboring countries. The demands of these stakeholders range from demonstrations of improved operational efficiency to ever greater safety, environmental, security, and nonproliferation assurances. The actions necessary to meet these needs – primarily the provision of additional information – are often expensive and difficult. In some cases, the demands of some stakeholders may even be in conflict with others. Nonetheless, they can not be ignored. As these problems are not specific to any single country or nuclear energy program, regional technical cooperation on monitoring and transparency measures may offer opportunities to reduce costs, resolve conflicting interests, and increase operational efficiency. In this presentation, I first propose a collaborative approach to assessing stakeholder needs – an activity which, in itself, may help to reduce suspicions and misperceptions. I then discuss several activities currently underway which seek to address informational and transparency needs in efficient and effective ways that may benefit stakeholders and operators alike.

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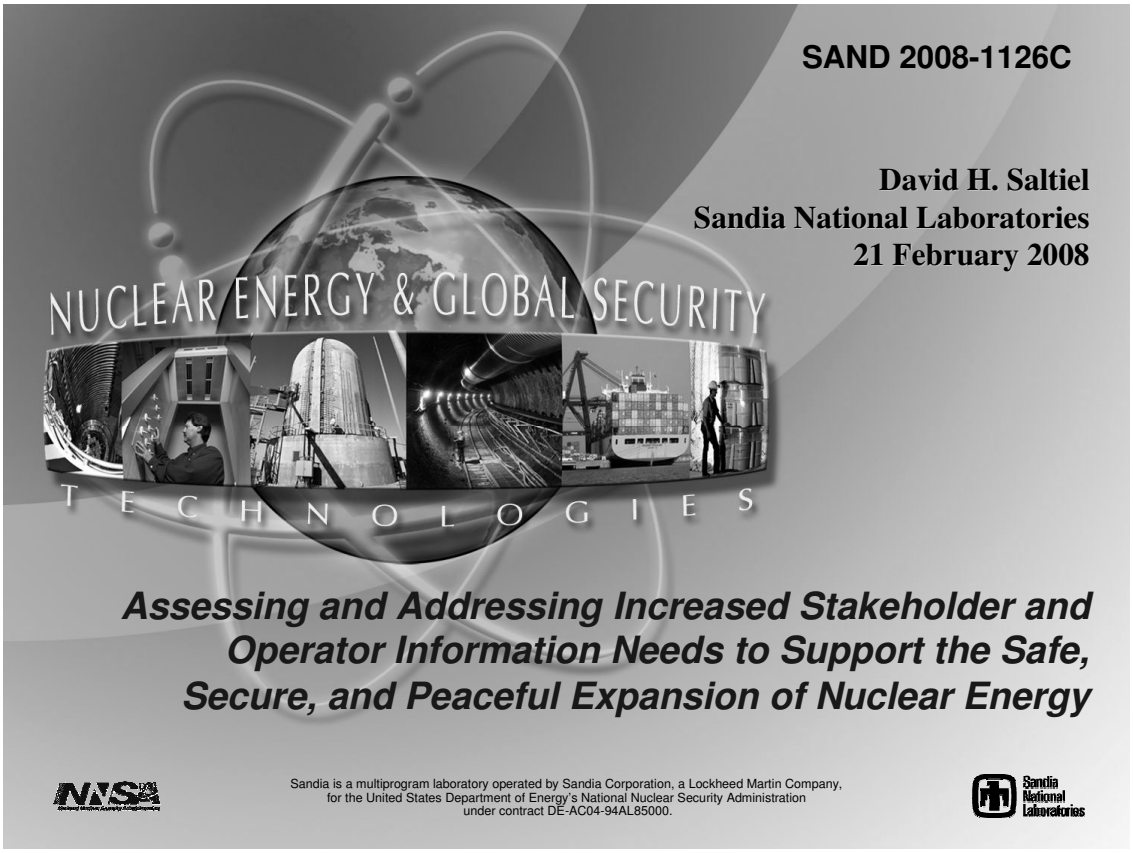
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David H. Saltiel
Sandia National Laboratories
21 February 2008
NUCLEAR ENERGY & GLOBAL SECURITY
TECHNOLOGIES
Assessing and Addressing Increased Stakeholder and Operator Information Needs to Support the Safe, Secure, and Peaceful Expansion of Nuclear Energy
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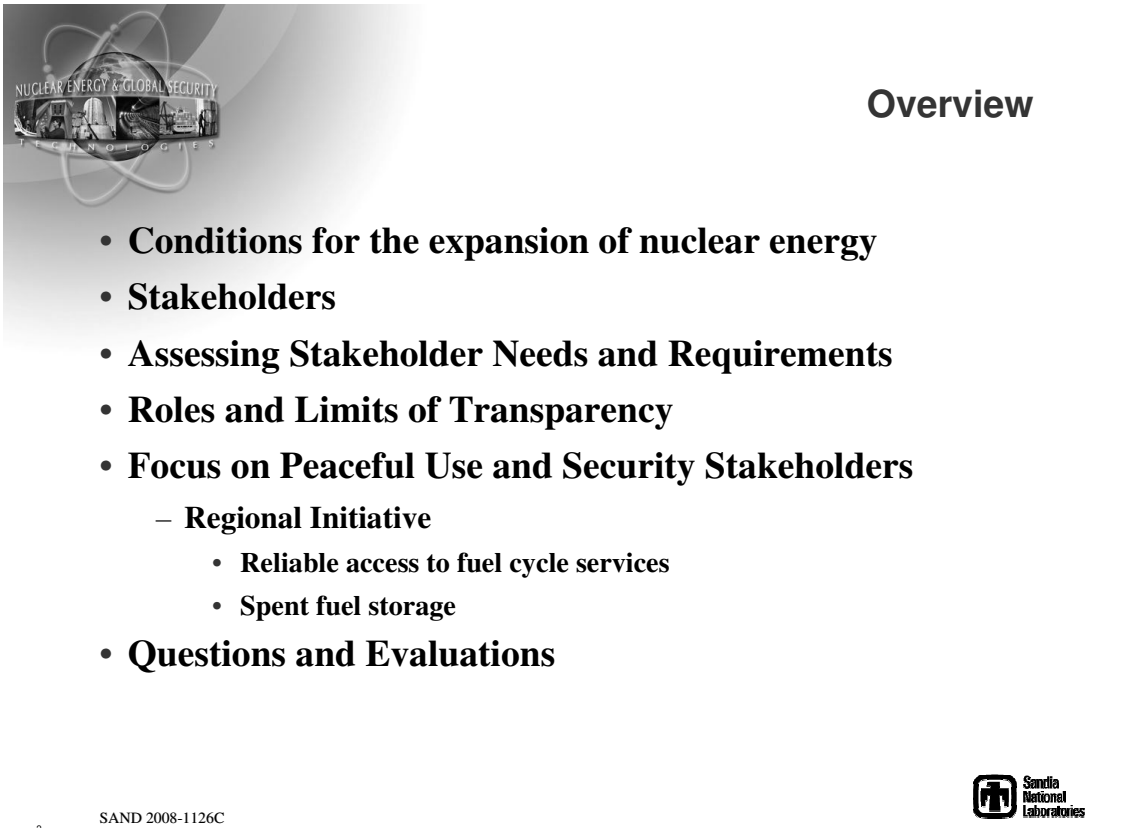
NUCLEAR ENERGY & GLOBAL SECURITY
TECHNOLOGIES
Overview
• Conditions for the expansion of nuclear energy
• Stakeholders
• Assessing Stakeholder Needs and Requirements
• Roles and Limits of Transparency
• Focus on Peaceful Use and Security Stakeholders
– Regional Initiative
• Reliable access to fuel cycle services
• Spent fuel storage
• Questions and Evaluations
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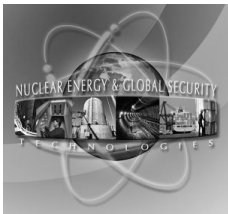

Conditions for the Expansion of Nuclear Energy

- **Nuclear energy has always faced questions, oversight, and opposition**
- **Increasing democratization of dialogue will only increase demands**
  - **Greater access to information**
- **A transnational issue**
  - **Failures elsewhere have international implications**
- **Conditions common to all users**
  - **Operations must be safe, secure, environmentally friendly, and peaceful**
    - **And economically viable!**
  - **Not enough to simply do these things, must DEMONSTRATE that they are true**
    - **Transparency is ONE approach to addressing this demand**

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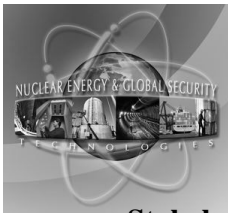

Stakeholders

- **Stakeholders come from different perspectives and have different (although occasionally) overlapping interests**
  - **Operators (and shareholders) are a key stakeholder!**

	Safety	Security	Environment	Peaceful Use	Operations
Local					
National					
Regional					
International					

- **Needs and requirements differ**
  - **Need/want different information**
  - **Need/want information in different ways**
- **Meeting these needs may be expensive, difficult, or even impossible**
  - **Needs may conflict with one another**

Need to understand needs and requirements before evaluating how to address them

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Assessing Stakeholder Needs and Requirements

- Identifying stakeholders
- Identifying needs
- Identifying requirements
- Develop approaches
- Evaluate effectiveness

- **Methods**
  - Discussions
  - Scenarios and simulations
    - Stakeholders may not always know!
  - Modeling tools
    - Design tools
    - Virtual walk-throughs

Assessing needs may be, in and of itself, a "transparency" or confidence building activity

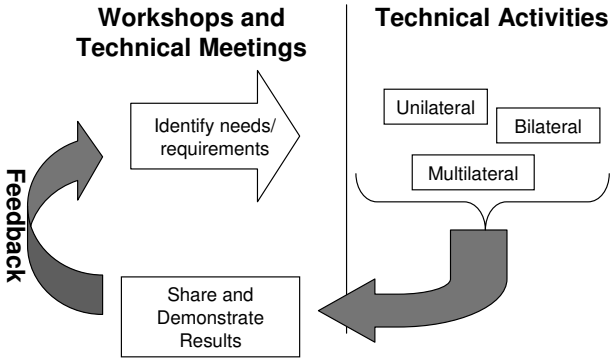
Roles and Limits of Transparency

- **What can transparency do:**
  - Reinforce conclusions of other evaluators, increase predictability, clarify intentions, reduce uncertainty, constrain opportunities
- **Many other ways to communicate with stakeholders, such as**
  - Unsolicited provision (Larrimore, et al distinction of openness vs. transparency?)
  - Demonstrated compliance with national and international regulations
- **Cautions:**
  - More information is not inherently good
  - Information must be trusted
  - Must meet specific needs to be valuable
  - Can be misunderstood or misinterpreted
  - Avoid provision of security or business sensitive information

Transparency *may* not always be the best way to meet stakeholder needs

Regional Initiative Focused on Reducing Proliferation Risk

- **Three year effort**
  - **Follows on past cooperative transparency effort**
- **All states in Asia using, planning to use, or contributing to the use of nuclear energy**
  - **Regional and international stakeholders**
    - **Dialogue includes operators**
  - **Security and peaceful use**
- **Focus on common challenges and shared concerns**



	Safety	Security	Environment	Peaceful Use	Operations
Local					
National					
Regional					
International					

Works across spectrum of approaches, including transparency

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Reducing Proliferation Risk: A Spectrum of Approaches

International Safeguards Technology Development and Implementation	Physical Protection Technology Development and Implementation	Capacity Development and Infrastructure Preparedness	Transparency and Openness

- **Best practices and standards development**
- **Advanced approaches**
- **Information sharing**
- **Increase efficiencies**
- **Build trust and confidence**

- **Two case studies**
  - **Fuel cycle services supply and demand**
  - **Spent fuel storage**

Overall initiative looks across the full set of nonproliferation approaches and is focused on reducing proliferation risk NOT on transparency

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Case Study One: Reliable Access to Fuel Cycle Services

International Safeguards Technology Development and Implementation	Physical Protection Technology Development and Implementation	Capacity Development and Infrastructure Preparedness	Transparency and Openness

Participation in a FCSS as a transparency measure (?)

- **Question:**
  - **Under what conditions would nuclear energy programs participate in multilateral fuel cycle service (FCS) arrangements?**
- **One area of concern**
  - **Global and/or regional demand will outstrip supply**
- **Response**
  - **Develop shareable, auditable, transparent approach to evaluating demand and supply scenarios**

- **Multiple stakeholders**
  - **National, Regional, International**
- **Multiple interests**
  - **Energy security, economics, peaceful use, security**

Creates common basis for discussion, understanding of plans. Addresses stakeholder need for information about viability and implications of FCS arrangements

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Case Study One: Reliable Access to Fuel Cycle Services

- **Needs**
  - **Information about implications**
  - **Ability to forecast**
  - **Common foundation for discussion**
- **Requirements (needs must be met with information that is):**
  - **Simple**
  - **Trustable**
  - **Auditable (transparent)**

Approach

- **Cooperatively develop a shareable, user-friendly, transparent tool capable of developing estimates of enrichment needs and spent fuel arising based on:**
  - **Size and rate of growth of reactor fleet**
  - **Average operating characteristics of reactor fleet**
- **Based on user inputs**

Inputs and calculation approaches are transparent

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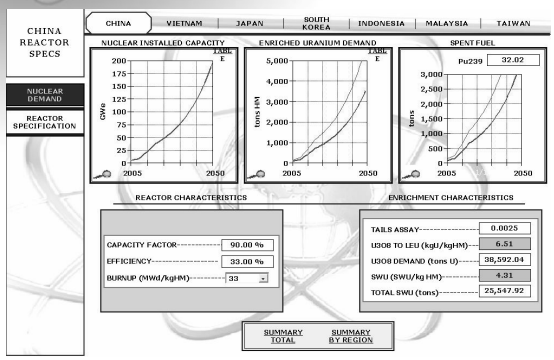
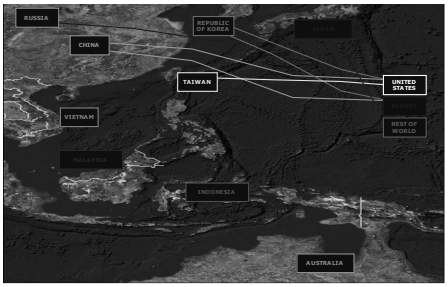
Case Study One: Reliable Access to Fuel Cycle Services





- **Inputs (by nuclear energy program)**
  - **Predicted growth of national reactor fleet (rate of growth)**
  - **Average Characteristics of Reactor Fleet and Enrichment (Capacity factor, burn up, efficiency)**
  - **Domestic service capacity (Nat U, SWU, SNF management capacity)**
- **Outputs (by nuclear program and region)**
  - **SWU demand**
  - **SNF arising**
  - **Balances and imbalances**

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Case Study Two: Integrated Monitoring and Data Management Systems for Spent Fuel Storage Facilities

International Safeguards Technology Development and Implementation	**Physical Protection Technology Development and Implementation**	**Capacity Development and Infrastructure Preparedness**	**Transparency and Openness**

- **Goals**
  - **Cost effective SNF storage systems**
  - **Public confidence and support**
- **Challenges**
  - **Proliferation sensitive material**
  - **Strong public sentiment**
- **Response**
  - **Develop common approach to integrated monitoring, data management, and the provision of data**

→

- **Multiple stakeholders**
  - **Local, National, Regional, International**
- **Multiple interests**
  - **Safety, Peaceful use, Security, Environment, Operations**

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Case Study Two: Integrated Monitoring and Data Management Systems for Spent Fuel Storage Facilities

- **Needs:**
  - **Multiple types of data**
  - **Understandable information**
- **Requirements:**
  - **Authentic and secure**
  - **Real-time (?)**
  - **Managed access**

Approach

- **Develop a comprehensive system for managing information acquired by facility monitoring tools, and providing portions of that information to key stakeholders**
- **Provide access to information showing:**
  - **Critical system requirements have been met**
  - **Major functions and technologies have been implemented**
  - **Operations are conforming to the needs of the interested parties**
- **While simultaneously facilitating the optimization of operations**

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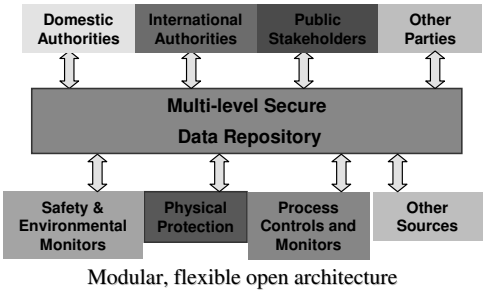
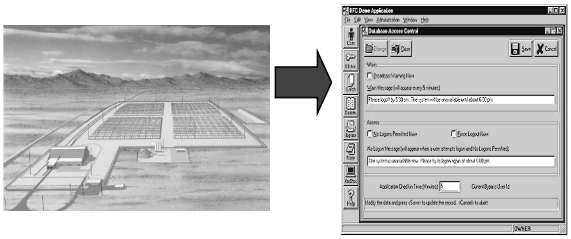
Case Study Two: Integrated Monitoring and Data Management Systems for Spent Fuel Storage Facilities

- **Facility "knowledge base" could include:**
  - **Facility description and design information**
  - **SNF characteristics**
  - **Safety Analysis Report**
  - **Monitoring and Sensors data**
- **Providing both descriptive information and results of the transparency, safeguards, non-proliferation, and monitoring capabilities of the system to appropriate parties**
- **Protecting that information from those without proper authorization**



Modular, flexible open architecture



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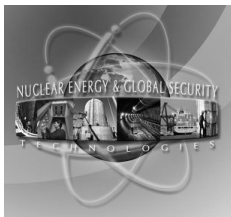

Evaluations

- **How can we evaluate the effectiveness of efforts to meet stakeholder needs?**
  - **Are some concerns are "beyond reason"?**
  - **Perceptions are hard to measure**
    - **Economic cost/benefit analysis?**
- **Can we develop approaches which both meet external stakeholder needs and offer benefits to operators?**
  - **Integrated facility monitoring and data management systems?**

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6.3 Remote Monitoring and Secure Communications for Transparency Applications

George T. Baldwin

Global Security and Nuclear Energy Technologies
Sandia National Laboratories, USA

Abstract

Peaceful nuclear activities have several dimensions of concern. Transparency is just one such dimension, which must coexist with facility operations, physical protection, safety, environmental oversight, domestic regulations, and international nuclear safeguards. One convenient technical approach for addressing transparency objectives for likely audiences involves remote monitoring and secure communications. However, many issues and details are involved in developing a viable remote monitoring solution for transparency. The technical solution itself should likely involve sensors, sensor platforms and/or tamper-indicating enclosures, data authentication and encryption, communications, storage, and analysis and review tools. The implementation of a transparency solution, involving technical design, installation, configuration, operation, maintenance, troubleshooting, assessment and evaluation, can be even more daunting. The individual technologies are not inherently for transparency; depending on the application, they may instead be part of another dimension of concern, such as safeguards. It is the system design for the application that is critical. An essential challenge for transparency is to be able to provide trusted information securely to an intended audience, with procedures established for dealing with anomalies, and in harmony with the other dimensions of concern for peaceful nuclear activities.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

SAND2008-1217C

Remote Monitoring and Secure Communications for Transparency Applications

George Baldwin
Sandia National Laboratories
February 2008

SAND2008-1158P

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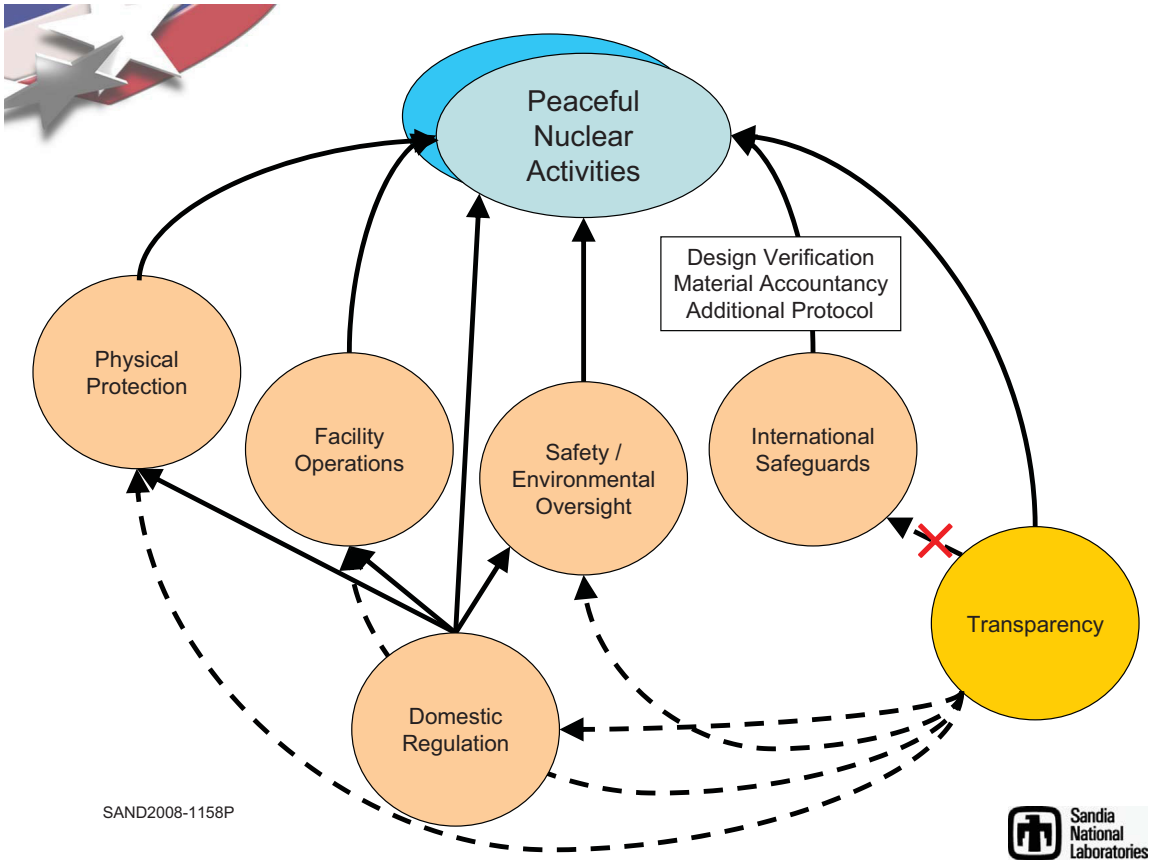

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How might Remote Monitoring and Secure Communications play a role?

- Who is the transparency audience?
  - Regional states / the public / nongovernmental organization or other 3rd party (“watchdog”) …?
  - The interested parties may be geographically distant or otherwise without ready access
  - Thus: remote monitoring
- But the audience is not necessarily everyone
  - There are reasons to exclude others
  - Thus: secure communications

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Remote monitoring conveys *information,* but we need to be specific:

- *Why* is information conveyed?
  - For what purpose will it be used?
  - Will it be acted upon? If so, how?
  - Context: Normal or abnormal situations?
- *What* information is conveyed? How much?
  - State of health
  - Raw data
  - Abstracted, reduced, or aggregated data
  - Assessment, conclusions
- *How* is information conveyed?
  - Pushed data, or pulled? / routine, periodic delivery, or demand delivery
  - A constant flow of routine information, left up to the recipient to interpret
  - Notification only of deviation from normal condition (e.g., “no news is good news”)
- *When* is the information provided and available?
  - In advance, prompt or delayed? Historical data retained?

- IN ALL CASES, the information must convey *truth*
  - We must be able to trust the source, and trust the absence of tampering

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Elements of a technical solution for transparency:

- Sensors
  - Video, switches, active seals, motion/IR detectors, radiation sensors…
  - Sensor platforms / tamper-indicating enclosures
- Communication media
  - Dedicated
  - Wireless
  - Public or commercial infrastructure (Internet, telephone, satellite…)
- Data surety
  - authentication & encryption
- Data Buffer / Storage
  - could be at the sending or receiving end, or both
- Analysis / Display / Review tools
- Procedures

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For a transparency system to be trusted, it must resist corruption.

- Accidental causes
  - things break, things happen!
- Malicious attack: an adversary has *many* options
  - Change data
  - Create data
  - Replay or substitute data
  - Claim to be another
  - Claim to not have sent data
  - Others?????
- Data surety can address many of these threats

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Cryptographic methods are essential for authenticating and encrypting data.

- Data authentication
  - Verifies the source of the data *and* its integrity
  - Public key methods enable multiple recipients
  - Time-varying parameters prevent replay attacks
    - Counter, time stamp, challenge response
- Encryption / Virtual Private Network (VPN)
  - Hides the content of the message, but not the fact that there is a message
- Key management issues
  - generation, lifetime, protection…

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Implementation aspects for transparency applications:

- Establish goals / define requirements
- Technical design (including modeling & simulation)
- Coordination with policy, stakeholders, etc
- Installation / configuration
- Use: operation & monitoring
- Process / procedure for handling anomalies
  ("It works! Now what do we do?")
- Maintenance & troubleshooting
- Performance assessment & evaluation

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Concluding Observations

- Any transparency application must coexist with existing controls—at the very least, it should do no harm
- Technologies already exist to accomplish many potential transparency objectives, but they can only be effective if the application is well-conceived and implemented
- Just because information is offered voluntarily, does not mean that it is inherently believable or true
- Systems engineering is essential
  - Consider all facets of the application completely
  - Technology is only part of the solution: Procedures!
  - Vulnerability analysis: assume someone will try to defeat the system, and design accordingly
  - Operational analysis: examine potential results and outcomes

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6.4 Containment & Surveillance System Development for the Safeguards of the Advanced Spent Fuel Conditioning Process Facility (ACPF)

Chul-Yong Lee* and Ho-dong Kim

Korea Atomic Energy Research Institute

Abstract

R&D efforts in the containment & surveillance (C/S) area are directed to an unattended, continuous, integrated surveillance system. In the development of the system, a particular effort is made for a digital analysis of the events by incorporating an advanced diagnosis mechanism to selectively draw a conclusion on the significant events only throughout the monitoring period. This was done by integrating the video and radiation sensors into a common time dimension through an image processing, and designing a computer interface for a neutron counting sensor. This system is able to draw to attention the spent fuel material movements to and from a typical hot cell system. KAERI has developed the safeguards for the advanced spent fuel conditioning process facility (ACPF). The main computer takes an image signal and a radiation signal periodically, analyzes them, and diagnoses the C/S status to report the results to the remote client.

The DAQ server program consists 4 parts as follows.

- Counter Module : Neutron Counter for ASNM1, ASNM2, ASNC
- MD Module : Motion Detection for 4 CCTV and display
- SMS Module : Shot Message Service by cellular phone
- AMSR Interface Module : Interface of Shift Register

Each neutron monitor installed at the ACPF includes two pairs of He-3 gas proportional counter tubes and a preamp to increase its efficiency and reliability. There is no gamma shielding because they are located outside of a hot cell, and their structures are constructed with a high density polyethylene, which also has the function of a neutron moderation. The signals from the ASNMs are acquired with a DAQ card which has six input channels and it simply counts the number of neutrons detected. The periodically acquired data is processed to be fed to the alarm diagnosis system. The used radiation data is the ASNM's neutron value and the ASNC's background value. Also the image data from the motion detection are evaluated. The evaluation process by this system is continuous and a in-process monitoring will be added in the near future. Also, KAERI's C/S system may be applied with the IAEA's C/S system after its development is completed.

JAEA-NPSTC Workshop

Containment & Surveillance System Development for the Safeguards of the Advanced Spent Fuel Conditioning Process Facility (ACPF)

Feb. 21, 2008

Chul-Yong Lee
KAERI

Outline

1. Introduction of Pyroprocess at KAERI
2. History of Safeguards R&D at KAERI
3. DUPIC Surveillance System
4. ACPF Surveillance System
5. International Cooperation
6. Summary

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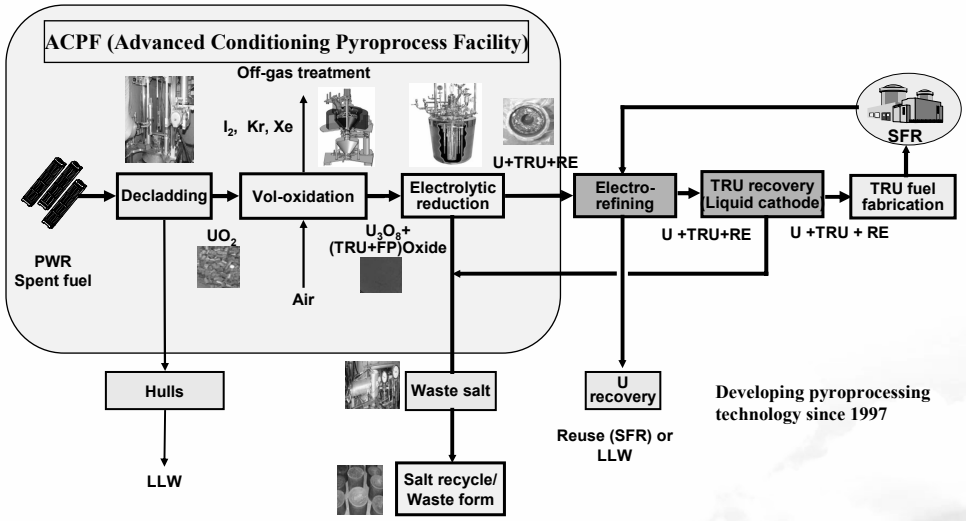
A Flow Diagram of Pyroprocess of KAERI



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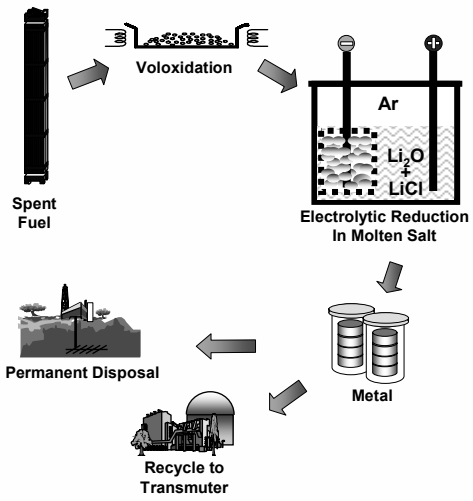
Introduction of ACP (Advanced spent fuel Conditioning Process)



What are the final products ?

- **Metal (U+TRU+ some FPs)**

What is the final destination?

- **Permanent disposal**
  - ✓ **Reduction of spent fuel heat power, volume and radioactivity**
- **Recycling to GEN IV reactors**
  - ✓ **Direct link with TRU burning in SFR**

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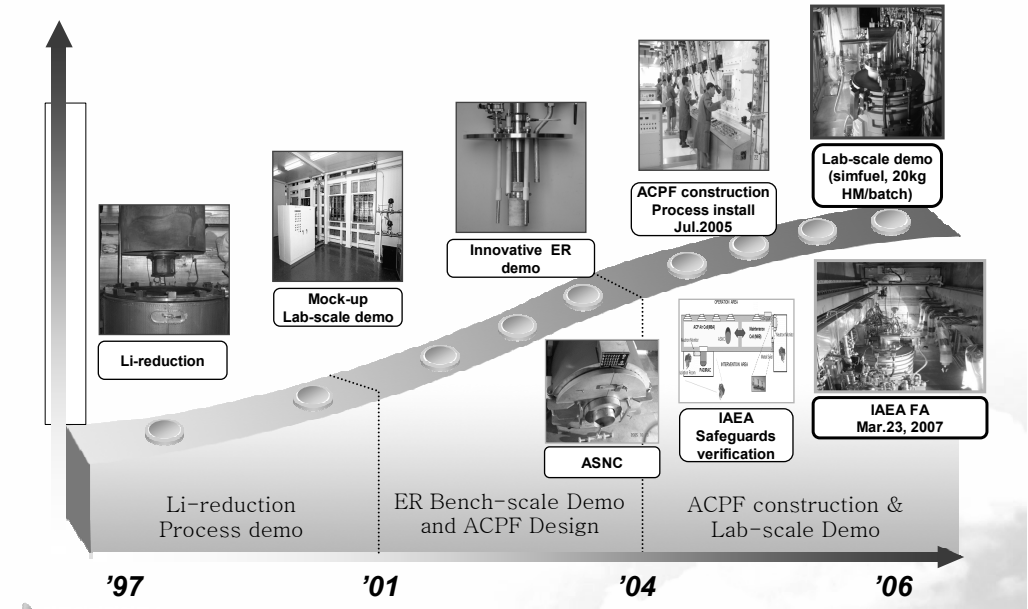
10 Year History of ACP Development



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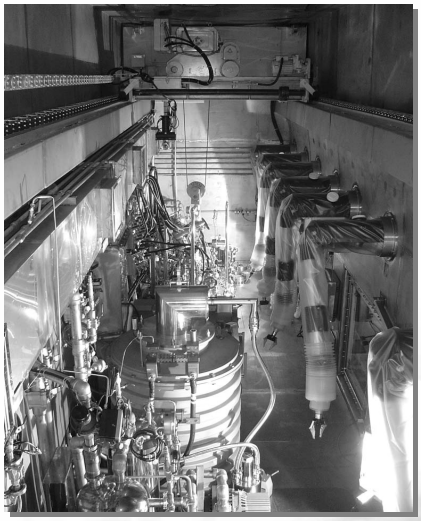
Lab-scale ACPF

- **20 kgHM/batch Demonstration Process**
  - Remote Operation and Maintenance
  - Interface Systems between Process Steps
  - Performance Evaluation of Process Systems

Working Area



Inside Process Hot Cell

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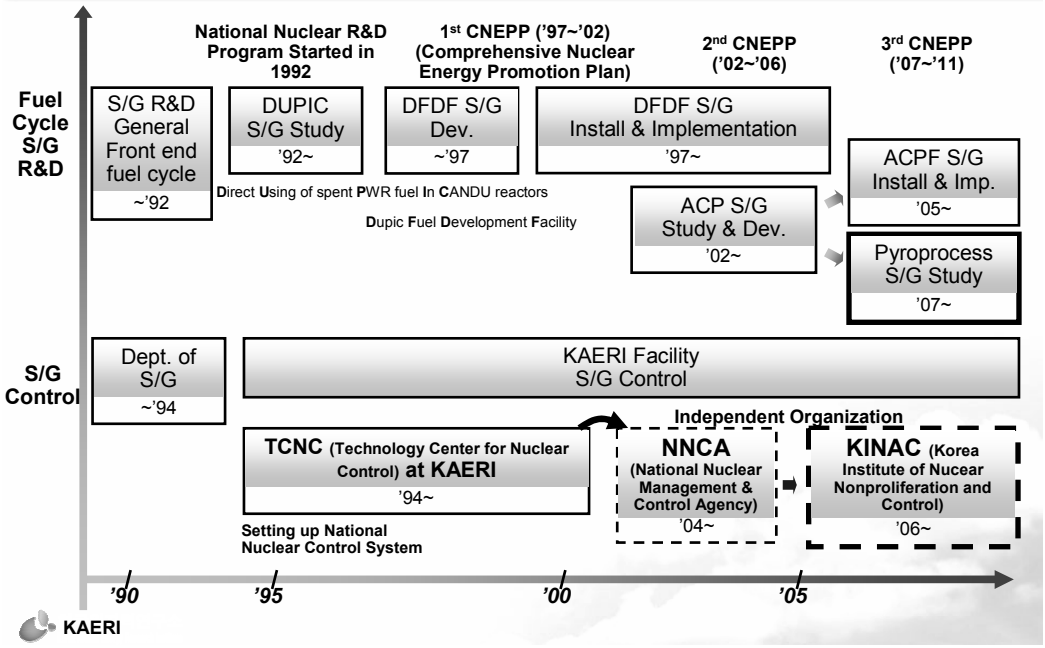
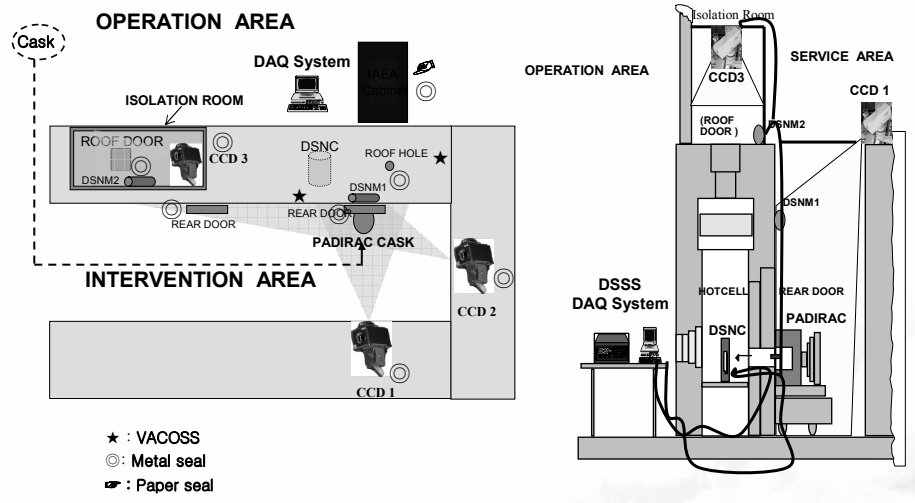
KAERI Safeguards History



DUPIC Surveillance System Installation



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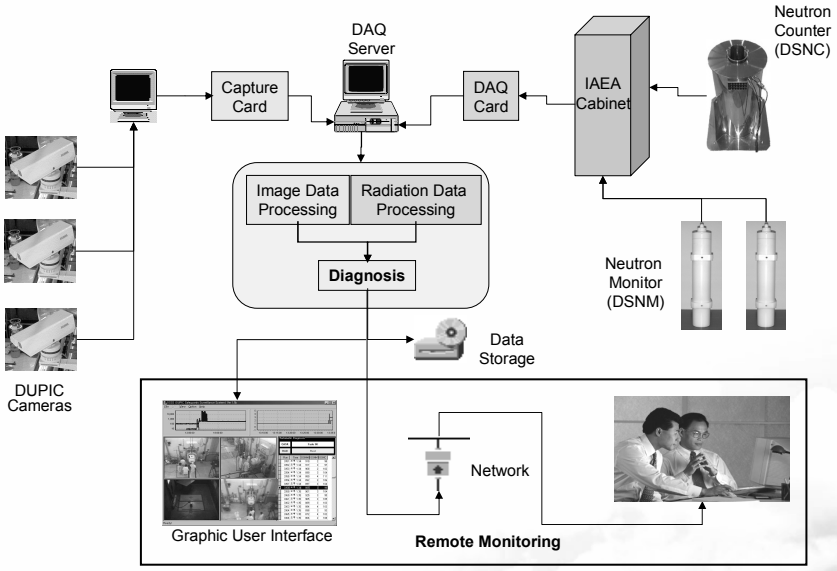
DUPIC Intelligent Surveillance System



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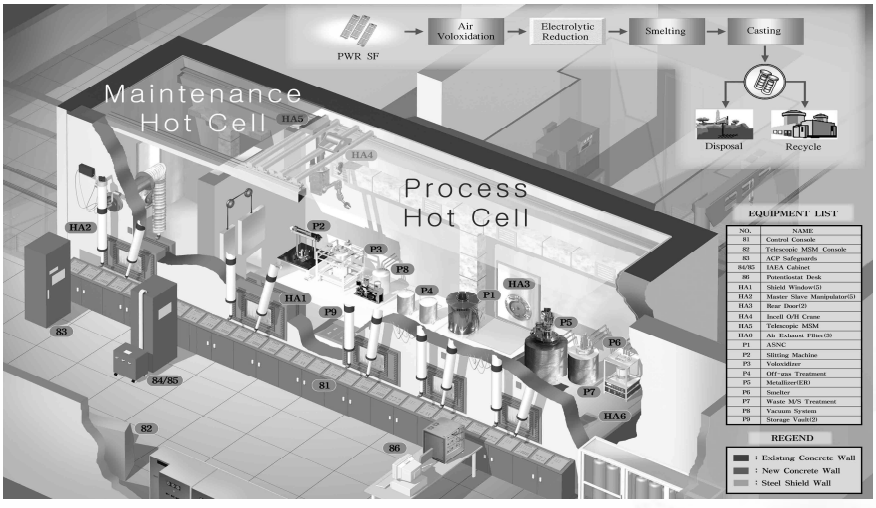
ACPF



- **Input material of the hot cell is spent fuel rodcuts (JD procedure is processing)**
- **Anticipated throughput: 100 kgU of PWR SF to be processed in several batches**

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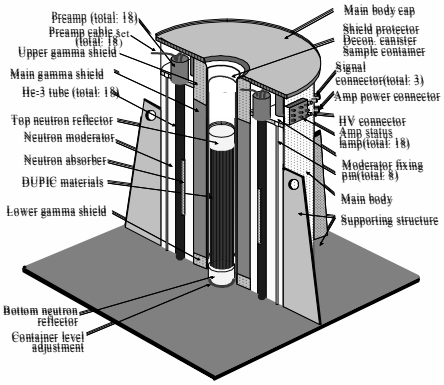
KAERI's Neutron Coincidence Counters

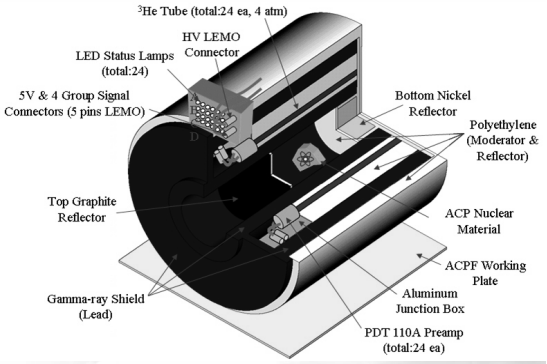
DUPIC Safeguards Neutron Counter (DSNC)

- Developed in 1999
- Passive neutron coincidence counter
- Gamma-ray shield: Tungsten 4 cm (Inner)
- Neutron detection efficiency: 13.5 %
- Sample cavity: 13 cm × 50 cm



ACP Safeguards Neutron Counter (ASNC)

- Developed in 2005
- Passive neutron coincidence counter
- Gamma-ray shield: Lead 6 cm (Inner/Outer)
- Neutron detection efficiency: 21 %
- Sample cavity: 21 cm × 33 cm
- Horizontal geometry and LEMO connectors
- Full remote maintenance capabilities



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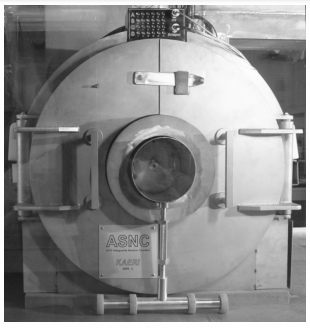
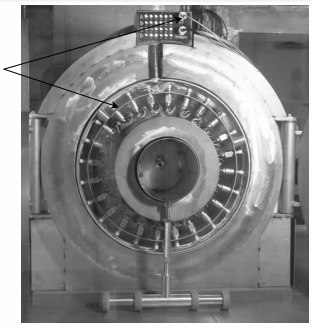
ASNC Installation

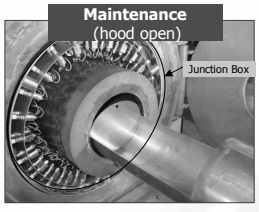


Front view of ASNC (Normal operation)

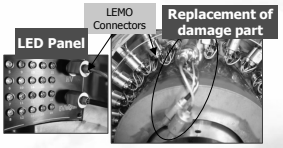
LEMO Connectors



Front view of ASNC - Open hood (Maintenance)



ASNC installed in the ACPF hot cell



LED Panel, Junction Box, LEMO con-/disconnection of the ASNC

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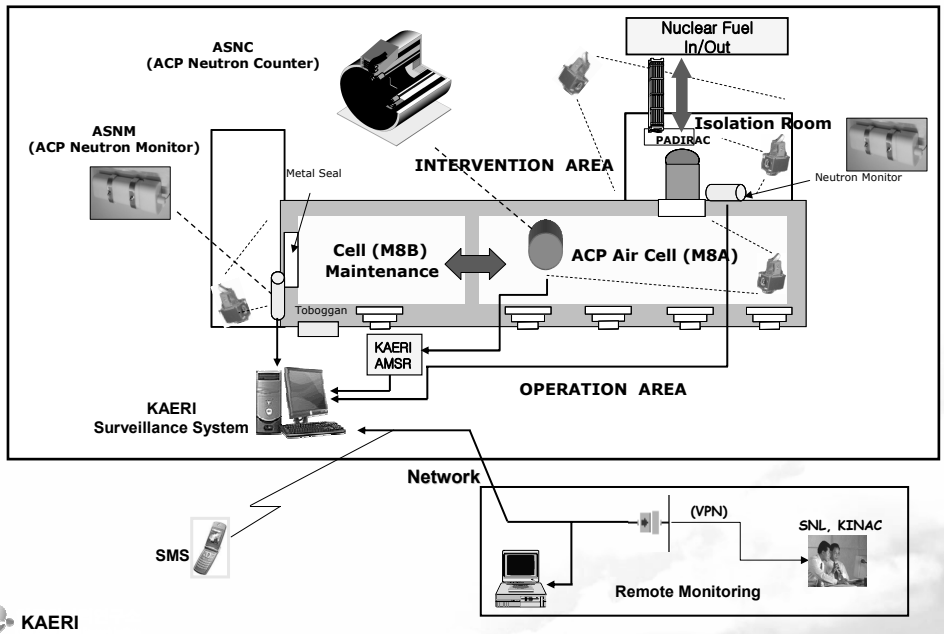
KAERI's Surveillance System



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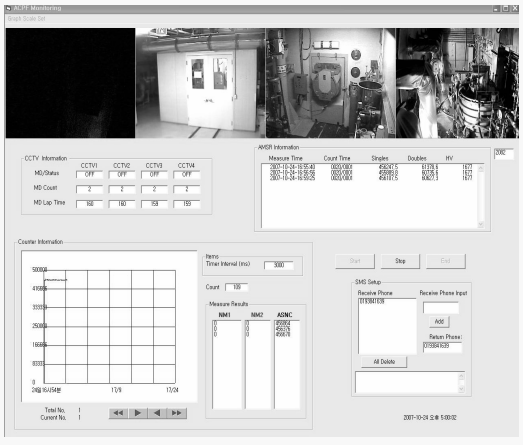
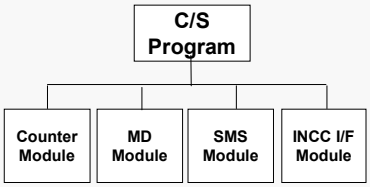
Advanced Monitoring System





- Counter Module : Neutron Count for ASNM1, ASNM2, ASNC
- MD Module : Motion Detection for 4 CCTV's
- SMS Module : Shot Message Service by Cellular Phone
- INCC I/F Module : Shift Register Interface

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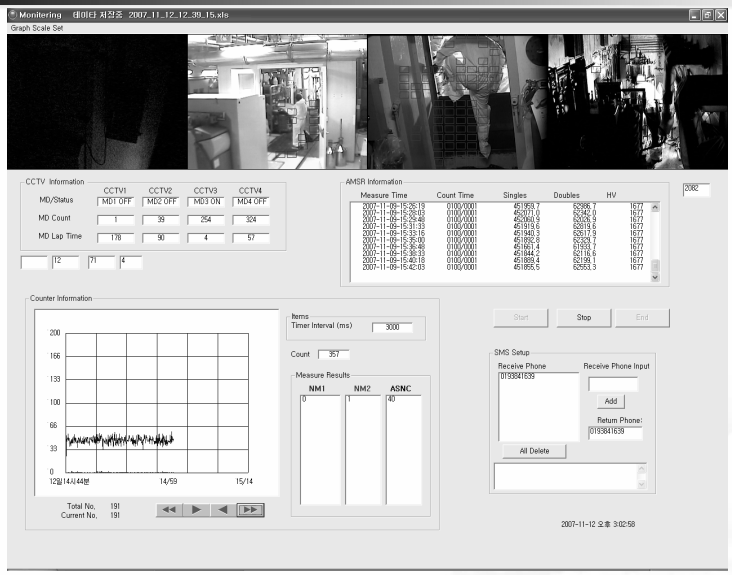
Motion Detection



- **Motion Detection compare change of pixel frame**

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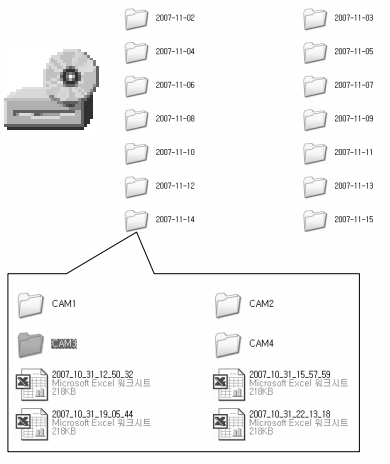
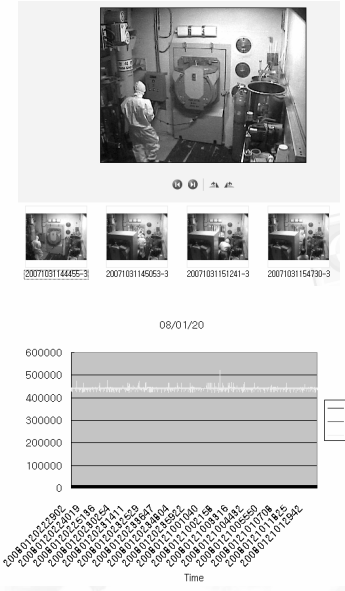
Data file & Image file





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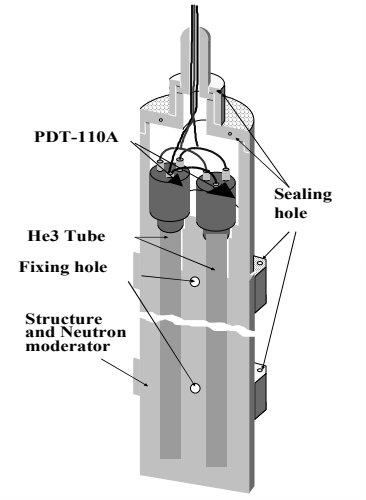
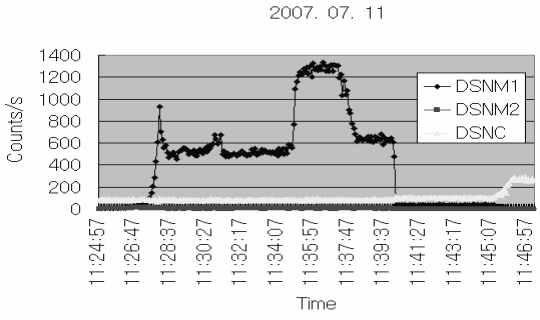
ACPF Neutron Monitor





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IAEA Containment and Surveillance

ACPF Side Rear Door

Metal Seal

TROVAN Seal

ALIS Camera

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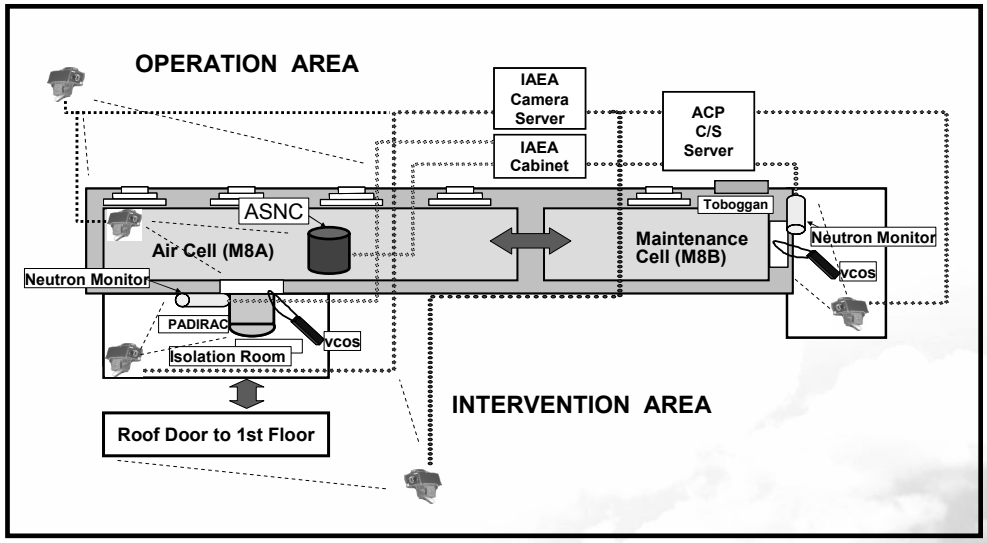
ACPF Surveillance System

❑ **cooperation with LANL and IAEA**



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International Cooperation

R.O.K	IAEA	U.S.A
KAERI	Safeguards Department	USDOE *- LANL etc.*

❑ **PCG : LANL**

- Cooperation on the Development, Implementation and Support of a Safeguards System for the ACP Facility and DUPIC Facility (AS # 17)

- Cooperation on a Study for Self-Indication Neutron Resonance Densitometry (SINRD) for Advanced Fuel Cycle (AS # 18)

❑ **KAERI-10 : LANL/INL**

- Safeguards Study for the KAPF – Evaluation of Proliferation Resistance of the KAPF

- Development of PNAR for measurement of fissile material of Pyroprocess facilities

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Summary

- The C/S system of lab-scale Pyroprocess Facility in KAERI was successfully designed and established under an international cooperation program.
- Based on performance test, it seems that C/S system is reliable enough to be used for the safeguards system.
- Some R&D for upgrading C/S system and IAEA authentication method will continue.
- Pyroprocess material measurement system, Process monitoring and Near real time accountability system will be integrated into the safeguards system in the next R&D stage.
  - Pu:U:Cm fraction in the Pyroprocess
  - Cell voltage, Cell current, Li_2O concentration monitoring
- The KAERI will continue to work closely with the IAEA and international partners for the future nuclear fuel cycle

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