LA-UR- 11-02669

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Title:	Safeguards by Design (SBD) for the Next Generation Safeguards Initiative (NGSI) - Accomplishments and Future Plans
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Intended for:	Presentation at ESARDA 2011 Budapest, Hungary May 16-19, 2011

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EST. 1943

Form 836 (7/06)

Safeguards by Design (SBD) for the Next Generation Safeguards Initiative (NGSI)

Accomplishments and Future Plans

ESARDA 2011

Budapest, Hungary

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Abstract

The International Atomic Energy Agency (IAEA) has described the safeguards-by-design (SBD) concept as an approach in which "international safeguards are fully integrated into the design process of a new nuclear facility from the initial planning through design, construction, operation, and decommissioning." International safeguards features often are added following completion of the facility design. Earlier consideration of safeguards features could reduce the need for costly retrofits of the facility and could result in a more efficient and effective safeguards design. The United States National Nuclear Security Administration (NNSA) is sponsoring a project through its Next Generation Safeguards Initiative (NGSI) to promote a global norm for the use of SBD for international safeguards. The NGSI SBD program has been developed in parallel with a similar effort at the IAEA while taking into account the IAEA's SBD achievements and future plans. The NGSI program includes DOE laboratory studies, international workshops, engagement with industry and the IAEA, and the setting of an example through its planned use in new nuclear facilities in the US. Consistent with this effort, the NGSI program has sponsored "lessons-learned" studies, the preparation of facility-specific SBD guidance documents, and an SBD workshop at the third international meeting for NGSI (NGS3). The following paper describes past accomplishments and future plans for the NGSI SBD program.

Contents

- Introduction to Safeguards by Design (SBD)
- Next Generation Safeguards Initiative (NGSI) program plan for SBD
- NGSI SBD Accomplishments
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Introduction to Safeguards by Design (SBD)
IAEA Definition

- "For the effective and efficient implementation of safeguards at a new facility, safeguards concepts need to be considered in the initial design planning stages, not only to improve its ability to be safeguarded and its proliferation resistance, but also to facilitate design changes when the costs of making such changes are still reasonably low."

- "Under the SBD concept, international safeguards would be fully integrated into the design process of a nuclear facility from the initial planning through design, construction, operation, and decommissioning."

-- IAEA Annual Report 2009

Introduction to Safeguards by Design (SBD) Objectives

- Design new civil nuclear facilities that meet national and international nuclear safeguards requirements
- Make implementation of safeguards at such facilities more effective and efficient
- Avoid costly and time-consuming redesign and retrofit of facilities; minimize disruptions of facility operations; and protect sensitive information.
- Design facilities so that the misuse of the facility and/or diversion of nuclear material is more technically difficult and easier to detect

Introduction to Safeguards by Design (SBD) History

- SBD is not a New Concept
  - Concept researched in 1970s and 1980s – called, among other things, in those days "Engineered Safeguards"

- Gaining Momentum with Recent Developments
  - IAEA SBD Workshop in October 2008
  - NGSI SBD program launched in FY2008
  - IAEA MSSP general SBD document under preparation
  - Special Session at INMM Annual Conference in Baltimore in July 2010
  - GC Safeguards Resolution included SBD mention in September 2010
  - SBD posters and presentations at IAEA SG Symposium in November 2010
  - NGS3 Workshop in Washington in December 2010

NGSI SBD Program Plan

- NGSI SBD program is starting 4th year
- Working with international safeguards experts at four U.S. labs: INL, LANL, PNNL, and ORNL to identify lessons learned , best practices and advanced concepts
- Engaging with companies considering, planning or actually building new nuclear facilities in the U.S.
- Coordinating closely with the IAEA Secretariat
- Sponsoring and supporting symposia and workshops to promote the SBD concept
- Preparation of "model" SBD guidance documents based on studies that have identified best practices for satisfying IAEA safeguards objectives and advanced concepts that may enhance future safeguards performance

NGSI SBD Industry Engagement
Reasons Industry Should Plan for IAEA Safeguards in the United States

- Under its Voluntary Offer Agreement (VOA) the United States has made a commitment to make civil nuclear facilities eligible for IAEA safeguards so that NNWS will not be under a commercial disadvantage by accepting safeguards on their facilities
- It is unlikely that reactors in the U.S. will be under IAEA safeguards in the near future; however, sensitive fuel cycle technologies (enrichment and reprocessing) could be selected for IAEA safeguards
- For gas centrifuge enrichment plants, the U.S. has made various commitments under the 1983 Hexapartite Safeguards Project (HSP) and the 1992 Washington Agreement with URENCO governments
- When a Fissile Material Cut-off treaty (FMCT) is negotiated and implemented, it is likely that IAEA will monitor reprocessing and enrichment plants in nuclear weapons states (NWS) as part of the verification regime
- If U.S. technology is exported to a non nuclear weapons state (NNWS) it will be under IAEA safeguards and SBD could help to limit project risk

NGSI SBD Accomplishments
Industry Engagement (Enrichment)

- The US Nuclear Regulatory Commission (NRC) has recently hosted efforts to facilitate the use of SBD for new uranium enrichment facilities currently being planned for construction in the US
  - Louisiana Enrichment Services (LES) for its GCEP facility under construction in Eunice, New Mexico
  - AREVA for its planned GCEP facility in Eagle Rock, Idaho
  - Global Laser Enrichment (GLE) for its laser enrichment facility under consideration.

NGSI SBD Accomplishments
Industry Engagement (Plutonium Recycle)

- Discussion with Shaw AREVA MOX Services concerning surplus plutonium recycle from U.S. defense programs in the Mixed Oxide (MOX) Fuel Fabrication Facility currently being built at the DOE Savannah River site in Aiken, South Carolina.
- Discussions with AREVA focused on potential future plutonium recycle in the US for reactor-grade plutonium.
  - May be based on advanced aqueous separations such as AREVA's co-extraction (COEX) process with potential modification for actinide separations
- Discussions with GE focused on potential plutonium separation by electrochemical processing and recycle in their planned fast reactor.
- Discussions with General Atomics (GA) regarding their planned Next Generation Nuclear Plant (NGNP)

NGSI SBD Accomplishments
Symposia and Workshops

- NGSI personnel participated in the October 2008 IAEA international workshop to discuss how safeguards could be better facilitated in nuclear plant design and operations.
- The NGSI program sponsored a session on SBD at the Institute of Nuclear Materials Management (INMM) symposium July 11–16, 2010, in Baltimore, Maryland, during which 10 papers were presented by representatives of governments and industry.
- The NGSI sponsored several SBD posters at the IAEA safeguards symposium November 2010, in Vienna.
- The *Third International Meeting on Next Generation Safeguards*, hosted by NGSI on December 14–15, 2010 in Washington, D.C., was a 2-day technical meeting to discuss implementation of the SBD concept.
  - There were approximately 100 meeting participants from thirteen countries, comprised of safeguards policy and technical experts from government and industry.

NGSI SBD Accomplishments
Recent Publications (Examples)

- General SBD Guidance

  Thomas, K., Safeguards by Design General Guidance, Los Alamos National Laboratory, LA-UR-09-05802, October 2009.

- Enrichment SBD Guidance

  Laughter, M., McGinnis, B., Morgan, J. and Whitaker, M., Implementing Safeguards by Design at Gas Centrifuge Enrichment Plants, ORNL/TM-2010/87, Draft, May 2010.

- Gen III/III+ LWR SBD Guidance

  Pan, P., Boyer, B., and Scherer, C., Safeguards by Design: Safeguards Guidance for Gen III/III+ Light Water Reactors, Los Alamos National Laboratory, LA-UR-10-05336, Rev 0, August 2010.

- Third International Meeting on Next Generation Safeguards

  Safeguards by Design, Final Meeting Report, meeting held Washington, DC, 14-15 December 2010, U.S. Department of Energy (DOE)/ National Nuclear Security Administration (NNSA) Office of Nonproliferation and International Security, to be published.

NGSI SBD Future Plans

- In 2011 and beyond, the NGSI will continue engaging industry for SBD of new nuclear facilities in the US.
- In 2011 the NGSI will sponsor the preparation of three new model SBD guidance documents prepared by the DOE national laboratories. These documents were selected by considering the interests of the IAEA and US DOE.
  - uranium conversion
  - research reactors
  - interim spent fuel storage installations
- As in 2010, the NGSI will sponsor a session on SBD at the INMM annual meeting planned for July 17–21, 2011, in Desert Springs, California.
- The NGSI will support future IAEA efforts assisted by the European Commission Support Programme, to develop a document that describes the basic principles of safeguards and the fundamental design features and measures that facilitate the implementation of international safeguards.
- The NGSI will support future IAEA efforts to propose a support program task to the participating IAEA Member State Support Programs to prepare facility-specific SBD guidance relative to those facility types in which specific States have experience and expertise.