Design Principles for Advanced Transparency Implementation in the Next Generation of Nuclear Facilities

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Outline

- Advanced Transparency Framework

- Benefits of Advanced Transparency

- Design Principles

- Conclusions

I would prefer if you use the red and blue ones I have rather than the yellow and green

Nuclear fuel cycle transparency involves the cooperative sharing of relevant nuclear material, process and facility information among all authorized parties to ensure the *safe and legitimate* use of nuclear material and technology
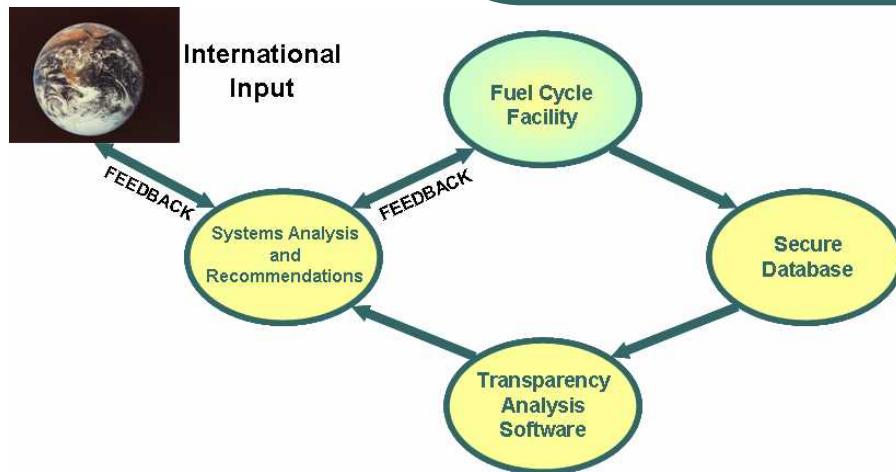
***Transparency* is a confidence building approach among political entities to ensure civilian nuclear facilities are not being used for the development of nuclear weapons**

A system is transparent when all parties feel that the _proliferation risk_ is at an acceptable level. For this to occur, proliferation risk should be monitored in a _continuous_ fashion.

International Input

Fuel Cycle Facility

FEEDBACK

FEEDBACK

Systems Analysis and Recommendations

Secure Database

Transparency Analysis Software

I would prefer if you use the red and blue ones I have rather than the yellow and green

NEW
Increasingly automated fuel handling activities
Use of process data
Real-time quantitative analysis

OLD
Monitoring fuel handling activities by inspection
Slow and subjective

REDEFINING TRANSPARENCY

A traditional transparency system involves:

- Use of external devices
- Comparison of recorded and declared activities
- Provides no feedback

An advanced transparency system MUST:

- Operate in real-time
- Utilize plant process and design data
- Utilize declared plant operations
- Conduct real-time, quantitative analysis of proliferation-risk
- Securely provide analysis to the facility and authorized parties

Conceptual Framework for Advanced Transparency
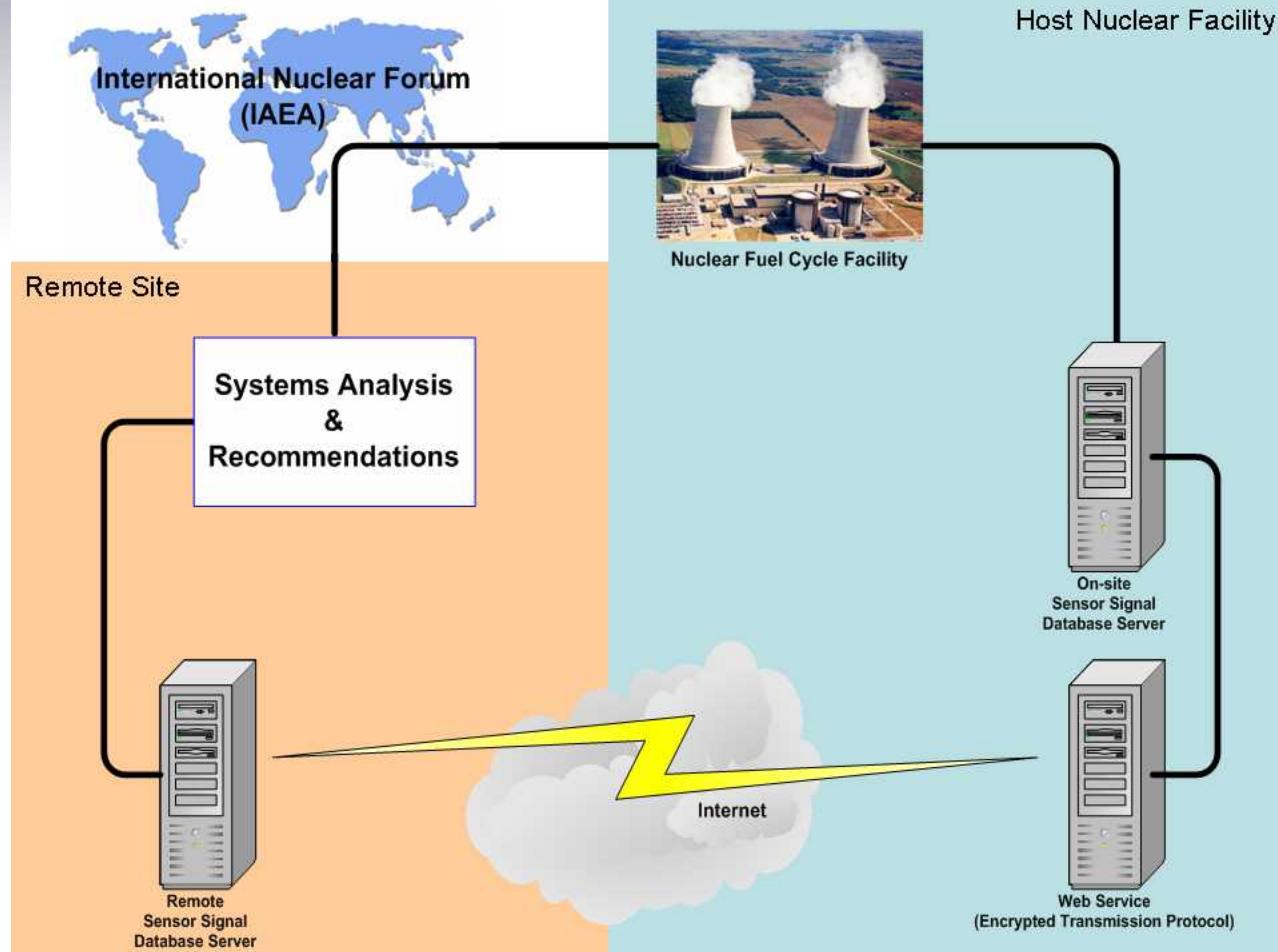
Benefits of Advanced Transparency

- Provides a means for <u>uniformly gathering verified data</u> for building trust relationships between countries

  vdc1

- Advanced Transparency systems are capable of remotely <u>gathering intrinsic process data from an automated facility</u>

  vdc2

- Supports confidence building by <u>monitoring operations in a continuous fashion</u>

- Capability for <u>real-time analysis</u> of <u>purely objective data</u> can provide an alternative source of information to flag real-time deviations from declared operations

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vdc1   i don't think we can use the term verified with out having the IPB folks jump all over us
Virginia D. Cleary, 5/21/2008

vdc2   i wouldn't use this word either
Virginia D. Cleary, 5/21/2008

Building-in Transparency

- The Advanced Transparency Framework was developed under the premise that higher levels of Transparency should be engineered into a facility while it is designed

- This calls for a concurrent engineering design approach:
  - Multilateral design team, including a transparency engineer
  - Participation from all operational and processes areas

- The entire facility is engineered as a system
  - Considering event-consequence relationships, and
  - Defining clear boundaries to facilitate a comprehensive diversion pathway analysis

Benefits of Built-in Advanced Transparency

- <u>Optimizing facility design</u> to minimize the risk of host diversion and theft

- <u>Minimizing cost</u> by eliminating the need for retrofitting the facility with extrinsic monitors and sensors

- <u>Increasing safety and reliability of operations</u> by allowing detection of failure

- <u>Providing secure data</u> for IAEA independent verification and validation.

vdc3

vdc3   can't say independent verification and validation either - you can say providing a secured data source for IAEA use
Virginia D. Cleary, 5/21/2008

Designing Advanced Transparency Facilities

- Current technology readiness allows:
  - A very high degree of functional information on a data bus that can be authenticated, tamper-indicating, and encrypted
  - Real-time access to information as it is being generated
  - A system of necessarily required highly reliable components for effective and efficient automation

Technology Advancements
- **Automation**
- **Digital Electronics**
- **Encryption**

Design Principles

- Fully automated system, minimum manual operation
- All signals should pass through a single central processing unit for all plant operations
- System components and sensors should be highly reliable, fail-safe, and tamper resistant
- Secure information systems to distribute data without providing data to potential adversaries
- Analysis tools to digest the data provided into a uniform standard

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Conclusions

- Augmentation of the current transparency ideology can support the IAEA mission to ensure safe and peaceful use of nuclear technology.

- New ideas for fuel cycle transparency can result in increased confidence and optimized resources.

- Built-in Advanced Transparency will allow nuclear suppliers a means of designing systems that are demonstrably safe and proliferation resistant.

- Advanced Transparency facilities will have the confidence that every aspect of proliferation concern has been addressed in the vdc4 design.

- A new paradigm can be utilized to facilitate deployment of nuclear technology to developing nations, optimize inspections, and enforce agreements.

vdc4   i would say diversion
Virginia D. Cleary, 5/21/2008