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Designing in Transparency

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- Subtitle 24 pt
  - Second level 22 pt
    - Third level 20 pt
      - Fourth level 18pt
        - Fifth level 18pt

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Topics to be Covered

- What is Advanced Nuclear Fuel Cycle Transparency
- Why is Transparency important?
- How to design it in to exported systems.
- Benefits of a Transparency System

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Advanced Nuclear Fuel Cycle Transparency

A Proliferation Perspective

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.

Substitute:
"Safety"
"Operations"
"Security"

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The Three Levels of Transparency

A system is considered *TRANSPARENT* when the parties involved feel that the *PROLIFERATION RISK* is at an acceptable level. For this to occur, proliferation risk should be monitored in a continuous fashion.

The highest levels of transparency imply multilateral control of nuclear facilities and processes.

1. Bilateral or multilateral agreements on the operation, inspection, and verification of nuclear operations within a host country.

2. Added surveillance and remote monitoring of nuclear operations usually at random or without notification.

3. DIRECT MONITORING OF NUCLEAR OPERATIONS IN REAL TIME.

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The Transparency Framework: Supporting International Agreements

International Input

Fuel Cycle Facility

FEEDBACK

FEEDBACK

Systems Analysis and Recommendations

Nuclear Fuel Cycle Transparency Framework

Secure Database

Transparency Analysis Software

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The Transparency Framework

- Plant process is automated
- Plant process data generated during operations is immediately available for analysis
- Measure diversion risk
- Secure communication protocol between remote locations
- Secondary verification of operations

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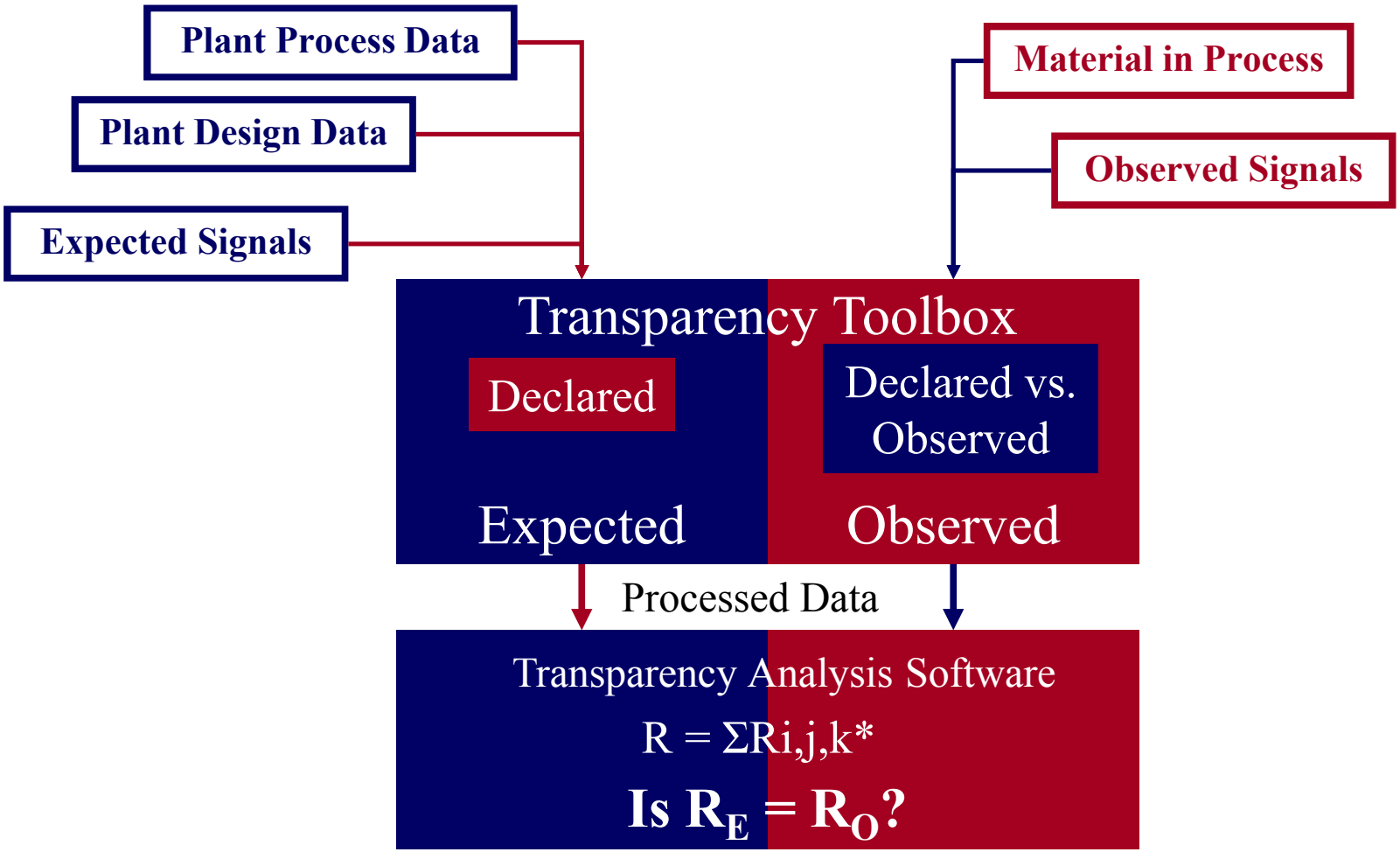
Diversion Risk



*where i,j,k = step, process, plant

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The Advantages of Installing a Transparency Framework

1. Optimized facility design to minimize the risk of host diversion and theft
2. The use of automated systems provides intrinsic data and minimizes labor costs
3. Provision for secure data for IAEA independent verification and validation, thus eliminating the need for a secondary monitoring system
4. Provision for an international standard for transparent systems to reduce proliferation risk
5. Increased safety and reliability of operations by allowing detection of failures resulting in maximum availability of the plant
6. Provides technology base for the allowance for the exporter of the nuclear facility to remotely secure and inhibit operations to ensure the legitimate use of the facility

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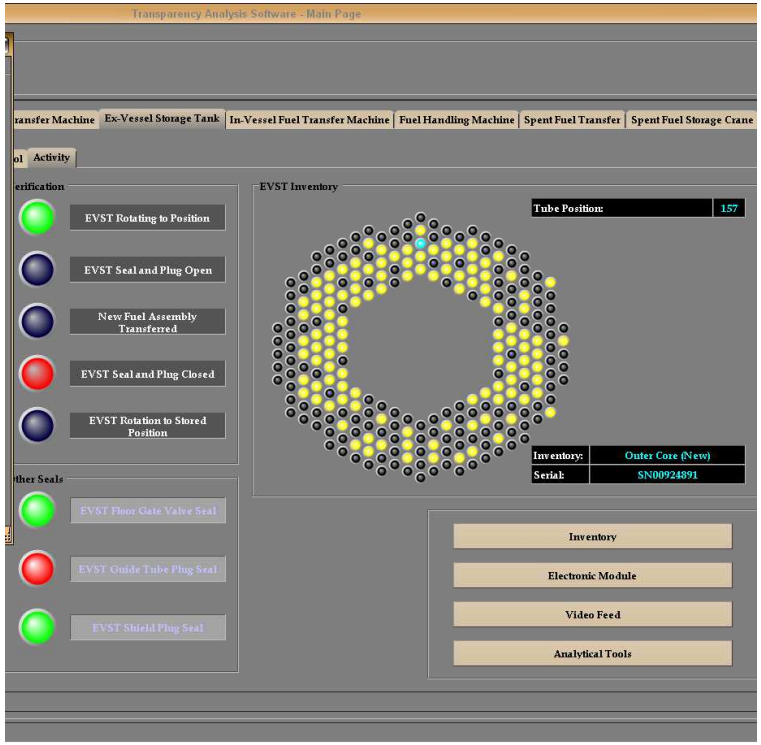
Technical Developments

- Accurate collection of signals internal to the Monju Nuclear Fuel Cycle Model
- Live collection and transfer of these signals from the Monju Database Server (in Japan) to Sandia
- Accurate interpretation of signals in accordance with model operations
- Detection of “manual override events” or interruptions in automated processes
- Quantitative methodologies to determine material diversion risk
- Timely information supporting real-time assessment of conditions
- Comprehensive technology database for designing and supporting effective transparency systems



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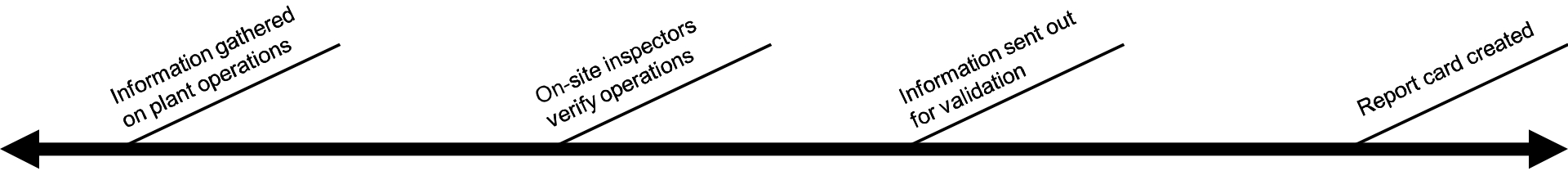
Designing in Transparency

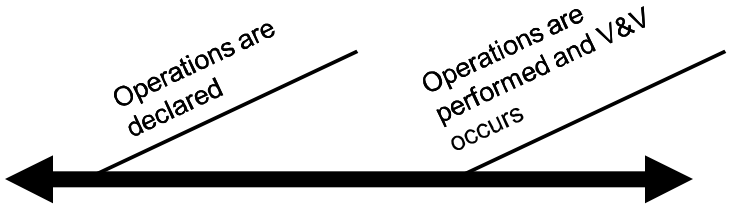
- Designing in a transparency framework would require that the nuclear facility be designed such that:
  1. All processes would be automated
  2. There would be limited hands on operation with limited access
  3. All signals would pass through a single central processing unit for all plant operations
- In addition, a transparency engineer will need to be an essential part of the design team so that efficiency of the transparency system can be increased while reducing the costs of adding in the transparency framework

Before and After

1. Plant operations are not known until operators declare operations
2. Information only gathered on what enters and leaves the system
3. Analysis of declared operations goes through a long bureaucratic process
4. On-site inspectors provide verification when able
5. Safeguards & Verification report cards generate annually
6. Verification operations and cost are enormous in terms of hardware and manpower

1. Operations are declared before they occur and are confirmed during the process
2. Every process step was followed and modeled; we track every SQ of material
3. Operations are declared in advance; thus, operations are verified instantaneously (real-time)
4. Inspectors are only need when the analysis says there are anomalies
5. Report cards are updated minute by minute
6. Engineered up front and built in by design to minimize manpower while enhancing accuracy and timeliness





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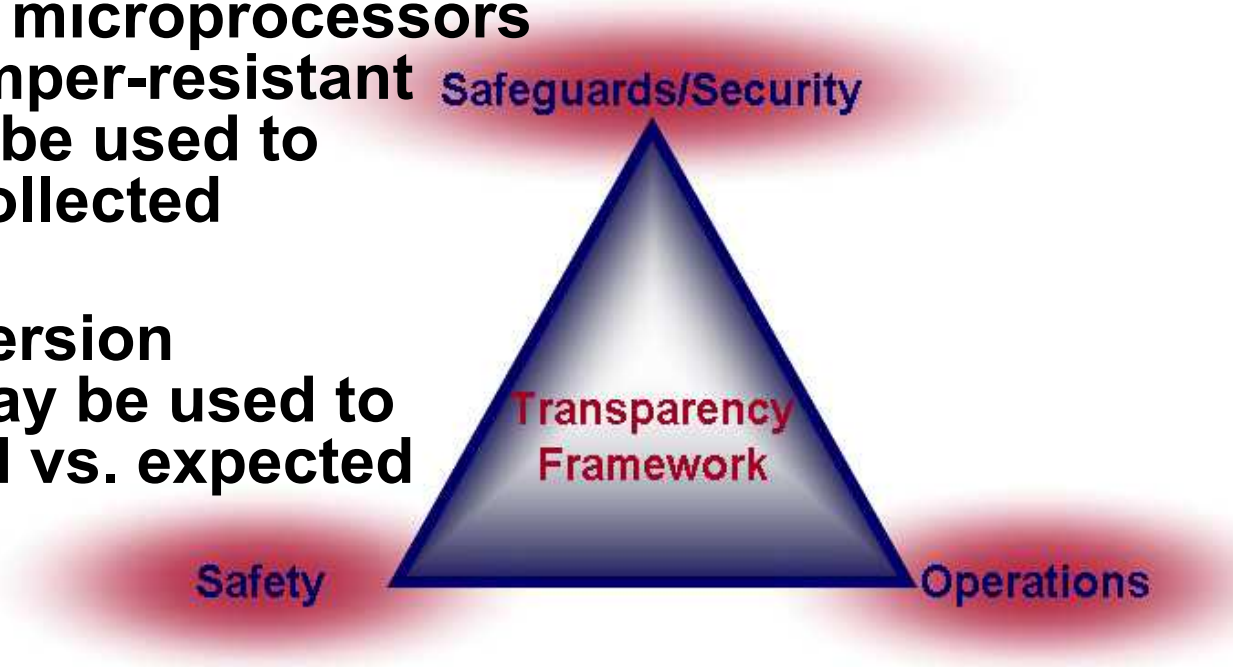
Issues to Consider in Design

- Degree of Process Automation
- Common structure of operations data
- Secure, tamper-indicating structures
- Secured Transparency Processors making reports
- Reporting mechanisms to international centers and manufacturers

Conclusion

- Nuclear Fuel Cycle Transparency Framework is an advanced means to verify facility operations
- Collection of internal automated process data may be used to augment safeguards
- External, wireless microprocessors with advanced tamper-resistant technology could be used to verify internally collected signal data
- Sophisticated diversion risk algorithms may be used to evaluate observed vs. expected activities



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