The European experience in safeguarding nuclear fuel recycle processes and Pu stores

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Overview

- Introduction
- Safeguards approaches in Recycling plants
- The development of purpose safeguards equipment including remote data transmission
- Optimising the inspection regime
- Conclusions
Introduction

- Characteristics of recycling plants
  - Continuous mode of operation
  - NM difficult to access
  - Significant throughput and inventory

- Safeguards approaches based on:
  - Safeguards by design
  - Unattended measurement systems
  - Extensive use of C/S systems
  - Central collection of signals
Safeguards approaches in Recycling plants(1)

- Early involvement of Euratom – design to take into account safeguards requirements (e.g. laying of cables- installation of equipment- additional accountancy tanks?)
- MBA structure for effective accountancy controls
- Verification activities at KMPs
Safeguards approaches in Recycling plants (2)

- MBA structure for Reprocessing plants
  - Wet storage of irradiated fuel elements
  - Shearing and dissolution of elements
  - Separation and conditioning of Pu, U and fission products
  - Pu product storage
  - U product storage
  - Waste treatment facility

- KMPs
Safeguards approaches in Recycling plants(3)

- MBA structure for MOX fabrication plants
  - Powder receipt area
  - Mixed oxide production area
  - MOX element assembly area
  - Waste treatment area

- KMPs
Safeguards approaches in Recycling plants(4)

- Elements of Safeguards Approach
  - Verification of the flux of nuclear material
  - Annual Physical Inventory Verification
  - Evaluation of the MUF (in the bulk handling MBAs)
  - Evaluation of the C/S measures for Continuity of Knowledge purposes
Safeguards approaches in Recycling plants (5)

- Verification activities
  - Item Identification
  - Weighing
  - Volume and density measurements of tanks
  - Continuous monitoring of the liquid level in the tanks
  - DA sample taking and analysis (concentration, assay, isotopic composition)
  - NDA measurements (neutron and gamma)
  - Neutron monitoring
  - Video surveillance and electronic sealing
  - Use of Copper Brass metal seals
Safeguards approaches in Recycling plants(6)

- Verification activities based on continuous monitoring (except ID, metal seals, weighing)
- Raw data compiled to ‘events’ data base
- ‘Events’ compared to operating records
- ‘Events’ + Operating records transferred to HQ via USB

Inspection frequency/resources depending on volume of information/analysis required
Development of safeguards equipment

- Data available electronically
- Data confidentiality classification
- Use commercially available transmission lines for their transmission from nuclear Installation to HQ (=RDT)
Development of safeguards equipment

- Examples of software packages developed by Euratom include:

  - The **RADAR** (Remote Acquisition of Data and Review) software package aiming at the unattended acquisition of data from a variety of instruments, which combined with the data evaluation package **CRISP** (Central Radar Inspection Software Package) provides for the unattended creation of the events database and its comparison with the Operator's declarations.

  - The **DAI** (Data Analysis and Interpretation) monitoring software tool, capturing a vast amount of signals from different types of instruments and analysing them in a way that nuclear material flow through a recycling plant can be tracked and compared to the Operator's declarations.
Development of Remote Data Transmission

Data candidate for RDT

- Euratom equipment state of health
- Euratom equipment measurement data
- Branching of Operator's equipment
- Euratom video surveillance data
- Euratom electronic seals data
- Operator's operating records
- Operator's operating reports
- Operator's supporting documents
- Inspector's inspection working documents
Development of Remote Data Transmission

Euratom/Operator and State to agree:
- Which data to be transferred
- Security requirements
- Technical solutions

Either:
- Transfer data (Big volume, synchronization issues)
Or:
- Store on site, access remotely via secure protocols
Advantages of Remote Data Transmission

- Increased data security through appropriate secure transmission
- Better possibilities of organising, exploring and archiving the data
- Data consolidation and stratification through early agreement on which data need to be provided
- Better possibilities to develop programs for data analysis and evaluation, based on the agreed format and context of data transmitted
- Increased efficiency through harmonisation and streamlining between facilities of the same kind
- Improved conservation and transfer of inspection know-how and the cross-fertilisation between teams of inspectors
Optimising the inspection regime

- Activities that could be performed at HQ (equipment)
  - Follow up of the state of health of equipment and planning of interventions
  - Planning of alternative safeguards measures in case of equipment failure or loss of containment
  - Remote update of system parameters (mainly software)
  - Checking of completion of maintenance or upgrade actions requested by the inspectors (e.g. transducers calibration, or testing of proximity switches)
Optimising the inspection regime

- Activities that could be performed at HQ (Information)
  - Review of surveillance records and reconciliation with events as declared by the operator
  - Review of electronic seal events and reconciliation with events as declared by the operator
  - Evaluation of continuous measurements (e.g. accountancy tank volume and density, or neutron and gamma measurements) and comparison with operating records.
  - Evaluation of unattended NDA measurements of discrete items against the operator's declarations
  - Comparison of operating records and reports with accountancy declarations received in Luxembourg
Optimising the inspection regime

- Advantages of inspection activities at HQ
  - More familiar/better equipped environment?
  - More time left for:
    - BTC re-verification
    - examination of supporting documents
    - NMAC audit
    - Resolution of anomalies
  - More effective use of inspector resources:
    - Less travel days
    - Homogenisation of their work pattern
    - Better planning of fieldwork (less surprises)
Optimising the inspection regime

- Disadvantages of inspection activities at HQ
  - Reduced familiarisation of inspectors with installation
  - Inspector presence promotes good operational practices
  - Problem solving via personal contact
  - Inspector presence as a deterrent!
Optimising the inspection regime

Advantages of RDT/RSA for Operator
» Flexibility in planning equipment maintenance
» Enhanced access for maintenance
» Dose uptake reduction
» Predictability of Inspectorate’s requirements
» More time to resolve discrepancies
» Reduced need for provision of escorts
» Less frequent manipulations involving NM
Optimising the inspection regime

Integration of activities at HQ and on site
- An ‘inspection’ to comprise HQ and on site activities
- ‘opening meeting’ to be replaced by …
  - A mailbox?
  - Checklists?
- ‘Final inspection meeting’ could be substituted by a videoconference- the operator will be informed of any preliminary inspection conclusions
Conclusions

- Recycling plants and NM stores well suited for RDT
- RDT presents a number of advantages
- RDT security related issues to be resolved in advance
- Remote activities could contribute to the efficiency and effectiveness of the safeguards system
- Under an optimised inspection scheme, range of inspection activities to be revisited
- No undue burden on operators
Thank you for your attention