European Commission
Safeguards at modern MOX Fuel Fabrication Plants

European Commission
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Presentation at JAEA-IAEA Workshop on Advanced Safeguards Technology for the Nuclear Fuel Cycle at the Techno Community Square, Ricoti, Tokai-mura, Ibaraki, Japan, November 2007
Purpose of this presentation

- Legal Background of European Commission (EC) Safeguards scheme
- General overview on EC Safeguards scheme for MOX Fuel Fabrication Plants (FFP)
- Feedback on safeguards experience gained from industrial sized MOX FFP
- Outlook on further developments planned
Legal Basis

- EURATOM Treaty 25.3.1957
  - No diversion from intended use
- NPT 5.3.1970
  - INFCIRC/193 (NNW EU MS, Euratom and IAEA)
  - INFCIRC/263 (United Kingdom, Euratom and IAEA)
  - INFCIRC/290 (France, Euratom and IAEA)
- Additional Protocol INFCIRC/540
- Commission Regulation 302/2005
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- Basic Technical Characteristics (BTC)
- Programme of activities
- Nuclear Material Accountancy
- Particular Safeguards Provisions (PSP)
- Reporting formats
Nuclear Safeguards in the European Union

- 27 Member states
- Regional Safeguards System
- Interface and support to IAEA
- About 1000 active Material Balance Areas (MBA) in more than 900 installations in the EU
- About 120 European Commission Safeguards inspectors performed nearly 1500 inspections in 2006
MOX FFP in Nuclear Fuel Cycle

Source: Atomwirtschaft
EC Safeguards in MOX FFPs

- More than 30 years experience with MOX Fuel Fabrication Plants in Europe using separated Plutonium from LWR reprocessing
- Among most complex plants in the nuclear fuel cycle with respect to safeguards
- Highly automated, limited human access
- Adapted Safeguards approaches needed
Main MOX Fuel Fabrication Plants in Europe

- **MELOX**
  - **Marcoule, France**
  - Throughput 195 t HM/y (license to increase from 145 t HM/y received in April 2007)
  - Operational since 1994

- **SMP**
  - (Sellafield MOX Plant), UK
  - Throughput ramping up (originally foreseen 120 t/HM)
  - Operational since 2002
Specificities of a MOX Fuel Fabrication Plant

- Direct use material
- Material in parts of the plants handled in bulk form
- Strategic facilities in nuclear fuel cycle
  - Preferred location for Fuel Assembly verification instead of at reactor site
  - Last chance for high quality material verification in fuel cycle until reprocessing
Construction and Commissioning phase

- Early inspectors’ involvement ensured comprehensive plant knowledge
- Safeguards awareness at all plant levels
- Shared project documentation as common reference for all stakeholders
- Stability of inspection team and interfaces with the operator ensures consistency and maintains knowledge
GENERAL PRINCIPLES AND CRITERIA

- Plant complexity and production targets require tailored Safeguards concepts
- Plants run continuously and normally not stopped for routine safeguards verifications
- Automated plant designs do not allow for human interventions in many areas
- Dose uptake for operators and inspectors to be minimised
Main Process areas

- Production split in process and storage areas
- Parallel production lines in most process steps
- Front End: Bulk Handling Facility
- Back End: Item Facility
Detection probabilities

- Basis: IETS
  (Implementing Euratom Treaty Safeguards)

- General guide for direct use material
  Detection Probability 60 – 95 %
    - Under normal circumstances DP 60% at PIV
    - Depending on Commission’s confidence in operator and his NMAC system
**Inspection frequency**

- **IETS:** Annual PIV plus 6 – 11 inspections
  - Major reduction of inspection effort and frequency in comparison to original scheme
  - Instrumentation and software applications need to be adapted
  - Sensitivity, complexity and operating mode of plants require tailored safeguards concepts using unattended instrumentation
  - Remote data transmission (RDT) essential to attain DP with reduced inspection scheme

- Bi-weekly inspections until RDT fully established and instrumentation with related software working reliably
Safeguards measures and tools

- Required DP in industrial size facilities only achievable with unattended instrumentation installed at strategic points in the plants
- C/S in major storage areas
- Additional random verifications in process areas and stores without C/S
- Continuous review of operators’ performance to be able to adapt Detection Probability to circumstances
Inspection activities

- Principle:
  Concentrate on necessary site activities
  
  » BTC verifications
  
  » Physical verifications / Sample taking
  
  » Issue follow up
  
  » Auditing of the operator’s NMAC system

- Use data transmission wherever possible
Verification of Basic Technical Characteristics (BTC)

- Detailed plant configuration and process verification at PIV or at dedicated inspection
- Frequent re-verification of plant changes during interim inspections
- Verification of operator’s NMAC system
- Verification of operator’s measurement system
Physical inventory verification

- Scheduled to have minimum impact on plant operations
- Verification of operator’s PIT
- Use of C/S in storage areas to limit re-verification
- Verifications include independent measurements and sampling for external analysis
Interim inspections

- BTC re-verification if necessary
- Verification of operators NMAC system
- Physical verifications
- Issue follow up
- Data collection for HQ evaluation if Remote Data Transmission not implemented
Safeguards IT concept for MOX FFP

EURATOM

Plant Operator

Data complexity +

Data Management level

Plant control level

Plant Equipment level

NMAC system of operator

TV

D

B

M

M

D

Local Data Acquisition PC

Local Data Acquisition PC

Site office

Operator Data Evaluation Software

Instrument Data Evaluation Software

Site Data Server

Video system

HQ Data Servers

Operators' Reports

Central Accountancy System

Operator Data Evaluation software

C/S Data

Instrument Data Evaluation software

HQ Luxembourg

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Remote data transmission

- Processing of instrument and operators’ data can be done at HQ
- More efficient and effective use of inspection resources, including standardisation effects
- Routine evaluation activities are more efficient at HQ where full infrastructure is available
- Technical interventions can be planned and prepared better if all necessary data are available for preparation
- Central archiving of data at HQ allows for better issue follow up and statistical analysis
- Security concerns need to be addressed
Follow-up procedures and the installation file

- Structured inspection and issue follow up
- Reduced inspection frequency requires new modes of communication
- Regular review meetings with operators
- Central data repository in HQ to allow comparison of different material balance periods, installations, operators
Annual review of activities and establishment of a work programme

- Regular evaluation of inspection results and findings
- Performance indicators to harmonise assessment
- Regular review of inspection scope and scheme depending on inspection results and related performance indicators
- Adaptation of detection probabilities and inspection frequencies depending on confidence in the operator and his NMAC system
Future plans

- Full implementation of new IETS elements
- New working methods and interface modalities to be agreed with all stakeholders
- Software standardisation and further software and instrument development
- Installation of further secure network links
  - status of health of instrumentation
  - data review in HQ
  - remote software maintenance
  - access to HQ info
Berlin | 25. März 2007

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Thank you