The German Guideline for the Protection of Computer Systems in Nuclear Facilities and the Assessment of its Implementation

Uwe Stoll, Dagmar Sommer, GRS

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Outline

- Introduction
- Requirements for Computer Security in Germany
- GRS Experience in Implementation of Computer Security in German Nuclear Facilities
- GRS Experience in the Assessment of Computer Systems in German Nuclear Facilities
- Conclusion

Introduction (1 / 2)

- The operational and safety-related components of German NPPs are often in use since their commissioning in the 1970ies / 1980ies
  - Components reach their end of lifetime
  - ↳ Replacement of these “old” components is ongoing
- A replacement with identical components is not always possible or even not wanted
  - Procurement of spare parts is getting more and more difficult
  - Process optimisation due to the use of modern software-based components
  - ↳ Increasing integration of software-based technology into safety, safety-related and security systems throughout the plants

⇨ The threat of malevolent interferences and cyber-attacks is rising, so that nuclear security can be **seriously endangered**

Introduction (2 / 2)

- Cyber-attacks on industrial control systems (ICS) in recent years:
  - **Stuxnet** - manipulation of ICS systems (2010)
  - **Havex** - collecting configuration data of ICS systems (2014)
  - **Blackenergy-** manipulation of control systems for electrical grid in Ukraine (2015)
  - **CrashOverride** – manipulation of ICS systems in Ukraine (2016)
  - **Triton** – manipulation of ICS systems

  ↳ About 800 million known malicious software

  ↳ About 390.000 new variants per day

- Maintaining the nuclear security of nuclear facilities
  - Physical protection measures and
  - Protection measures in the field of computer security

⇨ Existing security management process has to be expanded to **computer security** aspects

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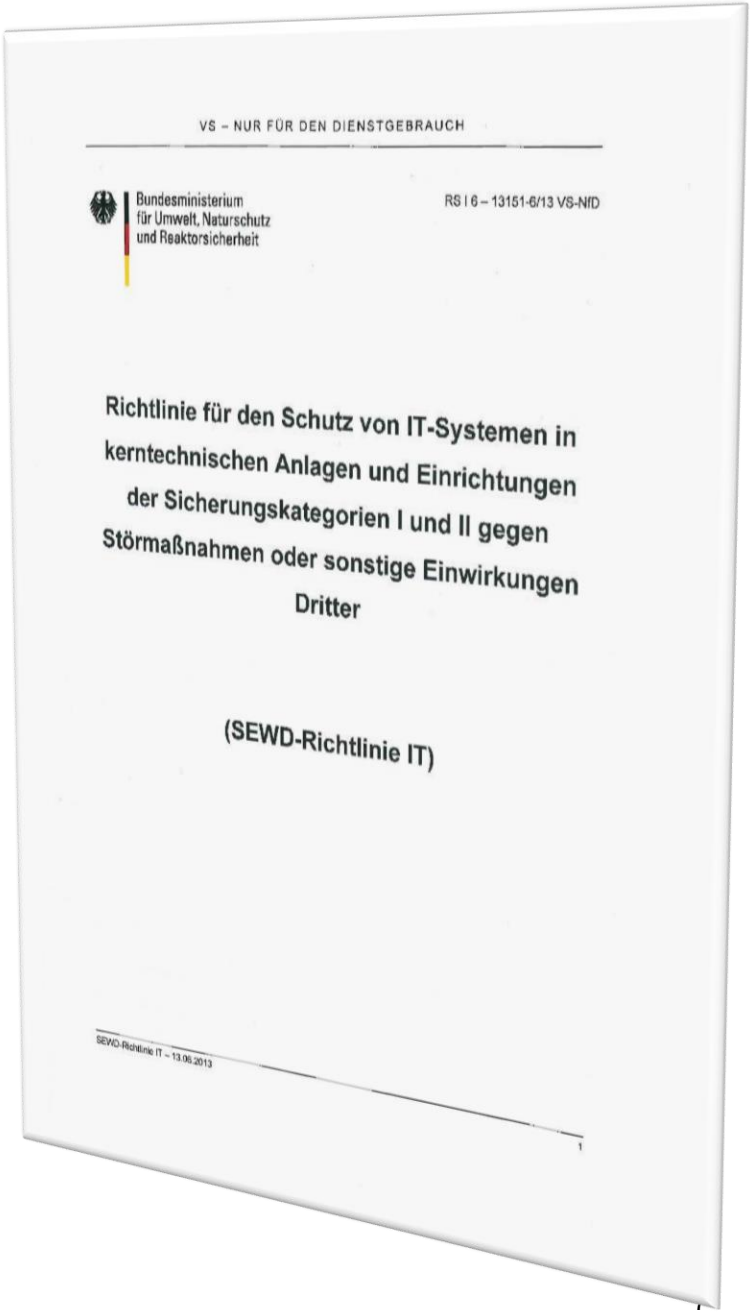
German Cyber Design Basis Threat (cyber DBT)

- Confidential document (announced in 2013)
- Based on a threat assessment by competent authorities
  - Which attacks can lead to unacceptable consequences?
- Not scenario-based => set of characteristics
  - Important characteristics of cyber-attackers and cyber-attacks
    - Blended attack (Cyber-attacks combined with non-cyber-attacks) (e.g. for information gathering)
    - Attacks can consist of several steps
    - One attack may hit many targets at different places at the same time
    - Attacker may act from a far remote place

German Malicious Acts Guideline IT (1 / 3)

- Guideline for the Protection of IT Systems in Nuclear Plants and Facilities of Protection Category I and II
- Restricted document (announced in 2013)
  - Relevant for nuclear facilities with protection category I and II such as NPPs, interim storage facilities
  - Definition of one computer security objective
  - Definition of the term “computer system”
- Requirements:
  - Protection of all computer systems of a nuclear facility which may be used for malicious actions (i.e. also office systems)
  - Introduction of a computer security organisation
    - Appointment of a computer security officer (CSO)


VS – NUR FÜR DEN DIENSTGEBRAUCH

Bundesministerium
für Umwelt, Naturschutz
und Reaktorsicherheit

RS I 6 – 13151-6/13 VS-NfD

Richtlinie für den Schutz von IT-Systemen in kerntechnischen Anlagen und Einrichtungen der Sicherungskategorien I und II gegen Störmaßnahmen oder sonstige Einwirkungen Dritter

(SEWD-Richtlinie IT)

SEWD-Richtlinie IT – 13.06.2013

1

German Malicious Acts Guideline IT (2 / 3)

- Introduction of a computer security concept
  - Structure analysis of all existing computer systems, their structures and the entire network topology
  - Protection according to four graded computer security levels
  - Allocation into computer security zones

- Generic requirements for computer security measures
  - General requirements
  - Computer security level-dependent requirements
  - Computer security zone-dependent requirements
  - ↳ Computer security measures can be of organisational, structural or technical manner

German Malicious Acts Guideline IT (3 / 3)

- Requirement for the facilities to perform a basic security analysis and a supplementary security analysis (depending on the security level)
- Consideration of the whole life cycle of computer systems
- Responsibility to apply computer security measures also for supply chains, for external services and for remote maintenance access connections

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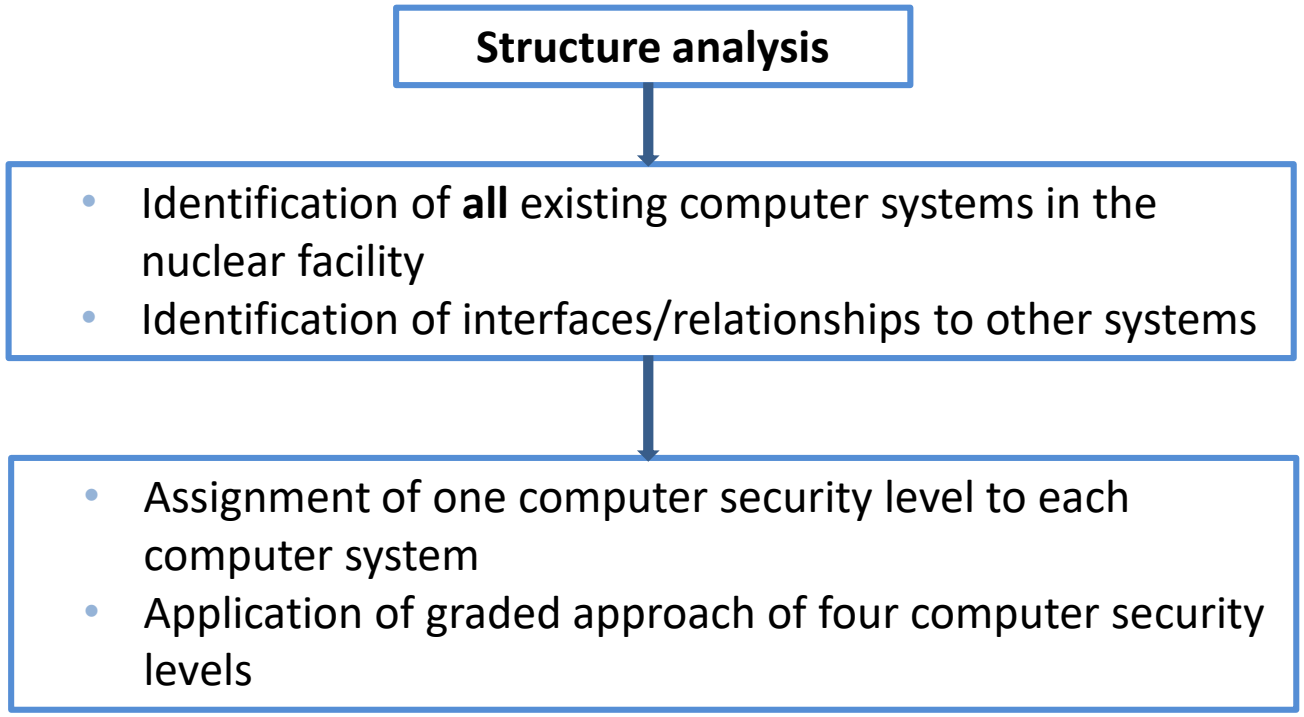
GRS Experience in Implementation of Computer Security in German Nuclear Facilities (1 / 4)

- Development / Implementation of a **computer security management process**
  - Definition of
    - appropriate procedures,
    - necessary organisational structures,
    - resources and
    - management principles regarding to computer security

- Integration of a computer security organisation (structures / roles)
  - Introduction of a **computer security officer** (CSO)
  - Definition of tasks / responsibilities / powers
  - Advantage: CSO is under the control of the head of the facility security

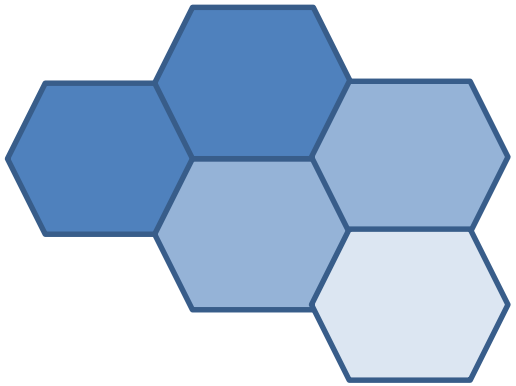
GRS Experience in Implementation of Computer Security in German Nuclear Facilities (2 / 4)

- Development and introduction of a computer security concept



↳ Germany: Predetermination of computer security levels for different computer systems of the NPPs

GRS Experience in Implementation of Computer Security in German Nuclear Facilities (3 / 4)



- Introduction of computer security zones
  - Possible to summarize computer systems with the same computer security level in one computer security zone

  ↳ Advantage: Computer security measures can be placed at zone borders, so that in this case not every system needs all computer security measures separately

- Conducting a basic security analysis and a supplementary security analysis according to the computer security level
- Determination / consolidation / implementation of specific computer security measures
  - Highest protection for the highest computer security level,…
  - Basic protection for the lowest computer security level

GRS Experience in Implementation of Computer Security in German Nuclear Facilities (4 / 4)

- Examples of computer security measures:
  - Prohibition of data links into the highest computer security level
  - Regulated access to computer systems
    - Strict user identification (e.g. ID card and biometric feature)
    - User access restriction
  - Prohibition to connect private technology (e.g. mobile phones) to plant systems and to use plant systems for private purposes
  - Usage of the two-person-principle (e.g. against an internal attacker)
- In addition, also physical protection measures have to be installed to protect the computer systems (e.g. entrance limitation)

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Example 1: Implementation of a computer security concept at a NPP

- Assessment aspects: Review of
  - appropriate documents,
  - organisational structure,
  - derivative of the necessary security requirements and
  - technical realisation of the computer security measures
- Conceptual assessment: Verification of the documented requirements
- Technical assessment: Review of the technical realisation
  - Extensive discussions of open points and disagreements between licensee, regulator and reviewers

⇨ Approval of the computer security concept of the plant

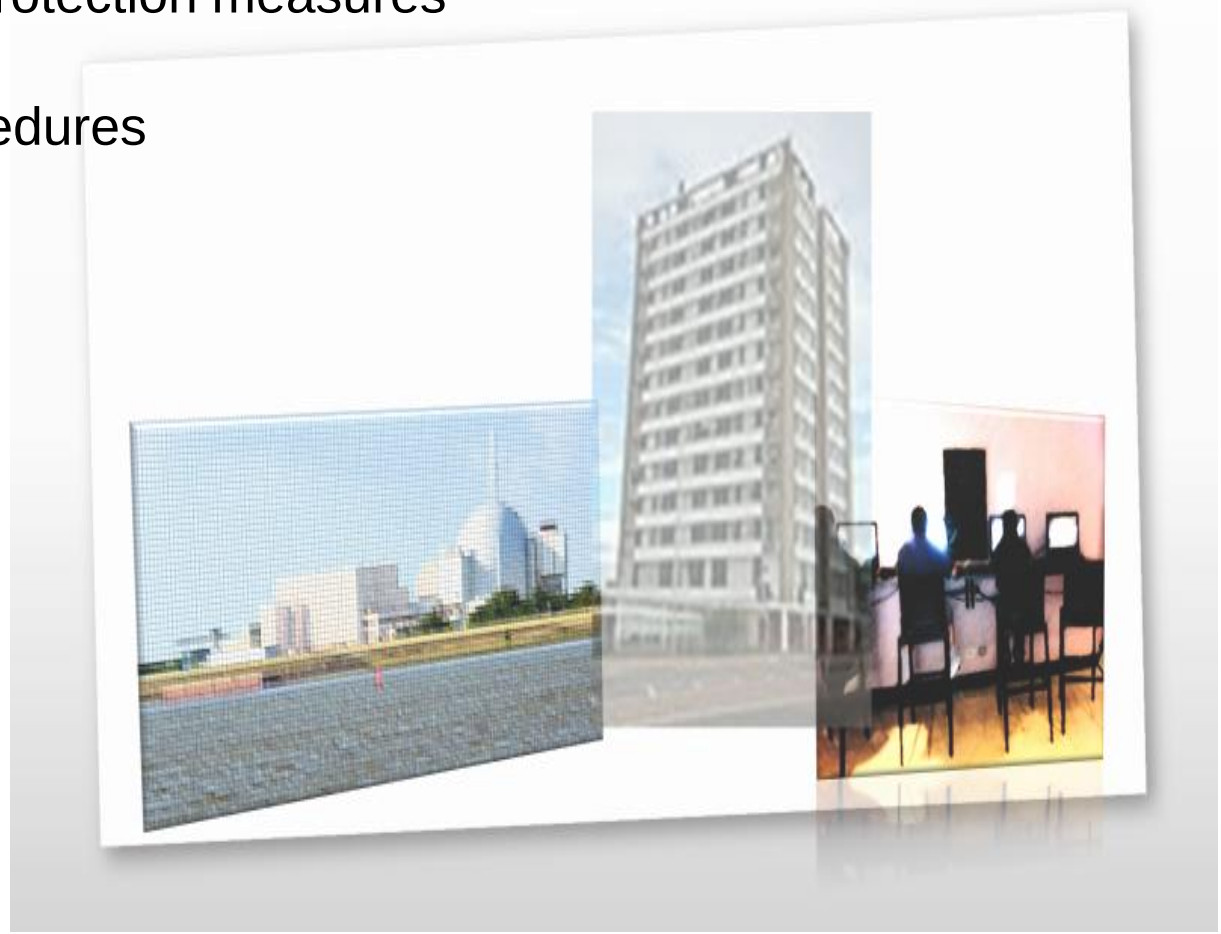
Example 2: Outsourcing of plant computer systems to an external data centre (1 / 3)

- First step: Approval of the physical protection measures of the building
- Second step: Review of the computer security organisational and personal procedures as well as their technical realisation
  - Transfer of the security (physical and computer) objectives from the plant to the data centre
- Major focus: Communication between plant and data centre
  - Data connection with strong encryption technology that spans end-to-end
  - Dedicated network line
- Completion: Internal (by the plant staff) and external (by the reviewer) review to assess the different protection and security measures

  ↳ Advantage: Periodically repetition of these reviews to maintain the achieved protection degree

Example 2: Outsourcing of plant computer systems to an external data centre (2 / 3)

- Examples of possible computer security / physical protection measures
  - Integration of the two-person-principle in the procedures of the data centre due to technical solutions
    - Electronic locks at the doors to secure that at least two persons go into the room
    - Specially protected computer security racks
    - Restricted user accesses in combination with strict user identifications
    - Specific data administrator rights for different persons



Example 2: Outsourcing of plant computer systems to an external data centre (3 / 3)

- Minimal functionality for both software and hardware
  - Software of servers and clients
  - Network connections between the computer systems
  - Users, administrators and their access rights on the computer systems

⇨ Approval of the whole outsourcing process

  - Allowed traffic through firewalls

Example 3: Implementation of an IP-based leased line between plant security and police (1 / 2)

- Intention: Migration of the (analogue) leased line system between the plant security and the police to a computer system (incl. IP-protocol)
  - Maintenance of the analogue leased line system by the line operator ends
- Basis: Leased line system is an important component for the plant security
  - Requirements to protect this system are high
  - Operated by a third party (not under the nuclear regulatory control)
- Examples of computer security measures
  - Strongly encrypted communication between both partners
  - Limited administrative access to the communication systems
  - Detection of an information security loss in between the communication partners

Example 3: Implementation of an IP-based leased line between plant security and police (2 / 2)

- Challenge: Complete assessment of an extensive firewall systems cannot be achieved during such a review process
  - Consideration of internationally accepted security assessment certificates
    - "Common Criteria for Information Technology Security Evaluation" provide lots of requirements concerning computer security management and used technologies
  - Examination of the unique aspects for the nuclear security

↳ Advantage: The amount of reviewing can be reduced and the transparence of the reviewing process is strengthened

⇨ Approval of the implementation of the IP-based leased line

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Conclusion (1 / 2)

- Increasing number of cyber-attacks on industrial control systems (ICS) in recent years
- An increasing amount of analogue (not software-based) components in nuclear facilities is already or will be replaced by software-based components
  - Thus the threat of malevolent interferences and cyber-attacks via these components to the nuclear facilities also increases
    - ↳ In addition to the physical protection of a NPP also the computer security must be considered in order to maintain the nuclear security
- Requirements for computer security in German NPPs and certain nuclear facilities
  - German cyber design basis threat
  - German Malicious Acts Guideline IT

Conclusion (2 / 2)

- GRS experiences in implementation of computer security
  - Expanding the existing security management process of the nuclear facilities to computer security aspects
    - Integration of a computer security organisation (structures / roles)
      - Tasks / responsibilities / powers of a computer security officer (CSO)
    - Implementation of a computer security concept
      - Graded approach of four computer security levels and security zones
- GRS experiences in the assessment of computer systems
  - Implementation of a computer security concept
  - Outsourcing of plant computer systems into an external data centre
  - Implementation of an IP-based leased line

Thank you for your attention!

Any questions?