Öko-Institut e.V.
Institut für angewandte Ökologie
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Nuclear Power Plants and Terrorism

Some remarks on a sensitive topic

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Nuclear Power Plants and Risks

- Nuclear Power Plants have a huge radioactive inventory
- Confinement of radioactive inventory is fundamental safety function
- Risk is a function of the hazard potential (radioactive inventory) and the possible causes for releases
- Causes for releases may stem from
  - Accidents but also
  - Incidental Attacks

Nuclear Power Plants and Terrorism – Is there a Threat?

- Sweden 2012: civil protesters enter nuclear power plant – remain undetected for serveral hours
- France: over months, drones fly over nuclear power plants – counter measures do not help, no responsible person identified yet
- Belgium:
  - August 2014: possible sabotage of steam turbine in nuclear power plant
  - 2014: known islamic fundamentalist identified working in high security area in nuclear power plant since 2012
  - After Paris attacks: nuclear power plants being evacuated, videos of director of nuclear research facility found in terrorists houses

Nuclear Power Plants and Terrorism – Is there a Threat?

- Ukraine:
  - May 2014: approx. 20 armed activists enter nuclear facility – to protect it against hostile forces
  - November 2015: transmission towers of national grid attacked – loss of external grid at nuclear power plant
- Germany April 2016: computer virus „Conficker“ and comparable viruses located in safety relevant computer systems in operating BWR plant

Nuclear Power Plants and Terrorism – Kinds of Threats

Different kinds of threat to be taken into account

- War-like situations with direct or indirect consequences for nuclear power plants
- Terror attacks from the outside (who, how many, what capabilities?)
- Terror attacks from insiders (permanent staff, temporary workers?)
- Cyber attacks

- Different threats require different approaches
- Threats might change over (relatively short) timeframes

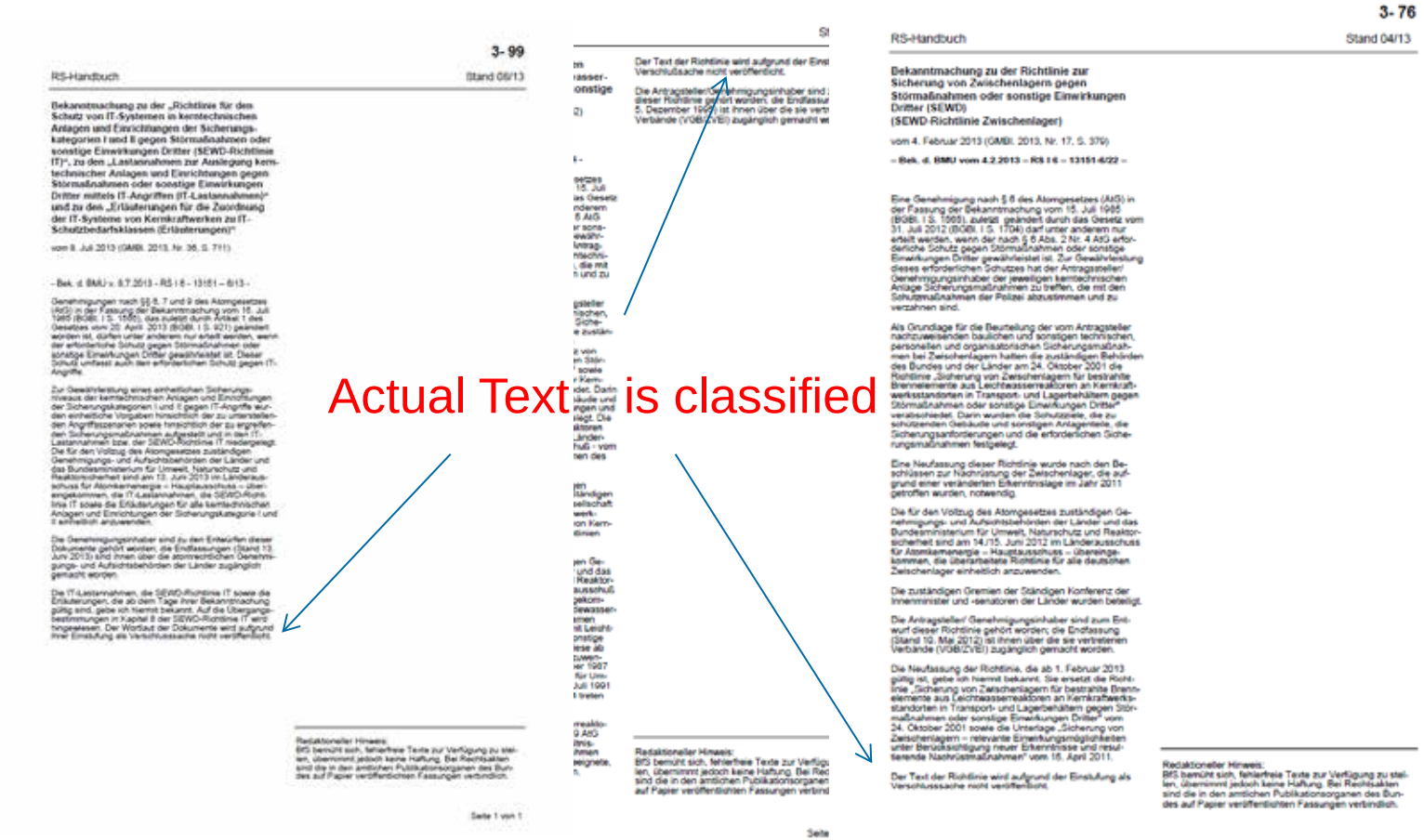
Regulatory Requirements

- IAEA:
  - “Nuclear Security: The prevention and detection of, and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities.”
- Western European Nuclear Regulators Association:
  - “O5. Safety and security interfaces
    ensuring that safety measures and security measures are designed and implemented in an integrated manner. Synergies between safety and security enhancements should be sought”
- German Atomic Energy Act:
  - Ensure that “the necessary protection has been provided against disruptive action or other interference by third parties”

„Design Basis Threat“ – How to define?

- Ministry of the Interior and Ministries responsible for nuclear safety are in charge to define DBTs and corresponding responsibilities of the operator
- Protection has to be provided
  - By the operator: ensure protection of facilities for a certain time
  - By the state: ensure police forces engage after a certain time
- In Germany, DBTs and corresponding responsibilities are defined with respect to disruptive action or other interference by third parties (SEWD)
- Details about DBTs and corresponding responsibilities are not public

SEWD – Nuclear Facilities, IT-Safety, Interim Storages



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RS-Handbuch Stand 08/13

Bekanntmachung zu der „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)", zu den „Lastannahmen zur Auslegung kerntechnischer Anlagen und Einrichtungen gegen Störmaßnahmen oder sonstige Einwirkungen Dritter mittels IT-Angriffen (IT-Lastannahmen)" und zu den „Erläuterungen für die Zuordnung der IT-Systeme von Kernkraftwerken zu IT-Schutzbedarfsklassen (Erläuterungen)"

vom 8. Juli 2013 (GMBl. 2013, Nr. 36, S. 711)

- Bek. d. BMU v. 8.7.2013 - RS I 8 - 13151 – 6/13 -

Actual Text is classified

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RS-Handbuch Stand 04/13

Bekanntmachung zu der Richtlinie zur Sicherung von Zwischenlagern gegen Störmaßnahmen oder sonstige Einwirkungen Dritter (SEWD) (SEWD-Richtlinie Zwischenlager)

vom 4. Februar 2013 (GMBl. 2013, Nr. 17, S. 379)

– Bek. d. BMU vom 4.2.2013 – RS II 6 – 13151-6/22 –

Redaktioneller Hinweis:

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General Protective Measures

Two Pilars

- Robust systems, structures and components
  - See example of airplane crash in the following
  - Threat is evolving (external attack with modern weapons: need for reinforcements in German Interim Storage Facilities and Power Plants)!
- Administrative measures
  - Access restrictions to facilities (inner and outer perimeter)
  - Physical protection services (guards)
  - Background checks for workers in nuclear facilities (three different levels of checks)
  - …

Robustness: The Example of Aircraft Crash Impacts

- In German nuclear power plants, accidental aircraft crashes were initially not taken into account
- Starting in 1974, accidental aircraft crash of militray aircrafts had to be taken into account, detailed requirements (mass, size and speed of airplane, amount of fuel …) in regulation
  - Protection by robustness of buildings OR spatial seperation
- After 09.11.2001: Public discussions of consequences of intentional aircraft attack on nuclear facilities
  - Evaluations of resistance of buildings against consequences of aircraft attacks are performed but detailed assumtions and results are not publicly available

Robustness: The example of Aircraft Crash Impacts

- In 2011: Plant-specific safety review (RSK-SÜ) of German nuclear power plants in the light of the events in Fukushima-1 (Japan)
  - Mechanical impact (impact of the aircraft) and thermal impact (kerosene fire) considered
  - Three degrees of protection defined for each impact categories
    - Degree 1: Military aricraft (Starfighter)
    - Degree 2: Military aircraft (Phantom) or medium sized commercial aircraft
    - Degree 3: Large commercial aircraft
  - Plants not fulfilling Degree 1 have been shut down 2011
  - All plants still in operation in Germany today fulfill degree 2 with respect to Phantom, but questions remain with respect to commercial aircraft
  - Investigations with respect to degree 2/3 still ongoing but not public

Robustness: The example of Aircraft Crash Impacts

- Robustness of safety related buildings (concrete thickness)
- Robustness of cooling water supply
  - Spatially separated buildings, protected pipings
  - More recently also mobile equipment as backup
- Robustness of electricity supply
  - Two independant and divers emergency power supply systems (two diesel generator groups)
  - Three independant connections of the plant to the external grid, one of those specifically protected (underground)
  - More recently also mobile electricity supply, accesspoints

Cyber Security

- Remember: Stuxnet 2010 (continous development of the capabilities to attack since then)
- Relatively new threat:
  - Protection not as well developed as physical protection?
  - Awareness not as high as with other threats?
  - Details of threats still evolving!
- Strongly increasing rate of cyber attacks against industry in general
- Small risk for attacker
- Infection pathways via: Internet, USB, mobile Disks …

Cyber Security

- Important parts of the response (in Germany):
  - no software-based systems are in use in the reactor protection systems of German nuclear power plants
  - separation of safety and security related computer systems from external net, access controls to computer systems
  - (Law on IT-Safety of 25. Juli 2015)
- Dilemma:
  - Air gap can (easily) be overcome (see Stuxnet)
  - Separation of computer systems from external net hinders continous updates: Virus found in Germany in 2016 dated back several years and would have easily been identified, but no up to date virus protection was installed

Openness vs. Classification

- Some information must be protected, because of security concerns
- But:
  - Interface between safety and security is difficult:
    - By learning from operational experience in nuclear power plants (analysing and discussing safety incident), insiders might learn how to sabotage the plant
    - By discussing incidents with the public, security aspects might become public
  - Engagement of public is difficult
    - How to check adequateness of Design Basis Threats?
    - How to check whether protection against DBTs is adequate?
- Example of Interim Storage Facilities in Germany:
  - Lawsuits against licences for interim storage facilities due to deficiencies in security → Loss of licence of operating interim storage facilities!

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Vielen Dank für Ihre Aufmerksamkeit!
Thank you for your attention!

Haben Sie noch Fragen?
Do you have any questions?