

# **GLOBAL NUCLEAR SAFETY (AND SECURITY) REGIME**

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# 1970s – the golden age of nuclear energy

- Nuclear power plants built and planned all over the world – also because of the OPEC crisis
- Nuclear industry brings a new dimension to quality assurance and safety
- IAEA starts work on the NUSS (**NU**clear **S**afety **S**tandards) program – Siting, Design, Operation, Governmental Organization and Quality Assurance



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# TMI (1979) and aftermath

- First major (severe) accident in a commercial NPP.
- Beginning of 1980s witnesses the end of the OPEC crisis (oil prices stabilize)
- Sharp downturn (especially in the USA) for new NPP orders
- Two outcomes of the TMI event – look at severe accidents seriously (design fixes and/or accident management) and a proof that DiD actually works, although a severe accident occurred no offsite consequences due to the containment



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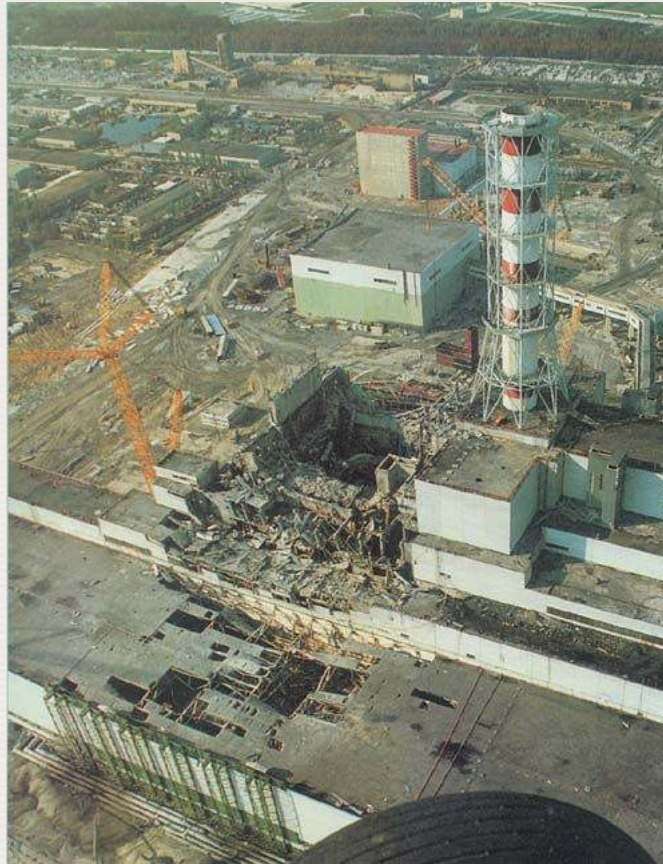
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## 1980s and Chernobyl – the role of the IAEA in the post Chernobyl world – polarization and “rapprochement”

- (mid-1980s) Signs of socio-political changes in Eastern Europe and the USSR (Perestroika and Glasnost)
- April 1986: Chernobyl accident – the worst nuclear accident with major offsite consequences
- August 1986 – Conference in Vienna (IAEA) on Chernobyl

# Chernobyl Aftermath



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## 1980s and Chernobyl – the role of the IAEA in the post Chernobyl world – polarization and “rapprochement”

- (Vienna Conference, August 1986) –
- USSR delegation view: human error → will be fixed, responsables are punished → will not be allowed to happen again.
- Western view: design error (although design of RBMKs was not well known in the West) → therefore cannot happen in the West
- Cold war approach to the problem – polarized and political. However, some major technical points surface during discussion.



# RBMKs and WWERs

- Rapid evolution of events until 1990 – public associates Soviet designed NPPs (RBMKs and WWERs thought to be similar by the public) push Eastern European countries for safety review of WWERs
- German unification forces WWER in East Germany to shut down
- In USSR itself, the first design review (1989) by the IAEA to Gorky NPP (a district heating plant – completed but never operated). Sakharov was interned in Gorky at the time and IAEA team was the first foreign group to visit to the “closed” city.



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# 1990s - Consensus Building and the CNS

- General agreement on the “why”s of Chernobyl – Design/analysis shortcomings led to the result that human errors caused a catastrophic failure – i.e. design was not “forgiving” of human errors. DiD did not consider beyond design basis events.
- The term “safety culture” used for the first time (by INSAG chairman, Edmondson) – “having the safety requirements and complying with them voluntarily”



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# Safety standards, safety services, safety culture

- Two major projects on safety of WWERs and RBMKs started early 1990s at the IAEA
- Consensus building consolidated – IAEA SS revised (ad hoc) taking into account the lessons learned (from TMI and Chernobyl)
- Safety Fundamentals (for nuclear installation safety) issued
- First steps for the Convention on Nuclear safety (CNS) using the IAEA Safety Fundamentals as basis

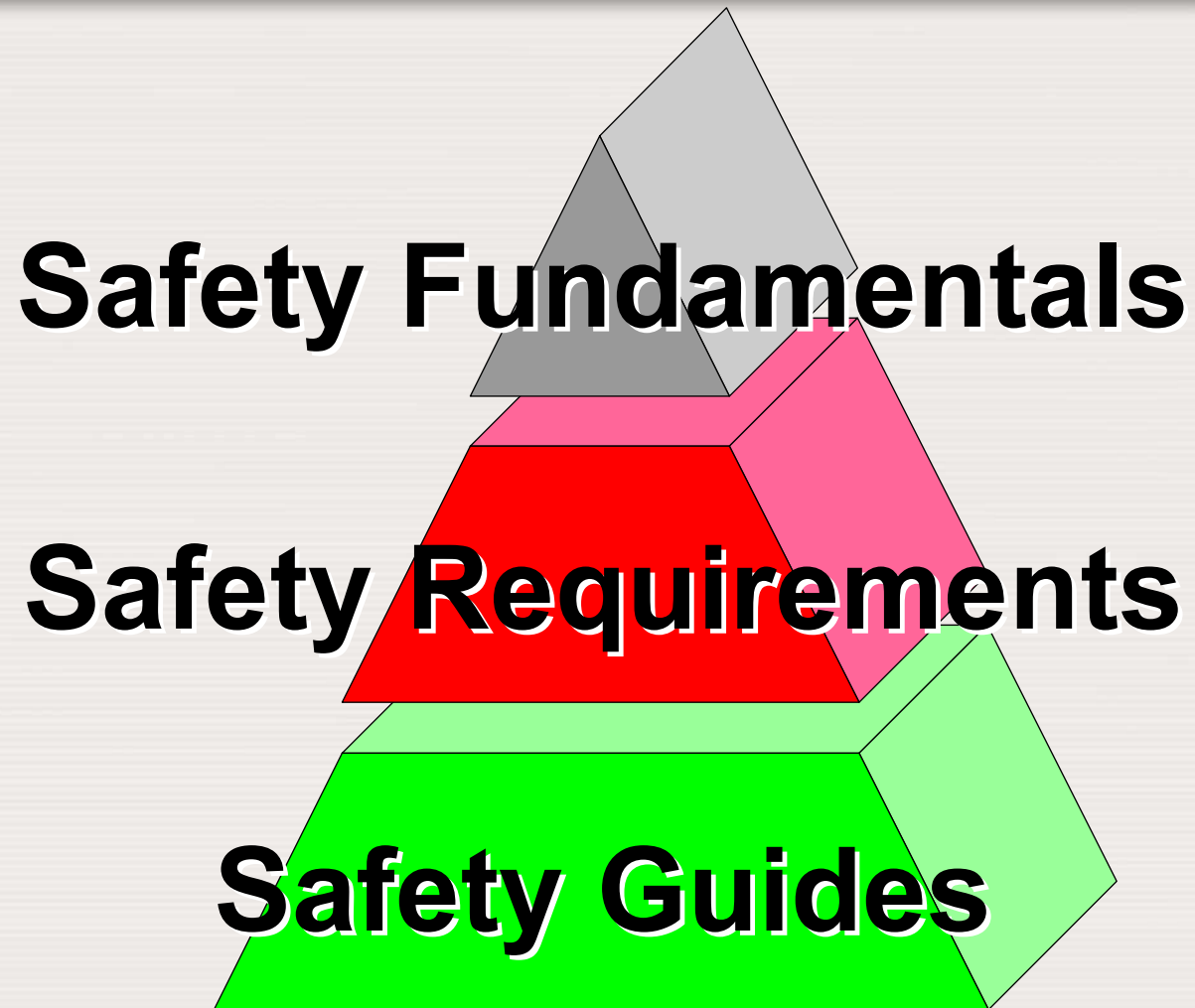
# Safety standards, safety services, safety culture

- Boom in IAEA Safety Review Services
  - Operational safety review teams (OSARTs)
  - Design Reviews (mainly for operating WWERs)
  - Site/seismic reviews
  - Plans for regulatory reviews (IRRTs)
- First review meeting of the CNS in Vienna (1999)

## 2000 – consolidation of the global nuclear safety regime – CNS, standards/services top down approach

- Beginning to mid-2000s – top down approach to safety standards – logical structure (thematic and facility specific standards), integrating nuclear installation safety with radiation safety, waste safety and transport safety.
- IAEA SS become the foremost reference to the regulations of major countries (UK, France, China, WENRA, Japan, Korea, Russia, ..)
- IAEA Revision of Fundamental Safety Principles published (2006)

# SAFETY STANDARDS HIERARCHY

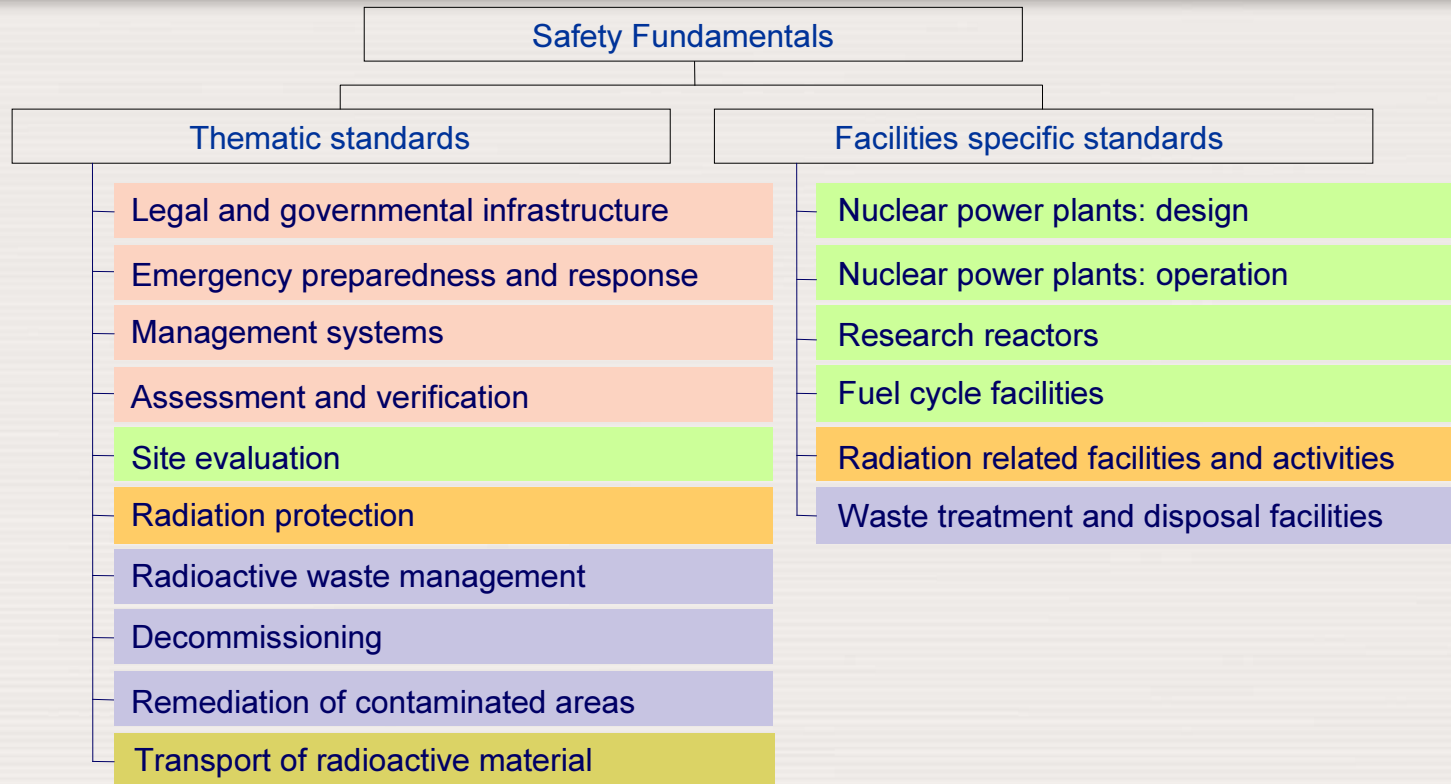


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# STRUCTURE OF THE STANDARDS



- General safety (cross-cutting themes)
- Safety of nuclear facilities
- Radiation protection and safety of radiation sources
- Safe management of radioactive waste
- Safe transport of radioactive material

## 2000 – consolidation of the global nuclear safety regime – CNS, standards/services top down approach

- IAEA Safety Services are cited as assets in country reports and CNS review meetings – their absence considered a shortcoming and criticized.
- IRRT turns to IRRS (Integrated Regulatory Review Services) covering all NS (not only installations) – major countries are in queue: FUK, France, Japan, Canada, Spain, Germany, USA, Russia, China



# Changing World and Challenges to the International Nuclear Community

- Globally Shared Perceptions
  - All in the same boat now.



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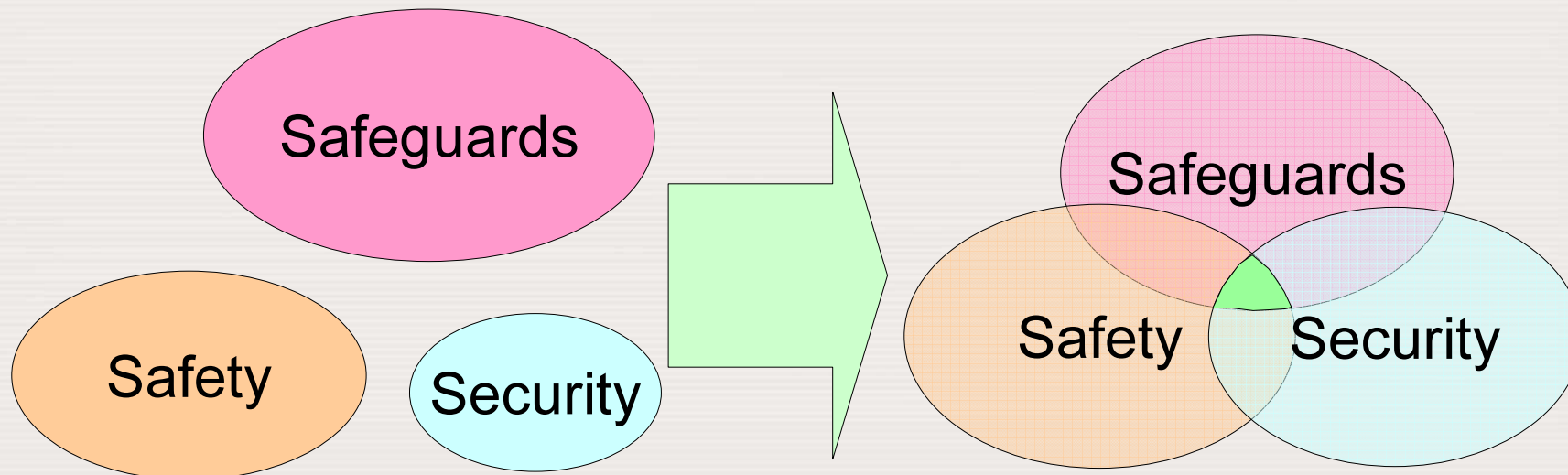
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# Global Nuclear Safety and Security Regime



# Holistic Approach

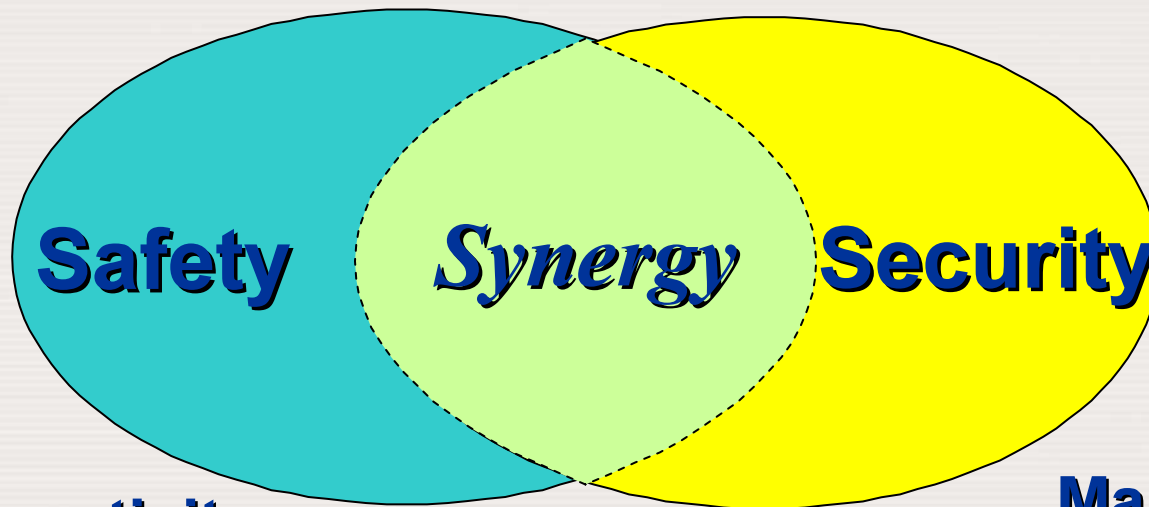
- Nuclear Safeguards – Non-proliferation
- Nuclear Security – Counter Terrorism
- Nuclear Safety – Leadership for Technical Control



**Peaceful, safe and secure use of nuclear technology**

# Safety and Security Synergy

**Safety and Security share a common aim:  
preventing or restricting harm to people and environment**



**Intrinsic to activity**

**Transparency**

**Management and Control  
Regulatory Infrastructure  
Emergency Preparedness**

**Malevolent acts**

**Confidentiality**



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# Pentagon Aftermath (9/11)



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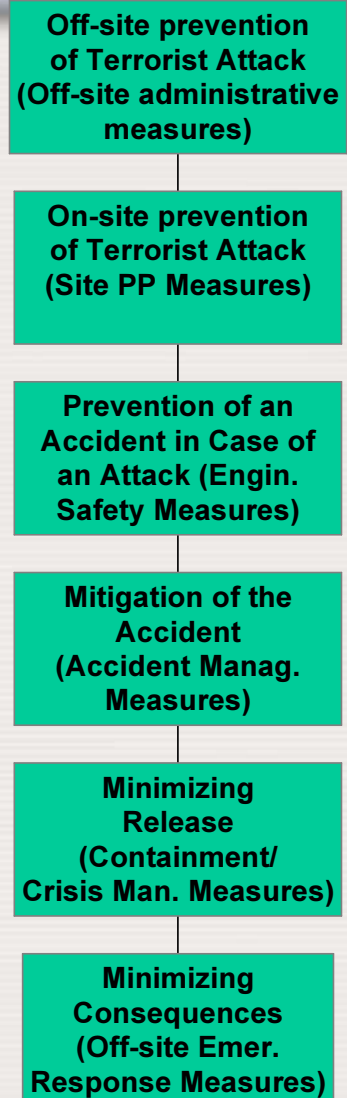
# 9/11 – security concerns – another round of consensus building (safety/security)

- Major impact on nuclear security concerns. For NPPs, checks for major sabotage events (including malevolent crash of commercial airliners) – IAEA starts the only international nuclear security program.
- The IAEA program is very comprehensive – here we will only touch on the “sabotage protection” related aspects

# 9/11 – security concerns – another round of consensus building (safety/security)

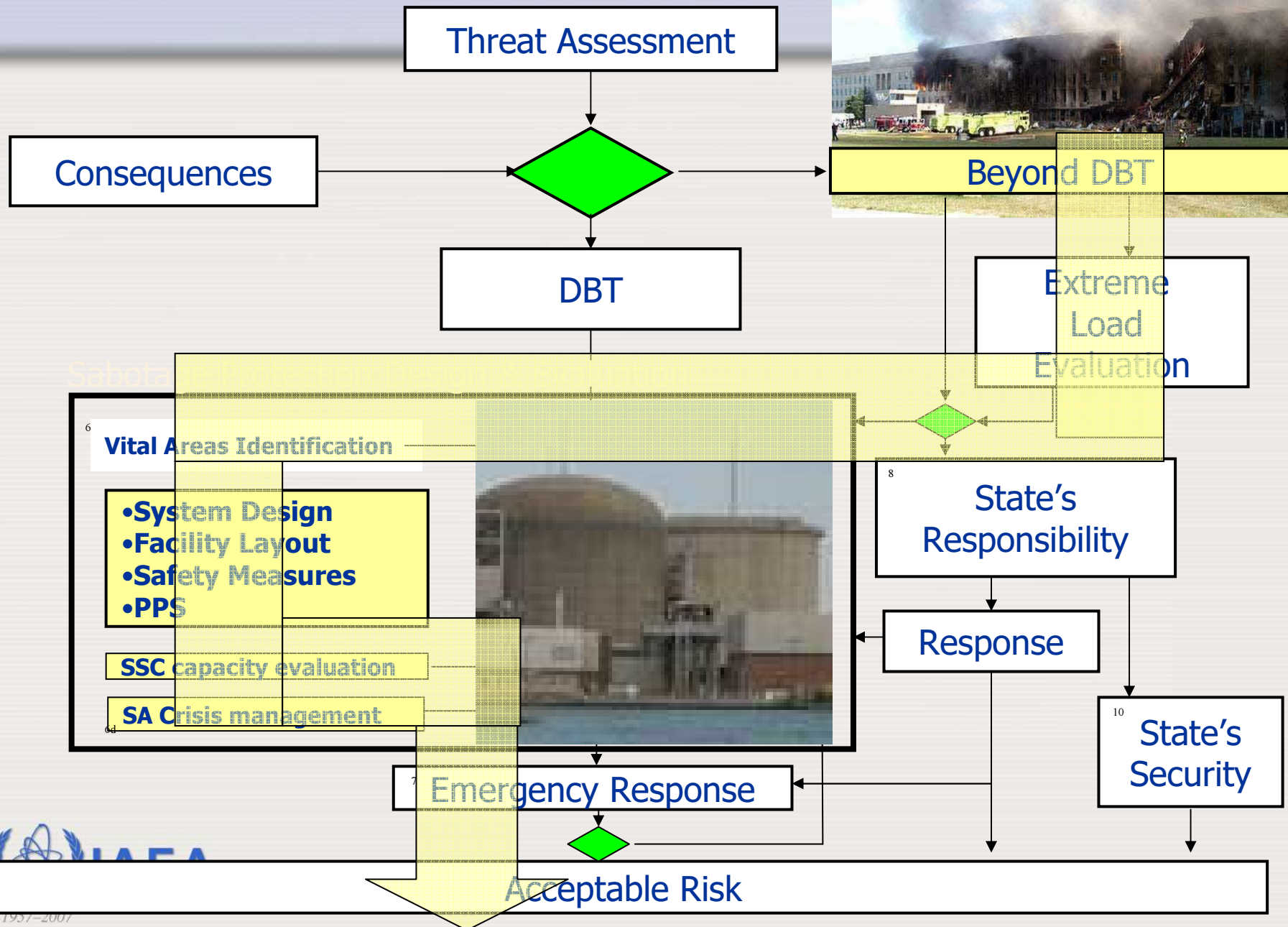
- In 2005 CPPNM is amended to include nuclear facilities more explicitly
- The suicidal nature of attacks and the sophistication in planning are new elements in the “threat” to nuclear installations
- In 2007 (after 5 years of consensus building between MS as well as between safety/security specialists) publishes the security series Technical Guidance on the Engineering Safety Aspects for the Protection of NPPs against Sabotage

## Defense in Depth for Safety/Security of Nuclear Power Plants





# Protection of Nuclear Facilities Against Sabotage



# General optimism for nuclear renaissance

- 21 years after Chernobyl good (and improving) track record on safety
- Concerns for global warming and tendency for technologies that do not contribute to green house gas emissions
- Increasing and unstable prices in the gas market – also difficult to store for long periods
- Sharp increase for electricity demand in emerging economies

# Remaining issues

- Overconfidence/complacency – countries considered to have “good safety culture” keep having incidents (USA, France, Germany, Japan, Sweden)
- Gap in knowledge base – retiring generation not replaced by younger cadres
- Public information on nuclear safety, environmental impact communicated poorly



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# Nuclear energy and the environment

## Public Opinion Understanding

Does nuclear contribute to global warming?

