NAS Spent Fuel Storage Study

Energy & Water Development Appropriations Bill

Introduction

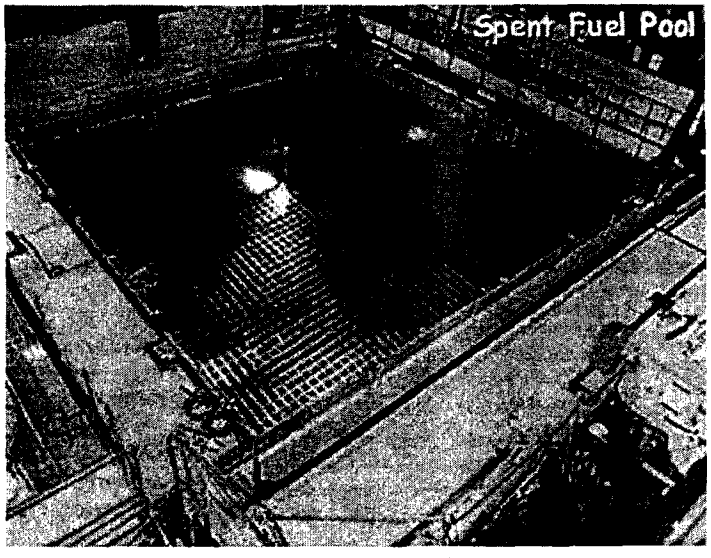
- Types of dry storage casks
- Safety features of dry storage
- Spent fuel pool safety
- Spent fuel pool studies

Spent Fuel Safety

- Staff concludes that public health and safety is protected with spent fuel stored in pools or dry casks
- Spent fuel pools are robust structures constructed of reinforced, thick concrete walls with stainless steel liners. Pools may be further protected by surrounding structures or located underground

Alvarez Report

- **Article "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States," dated April 21, 2003, by Robert Alvarez, et al., (published in Science and Global Security, spring 2003) AKA The Alvarez Report**



Spent Fuel Pool

Water level

40 ft

Sectioned View

1/4 inch-thick steel liner

5-6 ft thick concrete walls

Reinforcement

Spent Fuel Pool - Background

- The fuel in the spent fuel pool generates small fraction of the heat in the reactor
  - Fuel in spent fuel pool which is relatively full generates heat at a rate which is 10 to 40 times lower than that of fuel in reactor when reactor is shutdown
  - Lower heat generating capacity of spent fuel means heat removal is simple, even under adverse conditions

Spent Fuel Pool Studies

- Past NRC studies of spent fuel pools have used very conservative models/methods and assumptions to evaluate potential for fuel heatup, fission product release (radiation) and offsite consequences
  - Bounding pool conditions
  - Simplified/conservative models for fuel heatup
  - Limited or no credit for fission product release attenuation

Spent Fuel Pool Studies

- Very conservative analyses were adequate for the original intended purpose where more realistic and accurate (and more detailed) evaluation was not needed
- When past studies are taken out of original context, where applied to very low probability events, the predicted behavior including consequences are not appropriate
  - Risk = Frequency x Consequences

Spent Fuel Pool Studies

- More detailed modeling and analysis is underway
  - Based on actual pool conditions, fuel inventory and loading pattern
- Insights from ongoing analyses indicate that fuel in the spent fuel pool may be much more easily cooled than predicted in earlier studies
- Ongoing analyses also indicate that even if cooling is lost more time is available to restore cooling and prevent fuel damage
- Ongoing analyses indicates that even if fuel is damaged (and radiation is released) consequences will be reduced from past studies
- Ongoing work is evaluating effectiveness of potential mitigative options for enhancing the coolability of spent fuel in pool storage

Cost to Store Spent Fuel

- Cost to store all spent fuel in dry cask storage systems.
- NRC does not maintain this kind of information. Industry, for competitive reasons, does not share actual cost information.
- A cask cost is estimated, by industry, to be between about $750,00 and $1.5 million dollars (depends on design).
- The biggest and most variable expense is the design work, construction, update of procedures and site modification to accept an ISFSI, estimated to be about $10 to 15 Million, but has been reported as high as $30 Million.
- Annual operating costs for an operating power reactor are between $200,000 - $300,000, this is for resources dedicate to the support of the ISFSI. Other costs are typically Bourne by the power reactor.
- Annual operating costs for a shut down plant are estimated to be between $2 and $4 Million.
- These costs does not include initial loading costs, identification of cost savings from operating a spent fuel pool versus only dry storage or purchase of support equipment.

Spent Fuel Safety

- Staff concludes that public health and safety is protected with spent fuel stored in pools or dry casks
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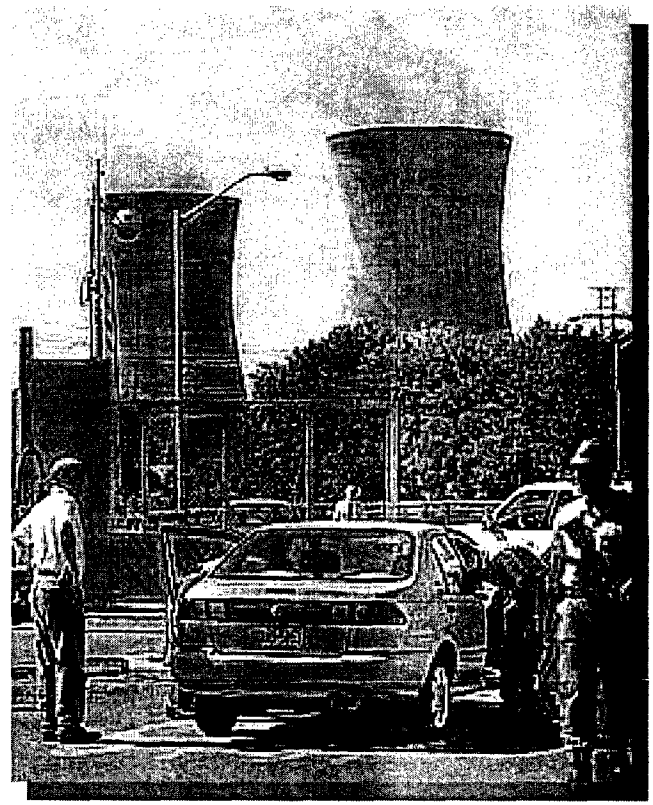
Key Messages

- Reactor licensees can safely store spent fuel in either spent fuel pools or in dry spent fuel storage casks
- There is reasonable assurance that the health and safety of the public is protected against such potential terrorist attacks for both types of spent fuel storage
- Utilities have developed independent spent fuel storage installations (ISFSIs) as a means for expanding the spent fuel storage capacity on an interim basis until the federal repository is operating
- The Nuclear Waste Policy Act required NRC to develop a rule and procedures for licensing of any interim storage of spent nuclear fuel technology
- NRC approved dual purpose casks to store spent fuel are in use today.

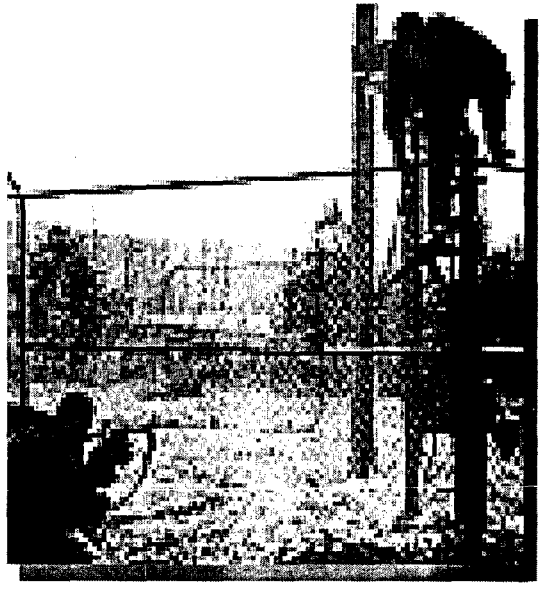
Security Programs

- Physical security
- Personnel security
- Information security
- Response plans
- Heightened security modes



Security Principles

- Detect and assess intrusion
- Communicate internally and externally
- Respond with:
  - –Onsite force
  - –Off-site response



- Comprehensive Security Programs, Including:
  - Physical Security
    - Barriers — Detection & Assessment Systems
    - Access Controls — Alarm Stations
    - Well Trained Guard Force — Response Strategies
  - Personnel Security
    - Background Checks — Access Authorization
    - Fitness for Duty
- Robust Structures with Redundant Safety Systems
- Perhaps Best Protected of Civilian Facilities

Typical Nuclear Facility