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NAS Spent Fuel Storage Study

Energy & Water Development Appropriations Bill

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Introduction

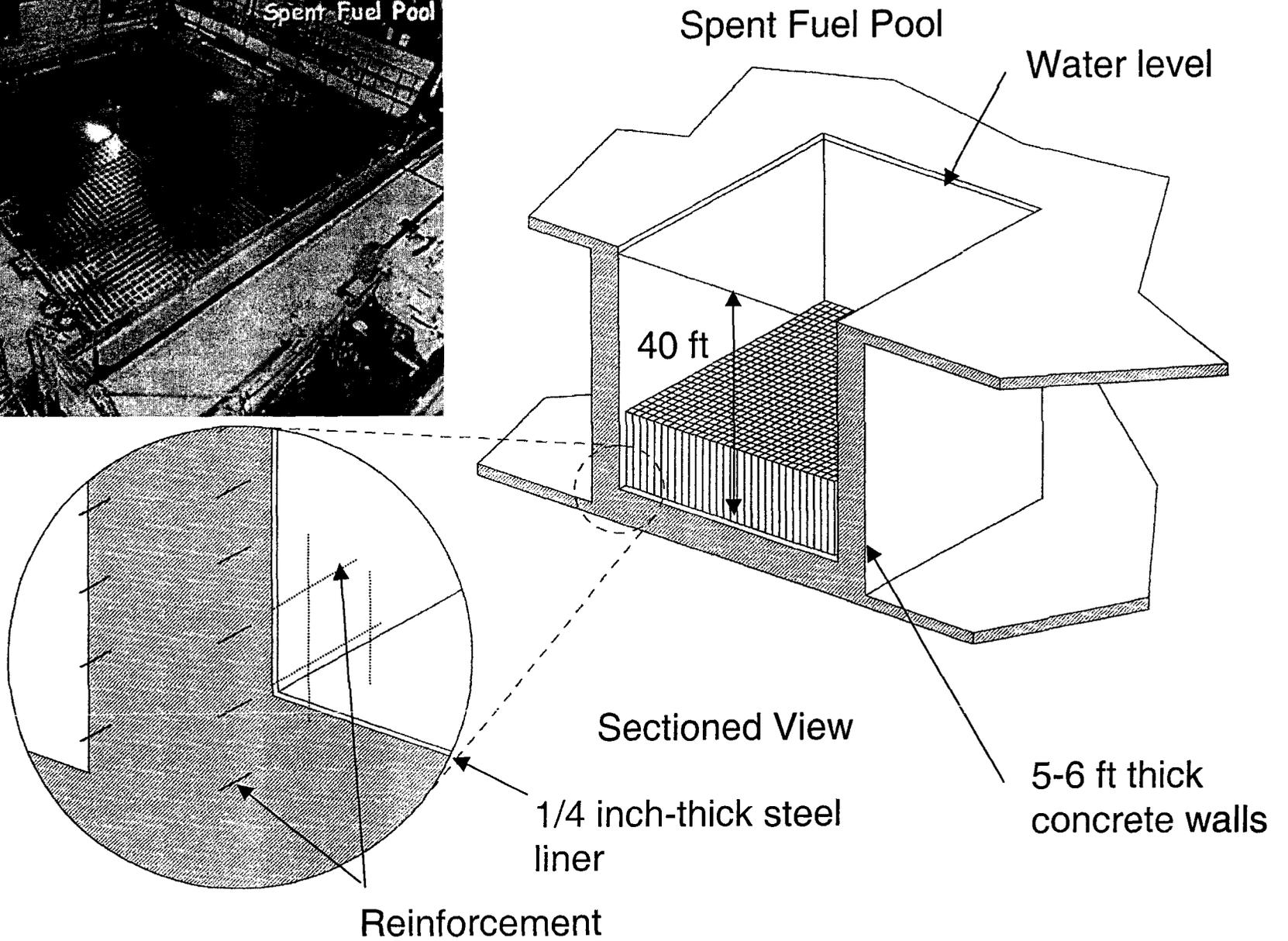
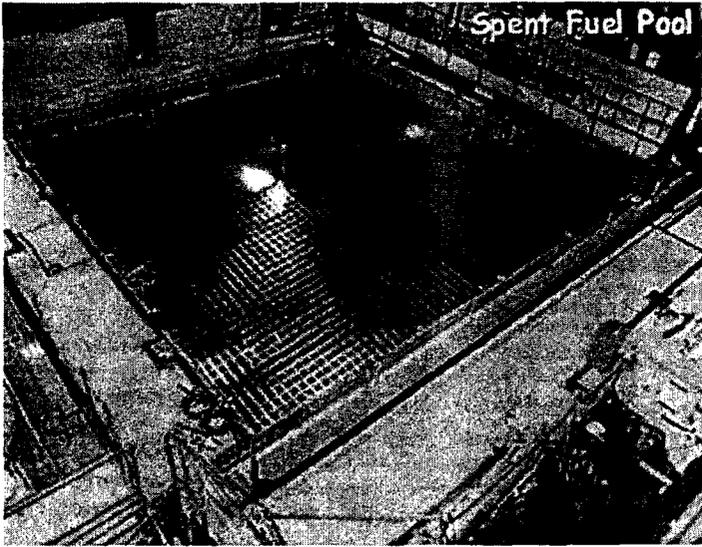
- Types of dry storage casks
- Safety features of dry storage
- Spent fuel pool safety
- Spent fuel pool studies

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 - 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

Reactor Ex 2

Ex 2

↓ Ex 2

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

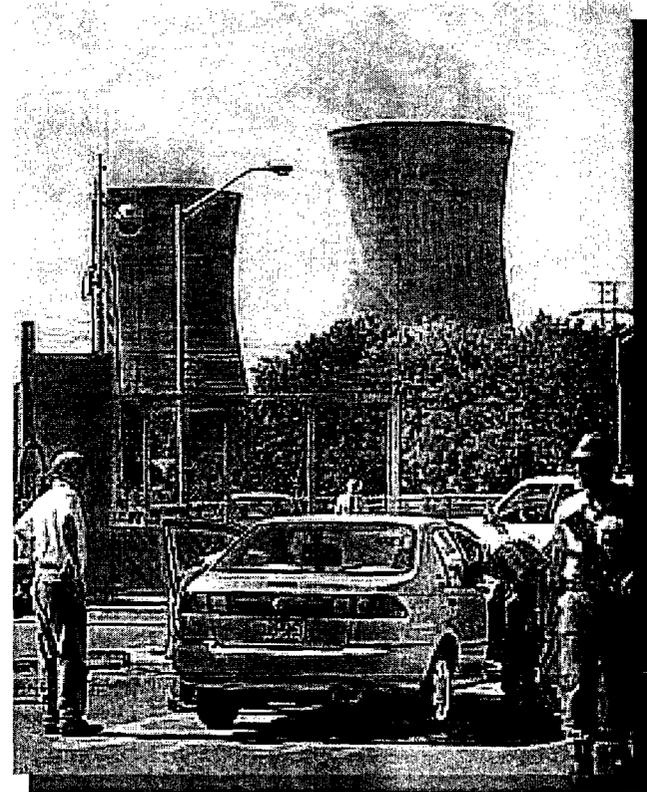
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Key Messages

- **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.**

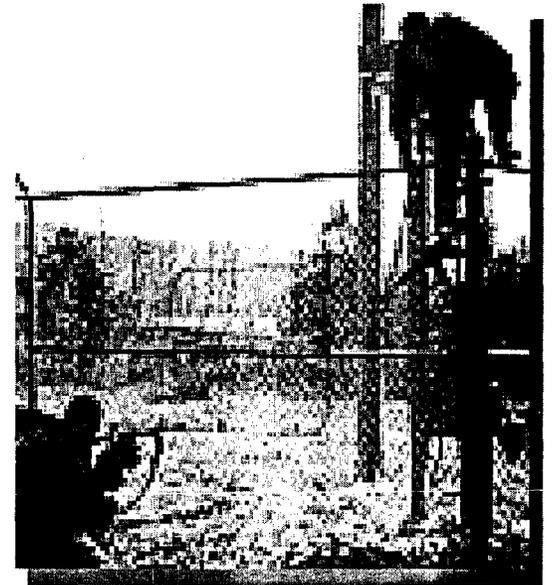
Security Programs

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

Typical Nuclear Facility

Plant Security

Owner
Controlled Area

Protected Area
Double Fence

Protected
Area

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