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ASME NED Newsletter

Nuclear Engineering Division Newsletter
Joe Miller – Editor 703-356-4149

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- New Reactor References
- Selected Abstracts from ICONE17
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Message from the NED Chairman

Robert W. Tsai, PhD
Chairman NED
robert.tsai@exeloncorp.com

Dear members and friends of the Nuclear Engineering Division,

Happy New Year! I hope this Newsletter finds you well and you all have had time to enjoy the holidays. On behalf of the ASME Nuclear Engineering Division (NED) Executive Committee, I would like to extend our warmest greetings to you.

Over the last months, the ICONE17 organizers, which include the NED Executive Committee, and the ASME staff along with many volunteers, have worked very hard to plan the upcoming ICONE17 conference to be held July 12-16, 2009 in Brussels, Belgium. On December 12, 2008, an ICONE17 planning meeting was held in Brussels with over 30 key organizers from Japanese Society of Mechanical Engineers (JSME), Chinese Nuclear Society (CNS), Europe and ASME. The meeting was a great success as the program plan was thoroughly reviewed and approved by the four organizing groups. We'd like to express our special thanks to our Belgium colleagues of FORATOM, GDF SUEZ, and Belgoprocess for their contributions.

Due to the hard work the Track Leaders, we have received, reviewed and accepted more than 900 abstracts from 15 Technical Tracks. Preparation, review and approval of the final papers are in progress. I'd like to commend everyone for this great effort. We are also planning a Nuclear Industry Forum that includes nine invited panels featuring senior leaders and technical experts from government, industry and academia. Two special workshops are planned on Computational Fluid Dynamics (CFD) and Engineering Reliability/Life Cycle Management with international experts to provide in-depth discussions of these subjects.

We are very excited about ICONE17. Again, your input and support will be the key to the Conference's success and your participation will contribute greatly to this initiative. Further information and status regarding ICONE17 may be obtained at the official web site: **http://www.asmeconferences.org/icone17/**.

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Editor's Message

The purpose of this newsletter is to keep the NED membership informed on new developments and important activities in the nuclear industry. This newsletter places an emphasis on the safety and security issues in nuclear industry. The nuclear power industry has for many years tolerated scare tactics such as these provided by the Union of Concern Scientist. (See page 2 for a recent scare attempt), but the industry with real science and engineering has always shown that nuclear energy is the correct path to energy self sufficiency. This newsletter is dedicated to providing Safety and security information from the nuclear industry.

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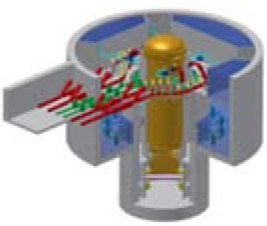
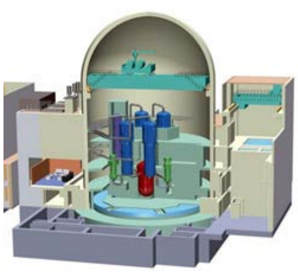
ABWR



ESBWR



US APWR

Serious Safety and Security Risks Undercut Nuclear Power's Role in Minimizing Global Warming, New Report Finds

Science Group Recommends Stronger Federal Oversight, Safer Designs, U.S. Ban on Reprocessing

WASHINGTON (December 11, 2007) – An expansion of nuclear power capacity in the United States could help reduce global warming pollution, but could also increase threats to public safety and national security, according to a report released today by the Union of Concerned Scientists (UCS). Those risks include a massive radiation release from a power plant meltdown or terrorist attack, and the death of hundreds of thousands from the detonation of a nuclear weapon made with materials obtained from civilian nuclear facilities. (The report is available for amusement at www.ucsusa.org/nuclearandclimate.)

New Reactor References

Nuclear Regulatory Commission

- New Reactor Licensing - http://www.nrc.gov/reactors/new-reactors.html
- Design Certification – Licensing Reviews – http://www.nrc.gov/reactors/new-reactors/design-cert.html
- Early Site Permits – Licensing Reviews – http://www.nrc.gov/reactors/new-reactors/esp.html
- Licensing Process – http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/licensing-process-bg.html
- Rulemaking - http://www.nrc.gov/reactors/new-reactors/regs-guides-comm.html
- Construction Inspection Program and NRC Oversight - http://www.nrc.gov/reactors/new-reactors/oversight.html
- Public Involvement – http://www.nrc.gov/reactors/new-licensing/public-involvement.html
- Related Documents – SECY Papers, Fact Sheets, History - http://www.nrc.gov/reactors/new-reactors/regs-guides-comm/related-documents.html
- Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (NUREG-0800) – http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0800/

International Atomic Energy Agency

- Achievements and Prospects for Advanced Reactor Design and Fuel Cycles - Roberto O. Cirimello Argentina IAEA – Scientific Forum 2004 – Nuclear Fuel Cycles Issues and Challenges – http://www-pub.iaea.org/MTCD/Meetings/PDFplus/2004/gcsfSess1-Cirimello.pdf
- Advanced Reactors – Fact Sheet – http://www.iaea.org/Publications/Factsheets/English/advrea.html

Selected Abstracts from ICONE17

STPNOC Electrical Auxiliary Building Temperature Transient Analysis: Loss of EAB HVAC Initiating Event Frequency ICONE17-75005
by Ernie Kee, STP

In a typical commercial nuclear power plant such as the South Texas Project (STP), inefficient electrical switchgear and process control electronics are located in an air conditioned building we refer to as the Electrical Auxiliary Building (EAB). One of the main air conditioning loads in the STP EAB is heat loss from the inefficient electrical equipment into the EAB environs. In the unlikely event all air conditioning is lost in the EAB, the STP Probabilistic Risk Assessment shows that the conditional core damage probability is quite high due to hypothesized loss of control of essential core damage mitigation equipment as the switchgear and control electronics become overheated. A primary reason the conditional core damage probability is so high for this air conditioning loss event is that analyses performed to date show there is very little time (an hour or less) to mitigate the overheat condition.

In a joint project, STP and Texas A&M are developing a new model of the transient thermal-hydraulic response in the STP EAB when air conditioning is lost. As other investigators have done, we use a computational fluid dynamics (CFD) model to simulate the heat up transient following loss of air conditioning. However in our approach, we have not assumed constant energy transfer from lossy equipment during the heat up transient. Instead, we account for the energy stored in active heat sources (such as transformers) and overcome the difficulty of modeling the conduction response in the devices by conservatively assuming steady state conduction during heat up. We mechanistically model the convective heat transfer from the equipment surfaces of the active heat sinks. These differences from previous work are expected to show that more time is available to mitigate the loss of air conditioning. If successful in initial simulations, the model can be extended to develop robust response strategies should air conditioning ever be lost in the EAB. Development of robust response strategies would require good estimates of the time available for mitigation which we believe we can get from the model we are developing.

We describe the overall problem including plant data and boundary conditions. We summarize results we have obtained using the classic approaches and summarize where believe assumptions may lead to unrealistic results. We summarize the new CFD model developed at Texas A&M, modeling assumptions and present preliminary results. We describe proposed future work including equipment testing for high temperature conditions.

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Salary and Career Articles

From http://www.payscale.com/resources_archives

Resumes and Cover Letters

Resume Tips - Whip Your Resume into Shape
How to Write a Killer Cover Letter - 9 Tips
Q&A: How to Put References in Your Resume

Financial Planning

Understanding Payroll Deductions
Calculating Your Salary After Relocation
The American Dream - Dead or Alive?
Three Tales of how the American Dream is Still with Us.
Middle Class to Millionaire - 3 Women's Stories
The 60/40 Rule: One Mom's Recipe for Millions
Recommended Book: The Automatic Millionaire
Become a Middle-class Millionaire - 5 Tips

Fact Sheet on Safety and Security Improvements at Nuclear Plants

Post 9-11 Actions

The Nuclear Regulatory Commission (NRC) - responsible for protecting public health and the environment from potential hazards involved in using nuclear materials - took prompt action to enhance safety and security, and has comprehensively re-evaluated security at nuclear power plants and other facilities it regulates.

Since September 11, 2001, NRC has strengthened security at nuclear facilities by working with national experts using state-of-the-art structural and fire analyses to realistically predict the consequences of terrorist acts. These studies confirm that, given robust plant designs and the additional enhancements to safety, security, and emergency preparedness and response, it is unlikely that significant radiological consequences would result from a wide range of terrorist attacks, including one from a large commercial aircraft.

Actions taken by Federal aviation safety and security agencies - Federal Air Marshals, reinforced cockpit doors, airport passenger and baggage screening, improved ability to detect deviation from planned flight paths and greater military aircraft intercept capability - have reduced the likelihood that large commercial aircraft could be used to attack critical infrastructure, including a nuclear facility. Other actions, such as improved communication between military surveillance authorities, NRC, and its licensees, would allow plant operators to prepare the plant for safe shutdown should it be necessary. These actions, coupled with those taken by the NRC and the nuclear industry, are an integral part of the government's overall strategy for protecting the nation's critical infrastructure.

Safety and security studies show that a radiological release affecting public health and safety is unlikely from a terrorist attack, including large commercial aircraft

- Power plants are among the most hardened commercial structures in the country and are designed to withstand extreme events, such as hurricanes, tornadoes, and earthquakes;
- Power plants have redundant safety systems and are operated by highly trained staff;
- Multiple barriers protect the reactor and prevent or minimize off-site releases;
- With mitigation strategies and measures in place, the probability of damaging the reactor core and releasing radioactivity that could affect public health and safety is low;
- Significant releases due to a terrorist attack on a spent fuel pool are very unlikely;
- It is highly unlikely that a significant release of radioactivity would occur from a dry spent fuel storage cask; and
- No release of radioactive material is expected from an aircraft attack on a transportation cask.

Time is available to protect the public in unlikely event of a radiation release

- If a radiation release did occur, there would be time to implement mitigating actions and offsite emergency plans at power plants, spent fuel pools, and dry-cask storage installations; and
- Safety and security studies confirm that NRC's emergency planning basis remains valid.

Taken from http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/safety-security.html

Important and Interesting Links

For information on ICONE17 go to http://www.asmeconferences.org/icone17/
Go to NED Web Site - http://www.divisions.asme.org/ned/
To pick up the latest ASME News - http://www.asmenews.org/latebrk/latebrk.html
New Nuclear Plants - http://www.nrc.gov/reactors/new-reactor-licensing.html
Other Important Links at http://divisions.asme.org/ned/links/index.html
Booking airline reservations use http://www.kayak.com/
Cheap Books use www.campusbooks.com and www.cheapestextbooks.com

Message from the NED Chairman (cont.)

Continued from Page 1

Under the leadership of Dick Schultz, the NED Executive Committee has been actively investigating feasibility of a number of initiatives that include the NED Scholarship Program, NED Journal and other endeavors. The purpose of these efforts is to develop additional avenues to strategically use NED assets and resources to promote advancement of the nuclear programs throughout the world. I will provide an update once the plan is firmed up. Our Division has been working with the Environmental Engineering Division to co-sponsor a "Climate Change" Track in the 2009 IMECE (November 2009; Orlando). NED has also agreed to participate in the 2010 "International Heat Transfer Conference" (IHTC2010, August 2010, Washington, DC) with five other ASME Divisions and American Nuclear Society (ANS). Lastly, ASME/NED and ANS are co-sponsoring PHYSOR2010 (MAY 2010; Pittsburgh), "Advances in Reactor Physics to Power the Nuclear Renaissance."

As you know, currently there are 439 operating nuclear power plants in 31 countries and there are 37 nuclear plants under construction worldwide. Approximately 40–50 non-nuclear-power countries are considering the nuclear option. Consequently, 2009 and beyond will be a very exciting time for the future of nuclear industry as it offers safe, clean and economic power to meet the global energy need. I cordially invite you to step up and actively participate in and contribute to this historic Nuclear Renaissance ride.

Robert W. Tsai, Chairman, ASME/NED
Exelon Generation Company
630.657.2162
robert.tsai@exeloncorp.com

How to Build a Career Network from Payscale.com

Studies show that the number one way to get a job is by career networking - and when it comes to starting or advancing a career, your career network should be the first place you look. And slow economy is the perfect excuse to kick up your networking efforts.

Have you ever asked yourself why networking is important to your career? Studies show that the number one way to get a job is by career networking - and when it comes to starting or advancing a career, your career network should be the first place you look. So rather than asking why networking is important to your career, start with asking, "How do I network?"

We know what you're thinking: More easily said than done. That's why we put together a few easy tips for making the most of your career network:

- **Build a local career network**
- **Use online social networking tools**
- **Be inclusive in building your career network**
- **Find opportunities to be generous within your career network**

Build a Local Career Network
If you've been working for a few years, the likelihood is that you have an assortment of work contacts. The best place to start refining your career network is at the local level, by building relationships with the people who work with you regularly. Here's how to think more strategically about building your network.

More at **http://www.payscale.com/how-to-build-a-career-network-recession**

International Conference on Nuclear Engineering ICONE 17

About the Conference
The American Society of Mechanical Engineers (ASME), Japan Society of Mechanical Engineers (JSME) and Chinese Nuclear Society (CNS) are jointly organizing the **17th International Conference on Nuclear Engineering (ICONE17)**. The **International Conference on Nuclear Engineering (ICONE)** is the premier global conference for addressing the needs of the nuclear industry. The conference will take place July 12-16, 2009 and will be held at the Sheraton Brussels Hotel. Go to **http://www.asmeconferences.org/ICONE17/** for more information.

Previous Conference
The ICONE-16 was held on May 11-15, 2008, at the Disney's Contemporary Resort in Orlando, Florida. Over 620 presentations were made and 733 worldwide nuclear professionals attended the Conference.

Technical Tracks
ICONE17 will be accepting abstracts for submission to the following technical tracks:
We invite you to join us at ICONE17. Topics will include:

TRK-1: Plant Operations, Maintenance, Engineering, Modifications and Life Cycle
TRK-2: Component Reliability And Materials Issues
TRK-3: Structural Integrity
TRK-4: Advanced Applications Of Nuclear Technology
TRK-5: Next Generation Systems
TRK-6: Safety And Security
TRK-7: Codes, Standards, Licensing And Regulatory Issues
TRK-8: Fuel Cycle and High & Low Level Waste Management and Decommissioning
TRK-9: Balance of Plant for Nuclear Applications
TRK-10: Thermal Hydraulics
TRK-11: Computational Fluid Dynamics (CFD), Neutronics Methods And Coupled Codes
TRK-12: Current Advanced Reactors – Plant Designs, Construction, Workforce And Public Acceptance
TRK-13: Instrumentation & Controls (I&C)
TRK-14: Student Paper Competition
TRK-15: Nuclear Industry Forum - Keynote, Plenary and Panel Sessions
For more information, view the technical track descriptions.

Abstract Submission
We have over 950 abstracts submitted.

Further information and status regarding ICONE17 may be obtained at the official web site:
http://www.asmeconferences.org/icone17/.

Links to ASME Codes and Standards

Links for Students

- An Introduction to Codes & Standards for Students
  http://files.asme.org/ASMEORG/Codes/About/Links/1028.pdf
- ASME C&S - Examples of Use for Mechanical Engineering Students
  http://files.asme.org/ASMEORG/Codes/About/Links/3116.pdf

ANSI Links

- ANSI Standards Action
  http://www.ansi.org/news_publications/periodicals/standards_action/standards_action.aspx?menuid=7
- The National Standard Systems Network (NSSN) http://www.nssn.org/

What actions has the NRC required nuclear power plants to implement to protect against deliberate aircraft attacks?

Response: In February 2002, the NRC ordered nuclear power plant licensees to develop specific plans and strategies to respond to a wide range of events, including the impact of an aircraft. Licensees have taken actions as a result of the NRC Advisories and Orders to mitigate the effects of a September 11-type aircraft attack. The NRC considers the list of specific actions taken to be information that potentially would benefit terrorists if released publically.

Even before these actions, nuclear power plants were designed to protect public health and safety. The plants achieved this through their robust containment buildings, redundant safety systems, highly trained operators and maintenance staff, stringent security plans, and armed security personnel. These plants are among the strongest and most difficult structures to break into in the country. They are designed to withstand extreme events, such as hurricanes, tornadoes, and earthquakes. Currently, the NRC and nuclear power plant licensees are performing site-specific safety and security assessments. These assessments are identifying ways each nuclear power plant can withstand a wide range of terrorist attacks.

The NRC has used defense-in-depth to define its safety philosophy at nuclear power plants. Defense-in-depth means there are multiple measures that could prevent an accident or lessen the effects of damage if a malfunction or accident occurs at a nuclear facility. The NRC's safety philosophy ensures that the public is protected and that emergency plans for areas surrounding a nuclear facility are well thought out and workable. In that regard, NRC-licensed nuclear power plants and other facilities have detailed, well coordinated, and tested emergency response plans. These plans work to reduce the impact on the public in the event of a radiation release.

The NRC regularly communicates with other federal agencies, including the Department of Homeland Security (DHS), the Federal Aviation Administration (FAA), and the Department of Defense (DOD), which have acted on specific occasions to protect airspace above nuclear power plants. The Aviation and Transportation Security Act of 2001 also provides additional protection against air attacks on all industrial facilities, both nuclear and non-nuclear, by strengthening aviation security.

What is the Phase 1 effort?

Response: Phase 1 is part of a larger NRC effort to enhance the safety and security of the nation's nuclear power plants. The Phase 1 effort was initiated as part of a February 2002 NRC Order. The Order, among other things, required licensees to look at what might happen if a nuclear power plant lost large areas due to explosions or fire. The licensees then were required to identify – and later implement – strategies that would maintain or restore cooling for the reactor core, containment building, and spent fuel pool. The requirements listed in Section B.5.b of this Order directed licensees to identify "mitigative strategies" (meaning the measures licensees could take to reduce the potential consequences of a large fire or explosion) that could be implemented with resources already existing or "readily available." The NRC held inspections in 2002 and 2003 to identify whether licensees had implemented the required mitigative strategies.

These inspections, as well as additional studies, showed significant differences in the strategies implemented by the plants. As a result, the NRC developed additional mitigative strategy guidance as part of Phase 1. Among other things, the guidance was based on "lessons learned" from NRC engineering studies. In addition, the guidance included a list of "best practices" for mitigating losses of large areas of the plant. Each plant was requested to consider implementation of applicable additional strategies by August 31, 2005. The NRC inspected each plant in 2005 to review their implementation of any additional mitigative measures. The NRC is continuing to ensure licensees appropriately implement these measures.

Due to the sensitive nature of the information, the NRC is not releasing specific details about the assessments or what was found.

Taken from http://www.nrc.gov/security/faq-security-assess-nuc-pwr-plants.html#4

Operational Safety, Plant Security and Emergency Preparedness from NEI http://www.nei.org/keyissues/safetyandsecurity/

Operational Safety, Plant Security and Emergency Preparedness

U.S. nuclear plants are well-designed, operated by trained personnel, defended against attack and prepared in the event of an emergency.

Operational Safety

Stringent federal regulation, automated, redundant safety systems and the industry's commitment to comprehensive safety procedures keep nuclear power plants and their communities safe.

Personnel Training and Screening

Operators receive rigorous training and must hold valid federal licenses. All nuclear power plant staff are subject to background and criminal history checks before they are granted access to the plant.

Plant Security

Each nuclear power plant has extensive security measures in place to protect the facility from intruders. Since Sept. 11, 2001, the nuclear energy industry has substantially enhanced security at nuclear plants.

Emergency Preparedness

Soviet-Designed Nuclear Power Plant Profiles Introduction

Purpose

The U.S. Department of Energy (DOE) manages a comprehensive effort, in cooperation with partners in other countries, to reduce risks at Soviet-designed nuclear power plants. This program is conducted in cooperation with Armenia, Bulgaria, the Czech Republic, Hungary, Kazakhstan, Lithuania, Russia, Slovakia, and Ukraine (the host countries) in their efforts to make plant operations safer and build their own infrastructure to sustain safety improvements. These nuclear safety activities are promoting a lasting safety culture in the host countries that is consistent with international practices.

Background

DOE's cooperative program originated from U.S. commitments made in 1992 at the G-7 economic group conference, where world leaders agreed to collaborate with the host countries to reduce the risks at Soviet-designed reactors. This effort now includes safety-related activities at 21 nuclear power stations in nine countries.

Safety improvements at Soviet-designed nuclear power plants are needed to ensure the protection of the public, economic health, and environment of many countries, because, as evidenced by the 1986 Chornobyl accident, a nuclear disaster can extend well beyond national borders. Safety improvements are also important in helping guard against a nuclear accident that could destabilize the emerging democracies of the former Soviet Union and Central and Eastern Europe.

Taken from http://insp.pnl.gov/-profiles.htm

Selected Abstracts from ICONE17 (cont)

Continued from Page 3

Improving Safety through the Resolution of Generic Safety Issues ICONE17-75112

by John Kauffman, NRC

The United States Nuclear Regulatory Commission (NRC) developed a Generic Issues Program (GIP) in the mid-1970s to address complex questions with a potential safety impact. The efficient and effective means of assessing and addressing such issues is necessary in the regulatory process.

Each nation defines "Generic Safety Issues" somewhat differently. In the U.S., an issue must meet criteria which ensure that the issue: 1) is sufficiently safety significant that it can pass restrictions limiting the imposition of backfit regulations, 2) does not require long term research to understand or quantify its risk, 3) cannot be readily addressed by existing NRC programs and processes or industry initiatives, 4) is well-defined, discrete, and technical, and 5) is generic. Taken together, these criteria ensure that the NRC GIP deals only with important issues where the outcome may be a change to the body of regulations or associated guidance. In many cases, an issue does not proceed all the way through the GIP; but the communications and interactions fostered by the GIP lead to the identification of a way to address the issue using existing NRC programs and processes or industry initiatives; or to conduct the necessary research to better understand the issue or phenomenon.

This paper provides several detailed examples of safety improvements resulting from the resolution of Generic Safety Issues. The paper also provides a discussion of publicly available GIP information, and different means to access the information (GIP public web page -- http://www.nrc.gov/about-nrc/regulatory/gen-issues.html). Publicly available information includes the resolution of the more than 850 issues processed by the program to date, NUREG-0933, "Resolution of Generic Safety Issues," the GIP annual SECY paper, program procedures and management directive, and the current Quarterly Report on Active Generic Issues. The U.S. GIP also participates with the International Atomic Energy Agency to make GIP information available on the Global Nuclear Safety Network. Such information sharing offers potential safety benefits because other safety organizations can consider the implications for their reactors.

The paper provides a discussion of GI-199, "Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants," GI-191, "Assessment of Debris Accumulation on PWR Sump Performance ," and three or four more recent generic issues chosen by the authors to illustrate how the program functions to improve safety.

U.S. Fire PRA Peer Review Status and Lesson-Learned ICONE17-75751

by Clarence L. Worrell, Westinghouse

Most U.S. PWR and BWR plants are developing Fire PRAs for regulatory applications such as NFPA 805. Through Regulatory Guide 1.200, the USNRC has defined "one acceptable approach for determining whether the quality of the PRA, in total or the parts that are used to support an application, is sufficient to provide confidence in the results, such that the PRA can be used in regulatory decision-making for light-water reactors."

To determine Fire PRA technical adequacy, U.S. plants are performing Peer Reviews organized and led by the PWR and BWR Owners Groups. This presentation is co-authored by the Fire PRA leads of the PWR and BWR Owners Groups and provides an overview of the Fire PRA Peer Review Process, a status of U.S. peer reviews, and lessons learned from the early peer reviews.

Continued on Page 10

Editor's Message (cont.)

Continued from Page 1

We have articles about Russian safety improvements and the NRC efforts to improve safety after 9/11. We have also included some selected abstracts from ICONE17. Go to **http://www.asmeconferences.org/ICONE17/** for more information on ICONE17. If you have any questions or comments, email me at jsmeda@cox.net. Joe Miller

Selected Abstracts from ICONE17 (cont)

Continued from Page 9

The Fire PRA Peer Review Process is defined in NEI 07-12. The peer review involves a team of 6-8 performing one week of pre-review, one week on-site review, and one week report preparation. The team contains personnel with expertise in all areas of Fire PRA (i.e., Classical PRA, Fire Protection, Circuit Analysis, Fire Modeling, etc.). The team is onsite for one week and performs an assessment of how the Fire PRA satisfies each applicable High Level Requirement and Supporting Requirement of the combined ASME/ANS PRA Standard.

To date, the peer review process has been piloted at Diablo Canyon and implemented at Shearon Harris. Lessons-learned from these initial peer reviews have already resulted in improvements to NEI 07-02. Prior to ICONE 17, an additional seven peer reviews will have been performed. Lessons learned, such as key areas for improvement, from these peer reviews will be presented.

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Nuclear Related Conference

ICEM'09 Announces it's ...

12th International Conference on ...

Environmental Remediation and Radioactive Waste Management

Conference Date: October 11-15, 2009
Location: Liverpool, UK
Arena and Convention Centre (ACC), UK
http://www.icemconf.com/ *We look forward to your participation*
Abstract Deadline – December 31, 2008
Author Notification – March 06, 2009

Safety of Nuclear Power Reactors

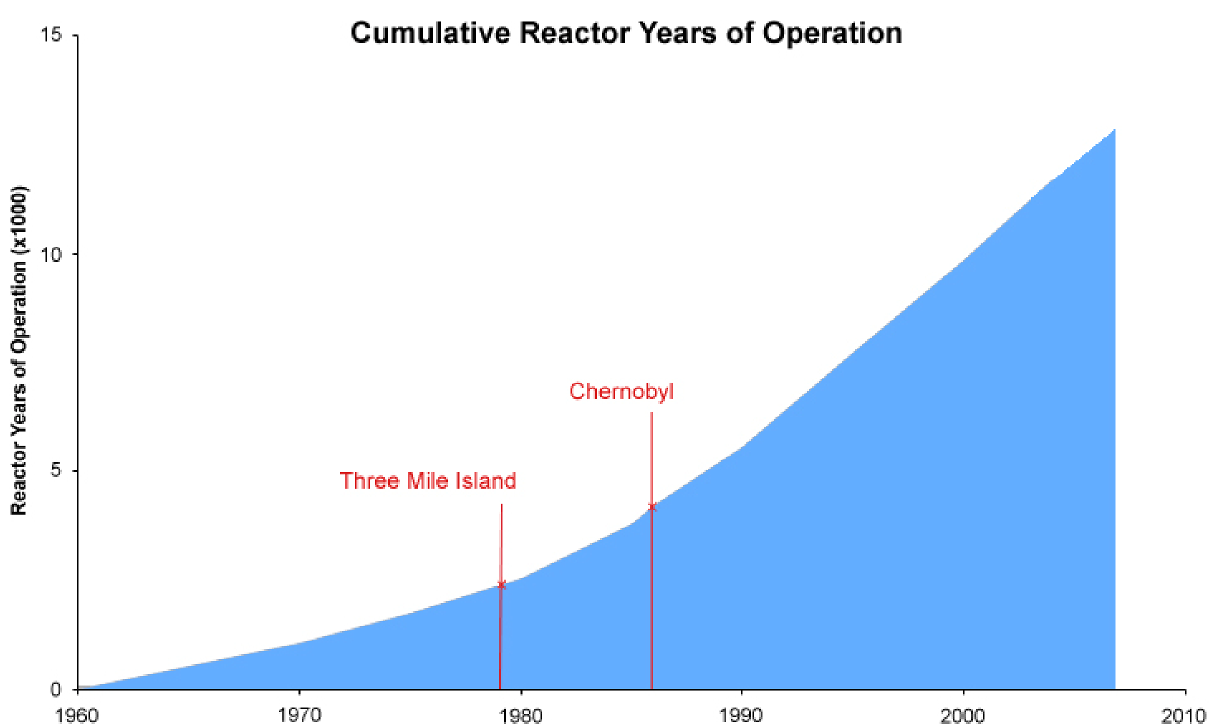
To give you a perspective of other energy related fields, some energy-related accidents with multiple fatalities are shown in Appendix 1 on Page 12. In contrast, there were only two significant accidents that occurred during more than 12,700 reactor-years of civil reactor power operation (See figure below). Of all the accidents and incidents, only the Chernobyl accident resulted in radiation doses to the public greater than those resulting from the exposure to natural sources. Other incidents (and one 'accident') have been completely confined to the plant.

Apart from Chernobyl, no nuclear workers or members of the public have ever died as a result of exposure to radiation due to a commercial nuclear reactor incident. Most of the serious radiological injuries and deaths that occur each year (2-4 deaths and many more exposures above regulatory limits) are the result of large uncontrolled radiation sources, such as abandoned medical or industrial equipment. (There have also been a number of accidents in experimental reactors and in one military plutonium-producing pile - at Windscale, UK, in 1957, but none of these resulted in loss of life outside the actual plant, or long-term environmental contamination.) It should be emphasized that a commercial-type power reactor simply cannot under any circumstances explode like a nuclear bomb.

The International Atomic Energy Agency (IAEA) was set up by the United Nations in 1957. One of its functions was to act as an auditor of world nuclear safety. It prescribes safety procedures and the reporting of even minor incidents. Its role has been strengthened since 1996 (see later section). Every country which operates nuclear power plants has a nuclear safety inspectorate and all of these work closely with the IAEA.

While nuclear power plants are designed to be safe in their operation and safe in the event of any malfunction or accident, no industrial activity can be represented as entirely risk-free. However, a nuclear accident in a western-type reactor is now understood to have severe financial consequences for the owner but will give rise to minimal off-site consequences.

Taken from http://www.world-nuclear.org/info/inf06.htm



Safety of Nuclear Power Reactors – Appendix 1

Continued from Page 11

(January 2008)

Appendix 1. The Hazards of Using Energy:Some energy-related accidents since 1977

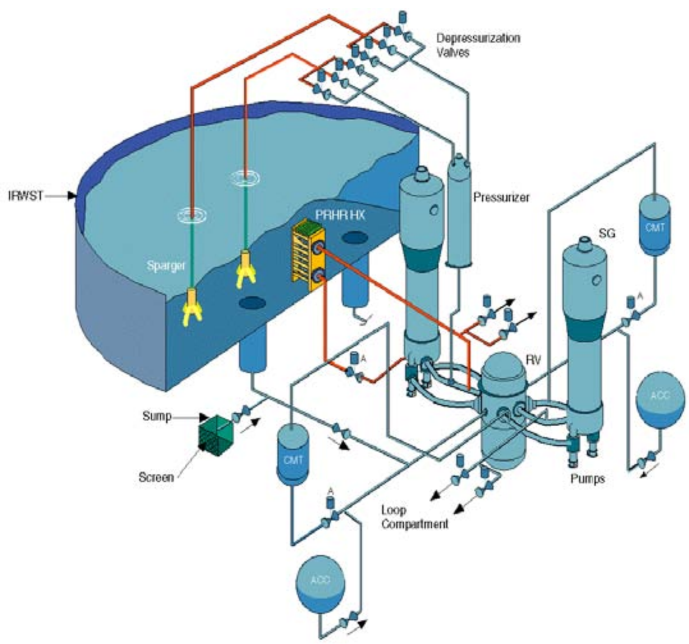
Place	Year	Number killed	Comments
Machhu II, India	1979	2500	hydro-electric dam failure
Hirakud, India	1980	1000	hydro-electric dam failure
Ortuella, Spain	1980	70	gas explosion
Donbass, Ukraine	1980	68	coal mine methane explosion
Israel	1982	89	gas explosion
Guavio, Colombia	1983	160	hydro-electric dam failure
Nile R, Egypt	1983	317	LPG explosion
Cubatao, Brazil	1984	508	oil fire
Mexico City	1984	498	LPG explosion
Tbilisi, Russia	1984	100	gas explosion
northern Taiwan	1984	314	3 coal mine accidents
Chernobyl, Ukraine	1986	31+	nuclear reactor accident
Piper Alpha, North Sea	1988	167	explosion of offshore oil platform
Asha-ufa, Siberia	1989	600	LPG pipeline leak and fire
Dobrnja, Yugoslavia	1990	178	coal mine
Hongton, Shanxi, China	1991	147	coal mine
Belci, Romania	1991	116	hydro-electric dam failure
Kozlu, Turkey	1992	272	coal mine methane explosion
Cuenca, Equador	1993	200	coal mine
Durunkha, Egypt	1994	580	fuel depot hit by lightning
Seoul, S.Korea	1994	500	oil fire
Minanao, Philippines	1994	90	coal mine
Dhanbad, India	1995	70	coal mine
Taegu, S.Korea	1995	100	oil & gas explosion
Spitsbergen, Russia	1996	141	coal mine
Henan, China	1996	84	coal mine methane explosion
Datong, China	1996	114	coal mine methane explosion
Henan, China	1997	89	coal mine methane explosion
Fushun, China	1997	68	coal mine methane explosion
Kuzbass, Russia/Siberia	1997	67	coal mine methane explosion
Huainan, China	1997	89	coal mine methane explosion
Huainan, China	1997	45	coal mine methane explosion
Guizhou, China	1997	43	coal mine methane explosion
Donbass, Ukraine	1998	63	coal mine methane explosion
Liaoning, China	1998	71	coal mine methane explosion
Warri, Nigeria	1998	500+	oil pipeline leak and fire
Donbass, Ukraine	1999	50+	coal mine methane explosion
Donbass, Ukraine	2000	80	coal mine methane explosion
Shanxi, China	2000	40	coal mine methane explosion

AP1000 Passive Reactor Safety Design

The passive core cooling system (PXS), shown in the Figure below, protects the plant against RCS leaks and ruptures of various sizes and locations. The PXS provides core residual heat removal, safety injection, and depressurization. Safety analyses (using NRC-approved codes) demonstrate the effectiveness of the PXS in protecting the core following various RCS break events. Even for breaks as severe as the 20.0-cm (8-in) vessel injection lines, there is no core uncovery for either AP600 or AP1000. Following a double-ended rupture of a main reactor coolant pipe, the PXS cools the reactor with ample margin to the peak clad temperature limit.

The PXS uses three sources of water to maintain core cooling through safety injection. These injection sources include the core makeup tanks (CMTs), the accumulators, and the in-containment refueling water storage tank (IRWST). These injection sources are directly connected to two nozzles on the reactor vessel so that no injection flow can be spilled in case of larger breaks. Long-term injection water is provided by gravity from the IRWST, which is located in the containment just above the RCS loops. Normally, the IRWST is isolated from the RCS by squib valves and check valves. This tank is designed for atmospheric pressure. The RCS must be depressurized before injection can occur. The RCS is automatically controlled to reduce pressure to about 0.83 bar (12 psig), at which point the head of water in the IRWST overcomes the low RCS pressure and the pressure loss in the injection lines. The PXS provides depressurization using the four stages of the automatic depressurization system (ADS) to permit a relatively slow, controlled RCS pressure reduction. To maintain similar margins for accidents requiring safety injection, a few lines in the PXS were made larger for AP1000. In addition, the CMTs were enlarged to provide adequate margin without requiring redesign of adjacent piping and structure.

For simulations and info click on
http://www.ap1000.westinghousenuclear.com/ap1000_psrs_pccs.html and
http://www.ap1000.westinghousenuclear.com/ap1000_psrs_pcs.html
http://nuclearinfo.net/twiki/pub/Nuclearpower/WebHomeCostOfNuclearPower/AP1000Reactor.pdf



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