## Beasley, Benjamin

**From:** Beasley, Benjamin
**Sent:** Monday, March 21, 2011 2:02 PM
**To:** Boska, John
**Cc:** Kauffman, John; Coe, Doug
**Subject:** RE: need help

John,

On the conference call last week between Region 1 and the executives from counties surrounding Indian Point, the executives inquired about the NRC guidance to U.S. citizens in Japan to evacuate up to 50 miles. Since New York city is less than 50 miles from Indian Point, this evacuation recommendation may be of particular interest.

I note that the Director of the NY Office of Emergency Management will attend the meeting. It would be prudent to have some thoughts ready on the 50 mile evacuation recommendation and the implications for US incidents.

Ben Beasley

---

**From:** Boska, John
**Sent:** Monday, March 21, 2011 11:28 AM
**To:** Kauffman, John; Beasley, Benjamin
**Subject:** need help
**Importance:** High

See attached. Any comments on it? Need today. Thanks.

John Boska
Indian Point Project Manager, NRR/DORL
U.S. Nuclear Regulatory Commission
301-415-2901
email: john.boska@nrc.gov

WP201

## Beasley, Benjamin

**From:** Beasley, Benjamin
**Sent:** Tuesday, March 22, 2011 6:44 AM
**To:** Coyne, Kevin
**Cc:** Coe, Doug
**Subject:** RE: Support for Japan Response

Please add the following OEGIB staff that have / are supporting the Ops Center:

Michelle Bensi
John Kauffman
John Lane

---

**From:** Coyne, Kevin
**Sent:** Monday, March 21, 2011 7:24 PM
**To:** Demoss, Gary; Xing, Jing; Salley, MarkHenry; Wood, Jeffery; Beasley, Benjamin; Ott, William
**Cc:** Peters, Sean; Coe, Doug
**Subject:** Support for Japan Response

The agency has lifted overtime restrictions for folks supporting the Japan incident response. In order to ensure that HRMS will accept time correctly, PMDA needs to know who might be charging overtime/comp time for the recent events in excess of the normal limits. Please let me know if you have any folks so involved and we'll pass the information onto PMDA. I currently have the following possible names:

Dave Stroup
Felix Gonzalez
Mark Salley
Don Marksberry
Don Helton

Let me know who I've missed...

Thanks!

Kevin

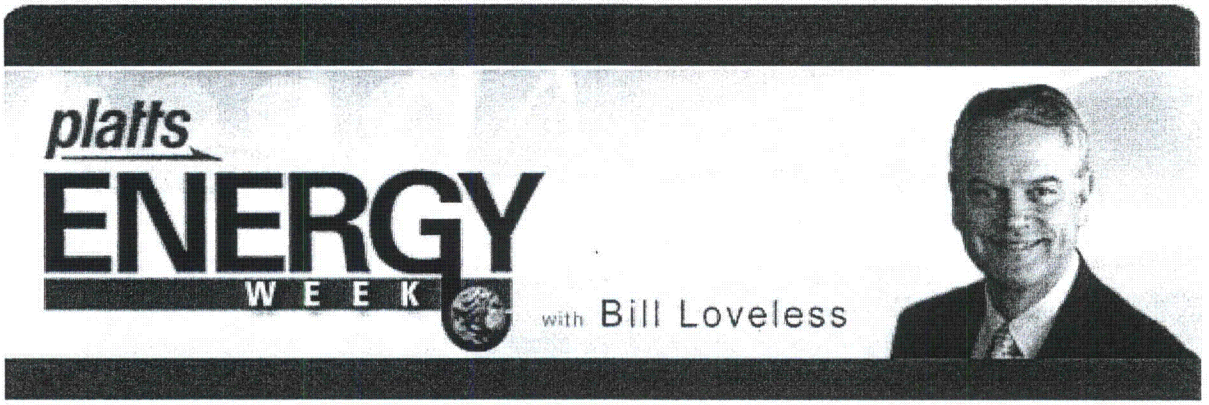
w/202

Appendix H

## Reeves, Rosemary

**From:** Platts Energy Week TV [ann_forte@platts.com]
**Sent:** Friday, March 18, 2011 4:35 PM
**To:** Reeves, Rosemary
**Subject:** Japan's Tragedy Prompts New Look at Nuclear Energy

If your email program has trouble displaying this email, view it as a web page.




### Watch Sunday at 8 a.m. Eastern Time on W*USA9

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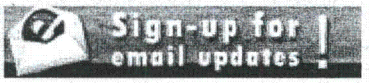
**www.PlattsEnergyWeekTV.com**
Sunday's show video available online at 9am Eastern Time

Click here to see pictures from the Platts Energy Week Launch Reception at the Petroleum Club of Houston.



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### What's Happening on March 20th

**Streaming video available at 9 a.m Eastern Time.**

### Japan's Tragedy Prompts New Look at Nuclear Energy

With the disaster in Japan, nuclear energy is coming under close scrutiny again as a safe and reliable power source for the U.S. Even pro-nuclear lawmakers are raising questions with the Nuclear Regulatory Commission and the Department of Energy. Among them is **Representative Ed Whitfield**, **chairman of the House Energy and Power Subcommittee**, who tells Bill what Washington should do — and not do — when it comes to nuclear energy.

### Could Another Nuclear Disaster Hit the U.S.?

How does nuclear technology and regulation in Japan and the U.S. compare? And is the U.S., 32 years after the Three Mile

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w/203

Island accident, any different when it comes to the potential for another nuclear meltdown? The **director of Idaho National Laboratory and former nuclear submarine commander, John Grossenbacher**, gives Bill his insight.

## Whither the Nuclear Renaissance?

With applications pending for 20 new reactors in the U.S., and more on the drawing board, the nuclear power industry has been anticipating a renewal. But will financing become more difficult in light of the nuclear catastrophe in Japan? **Dmitri Nikas, with Standard & Poor's utilities and infrastructure unit, and Benjamin Salisbury, with FBR Capital Markets**, offer Bill some answers.

## Fallout for Other Energy Commodities

**Vandana Hari, Platts senior editorial director for Asia**, discusses with Bill how Japan is making up for losses in nuclear power, and what it means for markets in liquefied natural gas, coal and oil.

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## Upcoming complimentary webinars

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### Trading LNG in a Changing Global Market

Tuesday, March 22, 2011 • 1 - 2 pm ET - *SPONSOR This Event*

### Option Trading's Irresistible Modernization: A Look At Energy and Precious Metals

Wenesday, March 23, 2011 • 3:30 - 4:30 pm ET

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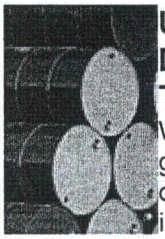
## March 13th Show Now Online

**Streaming Video at: www.PlattsEnergyWeekTV.com**

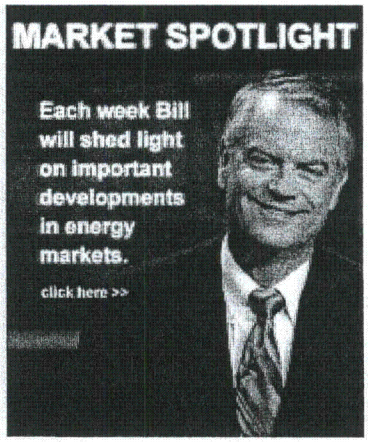


## Unrest in Libya — Is Risk of Oil Supply Disruption Enough to Get Uncle Sam Tapping?

What does it take to prompt the United States government to tap into its stockpile of "safety net" oil – the Strategic Petroleum Reserve – to increase supply and help temper prices at the pump for the consumer? Bill Loveless will speak with **Platts global director of news, John Kingston**, a long-time oil veteran, about the full factors behind the price spike and whether the U.S. should be tapping its SPR. Watch Now

## Macondo Oil Spill One Year Later—Could We Contain Another Spill?

Despite lessons learned last year, there are only a couple of remedies for containing another offshore deep-water oil rig blowout. Hear from **Helix Energy's CEO, Owen Kratz,** about his company's solution to any future disasters in the U.S. Gulf




bill@plattsenergyweektv.com

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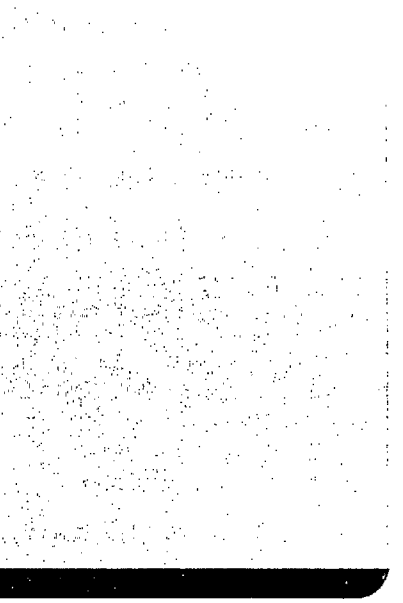
## What Does the Island State of Hawaii Know About Clean Energy That You Don't?

Hawaii is one of the few U.S. states that "lives" its dependence on oil, with crude providing nine-tenths of the state's energy consumption and three-quarters of its electricity generation. **CEO of Hawaiian Electric Connie Lau** shares the secrets of success and her company's scorecard since reaching an agreement in 2008 to provide 70% of the state's energy needs from clean energy sources by 2030. Watch Now






**From:** Howe, Allen NRR
**To:** Andersen, James
**Cc:** Gratton, Christopher; Grobe, Jack
**Subject:** RE: Materials for March 21st Commission Briefing on Japan Event
**Date:** Friday, March 18, 2011 5:49:49 PM

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Jim – Jack Grobe has the list. He is working an email to the Office Directors and Deputy Directors, those on the list and, of course, you.

Thanks - Allen

---

**From:** Andersen, James OEDO
**Sent:** Friday, March 18, 2011 4:57 PM
**To:** Borchardt, Bill; Virgilio, Martin; Weber, Michael; Ash, Darren; Muessle, Mary; Landau, Mindy; Leeds, Eric; Grobe, Jack; Howe, Allen; Gratton, Christopher; Boska, John
**Subject:** FW: Materials for March 21st Commission Briefing on Japan Event

FYI.

Allen, once you are finished identifying the technical staff who will be available to answer specific technical questions, can you please forward the list to me. I need to provide it to SECY so they know who to hold seats for. I assume the seats in the well will be for Darren, Marty, NRR, NRO, RES, NSIR, OIP, CFO. Anyone else?

---

**From:** Laufer, Richard SECY
**Sent:** Friday, March 18, 2011 4:46 PM
**To:** Bavol, Rochelle; Svinicki, Kristine; Montes, David; Adler, James; Bates, Andrew; Batkin, Joshua; Bubar, Patrice; Bupp, Margaret; Chairman Temp; Clark, Lisa; Coggins, Angela; Davis, Roger; Dhir, Neha; Hart, Ken; Loyd, Susan; Monninger, John; Nieh, Ho; Pearson, Laura; Reddick, Darani; Rothschild, Trip; Joosten, Sandy; Sharkey, Jeffry; Shea, Pamela; Sosa, Belkys; Burns, Stephen; Vietti-Cook, Annette; Warren, Roberta; Zorn, Jason; Baggett, Steven; Bradford, Anna; Castleman, Patrick; Kock, Andrea; Tadesse, Rebecca; Thoma, John; Franovich, Mike; Hipschman, Thomas; Batkin, Joshua; Marshall, Michael; Orders, William; Snodderly, Michael; Warnick, Greg; Lisann, Elizabeth
**Cc:** Dudley, Richard; Ruland, William; Tregoning, Robert; Wittick, Brian; Andersen, James; Blake, Kathleen; Bozin, Sunny; Cianci, Sandra; Crawford, Carrie; Gibbs, Catina; Harves, Carolyn; Hasan, Nasreen; Jimenez, Patricia; KLS Temp; Landau, Mindy; Lepre, Janet; Lewis, Antoinette; Herr, Linda; Muessle, Mary; Pace, Patti; Pulley, Deborah; Savoy, Carmel; Speiser, Herald; Taylor, Renee; Temp, GEA; Temp, WCO; Temp, WDM; Wright, Darlene; Wittick, Susan; Sargent, Kimberly; Hayden, Elizabeth; Brenner, Eliot; Powell, Amy; Schmidt, Rebecca
**Subject:** Materials for March 21st Commission Briefing on Japan Event

Attached is the final scheduling note for the March 21st Commission briefing on the Japan Event. Staff slides should be emailed later today by Jim Andersen (OEDO).

Note that Commissioner Magwood goes first with questions.

Below are a few meeting logistics for your information:

- Bill Borchardt will be the only NRC staff member at the table.
- The seats in the well are reserved for DEDOs / Office Directors
- The stadium seating to the Commissioners left will be reserved for designated technical

3/2004

staff (who may be called upon during the meeting) and Commission Office EAs/TAs
- The stadium seating to the Commissioners right will be reserved for Press Corps/OPA
- Some of the stadium seating in front of the Commissioners will be reserved for VIPs (Congressional Office staffers).
- The remaining stadium seats in front of the Commissioners will be open to the public.

Once the available public seats are filled, members of the public will be directed around the back of the building where they will enter the TWFN Auditorium to view the Commission meeting.

Thanks,
Rich

**From:** OST01 HOC

**To:** Abrams, Charlotte; Adams, John; Afshar-Tous, Mugeh; Alemu, Bezakulu; Alter, Peter; Anderson, James; Ashkeboussi, Nima; Baker, Stephen; Bergman, Thomas; Berry, Rollie; Bloom, Steven; Blount, Tom; Boger, Bruce; Bower, Anthony; Brandon, Lou; Brandt, Philip; Brock, Kathryn; Brown, Cris; Brown, David; Brown, Eva; Brown, Frederick; Bukharin, Oleg; Camper, Larry; Carpenter, Cynthia; Case, Michael; Casto, Greg; Cervera, Margaret; Chazell, Russell; Chen, Yen-Ju; Chokshi, Nilesh; Chowdhury, Prosanta; Circle, Jeff; Clement, Richard; Clinton, Rebecca; Collins, Frank; Cool, Donald; Costa, Arlon; Crutchley, Mary Glenn; Cruz, Zahira; Dacus, Eugene; DeCicco, Joseph; Decker, David; Dembek, Stephen; Devlin, Stephanie; Doane, Margaret; Dorman, Dan; Dozier, Jerry; Droggitis, Spiros; Dudek, Michael; Dudes, Laura; Emche, Danielle; English, Lance; Erlanger, Craig; Esmaili, Hossein; Figueroa, Roberto; Fiske, Jonathan; Franovich, Rani; Fuller, Edward; Galletta, Thomas; Gambone, Kimberly; Giitter, Joseph; Gordon, Dennis; Gott, William; Grant, Jeffery; Grobe, Jack; Hale, Jerry; Hardesty, Duane; Hart, Ken; Hart, Michelle; Hasselberg, Rick; Henderson, Karen; Hiland, Patrick; Holahan, Patricia; Holahan, Vincent; Holian, Brian; Huyck, Doug; Howard, Tabitha; Huffert, Anthony; Hurd, Sapna; Isom, James; Jackson, Karen; Jessie, Janelle; Johnson, Michael; Jolicoeur, John; Jones, Andrea; Jones, Cynthia; Kahler, Carolyn; Kammerer, Annie; Karas, Rebecca; Khan, Omar; Kowalczik, Jeffrey; Kozal, Jason; Kratchman, Jessica; Kugler, Andrew; Lamb, Christopher; Larson, Emily; LaVie, Steve; Lewis, Robert; Li, Yong; Lombard, Mark; Lubinski, John; Lynch, Jeffery; Mamish, Nader; Manahan, Michelle; Marksberry, Don; Marshall, Jane; Mavros, Lauren; Mazaika, Michael; McConnell, Keith; McCoppin, Michael; McDermott, Brian; McGinty, Tim; McMurtray, Anthony; Merritt, Christina; Meyer, Karen; Miller, Charles; Miller, Chris; Milligan, Patricia; Mohseni, Aby; Moore, Scott; Morlang, Gary; Morris, Scott; Mroz (Sahm), Sara; Munson, Clifford; Murray, Charles; Nerret, Amanda; Norris, Michael; Norton, Charles; Ordaz, Vonna; Padovan, Mark; Patel, Jay; Parillo, John; Pope, Tia; Purdy, Gary; Quinlan, Kevin; Ragland, Robert; Ralph, Melissa; Reed, Elizabeth; Reed, Wendy; Reis, Terrence; Riley (OCA), Timothy; Rini, Brett; Rodriguez-Luccioni, Hector; Rosenberg, Stacey; Ross-Lee, MaryJane; Roundtree, Amy; Ruland, William; Salay, Michael; Salus, Amy; Sanfilippo, Nathan; Scarbrough, Thomas; Schaperow, Jason; Schmidt, Duane; Schoenebeck, Greg; Schrader, Eric; Schwartzman, Jennifer; Seber, Dogan; Shane, Raeann; Shea, James; Shepherd, Jill; Sheron, Brian; Skeen, David; Sloan, Scott; Smiroldo, Elizabeth; Smith, Theodore; Stahl, Eric; Stang, Annette; Steger (Tucci), Christine; Stieve, Alice; Stone, Rebecca; Stransky, Robert; Sturz, Fritz; Sullivan, Randy; Sun, Casper; Tappert, John; Temple, Jeffrey; Thaggard, Mark; Thomas, Eric; Thorp, John; Tobin, Jennifer; Trefethen, Jean; Tschiltz, Michael; Turtil, Richard; Uhle, Jennifer; Valencia, Sandra; Vaughn, James; Vick, Lawrence; Wastler, Sandra; Watson, Bruce; Weber, Michael; Webber, Robert; White, Bernard; Wiggins, Jim; Williams, Donna; Williams, Joseph; Williamson, Linda; Willis, Dori; Wimbush, Andrea; Wittick, Brian; Wray, John; Wright, Lisa (Gibney); Wright, Ned; Wunder, George; Young, Francis; Zimmerman, Roy

**Cc:** OST02 HOC; OST01 HOC

**Subject:** Work Schedule and Pay Guidance for Reponders to Japan Events

**Date:** Friday, March 18, 2011 5:07:01 AM

**Attachments:** Work Schedule and Premium Pay Guidance for Japan Response 3.docx

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**From:** Davidson, Lawrence
**Sent:** Thursday, March 17, 2011 5:14 PM
**To:** OST02 HOC; McMurtray, Anthony
**Cc:** Evans, Michele; Johns, Nancy; Scott, Tracy; Tallarico, Alison
**Subject:** FW:

Please distribute to everyone who serves in and supports the Ops Center in response to the events in Japan...

---

**From:** Davidson, Lawrence
**Sent:** Thursday, March 17, 2011 2:06 PM
**To:** Abraham, Susan; Abrams, Charlotte; Ader, Charles; Akstulewicz, Frank; Albert, Ronald; Allwein, Russell; Alston, Timothy; Andersen, James; Anderson, Joseph; Armentrout, Deborah; Ash, Darren; Ash, Melissa; Astwood, Heather; Auluck, Rajender; Austin, Joseph; Ayres, David; Bahadur, Sher; Bailey, Marissa; Bailey, Stewart; Baker, Pamela; Banas, Paul; Barss, Dan; Bartlett, Bruce; Bartley, Jonathan; Bartley, Malion; Batkin, Joshua; Baum, Robin; Bayliff, Shirley; Beardsley, James; Beasley, Benjamin; Bell, Hubert; Bell, Marvin; Bellamy, Ronald; Bellinger, Alesha; Benjamin, Jamie; Benner, Eric; Benney, Brian; Bergman, Thomas; Biggins, James; Bladey, Cindy; Blamey, Alan; Bloom, Steven; Bloomer, Tamara; Blount, Tom; Boger, Bruce; Boland, Anne; Bolduc, Angela; Bonser, Brian; Borchardt, Bill; Borden, William; Bouling, Ramona; Bower, Fred; Bower, Phyllis; Boyce, Tom (RES); Boyce, Thomas (OIS); Brady, Joseph; Brenner, Eliot; Brezovec, Michael; Broaddus, Doug; Brooks, Kenneth; Brown, Frederick; Brown, Tony; Brown, Milton; Brown, Rohn; Bubar, Patrice; Buchholz, Jeri; Buckley, Michael; Bumpass, Sheila; Burns, Stephen; Burritt, Arthur; Burton, Stephen; Burton, William; Bush-Goddard, Stephanie; Cain, Chuck; Caldwell, Robert; Calle, Joselito; Cameron, Jamnes; Campbell, Andy; Campbell,

Larry; Campbell, Stephen; Campbell, Vivian; Camper, Larry; Caniano, Roy; Cardenas, Daniel; Carlson, Robert; Carpenter, Cynthia; Case, Michael; Casto, Chuck; Casto, Greg; Cataldo, Paul; Catts, Michelle; Champion, Bryan; Chang, Helen; Chang, Lydia; Cheok, Michael; Chernoff, Harold; Chernoff, Margaret; Chokshi, Nilesh; Christensen, Harold; Clark, Jeff; Clay, Earnestine; Clayton, Brent; Clifford, James; Cobey, Eugene; Cochrum, Steven; Coe, Doug; Cohen, Miriam; Cohen, Ronald; Cohen, Stephen; Colaccino, Joseph; Coleman, Judy; Collins, Daniel; Collins, Elmo; Conte, Richard; Cook, Christopher; Corbett, James; Cordes, John; Correia, Richard; Costello, Ralph; Coyne, Kevin; Croteau, Rick; Crowe, Eddy; Cruz, Jeffrey; Csontos, Aladar; Cubbage, Amy; Cubellis, Louis; Cullison, David; Curtis, David; Daley, Robert; Daly, Jill; Dambly, Jan; Daniel, Susan; Danna, James; Dapas, Marc; Davis, Henry; Davis, Jack; Davis, Marlone; Dean, Michael; Dean, Bill; Dehn, Janine; Delligatti, Mark; Dembek, Stephen; Demoss, Gary; Dennig, Robert; Dentel, Glenn; Desai, Binoy; Dias, Antonio; Diaz-Toro, Diana; Dickson, Billy; Dingbaum, Stephen; DiPaolo, Eugene; Dixon, John; Dixon-Herrity, Jennifer; Doane, Margaret; Dodmead, James; Doerflein, Lawrence; Donaldson, Leslie; Donnell, Tremaine; Donoghue, Joseph; Doornbos, Roger; Dorman, Dan; Dorsey, Jeryll; Dosch, William; Dreisbach, Jason; Droggitis, Spiros; Dudes, Laura; Dumbacher, David; Duncan, Eric; Dwyer, James; Dyer, Jim; Eads, Johnny; Easson, Pamela; Egan, Dennis; Egli, Richard; Einberg, Christian; Elkins, Scott; Ellegood, John; Elliott, Robert; Ellsbury, Richard; Erlanger, Craig; Ernstes, Michael; Brown, Cris; Evans, Carolyn; 'Michele.ca@nrc.gov'; Farnholtz, Thomas; Felts, Russell; Fenton, Darlene; Ferdas, Marc; Ferrell, Kimberly; Ficks, Ben; Fields, Leslie; Finney, Patrick; Fitch, Karen; Flanders, Scott; Flynn, Sean; Foster, Jack; Franke, Mark; Franovich, Rani; Fredericks, Carl; Freeman, Scott; Fretz, Robert; Frumkin, Daniel; Frye, Timothy; Fuller, Michael; Gaddy, Vincent; Gallo, Jenny; Galloway, Melanie; Gartman, Michael; Gavrilas, Mirela; Giantelli, Adelaide; Gibson, Kathy; Giessner, John; Giitter, Joseph; Givvines, Mary; Gody, Tony; Golder, Jennifer; Golshan, KG; Gorham, Tajuan; Gott, William; Graham, Thorne; Grancorvitz, Teresa; Grant, Jeffery; Graser, Dan; Gray, Mel; Greene, Kathryn; Grice, Thomas; Griffin, Steven; Grobe, Jack; Hawkins, Kimberly; Gusack, Barbara; Guthrie, Eugene; Guttmann, Jack; Haag, Robert; Habighorst, Peter; Hackett, Edwin; Haeg, Lucas; Haire, Mark; Hall, Donald; Hall, Patricia; Hamzehee, Hossein; Haney, Catherine; Hansell, Samuel; Harris, Tim; Harrison, Donnie; Hatchett, Gregory; Hawkens, Roy; Hay, Michael; Hayden, Elizabeth; Hays, Myra; Heck, James; Heck, Jared; Helton, Shana; Henderson, Pamela; Hickey, James; Hiland, Patrick; Hills, David; Hilton, Nick; Hiltz, Thomas; Hirsch, Patricia; Hoeg, Tim; Hogan, Rosemary; Holahan, Gary; Holahan, Patricia; Holian, Brian; Holland, Crystal; Holody, Daniel; Holonich, Joseph; Holt, BJ; Hopper, George; Howard, Patrick; Howe, Allen; Howell, Art; Howell, Linda; Hoxie, Chris; Hsia, Anthony; Hsu, Caroline; Hsueh, Kevin; Huber, Deborah; Hudson, Jody; Humerick, David; Hunegs, Gordon; Hunter, James; Huth, Virginia; Hutto, Andy; Huyck, Doug; Imboden, Andy; Itzkowitz, Marvin; Jackson, Deborah; Jackson, Donald; Jackson, Terry; James, Lois; Jankovich, John; Janney, Margie; Jarvis, Rodney; Jenkins, Ronaldo; Jernell, Eleni; Johns, Nancy; Johnson, Michael; Johnson, Clay; Johnson, Robert; Jolicoeur, John; Jones, Bradley; Jones, Evan; Jones, William; Josey, Jeffrey; Joustra, Judith; Julian, Emile; Jung, Ian; Junge, Michael; Kahler, Robert; Kaplan, Michele; Karas, Rebecca; Kellar, Ray; Kelley, Corenthis; Kemerer, Myron; Kemker, Brian; Kennedy, Kriss; Kennedy, Silas; Kerben, Valerie; Kern, David; Khanna, Meena; Kim, Yong; Kimble, Daniel; King, Donald; King, Michael; Kinneman, John; Kirkland, John; Kirkwood, Sara; Klein, Alex; Knutson, Ed; Kobetz, Timothy; Kokajko, Lawrence; Kolaczyk, Kenneth; Konzman, Carl; Koshy, Thomas; Kowal, Mark; Kramer, John; Krohn, Paul; Krsek, Robert; Krupnick, David; Kulesa, Gloria; Kulp, Jeffrey; Kunowski, Michael; Lam, Donna; Lambert, Kenneth; Landau, Mindy; Langan, Scott; Lankford, Jeffrey; Lantz, Ryan; Lara, Julio; Larkin, Grant; Laura, Richard; Layton, Michael; Le, Hong; Lee, Bert; Lee, David; Lee, Richard; Lee, Samson; Lee, Samuel; Leeds, Eric; Lennartz, Jay; Lesser, Mark; Lew, David; Lewis, Robert; Lipa, Christine; Lombard, Mark; Long, Chris; Lopez, Joseph; Lorson, Raymond; Louden, Patrick; Lubinski, John; Luehman, James; Lui, Christiana; Lukes, Robert; Lund, Louise; Lupold, Timothy; Lyons-Burke, Kathy; Ma, May; Madden, Patrick; Madison, Wil; Magruder, Stewart; Mamish, Nader; Markley, Michael; Marshall, Jane; Marshfield, Mark; Martin, Gillian; Masnik, Michael; Masse, Todd; Matheson, Mary; Mathew, Roy; Matthews, David; Mattingley, Joel; Maxin, Mark; Mayfield, Michael; McCann, Carrie; McConnell, Keith; McCoppin, Michael; McCoy, Gerald; McCrary, Cheryl; McCree, Victor; McDermott, Brian; McGhee, James; McGill, Clinton; McGinty, Tim; McGowan, Anna; McHale, John; McKelvey, Harold; McKenna, Eileen; McKenney, Christepher; McKirgan, John; McMillan, Joseph; McMurtray, Anthony; Mendiola, Anthony; Meyer, David; Michalak, Paul; Miller, Charles; Miller, Chris; Miller, Geoffrey; Miller, Marie; Miller, Mark; Miller, Michael; Miotla, Sherri; Mitchell, Matthew; Mitchell, Reggie; Mohseni, Aby; Monk, Robert; Monninger, John; Montgomery, Jack; Moore, Scott; Moore, Thomas; Moorman, James; Morris, Eddie; Morris, James; Morris, R. Michael; Morris, Scott; Morrissey, Thomas; Moulding, Patrick; Moy, Romena; Mrowca, Lynn; Muessle, Mary; Munday, Joel; Murphy, Jerome; Murphy, Martin; Musser, Randy; Narick, Marianne; Nazario, Tomy; Nease, Rebecca; Neff, Deborah; Nelson, Robert; Nichols, Russell; Nieh, Ho; Norato, Michael; Norris, Michael; Nute-Blackshear, Lora; OBrien, Kenneth; OBryan, Phil; O'Donohue, Kathleen;

Offutt, David; Ogle, Chuck; OKeefe, Neil; Oklesson, Edward; Ordaz, Vonna; Orth, Steven; O'Sullivan, Kevin; Ott, William; Ousley, Elizabeth; Owens, Janice; Paradiso, Karen; Partlow, Benjamin; Pascarelli, Robert; Peck, Michael; Pederson, Cynthia; Pelke, Patricia; Pellet, John; Pelton, David; Peralta, Juan; Perry, Jamila; Perry, Neil; Persinko, Andrew; Peters, Sean; Peterson, Gordon; Peterson, Hironori; Pham, Bo; Phillips, Charles; Piccone, Josephine; Pool, Stephen; Poole, Brooke; Powell, Amy; Powell, Dawn; Powell, Raymond; Prescott, Peter; Pretzello, Andrew; Price, Georgette; Pruett, Troy; Pstrak, David; Pulliam, Timothy; Quay, Theodore; Quichocho, Jessie; Rabideau, Peter; Rahimi, Meraj; Raione, Richard; Rajnic, Cecilia; Ramirez, Frances; Rasmussen, Richard; Rasouli, Houman; Raspa, Rossana; Rayland, Andrew; Raymond, William; Reckley, William; Reddick, Darani; Reece, James; Regan, Christopher; Reis, Terrence; Remsburg, Kristy; Reynolds, Steven; Reynoso, John; Rheaume, Cynthia; Ricci, John; Rich, Daniel; Rich, Thomas; Richards, Stuart; Ricketts, Paul; Riemer, Kenneth; Ring, Mark; Roach, Edward; Roach, Gregory; Roberts, Darrell; Rodgers, Felecia; Rogge, John; Rosenberg, Stacey; Ross, Thierry; Ross-Lee, MaryJane; Rothschild, Trip; Rough, Richard; Rowhani, Bahman; Royal, Judith; Rubenstone, James; Rubic, Mark; Ruiz, Robert; Ruland, William; Rule, David; Rutkowski, John; Rutledge, Steven; Rzepka, Robert; Sabisch, Andrew; Safford, Carrie; Salgado, Nancy; Salley, MarkHenry; Salter, Susan; Sanchez, Alba; Sanchez, Alfred; Sangimino, Donna-Marie; Santiago, Patricia; Santos, Cayetano; Sargent, Kimberly; Satorius, Mark; Schaaf, Robert; Schaeffer, James; Schmidt, Rebecca; Schneider, Max; Schnetzler, Bonnie; Schoenmann, Sandra; Schroeder, Daniel; Schum, Constance; Scott, Catherine; Scott, Michael; Sealing, Donna; Segala, John; Serepca, Beth; Seymour, Deborah; Shaeffer, Scott; Shaffer, Steve; Shannon, Mel; Shannon, Michael; Sharkey, Jeffry; Shay, Jason; Shear, Gary; Shehee, James; Sheron, Brian; Shields, James; Shoop, Undine; Shuaibi, Mohammed; Silva, Patricia; Simms, Sophonia; Skeen, David; Skokowski, Richard; Smith, Arthur; Smith, Brian; Smith, Galen; Smith, Rich; Smith, Tuwanda; Solorio, Dave; Sosa, Belkys; Sotiropoulos, Dina; Spencer, Mary; Spindler, David; Spitzberg, Blair; StAmour, Norman; Stablein, King; Stapleton, Bernard; Stetson, Kathleen; Stewart, Scott; Stewart, Sharon; Stoedter, Karla; Stone, AnnMarie; Suber, Gregory; Subosits, Stephen; Sullivan, Allen; Swain, Karol; Sydnor, Russell; Sykes, Marvin; Szyperski, Bill; Tailleart, Don; Talley, Sandra; Tappert, John; Tate, Travis; Taylor, Robert; Tenaglia, Mickey; Terao, David; Terry, Leslie; Thaggard, Mark; Thomas, Brian; Thomas, Christopher; Thorp, John; Tonacci, Mark; Tracy, Glenn; Tran, Tu; Trapp, James; Travick, Vanette; Trent, Glenn; Tschiltz, Michael; Turner, Joseph; Turtil, Richard; Uhle, Jennifer; Ulses, Anthony; Usilton, William; Valentin, Andrea; Vegel, Anton; Vias, Steven; Vietti-Cook, Annette; Virgilio, Martin; VonTill, Bill; Voytko, Victoria; Walker, Tracy; Walker, Wayne; Wall, Scott; Warnick, Greg; Wastler, Sandra; Waters, Michael; Watson, Bruce; Weaver, Doug; Webber, Robert; Weber, Michael; Weerakkody, Sunil; Welling, Blake; Werkheiser, David; Werner, Greg; Wert, Leonard; West, Garmon; West, Steven; Westreich, Barry; Whetstine, Jack; White, Duncan; White, Darrell; Whited, Ryan; Whitten, Jack; Widdup, Joseph; Widmann, Malcolm; Wiggins, Jim; Williams, Barbara; Williams, Evelyn; Williams, Kevin; Williams, Michael; Williams, Mona; Williams-Johnson, Patrice; Williamson, Edward; Wilson, Ernest; Wilson, George; Wilson, Peter; Wood, Gene; Wood, Kent; Wright, Lisa (Gibney); Wrona, David; Wunder, George; Yerokun, Jimi; Young, Cale; Young, Mitzi; Zane, Steven; Zeiler, John; Zimmerman, Jacob; Zimmerman, Roy; Zobler, Marian

**Cc:** Scott, Tracy; Tallarico, Alison; Thoman, Raymond; Jones, Jackie; Blair, Tina; Chin, Allison; Dean, Vivian; Evans(HR), Marilyn; Himmelberg, Jude; Jackson, Briana; Jaigobind, Savi; Silberfeld, Dafna; Watson, Madonna; Williams, Michelle; Atkinson, Jeanne; Broadwater, Lynne; Brown, Keisa; Hicks, Beverly; Hicks, Valencia; Jonsson, Dawn; Lindsay, Sandy; Marziale, Riqueza; ORourke, Christine; Reeves, Gloria; Scott, Mary; Thomas-Richards, Karen; Todd, Colleen

**Subject:**

Managers, supervisors, team leaders, and T&L Coordinators,

Attached for your information is a document that addresses, in detail, work schedules and premium pay for individuals who serve in and support the NRC Operations Center or work in Japan, in response to the current, serious nuclear power plant issues in that country. NSIR and the NRC Japanese support team leader will provide the document to all participants.

T&L Coordinators, please note that participants in your organization may contact you to request a change in their HRMS workgroups for pay periods in which they perform emergency response work.

Participants should contact me if they have any questions on work schedules or premium pay.

Larry Davidson
Office of Human Resources
Nuclear Regulatory Commission
301-492-2286; lawrence.davidson@nrc.gov

**WORK SCHEDULE AND PREMIUM PAY GUIDANCE**
**FOR RESPONSE TO EVENTS IN JAPAN**

Please first review this document and contact Larry Davidson of the Office of Human Resources (301-492-2286 or lawrence.davidson@nrc.gov) for any needed assistance.

## Work Schedules

One or more types of work schedules may be appropriate during a pay period in which you serve in and support the NRC Operations Center or work in Japan, in response to the current, serious nuclear power plant issues in that country. You are authorized to select the type of work schedule you will work during the pay period depending on:

- Your specific workdays and work clocks hours in the Operations Center or in Japan, as well as any flexibility you have to choose those workdays and clock hours;
- Your entitlement to premium pay for work in the Operations Center or Japan;
- Your performance, if any, of regular duties outside of the Operations Center/Japan during the pay period; and,
- Your loss of earned credit hours if you switch from NEWFlex to another type of work schedule.

Possible work schedules include:

- Compressed work schedule – Appropriate if, during the entire pay period, your workdays and work clock hours are fixed (i.e., you do not have any flexibility to choose either) and there are fewer than ten nonovertime workdays in the pay period (at least one nonovertime workday contains more than eight nonovertime hours). Note that restrictions on nonovertime work clock hours and weekend workdays have been lifted for the pay period. An Expanded-Compressed Work Schedule may be appropriate (see the Yellow Announcement at http://www.internal.nrc.gov/announcements/yellow/2003/2003-032.html and Article 6.10.3 of the Collective Bargaining Agreement).
- NEWFlex - Appropriate if, during at least a portion of the pay period, you have some discretion to select your workdays and/or work clock hours (for example, if/when performing regular duties outside of the Operations Center or Japan). Note that restrictions on nonovertime work clock hours and weekend workdays have been lifted for the pay period.
- First-40 – Appropriate if it is impracticable to prescribe a regular schedule of definite hours of duty for each workday of the workweek (likely not appropriate).

Note that you must advise your T&L coordinator to change your HRMS workgroup if you change the type of schedule you work, e.g., if you normally work CWS and change to NEWFlex for the pay period in which you serve in and support the NRC Operations Center or work in Japan. Also note that if you switch from NEWFlex to another type of work schedule, you will lose and will be paid for any accumulated credit hours.

Also note that if you work fewer than 80 hours serving in and supporting the NRC Operations Center or working in Japan, your "home" supervisor will allow you discretion, to the extent possible, to decide how/when to cover any missing time.

**Premium Pay**

Cap on Combined Salary Plus Premium Pay –The biweekly cap on premium pay has been lifted and will be applied on an annual basis during any pay period in which you serve in and support the NRC Operations Center or work in Japan (the annual cap will benefit you if you are paid a salary below the GG-15 step 10 salary rate). Your organization has been advised to contact CFO with employee names and dates of work.

Overtime pay or regular comp time – Overtime (limited to the higher of: your regular rate; or, 150% of GG-10 step 10) is paid for your work in excess of your full-time work schedule during the pay period. You may choose to be compensated via regular compensatory time off instead (limited to a 40-hour pay period carryover) if your overtime work was not scheduled in advance of the workweek, or regardless of when it was scheduled if you are on NEWFlex.

TRCs – Use "OT" for overtime pay and "COMPE" for regular comp time.

Night premium (10%) –This premium is paid for your *nonovertime* work between 6:00 p.m. and 6:00 a.m. the following morning, and for your *overtime* work during these clock hours if the work was scheduled in advance of the week in which you performed it. Also, this premium is paid for your periods of paid leave, if any, during night clock hours if, during the pay period, you have fewer than 8 hours of total paid leave inclusive of both night and day work.

TRC – NDIFF (hours must also be recorded under another TRC such as REG or OT).

Sunday premium (25%) – This premium is paid for your *nonovertime* work performed on a shift(s), any part(s) of which falls on a Sunday (e.g., a shift from Saturday at 6:00 p.m. to Sunday at 6:00 a.m.). Sunday premium is not payable for periods of nonwork, including leave, holidays not worked, and excused absence.

TRC – SUNP (hours must also be recorded under another TRC such as REG).

Standby status - You are eligible for special overtime pay if you are restricted by official order to a designated post of duty and assigned to be in a state of readiness to perform work, versus actually performing work, with limitations on your activities so substantial that you cannot use

your time effectively for your own purposes. We do not anticipate that any employee will be in a standby status.

**Miscellaneous**

Employee Assistance Program (EAP)

Free, confidential counseling is available to you and your family members to address emotional issues, work problems, substance abuse, stress, crisis, marital/family concerns, financial matters, legal issues, eldercare resources, and childcare referrals. Call 1-800-869-0276 or check www.eapconsultants.com.

Travel

If you travel to/from Japan:

- Keep a log of specific travel times and work clock hours to help NRC compute your entitlement to compensation.

- Consider enrolling in the Smart Traveler Enrollment Program or STEP) to make it easier for the Embassy/Consulates to contact you in case of an emergency. You may enroll at https://travelregistration.state.gov, or if you have no internet access, directly at the U.S. Embassy or U.S. Consulates.

- If you are paid a salary below the GG-15 step 10 salary rate, you are entitled to overtime pay (limited to higher of: your regular rate; or, 150% of GG-10 step 10) for travel to/from Japan, and if the travel is during night hours (6:00 p.m. to 6:00 a.m.) and scheduled in advance of the workweek, you are also entitled to night premium pay. You may substitute regular compensatory time off (limited to a 40-hour pay period carryover) for overtime pay if your travel was not scheduled in advance of the workweek, or regardless of when it was scheduled if you are on NEWFlex.

  TRCs – Use "OT" for overtime pay, "COMPE" for regular comp time, and "NDIFF" for night premium pay.

**Satorius, Mark**

**From:** jean.brown@gsa.gov
**Sent:** Friday, March 18, 2011 4:59 PM
**To:** &FEB_ONLY__FEB_Master_List@gsa.gov; &FEB_ONLY__FEB_List_2@gsa.gov; &FEB_ONLY__DOL_Only@gsa.gov; &FEB_ONLY__HHS_Only@gsa.gov
**Subject:** FBI warns against fraudulent charities re: Japanese disaster

** Please forward broadly ***

Colleagues:

The Federal Bureau of Investigation reminds the public to use caution when making donations in the aftermath of natural disasters. Unfortunately, criminals can exploit these tragedies for their own gain by sending fraudulent e-mails and creating phony websites designed to solicit contributions. The FBI and the National Center for Disaster Fraud have an existing tip line to receive information from the public about suspected fraud associated with the earthquake and tsunami that affected Japan. Tips should be reported to the National Center for Disaster Fraud, (866) 720-5721. The line is staffed by a live operator 24 hours a day, seven days a week. Additionally, e-mails can be sent to disaster@leo.gov, and information can be faxed to (225) 334-4707. More than 350 fraudulent websites claiming to be related to the disaster relief have been created in just the first week.

The National Center for Disaster Fraud was created by the Department of Justice to investigate, prosecute, and deter fraud in the wake of Hurricane Katrina, when billions of dollars in federal disaster relief poured into the Gulf Coast region. Now, its mission has expanded to include suspected fraud from any natural or man-made disaster. More than 20 federal agencies, including the FBI, participate in the NCDF, which allows the center to act as a centralized clearinghouse of information related to disaster relief fraud.

The FBI continues to remind the public to perform due diligence before giving contributions to anyone soliciting donations or individuals offering to provide assistance to the people of Japan. Solicitations can originate from e-mails, websites, door-to-door collections, flyers, mailings, telephone calls, and other similar methods.

Consumers can also report suspicious e-mail solicitations or fraudulent websites to the FBI's Internet Crime Complaint Center, www.ic3.gov.

Before making a donation of any kind, consumers should adhere to certain guidelines. Check out the FBIs tips at: :

http://www.fbi.gov/news/pressrel/press-releases/tips-on-avoiding-fraudulent-charitable-contribution-schemes

Jean Brown
Executive Director, Chicago Federal Executive Board
77 W. Jackson Suite 2115, Chicago, IL 60604
p: 312-353-6790, f: 312-353-3058



3/2011

e: Jean.Brown@GSA.Gov
www.Chicago.FEB.GOV

**From:** Wiggins, Jim
**To:** Weber, Michael; Virgilio, Martin; Dorman, Dan; Grobe, Jack; Miller, Charles
**Cc:** Evans, Michele; McDermott, Brian; Mroz (Sahm), Sara
**Subject:** FYI: ARTICLE ON NUC INDUSTRY RESPONSE TO JAPAN EVENT
**Date:** Friday, March 18, 2011 5:38:13 AM

Note the –ve statement from Ralph Anderson, NEI, re: US evac decision.....

March 18, 2011

# U.S. Utilities Pledge Fresh Review Of Nuke Plant Readiness

BY JEFF BEATTIE

With Japanese emergency workers reduced to increasingly desperate measures to cool overheating spent fuel pools at the crippled Fukushima Daiichi nuclear plant, U.S. nuclear plant operators Thursday announced a series of extraordinary steps to review the readiness of the nation's nuclear fleet and workers to respond to more serious levels of crises than the federal government currently requires.

In a media conference call, U.S. Nuclear Energy Institute (NEI) officials said U.S. utilities' chief nuclear officers met this week in response to the Japanese nuclear crisis, and agreed to immediately begin testing the ability of the nation's 104 nuclear reactors to weather more severe catastrophes than current federal regulations mandate.

Among other things, the chief nuclear officers will lead plant-by-plant "walk downs" of equipment needed to respond to fires and floods; verify that a plant would remain "proper and functional" given a total loss of electric power; and verify that required materials and equipment are properly located to keep the plant operational during severe floods.

While some of the steps merely confirm compliance with existing Nuclear Regulatory Commission (NRC) rules, others will safeguard plants for events more severe than NRC rules contemplate, said NEI Senior Vice President and Chief Nuclear Officer Tony Pietrangelo.

"What the chief nuclear officers agreed to do this week was focus more on beyond design-basis events," said Pietrangelo, with "design basis" referring to the set of threats plant operators must typically show they can handle.

"At least the initial feedback we're getting from the Fukushima events is that these were beyond design-basis events," he said.

The NEI announcement came as President Obama late Thursday announced that he has asked the NRC to undertake a "comprehensive review of our nuclear plants" in light of the unfolding disaster in Japan.

The U.S. industry response came on the sixth day of the crisis at the Fukushima Daiichi site, which has been rocked by cooling system failures, explosions and—increasingly—dangerous levels of radioactivity releases after the March 11 earthquake and tsunami knocked out key safety systems.

Japanese emergency-response concerns now are focused on spent fuel pools at the plant's Unit 3 and Unit 4 reactors that now contain little or no water, leaving spent fuel rods at least partially exposed and

releasing dangerous levels of radiation.

Tokyo Electric Power Co. (TEPCO) officials reported Thursday that a previous hydrogen explosion blew away one side wall of the spent fuel pool at Unit 4, although a steel liner remains intact to contain at least some level of cooling water.

Late Thursday, International Atomic Energy Agency officials said Unit 4's spent fuel pool "remains a major safety concern", adding that "no information is available on the level of water in the spent fuel pool."

In a desperate attempt to re-stock the cooling pool on Unit 3, Japanese officials say they dropped four multi-ton loads of water from helicopters Thursday morning.

As of early evening Thursday Japan time, Japanese officials reported extremely high radiation levels between 100 and 400 millisieverts per hour around the plant's Units 3 and 4 reactors.

At those exposure levels, emergency responders in hotter regions of the site could work only for a total of 40 minutes before departing the site for good, according to the World Nuclear Association.

That poses severe manpower problems for TEPCO and emergency response agencies as they face the need for round-the-clock cooling of the spent fuel pools and at least three damaged reactors at the Fukushima Daiichi site.

Since the Japan crisis began, U.S. nuclear officials have maintained their plants' designs and emergency response plans make a similar crisis unlikely here.

In particular, they point to new plant protections enacted after the September 11 terrorist attacks.

Nevertheless, industry watchdogs say the Japan disaster illuminates key vulnerabilities at U.S. reactors, including 10-mile "emergency planning" zones they say may be far too small to protect populations living and working near a compromised reactor.

NEI officials insisted Thursday that the current 10-mile emergency planning zones remain appropriate for U.S. plants, and that NRC regulations provide for expanding the zones if conditions warrant.

NEI officials also suggested yesterday they do not entirely agree with an NRC decision Wednesday to recommend that U.S. citizens in Japan evacuate a 50-mile radius of the crippled plant, rather than the 12.5-mile radius ordered by Japanese officials.

NEI Senior Director of Radiation Safety and Environmental Protection Ralph Andersen said the NRC evacuation decision was based on "preliminary, highly conservative evaluations with a very limited set of information...."

NRC officials have said little about how the Japanese experience might change regulation of the U.S. nuclear industry, saying they want first to understand exactly what occurred at Fukushima Daiichi.

However, several experts this week identified areas that NRC is most likely to re-examine as lessons from the Japan crisis become clear:

• **Plant back-up power.** Most U.S. plants have one extra, final level of backup power that the Fukushima Daiichi nuclear plant did not—so-called "red-shirt" power sources like portable diesel generators. But David Lochbaum, director of the Nuclear Safety Project for the Union of Concerned Scientists, said NRC should consider requiring U.S. plant operators to stockpile batteries with operating

lives longer than the four hours that he said is standard at most U.S. plants today. He said only about eight U.S. plants have batteries that run longer than four hours.

• **Earthquake risk.** NRC says U.S. plants are designed to withstand the largest historical earthquake for a given region, with a substantial additional margin of safety. The NRC says it routinely evaluates updated seismological information, including recently for the Midwest and central United States. But critics say the risk should be updated, particularly for reactors on the earthquake-active West Coast. On Wednesday, Calif. Sens. Barbara Boxer (D) and Dianne Feinstein (D) wrote Jaczko urging that the safety of two plants in that state be re-evaluated given the relatively recent discovery of new fault lines near the plants. An NRC spokesman was not immediately available Thursday to comment on NRC requirements for backup power or earthquake protections. NRC has limited comment in recent days mostly to the chairman's public statements.

## Greenwood, Carol

**From:** Gibson, Kathy
**Sent:** Friday, March 18, 2011 3:51 PM
**To:** Scott, Michael
**Subject:** Monday and beyond.

If you get sent to Japan and I am in Ops Center we will need an actor Monday. I am thinking Scott Elkins. Can you call him and give him a debrief just in case?



W/DOS

## Greenwood, Carol

**From:** Gibson, Kathy
**Sent:** Friday, March 18, 2011 9:42 PM
**To:** Tinkler, Charles
**Cc:** Wagner, Katie
**Subject:** Re: Did we get the docs to GE?

Thanks

----- Original Message -----
From: Tinkler, Charles
To: Gibson, Kathy
Sent: Fri Mar 18 17:35:46 2011
Subject: RE: Did we get the docs to GE?

Yes

-----Original Message-----
From: Gibson, Kathy
Sent: Friday, March 18, 2011 2:40 PM
To: Lee, Richard; Tinkler, Charles
Subject: Did we get the docs to GE?



W/209

## Greenwood, Carol

**From:** Gibson, Kathy
**Sent:** Friday, March 18, 2011 9:43 PM
**To:** Tinkler, Charles; Uhle, Jennifer
**Subject:** Re: PMT

Agree Agree Agree

---

**From:** Tinkler, Charles
**To:** Uhle, Jennifer; Gibson, Kathy
**Sent:** Fri Mar 18 17:22:54 2011
**Subject:** PMT

The PMT has called (Jason is there) to ask our recommendation for a source term for another RASCAL calc. We (myself and Randy Gauntt) are inclined to give them our best judgement estimate of a source term, not an exteremely conservative estimate (they already have that in their own original estimate))

If you disagree please let me know

Charles Tinkler
Charles.Tinkler@nrc.gov



3/21/0

## Greenwood, Carol

**From:** Gibson, Kathy
**Sent:** Friday, March 18, 2011 10:46 PM
**To:** Scott, Michael; Sheron, Brian
**Cc:** Uhle, Jennifer
**Subject:** Re: Sandia SFP Report

We did BWR fuel first and doing PWR now. I'm pretty sure we send the right one.

----- Original Message -----
From: Scott, Michael
To: Sheron, Brian; Gibson, Kathy
Cc: Uhle, Jennifer
Sent: Fri Mar 18 22:44:40 2011
Subject: RE: Sandia SFP Report

Brian:

The one Pat sent was 4 years old. That would not be it?

Mike

-----Original Message-----
From: Sheron, Brian
Sent: Friday, March 18, 2011 10:30 PM
To: Scott, Michael; Gibson, Kathy
Cc: Uhle, Jennifer
Subject: Sandia SFP Report

Mike, let me know if and when you find the old SNL SFP Report that Commissioner Magwood's office wanted.



3/2/11

## Greenwood, Carol

**From:** Gibson, Kathy
**Sent:** Saturday, March 19, 2011 6:46 PM
**To:** Huffert, Anthony; Yarsky, Peter; Rubin, Stuart; Salley, MarkHenry
**Cc:** Uhle, Jennifer; Coyne, Kevin; Bush-Goddard, Stephanie; Elkins, Scott; Scott, Michael
**Subject:** Japan

**Importance:** High

You will NOT be going to Japan at this time. Thank you so much for your willingness to serve.

Kathy



3/2/12

## Greenwood, Carol

**From:** Gibson, Kathy
**Sent:** Sunday, March 20, 2011 1:13 AM
**To:** Tinkler, Charles; Scott, Michael
**Cc:** Elkins, Scott; Santiago, Patricia
**Subject:** Monday Commission meeting

Charlie,
Brian wants you to attend the Commission meeting on Monday at 9 am in the Commission Hearing Room (OWFN) to answer severe accident questions if cued by Brian or Bill Borchardt.

There will be sections of seating for public, media, and NRC staff. You should sit in the staff section (Brian and other office directors will be in the pit). Borchardt is the only one at the table.

Jennifer is listed to attend to represent severe accidents but she (and I) are working night shift Sunday and won't be in on Monday. If anyone questions you, tell them you are there at Brian's request in place of jennifer.

Mike, Scott, Pat - please verify that Charlie gets this message before Monday morning in time to get to the meeting.

Thanks!



3/2/12

## Greenwood, Carol

**From:** Gibson, Kathy
**Sent:** Sunday, March 20, 2011 2:30 PM
**To:** Scott, Michael
**Subject:** Re: MONDAY COMMISSION MEETING

Try to go if you can. Make sure Charlie gets over there early and then you should be able to get a seat.

---

**From:** Scott, Michael
**To:** Sheron, Brian
**Cc:** Gibson, Kathy; Uhle, Jennifer
**Sent:** Sun Mar 20 09:50:42 2011
**Subject:** MONDAY COMMISSION MEETING

Brian:

Although I was the lead for RES support for development of the presentation for the Monday Japan Commission brief, I will assume my presence at the meeting not needed unless you say otherwise.

Mike



3/2/14

## Schaperow, Jason

**From:** Schaperow, Jason
**Sent:** Monday, March 21, 2011 1:44 PM
**To:** Santiago, Patricia
**Subject:** RE: Reminder: FW: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

O.K.

---

**From:** Santiago, Patricia
**Sent:** Monday, March 21, 2011 12:54 PM
**To:** Schaperow, Jason
**Subject:** FW: Reminder: FW: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

As you respond...can you add when you are responding so they can track and be aware.
thanks

---

**From:** Greenwood, Carol
**Sent:** Friday, March 18, 2011 10:31 AM
**To:** Armstrong, Kenneth; Bajorek, Stephen; Boyd, Christopher; Elkins, Scott; Hoxie, Chris; Lee, Richard; Rubin, Stuart; Santiago, Patricia; Sherbini, Sami; Tinkler, Charles; Voglewede, John; Zigh, Ghani; Tomon, John
**Subject:** FW: Reminder: FW: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

Please update the Excel spreadsheet by clicking here with names and dates of any staff that have or will be performing emergency-related premium work in response to the events in Japan.
This applies to the IRC, OIP, OPA or wherever they are doing emergency work.

Please confirm to me when your branch is updated.

The spreadsheet is at g:\DSA\Directors Office\JapanResponseWork.xlsx if the above link doesn't work.

Regards

***Carol Greenwood***
Lead Administrative Assistant
RES/DSA
U.S. Nuclear Regulatory Commission
Phone: 301-251-3319

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

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**From:** Gibson, Kathy
**Sent:** Friday, March 18, 2011 8:07 AM
**To:** Greenwood, Carol
**Subject:** Fw: Reminder: FW: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN



3/21

Would you check with the BCs and compile this list for Andrea for DsA? Thx

---

**From**: Valentin, Andrea
**To**: Gibson, Kathy; Scott, Michael; Coyne, Kevin
**Sent**: Fri Mar 18 08:00:34 2011
**Subject**: Reminder: FW: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

This is a reminder to provide me with a list of names of staff that are performing emergency-related premium work (and the dates that the people worked) in response to the events in Japan. This applies to the IRC, OIP, OPA or wherever they are doing emergency work.

Thanks,
Andrea

---

**From:** Khan, Charline
**Sent:** Thursday, March 17, 2011 7:29 AM
**To:** RidsAcrsAcnw_MailCTR Resource; RidsAslbpManagement Resource; RidsOgcMailCenter Resource; RidsOcaaMailCenter Resource; RidsOcfoMailCenter Resource; RidsOigMailCenter Resource; RidsOipMailCenter Resource; RidsOcaMailCenter Resource; RidsOpaMail Resource; RidsSecyMailCenter Resource; RidsSecyCorrespondenceMCTR Resource; RidsEdoMailCenter Resource; RidsAdmMailCenter Resource; RidsCsoMailCenter Resource; RidsOeMailCenter Resource; RidsFsmeOd Resource; RidsOiMailCenter Resource; RidsOIS Resource; RidsHrMailCenter Resource; RidsNroOd Resource; RidsNroMailCenter Resource; RidsNmssOd Resource; RidsNrrOd Resource; RidsNrrMailCenter Resource; RidsResOd Resource; RidsResPmdaMail Resource; RidsSbcrMailCenter Resource; RidsNsirOd Resource; RidsNsirMailCenter Resource; RidsRgn1MailCenter Resource; RidsRgn2MailCenter Resource; RidsRgn3MailCenter Resource; RidsRgn4MailCenter Resource
**Cc:** Davidson, Lawrence; Buchholz, Jeri; Johns, Nancy
**Subject:** WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

MEMORANDUM TO: Those on the Attached List

FROM: Miriam L. Cohen, Director/**RA by J. Buchholz for/**
Office of Human Resources

DATED: March 16, 2011

**SUBJECT: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN**

ADAMS Accession No. ML11075A003 refers

## NOTE: Electronic distribution only

*Charline Khan*
***Administrative Assistant (Rotation)***
***U.S. NUCLEAR REGULATORY COMMISSION***
***Office of Human Resources***
***P:301-492-2318***
***Charline.Khan@nrc.gov***

## Schaperow, Jason

**From:** Schaperow, Jason
**Sent:** Monday, March 21, 2011 4:36 PM
**To:** Santiago, Patricia
**Subject:** RE: Reminder: FW: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

Hi Pat,

I just added to the Excel spreadsheet (at the link below) what I have been doing to respond to the Japanese accident. Could you take a look at what I added and see if I put in enough detail?

Thanks,
Jason

---

**From:** Santiago, Patricia
**Sent:** Monday, March 21, 2011 12:54 PM
**To:** Schaperow, Jason
**Subject:** FW: Reminder: FW: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

As you respond...can you add when you are responding so they can track and be aware.
thanks

---

**From:** Greenwood, Carol
**Sent:** Friday, March 18, 2011 10:31 AM
**To:** Armstrong, Kenneth; Bajorek, Stephen; Boyd, Christopher; Elkins, Scott; Hoxie, Chris; Lee, Richard; Rubin, Stuart; Santiago, Patricia; Sherbini, Sami; Tinkler, Charles; Voglewede, John; Zigh, Ghani; Tomon, John
**Subject:** FW: Reminder: FW: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

Please update the Excel spreadsheet by clicking here with names and dates of any staff that have or will be performing emergency-related premium work in response to the events in Japan.
This applies to the IRC, OIP, OPA or wherever they are doing emergency work.

Please confirm to me when your branch is updated.

The spreadsheet is at g:\DSA\Directors Office\JapanResponseWork.xlsx if the above link doesn't work.

Regards
***Carol Greenwood***
Lead Administrative Assistant
RES/DSA
U.S. Nuclear Regulatory Commission
Phone: 301-251-3319

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*



3/2/16

**From:** Gibson, Kathy
**Sent:** Friday, March 18, 2011 8:07 AM
**To:** Greenwood, Carol
**Subject:** Fw: Reminder: FW: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

Would you check with the BCs and compile this list for Andrea for DsA? Thx

---

**From:** Valentin, Andrea
**To:** Gibson, Kathy; Scott, Michael; Coyne, Kevin
**Sent:** Fri Mar 18 08:00:34 2011
**Subject:** Reminder: FW: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

This is a reminder to provide me with a list of names of staff that are performing emergency-related premium work (and the dates that the people worked) in response to the events in Japan. This applies to the IRC, OIP, OPA or wherever they are doing emergency work.

Thanks,
Andrea

---

**From:** Khan, Charline
**Sent:** Thursday, March 17, 2011 7:29 AM
**To:** RidsAcrsAcnw_MailCTR Resource; RidsAslbpManagement Resource; RidsOgcMailCenter Resource; RidsOcaaMailCenter Resource; RidsOcfoMailCenter Resource; RidsOigMailCenter Resource; RidsOipMailCenter Resource; RidsOcaMailCenter Resource; RidsOpaMail Resource; RidsSecyMailCenter Resource; RidsSecyCorrespondenceMCTR Resource; RidsEdoMailCenter Resource; RidsAdmMailCenter Resource; RidsCsoMailCenter Resource; RidsOeMailCenter Resource; RidsFsmeOd Resource; RidsOiMailCenter Resource; RidsOIS Resource; RidsHrMailCenter Resource; RidsNroOd Resource; RidsNroMailCenter Resource; RidsNmssOd Resource; RidsNrrOd Resource; RidsNrrMailCenter Resource; RidsResOd Resource; RidsResPmdaMail Resource; RidsSbcrMailCenter Resource; RidsNsirOd Resource; RidsNsirMailCenter Resource; RidsRgn1MailCenter Resource; RidsRgn2MailCenter Resource; RidsRgn3MailCenter Resource; RidsRgn4MailCenter Resource
**Cc:** Davidson, Lawrence; Buchholz, Jeri; Johns, Nancy
**Subject:** WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN

MEMORANDUM TO: Those on the Attached List

FROM: Miriam L. Cohen, Director/**RA by J. Buchholz for/**
Office of Human Resources

DATED: March 16, 2011

**SUBJECT: WAIVER OF WORK SCHEDULE AND PAY CAP RULES FOR WORK IN RESPONSE TO THE EVENTS IN JAPAN**

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*P:301-492-2318*
*Charline.Khan@nrc.gov*

Appendix A

**Reeves, Rosemary**

**From:** Reeves, Rosemary
**Sent:** Monday, March 21, 2011 2:29 PM
**To:** Chapman, Gregory
**Subject:** RE: Crisis in Japan - Understanding Radiation Units

I liked the fact that it is in Sv, rather than rems, so it gave me a comparable tool for the Japanese event, in which the doses are being reported in Sv.

-----Original Message-----
From: Chapman, Gregory
Sent: Monday, March 21, 2011 1:36 PM
To: Reeves, Rosemary
Subject: RE: Crisis in Japan - Understanding Radiation Units

I don't have the report providing doses due to exams, etc. but nothing appears too out of whack...although the annual avg exposure for Americans is higher than reported (data is from an older report). It's interesting but may lead to confusion as the doses are based upon different time frames of reference. Not something I'd push as a learning tool personally but I can see where someone may get something out of it.

-----Original Message-----
From: Reeves, Rosemary
Sent: Monday, March 21, 2011 10:47 AM
To: Chapman, Gregory; Smith, James; Naquin, Tyrone
Subject: FW: Crisis in Japan - Understanding Radiation Units

Please see the link below.

http://xkcd.com/radiation/

Without doing a thorough detailed review of the entire chart, as a health physicist, what do you think of this radiation dose chart? Does it appear to be relatively accurate?

Rosemary

W/21

Appendix A

**Reeves, Rosemary**

**From:** Reeves, Rosemary
**Sent:** Monday, March 21, 2011 2:33 PM
**To:** Naquin, Tyrone
**Subject:** RE: Crisis in Japan - Understanding Radiation Units

Thanks Ty. I certainly don't want you to even consider doing a thorough review. But I liked the idea that the comparison of doses is in Sv, rather than rem. I'm used to thinking in rem, but the data from Japan is being reported in Sv, so I have to re-calibrate my thinking.

R

-----Original Message-----
From: Naquin, Tyrone
Sent: Monday, March 21, 2011 11:15 AM
To: Reeves, Rosemary; Chapman, Gregory; Smith, James
Subject: RE: Crisis in Japan - Understanding Radiation Units

Without doing a thorough review, I like the approach. Perspective is always good to offer when discussing units.

T. D. Naquin, CHP
LES Project Manager
NMSS/FCSS/FFLD/UEB
6003 Executive Blvd.
Rockville, MD 20852

Work: (301) 492-3187
Fax: (301) 492-3363
website: http://www.nrc.gov/

-----Original Message-----
From: Reeves, Rosemary
Sent: Monday, March 21, 2011 10:47 AM
To: Chapman, Gregory; Smith, James; Naquin, Tyrone
Subject: FW: Crisis in Japan - Understanding Radiation Units

Please see the link below.

http://xkcd.com/radiation/

Without doing a thorough detailed review of the entire chart, as a health physicist, what do you think of this radiation dose chart? Does it appear to be relatively accurate?

Rosemary



3/218

## Lee, Richard

**From:** Lee, Richard
**Sent:** Monday, April 11, 2011 9:34 AM
**To:** 'dapower@sandia.gov'
**Subject:** FW: TEPCO Seismic data

fyi

-----Original Message-----
From: Kammerer, Annie
Sent: Saturday, April 09, 2011 9:27 AM
To: Lee, Richard
Subject: RE: TEPCO Seismic data

I concur with the basic premise. The diesels started up until the fuel ran out, due to the fuel tanks being destroyed by the tsunami. They may have had seismic damage, but they would not have had an accident.

---

From: Lee, Richard
Sent: Saturday, April 09, 2011 9:19 AM
To: Kammerer, Annie
Subject: RE: TEPCO Seismic data

Thanks, Annie:

I will let Dana knows. So far, he said the plant survived the earthquake, but the tsunami did them in.

Richard

---

From: Kammerer, Annie
Sent: Saturday, April 09, 2011 6:21 AM
To: Lee, Richard
Subject: FW: TEPCO Seismic data

I hope this answers Dana's questions. Of course, PGA is site specific.

BTW, I forgot to put a notification on, but I'm out of the country.

Annie

3/219

## Greenwood, Carol

**From:** Gibson, Kathy
**Sent:** Monday, March 21, 2011 3:14 PM
**To:** Bush-Goddard, Stephanie
**Subject:** Re: Work Schedule in Op Center

Ok

---

**From:** Bush-Goddard, Stephanie
**To:** Gibson, Kathy
**Sent:** Mon Mar 21 15:12:36 2011
**Subject:** RE: Work Schedule in Op Center

Yes, but one thing....cancer brief tomorrow with Brain.

Shirley said it was on...you want us to go ahead with it.

---

**From:** Gibson, Kathy
**Sent:** Monday, March 21, 2011 3:06 PM
**To:** Bush-Goddard, Stephanie
**Subject:** Re: Work Schedule in Op Center

Sure but fairly incoherent. Can it wait til tomorrow when I am awake?

---

**From:** Bush-Goddard, Stephanie
**To:** Gibson, Kathy
**Sent:** Mon Mar 21 14:50:30 2011
**Subject:** RE: Work Schedule in Op Center

Ok

Are you available to talk for 5 to 10 minutes.

Thanks
-Steph

---

**From:** Gibson, Kathy
**Sent:** Monday, March 21, 2011 2:46 PM
**To:** Bush-Goddard, Stephanie
**Cc:** Elkins, Scott
**Subject:** Re: Work Schedule in Op Center

You are not expected to work your regular job when you are working in the ops center.

Please have somebody act for you.

Also please encourage any of your staff that doesn't currently have ops center assignments to volunteer. Thanks!

---

**From:** Bush-Goddard, Stephanie
**To:** Gibson, Kathy



W/220

**Cc**: Elkins, Scott
**Sent**: Mon Mar 21 13:30:14 2011
**Subject**: Work Schedule in Op Center

Kathy, and Scott

My schedule in the Op Center (as a GIS Analyst) is

3/27, 3/31 & 4/1

From 3pm to 11 pm.

I will work my regular job 11ish to 3pm on the days that I need to come in at 3pm.

Thanks
-Stephanie

## Bensi, Michelle

**From:** Kammerer, Annie
**Sent:** Monday, March 21, 2011 10:00 PM
**To:** Bensi, Michelle
**Subject:** RE: end of the day update
**Attachments:** Peak Acceleration Map from KNET.pdf; Peak Acceleration Map from KNET.docx

See attached for inclusion into the figures section.

---

**From:** Bensi, Michelle
**Sent:** Monday, March 21, 2011 8:06 PM
**To:** Kammerer, Annie
**Subject:** end of the day update

**Requests:**

- Please send the Word version of the commission briefing document

**Summary of document changes/additions:**

- Replaced questions #11 and #91
- Added PGA contour map (without location of plants on the map)
- Added B.5.b fact sheet (unedited from text used in Commission Document)
- Stephanie is currently compiling the definition list. I will add to it if necessary and put it in the Q&A document tomorrow.

**Tasks for tomorrow:**

- Add GI-199 factsheet
- Add station blackout rule factsheet
- Add SOARCA Q&A document
- Create spent fuel pool section (rearrange questions from other sections into a spent fuel section; add additional questions contained in the Commission Briefing report to the Q&A document).
- Add tsunami data from NEI until Japan section of Q&A document.
- Create factsheet on the current Japanese approach to tsunami (note: JSCE is currently finalizing guidance PTHA = prob tsunami hazard analysis for Japan)
- Create a factsheet using the ICAPP presentation (seismic considerations of WUS)
- Look at Wikipedia page for images that could be added long term (e.g. add to fact sheet)
- Stephanie may start a document with the acronyms. If she doesn't have time, I will compile it.

---

**From:** Kammerer, Annie
**Sent:** Monday, March 21, 2011 5:42 PM
**To:** Bensi, Michelle
**Subject:**

## Please replace teh original text with this...

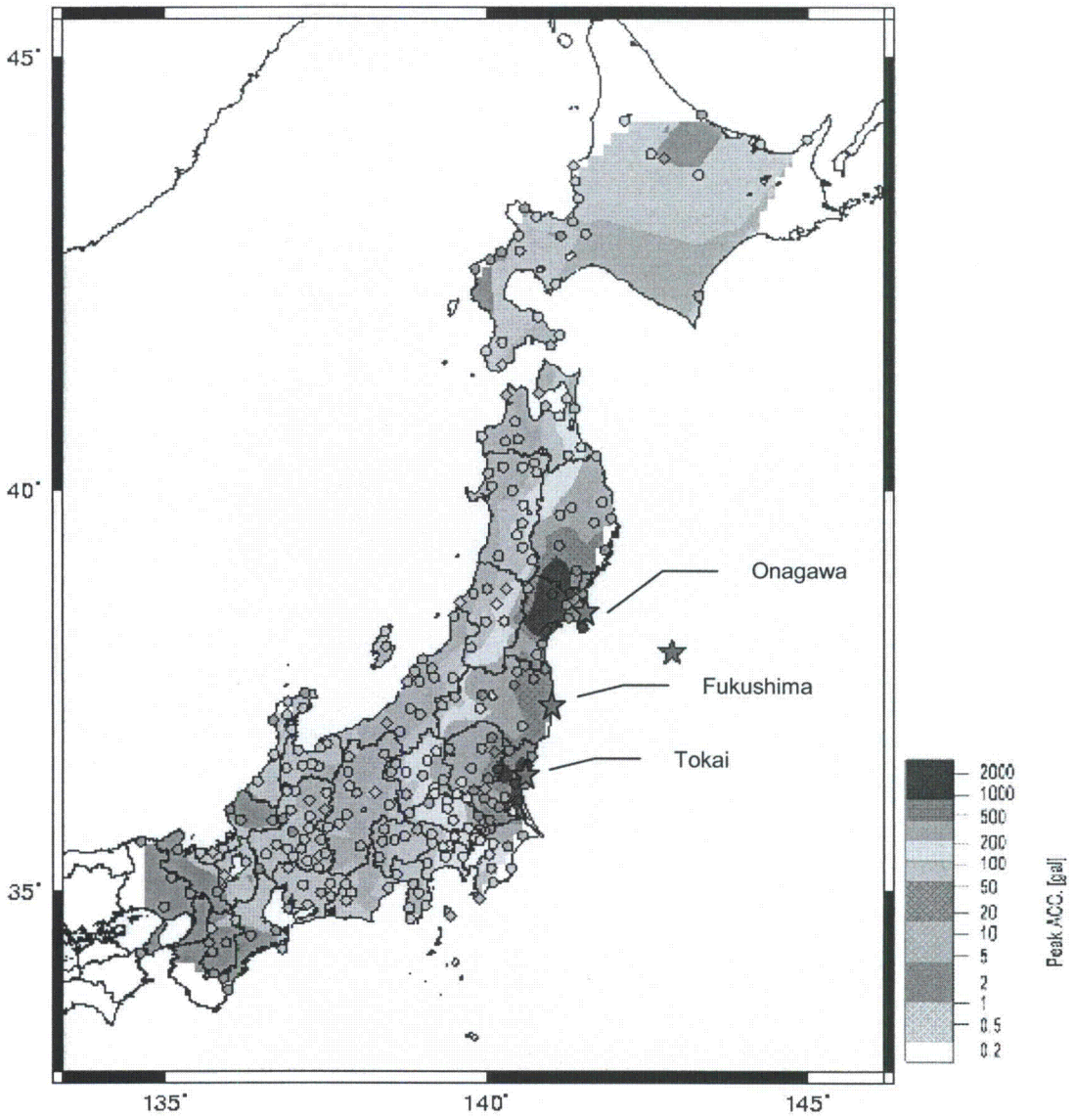
### How was the seismic design basis for an existing nuclear power plant established?

**Public Answer:** The seismic ground motions used for the design basis of existing nuclear plants were determined from the evaluation of the maximum historic earthquake within 200 miles of the site, without explicitly considering the time spans between such earthquakes; safety margin was then added beyond this



3/22/

maximum historic earthquake to form a hypothetical *design basis earthquake*. The relevant regulation for currently operating plants is 10 CFR Part 100, Appendix A, "Seismic and Geologic Siting Criteria for Nuclear Power Plants" (http://www.nrc.gov/reading-rm/doc-collections/cfr/part100/part100-appa.html).




2011/03/11–14:46 38.0N 142.9E 24km M9.0

**Peak Acceleration Map from K-NET NEID**

**Table of Nuclear Plant Design and Review Ground Motions for the Plants that Automatically Tripped (provided by JNES)**

| Plant sites | Contributing earthquakes used for determination of hazard | New DBGM $S_s$ | Original DBGM $S_1$ |
|---|---|---|---|
| Onagawa | Soutei Miyagiken-oki (M8.2) | 580 gal (0.59g) | 375 gal (0.38g) |
| Fukushima (both) | Earthquake near the site (M7.1) | 600 gal (0.62g) | 370 gal (0.37g) |
| Tokai | Earthquakes specifically undefined | 600 gal (0.62g) | 380 gal (0.39g) |

Note: We also have information from JNES that the foundation level acceleration at Onagawa was 0.58g

**From:** Case, Michael
**To:** Pires, Jose; Richards, Stuart
**Subject:** RE: Earthquake info - From Sen Boxer
**Date:** Tuesday, March 22, 2011 8:19:00 AM

---

Beautiful!

-----Original Message-----
From: Pires, Jose
Sent: Tuesday, March 22, 2011 8:08 AM
To: Case, Michael; Richards, Stuart
Subject: FW: Earthquake info - From Sen Boxer

Annie has done this already.

-----Original Message-----
From: Kammerer, Annie
Sent: Tuesday, March 22, 2011 8:06 AM
To: Pires, Jose
Subject: RE: Earthquake info - From Sen Boxer

Already done. Thanks,

-----Original Message-----
From: Pires, Jose
Sent: Tuesday, March 22, 2011 8:05 AM
To: Kammerer, Annie
Subject: FW: Earthquake info - From Sen Boxer
Importance: High

Annie,
Please see the request for information from the office of congressional affairs and Brian Sheron. Three questions (dealing with low, moderate and high seismicity):
- First, they asked if all others plants fall in the low category
- Second, what is the definition of seismicity?
- Third, what are the definitions of high, moderate and low?

I will call you as well.

-----Original Message-----
From: Case, Michael
Sent: Tuesday, March 22, 2011 6:29 AM
To: Pires, Jose
Cc: Richards, Stuart
Subject: FW: Earthquake info

Hi Jose. Could you follow up with Annie in the morning? Thanks.

-----Original Message-----
From: Sheron, Brian
Sent: Monday, March 21, 2011 9:12 PM
To: Case, Michael; Richards, Stuart
Subject: FW: Earthquake info

See below. Please make sure Annie responds to Becky first thing tomorrow morning. Thanks.

---

From: Schmidt, Rebecca
Sent: Monday, March 21, 2011 9:09 PM

w/222

To: Kammerer, Annie; Sheron, Brian
Cc: Powell, Amy
Subject: Fw: Earthquake info

So this what I sent and Sen Boxer's staff came back with three questions. First, they asked if all others plants fall in the low category. (I assume so but I thought I would check). Second, what is the definition of seismicity? Third, what are the definitions of high, moderate and low? Are there some scientific parameters? The Senator is touring Diablo Canyon tomorrow so I need an answer tomorrow morning.

---

From: Schmidt, Rebecca
To: Dedrick, Kathy (EPW) <Kathy_Dedrick@epw.senate.gov>; Bettina_poirier@epw.senate.gov <Bettina_poirier@epw.senate.gov>
Cc: Powell, Amy; Batkin, Joshua
Sent: Mon Mar 21 17:43:07 2011
Subject: Earthquake info

Press info – I talked to our Director of Public Affairs and will follow up with a call to you.

Earthquake info –

Although we often think of the US as having "active " and non-active" earthquake zones, earthquakes can actually happen almost anywhere. Seismologists typically separate the US into low, moderate and high seismicity zones. The NRC requires that every nuclear plant be designed for site specific ground motions that are appropriate for their locations. In addition, the NRC has specified a minimum ground motion level to which nuclear plants must be designed. The designation of type of zone is open to interpretation but a conservative interpretation – meaning a larger zone—would include the following preliminary estimates:

High Seismicity—Diablo Canyon, SONGS

Moderate Seismicity – Brunswick, Robinson, Summer, Vogtle, Hatch, Clinton, Watts Bar, Sequoya, North Anna

I do not have a definition of High or Moderate but I wanted to get this to you now

## Greenwood, Carol

**From:** Gibson, Kathy
**Sent:** Tuesday, March 22, 2011 9:13 PM
**To:** Lee, Richard
**Cc:** Wagner, Katie; Sheron, Brian
**Subject:** Re: Conference call

Thanks Richard!

----- Original Message -----
From: Lee, Richard
To: Gibson, Kathy
Cc: Wagner, Katie
Sent: Tue Mar 22 20:32:59 2011
Subject: RE: Conference call

Kathy:

I will participate in the call tomorrow. No problem.

Richard

---

From: Gibson, Kathy
Sent: Tuesday, March 22, 2011 7:15 PM
To: Lee, Richard
Cc: Wagner, Katie
Subject: FW: Conference call

Can you do this? If not, let me know right away so we can identify another appropriate participant.

[cid:image001.jpg@01CBE8C5.76307680]

From: Sheron, Brian
Sent: Tuesday, March 22, 2011 6:20 PM
To: Gibson, Kathy
Subject: Conference call

Recall last week Richard Lee and I went down to a meeting at DOE with secretary Chu. He was pulling together a brain trust from academia and the national labs to "think outside the box" about ways to help the Japanese cope with the Fukushima disaster.

After the meeting, they agreed to get back together via conference calls.

I missed the call yesterday because I was briefing hill staffers at the time of the call.

I participated in the one today. It was scheduled for an hour, but took 1.5 hours. The Secretary of Energy was on the call initially, although I did not hear him participate in the conversations, so he might have slipped out the back door.

The gist of these conversations is this brain trust pontificating about how to measure water level in the SFP, how to get fresh water into the reactor, etc.



W/223

Interesting as it is, I think I have more important things to focus on right now. Is it possible for Richard to participate in these calls for me? He attended the meeting, so he know who the people are that are on the phone.

The next conference call is at 12:30 pm tomorrow. The call-in number is 202-586-2535.

Let me know if Richard can participate in the call. Thanks.

## Greenwood, Carol

**From:** Gibson, Kathy
**Sent:** Wednesday, March 23, 2011 8:43 AM
**To:** Elkins, Scott
**Subject:** Fw: Upcoming Comm Meeting on Fukushima rad consequences

----- Original Message -----
From: Gibson, Kathy
To: Evans, Michele
Sent: Wed Mar 23 08:28:43 2011
Subject: Upcoming Comm Meeting on Fukushima rad consequences

Michele,
Mike Weber opined that we need an SES with Bill and the SLs to respond to Commission questions. Brian and I discussed this and think Charlie Miller may be a good choice. FYI and consideration.

K



W/224

**Kauffman, John**

**From:** Hiland, Patrick - NRR
**Sent:** Wednesday, March 23, 2011 1:53 PM
**To:** Coe, Doug
**Cc:** Burnell, Scott; Hayden, Elizabeth; Skeen, David; Beasley, Benjamin; Kauffman, John; Killian, Lauren; Khanna, Meena
**Subject:** RE: ACTION: Talking points on GI-199

**Below is what was put together last week along with Comm Plan. I'll ask Meena to co-ordinate response to Eric Leeds and Scott Burnell.**

**GENERIC ISSUE 199, "IMPLICATIONS OF UPDATED PROBABILISTIC SEISMIC HAZARD ESTIMATES IN CENTRAL AND EASTERN UNITED STATES ON EXISTING PLANTS"**

Objective of GI-199

The objective of the GI-199 Safety/Risk Assessment was to perform a conservative, screening-level assessment to evaluate if further investigations of seismic safety for operating reactors in the central and eastern U.S. (CEUS) are warranted consistent with NRC directives.

- The results of the GI-199 safety risk assessment should not be interpreted as definitive estimates of plant-specific seismic risk.
- The nature of the information used (both seismic hazard data and plant-level fragility information) make these estimates useful only as a screening tool. The NRC does not rank plants by seismic risk.

Key Messages from the GI-199 Communications Plan (slightly revised) are:

(1) In August 2010, the Safety/Risk Assessment for GI-199 was completed. That assessment found that operating nuclear power plants are safe: Plants have adequate safety margin for seismic issues. The NRC's Safety/Risk Assessment confirmed that overall seismic risk estimates remain small and that adequate protection is maintained.
(2) Though still small, some seismic hazard estimates have increased: Updates to seismic data and models indicate increased seismic hazard estimates for some operating nuclear power plant sites in the Central and Eastern United States.
(3) Assessment of GI-199 will continue: Plants are safe (see key message 1), but the NRC has separate criteria for evaluating whether plant improvements may be imposed. The NRC's Safety/Risk Assessment used readily available information and found that for about one-quarter of the currently operating plants, the estimated core damage frequency change is large enough to warrant further attention. Action may include obtaining additional, updated information and developing methods to determine if plant improvements to reduce seismic risk are warranted.

Note: GI-199 Communication Plan is available in ADAMs: ML081850477.

Status of Operating Plants and Need of Additional Actions due to Japanese Event:

- Currently operating nuclear plants in the United States remain safe, with no need for immediate action.
- This determination is based on NRC staff reviews of updated seismic hazard information and the conclusions of the Generic Issue 199 Safety/Risk Assessment Panel.
- Existing plants were designed with considerable margin to be able to withstand the ground motions from the "deterministic" or "scenario earthquake" that accounted for the largest earthquake expected in the area around the plant.
- During the mid-to late-1990s, the NRC staff reassessed the margin beyond the design basis as part of the Individual Plant Examination of External Events (IPEEE) program.

- The results of the GI-199 assessment demonstrate that the probability of exceeding the design basis ground motion may have increased at some sites, but only by a relatively small amount. In addition, the Safety/Risk Assessment stage results indicate that the probabilities of seismic core damage are lower than the guidelines for taking immediate action.
- In summary, US plants are designed for appropriate earthquake levels and are safe. As addressed above, the NRC is conducting a program called Generic Issue 199, which is reviewing the adequacy of the earthquake design of US NPPs in central and eastern North America based on the latest data and analysis techniques. The NRC will look closely at all aspects of the response of the plants in Japan to the earthquake and tsunami to determine if any actions need to be taken in US plants and if any changes are necessary to NRC regulations.

Timeline for Preparation and Issuance of GI-199 Generic Letter:

- The NRC is working on developing a Generic Letter (GL) to request information of all affected plants (96 plants that are east of the Rockies).
- The GL is planned to be issued in draft form within the next 2 months to stimulate discussions with industry in a public meeting.
- Process will be followed, i.e., Committee to Review Generic Requirements, Advisory Committee on Reactor Safeguards Meeting and then GL will be issued as a draft for formal public comments (60 days), followed by a second meeting with ACRS.
- We expect to issue the GL by the end of this calendar year, as the new consensus seismic hazard estimates become available. (This effort is being coordinated with US NRC, DOE, EPRI, and USGS).
- The information from licensees will likely require 3 to 6 months to complete. Staff's review will commence after receiving licensees' responses. Based on staff's review, a determination can be made regarding cost beneficial backfits where it can be justified.

---

**From:** Coe, Doug
**Sent:** Wednesday, March 23, 2011 1:45 PM
**To:** Beasley, Benjamin; Kauffman, John; Killian, Lauren
**Cc:** Burnell, Scott; Hayden, Elizabeth; Skeen, David; Hiland, Patrick
**Subject:** RE: ACTION: Talking points on GI-199

Ben/John/Lauren,
Can we help out OPA by extracting bullets per Eric Leed's request? Just pull directly from the Comm plan but put into a brief but logical flow of bullets.

---

**From:** Hiland, Patrick
**Sent:** Wednesday, March 23, 2011 1:39 PM
**To:** Leeds, Eric
**Cc:** Khanna, Meena; Burnell, Scott; Hayden, Elizabeth; Grobe, Jack; Skeen, David; Coe, Doug; Beasley, Benjamin
**Subject:** RE: ACTION: Talking points on GI-199

We have a communication plan; I'll retrieve and make sure up to date.

---

**From:** Leeds, Eric
**Sent:** Wednesday, March 23, 2011 1:38 PM
**To:** Hiland, Patrick; Skeen, David
**Cc:** Khanna, Meena; Burnell, Scott; Hayden, Elizabeth; Grobe, Jack
**Subject:** ACTION: Talking points on GI-199

DE –

Please provide OPA with talking points on GI-199. Scott Burnell is their POC. They need high level info – the schedule for review, upcoming public meetings, why it's ok to wait, what we'll do with the info once we get it, etc. I don't think we need hard-core technical bullets on response spectra, etc, but we do need to be able to tell the public WHY things are ok right now (not just repeat reactors are safe right now), and what we'll do going forward.

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-1270

## Beasley, Benjamin

**From:** Beasley, Benjamin
**Sent:** Wednesday, March 23, 2011 3:34 PM
**To:** Khanna, Meena
**Cc:** Skeen, David; Manoly, Kamal; Hiland, Patrick; Kauffman, John; Stutzke, Martin; Munson, Clifford
**Subject:** RE: GI-199 Talking Points

Meena,

I have marked a few edits in the text below. I also suggest a response to the confusion over the "list of 27" and a condensed version of Comm Plan question 15:

**What plants will be evaluated?**
At this time, plans are to request information from all plants east of the Rocky Mountains. The data received from each plant will be screened for the potential of plant changes to improve safety. For plants where improvements are warranted, an evaluation to identify specific changes will be performed.

**Why is it okay to wait to do seismic evaluations?**
The NRC has guidelines for determining when immediate actions are warranted. The risks computed in the GI-199 safety risk assessment are less than half of the guideline for immediate actions. In addition, the safety risk assessment made conservative assumptions and there is considerable safety margin in plants designs which has been confirmed by evaluations in the 1990s.

Ben

---

**From:** Hiland, Patrick
**Sent:** Wednesday, March 23, 2011 2:35 PM
**To:** Beasley, Benjamin; Kauffman, John; Stutzke, Martin; Munson, Clifford; Manoly, Kamal
**Cc:** Khanna, Meena; Skeen, David; Manoly, Kamal
**Subject:** GI-199 Talking Points
**Importance:** High

Below is my shot at crafting simple talking points for OPA. Please provide comments to Meena Khanna COB.

**********

**GENERIC ISSUE 199, "IMPLICATIONS OF UPDATED PROBABILISTIC SEISMIC HAZARD ESTIMATES IN CENTRAL AND EASTERN UNITED STATES ON EXISTING PLANTS"**

Objective of GI-199

The objective of the GI-199 Safety/Risk Assessment was to perform a conservative, screening-level assessment to evaluate if further investigations of seismic safety for operating reactors in the central and eastern U.S. (CEUS) was warranted consistent with NRC directives.

- Results of the GI-199 safety risk assessment are not final estimates of plant-specific seismic risk.
- The seismic hazard data and plant-level fragility assumptions were conservative estimates useful as a screening tool.
- The NRC does not rank plants by seismic risk.



W/226

Key Messages:

1. Safety/Risk Assessment for GI-199 was completed in August 2010. It is publically available **on the public Web site and** in ADAMS at ML100270582. That assessment found that plants have adequate safety margin for seismic issues and are within their licensing basis.

2. Overall seismic risk estimates remain small and adequate protection is maintained.

3. Updates to seismic data and models indicate increased seismic hazard estimates for some operating nuclear power plant sites in the Central and Eastern United States.

4. NRC has separate criteria for **immediate action and** evaluating whether plant improvements may be imposed through a back-fit.

5. The Safety/Risk Assessment used readily available information and found that for about one-quarter of the currently operating plants, the change in seismic hazard is enough to warrant further NRC review.

6. Action may include obtaining additional, updated information and developing methods to determine if plant improvements to reduce seismic risk are warranted.

Status of Operating Plants and Need for Actions due to Japanese Event:

- Existing plants were designed with considerable margin to be able to withstand the ground motions from the largest earthquake expected in the area around the plant.
- During the mid-to late-1990s, the NRC staff reassessed the margin beyond the design basis as part of the Individual Plant Examination of External Events [IPEEE] program.
- The NRC's safety/risk assessment concluded that the probability of exceeding the design basis ground motion may have increased by a small amount at some plants. Those results also indicate that the probabilities of damage are lower than NRC's guidelines for taking immediate action.
- US plants are designed for appropriate earthquake levels and are safe.

The NRC is conducting a regulatory assessment, which includes reviewing the seismic capacity for plants located in central and eastern United States based on the latest data and analysis techniques.

Timeline for Preparation and Issuance of Generic Letter:

- The NRC is working on developing a Generic Letter (GL) to request information from all affected plants (96 plants that are east of the Rockies).

- The GL is planned to be issued in draft form for public comment in the late spring.

- Processes that are planned for review of the GL include a review by the NRC's Committee to Review Generic Requirements, **and a review by** the Advisory Committee on Reactor Safeguards (ACRS) **both before and after the public comment period.**, ~~and the GL will be issued as a draft for public comments (60 days), followed by a second meeting with ACRS.~~

- GL should be issued by end of 2011, ~~as~~ **near the time** the new consensus seismic hazard models become available.

- Consensus hazard models are being developed by NRC, DOE, and EPRI. In addition the USGS will review the model.

- Information requested from licensees will likely require 3 to 6 months to prepare. NRC's review will be on-going as information is collected.

- Based on NRC's review, a determination will be made regarding beneficial back-fits.

## Beasley, Benjamin

**From:** Beasley, Benjamin
**Sent:** Wednesday, March 23, 2011 12:11 PM
**To:** Wegner, Mary
**Subject:** RE: FYI

Thanks for the update.

Both yesterday and today I have not been able to connect to the Events Toolbox. Maybe I have the wrong URL. I am trying:
file://Twclfs01_nrc02s/nrc02/SHARED/EVENTS/RES%20Events/OEGIBToolbox.html

Ben

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**From:** Wegner, Mary
**Sent:** Wednesday, March 23, 2011 11:46 AM
**To:** Beasley, Benjamin; Garmon-Candelaria, David
**Subject:** FYI

**In regards to news reports – info from NISA and TEPCO**

**From NISA:**
Slightly blackish smoke generated from the reactor building. (Around 16:20 March 23rd)

**From TEPCO:**
At 4:20 pm on March 23rd, light gray smoke was observed belching from Unit 3 building. The situation was reported to the fire department at 4:25 pm on March 23rd.

The parameters of the reactor, the reactor containment vessel of Unit 3, and monitored figures around the site's immediate surroundings remained stable without significant change. To be safe, workers in the main control room of Unit 3 and around Unit 3 evacuated to a safe location

W/227

## Beasley, Benjamin

**From:** Beasley, Benjamin
**Sent:** Wednesday, March 23, 2011 11:19 AM
**To:** Coyne, Kevin
**Cc:** Coe, Doug; Hudson, Daniel; Stutzke, Martin
**Subject:** RE: Japan Response Impacts for DRA

Kevin,

It is possible (likely) that the activities on GI-199 will be accelerated / expedited. That will affect OEGIB some, but Marty to a greater extent. Is cloning technology perfected yet?

OEGIB will do what it can to aid Marty with John, Shelby and Lauren. Is it possible for Nathan to pick up some of the GI-199 and/or Level 3 work?

Ben

---

**From:** Coyne, Kevin
**Sent:** Wednesday, March 23, 2011 10:54 AM
**To:** Sheron, Brian
**Cc:** Uhle, Jennifer; Coe, Doug; Hudson, Daniel; Salley, MarkHenry; Beasley, Benjamin; Stutzke, Martin
**Subject:** Japan Response Impacts for DRA

Brian –

The biggest impact to DRA in supporting the Japanese response is on the Level 3 SECY paper. Although we can meet the accelerated schedule proposed by the EDO's office, loss of much more of Marty Stutzke's time to addressing GI-199 issues will adversely impact our ability to meet the schedule (Marty has a key role in developing the paper). The information requests on GI-199 and fire have also impacted our fire research and generic issues program, but to a more limited extent. In fact, the fire research staff minimized the impact to core research by working over the weekend to develop Q&A's for the Monday Commission briefing. Obviously, new requests for information or new research needs as a result of the event will add to our work load and have additional impacts.

Let me know if you need any additional information or have questions-

Kevin

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## Rodriguez-Luccioni, Hector

**From:** Boyce, Tom (RES)
**Sent:** Wednesday, March 23, 2011 5:19 PM
**To:** RES_DE_RGB
**Subject:** FW: SRM - COMGBJ-11-0002 - NRC Actions Following the Events in Japan
**Attachments:** SRM-CmGBJ11-0002.docx

This should be of interest to most. Commission is directing the staff to do a review of basically all of our regulatory processes for reactors in light of the events in Japan.

**From:** Richards, Stuart
**Sent:** Wednesday, March 23, 2011 5:02 PM
**To:** Boyce, Tom (RES); Csontos, Aladar; Gavrilas, Mirela; Hogan, Rosemary; Koshy, Thomas; Sydnor, Russell; Ali, Syed; Birla, Sushil; Murphy, Andrew; Santos, Daniel; Tregoning, Robert
**Subject:** FW: SRM - COMGBJ-11-0002 - NRC Actions Following the Events in Japan

Fyi - Stu

**From:** Lewis, Antoinette
**Sent:** Wednesday, March 23, 2011 4:34 PM
**To:**
**Subject:** SRM - COMGBJ-11-0002 - NRC Actions Following the Events in Japan

(ML110820875)

In an effort to keep the NRC staff informed of Commission decisions in a timely manner, attached for your information are the Staff Requirements Memoranda (SRMs) signed by the Secretary on March 23, 2011. Please make additional distribution to interested staff members in your office.

If you have any questions, please give me a call on 415-1969.



W/229

March 23, 2011

MEMORANDUM TO: Chairman Jaczko

FROM: Annette Vietti-Cook, Secretary **/RA/**

SUBJECT: COMGBJ-11-0002 – NRC ACTIONS FOLLOWING THE EVENTS IN JAPAN

This memorandum is to inform you that all Commissioners have concurred in your proposal regarding NRC actions following the events in Japan. The attached tasking memorandum provides staff direction on this issue.

This completes action on COMGBJ-11-0002.

Attachment:
As stated

cc: Commissioner Svinicki
Commissioner Apostolakis
Commissioner Magwood
Commissioner Ostendorff
EDO
OGC
OPA
OCA

March 23, 2011

MEMORANDUM TO: R. W. Borchardt
Executive Director for Operations

FROM: Chairman Jaczko **/RA/**

SUBJECT: TASKING MEMORANDUM – COMGBJ-11-0002 – NRC ACTIONS FOLLOWING THE EVENTS IN JAPAN

The staff should establish a senior level agency task force to conduct a methodical and systematic review of our processes and regulations to determine whether the agency should make additional improvements to our regulatory system and make recommendations to the Commission for its policy direction. The review should address the following near term and then longer term objectives.

## Near Term Review

- This task force should evaluate currently available technical and operational information from the events that have occurred at the Fukushima Daiichi nuclear complex in Japan to identify potential or preliminary near term/immediate operational or regulatory issues affecting domestic operating reactors of all designs, including their spent fuel pools, in areas such as protection against earthquake, tsunami, flooding, hurricanes; station blackout and a degraded ability to restore power; severe accident mitigation; emergency preparedness; and combustible gas control.
- The task force should develop recommendations, as appropriate, for potential changes to inspection procedures and licensing review guidance, and recommend whether generic communications, orders, or other regulatory requirements are needed.
- The task force efforts should be informed by some stakeholder input but should be independent of industry efforts.
- The report would be released to the public per normal Commission processes (including its transmission to the Commission as a Notation Vote Paper).

To ensure the Commission is both kept informed of these efforts and called upon to resolve any policy recommendations that surface, the task force should, at a minimum, be prepared to brief the Commission on a 30 day quick look report; on the status of the ongoing near term review at approximately the 60 day point; and then on the 90 day culmination of the near term efforts. Additional specific subject matter briefings and additional voting items that request Commission policy direction may also be added during the Commission's agenda planning meetings.

(EDO) (SECY Suspense: 30, 60, & 90 days)

Longer Term Review

- The task force's longer term review should begin as soon as NRC has sufficient technical information from the events in Japan with the goal of no later than the completion of the 90 day near term report, and the task force should provide updates on the beginning of the longer term review at the 30 and 60 day status updates.
- This effort would include specific information on the sequence of events and the status of equipment during the duration of the event.
- The task force should evaluate all technical and policy issues related to the event to identify potential research, generic issues, changes to the reactor oversight process, rulemakings, and adjustments to the regulatory framework that should be conducted by NRC.
- The task force should evaluate potential interagency issues such as emergency preparedness.
- Applicability of the lessons learned to non-operating reactor and non-reactor facilities should also be explored.
- During the review, the task force should receive input from and interact with all key stakeholders.
- The task force should provide a report with recommendations, as appropriate, to the Commission within six months from the start of the evaluation for Commission policy direction.
- The report would be released to the public per normal Commission processes (including its transmission to the Commission as a Notation Vote Paper).
- Before beginning work on the longer term review, staff should provide the Commission with estimated resource impacts on other regulatory activities.
- The ACRS should review the report as issued in its final form and provide a letter report to the Commission.

(EDO) (SECY Suspense: 9 months, if needed)

cc: Commissioner Svinicki
Commissioner Apostolakis
Commissioner Magwood
Commissioner Ostendorff
OGC
CFO
OCA
OPA
Office Directors, Regions, ACRS, ASLBP (via E-Mail)
PDR

**Weaver, Tonna**

**From:** Ruland, William
**Sent:** Thursday, March 24, 2011 11:35 PM
**To:** Ward, Leonard; Mendiola, Anthony
**Subject:** RE: additional Information regarding March 22 phone call with Japan at 2400

I opened a tracking item to make sure that we look at your data. Unfortunately, we can't read the attachments.

Bill

---

**From:** Ward, Leonard
**Sent:** Thursday, March 24, 2011 6:47 PM
**To:** RST01 Hoc; Ruland, William; Mendiola, Anthony
**Subject:** FW: additional Information regarding March 22 phone call with Japan at 2400

Bill Ruland:

FYI regarding Mar 22 phone call.

Sent to Anthony Mendiola on Mar 22 for clarification.....Please give to Bill Ruland. **ONLY**... PLEASE.DO NOT TRANSMIT ANY OF THIS TO ANYONE ELSE WITHOUT BILL RULAND's PERMISSION. Len

Dr. Leonard W. Ward, PhD
US Nuclear Regulatory Commission
NRR/DSS/SNPB
MS O10-B3
Washington DC 20555-001
Work (301) 415-2866
Fax (301) 415-3577

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**From:** Ward, Leonard
**Sent:** Wednesday, March 23, 2011 2:57 PM
**To:** Mendiola, Anthony
**Cc:** Miranda, Samuel
**Subject:** additional Information regarding March 22 phone call with Japan at 2400

RST/Tony:

I just wanted to offer some clarifications and pertinent assumptions regarding the staff calculations that were not passed on during call last night. Some additional observations are also listed. I might further suggest we talk to Tony Nakanishi among ourselves first, before this info is sent to him in Japan, so there is no misinterpretation of why and what was done regarding the salt build-up..

1) I looked at two cases for Unit 1; a) 48 gpm injection and b) 80 gpm injection of seawater. While it is understood that the concentration builup is a function of the boiloff rate, for an upper limit, the assumption is all injected seawater salt content is deposited into the RCS (boiloff with the rest evaporated). And at 100% evaporation/boiling, 50 g particulate per liter (from the US Bureau of



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Reclamation, Denver) is the seawater particulate precipitate rate. Given this particulate buildup, starting 2 days after shutdown and concentrating for 8 days, I calculated 230,733 lbs is deposited or 115 tons (this includes all precipitates). For Unit 1 if I use 115 L/min = 30.4 gpm, the result is 115 ton X (30.4 gpm/48gpm) = 72 ton . Clearly if one injects at greater than boiloff (=~ 30 -35 gpm at 10 days), it is expected the excess will buildup liquid in the vessel and exit the SRVs. The results suggest the lower plenum is approaching a complete filling. Moreover, placing all of the salt produced in the core into the lower plenum, in my opinion, produces a potential upper bound for timing for filling the lower plenum region, since there is a large amount of salt in the core (not all the salt instantaneously magically appears in the lower plenum). As salt propagates downward, more salt will build up in the core bundles to provide the density difference to drive the accumulating core salts/particulates into the lower regions of the vessel.

2) If boron is added to the injection with a large quantity of salt already present in the lower plenum and core regions plus voiding in the core, the remaining liquid in the mixing volume (the liquid in the core and what small amount resides in the lower plenum) is greatly reduced. This minimizes the mixing volume. This could cause a rapid and untimely precipitation of the boric acid in the core region where boiling occurs. At 212 F (100 C), this limit is 27.53 wt% (one wt% = 1748 ppm of boron) . At 107 C (226F), the precipitation limit increases to 31.47 % It is important that this potential precipitation behavior be identified. As with saltwater, one cannot add borated water to a boiling system indefinitely without having a plan to flush out the built up concentrations before the precipitation limit is reached.

3) Also, again it is important to note that when adding boron to the fresh water , at 50 F (10 C), the precipitation limit is 3.51 wt% (6135 ppm). Precipitation in the injection lines could prcelude further injection iif the boron content is not controlled below the precipitation limit.

4) Also, data from boric acid precipitation tests by Combustion Engineering, Westinghouse, the PKL facility, and tests in Finland show that the highest concentrations reside in the core and mixing of the boric acid does not enter the lower plenum until the boric acid density in the core exceeds the fluid density in the lower plenum. So injection entering the lower plenum and core from the downcomer will first begin to buildup salt in the core region, which later due to density and diffusion enters into the lower plenum region. As such, the salt is expected to build up in the region where boiling occurs or the core region, which then propagates downward into the lower plenum. With injection from the core spray or into the hot side of the vessel the salt and/ or boric acid will concentrate in the core first but will soon mix into the lower plenum since this region is not expected to be at as low a temperature had it been injected from the downcomer side. In any event, the point is the salt and boric acid buildup (if borated water is injected) is expected to build up in the core first, with migration to the lower plenum. The.concentration will always be highest in the core bundles(particularly, the higher power bundles) since this is the region of boiling. If one can stop the boiling, obviously, the concentration buildup ceases

5) There was some indication that the feedwater nozzles were elevated in temperature. If this is true one needs to be aware of the potential for thermal shock of the nozzles if cold water is injected via the feedwater system at very high rates...this suggests that the injection should be made at an acceptable increasing rate, and not at the max . (certaintly sufficient injection should be added to match boiloff, however putting several hundred gpm of 30 – 50 F water could damage the nozzles due to thermal shock. An awareness of this possibility need to be noted.

It appears that all of the salt calculations are in the same ball-park for lower plenum filling, given the variations in the assumed particulate build-up and densities, etc. That is, the lower plenum is nearing filling if some of the estimates take credit for some of the salt to be residing in the core region and not all in the lower plenum. It suggests there may not be a lot of time before the salt blocks the viable injection paths.

I would suggest you might want someone else to check or perform a separate salf calc as in 1) above. Have the Accident Analyst check these calcs on the current shift. Before transmitting to anyone!!!. Len

Dr. Leonard W. Ward, PhD
US Nuclear Regulatory Commission
NRR/DSS/SNPB
MS O10-B3
Washington DC 20555-001
Work (301) 415-2866
Fax (301) 415-3577

## Lee, Richard

**From:** Santiago, Patricia
**Sent:** Friday, March 25, 2011 7:58 AM
**To:** Lee, Richard
**Subject:** Out of Office: QUESTION FROM JAPAN

I will be out of the office and will not be responding to emails. Please contact the following:

March 24 Richard Chang 301- 251-7980
March 25 Tina Ghosh Call the NRC operator to connect to home or email.
March 28 Ken Armstrong 301-251-7551
March 29 Tina Ghosh
March 30 Ken Armstrong
March 31 Richard Chang
April 1 Tina Ghosh



3/23/1

## Dunn, Darrell

**From:** Dunn, Darrell
**Sent:** Friday, March 25, 2011 3:55 PM
**To:** Rathbun, Howard
**Subject:** RE: Detailed 3 stage SRV diagrams and material list attached

Well I am still not sure of what materials are wetted in normal and perhaps unusual conditions but the material degradation issues that may need to be considered are still the same as I mentioned earlier:

1. Stress corrosion cracking of the 300 SS components
2. Pitting/Crevice corrosion of the carbon steel body
3. Hydrogen embrittlement of the X-750 spring if is it exposed to seawater and galvanically coupled to the carbon steel.
4. Galvanic corrosion of the carbon steel body is possible but the area ratio of carbon steel to stainless steel is large. Still galvanic coupling could be an issue for the carbon steel valve seat in contact with the 304L main disk. Actually I am surprised to see the valve seat listed as a low carbon steel material and not Stellite

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**From:** Rathbun, Howard
**Sent:** Friday, March 25, 2011 12:10 PM
**To:** Dunn, Darrell
**Cc:** Csontos, Aladar
**Subject:** Detailed 3 stage SRV diagrams and material list attached



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## Lee, Richard

**From:** Wagner, Katie
**Sent:** Friday, March 25, 2011 4:02 PM
**To:** Lee, Richard
**Subject:** Sharepoint

Good Afternoon Richard,

Are you in the office? I have some questions about items in Sharepoint. Also, Kathy asked me on Wednesday to print out a copy of the Sharepoint report for all the DSA BCs this Friday so I am about to do that.

Thanks,

Katie Wagner
General Engineer
U.S. Nuclear Regulatory Commission
(301) 251.7917
Katie.Wagner@nrc.gov



W/233

## Beasley, Benjamin

**From:** Beasley, Benjamin
**Sent:** Friday, March 25, 2011 3:55 PM
**To:** Khanna, Meena
**Subject:** RE: GENERIC ISSUE 199.docx
**Attachments:** GENERIC ISSUE 199 with BB comments.docx

Meena,

Attached is a track changes version with my comments. I am also proposing another alternative to the first paragraph below. I cannot tell what the first paragraph is trying to accomplish, but it is wrong on a couple of points. We want to be careful about backing away from the Safety / Risk Assessment. It is a good analysis that we are using as the basis for decision making. It does have conservatism for some plants, but not all.

Also, the GI-199 Communications Plan has information on many of these items. It should be the preferred source since it received extensive review and comment by the entire agency.

Ben

Alternate first paragraph

The objectives of the GI-199 Safety/Risk Assessment were to: 1) determine, on a generic basis, if the risk associated with warranted further investigation for potential imposition as a cost-justified backfit, and 2) provide a recommendation regarding the next steps. The Safety/Risk Assessment concluded that, although plants are safe, the issue should continue to the Regulatory Assessment Stage to evaluate whether plant improvements might be imposed. Since information needed to perform the regulatory assessment was not available, the NRC was in the process of developing a Generic Letter (GL) request it from all affected plants (96 plants that are east of the Rockies). However, due to the recent Japanese event, the NRC has determined to expand the scope of the GL to all U.S. plants

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**From:** Khanna, Meena
**Sent:** Friday, March 25, 2011 3:19 PM
**To:** Manoly, Kamal; Beasley, Benjamin
**Cc:** Kammerer, Annie; Munson, Clifford
**Subject:** GENERIC ISSUE 199.docx
**Importance:** High

Here is the latest talking points for GI199...pls provide any comments or revisions to me asap, as Scott Burnell is waiting for this from us..thanks so much for your continued support.

meena



W/234

**GENERIC ISSUE 199, "IMPLICATIONS OF UPDATED PROBABILISTIC SEISMIC HAZARD ESTIMATES IN CENTRAL AND EASTERN UNITED STATES ON EXISTING PLANTS"**

Objective of GI-199

The objective of the GI-199 Safety/Risk Assessment was to evaluate whether further investigations of seismic safety for operating reactors was warranted, consistent with NRC directives. The assessment identified 27 plants that met the criteria to continue to the next phase which is to evaluate specific improvements. Recently, in light of the Japanese event, the NRC has determined to expand the scope of the plants to all 104 U.S. nuclear plants.

- Results of the GI-199 safety risk assessment are not final estimates of plant-specific seismic risk.
- The plant-level fragility assumptions were conservative estimates useful as a screening tool.
- The NRC does not rank plants by seismic risk.

Key Messages:

- Safety/Risk Assessment for GI-199 was completed in August 2010. It is publically available in ADAMS at ML100270582. That assessment found that plants have adequate safety margin for seismic issues and are within their licensing basis.
- Overall seismic risk estimates remain small and adequate protection is maintained.
- Updates to seismic data and models indicate increased seismic hazard estimates for some operating nuclear power plant sites in the Central and Eastern United States.
- NRC has separate criteria for evaluating whether plant improvements may be imposed through a back-fit.
- The Safety/Risk Assessment used readily available information and found that for about one-quarter of the currently operating plants, the change in seismic hazard is enough to warrant further NRC review.
- Action may include obtaining additional, updated information and developing methods to determine if plant improvements to reduce seismic risk are warranted.

Status of Operating Plants and Need for Actions due to Japanese Event:

- Existing plants were designed with considerable margin to be able to withstand the ground motions from the largest earthquake expected in the area around the plant.
- During the mid-to late-1990s, the NRC staff reassessed the margin beyond the design basis as part of the Individual Plant Examination of External Events [IPEEE] program.
- The NRC's safety/risk assessment concluded that the probability of exceeding the design basis ground motion may have increased by a small amount at some plants.

**Deleted:** Initially

**Deleted:** to perform a conservative screening-level assessment

**Deleted:** if

**Deleted:** As a result, the staff issued its safety

**Deleted:** report which

**Deleted:** with the safety assessment phase

**Deleted:** Later, the staff determined to increase the scope to the central and eastern U.S. (CEUS) plants (96 plants) due to the conservatism in the calculations and other approximations.

**Comment [BGB1]:** Do we need to say this? The S/RA results may be the seismic CDF we use for the backfit analysis, i.e. we are treating it as a final result.

**Deleted:** seismic hazard data and

Those results also indicate that the probabilities of damage are lower than NRC's guidelines for taking immediate action.

- US plants are designed for appropriate earthquake levels and are safe.
- The NRC is conducting a regulatory assessment, which includes reviewing the seismic capacity for all 104 U.S. nuclear plants, based on the latest data and analysis techniques.

Timeline for Preparation and Issuance of Generic Letter:

- The NRC is in the process of developing a Generic Letter (GL) that was originally intended to request information from all affected plants (96 plants that are east of the Rockies). However, due to the recent Japanese event, the NRC has determined to expand the scope to all 104 U.S. nuclear plants.
- The GL is planned to be issued in draft form to support a public meeting in late Spring 2011.
- The GL is planned to be issued in draft form for public comment in late Summer 2011. The final GL is expected to be issued by end of 2011, near the time when new seismic models become available. These new seismic models are being developed by NRC, DOE, and EPRI. In addition the USGS will review the model.
- Information requested in the GL will likely require 3 to 6 months for nuclear plant licensees to prepare. NRC's review will be on-going as information is collected. Based on NRC's review of that information, a determination will be made regarding potential changes at nuclear plants based on cost beneficial backfit.
- Processes that are planned for review of the GL include a review by the NRC's Committee to Review Generic Requirements, the Advisory Committee on Reactor Safeguards (ACRS), and the GL will be issued as a draft for public comments (60 days), followed by a second meeting with ACRS.

**Comment [BGB2]:** This may be misleading. We are not currently doing a technical analysis. We will do a backfit analysis, but the utilities will analyze the seismic capacity of their plants.

**Deleted:** of the plants

**Comment [BGB3]:** 3 months is not realistic. 6 to 12 months is more reasonable. Unless we are going to impose a deadline, we should not presume on the utilities for a response time.

Appendix A

**Reeves, Rosemary**

**From:** Reeves, Rosemary
**Sent:** Monday, April 11, 2011 4:31 PM
**To:** 'Reeves, Steven'
**Subject:** A 6.6 quake in Japan today

I was just catching up on things in Japan. I can't find the location of the sheets we were getting info on, but I'm going to make a few calls in a minute...

http://www.iaea.org/newscenter/news/tsunamiupdate01.html

W/235

## Cassidy, John

**From:** Phalen, Martin
**Sent:** Friday, March 25, 2011 10:21 AM
**To:** Cassidy, John; Mitchell, Mark; Go, Tony; Myers, Valerie
**Subject:** FW: P.B. I-131

FYI.....

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**From:** Burton, Stephen
**Sent:** Friday, March 25, 2011 6:25 AM
**To:** Kunowski, Michael
**Cc:** Dickson, Billy; Phalen, Martin
**Subject:** P.B. I-131

On Thursday sample results taken Tuesday reviled the presence on 131. Three samples were taken with the results ranging from 10-15 picocuries per liter. The licensee does not have the capability to analyze I-131 on site therefore the analysis process takes two days.

The licensee has established two sampling stations on the OCA; 1 near the warehouse (a nominal down-wind location) and 1 at the ISFSI (a nominal up-wind location). Samples will be drawn for two days and sent to the lab for analysis. Once the routine of sampling and analysis commences data will be e-mailed to the RIO on a regular basis to the resident office. I plan on sending a copy to Marty; if anyone else desires to be kept in the loop please advise.

Additionally, NEI has a national initiative to compile the data from all nuclear sites and periodically send a report to the NRC and the White House.

If you need any additional information please advise.

Glad to help,
Steve



W/236

## Lee, Richard

**From:** Lee, Richard
**Sent:** Wednesday, March 30, 2011 4:04 PM
**To:** Marksberry, Don
**Subject:** RE: BWROG EPGs/SAGs Abbreviations

Thx, Don. Great help.
Richard

---

**From:** Marksberry, Don
**Sent:** Wednesday, March 30, 2011 3:21 PM
**To:** Lee, Richard
**Subject:** BWROG EPGs/SAGs Abbreviations

°F.....degrees Fahrenheit
%.....percent
ADS.....Automatic Depressurization System
APRM.....Average Power Range Monitor
ARI.....Alternate Rod Insertion
BIIT.....Boron Injection Initiation Temperature
CRD .....Control Rod Drive
CST .....condensate storage tank
CSBW.....Cold Shutdown Boron Weight
CSIPL.....Mark III Containment Spray Initiation Pressure Limit
DHRP.....Decay Heat Removal Pressure
DWSIL.....Drywell Spray Initiation Limit
ECCS .....Emergency Core Cooling System
EPGs .....Emergency Procedure Guidelines
EPGs/SAGs.....Emergency Procedure and Severe Accident Guidelines
ft. .....feet
gal.....gallon
gpm .....gallons per minute
HCTL.....Heat Capacity Temperature Limit
HDOL.....Mark III Hydrogen Deflagration Overpressure Limit
HPCI .....High Pressure Coolant Injection
HPCS .....High Pressure Core Spray
hr .....hour
HSBW.....Hot Shutdown Boron Weight
HVAC.....Heating, Ventilation, and Air Conditioning
IC.....Isolation Condenser
in. .....inch
lbm .....pounds-mass
lbs.....pounds
LCO.....Limiting Condition for Operation
LOT.....Large Oscillation Threshold
LPCI.....Low Pressure Coolant Injection
LPCS.....Low Pressure Core Spray
MDRIR .....Minimum Debris Retention Injection Rate
MDSF.....Minimum Drywell Spray Flow

W/237

MIL .....Minimum Indicated Level
MSCP.....Minimum Steam Cooling Pressure
min. .....minutes
mr .....milliroentgen
MNSDHR .....Minimum Number of SRVs Required for Decay Heat Removal
MNSRED.....Minimum Number of SRVs Required for Emergency Depressurization
MPSPCWL .....Maximum Pressure Suppression Primary Containment Water Level
MRT.....Maximum Run Temperature
MSBWP.....Maximum Subcritical Banked Withdrawal Position
MSCRWL.....Minimum Steam Cooling RPV Water Level
MSIV.....Main Steam Isolation Valve
MSL .....Main Steam Line
MZIRWL .....Minimum Zero-Injection RPV Water Level
NPSH .....Net Positive Suction Head
PCPL.....Primary Containment Pressure Limit
psi.....pounds per square inch
psig.....pounds per square inch guage
PSP.....Pressure Suppression Pressure
RCIC .....Reactor Core Isolation Cooling
RHR .....Residual Heat Removal
rpm .....revolutions per minute
RPS .....Reactor Protection System
RPV.....Reactor Pressure Vessel
RSCS.....Rod Sequence Control System
RWCU .....Reactor Water Cleanup
RWM .....Rod Worth Minimizer
SAGs.....Severe Accident Guidelines
SBGT .....Standby Gas Treatment
SCSIP.....Suppression Chamber Spray Initiation Pressure
SLC .....Standby Liquid Control
SPMS .....Suppression Pool Makeup System
SRV.....Safety Relief Valve
STPLL.....SRV Tail Pipe Level Limit
TAF.....Top of active fuel
UIPC .....Ultimate Internal Pressure Capacity
VL .....Vortex Limit

## Lee, Richard

**From:** Lee, Richard
**Sent:** Thursday, March 31, 2011 11:20 AM
**To:** 'Gauntt, Randall O'; 'Powers, Dana A'
**Subject:** FW: FW: Link to story with photos of site

fyi

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**From:** Boyd, Christopher
**Sent:** Wednesday, March 30, 2011 3:26 PM
**To:** Lee, Richard
**Subject:** FW: Link to story with photos of site

http://www.dailymail.co.uk/news/article-1371375/Japan-nuclear-suicide-squads-paid-fortunes-battle-lost-reactor-2.html

Christopher Boyd
NRC Office of Nuclear Regulatory Research
Division of Systems Analysis
(301) 251-7525

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## Lee, Richard

**From:** Lee, Richard
**Sent:** Thursday, March 31, 2011 5:44 PM
**To:** 'Gauntt, Randall O'
**Subject:** RE: Questions from NY Times

Thx, Randy.
Richard

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**From:** Gauntt, Randall C [mailto:rogaunt@sandia.gov]
**Sent:** Thursday, March 3 , 2011 4:55 PM
**To:** Orrell, Stanley A; Pickering, Susan Y
**Cc:** Lee, Richard; Gibson, Kathy; Powers, Dana A
**Subject:** Questions from NY Times

I keep forgetting to report in that I got a call from a Ms Joe Becker from the NY Times who had been reading a a Sandia publication:

SAND2010-1633
Unlimited Release
Printed April, 2010
**Synthesis of VERCORS and Phebus Data in Severe Accident Codes and Applications**
Randall O. Gauntt

She had a question or two about the MOX/HBU modeling and test results from Phebus and Vercors tests. Specifically she asked about differences in release rate of fission products between LEU fuel and MOX fuel that are observed as release begins at around 2000K.

I answered her technical questions of clarification.

It didn't start out like an interview, but I think we will be mentioned in a forthcoming article. I did learn in the conversation that she was mentioning in the same article information from Ed Lyman of the UCS.

I know I need to report this, but not clear on who to send this to.

Like I said, the conversation was focused on understanding the information in the open report which I judged at the moment to be OK.

By the way, I have declined to respond to repeated interview requests from Associated Press.

randy

| | |
|---|---|
| **From:** | Miller, Charles |
| **To:** | Leeds, Eric; Johnson, Michael; Wiggins, Jim; Sheron, Brian; Moore, Scott; Zimmerman, Roy; Dean, Bill; McCree, Victor; Satorius, Mark; Collins, Elmo; Haney, Catherine; Doane, Margaret |
| **Cc:** | Virgilio, Martin; Weber, Michael; Borchardt, Bill; Grobe, Jack; Holahan, Gary; Williamson, Edward; Spencer, Mary; Cubbage, Amy; Sanfilippo, Nathan; Dorman, Dan |
| **Subject:** | Task force support and outline |
| **Date:** | Friday, April 01, 2011 3:32:20 PM |
| **Attachments:** | Task Force Report Outline.docx<br>Charter.docx |
| **Importance:** | High |

Over the course of the past week, the task force has been chartered (attached) and begun its work. We have developed a working outline (also attached) that the task force will follow in pursuing this task. During this effort, we will need support from various agency technical experts from many of your offices or regions. We expect this input to largely be in the form of technical advice, informal briefings, and pulled from existing documents which will aid us in formulating our recommendations to the Commission. Please let me know the best way to coordinate support with your office. One method would be to identify a primary point of contact to coordinate support for the task force; however, I'm open to other suggestions to suit your needs. We will try to minimize the impact on your offices and regions resources so that you can continue to go about your normal agency responsibilities and duties.

To date, the task force has had the benefit of interviewing some members of the team dispatched to Japan to gain their insights and seek their feedback on the scope of our efforts (included in the attached outline). In addition, Dan Dorman will be joining the task force upon return from Japan which will further inform our efforts.

I appreciate your continued cooperation to ensure the success of this agency effort. For example, we have already been able to schedule meetings next week with agency seismic and flooding experts. We will keep you informed as the review progresses, particularly on matters that could affect your programs.

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Draft – 4/1/11

# Organization of the Fukushima Task Force Report

1. Introduction

2. Commission Direction – Task Force Charter

3. Summary of the Events at Fukushima Daiichi

    a. Earthquake
    b. Tsunami
    c. Long-term loss of AC power
    d. Loss of cooling
    e. Core and spent fuel damage
    f. Hydrogen explosions
    g. Radiological releases

    We will write at the summary level. We need to collect information from other sources, create our write-up, and then have others review for validity (NRR OpE?).

4. Discussion of Approach to Formulating Recommendations
    a. Use of safety goals?
    b. Use of regulatory analysis guidelines?

5. Evaluation of NRC regulatory requirements, programs, and processes, and their implementation at U.S. plants (generically, by type/location, individually as appropriate)

    a. Screening Discussion
        i. Short-term review vs. long-term review
        ii. What is in scope vs. out of scope?
    b. Protection from Natural Phenomena
        i. Evaluation of the design basis and safety margins for seismic events
            1. Have U.S. plants considered the right bounding conditions for seismic events? (Does GI-199 need to be accelerated? Is current action enough?)
        ii. Evaluation of the design basis and safety margins for external events to protect against long-term station blackout (core and SFP?)
            1. Seismic
            2. Tsunami
            3. Other Flooding Issues
                a. Hurricanes (storm surge)
                b. Dam failures (flooding level)

c. Probable maximum precipitation (rivers and stream flooding, blizzard)
d. Internal flooding

4. External Fires
5. High Winds
    a. Hurricane winds
    b. Tornado winds
    c. Tornado missile
6. Sequentially related external events (e.g., earthquake causes tsunami)

iii. Evaluation of the design basis and safety margins for spent fuel pool integrity and cooling

c. Mitigation

i. Strategies for mitigating accidents at single or multiple units; including challenges from unit interactions

1. Strategies to Prevent Core Damage during a Long-Term Station Blackout (SBO)
    a. SBO rule and implementation
    b. SBO restoration capabilities and issues
    c. Instrumentation availability
    d. Staffing availability/effectiveness/protection
    e. Emergency operating procedures (EOPs) for coping with loss of A/C
    f. Severe accident management guidelines (SAMGs) for coping with loss of A/C
    g. 10 CFR 50.54(hh)(2)-type measures for coping with loss of A/C
2. Strategies to Prevent Fuel Damage in the Spent Fuel Pool
    a. SBO rule and implementation
    b. SBO restoration capabilities and issues
    c. Instrumentation availability
    d. Staffing availability/effectiveness/protection
    e. Emergency operating procedures (EOPs) for coping with loss of A/C
    f. Severe accident management guidelines (SAMGs) for coping with loss of A/C
    g. 10 CFR 50.54(hh)(2)-type measures for coping with loss of A/C
    h. Other spent fuel pool failure mechanisms
3. Strategies for Maintaining Reactor Containment Function
    a. SAMGs
    b. 10 CFR 50.54(hh)(2)-type measures
    c. Instrumentation availability
    d. Staffing availability/effectiveness/protection

e. Containment Performance Improvement program
    i. Containment venting capabilities
    ii. Hardened vents
f. Hydrogen control measures
g. SAMG training and procedures

4. Strategies for Maintaining Spent Fuel Pool Containment Function
    a. SAMGs
    b. 10 CFR 50.54(hh)(2)-type measures
    c. Instrumentation availability
    d. Hydrogen combustion control measures
    e. SAMG training and procedures

d. Preparedness and Response to Emergencies (note: consider MOX)
    i. Evaluation of Planning Framework
        1. Protection from Plume Exposure
            a. Emergency Planning Zone
            b. Protective Action Recommendations
            c. Use and availability of KI
            d. External event challenges/infrastructure damage
            e. Evacuation Time Estimates
        2. Protection from Ingestion Pathways
            a. Emergency Planning Zone
            b. Protective Action Recommendations
            c. Measures to control food and water exposures
            d. External event challenges/infrastructure damage
    ii. Licensee Dose Projection Capability
    iii. Radiation Monitoring (onsite/offsite)
    iv. Emergency Communications During Natural Disasters and SBO
        1. Emergency Response Data System
        2. Availability and capability of communications equipment
    v. Command and Control
        1. Agreements with outside organizations to support utility
        2. Impact on licensee when NRP is invoked
e. Evaluation of NRC Programs
    i. Reactor inspection
    ii. Near-term licensing impacts
    iii. Safety/security interface

6. International Cooperation and Coordination

7. Information Provided by Stakeholders

8. Conclusions and Recommendations
    a. Applicability regardless of initiating event
    b. Sufficiency of structure to ensure safety goals remain met

c. Priority?
d. Recommendations
    i. Near-term/immediate operational or regulatory issues
    ii. Long-term recommendations for follow-up
        1. Issues
        2. Research
        3. Resources
e. Conclusions

**CHARTER FOR THE NUCLEAR REGULATORY COMMISSION TASK FORCE**

**TO CONDUCT A NEAR-TERM EVALUATION OF THE NEED FOR AGENCY ACTIONS**

**FOLLOWING THE EVENTS IN JAPAN**

Objective

The objective of this task force is to conduct a methodical and systematic review of relevant NRC regulatory requirements, programs, and processes, and their implementation, to recommend whether the agency should make near-term improvements to our regulatory system. This task force will also identify a framework and topics for review and assessment for the longer-term effort.

Scope

The task force review will include the following:

a. A near-term review to:

- Evaluate currently available technical and operational information from the events that have occurred at the Fukushima Daiichi nuclear complex in Japan to identify potential or preliminary near-term/immediate operational or regulatory actions affecting domestic reactors of all designs, including their spent fuel pools. The task force will evaluate, at a minimum, the following technical issues and determine priority for further examination and potential agency action:
    - External event issues (e.g. seismic, flooding, fires, severe weather)
    - Station blackout
    - Severe accident measures (e.g., combustible gas control, emergency operating procedures, severe accident management guidelines)
    - 10 CFR 50.54 (hh)(2) which states, "Each licensee shall develop and implement guidance and strategies intended to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities under the circumstances associated with loss of large areas of the plant due to explosions or fire, to include strategies in the following areas: (i) Fire fighting; (ii) Operations to mitigate fuel damage; and (iii) Actions to minimize radiological release." Also known as B.5.b.
    - Emergency preparedness (e.g., emergency communications, radiological protection, emergency planning zones, dose projections and modeling, protective actions)
- Develop recommendations, as appropriate, for potential changes to NRC's regulatory requirements, programs, and processes, and recommend whether generic communications, orders, or other regulatory actions are needed.

ENCLOSURE

b. Recommendations for the content, structure, and estimated resource impact for the longer-term review.

Coordination and Communications

The near-term task force will:

- Solicit stakeholder input as appropriate, but remain independent of industry efforts.
- Coordinate and cooperate where applicable with other domestic and international efforts reviewing the events in Japan for additional insights.
- Provide recommendations to the Commission for any immediate policy issues identified prior to completion of the near-term review.
- Provide recommendations to program offices for any immediate actions not involving policy issues, prior to completion of the near-term review.
- Identify resource implications of near-term actions.
- Consider information gained from Temporary Instruction 2515/183, "Followup to the Fukushima Daiichi Nuclear Station Fuel Damage Events."
- Develop a communications plan.
- Update and brief internal stakeholders, as appropriate.

Expected Product and Schedule

The task force will provide its observations, conclusions, and recommendations in the form of a written report to the Deputy Executive Director for Reactor and Preparedness Programs at the completion of the 90-day near-term review.

During the development of its report, the task force will brief the Commission on the status of the review at approximately the 30- and 60-day points.

The report will be transmitted to the Commission via a SECY paper, and the task force will brief the Commission on the results of the near-term effort at approximately the 90-day point. The report will be released to the public via normal Commission processes.

The task force will recommend a framework for a longer-term review as a part of the near-term report. The longer-term review will begin as soon as the NRC has sufficient technical information from the events in Japan (with a goal of beginning by the end of the near-term review).

Staffing

The task force will consist of the following members:

| | | |
|---|---|---|
| Leader | Charles Miller | FSME |
| Senior Managers | Daniel Dorman | NMSS |
| | Jack Grobe | NRR |
| | Gary Holahan | NRO |
| Senior Staff | Amy Cubbage | NRO |
| | Nathan Sanfilippo | OEDO |
| Administrative Assistant | Cynthia Davidson | OGC |

Additional task force members will be added as needed. For the near-term review, other staff members may be consulted on a part-time basis.

EDO Interface

The task force will keep agency leadership informed on the status of the effort and provide early identification of significant findings. The task force will report to Martin J. Virgilio, Deputy Executive Director for Reactor and Preparedness Programs.

## Bano, Mahmooda

**From:** Scott, Michael
**Sent:** Friday, April 01, 2011 8:28 AM
**To:** Smith, Stephen
**Subject:** Re: Congrats

Thanks Steve. I'm still in Japan - going home wednesday.

Hope all well with you.

Mike

Sent from my NRC blackberry
Michael Scott
301-873-3289

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**From:** Smith, Stephen
**To:** Scott, Michael
**Sent:** Fri Apr 01 08:12:10 2011
**Subject:** Congrats

Mike,

Congratulations on your promotion.

I hope all went well in Japan. I'm sure it was more fun than anyone should be allowed to have at work.

Steve
415-3190



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## Bano, Mahmooda

**From:** Scott, Michael
**Sent:** Saturday, April 02, 2011 2:45 AM
**To:** Ali, Syed; Sheikh, Abdul
**Cc:** Sheikh, Abdul; Case, Michael; Richards, Stuart; Hogan, Rosemary; Holian, Brian; Auluck, Rajender
**Subject:** RE: Japan Structural Team Report

Great work guys - well written and concise. Thanks.

Mike

-----Original Message-----
From: Ali, Syed
Sent: Saturday, April 02, 2011 2:23 AM
To: Scott, Michael
Cc: Sheikh, Abdul; Case, Michael; Richards, Stuart; Hogan, Rosemary; Holian, Brian; Auluck, Rajender
Subject: Japan Structural Team Report

Mike:

Please see attached Japan Structural Team Report.

Thanks,
Syed and Abdul



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## Ross, Robin

**From:** Wertz, Trent on behalf of Leeds, Eric
**Sent:** Thursday, April 14, 2011 11:31 AM
**To:** Wertz, Trent
**Subject:** FW: FUKUSHIMA AND MDEP
**Attachments:** WENRA task force.doc; WENRA JAPAN STATEMENT.doc; Stress Tests.ppt; Finnish stress tests.DOC

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**From:** Holahan, Gary NRO
**Sent:** Thursday, March 24, 2011 12:49 PM
**To:** Miller, Charles; Grobe, Jack; Sanfilippo, Nathan; Virgilio, Martin
**Cc:** Johnson, Michael; Williams, Donna; Leeds, Eric
**Subject:** FW: FUKUSHIMA AND MDEP

Info sharing starting on new reactors ... more work needed for coordination on operating reactors

I will be forwarding the Commission tasking paper and later the Charter

Gary

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**From:** Lawrence.BURKHART@oecd.org [mailto:Lawrence.BURKHART@oecd.org]
**Sent:** Thursday, March 24, 2011 10:54 AM
**To:** petteri.tiippana@stuk.fi; gclapiss@nnr.co.za; k210kig@kins.re.kr; Dave.Watson@hse.gsi.gov.uk; slee@kins.re.kr; Douglass.Miller@cnsc-ccsn.gc.ca; abe-kiyoharu@jnes.go.jp; Lawrence.Burkhart@oecd.org; thomas.houdre@asn.fr; Rosales-Cooper, Cindy; yuichi.onoda@cao.go.jp; Holahan, Gary; Philippe.Gress@oecd.org; javier.reig@oecd.org; ohmura-tetsuo@meti.go.jp; jiangwei@mep.gov.cn; j.lyons@iaea.org; David.Newland@cnsc-ccsn.gc.ca; i.sokolova@gosnadzor.ru; len.creswell@hse.gsi.gov.uk; M.Lipar@iaea.org; M.El-Shanawany@iaea.org; alejandro.huerta@oecd.org; Williams, Donna; bvs@gan.ru; sebastien.crombez@asn.fr
**Cc:** adeline.clos@asn.fr; Geoffrey.Vaughan@hse.gsi.gov.uk; EuropaM@nnr.co.za; diane.jackson@oecd.org; yindejian@tsinghua.org.cn; byung-soon.kim@oecd.org; oshima-toshiyuki@meti.go.jp; Doane, Margaret; PBester@nnr.co.za; fujiensc@163.com; bogdan@secNRS.RU; Rosales-Cooper, Cindy; k076kbs@kins.re.kr; huliguang@tom.com; bannai-toshihiro@meti.go.jp; v.kolobov@gan.ru; olivier.gupta@asn.fr; Marcel.deVos@cnsc-ccsn.gc.ca; akane.kawasue@cao.go.jp; akihide.hidaka@cao.go.jp; SRokita@nnr.co.za; sebastien.crombez@asn.fr
**Subject:** FUKUSHIMA AND MDEP

Dear MDEP STC members,

Bonjour! In an effort to keep MDEP members as up to date as possible on what each national regulator is undertaking in response to the Fukushima events, the NEA MDEP technical secretariat is gathering information as provided to us and placing that information in the MDEP library at:

https://www.mdep.oecd-nea.org/mdep/workspaces/sc/fukushima_info_shari/

In the MDEP Library, subfolders have been set up under the STC folder and by country and organization (WENRA, IAEA, NEA).

**We encourage you to share information about what your national regulatory authority is doing** so that we can keep each other informed about the work that is going on. Of course the MDEP continues to recognize and support the independent work that each regulator is doing in response to these events and we hope that this continued sharing of information will help each regulator be stronger in its efforts. Exchanging information as part of MDEP has proven to be



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an invaluable resource when it comes to cooperating multilaterally on significant safety issues as well as communicating to our stakeholders.

Please find attached information about recent WENRA statements and intended actions as well as information from Finland. Mr. Laaksonen and Mr. Lacoste hosted a press conference yesterday to discuss WENRA's, Finland's, and France's activities in light of the recent events in Japan. The video of the press conference may be found at :

http://qsb.webcast.fi/s/stuk/stuk_2011_0323_tiedotustilaisuus/

We anticipate that the NRC and ASN will be providing information to us soon about what each of their organizations will be doing over the short (30, 60, and 90 days or so) and long-terms to address these issues also. Task forces have been formed in these organizations to address Fukushima-related events. As soon as we receive relevant information, we will distribute to all MDEP STC members. If there are other members of your organizations that you would like copied on such emails in addition to yourselves, please let us know. Again, we will place all of these documents in the MDEP library so that you may access them when you like.

The issues brought up by the Fukushima events and how they may relate to MDEP activities are planned to be discussed in many upcoming MDEP meetings, including the STC meeting 27 – 29 April and the PG meeting 7 June. If working group chairs believe it is appropriate to discuss related issues in their WGs, please let your NEA technical secretariat and other WG members know. With that said, we also recognize that regulators will be taking steps in the very near future and that it probably is wise to share information prior to the meeting dates. So, if you have information that you think would be of interest to other MDEP regulators, please forward to us so that we can share with all.

Very Best Regards,

Larry Burkhart
Project Officer
Multinational Design Evaluation Programme
OECD-Nuclear Energy Agency
www.oecd-nea.org

WENRA – 23 March 2011

# First proposal about European "stress tests" on nuclear power plants

## Definition and objective

We define a "stress test" as a targeted reassessment of the safety margins of NPPs in the light of the events which occurred in Fukushima.

This reassessment will be based on the existing safety studies and engineering judgement to evaluate the behaviour of a nuclear power plant when facing a set of challenging situations (those envisaged under the following section "technical scope").

For a given plant, the reassessment will report on the behaviour of the plant (most probable behaviour, with mention of potential cliff-edge effect) for each of the considered situations.

The results of the reassessment may indicate a need for additional safety provisions being technical or organisational (such as procedures, human resources, emergency response organisation, use of external resources).

It remains a national responsibility to take any appropriate measures resulting from the reassessment.

## Technical scope

The scope takes into account the issues that have been directly highlighted by the events that occurred in Fukushima and the possibility for combination of initiating events. The following situations will be envisaged:

Initiating events
1. Earthquake exceeding the design basis
2. Flooding exceeding the design basis
3. Other extreme external conditions challenging the specific site

Consequential loss of safety functions
4. Prolonged total loss of electrical power
5. Prolonged loss of the ultimate heat sink

Accident management issues
6. Core melt accident, including consequential effects such as hydrogen accumulation
7. Degraded conditions in the spent fuel storage, including consequential effects such as the loss of shielding of radiation

Consideration should be given to:
- automatic actions,
- operators actions specified in emergency operating procedures,

- any other planned measures of prevention, recovery and mitigation of accidents,
- the situation outside the plant
- the possibility of several units being affected at the same time.

Given the tight timeframe of the exercise, very clear guidance for each selected scenario will be developed by WENRA.

**Methodology and timeframe**

The licensee has the prime responsibility for safety. Hence, it is up to the licensees to perform the reassessments, and to the regulatory bodies to independently review them.

A task force of WENRA should conduct discussions with the European nuclear industry and bring its proposal to the European Nuclear Safety Regulators Group (ENSREG) meeting scheduled on the 12th of May. This proposal will then be presented and further discussed at the European level.

Timeframe needs further consideration, taking into account the available resources for daily focus on safety. The following figures are just indications.

The licensees could be given 6 months to perform the reassessments as described above and to send the results and related documentation to their national regulator.

The regulator then would perform a review of the licensees' submissions. Interactions between European regulators will be necessary and could be managed through WENRA or ENSREG. Regulators will perform, within 3 months, the review and produce a report which should be published.

Results of the reviews could be discussed in a public seminar, to which other experts (from non nuclear field, from NGOs, etc) should be invited.

23 March 2011

# WENRA STATEMENT ON THE FUKUSHIMA NPP ACCIDENT

The Heads of the nuclear regulatory bodies of European nations with nuclear power plants met in Helsinki on the 22 and 23 March 2011. During the meeting WENRA discussed the tragic events in Japan, and in particular the role of nuclear safety regulators in understanding the circumstances.

WENRA wishes to express its utmost sympathy for the plight of the Japanese people, its admiration of the dedication of those personnel in responding to the event on the site, and its desire to offer what ever help it could to assist in the response and learning from the event.

At the present time the event is still in progress and much difficult work is required to bring the plant under full control. Furthermore, continued vigilance will be required for weeks if not months to come and the management of the consequences may take decades.

WENRA recognises that, despite the high levels of safety for European nuclear plants, it is important to learn any immediate lessons from the Fukushima accident and to aim for the highest levels of safety in line with the fundamental principle of nuclear safety – continuous improvement.

To this end, in addition to national level initiatives, and in response to discussions at the Council of the European Union for Energy held on 21st March, a WENRA task force is working to provide urgently an independent regulatory technical definition of a "stress test" and how it should be applied to nuclear facilities across Europe. This will take account of the detailed work which WENRA has done for existing reactors (safety reference levels) and for new reactors (safety objectives for new nuclear power plants). A proposal for this work has been prepared.

The aim of the work is to see what improvements to nuclear safety may be appropriate in light of the Fukushima nuclear accident, as far as it is understood. It will be given to European Nuclear Safety Regulators' Group (ENSREG) to assist in its response to requests for advice from the Council of the European Union and European Commission.

Additionally, WENRA members will be offering to the IAEA to send nuclear experts to their response centre to assist them in responding to the ongoing event, and possible future events, to understand the circumstances and lessons to be learnt, and to provide real time authoritative information to regulatory bodies.

# A LIST OF ISSUES SUGGESTED FOR ASSESSEMENT IN THE AFTERMATH OF FUKUSHIMA NPP

Jukka Laaksonen

# Summary

- Re-evaluation of external threats
  - emphasis in threats to AC power supply
  - coincident events / threats
  - damage to external infrastructure (roads, information transfer)
- On-site AC power supply and contingency measures
- Available heat sinks: designed systems and contingencies
- Decay heat removal possibilities
  - reactor core
  - spent fuel pools
  - Containment
- Availability of qualified people to handle accident in long-term

**Extreme weather and natural conditions at the plant site: potential impact to off-site or on-site power supply or to the functionality of the decay heat removal systems.**

Design basis limits and assumptions

- Assessment of the suitability of these limits and assumptions.
- Assessment of the possible needs to modify the previous design basis.

Short description of the design provisions against each weather and natural condition.

- Assessment of the sufficiency of the provisions.
- Potential possibilities to improve provisions if it is assessed to be necessary.

## Earthquakes taken into account in the design

Design basis earthquake and the methods used to define it.

- Summary of the safety analysis concerning earthquakes and of the measures done based on the analysis to ensure the safety.

- Potential possibilities to improve provisions if it assessed to be necessary.

**Other external threats that have been taken into account in the design.**

Include also the threats to the plant's electrical systems that are caused by disturbances in the national electric grid, plant's switchyard, transformers or main generator. Include also threats of lightning.

- A short summary on how the reliability of the normal and emergency AC power systems of the plant has been evaluated and improved, taking into account operating experience
- Assessment of the suitability of assumptions concerning each threat and the need to modify the assumptions.

Short description of the provisions concerning each threat

- Assessment of the sufficiency of the provisions
- Potential possibilities to improve provisions if it is assessed to be necessary.

Consider also the mutual dependencies of the external events and the possibility that they coincide.

Take into account the possible disturbances or loss of communications (traffic and data transfer).

## Reliability of power supply in a situation of the loss of off-site power

Reserve power sources designed for loss of off-site power

- Possibilities for crossed pinning between plant unit's safety divisions and different plant units. Assessment of the time required to make the crossed pinning.

Other AC power sources at the plant site or nearby that can be connected to supply power directly to the plant.

- Time needed to connect each electricity source
- How the power supply can connected.
- How each connection is protected against extreme weather conditions and external threats.

Possibilities to get portable AC power sources to the plant

- Power, voltage levels, and capability to carry transient loads
- Assessment of the time needed to transport these devices and risks related to the transport in extreme conditions.
- Connection to the plant's electric power supply system.

Assessment of the possibilities to improve the availability and connection possibilities of the contingency AC power devices

## A summary of the heat sinks suitable for the cooling of the reactor and spent fuel, their adequacy, and reliability.

Provisions in case the sea water intake tunnel is blocked.

Possibilities to remove heat to the atmosphere.

Water storage tanks containing demineralized water

- Possibilities and arrangements to fill these water tanks, taking into account also water of lower quality that is available in the neighborhood of the plant.
- Assessment of the need and possibilities to improve these arrangements.

Temporary provisions for feeding water directly from portable water sources (fire trucks) in extreme conditions into the reactor cooling system, PWR secondary system or spent fuel storage pools.

- Time needed to make these temporary arrangements
- Availability of personnel needed for this task.
- Assessment of the need and possibilities to improve the pipeline connections necessary to enable these temporary arrangements.

**A summary of the alternative possibilities to remove the residual heat when the reactor is at a hot shutdown state.**

- Verification of the availability of skilled personnel and appropriate procedures for utilization of each possibility.

**A summary of the alternative possibilities to get the reactor into cold shutdown state from the hot shutdown state.**

- Verification of the availability of skilled personnel and appropriate procedures for utilization of each possibility

**A summary of the alternative possibilities to remove the residual heat from the containment so that the pressure and the temperature do not exceed the design basis values.**

- Verification of the availability of skilled personnel and appropriate procedures for utilization of each possibility.

**A summary of the alternative possibilities to cool each of the spent fuel pools.**

- Assessment of the largest possible heat power in each spent fuel pool.
- Verification of the availability of skilled personnel and appropriate procedures for utilization of each possibility.

**Assessment of the adequacy of the available personnel for each of the relevant key tasks, taking into account potential accident situations lasting long and concerning more than one plant unit.**

1/C42259/2011

March 20, 2011

**A LIST OF ISSUES THAT STUK IS PLANNING TO ASSES TOGETHER WITH NPP LICENSE HOLDERS AND REPORT TO THE MINISTRY IN THE AFTERMATH OF FUKUSHIMA NPP**

1. Extreme weather and natural conditions at the plant site that can have effect on the reliability of plant's off-site or on-site power supply or on the functionality of the residual heat removal systems.
   - Design basis limits and assumptions regarding each weather and natural condition. Assessment of the suitability of these limits and assumptions compared to today's knowledge taking into account the historical information of the weather and natural phenomena, and the predicted development of these during the planned lifetime of the plant. Assessment of the possible needs to modify the previous design basis.
   - Short description of the design provisions against each weather and natural condition.
   - Assessment of the sufficiency of the provisions.
   - Potential possibilities to improve provisions if it is assessed to be necessary.

2. Earthquakes taken into account in the design
   - Design basis earthquake and the methods used to define it.
   - Summary of the safety analysis concerning earthquakes and of the measures done based on the analysis to ensure the safety.
   - Potential possibilities to improve provisions if it assessed to be necessary.

3. Other external threats that have been taken into account in the design. Threats shall include also the threats to the plant's electrical systems that are caused by disturbances in the national electric grid, plant's switchyard, transformers or main generator. Threats of lightning are assessed together with other threats to electrical systems. In addition, a short summary will be presented on how the reliability of the normal and emergency AC power systems of the plant has been evaluated and improved, taking into account reported operating experience from other nuclear power plants.
   - Assessment of the suitability of assumptions concerning each threat and the need to modify the assumptions.

- Short description of the provisions concerning each threat
- Assessment of the sufficiency of the provisions
- Potential possibilities to improve provisions if it is assessed to be necessary.

4. Under items 1-3 one should consider also the mutual dependencies of the external events and the possibility that they coincide. In addition, one should take into account the possible disturbances or loss of communications (traffic and data transfer).

5. Reliability of power supply in a situation of the loss of off-site power
   - Short description of the reserve power sources designed in case of loss of off-site power and possibilities for crossed pinning between plant unit's safety divisions and different plant units. Assessment of the time required to make the crossed pinning.
   - Other AC power sources at the plant site or nearby that can be connected to supply power directly to the plant. Information of the time needed to connect each electricity source and information of the place where the connection can be performed. Information how these connections are protected against extreme weather conditions and external threats.
   - Possibilities to get portable AC power sources to the plant, and information on these devices concerning the maximum power, voltage levels, and capability to carry transient loads related to start-up of electrical motors. Assessment of the time needed to transport these devices and risks related to the transport in extreme conditions.
   - Information of the arrangements enabling the connection of the portable AC power sources to the plant's electric power supply system.
   - Assessment of the possibilities to improve the availability and connection possibilities of those AC power devices that would function as AC power sources in a situation where the on-site reserve power sources were lost.

6. A summary of the heat sinks suitable for the cooling of the reactor and spent fuel, their adequacy, and reliability. References to provisions described in Sections 1-3 can be used if necessary.
   - Provisions in case the sea water intake tunnel is blocked.
   - Possibilities to remove the heat to the atmosphere.
   - Water storage tanks containing demineralized water that is available for feeding coolant into the reactor and the spent fuel pools. Possibilities and arrangements to fill these water tanks, taking into account also water of lower quality that is available in the neighborhood of the plant. Assessment of the need and possibilities to improve these arrangements.
   - Temporary provisions for feeding water directly from portable water sources (fire trucks) in extreme conditions into the reactor cooling

system, pressure water reactor secondary system or spent fuel storage pools. Assessment of the time needed to make these temporary arrangements and the availability of the personnel needed for this task. Assessment of the need and possibilities to improve the pipeline connections necessary to enable these temporary arrangements.

7. A summary of the alternative possibilities to remove the residual heat when the reactor is at a hot shutdown state.
   - Verification of the availability of skilled personnel and appropriate procedures for utilization of each possibility.

8. A summary of the alternative possibilities to get the reactor into cold shutdown state from the hot shutdown state.
   - Verification of the availability of skilled personnel and appropriate procedures for utilization of each possibility

9. A summary of the alternative possibilities to remove the residual heat from the containment so that the pressure and the temperature do not exceed the design basis values.
   - Verification of the availability of skilled personnel and appropriate procedures for utilization of each possibility.

10. A summary of the alternative possibilities to cool each of the spent fuel pools. Assessment of the largest possible heat power that can be released as a sum of the fuel assemblies in each spent fuel pool.
    - Verification of the availability of skilled personnel and appropriate procedures for utilization of each possibility.

11. Assessment of the adequacy of the available personnel for each of the relevant key tasks, taking into account potential accident situations lasting long and concerning more than one plant unit.

## Bano, Mahmooda

**From:** Hochevar, Albert R. (INPO) [HochevarAR@INPO.org]
**Sent:** Sunday, April 03, 2011 5:57 AM
**To:** Scott, Michael; Blamey, Alan; Miller, Marie
**Subject:** FW: TEPCO Mega Float
**Attachments:** 20110403 TEPCO Megafloat.doc

All,
For you situational awareness,
Al

---

**From:** Matsuda, Michio [mailto:mmatsuda@epri.com]
**Sent:** Sunday, April 03, 2011 10:01 AM
**To:** Hochevar, Albert R. (INPO); Fadel, Daniel P; keith.moser@exeloncorp.com
**Subject:** TEPCO Mega Float

FYR

Matsuda

---





w/244

20110403 GE TEPCO Megafloat

Saturday, April 2, 2011

# Tepco May Use Floating Island To Hold Tainted Water

TOKYO (Nikkei)--Tokyo Electric Power Co. (9501) on Friday began exploring the option of using a large artificial floating island to store contaminated water from its troubled nuclear power plant.

Tepco has been struggling to secure space for storing the radioactive water that has been pooling in the basements of turbine buildings.

The city of Shizuoka said Friday that it will provide a so-called megafloat that serves as a fishing park in Shimizu Port after receiving a request from the firm. This steel structure is said to be able to hold around 10,000 tons of water without sinking.

Tepco will tow the floating island to a Kanagawa Prefecture shipyard, where it will be outfitted, then transport it to alongside the Fukushima Daiichi plant. The power utility has yet to decide when to start using the megafloat.

Tepco also began spraying a resin on the plant grounds from 3 p.m. Friday to prevent the spread of radioactive materials. It sprayed an area of 500 sq. meters near the No. 4 reactor with 2,000 liters of the resin.

Jeff Immelt -- chairman and chief executive officer of General Electric Co., which was in charge of the construction of the plant's No. 1 reactor -- will visit Japan for talks with Tepco Chairman Tsunehisa Katsumata on Sunday. Immelt promised March 14 to provide all manner of technological support to customer Tepco and the Japanese government.

Immelt is slated to meet with Minister of Economy, Trade and Industry Banri Kaieda on Monday and is also expected to discuss the nuclear energy business with the heads of Toshiba Corp. (6502) and Hitachi Ltd. (6501).

(The Nikkei April 2 morning edition)

## Ross, Robin

**From:** Wertz, Trent on behalf of Leeds, Eric
**Sent:** Thursday, April 14, 2011 10:36 AM
**To:** Wertz, Trent
**Subject:** FW: Eric Leeds NGA Presentation
**Attachments:** NGA_Presentation_srb.pptx

---

**From:** Burnell, Scott
**Sent:** Monday, April 04, 2011 12:36 PM
**To:** Leeds, Eric
**Cc:** Hayden, Elizabeth; Nelson, Robert
**Subject:** RE: Eric Leeds NGA Presentation

Hi Eric;

It looks fine from my perspective, I only made a couple minor edits to the notes (additions in red text and deletions in strikeout) for clarity's sake. This would probably be a good resource to make available on Sharepoint as a template for other presentations. Thanks.

Scott

---

**From:** Leeds, Eric
**Sent:** Friday, April 01, 2011 4:55 PM
**To:** Dean, Bill; Lew, David; Roberts, Darrell; McCree, Victor; Wert, Leonard; Satorius, Mark; Pederson, Cynthia; West, Steven; Howell, Art; Kennedy, Kriss
**Cc:** Johnson, Michael; Flanders, Scott; Wiggins, Jim; Evans, Michele; Virgilio, Martin; Weber, Michael; Miller, Charles; Holahan, Gary; Brenner, Eliot; Hayden, Elizabeth; Schmidt, Rebecca; Powell, Amy; Meighan, Sean; Ruland, William; Boger, Bruce; Cheok, Michael; Moore, Scott
**Subject:** Eric Leeds NGA Presentation

Attached is our first draft of a generic slide presentation for the Fukushima event. Its geared for a non-nuclear, public audience and is meant to be modified based on the time allowed (generally 30 minutes or less) and level of detail the presenter chooses to provide.

Your comments and suggestions are welcome and requested. Sean Meighan is our POC.

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-1270



W/245

U.S.NRC

United States Nuclear Regulatory Commission

*Protecting People and the Environment*

# Presentation on Fukushima to NGA Center for Best Practices

Eric Leeds, Director

Office of Nuclear Reactor Regulation

(NRR)

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United States Nuclear Regulatory Commission
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# NRC Mission – What Do We Do?

- The mission of the NRC is to license and regulate the Nation's civilian use of byproduct, source, and special nuclear materials in order to **protect public health and safety, promote the common defense and security, and protect the environment.**

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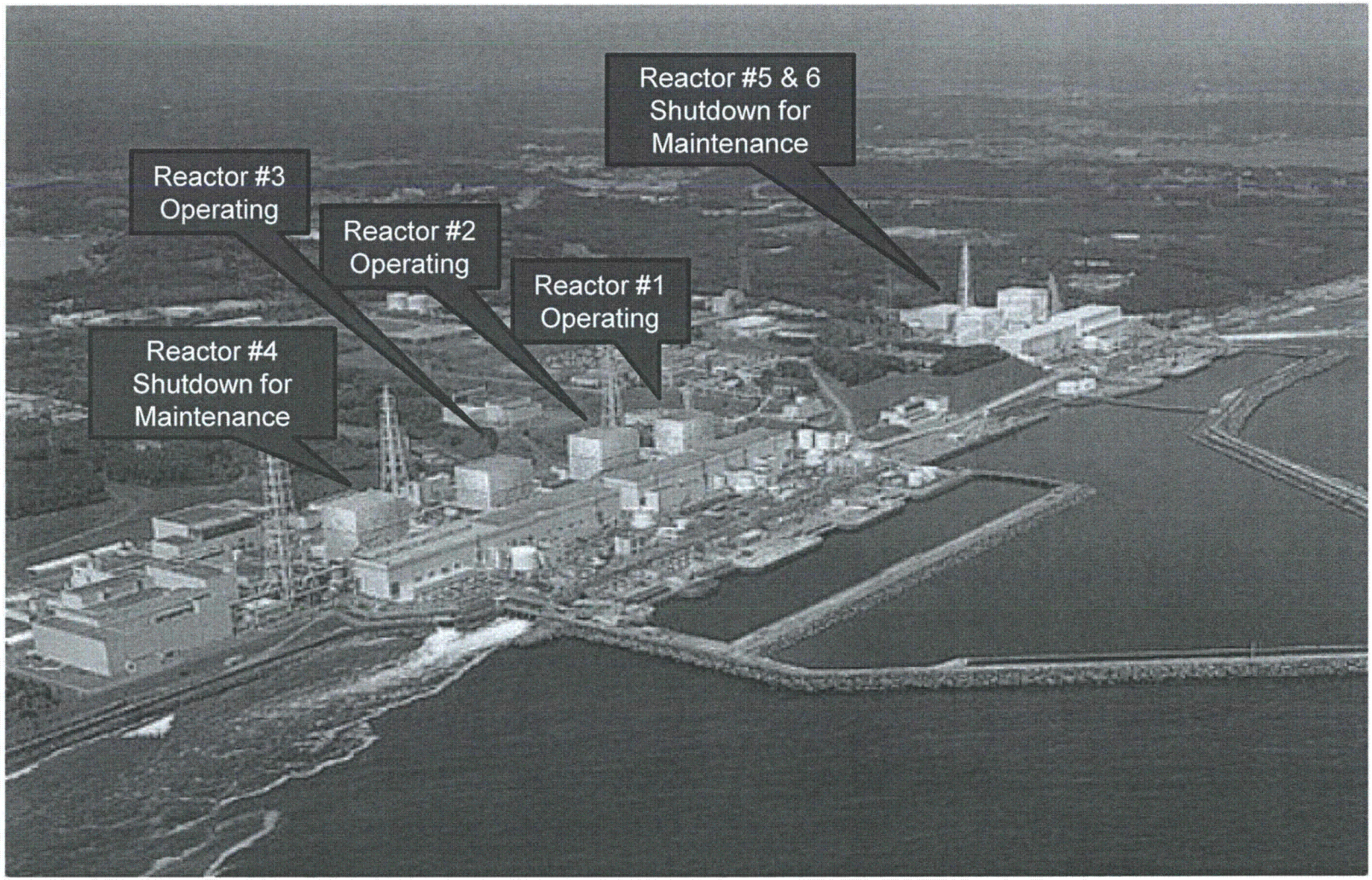
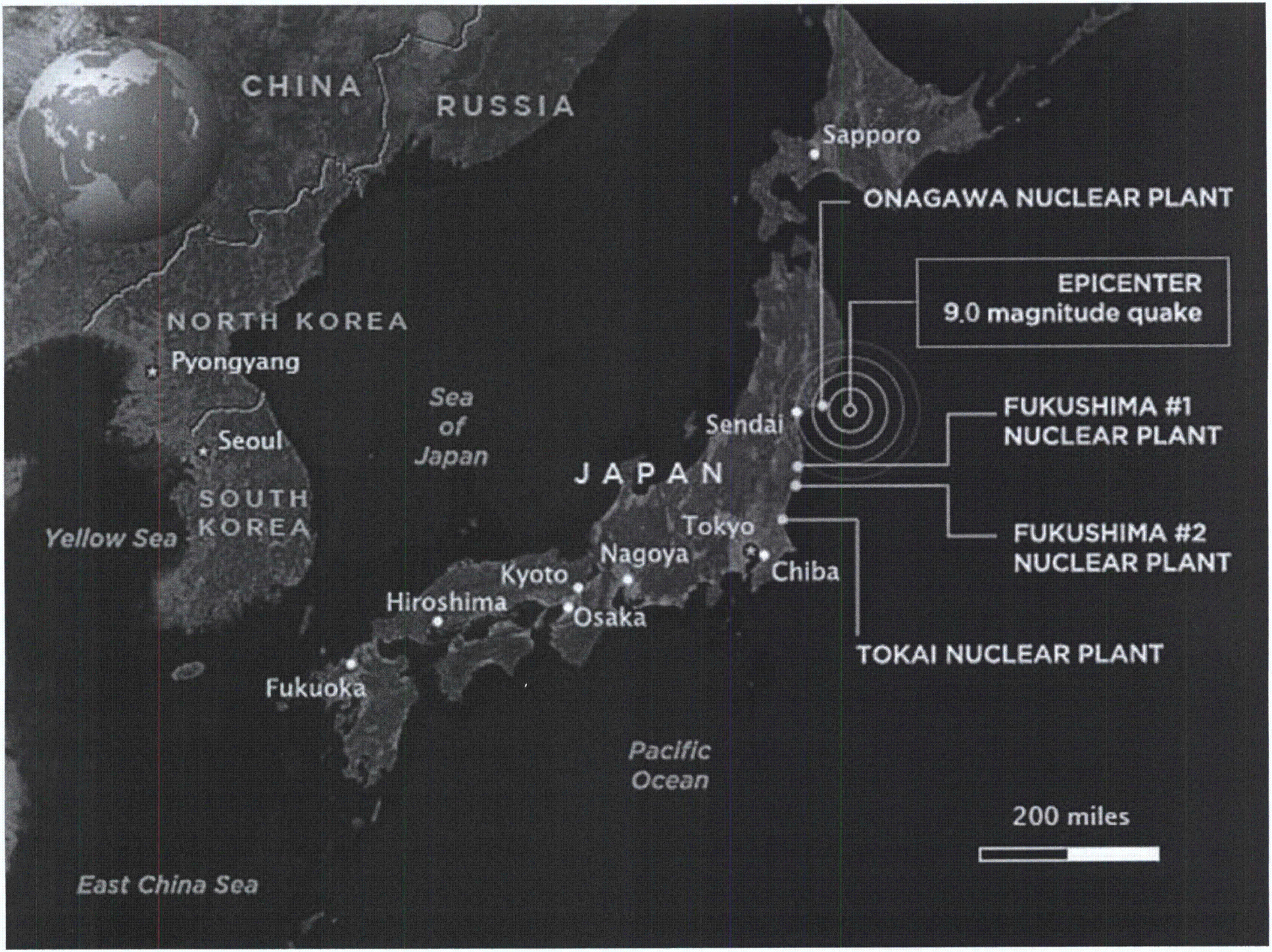
# Overview of Fukushima Daiichi Nuclear Power Station




CHINA
RUSSIA
Sapporo
ONAGAWA NUCLEAR PLANT
EPICENTER
9.0 magnitude quake
NORTH KOREA
Pyongyang
Sea
of
Japan
Sendai
FUKUSHIMA #1
NUCLEAR PLANT
Seoul
JAPAN
SOUTH
KOREA
Yellow Sea
Tokyo
FUKUSHIMA #2
NUCLEAR PLANT
Nagoya
Chiba
Kyoto
Hiroshima
Osaka
TOKAI NUCLEAR PLANT
Fukuoka
Pacific
Ocean
200 miles
East China Sea

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# Earthquake & tsunami sequence of events

Friday March 11th @ 2:36 pm local

- Magnitude 9.0 earthquake 231 miles northeast of Tokyo.
- Quake is fifth largest in the world (since 1900).
- Earthquake generated a 14m Tsunami

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# Plant Response

Earthquake

- Earthquake Caused Automatic Shutdown of 3 Operating Units
- Offsite Power Lost
- Initial indications were that Emergency Diesels operated

14m Tsunami (less than 1 hour later)

- All Emergency Back-up Power Lost
- 8-10 hours later Station Batteries Depleted

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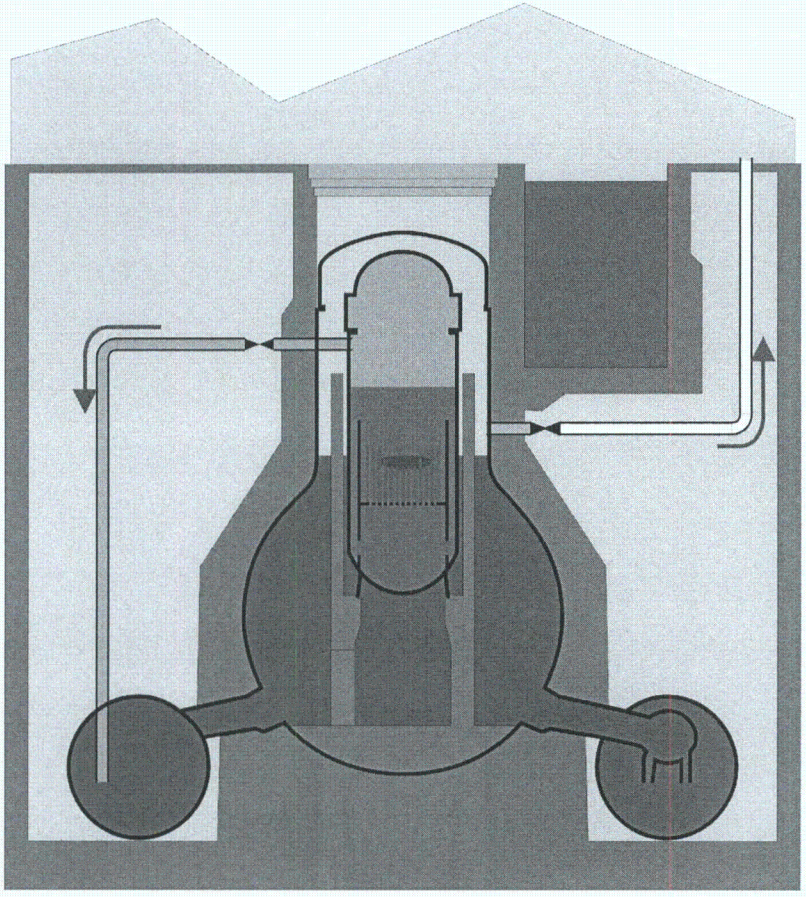
- Current status of the Reactors
  - Core Damage in Unit 1,2, 3
  - Electrical Power Restored
  - Fresh Cooling Water supplied to All Units
- Spent Fuel Pool Status
  - Suspect Fuel Damage in Pools 3 & 4
  - Providing periodic make up water



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# NRC Response

- Ops Center 24/7
- Team of experts to Tokyo
- Support to U.S. Ambassador and Japanese
- Coordinating Environmental Monitoring with DOE & EPA

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# Domestic Considerations

- No anticipated U.S. Health Effects from Fukushima
- U.S. Plants Designed for External Events
- NRC has initiated additional inspections at all U.S. Plants
- NRC conducting Near-Term and Long-Term Reviews.

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# NRC Near Term Actions

- Evaluate Fukushima Daiichi Events
- Domestic Operating Reactors and Spent Fuel Pools
  - External Events
  - Station Blackout
  - Severe Accident Mitigation
  - Emergency Preparedness
  - Combustible Gas Control
- Near Term Review due in 90 days (mid June)

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# NRC Longer Term Actions

- Based on Near Term Review and Additional Insights from Fukushima Event
- Identify Potential Technical and Policy Issues
  - Research Activities
  - Generic Issues
  - Reactor Oversight Process
  - Regulatory Framework
  - Interagency Emergency Preparedness

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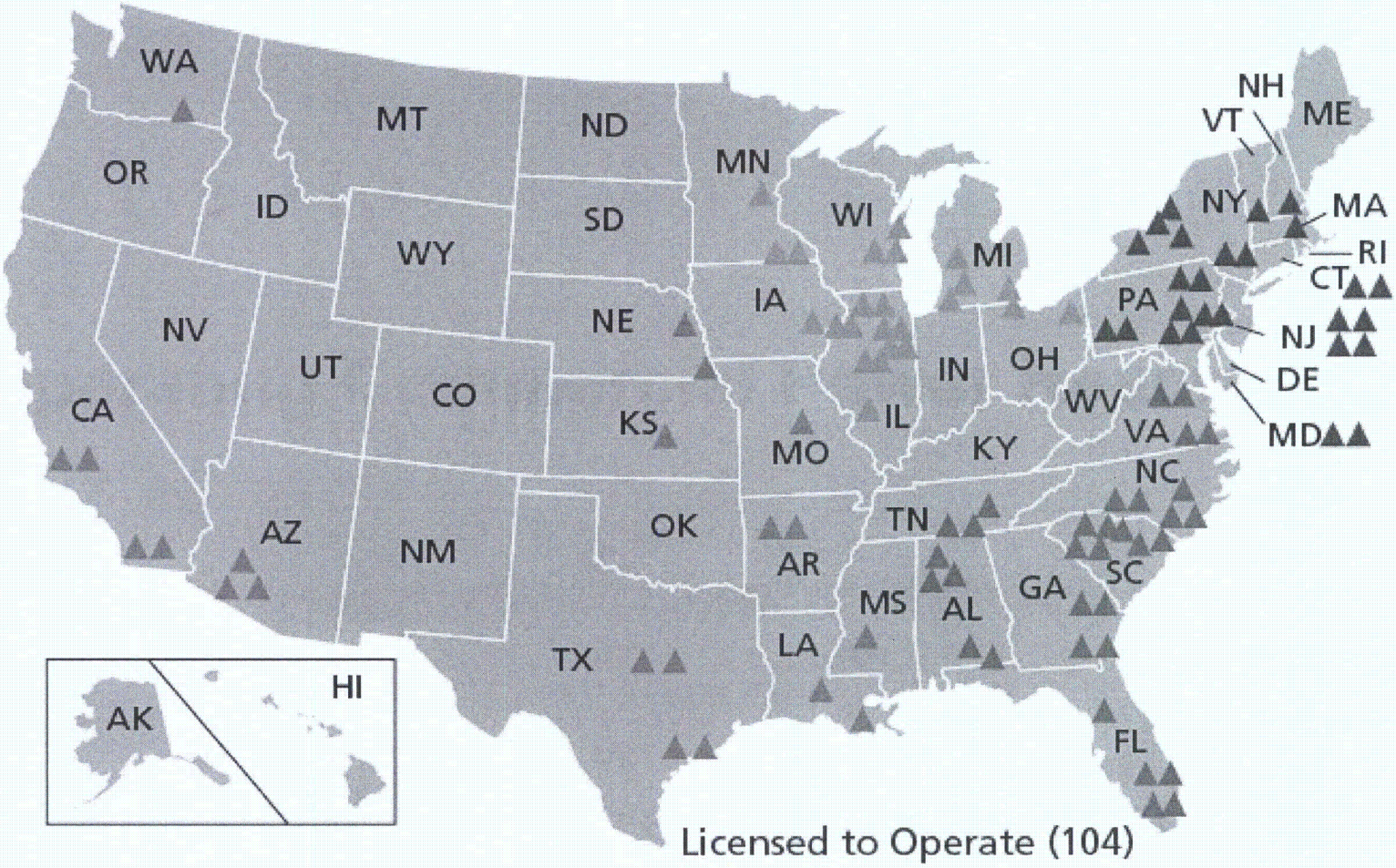
# Operating Commercial Power Reactors



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# Questions?

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# PARS

- NRC Regulations have 2 Emergency Planning Zones (EPZs)10/50 miles
- EPZs are not limits, but frameworks that allow for expansion as needed
- 50 miles in Japan due to extraordinary situation
  - 4 units severely challenged
  - Unclear information as to state of reactors, mitigative strategies, radiological releases
  - Decision to evacuate conservative, better to err conservatively
- Precautionary evacuation occurred days before fuel melt.

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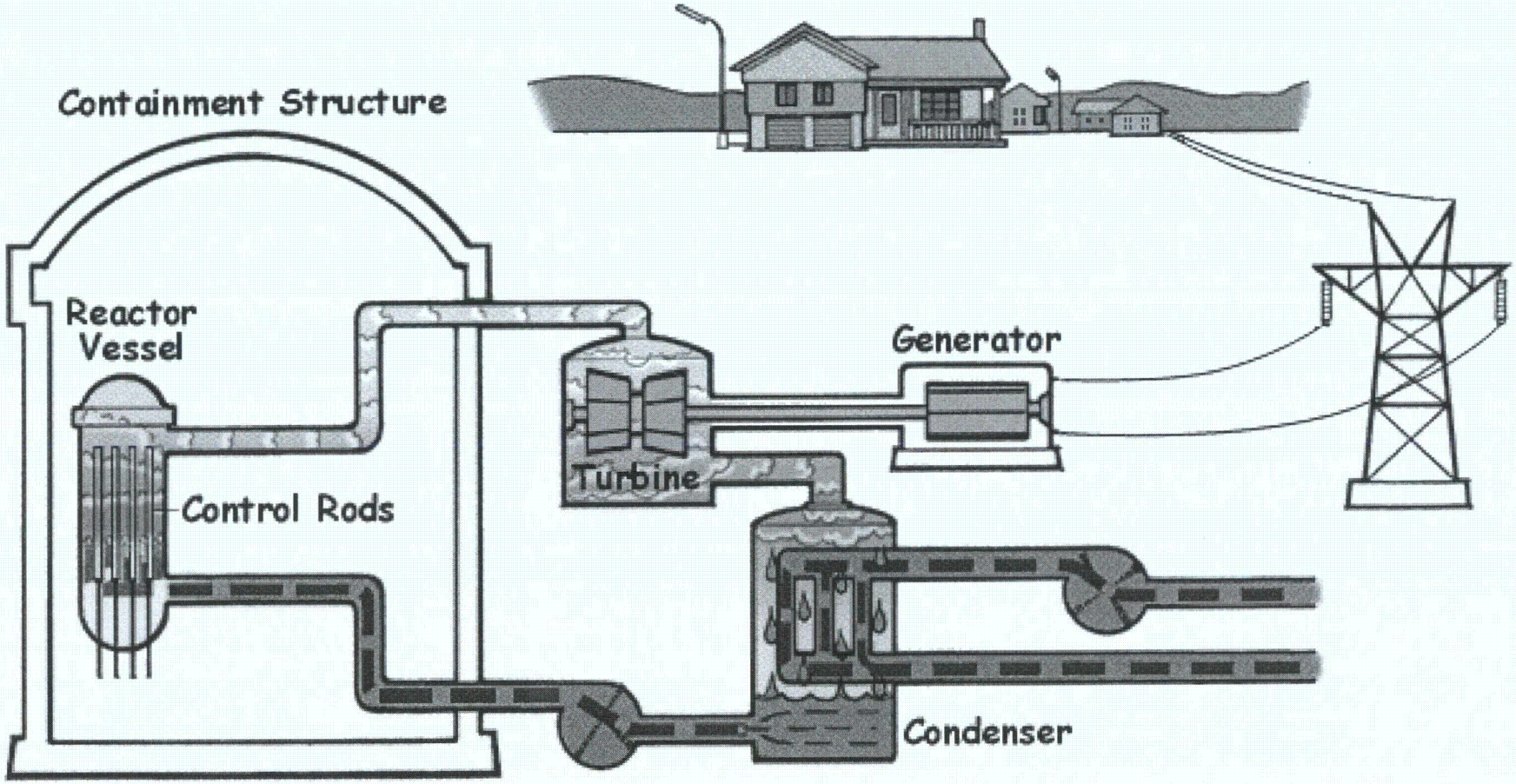
# Generic BWR



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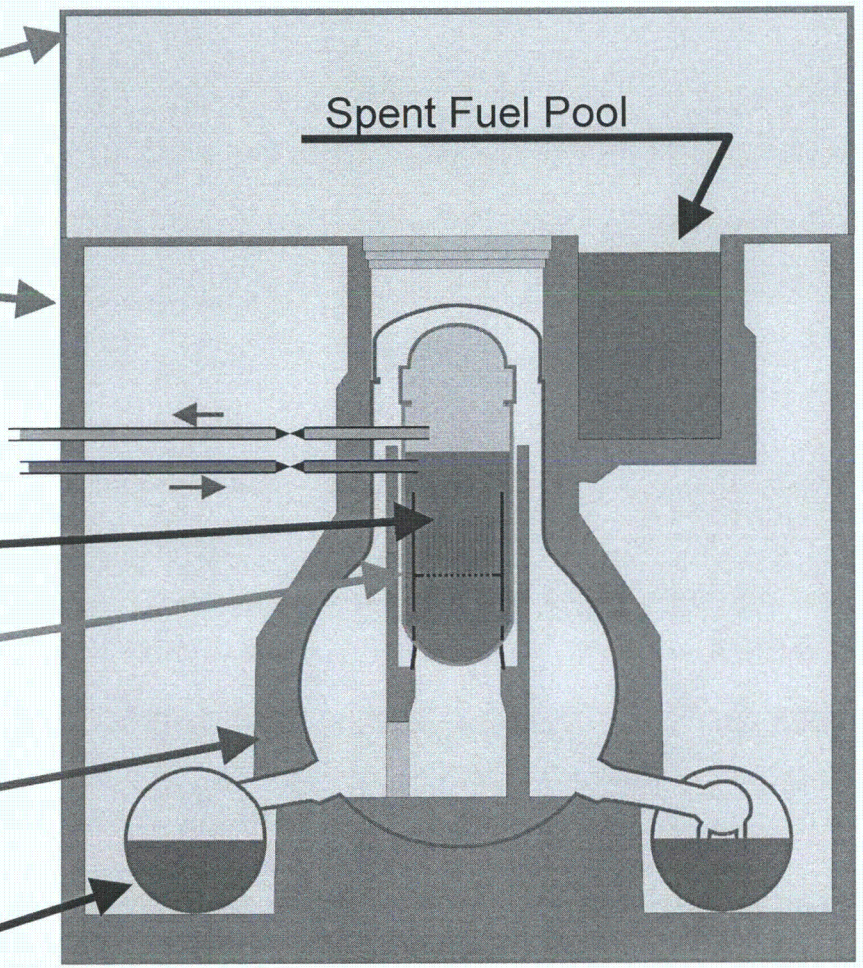
- Reactor Service Floor (Steel Construction)
- Concrete Reactor Building (secondary Containment)
- Reactor Core
- Reactor Pressure Vessel
- Containment (Dry well)
- Containment (Wet Well)



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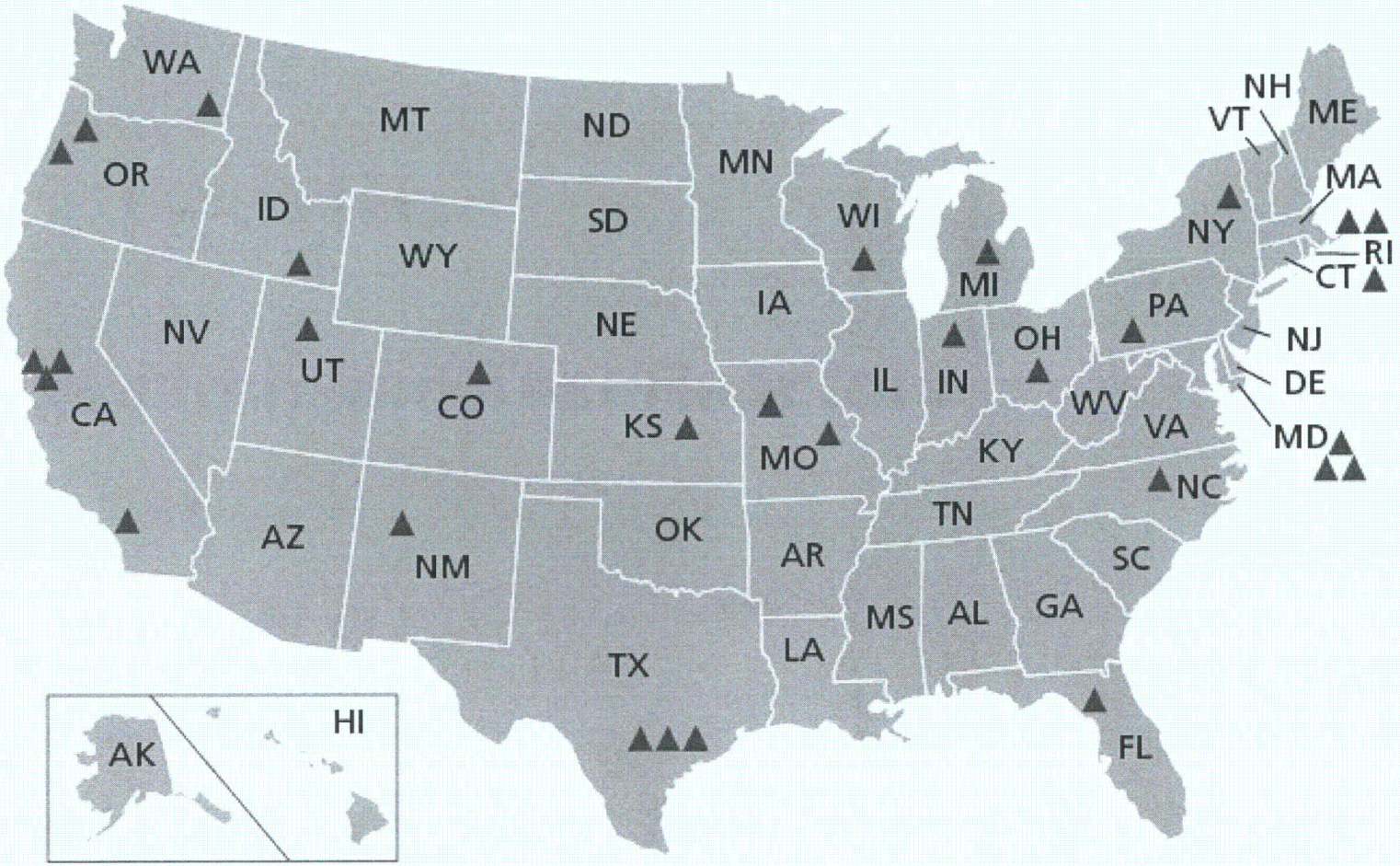
# Research and Test Reactors




▲ Licensed/Currently Operating (31)

## Ross, Robin

**From:** Wertz, Trent on behalf of Leeds, Eric
**Sent:** Thursday, April 14, 2011 10:36 AM
**To:** Wertz, Trent
**Subject:** FW: RESPONSE - CSIS INVITATION: Nuclear Safety After Fukushima

---

**From:** Weber, Michael
**Sent:** Monday, April 04, 2011 10:45 AM
**To:** Mamish, Nader
**Cc:** Dembek, Stephen; LIA06 Hoc; LIA08 Hoc; Williams, Shawn; Virgilio, Martin; Miller, Charles; Sanfilippo, Nathan; Leeds, Eric; Wiggins, Jim; Johnson, Michael; Haney, Catherine; Sheron, Brian; Droggitis, Spiros; Schmidt, Rebecca; Powell, Amy; Brenner, Eliot; Hayden, Elizabeth
**Subject:** RESPONSE - CSIS INVITATION: Nuclear Safety After Fukushima

Great. Thanks, Nader

---

**From:** Mamish, Nader
**Sent:** Monday, April 04, 2011 8:37 AM
**To:** Weber, Michael
**Subject:** FW: QUERY - CSIS INVITATION: Nuclear Safety After Fukushima

Steve Dembek will participate and share insights w/the team.

---

**From:** Weber, Michael
**Sent:** Friday, April 01, 2011 4:49 PM
**To:** Doane, Margaret; Mamish, Nader
**Cc:** LIA06 Hoc; LIA08 Hoc; Brenner, Eliot; Schmidt, Rebecca; Boger, Bruce; Thaggard, Mark; Muessle, Mary; Andersen, James; Leeds, Eric; Haney, Catherine; Sheron, Brian; Johnson, Michael; Virgilio, Martin
**Subject:** QUERY - CSIS INVITATION: Nuclear Safety After Fukushima

Does OIP want to take the lead in participating in this seminar for NRC? Someone should attend, listen, and share highlights back here to the rest of our team. If OIP cannot support, please advise.

---

**From:** CSIS Proliferation Prevention Program [mailto:tspitzer-hobeika@csis.org]
**Sent:** Friday, April 01, 2011 4:11 PM
**To:** Weber, Michael
**Subject:** CSIS INVITATION: Nuclear Safety After Fukushima

To ensure receipt of our email, please add us to your address book.

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES | Proliferation Prevention Program

INVITATION

*The CSIS Proliferation Prevention Program invites you to a timely*

*discussion on:*

# Nuclear Safety After Fukushima

The March 11, 2011 earthquake and tsunami have had a devastating effect on Japan. The impact has been magnified by the crisis at the Fukushima Daiichi nuclear power plant, where efforts continue to contain radiation from damaged reactors and spent fuel pools. Beyond the inevitable questions posed by the media in the midst of the crisis, national and international authorities will be reviewing safety regulations and their implementation. The U.S. Congress has already held several hearings and the International Atomic Energy Agency Director Yukiya Amano has called for a nuclear safety summit in June.

The CSIS Proliferation Prevention Program is pleased to bring two expert panels together to analyze the current situation and its impact on U.S. and international nuclear safety.

**Thursday, April 7, 2011**
**from 2:00pm to 5:00pm**
**B1 Conference Center**
CSIS, 1800 K Street NW, Washington, DC 20006

## Speakers:

Opening Remarks: Dr. John Hamre, President, Center for Strategic and International Studies
Moderator: Ms. Sharon Squassoni, Director, CSIS Proliferation Prevention Program

2:15-3:45: National Responses
Mr. Alex Flint, Senior Vice President for Governmental Affairs, Nuclear Energy Institute (Invited)
Ms. Ellen Vancko, Nuclear Energy and Climate Change Project Manager, Union of Concerned Scientists
Mr. Mark Holt, Specialist in Energy Policy, Congressional Research Service

3:45-5:00: International Responses
Dr. Olli Heinonen, Senior Fellow, Belfer Center for Science and International Affairs, Harvard Kennedy School
Mr. Carlton Stoiber, Chair of the Nuclear Security Working Group, International Nuclear Law Association
Ms. Carol Kessler, Chair of the Nonproliferation and National Security Department, Brookhaven National Laboratory

Please **RSVP** to Ms. Tamara Spitzer-Hobeika at tspitzer-hobeika@csis.org or 202.775.3239.

**Bano, Mahmooda**

**From:** E.Bradley@iaea.org
**Sent:** Sunday, April 03, 2011 7:15 PM
**To:** Scott, Michael
**Subject:** RE: Supplemental Information on Venting Rev 6

Received - thanks again.

Ed

---

From: Michael.Scott@nrc.gov [mailto:Michael.Scott@nrc.gov]
Sent: Sun 2011-04-03 11:52 PM
To: BRADLEY, Edward; LYONS, James E.
Subject: FW: Supplemental Information on Venting Rev 6

As requested - Rev 6 Supplemental document.

Mike Scott

NRC Japan team





w/246

**Bano, Mahmooda**

**From:** Scott, Michael
**Sent:** Sunday, April 03, 2011 4:03 AM
**To:** 'Hochevar, Albert R. (INPO)'
**Subject:** JAPANESE COMMENT ON E385

Item 3 in Figure 1 says that leak rate assumption does not matter to the paper's conclusions, as relative volumes of $H_2$ and $O_2$ would be unaffected by the leak rate.

Does that address the concern?

Mike



W/247

**From:** Ader, Charles
**To:** Johnson, Michael
**Cc:** Williams, Donna; Flanders, Scott; Holahan, Gary
**Subject:** Re: Task force support and outline
**Date:** Monday, April 04, 2011 8:25:32 AM

---

Saw that the Blackberry message could be misread. More correctly, "No" I would not mind being the POC

---

Yes
Charles Ader
Sent from my Blackberry.

---

**From:** Johnson, Michael
**To:** Ader, Charles
**Cc:** Williams, Donna; Flanders, Scott; Holahan, Gary
**Sent:** Mon Apr 04 01:28:28 2011
**Subject:** FW: Task force support and outline

Charlie,

Would you mind being the point of contact? Thanks.

Mike

---

**From:** Miller, Charles
**Sent:** Friday, April 01, 2011 3:32 PM
**To:** Leeds, Eric; Johnson, Michael; Wiggins, Jim; Sheron, Brian; Moore, Scott; Zimmerman, Roy; Dean, Bill; McCree, Victor; Satorius, Mark; Collins, Elmo; Haney, Catherine; Doane, Margaret
**Cc:** Virgilio, Martin; Weber, Michael; Borchardt, Bill; Grobe, Jack; Holahan, Gary; Williamson, Edward; Spencer, Mary; Cubbage, Amy; Sanfilippo, Nathan; Dorman, Dan
**Subject:** Task force support and outline
**Importance:** High

Over the course of the past week, the task force has been chartered (attached) and begun its work. We have developed a working outline (also attached) that the task force will follow in pursuing this task. During this effort, we will need support from various agency technical experts from many of your offices or regions. We expect this input to largely be in the form of technical advice, informal briefings, and pulled from existing documents which will aid us in formulating our recommendations to the Commission. Please let me know the best way to coordinate support with your office. One method would be to identify a primary point of contact to coordinate support for the task force; however, I'm open to other suggestions to suit your needs. We will try to minimize the impact on your offices and regions resources so that you can continue to go about your normal agency responsibilities and duties.

To date, the task force has had the benefit of interviewing some members of the team dispatched to Japan to gain their insights and seek their feedback on the scope of our efforts (included in the attached outline). In addition, Dan Dorman will be joining the task force upon return from Japan which will further inform our efforts.

I appreciate your continued cooperation to ensure the success of this agency effort. For

example, we have already been able to schedule meetings next week with agency seismic and flooding experts. We will keep you informed as the review progresses, particularly on matters that could affect your programs.

Draft – 4/1/11

# Organization of the Fukushima Task Force Report

1. Introduction

2. Commission Direction – Task Force Charter

3. Summary of the Events at Fukushima Daiichi

    a. Earthquake
    b. Tsunami
    c. Long-term loss of AC power
    d. Loss of cooling
    e. Core and spent fuel damage
    f. Hydrogen explosions
    g. Radiological releases

    We will write at the summary level. We need to collect information from other sources, create our write-up, and then have others review for validity (NRR OpE?).

4. Discussion of Approach to Formulating Recommendations
    a. Use of safety goals?
    b. Use of regulatory analysis guidelines?

5. Evaluation of NRC regulatory requirements, programs, and processes, and their implementation at U.S. plants (generically, by type/location, individually as appropriate)

    a. Screening Discussion
        i. Short-term review vs. long-term review
        ii. What is in scope vs. out of scope?
    b. Protection from Natural Phenomena
        i. Evaluation of the design basis and safety margins for seismic events
            1. Have U.S. plants considered the right bounding conditions for seismic events? (Does GI-199 need to be accelerated? Is current action enough?)
        ii. Evaluation of the design basis and safety margins for external events to protect against long-term station blackout (core and SFP?)
            1. Seismic
            2. Tsunami
            3. Other Flooding Issues
                a. Hurricanes (storm surge)
                b. Dam failures (flooding level)

c. Probable maximum precipitation (rivers and stream flooding, blizzard)
d. Internal flooding

4. External Fires
5. High Winds
    a. Hurricane winds
    b. Tornado winds
    c. Tornado missile
6. Sequentially related external events (e.g., earthquake causes tsunami)

iii. Evaluation of the design basis and safety margins for spent fuel pool integrity and cooling

c. Mitigation

i. Strategies for mitigating accidents at single or multiple units; including challenges from unit interactions

1. Strategies to Prevent Core Damage during a Long-Term Station Blackout (SBO)
    a. SBO rule and implementation
    b. SBO restoration capabilities and issues
    c. Instrumentation availability
    d. Staffing availability/effectiveness/protection
    e. Emergency operating procedures (EOPs) for coping with loss of A/C
    f. Severe accident management guidelines (SAMGs) for coping with loss of A/C
    g. 10 CFR 50.54(hh)(2)-type measures for coping with loss of A/C
2. Strategies to Prevent Fuel Damage in the Spent Fuel Pool
    a. SBO rule and implementation
    b. SBO restoration capabilities and issues
    c. Instrumentation availability
    d. Staffing availability/effectiveness/protection
    e. Emergency operating procedures (EOPs) for coping with loss of A/C
    f. Severe accident management guidelines (SAMGs) for coping with loss of A/C
    g. 10 CFR 50.54(hh)(2)-type measures for coping with loss of A/C
    h. Other spent fuel pool failure mechanisms
3. Strategies for Maintaining Reactor Containment Function
    a. SAMGs
    b. 10 CFR 50.54(hh)(2)-type measures
    c. Instrumentation availability
    d. Staffing availability/effectiveness/protection

e. Containment Performance Improvement program
    i. Containment venting capabilities
    ii. Hardened vents
f. Hydrogen control measures
g. SAMG training and procedures

4. Strategies for Maintaining Spent Fuel Pool Containment Function
    a. SAMGs
    b. 10 CFR 50.54(hh)(2)-type measures
    c. Instrumentation availability
    d. Hydrogen combustion control measures
    e. SAMG training and procedures

d. Preparedness and Response to Emergencies (note: consider MOX)
    i. Evaluation of Planning Framework
        1. Protection from Plume Exposure
            a. Emergency Planning Zone
            b. Protective Action Recommendations
            c. Use and availability of KI
            d. External event challenges/infrastructure damage
            e. Evacuation Time Estimates
        2. Protection from Ingestion Pathways
            a. Emergency Planning Zone
            b. Protective Action Recommendations
            c. Measures to control food and water exposures
            d. External event challenges/infrastructure damage
    ii. Licensee Dose Projection Capability
    iii. Radiation Monitoring (onsite/offsite)
    iv. Emergency Communications During Natural Disasters and SBO
        1. Emergency Response Data System
        2. Availability and capability of communications equipment
    v. Command and Control
        1. Agreements with outside organizations to support utility
        2. Impact on licensee when NRP is invoked
e. Evaluation of NRC Programs
    i. Reactor inspection
    ii. Near-term licensing impacts
    iii. Safety/security interface

6. International Cooperation and Coordination

7. Information Provided by Stakeholders

8. Conclusions and Recommendations
    a. Applicability regardless of initiating event
    b. Sufficiency of structure to ensure safety goals remain met

c. Priority?
d. Recommendations
    i. Near-term/immediate operational or regulatory issues
    ii. Long-term recommendations for follow-up
        1. Issues
        2. Research
        3. Resources
e. Conclusions

**CHARTER FOR THE NUCLEAR REGULATORY COMMISSION TASK FORCE**

**TO CONDUCT A NEAR-TERM EVALUATION OF THE NEED FOR AGENCY ACTIONS**

**FOLLOWING THE EVENTS IN JAPAN**

Objective

The objective of this task force is to conduct a methodical and systematic review of relevant NRC regulatory requirements, programs, and processes, and their implementation, to recommend whether the agency should make near-term improvements to our regulatory system. This task force will also identify a framework and topics for review and assessment for the longer-term effort.

Scope

The task force review will include the following:

a. A near-term review to:

- Evaluate currently available technical and operational information from the events that have occurred at the Fukushima Daiichi nuclear complex in Japan to identify potential or preliminary near-term/immediate operational or regulatory actions affecting domestic reactors of all designs, including their spent fuel pools. The task force will evaluate, at a minimum, the following technical issues and determine priority for further examination and potential agency action:
    - External event issues (e.g. seismic, flooding, fires, severe weather)
    - Station blackout
    - Severe accident measures (e.g., combustible gas control, emergency operating procedures, severe accident management guidelines)
    - 10 CFR 50.54 (hh)(2) which states, "Each licensee shall develop and implement guidance and strategies intended to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities under the circumstances associated with loss of large areas of the plant due to explosions or fire, to include strategies in the following areas: (i) Fire fighting; (ii) Operations to mitigate fuel damage; and (iii) Actions to minimize radiological release." Also known as B.5.b.
    - Emergency preparedness (e.g., emergency communications, radiological protection, emergency planning zones, dose projections and modeling, protective actions)
- Develop recommendations, as appropriate, for potential changes to NRC's regulatory requirements, programs, and processes, and recommend whether generic communications, orders, or other regulatory actions are needed.

ENCLOSURE

b. Recommendations for the content, structure, and estimated resource impact for the longer-term review.

Coordination and Communications

The near-term task force will:

- Solicit stakeholder input as appropriate, but remain independent of industry efforts.
- Coordinate and cooperate where applicable with other domestic and international efforts reviewing the events in Japan for additional insights.
- Provide recommendations to the Commission for any immediate policy issues identified prior to completion of the near-term review.
- Provide recommendations to program offices for any immediate actions not involving policy issues, prior to completion of the near-term review.
- Identify resource implications of near-term actions.
- Consider information gained from Temporary Instruction 2515/183, "Followup to the Fukushima Daiichi Nuclear Station Fuel Damage Events."
- Develop a communications plan.
- Update and brief internal stakeholders, as appropriate.

Expected Product and Schedule

The task force will provide its observations, conclusions, and recommendations in the form of a written report to the Deputy Executive Director for Reactor and Preparedness Programs at the completion of the 90-day near-term review.

During the development of its report, the task force will brief the Commission on the status of the review at approximately the 30- and 60-day points.

The report will be transmitted to the Commission via a SECY paper, and the task force will brief the Commission on the results of the near-term effort at approximately the 90-day point. The report will be released to the public via normal Commission processes.

The task force will recommend a framework for a longer-term review as a part of the near-term report. The longer-term review will begin as soon as the NRC has sufficient technical information from the events in Japan (with a goal of beginning by the end of the near-term review).

Staffing

The task force will consist of the following members:

| | | |
|---|---|---|
| Leader | Charles Miller | FSME |
| Senior Managers | Daniel Dorman | NMSS |
| | Jack Grobe | NRR |
| | Gary Holahan | NRO |
| Senior Staff | Amy Cubbage | NRO |
| | Nathan Sanfilippo | OEDO |
| Administrative Assistant | Cynthia Davidson | OGC |

Additional task force members will be added as needed. For the near-term review, other staff members may be consulted on a part-time basis.

EDO Interface

The task force will keep agency leadership informed on the status of the effort and provide early identification of significant findings. The task force will report to Martin J. Virgilio, Deputy Executive Director for Reactor and Preparedness Programs.

**From:** Holahan, Gary
**To:** Johnson, Michael; Miller, Charles
**Cc:** Sanfilippo, Nathan; Grobe, Jack; Cubbage, Amy; Spencer, Mary; Dorman, Dan
**Subject:** RE: Task force support and outline
**Date:** Monday, April 04, 2011 11:43:59 AM

Got it

**From:** Johnson, Michael
**Sent:** Monday, April 04, 2011 8:58 AM
**To:** Miller, Charles
**Cc:** Sanfilippo, Nathan; Holahan, Gary; Grobe, Jack; Cubbage, Amy; Spencer, Mary; Dorman, Dan
**Subject:** RE: Task force support and outline

Charlie Ader is the NRO POC.

**From:** Miller, Charles
**Sent:** Friday, April 01, 2011 3:32 PM
**To:** Leeds, Eric; Johnson, Michael; Wiggins, Jim; Sheron, Brian; Moore, Scott; Zimmerman, Roy; Dean, Bill; McCree, Victor; Satorius, Mark; Collins, Elmo; Haney, Catherine; Doane, Margaret
**Cc:** Virgilio, Martin; Weber, Michael; Borchardt, Bill; Grobe, Jack; Holahan, Gary; Williamson, Edward; Spencer, Mary; Cubbage, Amy; Sanfilippo, Nathan; Dorman, Dan
**Subject:** Task force support and outline
**Importance:** High

Over the course of the past week, the task force has been chartered (attached) and begun its work. We have developed a working outline (also attached) that the task force will follow in pursuing this task. During this effort, we will need support from various agency technical experts from many of your offices or regions. We expect this input to largely be in the form of technical advice, informal briefings, and pulled from existing documents which will aid us in formulating our recommendations to the Commission. Please let me know the best way to coordinate support with your office. One method would be to identify a primary point of contact to coordinate support for the task force; however, I'm open to other suggestions to suit your needs. We will try to minimize the impact on your offices and regions resources so that you can continue to go about your normal agency responsibilities and duties.

To date, the task force has had the benefit of interviewing some members of the team dispatched to Japan to gain their insights and seek their feedback on the scope of our efforts (included in the attached outline). In addition, Dan Dorman will be joining the task force upon return from Japan which will further inform our efforts.

I appreciate your continued cooperation to ensure the success of this agency effort. For example, we have already been able to schedule meetings next week with agency seismic and flooding experts. We will keep you informed as the review progresses, particularly on matters that could affect your programs.

## Bano, Mahmooda

**From:** Scott, Michael
**Sent:** Sunday, April 10, 2011 3:40 PM
**To:** Gibson, Kathy
**Subject:** RE: REVISED: Apr 10-16 Watchbill for Japan Response

That change was overdue in my humble opinion. Glad for you. Brian told us Friday, using you and me as examples, that if the DD is on watch or in Japan, he wanted the DDD in office, or vice versa. He also indicated that, despite the call for volunteers for wave 4 to Japan, he does not really support more RES staff participating. He appears to think the Japan contingent is not worthwhile.

Hope you can make my dog-and-pony show this week on that subject.

---

**From:** Gibson, Kathy
**Sent:** Sunday, April 10, 2011 1:45 PM
**To:** Scott, Michael
**Subject:** Fw: REVISED: Apr 10-16 Watchbill for Japan Response
**Importance:** High

Looks like I will be in the office next week as the Ops Center staffing has been significantly reduced.

See you tomorrow!

---

**From:** OST02 HOC
**To:** Dyer, Jim; Layton, Michael; Holonich, Joseph; Burkhalter, Cornelia; Bailey, Marissa; Rivers, Joseph; Noonan, Amanda; Rivera, Alison; MorganButler, Kimyata; Goetz, Sujata; Schneider, Stewart; Tomon, John; LaVera, Ronald; Richards, Stuart; Kavanagh, Kerri; Starefos, Joelle; Belen, Aixa; Wong, See-Meng; Iyengar, Raj; Criscione, Lawrence; Beasley, Benjamin; Caruso, Mark; Zoulis, Antonios; Phan, Hanh; Ghosh, Tina; Ramadan, Liliana; Flanagan, Michelle; Abrams, Charlotte; Abu-Eid, Boby; Adams, John; Afshar-Tous, Mugeh; Ahn, Hosung; Alemu, Bezakulu; Algama, Don; Alter, Peter; Anderson, Brian; Anderson, James; Arndt, Steven; Arribas-Colon, Maria; Ashkeboussi, Nima; Athey, George <george.athey@nrc.gov>; Baker, Stephen; Ballam, Nick; Barnhurst, Daniel; Barr, Cynthia; Barss, Dan; Bazian, Samuel; Benner, Eric; Bensi, Michelle; Bergman, Thomas; Berry, Rollie; Bhachu, Ujagar; Bloom, Steven; Blount, Tom; Boger, Bruce; Bonnette, Cassandra; Borchardt, Bill; Bowers, Anthony; Bowman, Gregory; Boyce, Tom (RES); Brandon, Lou; Brandt, Philip; Brenner, Eliot; Brock, Kathryn; Brown, Cris; Brown, David; Brown, Eva; Brown, Frederick; Brown, Michael; Bukharin, Oleg; Burnell, Scott; Bush-Goddard, Stephanie; Campbell, Stephen; Camper, Larry; Carlson, Donald; Carpenter, Cynthia; Carter, Mary; Case, Michael; Casto, Greg; Cecere, Bethany; Cervera, Margaret; Chazell, Russell; Chen, Yen-Ju; Cheng, May; Cheok, Michael; Chokshi, Nilesh; Chowdhury, Prosanta; Chung, Donald; Circle, Jeff; Clement, Richard; Clinton, Rebecca; Coe, Doug; Coggins, Angela; Collins, Frank; Cool, Donald; Correia, Richard; Corson, James; Costa, Arlon; Couret, Ivonne; Craffey, Ryan; Crutchley, Mary Glenn; Cruz, Zahira; Cuadrado, Leira; Dacus, Eugene; DeCicco, Joseph; Decker, David; Dembek, Stephen; Devlin, Stephanie; Dimmick, Lisa; Doane, Margaret; Dorman, Dan; Dorsey, Cynthia; Dozier, Jerry; Drake, Margaret <margaret.drake@nrc.gov>; Droggitis, Spiros; Dube, Donald; Dudes, Laura; Eads, Johnny; Easson, Stuart; Emche, Danielle; English, Lance; Erlanger, Craig; Esmaili, Hossein; Evans, Michele; Faria-Ocasio, Carolyn; Figueroa, Roberto; Fiske, Jonathan; Flanders, Scott; Flannery, Cindy; Floyd, Daphene; Foggie, Kirk; Foster, Jack; Fragoyannis, Nancy; Franovich, Rani; Frazier, Alan; Freshman, Steve <steve.freshman@nrc.gov>; Fuller, Edward; Galletta, Thomas; Gambone, Kimberly; Gardocki, Stanley; Gartman, Michael; Gibson, Kathy; Giitter, Joseph; Gilmer, James; Glenn, Nichole; Gordon, Dennis; Gott, William; Grant, Jeffery; Gray, Anita; Gray, Kathy; Greenwood, Carol; Grimes, Kelly; Grobe, Jack; Gross, Allen; Gulla, Gerald; Hackett, Edwin; Hale, Jerry; Hardesty, Duane; Hardin, Kimberly; Hardin, Leroy; Harrington, Holly; Harris, Tim; Harrison, Donnie; Hart, Ken; Hart, Michelle; Harvey, Brad; Hasselberg, Rick; Hayden, Elizabeth; Helton, Donald; Henderson, Karen; Hiland, Patrick; Hipschman, Thomas; Holahan, Patricia; Holahan, Vincent; Holian, Brian; HOO Hoc; Horn, Brian; Howard, Arlette; Howard, Tabitha; Howe, Allen; Huffert, Anthony; Hurd, Sapna; Huyck, Doug; Imboden, Andy; Isom, James; Jackson, Karen; Jacobson, Jeffrey; Jervey, Richard; Jessie, Janelle; Johnson, Don; Johnson, Michael; Jolicoeur, John; Jones, Andrea; Jones, Cynthia; Jones, Henry; Kahler, Carolyn; Kammerer, Annie; Karas, Rebecca; Kauffman, John; Khan, Omar; Kolb, Timothy; Kotzalas, Margie; Kowalczik, Jeffrey; Kratchman, Jessica; Kugler, Andrew; Lamb, Christopher; Lane, John; Larson, Emily; Laur, Steven; LaVie, Ste



W250

Lewis, Robert; Li, Yong; Lichatz, Taylor; Lising, Jason; Lombard, Mark; Lovell, Louise; Lubinski, John; Lui, Christiana; Lukes, Kim; Lynch, Jeffery; Ma, John; Mamish, Nader; Manahan, Michelle; Marksberry, Don; Marshall, Jane; Masao, Nagai <nagai.masao@nrc.gov>; Maupin, Cardelia; Mayros, Lauren; Mazaika, Michael; McConnell, Keith; McCoppin, Michael; McDermott, Brian; McGinty, Tim; McGovern, Denise; McIntyre, David; McMurtray, Anthony; Merritt, Christina; Meyer, Karen; Miller, Charles; Miller, Chris; Milligan, Patricia; Miranda, Samuel; Mohseni, Aby; Moore, Scott; Morlang, Gary; Morris, Scott; Mroz (Sahm), Sara; Munson, Clifford; Murray, Charles; Musico, Bruce; Nerret, Amanda; Nguyen, Caroline; Norris, Michael; Norton, Charles; Nosek, Andrew; Opara, Stella; Ordaz, Vonna; Orr, Mark; Owens, Janice; Padovan, Mark; Parillo, John; Patel, Jay; Patel, Pravin; Patrick, Mark; Perin, Vanice; Pope, Tia; Powell, Amy; Purdy, Gary; Quinlan, Kevin; Raddatz, Michael; Ragland, Robert; Ralph, Melissa; Ramsey, Jack; Reed, Elizabeth; Reed, Sara <sara.reed@nrc.gov>; Reed, Wendy; Reeves, Rosemary; Reis, Terrence; Resner, Mark; Riley (OCA), Timothy; Riner, Kelly; Rini, Brett; Roach, Edward; Robinson, Edward; Rodriguez-Luccioni, Hector; Roggenbrodt, William; Ropon, Kimberly <kimberly.ropon@nrc.gov>; Rosales-Cooper, Cindy; Rosenberg, Stacey; Ross-Lee, MaryJane; Roundtree, Amy; Ruland, William; Russell, Tonya; Ryan, Michelle; Salay, Michael; Salter, Susan; Salus, Amy; Sanfilippo, Nathan; Santos, Daniel; Scarbrough, Thomas; Schaperow, Jason; Schmidt, Duane; Schmidt, Rebecca; Schoenebeck, Greg; Schrader, Eric; Schwartzman, Jennifer; Seber, Dogan; See, Kenneth; Shane, Raeann; Shea, James; Shepherd, Jill; Sheron, Brian; Skarda, Raymond; Skeen, David; Sloan, Scott; Smiroldo, Elizabeth; Smith, Brooke; Smith, Stacy; Smith, Theodore; Solorio, Dave; Stahl, Eric; Stang, Annette; Stark, Johnathan; Steger (Tucci), Christine; Stieve, Alice; Stone, Rebecca; Stransky, Robert; Sturz, Fritz; Sullivan, Randy; Summers, Robert; Sun, Casper; Susco, Jeremy; Takacs, Michael; Tappert, John; Tegeler, Bret; Temple, Jeffrey; Thaggard, Mark; Thomas, Eric; Thorp, John; Tiruneh, Nebiyu; Tobin, Jennifer; Trefethen, Jean; Tschiltz, Michael; Turtil, Richard; Uhle, Jennifer; Valencia, Sandra; Vaughn, James; Velazquez-Lozada, Alexander; Vick, Lawrence; Virgilio, Martin; Virgilio, Rosetta; Ward, Leonard; Ward, William; Wastler, Sandra; Watson, Bruce; Webber, Robert; Weber, Michael; White, Bernard; Wiggins, Jim; Williams, Donna; Williams, Joseph; Williams, Tamera; Williamson, Linda; Willis, Dori; Wimbush, Andrea; Wittick, Brian; Wray, John; Wright, Lisa (Gibney); Wright, Ned; Wunder, George; Young, Francis; Zimmerman, Jacob; Zimmerman, Roy
**Sent**: Sat Apr 09 16:11:02 2011
**Subject**: REVISED: Apr 10-16 Watchbill for Japan Response

All,

The Chairman has approved a reduced staffing roster for this upcoming week. The reduced staffing will begin on Monday morning at 7am and will only include 6 positions, and as such, many of the previously staffed shifts will not be staffed. Please be aware that many of the positions on the attached list were changed to "N/A". While we appreciate your continued support, if your name was changed to "N/A", you will not be needed in the Operations Center.

If you have any questions, please contact your team coordinator and the following cognizant individuals:

Liaison Team: Jeff Temple
Reactor Safety Team: Rick Hasselberg / Peter Alter
Protective Measures Team: Lou Brandon
Executive Support Team: please reply to this email

Thank you,
OST02

## Lee, Richard

**From:** Lee, Richard
**Sent:** Monday, April 04, 2011 1:04 PM
**To:** Esmaili, Hossein; Salay, Michael; Schaperow, Jason; Tinkler, Charles
**Cc:** Marksberry, Don; Helton, Donald; Gibson, Kathy; Scott, Michael
**Subject:** N2 inerting of the Fukushima drywell

This is to let you know that the N2 inerting system has been delivered to the Fukushima site, and that TEPCO will begin inerting the drywell of the Fukushima Unit 1 commencing Tuesday (Japanese time).



W/251

**Lee, Richard**

**From:** Lee, Richard
**Sent:** Monday, April 04, 2011 5:20 PM
**To:** 'Powers, Dana A'; Powers, Dana
**Subject:** Japanese test on reactor head seal

Dear Dana:

You told us that the Japanese had performed testing (steam and pressure) on the reactor head seal and found that it will fail from temp. and steam before radiation (1 Grad dose) will cause it to fail. Do you know who did the experiments? Do you have the Japanese study?

Richard

W252

## Bano, Mahmooda

**From:** Scott, Michael
**Sent:** Tuesday, April 05, 2011 6:27 PM
**To:** Donaldson, Leslie
**Subject:** RE: Congrats on your SES Appt!

Spoken like the dog lover you (and I) are! No clue how he lasted that long with no water.

Mike

---

**From:** Donaldson, Leslie
**Sent:** Tuesday, April 05, 2011 8:56 AM
**To:** Scott, Michael
**Subject:** RE: Congrats on your SES Appt!

Safe travels Mike – I'm sure you have seen a lot in the past few weeks. One bright note was the dog they rescued off the barge and actually reunited w/its owner – yeah!

Take care, Leslie

---

**From:** Scott, Michael
**Sent:** Monday, April 04, 2011 6:31 PM
**To:** Donaldson, Leslie
**Subject:** RE: Congrats on your SES Appt!

Thanks Leslie! Hope all is well with you. See you soon (I hope). Leaving Japan tomorrow.

Mike

---

**From:** Donaldson, Leslie
**Sent:** Monday, April 04, 2011 9:29 AM
**To:** Scott, Michael
**Subject:** Congrats on your SES Appt!

Regards, Leslie

**Leslie A. Donaldson, Chief**
**Human Capital and Communications Branch**
**Program Management, Policy Development and Analysis Staff**
**Office of Nuclear Regulatory Research**
**301.251.7964**



W/253

**From:** Johnson, Michael
**To:** Miller, Charles
**Subject:** RE: Task force support and outline
**Date:** Tuesday, April 05, 2011 8:00:00 AM

Happy to help!

**From:** Miller, Charles
**Sent:** Tuesday, April 05, 2011 7:22 AM
**To:** Johnson, Michael
**Subject:** RE: Task force support and outline

Thanks Mike. And thanks again for Gary and Amy.

**From:** Johnson, Michael
**Sent:** Monday, April 04, 2011 8:58 AM
**To:** Miller, Charles
**Cc:** Sanfilippo, Nathan; Holahan, Gary; Grobe, Jack; Cubbage, Amy; Spencer, Mary; Dorman, Dan
**Subject:** RE: Task force support and outline

Charlie Ader is the NRO POC.

**From:** Miller, Charles
**Sent:** Friday, April 01, 2011 3:32 PM
**To:** Leeds, Eric; Johnson, Michael; Wiggins, Jim; Sheron, Brian; Moore, Scott; Zimmerman, Roy; Dean, Bill; McCree, Victor; Satorius, Mark; Collins, Elmo; Haney, Catherine; Doane, Margaret
**Cc:** Virgilio, Martin; Weber, Michael; Borchardt, Bill; Grobe, Jack; Holahan, Gary; Williamson, Edward; Spencer, Mary; Cubbage, Amy; Sanfilippo, Nathan; Dorman, Dan
**Subject:** Task force support and outline
**Importance:** High

Over the course of the past week, the task force has been chartered (attached) and begun its work. We have developed a working outline (also attached) that the task force will follow in pursuing this task. During this effort, we will need support from various agency technical experts from many of your offices or regions. We expect this input to largely be in the form of technical advice, informal briefings, and pulled from existing documents which will aid us in formulating our recommendations to the Commission. Please let me know the best way to coordinate support with your office. One method would be to identify a primary point of contact to coordinate support for the task force; however, I'm open to other suggestions to suit your needs. We will try to minimize the impact on your offices and regions resources so that you can continue to go about your normal agency responsibilities and duties.

To date, the task force has had the benefit of interviewing some members of the team dispatched to Japan to gain their insights and seek their feedback on the scope of our efforts (included in the attached outline). In addition, Dan Dorman will be joining the task force upon return from Japan which will further inform our efforts.

I appreciate your continued cooperation to ensure the success of this agency effort. For example, we have already been able to schedule meetings next week with agency seismic and flooding experts. We will keep you informed as the review progresses, particularly on matters that could affect your programs.

## Bano, Mahmooda

**From:** Scott, Michael
**Sent:** Tuesday, April 05, 2011 7:27 PM
**To:** 'Hochevar, Albert R. (INPO)'
**Cc:** Salay, Michael; Blamey, Alan; Bernhard, Rudolph
**Subject:** PLEASE ADD THE CC'S ON THIS NOTE TO YOUR DISTRO FOR JAPAN TEAM - THANKS <EOM>



W/255

## Bano, Mahmooda

**From:** ANS Broadcasts [broadcasts@ans.org]
**Sent:** Tuesday, April 05, 2011 8:59 PM
**To:** Scott, Michael
**Subject:** ALERT: Corradini to testify for ANS on Fukushima

On Wednesday, April 6, Dr. Michael Corradini will be appearing on behalf of the American Nuclear Society before the U.S. House Energy and Commerce Subcommittee on Oversight and Investigations. The hearing—which will begin at 9:00 am ET—is entitled "The U.S. Government Response to the Nuclear Power Plant Incident in Japan." A live webcast and additional information about the Hearing will be available via the Committee website.

Dr. Corradini is currently chair of the Nuclear Engineering and Engineering Physics program at the University of Wisconsin, Madison. He is also involved in a number of nuclear energy activities for the National Academies, the Department of Energy (DOE) and the Nuclear Regulatory Commission (USNRC). Specifically, Dr. Corradini is a member of the DOE Nuclear Energy Advisory Committee and Chair of its Reactor Technology Subcommittee. In addition, he is a member of the French Atomic Energy Scientific Committee and the NRC's Advisory Committee for Reactor Safeguards.

In his prepared testimony, Dr. Corradini announces that he has been asked by ANS leadership to serve as co-chair of an ANS Special Commission on Fukushima Daiichi. This ANS Commission will examine the major technical aspects of the event to help policymakers and the public better understand its consequences and its lessons for the US nuclear industry.

Dr. Corradini's prepared testimony will be posted in its entirety at the ANS Nuclear Cafe and will be made available via the ANS website following his testimony.



w/252

**Lee, Richard**

**From:** Lee, Richard
**Sent:** Wednesday, April 06, 2011 8:58 AM
**To:** Powers, Dana
**Subject:** RE: Head Seal Leakage

Thanks, Dana:
Richard

---

**From:** Powers, Dana
**Sent:** Wednesday, April 06, 2011 8:52 AM
**To:** Lee, Richard
**Subject:** Head Seal Leakage

Richard, Attached is some information on the head seal of Japanese reactors. I will have to get back to my office to find more. Radiation causes crosslinking that makes the polymer stiff. Note failure (leakage) occurs faster in steam than in nitrogen. Dana

W/257

**Bano, Mahmooda**

**From:** Scott, Michael
**Sent:** Wednesday, April 06, 2011 8:18 PM
**To:** Carter, Rozier; Trapp, James; Ulses, Anthony; Monninger, John; Nakanishi, Tony; Kolb, Timothy; Foster, Jack; Cook, William; Devercelly, Richard; Foggie, Kirk; Smith, Brooke; Ali, Syed; Sheikh, Abdul; Way, Ralph; Blamey, Alan; Jackson, Todd
**Subject:** RE: Outlook Mailbox Size

I'll let you know as soon as I send off all the FOIA stuff and can delete all those Japan e-mails.

---

**From:** Carter, Rozier
**Sent:** Wednesday, April 06, 2011 5:01 PM
**To:** Trapp, James; Ulses, Anthony; Monninger, John; Nakanishi, Tony; Kolb, Timothy; Foster, Jack; Cook, William; Devercelly, Richard; Foggie, Kirk; Smith, Brooke; Ali, Syed; Sheikh, Abdul; Way, Ralph; Blamey, Alan; Scott, Michael; Jackson, Todd
**Subject:** Outlook Mailbox Size

Good Afternoon,

In order to support the Operations Center and the Japan travelers, OIS doubled the size of your Outlook mailbox from 1 GB to 2 GB.

According to our records, you have returned to your normal duty station. If so, please let me know if and when we can lower your mailbox back down to the agency standard 1 GB limit. .

If this information is incorrect, or you anticipate being deployed to Japan again, please disregard this message.

Your cooperation in this matter is greatly appreciated.

Rozier Carter
OIS/ICOD/NOCSB
301-415-6330



W/258

**Bano, Mahmooda**

**From:** Scott, Michael
**Sent:** Wednesday, April 06, 2011 8:19 PM
**To:** Collins, Elmo
**Subject:** RE: Notification of your arrival in the U.S.

Best of luck! NYT not helpful in that regard.

Mike

---

**From:** Collins, Elmo
**Sent:** Wednesday, April 06, 2011 8:18 PM
**To:** Scott, Michael
**Subject:** Re: Notification of your arrival in the U.S.

Got through it - time will tell

---

**From**: Scott, Michael
**To**: Collins, Elmo
**Sent**: Wed Apr 06 20:16:07 2011
**Subject**: RE: Notification of your arrival in the U.S.

How'd you do with Nei-san yesterday?

---

**From:** Collins, Elmo
**Sent:** Wednesday, April 06, 2011 8:14 PM
**To:** Scott, Michael
**Subject:** Re: Notification of your arrival in the U.S.

Great job!
Elmo

---

**From**: Scott, Michael
**To**: LIA03 Hoc; Liaison Japan
**Cc**: LIA02 Hoc
**Sent**: Wed Apr 06 20:10:10 2011
**Subject**: RE: Notification of your arrival in the U.S.

I arrived U.S. 3:37 pm EDT 4/6/11.

---

**From:** LIA03 Hoc
**Sent:** Thursday, March 31, 2011 7:10 PM
**To:** Liaison Japan
**Cc:** LIA02 Hoc
**Subject:** Notification of your arrival in the U.S.

Dear NRC Japan Team - Upon your return, please "reply All" to this email and let the International Liaison Team know that you're back in the U.S.

Thank you in advance.



W/259

Mugeh
On behalf of the International Liaison Team

## Bano, Mahmooda

**From:** Scott, Michael
**Sent:** Thursday, April 07, 2011 11:25 AM
**To:** Cook, William
**Subject:** RE: Notification of your arrival in the U.S.

Thanks Bill. Same here. Have fun in R-wonderful.

Mike

---

**From:** Cook, William
**Sent:** Thursday, April 07, 2011 7:20 AM
**To:** Scott, Michael
**Subject:** RE: Notification of your arrival in the U.S.

Welcome home Mike. It was an honor working with you in Japan.
Regards,
Bill

---

**From:** Scott, Michael
**Sent:** Wednesday, April 06, 2011 8:10 PM
**To:** LIA03 Hoc; Liaison Japan
**Cc:** LIA02 Hoc
**Subject:** RE: Notification of your arrival in the U.S.

I arrived U.S. 3:37 pm EDT 4/6/11.

---

**From:** LIA03 Hoc
**Sent:** Thursday, March 31, 2011 7:10 PM
**To:** Liaison Japan
**Cc:** LIA02 Hoc
**Subject:** Notification of your arrival in the U.S.

Dear NRC Japan Team - Upon your return, please "reply All" to this email and let the International Liaison Team know that you're back in the U.S.

Thank you in advance.
Mugeh
On behalf of the International Liaison Team



W/260

## Bano, Mahmooda

**From:** Scott, Michael
**Sent:** Thursday, April 07, 2011 11:26 AM
**To:** Way, Ralph
**Subject:** RE: Notification of your arrival in the U.S.

Same here Ralph. Best wishes!

Mike

---

**From:** Way, Ralph
**Sent:** Thursday, April 07, 2011 6:57 AM
**To:** Scott, Michael
**Subject:** RE: Notification of your arrival in the U.S.

Welcome back. Enjoyed meeting and working with you.

r

*Ralph Way, Ph.D.*
*Senior Technical Advisor*
*U.S. Nuclear Regulatory Commission*
*Phone (V) Unclass 301 415 6825*
*Phone (V) Secure 301 415 6961*
*FAX (Unclass) 301 415 6661*

---

**From:** Scott, Michael
**Sent:** Wednesday, April 06, 2011 8:10 PM
**To:** LIA03 Hoc; Liaison Japan
**Cc:** LIA02 Hoc
**Subject:** RE: Notification of your arrival in the U.S.

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---

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**Cc:** LIA02 Hoc
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Dear NRC Japan Team - Upon your return, please "reply All" to this email and let the International Liaison Team know that you're back in the U.S.

Thank you in advance.
Mugeh
On behalf of the International Liaison Team



W/261

## Bano, Mahmooda

**From:** Scott, Michael
**Sent:** Thursday, April 07, 2011 11:30 AM
**To:** Giessner, John
**Subject:** RE: Notification of your arrival in the U.S.

Good luck – get out while the gettin's good!

---

**From:** Giessner, John
**Sent:** Wednesday, April 06, 2011 8:39 PM
**To:** Scott, Michael
**Subject:** RE: Notification of your arrival in the U.S.

You the man!
My flight got moved to 6:45—but I'm going!

---

**From:** Scott, Michael
**Sent:** Wednesday, April 06, 2011 8:10 PM
**To:** LIA03 Hoc; Liaison Japan
**Cc:** LIA02 Hoc
**Subject:** RE: Notification of your arrival in the U.S.

I arrived U.S. 3:37 pm EDT 4/6/11.

---

**From:** LIA03 Hoc
**Sent:** Thursday, March 31, 2011 7:10 PM
**To:** Liaison Japan
**Cc:** LIA02 Hoc
**Subject:** Notification of your arrival in the U.S.

Dear NRC Japan Team - Upon your return, please "reply All" to this email and let the International Liaison Team know that you're back in the U.S.

Thank you in advance.
Mugeh
On behalf of the International Liaison Team



W/262

## Bano, Mahmooda

**From:** Scott, Michael
**Sent:** Friday, April 08, 2011 8:11 AM
**To:** Giessner, John
**Subject:** RE: Notification of your arrival in the U.S.

Welcome home. Really enjoyed working with you and hope to do so again!

Mike

---

**From:** Giessner, John
**Sent:** Thursday, April 07, 2011 5:10 PM
**To:** LIA03 Hoc; Liaison Japan
**Cc:** LIA02 Hoc
**Subject:** Re: Notification of your arrival in the U.S.

I have arrived in Chicago (4PM cdt).
Jack
(Sent from Blackberry)

---

**From:** Scott, Michael
**To:** LIA03 Hoc; Liaison Japan
**Cc:** LIA02 Hoc
**Sent:** Wed Apr 06 20:10:10 2011
**Subject:** RE: Notification of your arrival in the U.S.

I arrived U.S. 3:37 pm EDT 4/6/11.

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**From:** LIA03 Hoc
**Sent:** Thursday, March 31, 2011 7:10 PM
**To:** Liaison Japan
**Cc:** LIA02 Hoc
**Subject:** Notification of your arrival in the U.S.

Dear NRC Japan Team - Upon your return, please "reply All" to this email and let the International Liaison Team know that you're back in the U.S.

Thank you in advance.
Mugeh
On behalf of the International Liaison Team



W/263

## Bano, Mahmooda

**From:** Scott, Michael
**Sent:** Friday, April 08, 2011 11:14 AM
**To:** Dion, Jeanne; Lee, Richard; Brock, Terry
**Cc:** Rini, Brett; Bush-Goddard, Stephanie
**Subject:** RE: QUESTION

Terry:

Stephanie said you could provide an edit to the below blurb, which is needed ASAP today. I think some revs are needed to it, but will let you take first crack. Okay?

Thanks

Mike

---

**From:** Dion, Jeanne
**Sent:** Friday, April 08, 2011 10:59 AM
**To:** Lee, Richard
**Cc:** Scott, Michael; Rini, Brett
**Subject:** FW: QUESTION
**Importance:** High

Mike-
If Mourad Aissa is not in the office today can we find someone else in FSTB to provide comments to highlighted portions below?
We need a response ASAP. Sorry for the quick turnaround.
Thanks,
Jeanne

---

**From:** Rihm, Roger
**Sent:** Friday, April 08, 2011 10:24 AM
**To:** Dion, Jeanne
**Subject:** FW: QUESTION

FYI

---

**From:** Rihm, Roger
**Sent:** Friday, April 08, 2011 10:23 AM
**To:** Rini, Brett
**Subject:** FW: QUESTION

FYI

---

**From:** Rihm, Roger
**Sent:** Friday, April 08, 2011 9:37 AM
**To:** Aissa, Mourad
**Cc:** Uhle, Jennifer; Sheron, Brian
**Subject:** QUESTION

Mourad, are you in today (I called but you were not at your desk). I'm contacting you because I have seen your name on MOX information previously provided to the chairman.



W/264

We are rushing today to wrap up some Qs and As for Senator Boxer. One question we had was the following: What increased risk is associated with exposure to MOX? At 10PM last night, the best answer we could come up with was the following:

Mixed oxide (MOX) fuel involves the use of plutonium as a fuel, in addition to enriched uranium. Plutonium is a long-lived alpha emitter, which presents different risks than those presented by uranium fission products. Regarding exposure to mixed oxide fuel, in Japan, prompt evacuation has minimized radiation exposure to the public, so long-term public health consequences from radiation exposure resulting from the events, whether due to MOX or uranium fuel, are expected to be small. Also, given the small number of MOX fuel assemblies at Fukushima Daiichi Unit 3 at the time of the event, coupled with the short time of irradiation of the MOX fuel, it is likely that the MOX fuel has had and will have no perceptible impact on any consequences from the event.

Do you have corrections/edits/additions to suggest for this response? Need to wrap this up by about 11AM. Thank you.

**Roger S. Rihm**
**Communications and Performance Improvement Staff**
**Office of the Executive Director for Operations**
**US NRC**
**301.415.1717**
**roger.rihm@nrc.gov**

## Bano, Mahmooda

**From:** Scott, Michael
**Sent:** Friday, April 08, 2011 12:56 PM
**To:** Dion, Jeanne
**Subject:** RE: QUESTION

Will have answer for you this afternoon.

---

**From:** Dion, Jeanne
**Sent:** Friday, April 08, 2011 10:59 AM
**To:** Lee, Richard
**Cc:** Scott, Michael; Rini, Brett
**Subject:** FW: QUESTION
**Importance:** High

Mike-
If Mourad Aissa is not in the office today can we find someone else in FSTB to provide comments to highlighted portions below?
We need a response ASAP. Sorry for the quick turnaround.
Thanks,
Jeanne

---

**From:** Rihm, Roger
**Sent:** Friday, April 08, 2011 10:24 AM
**To:** Dion, Jeanne
**Subject:** FW: QUESTION

FYI

---

**From:** Rihm, Roger
**Sent:** Friday, April 08, 2011 10:23 AM
**To:** Rini, Brett
**Subject:** FW: QUESTION

FYI

---

**From:** Rihm, Roger
**Sent:** Friday, April 08, 2011 9:37 AM
**To:** Aissa, Mourad
**Cc:** Uhle, Jennifer; Sheron, Brian
**Subject:** QUESTION

Mourad, are you in today (I called but you were not at your desk). I'm contacting you because I have seen your name on MOX information previously provided to the chairman.

We are rushing today to wrap up some Qs and As for Senator Boxer. One question we had was the following: What increased risk is associated with exposure to MOX? At 10PM last night, the best answer we could come up with was the following:

Mixed oxide (MOX) fuel involves the use of plutonium as a fuel, in addition to enriched uranium. Plutonium is a long-lived alpha emitter, which presents different risks than those presented by uranium fission products. Regarding



W265

exposure to mixed oxide fuel, in Japan, prompt evacuation has minimized radiation exposure to the public, so long-term public health consequences from radiation exposure resulting from the events, whether due to MOX or uranium fuel, are expected to be small. Also, given the small number of MOX fuel assemblies at Fukushima Daiichi Unit 3 at the time of the event, coupled with the short time of irradiation of the MOX fuel, it is likely that the MOX fuel has had and will have no perceptible impact on any consequences from the event.

Do you have corrections/edits/additions to suggest for this response? Need to wrap this up by about 11AM. Thank you.

**Roger S. Rihm**
**Communications and Performance Improvement Staff**
**Office of the Executive Director for Operations**
**US NRC**
**301.415.1717**
**roger.rihm@nrc.gov**

## Lee, Richard

**From:** Lee, Richard
**Sent:** Friday, April 08, 2011 5:35 PM
**To:** Kammerer, Annie
**Subject:** request from Dana Powers

Dear Annie:

Dana Powers asked whether you know what the peak ground acceleration is for the Fukushima earthquake.

Best regards,
Richard

W266

## Lee, Richard

**From:** Lee, Richard
**Sent:** Friday, April 08, 2011 5:40 PM
**To:** 'CLEMENT Bernard'
**Cc:** 'dapower@sandia.gov','Dana Powers'
**Subject:** sand filter interaction with FPs

Dear Bernard:

I appreciate it if you can send be papers and white papers on fission products interaction with sand/wet sands (filtered venting system used in European reactors).

Thanks, Richard

W/267

## Lee, Richard

**From:** Lee, Richard
**Sent:** Friday, April 08, 2011 5:53 PM
**To:** Powers, Dana
**Subject:** RE: peak acceleration

I asked Annie for the info. today for you.

---

**From:** Powers, Dana
**Sent:** Friday, April 08, 2011 5:49 PM
**To:** Lee, Richard
**Subject:** RE: peak acceleration

The accelerations are really mild. The tsunami must have been responsible for most of the problems. Most plants with safe shutdown earthquake accelerations of 0.3 g claim a high confidence of low probability of failure of 0.4 to 0.6 g. All these accelerations seem to be within this range. Dana

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**From:** Lee, Richard
**Sent:** Friday, April 08, 2011 5:36 PM
**To:** Powers, Dana; 'dapower@sandia.gov' Dana Powers
**Subject:** FW: peak acceleration

fyi

---

**From:** Fetter, Steve [mailto:Steven_A._Fetter@ostp.eop.gov]
**Sent:** Friday, April 08, 2011 5:35 PM
**To:** Larzelere, Alex; DL-NITsolutions
**Cc:** 'Busby, Jeremy T.'; Dixon, David; Schneider, Steve; Caponiti, Alice
**Subject:** peak acceleration

Yesterday's earthquake produced a peak acceleration at the Fukushima Daini plant of 0.58 m/s2 or 0.06 g.

For comparison, the peak accelerations on 3/11 were 5.1 m/s2 or 0.5 g (Daiichi) and 3.1 m/s2 or 0.3 g (Daini).

http://www.tepco.co.jp/en/press/corp-com/release/11040802-e.html
http://www.tepco.co.jp/en/press/corp-com/release/11040103-e.html

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## Bano, Mahmooda

**From:** Scott, Michael
**Sent:** Saturday, April 09, 2011 7:22 AM
**To:** Voglewede, John
**Subject:** RE: Password restricted NEA webpage - activities post-Fukushima
**Attachments:** image001.gif

I believe his message is – send nothing to OECD.

Mike

---

**From:** Voglewede, John
**Sent:** Friday, April 08, 2011 3:34 PM
**To:** Scott, Michael
**Cc:** Gibson, Kathy
**Subject:** RE: Password restricted NEA webpage - activities post-Fukushima

Michael,

In case you do not have access to the NEA Webpage in question, attached is an archive copy a few minutes old. The U.S. information appears to be limited and already in the public domain.

The notice that I received (also attached) about this site suggests that contributors contact Diane Jackson, an NRC employee who is now on assignment to OECD.

Maybe Brian should let her know. There is no way for individuals (here at NRC) to post anything on that website without going through the OECD staff.

John

---

**From:** Scott, Michael
**Sent:** Friday, April 08, 2011 3:10 PM
**To:** Zaki, Tarek; Bush-Goddard, Stephanie; Elkins, Scott; Hoxie, Chris; Lee, Richard; Santiago, Patricia; Armstrong, Kenneth; Bajorek, Stephen; Boyd, Christopher; Rubin, Stuart; Sherbini, Sami; Tinkler, Charles; Voglewede, John; Zigh, Ghani
**Subject:** FW: Password restricted NEA webpage - activities post-Fukushima

Please get the word out. Thanks

---

**From:** Sheron, Brian
**Sent:** Friday, April 08, 2011 2:53 PM
**To:** Case, Michael; Coe, Doug; Correia, Richard; Gibson, Kathy; Richards, Stuart; Scott, Michael; Uhle, Jennifer; Valentin, Andrea
**Subject:** FW: Password restricted NEA webpage - activities post-Fukushima

See below. I do not want anyone posting anything on the NEA web page about what the U.S. activities are in response to Fukushima.

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**From:** Greg.LAMARRE@oecd.org [mailto:Greg.LAMARRE@oecd.org]
**Sent:** Friday, April 08, 2011 9:58 AM
**Subject:** NEA: Password restricted NEA webpage - activities post-Fukushima

Dear CSNI, PRG and WG members,



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I would like to bring to your attention a new password protected NEA webpage.

It is a central page for the exchange of information regarding national activities following Fukushima entitled *Exchange of Information on Fukushima*.

This central page is accessible to all CNRA, CSNI, PRG and WG members. You can access the page-link through your password protected working area.

We will continue to post information as we are advised. I would ask that you please continue to share your national activities in response to the Fukushima event with the NEA Secretariat such that we can ensure that the site remains up-to-date and useful to members.

Thanks in advance and best regards,

Greg

**Greg Lamarre**
Nuclear Safety Division
OECD Nuclear Energy Agency (NEA)
Tel.: +33 (0)1 45 24 10 53
greg.lamarre@oecd.org

**Update your bookmarks!**
On 1 December 2010, the NEA is moving to:
www.oecd-nea.org

## Quayle, Lisa

**From:** LIA07 Hoc
**Sent:** Saturday, April 09, 2011 9:00 PM
**To:** Batkin, Joshua; Borchardt, Bill; Bradford, Anna; Coggins, Angela; Cohen, Shari; Collins, Elmo; Cooper, LaToya; Dyer, Jim; ET07 Hoc; Flory, Shirley; Gibbs, Catina; Haney, Catherine; Hudson, Sharon; Jaczko, Gregory; Johnson, Michael; Leeds, Eric; Loyd, Susan; Monninger, John; Pace, Patti; Schwarz, Sherry; Sheron, Brian; Speiser, Herald; Sprogeris, Patricia; Taylor, Renee; Virgilio, Martin; Walker, Dwight; Walls, Lorena; Weber, Michael
**Subject:** Go Book Update - 2200 EDT, April 9, 2011
**Attachments:** April 9 2200 EDT one pager.pdf

Attached, please find updated information for the "Go Books".

The update includes:

- The 2200 EDT, 04/09/11 One-pager/Briefing Sheet

Please let me know if you have any questions or concerns.

Yen

Yen Chen
Executive Briefing Team Coordinator
US Nuclear Regulatory Commission
LIA07.HOC@nrc.gov (Operations Center)



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April 9, 2011 2200 EDT

# Briefing Sheet
# Fukushima Daiichi

**ET Overview and Priorities**

- No significant changes on status of reactors – Analysis of U-2 possible Core Ex-vessel events provided to RST
- Working on transition plan for staffing at 6 persons through 4-16 and plan for continued staffing starting 4-17. Documents are in Web EOC under ET Miscellaneous documents collection.
- Working to staff an 11-person Site Team.
- Chairman call on 4-9 and 4-10 only at 15:15, TA brief at 8:30 a.m.
- Received strong adverse reaction to discontinuing SitRep in current form. Fed Partners may be open to reduced frequency; however content is needed to inform their products. Current plan is maintain format, reduce to 1 per daily issuance.

**RST Overview and Priorities**

- Briefing material for Secretary of State Clinton developed by site team. Meeting is anticipated the week of 17 April.
- Rev 2 of the RST Assessment Document is work in progress, INPO has comments.
- Ed Fuller provided analysis (D.Dube peer reviewed) of U2 core ex-vessel events occurring as early as 3/15/11. Providing analysis to Site Team, NR, GEH, and INPO for consideration regarding influence on SAMGs. Comments due Monday,4/11.
- Global assessment draft received from Mike Hay 4/9/11 @ 2115. Need to assign staff to follow-up.

**PMT Overview and Priorities**

- PMT developed the "composite" document crafted, input from RST. Covers the 3 issues, 1. Grab n Go criteria, 2. Defining 50-mile EPZ re-entry criteria, and 3. Defining stable conditions for Rx. Will coordinate with other agencies on Monday. T. Milligan also providing talking Pts for same.
- PMT reviewed a draft long-term habitability document developed by Knolls Atomic Power Laboratories (NR's recommendations regarding long-term re-entry based on KAPL). PMT provided comments to Naval Reactors.

**LT Overview and Priorities**

- The next consortium call will be Sunday evening.

## Lee, Richard

**From:** Lee, Richard
**Sent:** Saturday, April 09, 2011 9:20 AM
**To:** Kammerer, Annie
**Subject:** RE: TEPCO Seismic data

Thanks, Annie:

I will let Dana knows. So far, he said the plant survived the earthquake, but the tsunami did them in.

Richard

---

From: Kammerer, Annie
Sent: Saturday, April 09, 2011 6:21 AM
To: Lee, Richard
Subject: FW: TEPCO Seismic data

I hope this answers Dana's questions. Of course, PGA is site specific.

BTW, I forgot to put a notification on, but I'm out of the country.

Annie

WP71

| | |
|---|---|
| **From:** | Cusumano, Victor |
| **To:** | Lubinski, John; Evans, Michele; Thomas, Brian; Hardies, Robert; Karwoski, Kenneth; Lupold, Timothy; McMurtray, Anthony; Mitchell, Matthew; Taylor, Robert |
| **Subject:** | FW: INFORMATION Japan No radiation Leaks Or Abnormalities - 11 reactors shut down |
| **Date:** | Friday, March 11, 2011 8:53:11 AM |

FYI

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**From:** Astwood, Heather
**Sent:** Friday, March 11, 2011 8:25 AM
**To:** Leeds, Eric; Boger, Bruce; McGinty, Tim; Valentine, Nicholee; Titus, Brett; Susco, Jeremy; Roquecruz, Carla; Nguyen, Quynh; Meighan, Sean; Heida, Bruce; Fields, Leslie; Cusumano, Victor; Cartwright, William; Azeem, Almas
**Cc:** Cullingford, Michael; Hopkins, Jon; Quinones, Lauren; Regan, Christopher; Rodriguez, Veronica
**Subject:** INFORMATION Japan No radiation Leaks Or Abnormalities - 11 reactors shut down

FYI

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**From:** Breskovic, Clarence
**Sent:** Friday, March 11, 2011 4:05 AM
**To:** Breskovic, Clarence
**Subject:** Japan: No Radiation Leaks Or Abnormalities - 11 reactors shut down

**No Radiation Leaks Or Abnormalities in Quake-hit Japan: Prime Minister Kan**

Tokyo, March 11 Kyodo -- (EDS: RECASTING) Japan has detected no abnormalities such as radiation leakage at nuclear power plants in the country, Prime Minister Naoto Kan said Friday, following a powerful earthquake and aftershocks that hit a wide area on the Pacific coast of the northeastern region.

A total of 11 nuclear reactors were automatically shut down at the Onagawa plant, Fukushima No. 1 and No. 2 plants and Tokai No. 2 plant, the industry ministry said, adding there were no immediate reports from monitoring posts of fires or other abnormalities near the nuclear plants after the 2:46 p.m. quake.

Kan told a press conference, "Parts of nuclear plants were automatically shut down but we haven't confirmed any effects induced by radioactive materials outside the facilities." Tokyo Electric Power Co., which operates the Fukushima plants, said it kept operating the Kashiwazaki-Kariwa nuclear plant on the Sea of Japan coast in Niigata Prefecture, while Hokkaido Electric Power Co. reported no problems at its Tomari No. 1, No. 2 and No. 3 plants on the northernmost main island.

There were no immediate signs of any problems at the Hamaoka nuclear plant on the Pacific coast in Shizuoka Prefecture, southwest of Tokyo, the prefectural government said.

| | |
|---|---|
| **From:** | Kolb, Timothy |
| **To:** | Taylor, Robert |
| **Subject:** | Additional input for Chairmans questions |
| **Date:** | Sunday, March 13, 2011 11:45:45 AM |
| **Attachments:** | Questions and Answers for Chairman Jaczko 03-13-11.docx |

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Questions and Answers for Chairman Jaczko

March 11, 2011 Japan Earthquake/Tsunami Aftermath
As of 3 p.m., 3/13/2011

**1. What is the NRC doing about the emergencies at the nuclear power plants in Japan? Are you sending staff over there?**

Public Answer: We are closely following events in Japan, working with other agencies of the federal government, and have been in direct contact with our counterparts in that country. We are ready to provide assistance if there is a specific request. Two NRC staff members knowledgeable about boiling water reactors is participating in the USAID team that has departed for Japan.

Additional technical, non-public information:
We are taking the knowledge that the staff has about the design of the US nuclear plants and we are applying this knowledge to the Japan situation. For example, this includes calculations of severe accident mitigation that have been performed. Tony Ulses has been dispatched to Japan and should arrive Early Sunday.David Jim Trapp left 1600 Saturday should arrive in 20 hours

**2. What's going to happen following the steam explosion everyone's seen from the video footage?**

Public Answer: If a similar event occurred at a U.S. nuclear power plant, the NRC would be seeking information to answer several questions, including: What's the status of the reactor core, the reactor vessel and the containment building? What radiation measurement equipment is available and what measurements are being reported? What efforts are being taken to keep the public safe? How did the explosion affect efforts to keep the nearby reactors in a safe condition? And most importantly – What can the NRC do to help?

Additional technical, non-public information:

The explosion affected the secondary containment of the reactor plant. The primary containment was not affected by the explosion. The Japanese are taking actions to preserve the primary containment, cool the reactor core, maintain the reactor shut down and limit the spread of radioactive contamination.

The explosion affected the secondary containment of the reactor plant. The primary containment was not affected by the explosion. This does expose the spent fuel pools to atmosphere but should not affect the integrity of the spent fuel pool. With the integrity of the Secondary Containment breached it is more essential to maintain Primary Containment intact.

To provide additional protection to Primary Containment, US reactors of the containment type similar to Fukushima Unit 1 installed a hardened vent line from primary containment directly to the vent stack. A hardened vent provides a release path which would prevent an overpressurization of containment as experienced at Fukushima Unit One. Venting from the hardened vent is typically a manual operation that is controlled by the Emergency Operating Procedures as a last resort to protect the containment from failure. This vent path can be directly from the upper containment or from the torus (the preferred vent path due to scrubbing effect of the torus water).

**3. What should done to protect people in Alaska, Hawaii and the West Coast do from radioactive fallout?**

Public Answer: The available evidence shows the United States can be expected to avoid any impacts from radioactive material, so no public action is necessary. We believe there is very low risk to the US considering the long distance from the US and the type of event.

Additional technical, non-public information: NRC is working with DHS, EPA and other federal partners to ensure monitoring equipment is properly positioned, based on meteorological and other relevant information.

**4. Can this happen here i.e. an earthquake that significantly damages a nuclear power plant? Are the Japanese plants similar to U.S. plants?**

Public Answer: All U.S. nuclear power plants are built to withstand environmental hazards, including earthquakes and tsunamis. Even those plants that are located outside of areas with low and moderate seismic activity are designed for safety in the event of such a natural disaster. The NRC requires that safety-significant structures, systems, and components be designed to take into account even very rare and extreme seismic and tsunami events.

The Japanese facilities are similar in design to several US facilities.

Additional technical, non-public information:
Currently operating reactors were designed using a "deterministic" or "maximum credible earthquake" approach. Seismic hazard for the new plants is determined using a much more robust probabilistic seismic hazard assessment approach that explicitly addresses uncertainty, as described in RG1.208. The NRC requires that adequate margin beyond the design basis ground shaking levels is assured. The NRC further enhances seismic safety for beyond-design-basis events through the use of a defense-in-depth approach.

In addition, the NRC periodically reviews the seismic risk at operating reactors when information may have changed. Over the last few years the NRC has undertaken a program called Generic Issue 199, which is focused on assessing hazard for plants in the central and eastern US using the latest techniques and determining the possible risk implications of any increase in the anticipated ground shaking levels. This program will help us assure that the plants are safe under exceptionally rare and extreme ground motions that represent beyond-design-basis events.

**5. What would U.S. plants do in this situation?**

Public Answer: The NRC requires plant designs to include multiple and diverse safety systems, and plants must test their emergency preparedness capabilities on a regular basis. Plant operators are very capable of responding to significant events. In addition, NRC regulations require plants to have plans in place that would allow them to mitigate even "worst case scenarios".

Since 9/11, we have implemented requirements for licensees to have additional response capabilities for extreme situations.

Additional technical, non-public information:

Our nuclear plants have procedures in place to address a variety of accident scenarios, including abnormal operating procedures, emergency operating procedures, severe accident management guidelines and emergency plans. Additionally, the NRC activates Incident Response centers in Headquarters and individual Regions as necessary for the event to provide technical monitoring and support.

The NRC is capable of providing access to many external agencies (i.e., FEMA, Homeland Security, Military, etc.) to provide any additional help that individual plant sites may need. Additionally, the NRC has access to real-time plant information through the ERDS System for each site in the US and can monitor the status anytime.

**6. Are U.S. power plants designed to withstand tsunamis?**

Public Answer: Yes. Plants are built to withstand a variety of environmental hazards and those plants that might face a threat from tsunami are required to withstand large waves and the maximum wave height at the intake structure (which varies by plant.)

Additional, technical, non-public information:
Tsunami have been considered in the design of US nuclear plants since the publication of Regulatory Guide 1.59 in 1977, although the approaches that were used for design of the existing plants varied significantly. Nuclear plants are designed to withstand flooding from not only tsunami, but also hurricane and storm surge; therefore there is often significant margin against tsunami flooding. However, it should be noted that Japanese experience has shown that drawdown can be a significant problem. Drawdown was not generally analyzed in the past. The particular

Currently the US NRC has a tsunami research program that is focused on developing modern hazard assessment techniques and additional guidance through cooperation with the National Oceanic and Atmospheric Administration and the United States Geological Survey. This has already lead to several technical reports and an update to NUREG 0-800. The NOAA and USGS contractors are also assisting with NRO reviews of tsunami hazard. A new regulatory guide on tsunami hazard assessment is currently planned in the office of research, although it is not expected to be available in draft form until 2012.

**7. What happens when/if a plant "melts down"?**

Public Answer: In short, nuclear power plants in the United States are designed to be safe. To prevent the release of radioactive material, there are multiple barriers between the radioactive material and the environment, including the fuel cladding, the heavy steel reactor vessel itself and the containment building, usually a heavily reinforced structure of concrete and steel several feet thick.

Additional, technical, non-public information:
The melted core may melt through the bottom of the vessel and flow onto the concrete containment floor. The core may melt through the containment liner and release radioactive material to the environment.

**8. Why is KI administered during nuclear emergencies?**

Public Answer: KI – potassium iodide – is one of the protective measures that might be taken in a radiological emergency in this country. A KI tablet will saturate the thyroid with non radioactive iodine and prevent the absorption of radioactive iodine that could be part of the radioactive material mix of radionuclides in a release.KI does not prevent exposure from these other radionuclides.

Additional, technical non-public information.
There are a range of protective measures that we use ... the most effective is evacuation. Local government officials are responsible for determining the best means to protect their public. KI is another means for protection but evacuation and sheltering are the primary means that are used.

**9. Was there any damage to U.S. reactors from either the earthquake or the resulting tsunami?**

Public Answer: No

Additional, technical non-public information: Diablo Canyon Units 1 and 2 were the only US plants to declare any type of an emergency classification. The site entered an "unusual event" based on a tsunami warning from the State, NOAA, NWS, Coast Guard or System Dispatcher following the Japanese earthquake. They have since exited the "unusual event" declaration, based on a downgrade to a tsunami advisory.

**10. Has this incident changed the NRC perception about earthquake risk?**

Public Answer: There has been no change in the NRC's perception of earthquake hazard (i.e. ground shaking levels) for US nuclear plants. As is prudent, the NRC will certainly be looking closely at this incident and the effects on the Japanese nuclear power plant in the future to see if any changes are necessary to NRC regulations.

Additional, technical, non-public information.
We expect that there would be lessons learned, etc. It appears that the sites did not have any critical damage due to the earthquake from the fact that the emergency diesel generators initially responded to provide power to the site. The tsunami and consequential site flooding was responsible for the complete loss of power to the site, including the diesel generators which resulted in a Station Blackout.

**11. Will this incident affect new reactor licensing?**

Public Answer: It is not appropriate to hypothesize on such a future scenario at this point.

Additional, technical non-public information:
This event could potentially call into question the NRC's seismic and flooding requirements which could require the staff to re-evaluate the staff's approval of the AP1000 and ESBWR design and certifications.

**12. What magnitude earthquake are US plants designed to?**

Public Answer: Each plant is designed to a ground-shaking level that is appropriate for its location, given the possible earthquake sources that may affect the site and its tectonic environment. Ground shaking is

a function of both the magnitude of and earthquake and the distance from the fault plane to the site. The probabilistic approaches account for a large number of different magnitudes.

Additional, technical non-public information:
In the past, "deterministic" or "scenario based" analyses were used to determine ground shaking (seismic hazard) levels. Now a probabilistic method is used that accounts for all possible earthquakes coming from all possible sources (including background seismicity) and the likelihood that each particular hypothetical earthquake occurs.

**13. How many US reactors are located in active earthquake zones (and which reactors)?**

Public Answer: Although we often think of the US as having "active" and "non-active" earthquake zones, earthquakes can actually happen almost anywhere. Seismologists typically separate the US into low, moderate, and high seismicity zones. The NRC requires that every plant is designed for site-specific ground motions that are appropriate for their location. In addition, the NRC has specified a minimum ground shaking level to which the plants must be designed.

Additional, technical non-public information: No additional.

**14. How many reactors are along coastal areas that could be affected by a tsunami (and which ones)?**

Public Answer: Many plants are located in coastal areas that could theoretically be affected by tsunami. Two plants, Diablo Canyon and San Onofre, are on the Pacific Coast, which is known to have tsunami hazard. There are also two plants on the Gulf Coast, South Texas and Crystal River. There are many plants on the Atlantic Coast or on rivers that may be affected by a tidal bore. These include St. Lucie, Turkey Point, Brunswick, Oyster Creek, Millstone, Pilgrim, Seabrook, Calvert Cliffs, Salem/Hope Creek, and Surry. Tsunami on the Gulf and Atlantic Coasts occur, but are very rare. Generally the flooding anticipated from hurricane storm surge exceeds the flooding expected from a tsunami for plants on the Atlantic and Gulf Coast.

Additional, technical non-public information: None

**15. How many U.S. plants have designs similar to the affected Japanese reactors (and which ones)**

Public Answer: Six of the 104 US reactors are General Electric BWR 3 with Mark 1 containments similar to the design used at Fukushima Unit One.

Additional Information:
The units are: Dresden Units 2 and 3, Monticello unit 1, Pilgrim unit 1, Quad Cities Units 1 and 2.

| | |
|---|---|
| **From:** | Cusumano, Victor |
| **To:** | Thomas, Brian; Lubinski, John; Hardies, Robert; Karwoski, Kenneth; Lupold, Timothy; McMurtray, Anthony; Mitchell, Matthew; Taylor, Robert |
| **Subject:** | American Nuclear Society Mailings on the Fukushima Incident |
| **Date:** | Monday, March 14, 2011 8:57:12 AM |
| **Attachments:** | ANS Japan Backgrounder.pdf<br>ANS Talking Points - 2011-03-13 R1_2.pdf |

From the ANS...
Two attachments:
A short backgrounder on what is currently believed to be the operational chain of events at Fukushima, and second, the ANS/NEI "talking points" brief on implications on the US nuclear industry. This is what they are using during press briefings.

Cavaeat emptor... consider the source.

Vic

Victor Cusumano
Technical Assistant

NRR/DCI
Phone: 301.415.4011
Location: O-09C10

W/274

# American Nuclear Society Backgrounder:
# Japanese Earthquake/Tsunami; Problems with Nuclear Reactors

## 3/12/2011 5:22 PM EST

**To begin, a sense of perspective is needed... right now, the Japanese earthquake/tsunami is clearly a catastrophe; the situation at impacted nuclear reactors is, in the words of IAEA, an "Accident with Local Consequences."**

The Japanese earthquake and tsunami are natural catastrophes of historic proportions. The death toll is likely to be in the thousands. While the information is still not complete at this time, the tragic loss of life and destruction caused by the earthquake and tsunami will likely dwarf the damage caused by the problems associated with the impacted Japanese nuclear plants.

**What happened?**

Recognizing that information is still not complete due to the destruction of the communication infrastructure, producing reports that are conflicting, here is our best understanding of the sequence of events at the Fukushima I-1 power station.

- The plant was immediately shut down (scrammed) when the earthquake first hit. The automatic power system worked.
- All external power to the station was lost when the sea water swept away the power lines.
- Diesel generators started to provide backup electrical power to the plant's backup cooling system. The backup worked.
- The diesel generators ceased functioning after approximately one hour due to tsunami induced damage, reportedly to their fuel supply.
- An Isolation condenser was used to remove the decay heat from the shutdown reactor.
- Apparently the plant then experienced a small loss of coolant from the reactor.
- Reactor Core Isolation Cooling (RCIC) pumps, which operate on steam from the reactor, were used to replace reactor core water inventory, however, the battery-supplied control valves lost DC power after the prolonged use.
- DC power from batteries was consumed after approximately 8 hours.
- At that point, the plant experienced a complete blackout (no electric power at all).
- Hours passed as primary water inventory was lost and core degradation occurred (through some combination of zirconium oxidation and clad failure).

- Portable diesel generators were delivered to the plant site.
- AC power was restored allowing for a different backup pumping system to replace inventory in reactor pressure vessel (RPV).
- Pressure in the containment drywell rose as wetwell became hotter.
- The Drywell containment was vented to outside reactor building which surrounds the containment.
- Hydrogen produced from zirconium oxidation was vented from the containment into the reactor building.
- Hydrogen in reactor building exploded causing it to collapse around the containment.
- The containment around the reactor and RPV were reported to be intact.
- The decision was made to inject seawater into the RPV to continue to the cooling process, another backup system that was designed into the plant from inception.
- Radioactivity releases from operator initiated venting appear to be decreasing.

**Can it happen here in the US?**

- While there are risks associated with operating nuclear plants and other industrial facilities, the chances of an adverse event similar to what happened in Japan occurring in the US is small.
- Since September 11, 2001, additional safeguards and training have been put in place at US nuclear reactors which allow plant operators to cool the reactor core during an extended power outage and/or failure of backup generators – "blackout conditions."

**Is a nuclear reactor "meltdown" a catastrophic event?**

- Not necessarily. Nuclear reactors are built with redundant safety systems. Even if the fuel in the reactor melts, the reactor's containment systems are designed to prevent the spread of radioactivity into the environment. Should an event like this occur, containing the radioactive materials could actually be considered a "success" given the scale of this natural disaster that had not been considered in the original design. The nuclear power industry will learn from this event, and redesign our facilities as needed to make them safer in the future.

**What is the ANS doing?**

ANS has reached out to The Atomic Energy Society of Japan (AESJ) to offer technical assistance.

ANS has established an incident communications response team.

This team has compiling relevant news reports and other publicly available information on the ANS blog, which can be found at ansnuclearcafe.org.

The team is also fielding media inquiries and providing reporters with background information and technical perspective as the events unfold.

Finally, the ANS is collecting information from publicly available sources, our sources in government agencies, and our sources on the ground in Japan, to better understand the extent and impact of the incident.

The predominance of ANS members reside in the U.S. As we interact with our family, neighbors and citizens in our communities many questions will come based on news coverage of the nuclear power plant situation in Japan. These talking points key on the theme 'could it happen in the U.S.?' *

## ANS Member Talking Points
## Implications to U.S. nuclear energy program from the Japanese earthquake

It is premature for the technical community to draw conclusions from the earthquake and tsunami tragedy in Japan with regard to the U.S. nuclear energy program. Many opposed to nuclear power will try to use this event to call for changes in the U.S. Japan is facing beyond a "worst case" disaster since we, the technical community, did not hypotheses an event of this magnitude. Thus far, even the most seriously damaged of Japan's 54 reactors have not released radiation at levels that would harm the public. That is testament to the way professionals in our profession operate: our philosophy of defense in-depth, excellent designs, high standards of construction, conduct of operations, and most important the effectiveness of employees in following emergency preparedness planning.

The Nuclear Science and Technology (NS&T) community takes very seriously our commitment to safe operation of any nuclear facility and will incorporate lessons learned based on this experience into our safety and operating procedures. The ANS will facilitate the sharing of technical information so that these lessons receive wide distribution and be archived for future stewards of this technology. Some points to remember from this week:

- Nuclear power plants have proven their value to society in Japan, the United States and elsewhere. They provide large amounts of base load electricity on an around-the-clock basis, and they do so cost-effectively with the lowest electricity production costs of any large energy source. Both Japan and the United States have benefited greatly from nuclear energy; it has been instrumental in the nations' economic success over the past half century and their high standard of living.

- Our hallmark as a NS&T organization is to incorporate operating experience and lessons learned. When we fully understand the facts surrounding the event in Japan, we will share, document and use those insights to make NS&T even safer.

- Nuclear energy has been and will continue to be a key element in meeting America's energy needs. The nuclear industry sets the highest standards for safety and, through our focus on continuous learning; we will incorporate lessons learned from the events in Japan. The dominant factors determining technology used for new generation will be demand for new generation, the competitiveness of nuclear energy in comparison with other sources of electricity generation, and the continued safe operation of U.S. nuclear power plants.

- There has not been a rush to judgment on the part of U.S. policymakers during the first few days of this situation. We believe that is due in part to the recognition on their part that nuclear energy must continue to play a key role in a diversified energy portfolio that strengthens U.S. energy security and fuels economic growth.

* The genesis of this document is the NEI "Talking Points - Implications to U.S. nuclear energy program of the Japanese earthquake" dated March 13, 2011

**From:** Cusumano, Victor
**To:** NRR_DCI Distribution
**Subject:** Japan Updates
**Date:** Wednesday, March 16, 2011 9:24:55 AM

INRR

- From the Tepco (the utility) as of today (VERY detailed press release): http://www.tepco.co.jp/en/press/corp-com/release/11031608-e.html
- From Japan Atomic Industrial Forum (JAIF) detailed spreadsheet with unit/system status at-a-glance: complete summary PDF
- JAIF main site (english): http://www.jaif.or.jp/english/index.php

Vic

VICTOR CUSUMANO
TECHNICAL ASSISTANT

NRR/DCI
Phone: 301.415.4011
Location: O-09C10

W/275

| | |
|---|---|
| **From:** | Cunningham, Liza |
| **To:** | Auluck, Rajender; Boyce, Tom (RES); Brock, Kathryn; Campbell, Stephen; Carlson, Robert; Casto, Greg; Chernoff, Harold; Cranston, Gregory; Dennig, Robert; Dozier, Jerry; Eads, Johnny; Elliott, Robert; Franovich, Rani; Gavrilas, Mirela; Harrison, Donnie; Helton, Shana; Howe, Allen; Imboden, Andy; James, Lois; Kemper, William; Khanna, Meena; Klein, Alex; Kobetz, Timothy; Kulesa, Gloria; Lupold, Timothy; Manoly, Kamal; Markley, Michael; McHale, John; McMurtray, Anthony; Mendiola, Anthony; Mitchell, Matthew; Murphy, Martin; Pascarelli, Robert; Pelton, David; Pham, Bo; Raghavan, Rags; Rosenberg, Stacey; Salgado, Nancy; Scott, Michael; Shoop, Undine; Simms, Sophonia; Tate, Travis; Taylor, Robert; Thatcher, Dale; Thorp, John; Wilson, George; Wrona, David; Zimmerman, Jacob; Boger, Bruce; Givvines, Mary; Grobe, Jack; Leeds, Eric; Bahadur, Sher; Blount, Tom; Brown, Frederick; Cheok, Michael; Cunningham, Mark; Evans, Michele; Ficks, Ben; Galloway, Melanie; Giitter, Joseph; Hiland, Patrick; Holian, Brian; Lee, Samson; Lubinski, John; Lund, Louise; McGinty, Tim; Nelson, Robert; Quay, Theodore; Ruland, William; Skeen, David |
| **Cc:** | NRR_DIRS_IOEB Distribution |
| **Subject:** | FW: PNO-IV-11-001a Update - Diablo Canyon Power Plant Notification of Unusual Event |
| **Date:** | Monday, March 14, 2011 12:11:47 PM |
| **Attachments:** | PNO-IV-11-001a DC ADAMS.docx |

Attached is the PNO-IV-11-001A: UPDATE - DIABLO CANYON POWER PLANT NOTIFICATION OF UNUSUAL EVENT

Thanks,
Liza Cunningham

**From:** Tannenbaum, Anita
**Sent:** Monday, March 14, 2011 12:09 PM
**To:** R4; PN_Distribution
**Subject:** PNO-IV-11-001a Update - Diablo Canyon Power Plant Notification of Unusual Event

ADAMS ML110730377

W/276

March 14, 2011

**PRELIMINARY NOTIFICATION OF EVENT OR UNUSUAL OCCURRENCE -- PNO-IV-11-001a**

This preliminary notification constitutes EARLY notice of events of POSSIBLE safety or public interest significance. The information is as initially received without verification or evaluation, and is basically all that is known by the Region IV staff on this date.

| **Facility** | **Licensee Emergency Classification** |
|---|---|
| Pacific Gas and Electric Company | XX Notification of Unusual Event |
| Diablo Canyon Nuclear Plant Units 1 and 2 | ____Alert |
| Avila Beach, CA | ____Site Area Emergency |
| Docket: 50-275, 50-323 | ____General Emergency |
| License: DPR-80, DPR-82 | ____Not Applicable |

**SUBJECT:** UPDATE - DIABLO CANYON POWER PLANT NOTIFICATION OF UNUSUAL EVENT

**DESCRIPTION:**

This preliminary notification updates information provided in PNO-IV-11-001, which was issued on March 11, 2011. Diablo Canyon Power Plant declared a Notification of Unusual Event at 4:23 a.m. EST on March 11, 2011, based on receipt of a tsunami warning from West California Emergency Management Agency resulting from the earthquake in Japan. There was no impact on plant operations and both units continued to operate at full power throughout the event. Maximum wave surge estimated at the site was approximately 3 feet. The tsunami warning was lifted at 6:12 p.m. EST on March 11, 2011, and the licensee subsequently terminated the Unusual Event declaration at 6:28 p.m. EST. The NRC resident inspectors responded to the site to monitor plant conditions and licensee actions for the duration of the event.

NRC Region IV has been in contact with licensee and governmental officials within the areas affected and there have been no reported impacts from the tsunami on nuclear materials licensees and other NRC licensed facilities on the west coast.

The NRC entered the Monitoring Mode at 9:46 a.m. EST on March 11, 2011 in response to the tsunami warning at Diablo Canyon. The NRC is coordinating its actions with other Federal agencies as part of the U.S. government response to the events in Japan.

The state of California has been informed. This information has been discussed with licensee management and is current as of 10:55 a.m. EST.

This preliminary notification is issued for information only.

**ADAMS ACCESSION NUMBER: ML110730377**

**CONTACTS:**

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lara.uselding@nrc.gov

Geoffrey Miller
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Geoffrey.Miller@nrc.gov

| | |
|---|---|
| **From:** | Kammerer, Annie |
| **To:** | Brown, Frederick; Giitter, Joseph; Howe, Allen; Hiland, Patrick; Skeen, David; Case, Michael; Ruland, William; Dudes, Laura |
| **Cc:** | McDermott, Brian; Ross-Lee, MaryJane; Hasselberg, Rick |
| **Subject:** | RE: (Action) Tsunami Fact Sheet - NUREG issued in March 2009 Link |
| **Date:** | Monday, March 14, 2011 12:45:26 PM |
| **Attachments:** | NRC TsunamiPaper Bagchi.pdf<br>Paper 15-0007 Kammerer 14WCEE.pdf<br>Paper 15-0009 Kammerer 14WCEE.pdf<br>Appendix for DS 417 US NRC AKammerer GBagchi HJones.doc |

I have a fair amount of info on tsunami. I don't recall ever seeing a tsunami fact sheet, but could be wrong.

My suggestion, if we don't have one, is to get Henry Jones and Goutam Bagchi working on one. I lead the RES work, but can't really dig into this until tomorrow. Goutam and Henry are the two people in NRO who I work most closely with on this topic. They could give us an excellent start. Should I ask them?

BTW, there is a good (and only slightly out of date) summarization of our regulatory approach and regulatory research in an appendix on US practice that I wrote for an IAEA guide on flooding (DS417). Also, Goutam, Henry and I wrote a paper for an IAEA workshop last year.

Annie

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**From:** Brown, Frederick
**Sent:** Monday, March 14, 2011 7:13 AM
**To:** Giitter, Joseph; Howe, Allen; Hiland, Patrick; Skeen, David; Case, Michael; Ruland, William; Dudes, Laura
**Cc:** McDermott, Brian; Ross-Lee, MaryJane; Kammerer, Annie; Hasselberg, Rick
**Subject:** FW: (Action) Tsunami Fact Sheet - NUREG issued in March 2009 Link

FYI

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**From:** King, Mark
**Sent:** Monday, March 14, 2011 7:08 AM
**To:** Thorp, John; Boger, Bruce
**Cc:** Brown, Frederick; Thomas, Eric
**Subject:** RE: (Action) Tsunami Fact Sheet - NUREG issued in March 2009 Link

We had a NUREG issued on this subject back in March 2009.

**TSUNAMI HAZARD ASSESSMENT AT NUCLEAR POWER PLANT SITES IN THE UNITED STATES OF AMERICA**
**Click link to view: [NUREG/CR-6966]**

http://pbadupws.nrc.gov/docs/ML0915/ML091590193.pdf

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**From:** Thorp, John
**Sent:** Monday, March 14, 2011 6:57 AM

w/277

**To:** Boger, Bruce
**Cc:** Brown, Frederick; King, Mark; Thomas, Eric
**Subject:** RE: (Action) Tsunami Fact Sheet

We'll look for it; If we don't find it quickly, we'll start producing one. (Mark King, please start looking)

I take it we would define & describe the tsunami phenomena, then address which nuclear stations in the U.S. are located in areas subject to tsunami waves, and describe what we can regarding the design of plants to withstand tsunami impacts?

Thanks,

John

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**From:** Boger, Bruce
**Sent:** Monday, March 14, 2011 6:48 AM
**To:** Thorp, John
**Cc:** Brown, Frederick
**Subject:** Tsunami Fact Sheet

I seem to recall that OpE developed a tsunami fact sheet? Should we dust it off?

# Tsunami Safety Criteria and Current Site Reviews in the United States

By

Goutam Bagchi, Hosung Ahn, Henry Jones, Annie Kammerer, Richard Raione and Nilesh Chokshi

United States Nuclear Regulatory Commission

## Abstract

The U.S. Nuclear Regulatory Commission (NRC) has promulgated an alternate licensing framework for early site permits (ESPs), certified reactor designs, and combined construction permits and operating licenses (COLs) as described in 10 Code of Federal Regulations (CFR) Part 52. New applicants have been using the Part 52 framework in submittals since 2003. The reactor site criteria are addressed in 10 CFR Part 100. Guidance for the public on approaches that meet NRC requirements is outlined in NRC regulatory guides. Factors to be considered when selecting the site include physical characteristics of the site including seismology, meteorology, geology, and hydrology. The NRC staff review guidance and acceptance criteria are provided in a document, "Review of Safety Analysis Reports for Nuclear Power Plants, NUREG 0800, Revised March 2007." Section 2.4 of the staff guidance in NUREG 0800 relates to hydrology and flooding design basis for a nuclear power plant.

The objective of this paper is to describe several initiatives undertaken in the U.S. to capture the lessons learned from the 2004 Indian Ocean tsunami; to describe revision of the staff guidance documented in NUREG 0800 Section 2.4.6, "Probable Maximum Tsunami Hazards" and some essential elements from Section 2.4.5, "Probable Maximum Surge and Seiche Flooding;" and to describe efforts related to the revision of the regulatory guide 1.59, "Design Basis Floods for Nuclear Power Plants." This document also describes the efforts to use the lessons and insights learned from the current site reviews.

Several coastal sites are currently under review for assessment of flood parameters associated with tsunami and hurricane (e.g. maximum and minimum surge levels, residence time, recession rate, erosion and sedimentation effects, etc.). Modeling of wave propagation and overland runup is important for these efforts. Also, tsunami and hurricane surge estimates, including consideration of site-specific long term climate change and sea level rise effects are important aspects of the assessment. At coastal sites, the effects of tsunami and hurricane should be carefully examined to determine which effect governs the site flooding hazard.

## Introduction

The Code of Federal Regulation Title 10, Part 100 (10 CFR Part 100) relates to Reactor Site Criteria, and Subpart A applies to applications prior to 1997 and Subpart applies to applications after 1997. The site factors that are required to be considered include geological, seismological, hydrological, meteorological and other factors. In order to expedite site selection and certification of standard reactor designs a decoupled process was incorporated in 10 CFR Part 52 of the NRC regulation. This decoupled process allows for early site permit (ESP) applications to be separate from the standard reactor certification. The ESP needs to establish site characteristics that can accommodate an envelope of plant parameters. An applicant seeking to license a nuclear power plant can then use an ESP and a certified reactor design to submit an application for a combined operating license. Although the option exists for an applicant to use a new reactor design at a brand new site or use an ESP with a new reactor design.

NRC regulation 10 CFR Part 100.20 requires adherence to a set of siting factors. Assessment activities related to these factors include the following:

- The nature and proximity of man-related hazards (e.g., airports, dams, transportation routes, military and chemical facilities) must be evaluated to establish site parameters for use in determining whether a plant design can accommodate commonly occurring hazards, and whether the risk of other hazards is very low.
- Physical characteristics of the site, including seismology, meteorology, geology, and hydrology must be identified, characterized and assessed.
- Meteorological characteristics of the site that are necessary for safety analysis or that may have an impact upon plant design (such as maximum probable wind speed and precipitation) must be identified and characterized.
- Factors important to hydrological radionuclide transport (such as soil, sediment, and rock characteristics, adsorption and retention coefficients, ground water velocity, and distances to the nearest surface body of water) must be obtained from on-site measurements. The maximum probable flood along with the potential for seismically induced floods must be estimated using historical data.

In addition to the consideration of the siting factors above, a proposed facility must include the principal design criteria. The principal design criteria establish the necessary design, fabrication, construction, testing, and performance requirements for structures, systems, and components important to safety; that is, structures, systems, and components that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Appendix A to 10 CFR Part 50 specifies these general design criteria (GDC) to establish minimum requirements for the principal design criteria for water-cooled nuclear power plants similar in design and location to plants for which construction permits have been issued by the Commission. The General Design Criteria are also considered to be generally applicable to other types of nuclear power units and are intended to provide guidance in establishing the principal design criteria for such other units. GDC 2 requires appropriate consideration of the most severe

of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated. Appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena are also required.

## Regulatory Guidance on Flood Hazard Determination

Regulatory Guide (RG) 1.59, "Design Basis Floods for Nuclear Power Plants" provides guidance for one acceptable method of establishing the design basis floods at a specific site and NUREG 0800, "Standard Review Plan (SRP)" provides guidance to the NRC staff on details of conducting the review and the determination of safety findings. RG 1.59 is currently being revised, and the SRP was revised on March 31, 2007.

NRC has adopted the concept of a "probable maximum event," for estimating design bases. The probable maximum event, which is determined by accounting for the physical limits of the natural phenomenon, is the event that is considered to be the most severe reasonably possible at the location of interest and is thought to exceed the severity of all historically observed events. For example, dam failures, a probable maximum flood (PMF) is the hypothetical flood generated in the drainage area by a probable maximum precipitation (PMP) event. The probable maximum storm surge is generated by the probable maximum hurricane (PMH) or the probable maximum windstorm (PMWS). These events are defined by the American National Standards Institute (ANSI) and ANS in ANSI/ANS-2.8-1992 (ANS, 1992). Similar concepts exist for a probable maximum tsunami, which is not covered in the ANSI standard. Because the PMP is a deterministic concept with no associated probability distribution, estimating the PMF also is a deterministic process.

In order to assess the design basis flood, first, for the selected site of a nuclear power plant, the causal phenomena or mechanisms that could lead to flooding should be identified. Flooding causal mechanisms refer to the set of those hydro-meteorological, geo-seismic, or structural failure phenomena (embankment, near by water control structures) that may produce a flood at or near the site. The geographical area that is relevant when determining floods at or near the site for each flooding causal mechanism should be identified. This geographical area, generally termed the vicinity of the site or site region (or just "the vicinity"), depends on the nature of the flood causal mechanism being considered. Floods generated in the vicinity because of the hydro-meteorological, geo-seismic, or structural failure may propagate to the site. For example, a PMF in a river that flows by a site may consist of the entire watershed of the river upstream of the site. For a site located near coastal regions, an ocean, or a large lake may also be subjected to tsunamis or storm surges that might propagate to the site.

An inspection of historical data may reveal the flooding causal mechanisms that should be considered for a site. For example, an inspection of air temperature data may suggest potential for formation of ice jams or dams, the subsequent collapse of which may generate a flood. More important is the need to inspect the hydrology, topography,

morphology, and geology and the presence of any water control structures in the vicinity of the site (e.g., a site located on the banks of a river should be investigated for the PMF in the river; a site that has several upstream dams should be analyzed for floods from single and cascading dam failures). Typically, flooding causal mechanisms that should be considered include local intense precipitation, flooding in rivers and streams, flooding from upstream dam breaches or failures, flooding from storm surges or seiches, flooding from tsunamis, flooding from ice-induced events, and flooding from channel diversions towards the site. A hierarchical hazard assessment starts with the most conservative simplifying assumptions that maximize the hazards from the probable maximum event for each natural flooding causal phenomenon expected to occur in the vicinity of a proposed site. If the site is not inundated by floods from any of the phenomena, a conclusion that the site is not susceptible to flooding would be valid (ANS, 1992), and no further flood hazard assessment is needed. For these reasons, the SRP emphasizes the need to apply a hierarchical approach for establishing the design basis flood.

## U. S. Tsunami Initiatives Post-2004 Indian Ocean Tsunami

In response to the 2004 Indian Ocean tsunami, in 2005 the NRC coordinated a tsunami safety study with the National Tsunami Safety initiative conducted by the National Oceanic and Atmospheric Administration (NOAA). The NRC tsunami hazard study was conducted by the Pacific Northwest National Laboratory and the Pacific Marine and Environmental Laboratory which is a part of NOAA. This early effort resulted in the publication of two documents. They were NUREG-CR 6966, "Tsunami Hazard Assessment at Nuclear Power Plant Sites in the Untied States of America", which was published in final form in March 2009, and NOAA Technical Memorandum OAR PMEL-136, "Scientific and Technical Issues in Tsunami Hazard Assessment of Nuclear Power Plant Sites,", which was published in 2007. These documents form the basis of the 2007 tsunami-related updates to NUREG 0800.

In 2006, the NRC also initiated a long-term research tsunami research program. This program, which includes cooperative work with the United States Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA), was designed both to support activities associated with the licensing of new nuclear power plants in the U.S and to support development of new regulatory guidance. This research program has resulted in several publication and made important contributions to tsunami modeling approach and standards, as summarized in conference papers by Kammerer (2008)

Necessarily, the US NRC research program includes assessment of both seismic- and landslide-based tsunamigenic sources in both the near and the far fields. The inclusion of tsunamigenic landslides, an important category of sources that impact tsunami hazard levels for the Atlantic and Gulf Coasts, is a key difference between this program and most other tsunami hazard assessment programs that existed at the time. The initial phase of work undertaken by the USGS as part of the research program consisted of collection, interpretation, and analysis of available offshore data, with significant effort focused on characterizing offshore near-field landslides and analyzing their tsunamigenic potential

and properties. This work is summarized in ten Brink et al (2008). In addition, eight papers have been published in a special edition of Marine Geology Marine Geology Special Issue: Tsunami Hazard Along the U.S. Atlantic Coast, Volume 264, Issues 1-2, (2009) dedicated in whole to the results of the NRC research program. These papers are listed in the reference section of this document.

In the current phase of research, additional field investigations are being conducted in key locations of interest and additional analysis of the data is being undertaken. Simultaneously, the MOST tsunami generation and propagation model used by NOAA has been enhanced to include landslide-based initiation mechanisms and is being used to investigate the impact of the tsunamigenic sources identified and characterized by the USGS. The potential for probabilistic tsunami hazard assessment will also be explored in the final phases of the program.

Regulatory Guide 1.59 (1977) briefly discussed tsunami as a source of flooding. This regulatory guide is currently being updated. However, the update of this guide will not include tsunami-induced flooding. NRC staff is currently preparing a new regulatory guide focused on tsunami hazard assessment and risk.

## U. S. Storm Surge Initiatives Post-2005 Hurricane Katrina

At the end of August 2005, Hurricane Katrina made landfall near the Louisiana/ Mississippi border. Less than one month later, Hurricane Rita struck near the Louisiana/Texas border. Both of these storms produced catastrophic damage, and areas of the Louisiana and Mississippi coasts were devastated. NRC tasked the U.S. Army Corps of Engineers (USACE) to review the NOAA Technical Report NWS 23, "Meteorological Criteria for Standard Project Hurricane and Probable Maximum Hurricane Wind Fields, Gulf and East Coasts of the United States" and the NRC Regulatory Guide 1.59, "Design Basis Floods for Nuclear Power Plants". Regulatory Guide 1.59 and its supporting documents provide a methodology for estimating the probable maximum surge (PMS) for open coast locations of the Atlantic and Gulf of Mexico. The PMS estimates are determined by use of the probable maximum hurricane (PMH) parameters applied as input to a quasi-two-dimensional numerical storm surge model developed in the early 1970s. The PMH is a hypothetical hurricane having a combination of characteristics that give the highest sustained wind speed that can probably occur at a specified location.

In 2009, the Engineer Research and Development Center, Corps of Engineers Coastal and Hydraulics Laboratory (ERDC CHL) recommended that both the NWS Report 23 and Regulatory Guide 1.59 be updated. The meteorological criteria for the PMH wind fields are developed in the NOAA Technical Report NWS 23 published in September 1979. However, additional information from the many sources which were unavailable at the time of that study, along with data from many well-documented storms since 1979, have shown some potentially important inconsistencies between the PMH derived in that study and current understanding of the characteristics of intense hurricanes. Similarly, the two-dimensional storm surge model developed in 1971 is extremely limited by restrictions and simplifications made in order to make the problem computationally tractable given

the computer resources available in the early to mid 1970's. The model assumptions and simplifications reduce the applicability and accuracy of the model.

Based on new theoretical concepts and data, NRC has continued its strong collaboration with NOAA and USACE with the ultimate objective to transition storm surge regulatory guidance to a more risk-informed methodology (1) by accounting for annual probabilities of exceedance of joint wind speed/storm surge events, and (2) by considering the effects of topography and bathymetry at the sites of interest, as the storm surge at any specific location is highly dependent upon these factors. In general, the methodology involves the simulation and selection of a stochastic set of storm tracks (synthetic approach), integration of the selected storm tracks into a hydrodynamic simulation model to generate time histories of wind speeds and corresponding time histories of storm surge heights at a site, and the application of probabilistic methods to develop joint probabilities of exceedance and mean recurrence intervals for wind speed/storm surge height events.

Limited observed data and the scale and extent of coastal storm surges have defeated attempts to characterize them by a statistical analysis of direct measurements. Thus, it is necessary to perform simulation studies using knowledge of the local climatology combined with numerical models capable of accurately simulating storm surges throughout the coastal zone. The current state-of-the-art uses the Empirical Simulation Technique (EST) and Joint Probability Method (JPM). The EST method utilizes historic data to generate a large number of multi-year simulations of possible future storm events for a specific location. The approach is based on resampling and interpolation of data contained in a database of events derived from historic events. The ensemble of simulations is consistent with the statistics and correlations of past storm activity at the site, but allows for random deviations in behavior that are likely to occur in the future. The JPM method considers all possible combinations of storm characteristics at landfall, calculates the surge effects for each combination, and then combines these results considering the combinations' associated probabilities. The result is the annual probability of exceeding any desired storm stage. Both the EST and JPM methods have become the standard approach for the evaluation of surge inundation from tropical cyclones.

EST and JPM schemes have been developed and applied in recent probabilistic hurricane-studies performed by teams led by NOAA and by USACE for the central Gulf of Mexico coast. An empirical simulation technique for modeling the entire tracks of tropical cyclones was first published by Vickery, et al. (2000a) and used to determine hurricane wind speeds and storm surge for the Gulf of Mexico and Atlantic coasts for the NRC. The surge model used in the Vickery study was the NOAA standard storm surge model SLOSH (Sea, Lake and Overland Surges from Hurricanes). The USACE has an ongoing study for the Gulf of Mexico coast using the JPM method and ADCIRC (Advanced Circulation) storm surge model to refine the physics of the processes that contribute to storm surge (Resio and Westerink, 2008).

The Great Lakes and climate change remain challenges. Although the EST method is applicable to extratropical storms, more research will be required to update guidance for

future NRC nuclear power plant sites located on the Great Lakes. Current guidance for extratropical storm surge is defined by the American National Standards Institute (ANSI) and ANS in ANSI/ANS-2.8-1992 (ANS, 1992). Similar to tropical cyclones, PMS estimates are determined by use of the probable maximum storm (PMS) parameters applied as input to a quasi-two-dimensional numerical storm surge model developed in the early 1970s. Site-specific flooding analyses from PMS is carried out by using qualified and benchmarked wave run models based on detailed flow channel cross sections and contours. In regard to climate change, since the statistics, and thus the risks of certain surge heights, depend on the storms, any change in storm intensities will lead to a change in storm surge heights. While mean sea level is expected to rise, storms may become in some regions more frequent and violent, while in others less so. This remains an area of intense scientific scrutiny. When any significant change becomes evident, the NRC has regulatory measures available to implement changes, if necessary for adequate protection of public health and safety.

## Current Reviews for Coastal Sites

There are several coastal sites that are currently in review. Section 2.4.6 of the Final Safety Analysis Report (FSAR) for COL applications includes the description of PMT, historical tsunami record, source generator characteristics, tsunami analysis, tsunami water levels, hydrography and harbor or breakwater influences on tsunami, and effects on safety-related facilities. FSAR are produced by each licensee and submitted to the US NRC.

The NRC staff bases the PMT for the costal sites on the historical record of tsunamis and previously published tsunami assessments for the Gulf of Mexico or the Atlantic Ocean. Wave heights from offshore landslide sources were considered in the establishment of the PMT.

The NRC staff then establishes a maximum water level at the site of interest, by applying a runup amplification factor and taking into account 10% exceedance spring high tide and global sea-level rise within the next century. The staff determines whether the estimated PMT will not affect safety-related facilities at the proposed site or not based on the maximum on-site surge level. If affected, the staff proposes flood protection measures in FSAR Section 2.4.10. If the tsunami forces or erosion is of concern, the staff recommends sea walls or wave break structures. If the site flooding is of concern, then external flood protections\measures are necessary for plant safety.

### *Historical and/or Paleo Tsunami*

The staff examines published information to determine the source characteristics for several different types of potential tsunamis sources: seismogenic, volcanogenic, and landslide generated. Both far-field seismogenic sources and near-field submarine and above ground landslide sources as potential generators for the PMT are considered. After reviewing published and internet-based tsunami catalogs, databases, and historical accounts, the staff identifies historical tsunami events for the site of interest.

The application should address any evidence of paleo-tsunami deposits in the FSAR. For example for South Texas site in the USA, a deposit located in Falls County, Texas near the Brazos River was originally interpreted as caused by a paleo-tsunami. The common interpretation of this deposit is that it was emplaced by a tsunami generated from Chicxulub asteroid impact, owing to its date and the existence of impact ejecta at the Brazos site. Researchers suggested that a tsunami wave 50-100 m high was necessary to explain this deposit. It appears that the wave that created these deposits was not likely to be generated by any landslide source that would be of relevance to the present-day PMT determination. Waves emanating from such a source would not have the needed extreme wave heights and long periods to be able to propagate significant wave energy far inland to a potential NPP site. The common interpretation of this deposit is that it was emplaced by a tsunami generated by the Chicxulub impact. It is unlikely, however, that the wave heights inferred from the deposit are relevant to determination of the present-day PMT at a proposed site.

***Potential Tsunamigenic Sources***

Potential tsunami sources that are likely to determine the PMT at the U.S. costal sites are submarine landslides, subaerial landslides, volcanogenic sources, near-field intra-plate earthquakes and inter-plate earthquakes. These sources are identified as following:. .

*Subaerial Landslides:* With regard to subaerial landslides, the staff looks for major coastal cliffs near the site that would produce tsunami-like waves that exceed the amplitude of those generated by other sources.

*Volcanogenic Sources:* The staff relies on the databases developed by either USGS, NOAA, or other government agencies (e.g. the Global Volcanism Program of the Smithsonian Institution, from*http://www.volcano.si.edu/*). Catastrophic failures associated with volcanoes along the U.S. Coasts are considered as potential tsunami sources that generate significant wave activity near the sites of interests.

*Intra-Plate Earthquakes*: The staff relies on the tectonic plate boundary maps in the Gulf of Mexico and Atlantic regions. Also looking are the maximum magnitude and slip of earthquakes. The staff reviews the maximum slip, and consequently the maximum sea floor displacement, associated with an earthquake scales with its magnitude to determine the initial tsunami wave amplitude associated with an intra-plate earthquake..

*Inter-Plate Earthquakes*: In the far-field, description of major plate boundary faults, specific source parameters, and offshore tsunami amplitudes from oceanic inter-plate earthquakes are estimated.

*Local Submarine Landslides*: Submarine landslides in the U.S. Coasts are considered a potential tsunami hazard for the reactor sites for two reasons: (1) some dated landslides in the region have post-glacial ages, suggesting that triggering conditions for these landslides are still present and (2) analysis of

recent seismicity suggest the presence of small-scale energetic landslides in the region.

The primary landslide parameters that are used in the tsunami wave generation models include the excavation depth, volume and slide width, which can be directly measured from sea floor mapping of the largest observed slide in the four geologic provinces. The other necessary parameter is down slope landslide length, interpreted from the runout distance. The runout distance measured from sea floor mapping is a combination of fast plug flow (low viscosity, non-turbulent), creeping plug flow (high viscosity/viscoplastic, non-turbulent) and turbidity currents (turbulent boundary layer fluid). The latter two likely have little to no tsunami-generating potential. The amplitude of the initial negative wave above the excavation region is linked to the maximum excavation depth. The amplitude of the initial positive wave above the deposition region is determined from a conservation of landslide volume. The excavation volume can be well determined using GIS techniques (see below). Setting the deposition volume equal to the excavation volume, the positive amplitude is determined for a given landslide length. For a fixed volume, increasing the landslide length decreases the initial positive amplitude of the tsunami.

Landslide volume calculations are based on measuring the volume of material excavated from the landslide source area using a technique similar to that of ten Brink and others (2006) and Chaytor and others (2009). Briefly stated, the approach involves using multibeam bathymetry to outline the extent of the excavation area, interpolating a smooth surface through the polygons that define the edges of the slide to provide an estimate of the pre-slide slope surface, and subtracting this surface from the present seafloor surface.

The maximum observed landslide from multibeam surveys is taken as the maximum landslide for a given region. It may be possible that larger landslides could occur in a given region; however this determination of the maximum landslide is consistent with the overall definition of PMT as "the most severe of the natural phenomena that have been historically reported or determined from geological and physical data for the site and surrounding area". In this case, the maximum landslide is taken from geologic observations spanning tens of thousands of years.

### *Seismic Seiches*

Rather than being impulsively generated by displacement of the sea floor, seismic seiches occur from resonance of seismic surface waves within enclosed or semi-enclosed bodies of water. The harmonic periods of the oscillation are dependent on the dimensions and geometry of the body of water. For instance in 1964, seiches were set up along the Gulf Coast from seismic surface waves emanating from the M=9.2 Gulf of Alaska earthquake, owing in part to amplification of seismic waves from the thick sedimentary section along the Gulf Coast. Because the propagation path from Alaska to the Gulf Coast is almost completely continental and because the magnitude of the 1964 earthquake is close to the

maximum possible for that subduction zone, it is likely that the historical observations of 1964 seiche wave heights are the maximum possible and less than the PMT amplitudes from landslide sources.

***Tsunami Propagation Modeling***

Tsunami propagation, runup, and inundation have been computed using COULWAVE model which is a 2-dimentional non-linear wave model. At the beginning of the wave simulation, the staff used to make an initial simulation using a one-dimension wave model. The purpose of these initial simulations is to provide an upper limit of the tsunami wave height that could be generated by different landslide scenarios.

Source parameters for the simulation include landslide width, length, and excavation depth. Although landslide volume is not a direct parameter used in the model, the volumes of excavation and deposition are conserved and are used in determining the amplitude of the initial positive wave. Note that these limiting simulations use physical assumptions that are arguably unreasonable; the results of these simulations are useful to filter out tsunami sources under even the most conservative assumptions. Specifically, these assumptions are:

1. Time scale of submarine landslide motion is very small (i.e., instantaneous) compared the period of the generated tsunami
2. Bottom roughness, and the associated energy dissipation, is negligible in locations that are initially wet (i.e. locations with negative bottom elevation, offshore)

With Assumption 1, the free water surface response matches the change in the seafloor profile exactly. The landslide time evolution parameter, which is associated with a high degree of uncertainty, is thus removed. Assumption 2 prevents the use of an overly high bottom roughness coefficient, which could artificially reduce the tsunami energy reaching the shoreline. Such an assumption is too physically unrealistic to accept for the inland regions where the roughness height may be the same order as the flow depth. For tsunami inundation, particularly for inland regions such as those currently under review, the wave would need to inundate long reaches of densely vegetated land to reach the site; therefore inclusion of a conservative measure of bottom roughness is necessary in these cases.

Tsunami and Hurricane surge induced wave run-up modeling is important, since these can cause site flooding that can lead to erosion induced failure of levee/embankment etc that may be used as safety significant water control structures at the site.

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# OVERVIEW OF THE U.S. NUCLEAR REGULATORY COMMISSION COLLABORATIVE RESEARCH PROGRAM TO ASSESS TSUNAMI HAZARD FOR NUCLEAR POWER PLANTS ON THE ATLANTIC AND GULF COASTS

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**ABSTRACT :**

In response to the 2004 Indian Ocean Tsunami, the United States Nuclear Regulatory Commission (US NRC) initiated a long-term research program to improve understanding of tsunami hazard levels for nuclear facilities in the United States. For this effort, the US NRC organized a collaborative research program with the United States Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA) with a goal of assessing tsunami hazard on the Atlantic and Gulf Coasts of the United States. Necessarily, the US NRC research program includes both seismic- and landslide-based tsunamigenic sources in both the near and the far fields. The inclusion of tsunamigenic landslides, an important category of sources that impact tsunami hazard levels for the Atlantic and Gulf Coasts is a key difference between this program and most other tsunami hazard assessment programs. The initial phase of this work consisted of collection, interpretation, and analysis of available offshore data, with significant effort focused on characterizing offshore near-field landslides and analyzing their tsunamigenic potential and properties. In the next phase of research, additional field investigations will be conducted in key locations of interest and additional analysis will be undertaken. Simultaneously, the MOST tsunami generation and propagation model used by NOAA will first be enhanced to include landslide-based initiation mechanisms and then will be used to investigate the impact of the tsunamigenic sources identified and characterized by the USGS. The potential for probabilistic tsunami hazard assessment will also be explore in the final phases of the program.

**KEYWORDS:**
Tsunami, Landslide, Seismic, Hazard, Nuclear

## 1. BACKGROUND

In response to the 2004 Indian Ocean Tsunami, as well as the anticipation of the submission of license applications for new nuclear facilities, the United States Nuclear Regulatory Commission (US NRC) initiated a long-term research program to improve understanding of tsunami hazard levels for nuclear power plants and other coastal facilities in the United States. To undertake this effort, the US NRC organized a collaborative research program with researchers at the United States Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA) for the purpose of assessing tsunami hazard on the Atlantic and Gulf Coasts of the United States. The project work described in this paper represents the combined effort of a diverse group of marine geologists, geophysicists, geotechnical engineers, and hydrodynamic modelers to evaluate tsunami sources that have the potential to impact the U.S. Atlantic and Gulf coasts.

The Atlantic and Gulf Coasts are the focus of this program, both because of the number of existing and proposed nuclear facilities located on these coasts and because many promising research efforts for assessing tsunami

hazard in the Pacific Coast of the United States are already underway as a result of programs outside the US NRC. Tsunami has been long known as a hazard in the Pacific Ocean. However, the 2004 tsunami highlighted the fact the tsunamis can occur in other oceans that are less prepared for this rare phenomenon. Although tsunami are far rarer along the Atlantic and Gulf of Mexico coastlines, some areas can be highly vulnerable to tsunamis when they do occur because major population centers and industrial faculties are located near the shoreline at low-lying elevations, and often in estuaries. This is in comparison to the Pacific coast where tsunamis are more frequent but the coastline is more sparsely populated and most sections have more topographic relief.

Because the US NRC is interested in understanding hazard associated with the rare large tsunami that may occur over long time periods (in excess of 10,000 years), the research program was developed to investigate both seismic and landslide tsunamigenic sources. It also includes the study and characterization of large sources in the far field, as well as sources in the near field such that all key sources were considered. The study of near-field and far-field tsunamigenic landslides is a key difference between this research program and other tsunami hazard assessment programs, which are typically focused on seismic sources. Although seismic sources are important on the Atlantic and Gulf Coasts, submarine landslides have also historically generated destructive tsunamis and so must be fully investigated in this program. In landslide initiated tsunami, the extent of damaging waves generated by landslides is generally smaller and more localized. However, along coastlines proximal to catastrophic submarine landslides, tsunami run-up can be significant as exemplified by the 1929 Grand Banks tsunami (Newfoundland and Nova Scotia), which likely had a significant landslide-generated component. Less is generally known about submarine landslides as tsunami triggers in comparison to their earthquake counterparts.

Although only a few years old, this research program has already produced significant results that are currently or will soon be available to the public through a variety of technical publications. These publications include a USGS report to the US NRC (Ten Brink et al, 2007) and multiple articles in a special issue of Marine Geology to be published late 2008 or early 2009 (Barkana et al; Chaytor et al; Geist et al; Lee; Locat et al; Ten Brink et al, 2008). The early research and results discussed in the USGS report were focused on providing sufficient information on the source parameters useful for qualitative assessment of tsunami hazard for the Atlantic and Gulf coasts. This information is currently being used to develop and review tsunami hazard assessments for new nuclear power facilities in the United States. A companion paper in this conference summarizes and discusses in more detail some of the early results of the US NRC program (Kammerer et al, 2008)

## 2. INITIAL INVESTIGATION OF NEAR-FIELD LANDSLIDE SOURCES IN THE ATLANTIC

In the initial phase of work a significant level of effort was focused on identifying and characterizing offshore near-field landslides and on understanding their regional distribution along the coasts. In this work, efforts were made to consider the impact of varying conditions, such as the effects of glacial periods and sea level changes. Once early results on the location and characterization of offshore landslides was obtained, an effort towards modeling one of the larger slides, the Currituck Slide, was initiated to better understand the tsunami hazard posed by the mapped slides. Before tsunami generation and propagation modeling of the Currituck slide could be undertaken, important properties of the slide, such as flow velocity, needed to be characterized. Work at Laval University included analysis of the dynamic elements of the Carrituck slide; and modeling of the slide was undertaken by both Texas A&M University and the USGS. A summary of each of these steps is provided below and a more complete discussion of the results of key research elements is provided in the companion paper in this conference. This early work has also been well documented in the public USGS report (Ten Brink et al, 2007).

### *2.1 DATA COLLECTION*

The first step in the initial investigation of lanslides in the Atlantic was the collection and analysis of a large amount of available information useful for the identification and characterization of offshore landslides along the Atlantic coast of the U.S. Multibeam bathymetry, Geologic Long-Range Inclined Asdic (GLORIA) sidescan sonar imagery, a regional grid of high-resolution seismic profiles, and published accounts of sediment cores from

the region was collected (Figure 1). In addition to these data sets, a review of past work studying the geology of the offshore environment, as well as studies of offshore landslides were also collected, reviewed, and summarized. A discussion of the body of previous work is provided in the USGS report (Ten Brink et al, 2007).

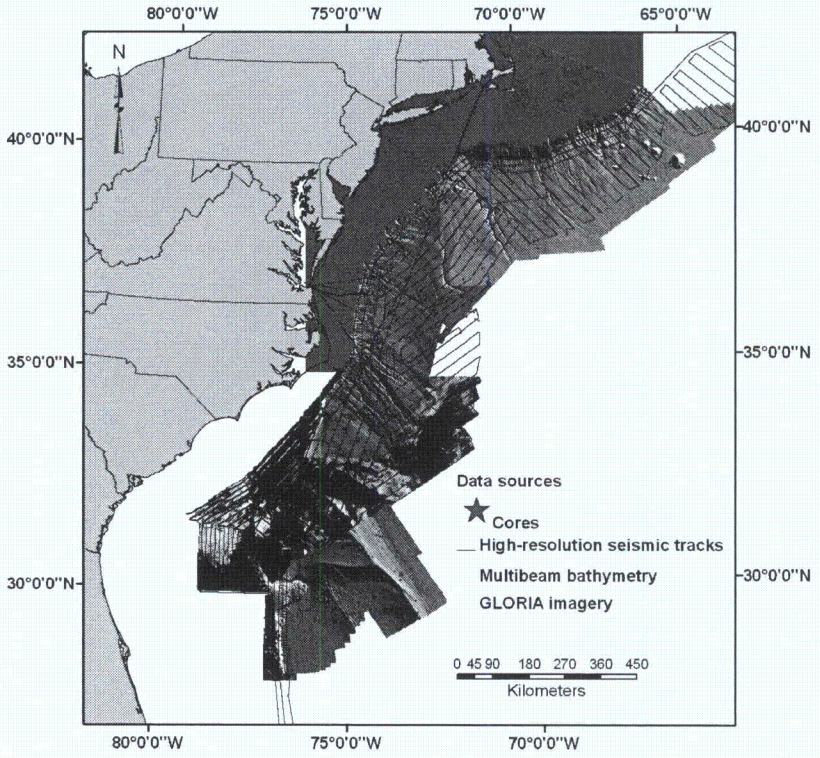


Figure 1 Data Collected for Study of Potential Tsunamigenic Landslides on U.S. Atlantic Coast

Data used in the compilation of the Atlantic coast bathymetry map used in the study were acquired from several sources and vary in age, sounding density, and positional accuracy. The primary data set was acquired by the University of New Hampshire (UNH) (Gardner et al., 2006; Cartwright and Gardner, 2005) and provides near continuous coverage of the U.S. Atlantic margin from the base of the continental slope down to the abyssal plain. These data include gridded bathymetric soundings and mosaiced acoustic backscatter. For sections of the continental slope and rise not covered by the UNH data set, several additional multibeam datasets were used. For areas in which no multibeam soundings were available, sounding data from the National Ocean Service hydrographic database and the NOAA coastal relief model provided bathymetric coverage of the continental slope. Efforts will be made to address some of these data gaps through field studies in future phases of the program. The final map developed for this project covers the ocean floor from the shoreline to depths greater than 5,000 m, between 43.5 and 24 degrees north latitude.

In addition to the acoustic backscatter data from the UNH multibeam surveys, GLORIA sidescan sonar data were used to identify and map landslide features along the U.S. Atlantic continental margin (EEZ-SCAN 87, 1991). Analogue records of 3.5-kHz seismic reflection profiles, co-acquired with the GLORIA sidescan imagery, were used to determine location, geometry, and thickness of landslide features. Although other data sets are available, the acquisition parameters and quality of these data are consistent over the entire area of study, and they provide a relatively clear picture of the upper sedimentary section.

Over 1400 cores have also been collected from the study area off the Atlantic coast, and descriptions of the cores are available. Approximately 1,000 have been visually described, and 145 of them have had general ages

assigned based on faunal content. While the descriptions provided are often brief, they provide a valuable summary of the overall lithology of many of the cores.

### *2.2 IDENTIFICATION AND CHARACTERIZATION OF LANDSLIDES*

The volume and quality of data collected greatly assisted in mapping the distribution and style of surficial submarine landslides along the eastern U.S. margin between the eastern end of Georges Bank and the northern end of the Blake Spur. The near-complete coverage of the Atlantic continental slope and rise by multibeam bathymetry provided a key high-quality and uniform data set that allowed for a more detailed and consistent view and assessment of the geomorphology of submarine landslides than had been possible in the past.

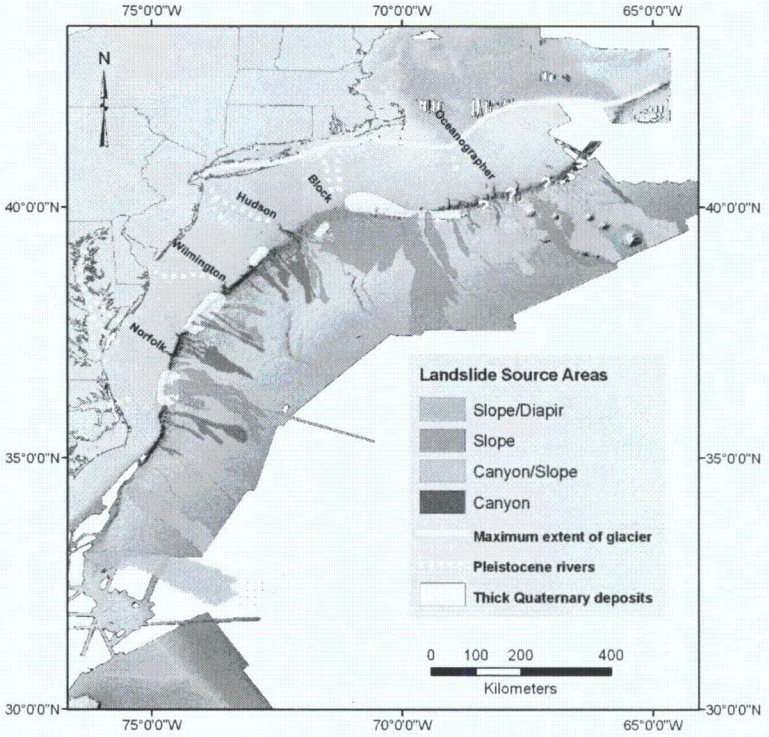


Figure 2 Initial Map of Landslide Source Areas Along the U.S. Atlantic Coast

The mapping of these landslide-affected areas was broken into several steps. The first step was to identify any scarps of significant size around and within landslide source areas. Scarps were easily identified in shaded-relief and slope maps derived from the bathymetric data. Next the areas affected by landslides were outlined. Depending on availability, a mix of shaded-relief imagery, backscatter imagery from the multibeam system, and GLORIA imagery were used. The final step was to merge the thickness information derived from subbottom profiles with the interpretation of the sea-floor imagery to distinguish the erosional and depositional sections of the landslide. The volumes of the source areas of mapped and potential slides of various sizes and differing geologic settings (e.g. submarine canyons or the open slope) were calculated.

This mapping indicates that landslides along the U.S. Atlantic margin initiate predominantly in two morphologic settings, canyon (heads and sidewalls) and on the open continental slope (Figure 2). The canyon-sourced failures often have several canyons feeding a single deposit, and the deposits are smaller than those derived from the open slope. As a result, they are unlikely to cause tsunami events. Open-slope failures commonly originate on the middle and lower slope in 800-2,200 m depths. These landslides extend farther offshore, are thicker, and have

considerably larger volumes than their canyon derived counterparts. As a result of the large volumes of material that sometimes fail, open slope-sourced slides are considered to have the most potential to initiate tsunami (Murty, 2003). However, a significant volume of material may also be mobilized in landslides associated with areas of salt diapirism as well. From the modeling of source volumes of individual scarps along the margin, we see that three regions (off Georges Bank, Currituck area, and in the Carolina Trough) have had a history of, and potential for, large volume failures. With the current data, it is difficult to determine if landslides on the southern New England slope involve large volumes of material per event, or if the region is dominated by smaller, but more numerous landslides.

### *2.3 CARRITUCK LANDSLIDE ASSESSMENT AND MODELING*

In order to gain an initial understanding of the implications of the mapped landslides on the tsunami hazard along the Atlantic coast, a study to characterize and perform hydrodynamic modeling of the Carrituck landslide was undertaken. This work also showed the potential for the methods employed. Tsunami magnitude depends strongly upon the size of the slide and how the landslide moves as it fails and flows. Therefore, the first step was to determine the parameters needed for the tsunami generation and propagation modeling. This work had significant challenges because the initial geometry of the material was not known, it was unclear if there had been a single event or multiple events, and the properties of the geologic material were not well characterized. During this work several issues were considered and the researchers endeavored to answer the following multiple lines of inquiry. Ultimately a possible initial velocity and acceleration of the failed mass was developed from the mobility analyses.

Once estimates of the important landslide parameters had been developed, preliminary hydrodynamic modeling of the slide was conducted for the purpose of determining the range of possible near-shore wave heights and understanding the possible impact of the continental shelf. Considerations of bottom friction and non-linearity were included in this work. This study was undertaken early in the program and played an important role for the US NRC because the modeling allowed staff to understand the general implications of the initial landslide mapping results. It also helped to scope and focus the organization of the broader research program.

## 3. INVESTIGATION OF FAR FIELD TSUNAMIGENIC LANDSLIDES IN THE ATLANTIC

The research related to far field tsunamigenic landslides, has focused on collecting information and assessing the potential impact to the U.S. Atlantic and Gulf coasts. Numerous debris deposits from landslides have been identified in the literature along the Canadian, European and African coasts of the Atlantic Ocean and a number of possible source areas were considered in detail for this program. These areas include the Canary Islands, the Mid-Atlantic Ridge, the glaciated margins of northern Europe and Canada, the Scotia margin immediately NE of the U.S. border, the northern European margin, and the Puerto Rico trench. In many cases, evidence of tsunamis from landslides were found, although the effects were often highly localized as is common for landslide-initiated tsunami. The USGS report provides information on both historical tsunamis and proposed modeling parameters for these areas.

Perhaps the most publicized hypothesized hazard is that of a possible collapse of Cumbre Vieja, a volcano on the Canary island of La Palma (Ward and Day, 2001). As envisioned by Ward and Day, a flank collapse of the volcano may drop a rock volume of up to 500 $km^3$ into the surrounding ocean. The ensuing submarine slide is further hypothesized to generate a strong tsunami with amplitudes of 25 m in Florida. In the time since the initial work was published, significant work by other researchers has been undertaken to look at their assumptions. A review of all associated work was undertaken for this program and it was concluded that the danger to the U.S. Atlantic coast from the possible collapse of Cumbre Vieja is exaggerated. Mader (2001) pointed out that Ward and Day's assumption of linear propagation of shallow water waves is incorrect, because it only describes the geometrical spreading of the wave and neglects dispersion effects. A more rigorous hydrodynamic modeling by Gisler et al. (2006), confirms Mader's criticism. Their predicted wave amplitude for Florida is between 1 and 77

cm. A fuller discussion is provided in the USGS report and the potential impact of a collapse of Cumbra Vieja will be further studies by NOAA as part of this project.

## 4. INITIAL INVESTIGATION OF TSUNAMIGENIC LANDSLIDES IN THE GULF OF MEXICO

This project has also started investigating the potential for tsunamigenic landslides in the Gulf of Mexico. The Gulf of Mexico is a small, geologically diverse ocean basin that includes three distinct geologic provinces: a carbonate province, a salt province, and canyon to deep-sea fan province. Currently the work in this area is not as advanced as the assessment in the Atlantic. However, early work investigating landslides undertaken by this project and others that indicates that submarine landslides have occurred in each of the three provinces, although they vary in style and size among these different provinces. Landslides also have been shown to be active throughout much of the history of this basin, including in the Quaternary Period, up to the present. Submarine landslides have been studied in the Gulf of Mexico in the past for two reasons: first they can pose a hazard to offshore platforms and pipelines and second, when more deeply buried they can serve either as hydrocarbon reservoirs or barriers in reservoirs depending on their composition. The threat of submarine landslides as a generator of tsunamis has not previously been addressed for the Gulf of Mexico region. However, the existing literature describing the distribution and style of submarine landslides that have occurred in the Gulf of Mexico during the Quaternary has been reviewed for this program and is summarized in the USGS report. The review focused on landslides that have occurred in on the continental slope and rise in the Gulf of Mexico; with much of the discussion focused on the part of the basin within the U.S. Exclusive Economic Zone (EEZ) due to the availability of a greater number of publications from this region. Research is on-going in this area.

## 5. IDENTIFICATION AND CHARACTERIZATION OF SEISMIC SOURCES THAT MAY IMPACT THE ATLANTIC OR GULF COASTS

### *5.1 Sources in the Atlantic Ocean*

Earthquake-generated tsunamis generally originate by the sudden vertical movement of a large area of the seafloor during a large magnitude earthquake. Such movement is generated by reverse or thrust faulting, most often in subduction zones. The Atlantic Ocean basin is generally devoid of subduction zones or potential sources of large reverse faults. The two exceptions are the Hispaniola-Puerto Rico-Lesser Antilles subduction zone, where the Atlantic tectonic plate subducts under the Caribbean plate, and the enigmatic zone of large earthquakes west of Gibraltar. These two earthquake source areas were investigated, an evaluation of their tsunamigenic potential was undertaken, and the potential for impact to the U.S. coastline by resulting tsunami was considered.

Four large tsunamigenic earthquakes have occurred in the Atlantic Ocean west of Gibraltar in the last 300 years. However, there is no simple tectonic model for this area that explains the generation of these earthquakes. As a result, promising work undertaken to determine the source parameters of the 1755 Lisbon earthquake is of particular interest. A variety of past studies have hypothesized various sources for this earthquake, which is known to have caused a tsunami around much of the Atlantic Ocean. However, prior to this project there had not been an attempt to fit cross-ocean tsunami reports of the 1755 Lisbon earthquake to any of the proposed fault sources. As part of this program, modeling of various sources is being undertaken to try to determine a viable source location and geometry that predicts the many records of tsunami impacts from the earthquake.

### *5.2 Sources in the Caribbean*

The 2004 magnitude 9.2 Sumatra-Andaman earthquake was a surprise from a geologic and tectonic perspective in that it occurred along a highly oblique subduction zone, where the convergence rate is low, and where very large earthquakes were thought unlikely to occur. Many of the tsunamigenic fault zones in the Caribbean and

Atlantic are characterized by similar tectonics and may have higher hazard than has been previously predicted. In particular, a major concern was raised about the Puerto Rico trench, because a tsunami initiating here has a potential impact on the U.S. East Coast. The USGS has recently carried out extensive fieldwork in the Puerto Rico trench to understand the tectonics of the area. As a result, researchers on the US NRC project were able to rapidly provide an evaluation for this source. As part of this analysis, tsunami propagation from several different large-magnitude earthquakes in the Caribbean was modeled to estimate deep ocean tsunami amplitudes offshore U.S. Atlantic and Gulf coasts. A range of tsunami amplitudes is determined based on natural variations in slip distribution patterns expected for large magnitude earthquakes along plate boundaries in the Caribbean. This work is ongoing and has been useful for providing general hazard information to the US NRC.

A series of large earthquakes with mostly thrust motion took place in the eastern half of northern Hispaniola between 1946 and 1953. One of the events in 1946 was accompanied by a destructive local tsunami. In contrast to the Puerto Rico trench, a larger vertical motion is expected for a given magnitude of slip on portions of the Hispaniola trench. It is unclear, whether the western part of the subduction zone would rupture in a single earthquake and how far west the rupture would extend. Modeling is needed to determine if the U.S. Atlantic coast would be protected from tsunamis generated in this subduction zone by the Bahamas banks which are near sea level and act as obstructions to tsunami wave propagation.

### *5.2 Sources in the Gulf of Mexico*

The Gulf of Mexico basin is devoid of subduction zones or potential sources of large reverse faults. However, the Caribbean basin contains two convergence zones whose rupture may affect the Gulf of Mexico, the North Panama Deformation Belt and the Northern South America Convergent Zone. Hydrodynamic modeling is needed to evaluate the role of the Yucatan straits (between Cuba and the Yucatan Peninsula) in modifying the propagation of tsunamis into the Gulf of Mexico, though some initial modeling hs been initiated.

## 6. UPCOMING ACTIVITIES

As part of the second phase of the program, which is currently underway, the USGS will conduct field investigations in key locations for the purpose of obtaining new data useful for determining tsunami hazard assessment of nuclear facilities. The USGS is also continuing investigations into assessing landslide potential in the Gulf of Mexico, determining the source of the 1755 Lisbon earthquake, and a variety of other topic of interest.

Simultaneously, the MOST tsunami generation and propagation model used by NOAA is currently being enhanced to include landslide-based initiation mechanisms and is being validated with case studies, including the 1958 Lituya Bay megatsunami. The enhanced MOST model will be used to investigate the tsunamigenic sources identified and characterized by the USGS, with the goal of creating an estimation of deterministic tsunami hazard levels for the full length of Atlantic and Gulf Coasts. This information may ultimately be developed into a map of deterministic tsunami hazard for these coastlines and will be of direct benefit to the US NRC efforts to assess tsunami hazard at coastal facilities.

The potential for developing tools and data to undertake probabilistic tsunami hazard assessments (PTHA) will also be a key focus of later phases of the research program. PTHA will require an understanding of the frequency of different initiating events. Some areas in which the US NRC is likely to initiate additional work in the coming years relates to understanding the timing of the submarine landslides identified in the Atlantic. One example is careful age dating on cores recovered from within and adjacent to mapped landslides. In the companion paper in this conference, information on the result of ongoing work, some of which is leading to PTHA is provided.

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# PRELIMINARY RESULTS OF THE U.S. NUCLEAR REGULATORY COMMISSION COLLABORATIVE RESEARCH PROGRAM TO ASSESS TSUNAMI HAZARD FOR NUCLEAR POWER PLANTS ON THE ATLANTIC AND GULF COASTS

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**ABSTRACT :**
In response to the 2004 Indian Ocean Tsunami, the United States Nuclear Regulatory Commission (US NRC) initiated a long-term research program to improve understanding of tsunami hazard levels for nuclear facilities in the United States. For this effort, the US NRC organized a collaborative research program with the United States Geological Survey (USGS) and other key researchers for the purpose of assessing tsunami hazard on the Atlantic and Gulf Coasts of the United States. The initial phase of this work consisted principally of collection, interpretation, and analysis of available offshore data and information. Necessarily, the US NRC research program includes both seismic- and landslide-based tsunamigenic sources in both the near and the far fields. The inclusion of tsunamigenic landslides, an important category of sources that impact tsunami hazard levels for the Atlantic and Gulf Coasts over the long time periods of interest to the US NRC is a key difference between this program and most other tsunami hazard assessment programs. Although only a few years old, this program is already producing results that both support current US NRC activities and look toward the long-term goal of probabilistic tsunami hazard assessment. This paper provides a summary of results from several areas of current research. An overview of the broader US NRC research program is provided in a companion paper in this conference.

**KEYWORDS:**
Tsunami, Landslide, Seismic, Hazard, Nuclear

## 1. BACKGROUND

In response to the 2004 Indian Ocean Tsunami, as well as the anticipation of the submission of license applications for new nuclear facilities, the United States Nuclear Regulatory Commission (US NRC) initiated a long-term research program to improve understanding of tsunami hazard levels for nuclear power plants and other coastal facilities in the United States. To undertake this effort, the US NRC organized a collaborative research program with researchers at the United States Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), and other key researchers for the purpose of assessing tsunami hazard on

the Atlantic and Gulf Coasts of the United States. The research described in this paper represents the combined effort of a diverse group of marine geologists, geophysicists, geotechnical engineers, and hydrodynamic modelers to evaluate tsunami sources that have the potential to impact the U.S. Atlantic and Gulf coasts.

The Atlantic and Gulf Coasts are the focus of this program, both because of the number of existing and proposed nuclear facilities located on these coasts and because many promising research efforts for assessing tsunami hazard in the Pacific Coast of the United States are already underway as a result of programs outside the US NRC. Tsunami has been long known as a hazard in the Pacific Ocean. However, the 2004 tsunami highlighted the fact the tsunamis can occur in other oceans that are less prepared for this rare phenomenon. Although tsunami are far rarer along the Atlantic and Gulf of Mexico coastlines, some areas can be highly vulnerable to tsunamis when they do occur because major population centers and industrial faculties are located near the shoreline at low-lying elevations, and often in estuaries. This is in comparison to the Pacific coast where tsunamis are more frequent but the coastline is more sparsely populated and most sections have more topographic relief.

Because the US NRC is interested in understanding hazard associated with the rare large tsunami that may occur over long time periods (in excess of 10,000 years), the research program was developed to investigate both seismic and landslide tsunamigenic sources. It also includes the study and characterization of large sources in the far field, as well as sources in the near field such that all key sources were considered. The study of near-field and far-field tsunamigenic landslides is a key difference between this research program and other tsunami hazard assessment programs, which are typically focused on seismic sources. Submarine landslides have also historically generated destructive tsunamis and so must be fully investigated in this program. In landslide initiated tsunami, the extent of damaging waves generated by landslides is generally smaller and more localized. However, along coastlines proximal to catastrophic submarine landslides, tsunami run-up can be significant as exemplified by the 1929 Grand Banks tsunami (Newfoundland and Nova Scotia), which likely had a significant landslide-generated component. Less is generally known about submarine landslides as tsunami triggers in comparison to their earthquake counterparts.

The development of tools and data to undertake probabilistic tsunami hazard assessments (PTHA) is a key long-term goal and the focus of later phases of the US NRC research program. Effectively developing PTHA tools will require an understanding of the frequency of different initiating events. Some areas in which the US NRC is likely to initiate additional work in the coming years relates to understanding the timing of the submarine landslides identified in the Atlantic. Some of the research discussed here represents the start of this long term element of the program.

Although less than two years old, this research program has already produced significant results that are currently or will soon be available to the public through a variety of technical publications. These publications include a USGS report to the US NRC (Ten Brink et al, 2007) and multiple articles in a special issue of Marine Geology to be published late 2008 or early 2009 (Barkana et al; Chaytor et al; Geist et al; Lee; Locat et al; Ten Brink et al, 2008). The early research and results discussed in the USGS report were focused on providing sufficient information on the source parameters useful for qualitative assessment of tsunami hazard for the Atlantic and Gulf coasts. The USGS report will be revised in 2008 and will include details related to the work summarized here. This information is currently being used to develop and review tsunami hazard assessments for new nuclear power facilities in the United States. A companion paper in this conference summarizes and discusses the complete US NRC program in more detail and provides a discussion of the seismic and landslide-based tsunami source characterizations (Kammerer et al, 2008).

## 2. SIZE DISTRIBUTION OF SUBMARINE LANDSLIDES ALONG THE U.S. ATLANTIC MARGIN AND ITS IMPLICATION TO TSUNAMI HAZARDS

The ability to determine the number, size, and frequency of large submarine landslides is a critical component in determining the hazard posed to coastal regions by destructive landslide-generated tsunamis. The efforts to characterize submarine landslides off the Atlantic coast represents the earliest effort of the US NRC tsunami

research program. This work is investigating the size distribution of submarine landslides along the U.S. Atlantic continental slope and rise using the size of the landslide excavation regions. The data collected for this effort, a description of methods used, and other information is discussed in more detail in the companion paper submitted to this conference (Kammerer et al, 2008).

The first step in the initial investigation of landslides in the Atlantic was the collection and analysis of a large amount of available information useful for the identification and characterization of offshore landslides along the Atlantic coast of the U.S. Multibeam bathymetry, Geologic Long-Range Inclined Asdic (GLORIA) sidescan sonar imagery, a regional grid of high-resolution seismic profiles, and published accounts of sediment cores from the region was collected. The near-complete coverage of the Atlantic continental slope and rise by multibeam bathymetry provided a key high-quality and uniform data set that allowed for a more detailed and consistent view and assessment of the geomorphology of submarine landslides than had been possible in the past.

This landslide mapping results indicated that landslides along the U.S. Atlantic margin initiate predominantly in two morphologic settings, canyon (heads and sidewalls) and on the open continental slope. The canyon-sourced failures often have several canyons feeding a single deposit, and the deposits are smaller than those derived from the open slope. As a result, they are unlikely to cause tsunami events. Open-slope failures commonly originate on the middle and lower slope in 800-2,200 m depths. These landslides extend farther offshore, are thicker, and have considerably larger volumes than their canyon derived counterparts. As a result of the large volumes of material that sometimes fail, open slope-sourced slides are considered to have the most potential to initiate tsunami. However, a significant volume of material may also be mobilized in landslides associated with areas of salt diapirism as well.

Landslide source excavation areas along the margin identified in a detailed bathymetric Digital Elevation Model (DEM) ranged between 0.89 $km^2$ and 2410 $km^2$. The volumes range between 0.002 $km^3$ and 179 $km^3$. The area to volume relationship of these source excavations is almost linear (power law exponent close to 1), suggesting a fairly uniform failure thickness of a few tens of meters in each event, with only rare, deep excavating landslides. The cumulative volume distribution of the excavations is well described by a log-normal distribution rather than by a power-law commonly used to describe both subaerial and submarine landslides. A log-normal distribution centered on a volume of 0.86 km3, may indicate that landslides preferentially mobilize a moderate amount of material (on the order of 1 km3), rather than large landslides or very small ones. Conversely, the log-normal distribution may reflect a power law distribution modified by a size-dependent probability of observing landslide excavations in the bathymetry data. If the latter is the case, for example, a power law distribution with an exponent of 1.3±0.3, modified by the conditional probability of success in identifying landslide excavations with increasing slide size, fits the observed size distribution equally well and predicts that geology of the source region has strong control on the size of the excavation. This exponent value corresponds favorably with the 1.2±0.3 predicted for subaerial landslides in unconsolidated material. The log-normal distribution of the observed excavation volumes suggests that large landslides, which have the greatest potential to generate damaging tsunamis, occur infrequently along the margin. The reader is directed to Chaytor et al (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

## 3. GEOLOGIC CONTROLS ON THE DISTRIBUTION OF SUBMARINE LANSLIDES ALONG THE U.S ATLANTIC CONTENTIAL MARGIN

Submarine landslides along the continental slope of the U.S. Atlantic margin are potential sources of tsunami hazard along the U.S. Atlantic coast. The magnitude of potential tsunamis depends on the volume and location of the landslides; and tsunami frequency depends on their recurrence interval. Unfortunately, both the size and recurrence interval of submarine landslides along the U.S. Atlantic margin is poorly understood.

Well-studied landslide-generated tsunamis in other parts of the world have been shown to generally be associated with earthquakes as a triggering mechanism. Because the size distribution and recurrence interval of earthquakes is generally better known than those for submarine landslides, if may be possible to estimate the size and

recurrence interval of submarine landslides from the size and recurrence interval of earthquakes in the near vicinity of the potential landslides. To do this it is necessary to calculate the maximum expected landslide size for a given earthquake magnitude, use recurrence interval of each magnitude of earthquake to estimate the recurrence interval of landslides of a certain size, and assume a threshold landslide size that can generate a destructive tsunami.

The maximum expected landslide size for a given earthquake magnitude is calculated in 3 ways: by slope stability analysis for catastrophic slope failure on the Atlantic continental margin, by using land-based compilation of maximum observed distance from earthquake to liquefaction, and by using land-based compilation of maximum observed area of earthquake-induced landslides. We find that the calculated distances and failure areas from the slope stability analysis is similar or slightly smaller than the maximum triggering distances and failure areas in subaerial observations. The results from all three methods compare well with the slope failure observations of the Mw=7.2, 1929 Grand Banks earthquake, the only historical tsunamigenic earthquake along the North American Atlantic margin.

The results further suggest that a Mw=7.5 earthquake (the largest expected earthquake in the eastern U.S.) must be located offshore and within 100 km of the continental slope to induce a catastrophic slope failure. Thus,based on this method a repeat of the 1755 Cape Anne and 1881 Charleston earthquakes would not be expected to cause landslides on the continental slope. The observed rate of seismicity offshore the U.S. Atlantic coast is very low with the exception of New England, where some microseismicity is observed. An extrapolation of annual strain rates from the Canadian Atlantic continental margin suggests that the New England margin may experience the equivalent of a magnitude 7 earthquake on average every 600–3000 yr. A minimum triggering earthquake magnitude of 5.5 is suggested for a sufficiently large submarine failure to generate a devastating tsunami and only if the epicenter is located within the continental slope. The reader is directed to Twitchell et al (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

## 4. GEOMORPHOLOGY, STABILITY, AND MOBILITY FROM THE CURRITUCK LANDSLIDE

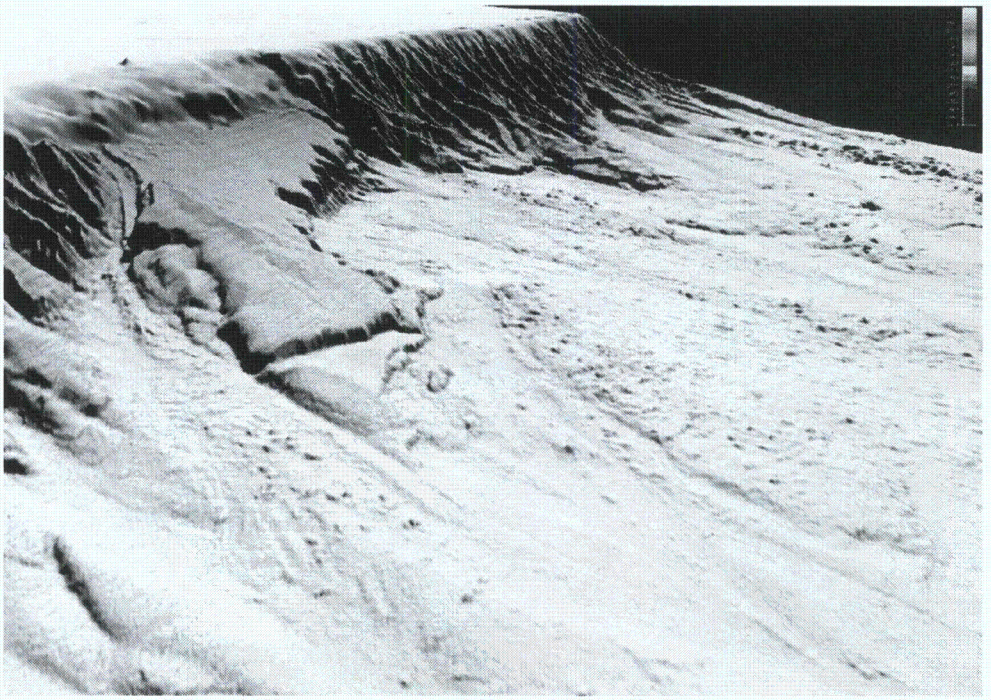

Figure 1 Image of the Carrituck Landslide Off the U.S. Atlantic Coast

In order to gain an initial understanding of the implications of the mapped landslides on the tsunami hazard along the Atlantic coast, a study to characterize and perform hydrodynamic modeling of the Carrituck landslide was undertaken. Tsunami magnitude depends strongly upon the size of the slide and how the landslide moves as it fails and flows. Therefore, the first step in the process was to determine the parameters needed for the tsunami generation and propagation modeling. This work had significant challenges because the initial geometry of the material was not known, it was unclear if there had been a single event or multiple events, and the properties of the geologic material were not well characterized. During this work several issues were considered and the researchers endeavored to answer the following multiple lines of inquiry. Ultimately a possible initial velocity and acceleration of the failed mass was developed from the mobility analyses.

The Currituck slide, located off the coast of Virginia, is a major submarine mass movement that was likely triggered during a time of low sea level. This slide removed a total volume of about 165 $km^3$ from this section of the continental slope. The departure zone still shows a very clean surface that dips at 4° and is only covered by a thin veneer of Holocene sediment. Multibeam bathymetric data suggest that this slide took place along three failures surfaces. The morphology of the source area suggests that the sediments were already at least normally consolidated at the time of failure. The slide debris covers an area as much as 55 km wide that extends 180 km from the estimated toe of the original slope.

The back analysis of slide initiation indicates that very high pore pressure, a strong earthquake, or both had to be generated to trigger slides on such a low failure plane angle. The shape of the failure plane, the fact that the surface is almost clear of any debris, and the mobility analysis, all support the argument that the slides took place nearly simultaneously. Potential causes for the generation of high pore pressures could be seepage forces from coastal aquifers, delta construction and related pore pressure generation due to the local sediment loading, gas hydrates, and earthquakes.

This slide, and its origin, is a spectacular example of the potential threat that submarine mass movements can pose to the US Atlantic coast and underline the need to further assess the potential for the generation of such large slides, like the Grand Banks 1927 landslide of similar volume. The reader is directed to Locat et al (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

## 5. HYDRODYNAMIC MODELING OF TSUNAMIS FROM THE CURRITUCK LANDSLIDE

Once estimates of the important landslide parameters of the Currituck landslide offshore North Carolina had been developed in the research discussed above, preliminary hydrodynamic modeling of the slide was conducted for the purpose of determining the range of possible near-shore wave heights and understanding the possible impact of the continental shelf. A long and intermediate wave modeling package (COULWAVE) based on the non-linear Boussinesq equations was used to simulate the tsunami. This model includes procedures to incorporate bottom friction, wave breaking, and overland flow during runup. Potential tsunamis generated from the Currituck landslide were analyzed using four approaches: (1) the tsunami wave history was calculated from several different scenarios indicated by geotechnical stability and mobility analyses; (2) a sensitivity analysis was conducted to determine the effects of both landslide failure duration during generation and bottom friction along the continental shelf during propagation; (3) the wave history was calculated over a regional area to determine the propagation of energy oblique to the slide axis; and (4) a high resolution 1D model was developed to accurately model wave breaking and the combined influence of nonlinearity and dispersion during nearshore propagation and runup.

From the sensitivity analyses, it was concluded that the primary source parameter that affected tsunami severity for this case study is landslide volume, with failure duration having a secondary influence. Bottom friction during propagation across the continental shelf has a strong influence on the attenuation of the tsunami during propagation. The high-resolution1D model also indicates that the tsunami undergoes non-linear fission prior to wave breaking, generating independent, short-period waves. Wave breaking occurs approximately 40-50 km offshore where a tsunami bore is formed that persists during runup. These analyses illustrate the complex nature

of landslide tsunamis, necessitating the use of detailed landslide stability/mobility models and higher-order hydrodynamic models to determine their hazard.

This study was undertaken early in the program and played an important role for the US NRC because the modeling allowed staff to understand the general implications of the initial landslide mapping results. It also helped to scope and focus the organization of the broader research program. The reader is directed to Geist et al (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

## 6. ASSESSMENT OF SOURCE PROBABILITIES FOR POTENTIAL TSUNAMI AFFECTING THE U.S. COASTS

A key element of determining risk to a coastal facility from tsunami is understanding the likelihood that a tsunami will occur. Estimating the likelihood of tsunamis occurring along the U.S. Atlantic coast critically depends on knowledge of the annual probability of all potential tsunami sources that may impact a site of interest. To address this need a review of available information on both earthquake and landslide probabilities from potential sources that could generate local and transoceanic tsunamis has been performed. Estimating source probability includes defining both size and recurrence distributions for earthquakes and landslides. For the former distribution, source sizes are often distributed according to a truncated or tapered power-law relationship. For the latter distribution, sources are often assumed to occur in time according to a Poisson process, simplifying the way tsunami probabilities from individual sources can be aggregated. For the U.S. Atlantic coast, earthquake tsunami sources primarily occur at transoceanic distances along plate boundary faults. Probabilities for these sources are constrained from previous statistical studies of recorded seismicity.

In contrast, there is presently little information constraining landslide probabilities that may generate local tsunamis. Though there is significant uncertainty in tsunami source probabilities for the Atlantic, results from this study yield a comparative analysis of tsunami source recurrence rates that can form the basis for future probabilistic analyses. The reader is directed to Lee (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

## 7. TIMING OF LARGE SUBMARINE LANDSLIDES ON THE ATLANTIC OCEAN MARGIN

The frequency of occurrence of tsunami due to specific sources, such as tsunamigenic landslide is a necessary and important parameter required for any probabilistic tsunami hazard assessment (PTHA). Thus, developing and understanding of the frequency of tsunamigenic landslides that may impact the U.S. coastline is an important element in reaching the long term program goal of developing PSHA tools for the Atlantic and Gulf coasts.

However, landslides are complicated and non-stationary process. Submarine landslides are distributed unevenly both in space and time. Spatially, they occur most commonly in fjords, active river deltas, submarine canyon-fan systems, the open continental slope, and on the flanks of oceanic volcanic islands. Temporally, they are influenced by the size, location, and sedimentology of migrating depocenters, changes in seafloor pressures and temperatures, variations in seismicity and volcanic activity, and changes in groundwater flow conditions.

In the past, the dominant factor influencing the times of submarine landslide occurrence has been glaciation. A review of known ages of submarine landslides along the margins of the Atlantic Ocean, augmented by a few ages from other submarine locations shows a relatively even distribution of large landslides with time from the last glacial maximum until about five thousand years after the end of glaciation. During the past 5000 years the frequency of occurrence is less by a factor of 1.7 to 3.5 than during or shortly after the last glacial/deglaciation period. Such an association likely exists because of the formation of thick deposits of sediment on the upper continental slope during glacial periods and increased seismicity caused by isostatic readjustment during and following deglaciation. Hydrate dissociation may play a role, as suggested previously in the literature, but the connection is unclear.

Developing an full understanding of the rate of past event, as well as the underlying causes, will continue to be an important research topic within the US NRC program. By understanding the underlying causes of past behavior, a more informed assessment of future rates will be possible. The reader is directed to Lee (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

## 8. INVESTIGATION OF THE SOURCE OF THE 1755 LISBON EARTHQUAKE AND TSUNAMI USING TRANS-OCEANIC MODELING

Four large tsunamigenic earthquakes have occurred in the Atlantic Ocean west of Gibraltar in the last 300 years. The great Lisbon earthquake is one of these. However, there is no simple tectonic model for this area that explains the generation of these earthquakes. As a result, promising work undertaken to determine the source parameters of the 1755 Lisbon earthquake is of particular interest.

The Lisbon earthquake occurred in 1755 and had an estimated moment magnitude of 8.5 to 9.0 and was the most destructive earthquake in European history. In the near field associated tsunami run-up was reported to have reached 5-15 m along the Portuguese and Moroccan coasts and the run-up was significant at the Azores and Madeira Island. However, Lander et al. (2002) compiled a list of reports on the effect of the 1755 Lisbon tsunami in distant locations such as the Caribbean: Antigua, Saba, St. Martin at the northeast corner of the Caribbean had the highest flooding, but flooding was also reported from Santiago de Cuba and Samana Bay, Dominican Republic, in the north to Barbados in the south. There are also reports about flooding in Bonavista, north of St. Johns, Newfoundland. However, there are no reports of flooding anywhere else between Cuba and Newfoundland, despite the presence at that time of population centers in low-lying areas of the eastern U.S. and Canada.

A variety of past studies have hypothesized various sources for this earthquake based on geophysical surveys, modeling the near-field earthquake intensity, or tsunami effects. However, as part of this research, modeling of various sources is being undertaken to determine the source location and geometry that best fits the many far field records of tsunami impacts from the earthquake. Prior to this project there had not been an attempt to fit cross-ocean tsunami reports of the 1755 Lisbon earthquake to any of the proposed fault sources. Studying far field effects, as undertaken in this research, is advantageous because the tsunami is less influenced by near source bathymetry and is unaffected by triggered submarine landslides at the source. Source location, fault orientation and bathymetry are the main elements governing transatlantic tsunami propagation to sites along the U.S. East Coast, much more than distance from the source and continental shelf width.

Results of the far and near-field tsunami simulations undertaken and a relative amplitude comparison limit the earthquake source area to a region located south of the Gorringe Bank in the center of the Horseshoe Plain. This is in contrast with previously suggested sources such as Marqués de Pombal Fault, and Gulf of Cádiz Fault, which are farther east of the Horseshoe Plain. The earthquake was likely to be a thrust event on a fault striking ~345° and dipping to the ENE as opposed to the suggested earthquake source of the Gorringe Bank Fault, which trends NE-SW. Gorringe Bank, the Madeira-Tore Rise (MTR), and the Azores appear to have acted as topographic scatters for tsunami energy, shielding most of the U.S. Atlantic Coast from the 1755 Lisbon tsunami. Additional simulations to assess tsunami hazard to the U.S. Atlantic Coast from possible future earthquakes along the Azores-Iberia plate boundary indicate that sources west of the MTR and in the Gulf of Cadiz may affect the southeastern coast of the U.S. The Azores-Iberia plate boundary west of the MTR is characterized by strike-slip faults, not thrusts, but the Gulf of Cadiz may have thrust faults. Southern Florida seems to be at risk from sources located east of MTR and South of the Gorringe Bank, but it is mostly shielded by the Bahamas. The Gulf of Cádiz is another source area of potential tsunami hazard to the U.S. Atlantic Coast. Higher resolution near-shore bathymetry along the U.S. Atlantic Coast and the Caribbean as well as a detailed study of potential tsunami sources in the central west part of the Horseshoe Plain are necessary to verify the simulation results. The reader is directed to Barkana et al (2008) or the 2008 revision of the USGS report to the US NRC (Ten Brink et al, 2008) for additional details.

## 9. SUMMARY

This paper highlights some recent results from research performed for the US NRC tsunami research program. This information is provided as an overview of the types of projects undertaken in the program. The goal of the program is to develop an understanding of the deterministic hazard from tsunami along the U.S. Atlantic and Gulf coasts in the short term, with a long-term goal of developing the tools and parameters necessary to perform probabilistic seismic hazard assessments. The research here represents a wide variety of topics that are essential to ultimately meet these goals. For additional information, please see the companion paper in this conference (Kammerer et al, 2008).

## REFERENCES

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Ten Brink, U., Lee, H., Geist, E., and Twichell, D. (2008) Assessment of tsunami hazard to the U.S. East Coast using relationships between submarine landslides and earthquakes. Marine Geology Special Issue (accepted)

Ten Brink, U., Twichell, D., Geist, E., Chaytor, J., Locat, J., Lee, H., Buczkowski, B., and Sansoucy, M., (2007) The current state of knowledge regarding potential tsunami sources affecting U.S. Atlantic and Gulf Coasts. U.S. Geological Survey Administrative Report to the United States Nuclear Regulatory Commission.

**Summary of Current Regulations, Guidance, and Activities related to NRC Review of Tsunami Hazard Analyses for New NPPs in the United States**

The United States Nuclear Regulatory Commission (NRC) considers and assesses tsunami and tsunami-like phenomena under its tsunami hazard and risk assessment protocols. To perform a tsunami hazard and risk assessment, the NRC uses a hierarchical framework and a variety of technical approaches as appropriate for each of the various source types. Currently NRC guidance on tsunami uses a deterministic approach based on assessment of the Probable Maximum Tsunami (PMT). This annex describes the current approach NRC staff use in the review of license applications.

The NRC is moving towards risk-informed approaches and guidance across the agency. Probabilistic approaches can be proposed as a basis for review by the licensee. Current state-of-the-art practice in the U.S. uses probabilistic approaches to determine tsunami hazard on the Pacific coast. Probabilistic tsunami hazard assessment (PTHA) methods are an area of active research within the NRC and are currently viable on the Pacific coast. Currently a lack of information on the rate of activity of tsunamigenic sources that may affect the Atlantic and Gulf Coasts of the U.S. preclude the practical use of probabilistic methods.

**Regulations and Regulatory Guidance**

NRC regulations related to tsunami hazard assessments, as provided in the Code of Federal Regulations (CFR), include the following:

1. 10 CFR Part 100, as it relates to identifying and evaluating hydrological features of the site. The requirements to consider physical site characteristics in site evaluations are specified in 10 CFR 100.20(c) for new applications.

2. 10 CFR 100.23(d) sets criteria to determine the siting factors for plant design bases with respect to seismic induced floods and water waves at the site.

3. 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2, for CP and OL applications, as it relates to consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

4. 10 CFR 52.17(a)(1)(vi), for early site permit (ESP) applications, and 10 CFR 52.79, for combined operating licenses (COL) applications, as they relate to identifying hydrological site characteristics with appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

Regulatory Guide 1.59 (1977) briefly discussed tsunami as a source of flooding. This regulatory guide is currently being updated. However, the update of this guide will not include tsunami-induced flooding. NRC staff is currently preparing a new regulatory guide focused on tsunami hazard assessment and risk.

Section 2.4.6 of the NRC Standard Review Plan (SRP) NUREG 0800 (NRC, 2007) describes review procedures and acceptance criteria for tsunami hazards currently used by NRC staff.

The National Oceanic and Atmospheric Administration (NOAA) is responsible for developing standards of accuracy for tsunami simulation models for the U.S. federal government and for conducting research to support the National Tsunami Hazard Mitigation Program. In 2007, NOAA provided the NRC with a state-of-the-art report on tsunami hazard assessment in the U.S. which, along with NUREG/CR-6966, forms the basis for the current NRC review approach.

In 2006, the NRC initiated a long-term research tsunami research program. This program, which includes cooperative work with the United States Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA), was designed both to support activities associated with the licensing of new nuclear power plants in the U.S and to support development of new regulatory guidance.

Additional supporting documentation is available as described in the sections below.

**The Application of the Hierarchical Approach**

A hierarchical approach acceptable to NRC staff is described in NUREG/CR-6966. As noted in this document, a hierarchical-assessment approach consists of a series of stepwise, progressively more refined analyses that are used to evaluate the hazard resulting from a specific phenomenon. In the case of tsunami, this approach is defined by three steps that answer the following questions:

1. Is the site region subject to tsunamis?
2. Could the plant site be affected by tsunamis?
3. What is the risk to safety of the plant caused by tsunamis?

The first step, which is essentially a regional screening test, is performed to determine whether or not a site can be screened out based on its proximity to a water body capable of producing a tsunami or tsunami-like effect. If the region in which a site is located is not subject to tsunamis, no further analysis for tsunami hazards is required. This finding should be supported by region-specific evidence. If this cannot be conclusively shown, the second step, below, is required.

The second step can be regarded as a site-screening test. This step determines whether plant systems important to safety are exposed to hazards from tsunami. The methods used to perform site-specific hazard assessments, including the calculation of site-specific

run-up elevations, are described later in this Annex. It may be possible to determine that, even though the general site region is subject to tsunami hazards, all safety-related systems are located at an elevation above the calculated maximum wave run-up.

The third step assesses the risk to a facility that may exist if the elevation of the safety-significant structures, systems and components (SSC) cannot be conclusively shown to exceed the calculated tsunami run-up. This step requires the most refined and complex analysis.

**Areas of Review by NRC Staff**

NRC Staff review the technical areas summarized below. These review areas are described in more detail in the current version of the NRC SRP (NUREG 0-800), which is available for download at the NRC's online reading room.

1. Historical Tsunami Data. The staff reviews historical tsunami data, including paleotsunami data. Historical data may help in establishing the frequency of occurrence and other useful indicators such as the maximum observed run-up height. The NOAA National Geophysical Data Center collects and archives information on tsunami sources and effects to support tsunami modeling and engineering for the U.S. government and should be used as a key source of data. International sources that are relevant to plants exposed to trans-oceanic tsunami should also be investigated.

2. Probable Maximum Tsunami. Currently, NRC staff reviews applications for adequacy based on deterministic assessment of a Probable Maximum Tsunami (PMT), as noted in Regulatory Guide 1.59 (1977). The staff reviews the PMT with respect to the identification of the source mechanisms, the characteristics of these source mechanisms, and the simulation of the wave propagating towards the proposed plant site. A discussion of tsunamigenic sources is provided later in this Annex.

3. Tsunami Propagation Models. The staff reviews the computation models used in the hazard analysis. Elements of tsunami modeling are discussed in more detail later in this Annex.

4. Wave Run-up, Inundation, and Drawdown. The staff reviews the run-up caused by the PMT. An appropriate initial water surface elevation for the body of water under consideration, before the arrival of the tsunami waves, should be assumed. similar to that recommend for storm surges and seiches by ANSI/ANS-2.8-1992. For example, to estimate the highest tsunami wave run-up at a coastal site, the $90^{th}$ percentile of high tides must be used as the initial water surface elevation near the site. To estimate the lowest drawdown caused by receding tsunami waves, the $10^{th}$ percentile of the low tides may be used

Any inundation indicated by the assessment should be considered in the flooding design bases of the plant and may necessitate flooding protection for some safety-related SSC. Staff also reviews drawdown caused by tsunami waves and how it may affect the safety-related intakes, if they are used in the plant design and are exposed to the effects of the tsunami. The staff also reviews the duration of the drawdown to estimate the time during which a safety-related intake may be affected. The suggested criteria of Regulatory Guide 1.27 apply when the water supply comprises part of the ultimate heat sink.

It should be demonstrated that the extent and the duration of the inundation and the drawdown caused by the tsunami waves are adequately established for the purposes of the plant design bases.

5. Hydrostatic and Hydrodynamic Forces. The staff reviews the hydrostatic and the hydrodynamic forces on the safety-related SSC caused by the tsunami waves. Because the tsunami occurs as a train of waves, several incoming and receding wave cycles should be considered. Local geometry and bathymetry can significantly affect the height, velocity, and momentum flux near the locations of the safety-related SSC. The suggested criteria of Regulatory Guide 1.26 apply when the water supply comprises part of any water-cooled ultimate heat sink.

   It should be demonstrated that hydrostatic and hydrodynamic forces caused by the tsunami waves are adequately established for the purposes of the plant design bases.

6. Debris and Water-Borne Projectiles. The staff reviews the likelihood of debris and water-borne projectiles carried along with the tsunami currents and their ability to cause damage to the safety-related SSC. The suggested criteria of Regulatory guide 1.27 apply when the water supply comprises part of the ultimate heat sink. It should be demonstrated that any possibility of damage to the safety-related SSC from debris and water-borne projectiles is adequately established for the purposes of the plant design bases.

7. Effects of Sediment Erosion and Deposition. The staff reviews the sediment deposition during the tsunami, as well as the erosion caused by the high velocity of flood waters or wave action during the tsunami and its effect on foundations of the safety-related SSC, to ensure that these are adequately established for the purposes of the plant design bases. Any potential erosion and sediment deposition should not affect safety-related functioning of the exposed SSC. The suggested criteria of Regulatory Guide 1.27 apply when the water supply comprises part of the ultimate heat sink.

8. Consideration of other Site-Related Evaluation Criteria. 10 CFR Part 100 describes site-related proximity, seismic and non-seismic evaluation criteria for power reactor applications. Subpart A to 10 CFR Part 100 addresses the requirements for applications before January 10, 1997, and Subpart B is for

applications on or after January 10, 1997. The staff's review will include evaluation of pertinent information to determine if these criteria are appropriately used in postulation of worst-case tsunami scenarios.

**Tsunamigenic Source Characterization**

Tsunami hazard along the United States coastlines comes from two predominant source categories; landslides and seismic sources. Sources in these categories exist in both the near- and far-field. A regional assessment of tsunamigenic sources should be carried out to determine all sources that may generate the PMT at the proposed plant site. The source mechanisms considered in the assessment should include earthquakes, submarine and sub-aerial landslides and volcanoes. The characteristic of the sources that are used for the specification of the PMT should be conservative.

The landslide sources should be characterized using the maximum volume parameter determined from seafloor mappings or geologic age dating of the historical landslides. A slope-stability analysis should be performed to assess the potential tsunami generation efficiency of the candidate landslides. The tsunamigenic source types caused by volcanic activity considered in the PMT assessment should include pyroclastic flows, submarine caldera collapse, explosions, and debris avalanches or flank failures.

To support license activities related to new reactors, the NRC has initiated a long-term tsunami research program. As part of this program, the United States Geological Survey (USGS) has provided a report summarizing the tsunamigenic source mechanisms in the Atlantic Ocean and the Gulf of Mexico (ten Brink et al 2008). The sources detailed in this report are used by the NRC staff as a starting point for tsunami assessment for proposed sites located near these water bodies. Research is on-going in this area and additional references and source characterizations may become available in the future.

**Tsunami Modeling Methods**

As part of the licensing process, the staff reviews the computational models used in the tsunami hazard analyses. Tsunami propagation models should be used, such as those used by NOAA that are published in peer-reviewed literature and are verified using extensive testing.

The staff reviews propagation of the PMT waves from the source towards the proposed site. If appropriate, the shallow water wave approximate should be used to simulate propagation of the PMT waves in deep waters. The simulation of the propagation of the PMT waves in shallow waters, where the shallow water wave approximation is not valid, should use non-linear wave dynamics approaches.

The staff reviews the model parameters and the input data used to simulate the propagation of the PMT waves towards the site. The model parameters should be

described and their conservative values should be chosen. All other data used for model input should be described and their respective sources noted. Usually bathymetry and topography data archived and maintained by NOAA/NGDC, and the USGS, and the U.S. Army Corps of Engineers are sufficient for sites in the U.S. However, some sites may require additional data.

NOAA has the responsibility to develop standards of accuracy for tsunami simulation models for the U.S. federal government and to conduct research to support the National Tsunami Hazard Mitigation Program. NOAA, through USAID funding, has developed an interface tool, the Community Model Interface for Tsunami (ComMIT), that allows individuals and institutions to make use of NOAA seismic source models, tools, and results. This publically-available interface tool, when applied by an appropriately trained analyst and coupled with high-quality local bathymetric information, is a useful tool to undertake tsunami hazard analyses at many locations both within and outside the U.S. It is highly recommended than any analyst using the tool should first perform the benchmark test problems provided on the NOAA website.

The NRC intends to use the NOAA ComMIT tool, as appropriate, and will continue to work with NOAA to enhance NRC practices and guidance in the future. For landslide-related tsunamigenic sources alternate methods and tools are required. Development of guidance on landslide-based tsunami modeling is ongoing.

**References for Annex:**

The below references are available either through the NRC ADAMS system using the ML ascension number (if shown), or through the NRC reading room. Both can be accessed through the NRC website located at http://www.nrc.gov

10 CFR Part 50. Code of Federal Regulations. Title 10, Energy, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 52. Code of Federal Regulations. Title 10, Energy, Part 52 "Early Site Permits; Standard Design Certifications; and Combined License for Nuclear Power Plants."

10 CFR Part 100. Title 10, Energy, Part 100, "Reactor Site Criteria."

ANSI/ANS-2.8-1992, "Determining Design Basis Flooding at Power Reactor Sites" (not available at NRC site)

Gonzalez, F.I., Bernard, E., Dunbar, P., Geist, E., Jaffe, B., Kanoglu, U., Locat, J., Mofjeld, H., Moore, A., Synolakis, C., and Titov, V., (2007), "Scientific and Technical Issues in Tsunami Hazard Assessment of Nuclear Power Plant Sites," NOAA Technical Memorandum OAR PMEL-136, Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration, Seattle, Washington.

NOAA National Geophysical Data Center (NGDC), (2007) NOAA/WDC Historical Tsunami Database at NGDC, URL: http://www.ngdc.noaa.gov/hazard/tsu_db.shtml

NOAA Community Model Interface for Tsunami (ComMIT) download and documentation are available at http://nctr.pmel.noaa.gov/ComMIT/

Pacific Northwest National Laboratory (2009), "Tsunami Hazard Assessment at Nuclear Power Plant Sites in the United States of America." NUREG/CR-6996, PNNL-17397. Available for download at the NRC reading room.

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U.S. Nuclear Regulatory Commission (1976), "Ultimate Heat Sink for Nuclear Power Plants." Regulatory Guide 1.27, Revision 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (2007), "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," LWR Edition, Office of Nuclear Reactor Regulations, Washington, D.C.

**From:** Coggins, Angela
**To:** Taylor, Robert
**Cc:** Harrington, Holly; McIntyre, David; Schmidt, Rebecca; Powell, Amy
**Subject:** Re: Japanese-Rx-Incident addtl questions - March-14-2011 doc.docx
**Date:** Tuesday, March 15, 2011 8:36:00 PM

Thanks so much!! I appreciate all the effort!
Angela Coggins
Policy Director
Office of Chairman Gregory B Jaczko
US Nuclear Regulatory Commission
angela.coggins@nrc.gov/301-415-1828

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**From**: Taylor, Robert
**To**: Coggins, Angela
**Cc**: Harrington, Holly; McIntyre, David; Schmidt, Rebecca; Powell, Amy
**Sent**: Tue Mar 15 20:29:17 2011
**Subject**: Japanese-Rx-Incident addtl questions - March-14-2011 doc.docx

Angela,

We have done our best to incorporate your questions into the Chairman's Q&As that were developed earlier today and provided to OCA. The updated set of Q&As is undergoing ET review and we will hopefully have it to you in the near future. The attached provides a roadmap of where we believe the responses can be found. A few questions fell into the broader "After this event is over, we will determine what changes need to be made in the US" message. I did not directly incorporate them, but you can see a draft response in the attached.

Regarding the third question about past events, I did not try to evaluate all of the events you listed. I would propose sticking to the party line, in that, "The NRC routinely reassess its regulatory requirements in light of new operating experience and plant events."

Regards,
Rob

**From:** Shoop, Undine
**To:** Taylor, Robert; Harrington, Holly
**Subject:** RE: Potential OPA Questions.docx
**Date:** Tuesday, March 15, 2011 1:19:41 PM

Nope, I am answering the q's that the public/media is sending in.

**From:** Taylor, Robert
**Sent:** Tuesday, March 15, 2011 1:14 PM
**To:** Harrington, Holly
**Cc:** Shoop, Undine
**Subject:** RE: Potential OPA Questions.docx

Will do. Have I seen Undine's questions? Are they the 4 added to the end of the bigger Chairman questions?

**From:** Harrington, Holly
**Sent:** Tuesday, March 15, 2011 1:12 PM
**To:** Taylor, Robert
**Subject:** RE: Potential OPA Questions.docx

Correct answer to foregn travel, not our place. My changes to this one:

1. **My family has planned a vacation to Hawaii/Alaska/Seattle next week – is it safe to go, or should we cancel our plans?**

   Repeat our overall message about not affecting U.S. and then say: changes to travel is a personal decision. We are unaware of any travel restriction. that the events in Japan warrant any travel restrictions within the United States or its territories.

We'll marry these with Undine questions for the public. Yes?

**From:** Taylor, Robert
**Sent:** Tuesday, March 15, 2011 1:02 PM
**To:** Harrington, Holly
**Subject:** Potential OPA Questions.docx

Here are the responses I drafted to the questions Dave thought up. I added the last one regarding travel to Asia based on the email you sent me. I really don't think it is our place to speak regarding foreign travel. Your thoughts?

I plan to maintain this bank of questions and add as anyone from OPA deems necessary.

**From:** Karwoski, Kenneth MKK
**To:** Lubinski, John; Taylor, Robert
**Subject:** FW: Masaki FYI
**Date:** Tuesday, March 15, 2011 12:51:45 PM

---

FYI - it indicates there was a LOCA (but no real details).

Ken

-----Original Message-----
From: ennisk@asme.org [mailto:ennisk@asme.org]
Sent: Tuesday, March 15, 2011 12:34 PM
To: Karwoski, Kenneth
Subject: Masaki FYI

All,

Below is a message from Dr. Masaki Morishita sent to Frank Schaaf.

Regards,

Kevin
-----Original Message-----
From: morishita.masaki <morishita.masaki@jaea.go.jp>
To: treecode <treecode@cs.com>
Cc: tetsuo_yuhara <tetsuo_yuhara@me.com>
Sent: Tue, Mar 15, 2011 12:07 am
Subject: Re: How are you?

Frank,

Thank you for your message.
My family and I are fine and OK now, though we have been forced to live without liflines for three days. But our situation is far less serious than those of the people directly hit the earthquake and tsunami disaster.

The situation of TEPCO's Fukushima Daiichi Power Station is still going to be more serious, LOCA and radioactive material release have taken place. People within 20 km of the site was orderd to evacuate.

I would like to believe this worst situation will be overcome to be stabilized.

Thanks again and I will see you in some of the Code Weeks to come.

Regards,

Masaki

This email was brought to you through the ASME Volunteer Contact Center by Kevin Ennis.

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None

w/280

Member Distribution List:
None

Member cc Distribution List:
None

## Weaver, Tonna

**From:** Lee, Richard
**Sent:** Tuesday, March 15, 2011 10:23 AM
**To:** Ulses, Anthony
**Subject:** FW: Fukushima

Tony:

I do not know anyone looking at the spent fuel pools at all the units at Fukishima.

This suggestion came from ANL. Just for your consideration.
Best of luck in dealing with the situtation.

Richard

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**From:** Farmer, Mitchell T. [farmer@anl.gov]
**Sent:** Tuesday, March 15, 2011 9:58 AM
**To:** Tinkler, Charles
**Cc:** Basu, Sudhamay; Gavrilas, Mirela; Lee, Richard
**Subject:** RE: Fukushima

Still worried about pools in 1-3, and whether or not they can gain access to these or the cooling water connections to these pools given the state of the plants. I was thinking about the approach for getting water into these a little more and would suggest that this could be done as an unmanned operation if you attached a pipe to the lift that was off sufficient length to clear the wall of the damaged exterior wall adjacent to the deck of the pool. With a 90 degree elbow on it, you could direct water down into (or at least towards) the pool. The operator could articulate the lift platform with the attached pipe over the wall remotely and once in position you could add water with a fire pump through an attached fire hose.

I don't know if this is helpful but it can't hurt. Although I feel somewhat knowledgable about accident progression and accident management planning for the reactor, I wonder if the SAMGs also call for keeping track of the spent fuel pool while you are dealing with the reactor situation. If not, this could be a constructive lessons learned.

Again, let me know if you want me to stop.

Mitch

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**From:** Farmer, Mitchell T.
**Sent:** Monday, March 14, 2011 8:52 AM
**To:** 'Tinkler, Charles'
**Cc:** 'Sud Basu'; Gavrilas, Mirela; Lee, Richard
**Subject:** RE: Fukushima

Hi Charlie,

I just wanted to send you a note and let you know that I'm a little concerned about the spent fuel storage pools for Units 1 and 3 for the reasons we've talked about over the years. I know you've probably thought of this but it's a stressful time and I just want to make sure the people you've deployed are thinking about this.

I doubt they have access inside the building due to radiation levels so I'm going to make a suggestion which may or may not be nieve, but given the circumstances I'll make it anyway. I know you can get the aerial lifts that can go up at least 10 stories. I was thinking you could send a brave individual up on that with a fire hose on the exterior of the building with an alarming TLD so that he would know if the radiation level was getting to high. You would use the exterior of the secondary containment as shielding. He could place the hose over the exposed wall and then wire tire that to one of the ibeams so that it doesn't blow off when you start deluge over the edge and onto the deck. The wire tie is imparitive as it'll



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blow back when you start the pump. If they have an extra fire pump that could push water head to 10 stories, you could get some water over the top and into the pool. This might take 1/2 hour or so to execute and so if the dose rate stays below 20 R/hour this could be pulled off.

I hope you don't mind me making suggestions and if it is problematic, please don't hesitate to let me know. Mirela has my cell phone; call me 24/7 if I can be of any assistance. As you know, you have resources here at the lab and I'm sure management would approve of us supporting you know.

Best Regards,
Mitch

ps. I wish we were further along on that remote sensing project for the RCIC that we just started for you; that could be quite helpful now.

---

**From:** Tinkler, Charles [mailto:Charles.Tinkler@nrc.gov]
**Sent:** Saturday, March 12, 2011 1:18 PM
**To:** Farmer, Mitchell T.
**Subject:** RE: Fukushima

Thanks Mitch, right now I don't know exactly why they are unable to use their isolation condenser or inject water. Thanks for the reminder on flooding. I appreciate your offer.

---

**From:** Farmer, Mitchell T. [mailto:farmer@anl.gov]
**Sent:** Friday, March 11, 2011 7:43 PM
**To:** Gavrilas, Mirela; Tinkler, Charles; Basu, Sudhamay; Lee, Richard
**Cc:** Grandy, Christopher; 'corradin@cae.wisc.edu'
**Subject:** Fukushima

Hi Mirela, Charlie, Sud, Richard,

Don't know if you are out there. I've been watching the situation at Fukushima and don't like what I'm seeing, at least based on the news reports I have access to. I don't know how long a BWR can go w/o emergency core cooling and not sustain significant core damage but it seems like we're well into that time domain. Is there anything that can be done to help? I don't know, I'm searching. The one thing we learned from MCCI though: if you fear vessel failure and you have any means to flood the cavity then you should do that. They have siliecous concrete in Japan; too much interaction ex-vessel w/o water and coolability is lost. Let me know if there is anything I can do.

Mitch

**From:** Schwarz, Sherry on behalf of Leeds, Eric
**To:** NRR Distribution
**Subject:** Appreciation and Continued Mission Focus
**Date:** Wednesday, March 16, 2011 5:05:53 PM

NRR

During this period of heightened activity in response to the events in Japan, I want to take the time to let you know how much I value the work that all of you do in NRR. Some of you are providing key support in emergency response, while others are performing the equally vital day-to-day regulatory duties. Throughout these distracting times abroad, it is so important to keep our focus on the safe operation of nuclear power plants here in the United States. Whether you are involved with licensing actions, technical analysis, budget preparations, or administrative functions to help us execute our essential regulatory work, your continued dedication and commitment are vital for us to maintain our mission of protecting the American public's health and safety.

I know that there can be anxiety and stress as events unfold; take time to take good care of yourself. To keep informed, there will be periodic updates from the EDO, and I encourage you to stay abreast of the agency's public announcements and blog at www.nrc.gov. As regulators, we excel at our steadiness in protecting people and the environment. Again, thanks for all you do.

*Eric*

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**From:** NEIGA@nei.org
**To:** Taylor, Robert
**Subject:** **Update 1:15pm March 16** Information on the Japanese Earthquake and Reactors in that Region
**Date:** Wednesday, March 16, 2011 2:01:31 PM

**UPDATE AS OF 1:15 P.M. EDT, WEDNESDAY, MARCH 16:**

NEI has posted an updated version of the fact sheet Used Nuclear Fuel Storage at the Fukushima Daiichi Nuclear Power Plant. Also available is a new fact sheet called Industry Taking Action to Ensure Continued Safety at U.S. Nuclear Energy Plants.

As always, please go to http://resources.nei.org/japan for the latest updates.



## Weaver, Tonna

**From:** Case, Michael
**Sent:** Thursday, March 17, 2011 9:32 AM
**To:** Ruland, William
**Subject:** FW: Assessement of cooling requirements for Fukushima units 1-3

FYI

-----Original Message-----
From: Gavrilas, Mirela
Sent: Thursday, March 17, 2011 9:24 AM
To: Case, Michael; Gibson, Kathy
Subject: FW: Assessement of cooling requirements for Fukushima units 1-3

fyi

-----Original Message-----
From: Michael Corradini [mailto:corradini@engr.wisc.edu]
Sent: Thursday, March 17, 2011 9:23 AM
To: Farmer, Mitchell T.
Cc: Tinkler, Charles; Basu, Sudhamay; Lee, Richard; Gavrilas, Mirela
Subject: RE: Assessement of cooling requirements for Fukushima units 1-3

Mitch - I agree with your analysis. I am doing RASCAL calcs about dose effects.
--

Michael Corradini, Chair
Engineering Physics
University of Wisconsin
(608)263-1648 [Fax: 3-7451]
corradini@engr.wisc.edu
http://www.engr.wisc.edu/ep

Quoting "Farmer, Mitchell T." <farmer@anl.gov>:

> Hi everyone,
>
> I want to make two final sugestions that I thought of this morning and
> I'm sending it to you in hopes that it can be factored into the
> accident management at the site ASAP. My hand calculations below
> indicated that at the fire pumping rate of 30 T/hour through the
> cores (?) outlet core temp on unit 1 should go subcooled today.
> However, it's going to be another week at least for units 2-3. I've
> also heard about salt crystalization concerns, and that may be
> detrimental to flow passages through the core/core debris. So, if they
> are getting more equipment on site, it would be very beneficial to
> double the pumping capacity for units 2/3 to try to get those
> subcooled ASAP. This would: 1) decrease crystalization rate of salt
> and 2) really reduce source term from the cores. Then, the only
> steaming you should be able to see from the plants would be the spent
> fuel pools which they are attacking now. This would help clarify some
> of the aerial data from units 2-3 iof the only steam source were the



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> pools.
>
> Second, I don't know if the drywell plugs are still in place, but if
> you flood the drywell to the extent that it fills out the top, then
> some of the water spilling onto the deck would make it into the SFP??
>
> This is my last direct contact, we now have to go through DOE, but I
> want to get info out as fast as possible so that it can help if
> viable.
>
> Praying for the Japanese,
> Mitch
> _____
> From: Farmer, Mitchell T.
> Sent: Monday, March 14, 2011 1:31 PM
> To: 'Tinkler, Charles'; Basu, Sudhamay; Lee, Richard; Gavrilas, Mirela
> Subject: FW: Assessement of cooling requirements for
> Fukushima units 1-3
>
>
> FYI.
> Mitch
> _____
> From: Farmer, Mitchell T.
> Sent: Monday, March 14, 2011 1:22 PM
> To: Grandy, Christopher; Khalil, Hussein S.; Peters, Mark T.;
> Sattelberger, Alfred P.
> Cc: 'corradin@cae.wisc.edu'; Seidensticker, Ralph W.
> Subject: Assessement of cooling requirements for Fukushima units 1-3
>
> All,
>
> I did a few back of the envelope calculations to scope out what the
> cooling requirements will be at Fukushima units 1-3 in the event that
> they are not able to reestablish power to the site and, thereby,
> normal cooling functions at these plants.
>
> The limited information I have suggests that they are supplying 30
> MT/hour of seawater to unit 1, and so I'll assume that the same is
> currently going to units 2 and 3. To put this in perspective, that
> amount of cooling flow can remove 2.8 MW while remaining subcooled at
> atmospheric conditions, and up to 21.7 MW if this amount of water is
> completely boiled off. Ideally, you would like to get to subcooled
> outlet core conditions so you'll stop forming steam and then you can
> stop the venting that is causing concern right now.
>
> That amount of heat removal needs to be compared to the decay heat
> levels in these reactors to determine when subcooled conditions can be
> reached. Unit 1 was 460 Mwe and Units 2- 3 were 784 Mwe per Chris's
> previous email. Thus, I estimate the thermal power levels of these
> reactors to be 1200 MWt and 2000 MWt, respectively. After three days
> (or currently), the power level for a U core would fall to about 0.4 %
> assuming that the reactors had operated for 200 full-power days before
> the earthquake (a little higher for the MOX core but I don't have data
> to assess that). Thus, decay heat in Unit 1 is now about 4.8 MW and
> for Units 2/3 it's about 8 MWt. Thus, I suspect they're still venting

> steam at all three units. I then looked at the times when the decay
> heat will fall below the level at which subcooling can be achieved (ie
> 2.8 MWt core decay heat level) and for unit 1 that is 6 days total (ie
> 3 days from now) and for units 2 and 3 it will be about 16 days (ie 13
> more days).
>
> This is a worst case scenario that assumes they can't get electricit
> back to the site and establish normal cooling function; ie they have
> to rely on sea water injection. Also, I assumed 200 full power days;
> the power level could be less or a little more if I
> overestimated/understimated operation times.
>
> As far as coolability of the degraded cores, my opinion is that units
> 1 and 3 are in coolable configurations; it's been 3 days now and if
> the configuraiton was not coolable the material most likely would have
> failed the reactor pressure vessel. I guess the jury is still out on
> Unit 2; I think the entire core has gone dry at least once. The good
> news is that the decay heat is way down from what it was a few hours
> after the accident was initiated.
>
> Mitch
>
>

| | |
|---|---|
| **From:** | Lubinski, John |
| **To:** | McMurtray, Anthony; Thomas, Brian; Lupold, Timothy; Mitchell, Matthew; Taylor, Robert; Wolfgang, Robert; Klein, Paul; Cusumano, Victor; Karwoski, Kenneth; Hardies, Robert |
| **Subject:** | FW: Outline from today"s emergency LT attached |
| **Date:** | Wednesday, March 16, 2011 3:30:19 PM |
| **Attachments:** | Commission Meeting Outline.pdf |

Fyi – information that we discussed at our morning this afternoon.

**From:** Howe, Allen
**Sent:** Wednesday, March 16, 2011 11:22 AM
**To:** Cheok, Michael; Holian, Brian; Ruland, William; Wilson, George; Lubinski, John; Thomas, Brian; Quay, Theodore; Nelson, Robert; Giitter, Joseph; Brown, Frederick
**Subject:** Outline from today's emergency LT attached

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open & closed

Commission Meeting Outline

NRC Response to Core Damage Accident in Japan

Current Status of Fukushima Daiichi

- Reactors
- Spent Fuel Pools

Consequence Projections

NRC Response Objectives

- Support of US Citizens in Japan
- Support of the Japanese Government
- Advance Our Understanding of Safety and Risk

NRC Response Actions

- In Japan
- At HQ

US Government Response

- NRC Partners and Stakeholders

Challenges to Success in the Response

- Information
- Coordination

Situation Assessment For US Reactors and Applicants (JCO)

- External Events
- Severe Accidents

Path Forward and Priorities

- Near Term Actions
  In Support of Response
- Longer Term Actions
  Lessons Learned From this Event
  Resolution of GSI 19 9

What's not getting done

## Fukushima Daiichi Summary

| Unit | STATUS AS OF 2130 EDT, 03/18/2011 - (1030 03/19/2011JDT) | Priority |
|---|---|---|
| 1 | **Core Status** damaged, RCS depressurized. Sea water injection enough to cool core (NISA) | 4 |
| | **Containment** Primary Containment functional (JAIF) Secondary Containment lost (visual) | |
| | **Spent Fuel Pool** 292 Bundles in SFP (GEH) SFP Level unknown (JAIF). Margin 128 days(Monninger) | |
| 2 | **Core Status** Damaged, RCS depressurized (FEPC). Sea water injection enough to cool core (NISA) Off site power line being installed (NISA) | 3 |
| | **Containment** Primary Containment – Possible Torus damage Secondary Containment , Hole cut in side of Fuel Floor metal to reduce H2 buildup, steam coming from hole (visual). | |
| | **Spent Fuel Pool** 587 Bundles in SFP (GEH) Fire trucks supplying seawater for cooling spray. Time Margin 40 days (Monninger) | |
| 3 | **Core Status** Damaged, RCS depressurized (FEPC) Radiation released. Using sea water injection to cool core. (NISA) | 1 |
| | **Containment** Primary Containment status unknown. Secondary Containment lost (visual). | |
| | **Spent Fuel Pool** 514 Bundles in SFP (GEH) **Pool Dry** (U.S. Site Team), helicopter and fire fighting spray used on Mar 17 (METI) Time margin (to fuel uncovery from evap rate & volume): 0 days (Monninger) | |
| 4 | **Spent Fuel Pool** 1201 Bundles in SFP (GEH) Damage to fuel rods suspected (JAIF) Water dumped on site with water cannons, fire trucks supplying cooling spray. Margin – 6 days (Monninger) | 2 |
| 5 | **Shutdown since 1/3/11.** Core in RPV (INPO). SFP 950 Bundles (GEH), Unit 6 EDG available and supplying power to units 5 & 6. Water injection to RPV & SFP continuing. (NISA) | 5 |
| 6 | **Shutdown since 8/14/10.** Core in RPV (INPO). SFP 876 Bundles (GEH), Unit's EDG available. | 6 |
| N/A | **Common Spent Fuel Pool:** 6,000 spent fuel bundles (GEH) Located on land side of Unit 4. (visual) SFP water level full, maintained at 55C (3/18 at 11:19 local) (NISA) | 7 |
| | **Electrical Power** Restoration from Switchyard to Unit 2 480 v Pumps (first) in progress | |

## Fukushima Daiichi Summary

| Priority | Unit | STATUS AS OF 1200 EDT, 03/17/2011 - (0100 JDT) |
|---|---|---|
| 1 | 3 | **Core Status** Damaged, fuel 1/2 covered (JAIF). Radiation released. Sea water injection sufficient to cool core. (WANO) |
| | | **Containment** Primary Containment, some damage. Secondary Containment lost (visual). |
| | | **Spent Fuel Pool** 514 Bundles in SFP (GEH) Low Level (JAIF), Dumping water with helicopter suspended (Casto 0420 EDT) |
| 2 | 4 | **Spent Fuel Pool** 1201 Bundles in SFP (GEH) Low level (JAIF), Damage to fuel rods suspected (JAIF) dumping water from helicopter suspended (Casto 0420 EDT) |
| 3 | 2 | **Core Status** damaged, fuel 2/3 covered (JAIF). Sea water inject enough to cool core (WANO) |
| | | **Containment** Primary Containment, some damage. Secondary Containment , Hole cut to reduce H2 buildup, steam coming from hole (visual). |
| | | **Spent Fuel Pool** 587 Bundles in SFP (GEH) No information on SFP status (JAIF). |
| 4 | 1 | **Core Status** damaged, 1/2 fuel covered (JAIF). Sea water inject enough to cool core (WANO) |
| | | **Containment** Primary Containment functional (JAIF) Secondary Containment lost (visual) |
| | | **Spent Fuel Pool** 292 Bundles in SFP (GEH) SFP Level unknown (JAIF). |
| 5 | 5 | **Shutdown since 1/3/11.** Core in RPV. SFP 950 Bundles (GEH), level down 40 cm in 5 hrs (0800, 3/15/2011, IAEA) TEPCO plans to use operable DG @ Unit 6 to provide water to Unit 5 |
| 6 | 6 | **Shutdown since 8/14/10.** Core in RPV. SFP 876 Bundles (GEH), level lower than normal. SFP reported to be heating up. (NHK) Unit EDG available. |
| 7 | N/A | **Common Spent Fuel Pool:** 6,000 spent fuel bundles (GEH) Located on land side of Unit 4 (visual) |

**From:** Bowman, Eric NRR
**To:** Taylor, Robert; Rosenberg, Stacey
**Cc:** McGinty, Tim; Burnell, Scott; Akstulewicz, Brenda
**Subject:** RE: Press Release for Information Notice
**Date:** Friday, March 18, 2011 4:58:56 PM

---

It's just been declared and is going on the internet site now.

Thanks!

Eric

---

**From:** Taylor, Robert NRR
**Sent:** Friday, March 18, 2011 4:44 PM
**To:** Rosenberg, Stacey; Bowman, Eric
**Subject:** RE: Press Release for Information Notice

Any word on the IN status?

---

**From:** Rosenberg, Stacey NRR
**Sent:** Friday, March 18, 2011 3:30 PM
**To:** Taylor, Robert
**Subject:** RE: Press Release for Information Notice

Thanks so much Rob!!

---

**From:** Taylor, Robert
**Sent:** Friday, March 18, 2011 3:27 PM
**To:** Bowman, Eric
**Cc:** Rosenberg, Stacey; McGinty, Tim; Burnell, Scott; Akstulewicz, Brenda
**Subject:** FW: Press Release for Information Notice
**Importance:** High

Eric,

You are a go for issuing the IN. Please reply to all when the IN is out to let us know we can go with the press release. Thanks for your patience.

Regards,
Rob

---

**From:** Burnell, Scott OPA
**Sent:** Friday, March 18, 2011 3:24 PM
**To:** Taylor, Robert; Brenner, Eliot; Akstulewicz, Brenda
**Subject:** FW: Press Release for Information Notice
**Importance:** High

Rob;

We're good with ET approval, so tell NRR to push its buttons.

Brenda, please make this final and we'll wait for Rob to tell us NRR has sent the IN out.

W/289

Thanks.

Scott

---

**From:** Taylor, Robert
**Sent:** Friday, March 18, 2011 2:04 PM
**To:** Brenner, Eliot
**Cc:** Burnell, Scott
**Subject:** Press Release for Information Notice

Eliot,

Attached in the press release Scott drafted last night. It has been blessed by Ops Center ET and is ready for the next step (your review?). NRR is still driving to issue the IN today.

Regards,
Rob

**From:** Rosenberg, Stacey
**To:** Taylor, Robert
**Cc:** Bowman, Eric
**Subject:** RE: Press Release for Information Notice
**Date:** Friday, March 18, 2011 4:49:15 PM

We are waiting on ADAMS to get it into a PDF file so we can send it to webservices. I'm hoping it will just be a few minutes or so.

---

**From:** Taylor, Robert
**Sent:** Friday, March 18, 2011 4:44 PM
**To:** Rosenberg, Stacey; Bowman, Eric
**Subject:** RE: Press Release for Information Notice

Any word on the IN status?

---

**From:** Rosenberg, Stacey
**Sent:** Friday, March 18, 2011 3:30 PM
**To:** Taylor, Robert
**Subject:** RE: Press Release for Information Notice

Thanks so much Rob!!

---

**From:** Taylor, Robert
**Sent:** Friday, March 18, 2011 3:27 PM
**To:** Bowman, Eric
**Cc:** Rosenberg, Stacey; McGinty, Tim; Burnell, Scott; Akstulewicz, Brenda
**Subject:** FW: Press Release for Information Notice
**Importance:** High

Eric,

You are a go for issuing the IN. Please reply to all when the IN is out to let us know we can go with the press release. Thanks for your patience.

Regards,
Rob

---

**From:** Burnell, Scott
**Sent:** Friday, March 18, 2011 3:24 PM
**To:** Taylor, Robert; Brenner, Eliot; Akstulewicz, Brenda
**Subject:** FW: Press Release for Information Notice
**Importance:** High

Rob;

We're good with ET approval, so tell NRR to push its buttons.

Brenda, please make this final and we'll wait for Rob to tell us NRR has sent the IN out. Thanks.

Scott

**From:** Taylor, Robert
**Sent:** Friday, March 18, 2011 2:04 PM
**To:** Brenner, Eliot
**Cc:** Burnell, Scott
**Subject:** Press Release for Information Notice

Eliot,

Attached in the press release Scott drafted last night. It has been blessed by Ops Center ET and is ready for the next step (your review?). NRR is still driving to issue the IN today.

Regards,
Rob

**From:** Rosenberg, Stacey INRR
**To:** Taylor, Robert
**Subject:** RE: Press Release for Information Notice
**Date:** Friday, March 18, 2011 5:15:40 PM

---

Rob,

The IN is now on our public website.

Thanks,
Stacey

---

**From:** Taylor, Robert INRR
**Sent:** Friday, March 18, 2011 4:44 PM
**To:** Rosenberg, Stacey; Bowman, Eric
**Subject:** RE: Press Release for Information Notice

Any word on the IN status?

---

**From:** Rosenberg, Stacey
**Sent:** Friday, March 18, 2011 3:30 PM
**To:** Taylor, Robert
**Subject:** RE: Press Release for Information Notice

Thanks so much Rob!!

---

**From:** Taylor, Robert
**Sent:** Friday, March 18, 2011 3:27 PM
**To:** Bowman, Eric
**Cc:** Rosenberg, Stacey; McGinty, Tim; Burnell, Scott; Akstulewicz, Brenda
**Subject:** FW: Press Release for Information Notice
**Importance:** High

Eric,

You are a go for issuing the IN. Please reply to all when the IN is out to let us know we can go with the press release. Thanks for your patience.

Regards,
Rob

---

**From:** Burnell, Scott IOPA
**Sent:** Friday, March 18, 2011 3:24 PM
**To:** Taylor, Robert; Brenner, Eliot; Akstulewicz, Brenda
**Subject:** FW: Press Release for Information Notice
**Importance:** High

Rob;

We're good with ET approval, so tell NRR to push its buttons.

Brenda, please make this final and we'll wait for Rob to tell us NRR has sent the IN out.

W1289

Thanks.

Scott

---

**From:** Taylor, Robert
**Sent:** Friday, March 18, 2011 2:04 PM
**To:** Brenner, Eliot
**Cc:** Burnell, Scott
**Subject:** Press Release for Information Notice

Eliot,

Attached in the press release Scott drafted last night. It has been blessed by Ops Center ET and is ready for the next step (your review?). NRR is still driving to issue the IN today.

Regards,
Rob

**From:** Bowman, Eric
**To:** Taylor, Robert
**Cc:** Rosenberg, Stacey; McGinty, Tim
**Subject:** RE: Final Version of IN
**Date:** Friday, March 18, 2011 2:54:50 PM

Thanks!

Eric

**From:** Taylor, Robert
**Sent:** Friday, March 18, 2011 2:52 PM
**To:** Bowman, Eric
**Cc:** Rosenberg, Stacey; McGinty, Tim
**Subject:** RE: Final Version of IN

Thank you. We have provided the press release to Eliot Brenner, OPA Director, to get blessing from him and the Chairman. We will keep you apprised.

**From:** Bowman, Eric
**Sent:** Friday, March 18, 2011 2:06 PM
**To:** Taylor, Robert
**Cc:** Rosenberg, Stacey; McGinty, Tim
**Subject:** Final Version of IN

Rob,

Attached is the final version of the IN, just left you a voice mail. (The file isn't updated for the date, final concurrences and signatures.) We are holding off on processing/releasing it until we hear from you regarding the press release. If it looks like it will go past 5:00, please let me know (if possible) since we will need to make arrangements with OIS to have someone available to process it.

Thanks!

Eric

*Eric E. Bowman*
Sr. Project Manager
Generic Communications & Power Uprate Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-2963
Eric.Bowman@nrc.gov

W/090

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, DC 20555-0001

NRC INFORMATION NOTICE 2011-05: TOHOKU-TAIHEIYOU-OKI EARTHQUAKE EFFECTS ON JAPANESE NUCLEAR POWER PLANTS

## ADDRESSEES

All holders of or applicants for operating licenses for nuclear power reactors under the provision of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

All holders of or applicants for a standard design certification, standard design approval, manufacturing license, limited work authorization, early site permits or combined license issued under 10 CFR Part 52, "Licenses, Certifications and Approvals for Nuclear Power Plants."

## PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of effects of the Tohoku-Taiheiyou-Oki Earthquake on nuclear power plants in Japan. The NRC expects that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. Suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

## DESCRIPTION OF CIRCUMSTANCES

The following summary of events is provided based on the best information available at this time. The situation in Japan regarding recovery efforts for the Fukushima Daiichi Nuclear Power Station continues to evolve on an hourly basis.

On March 11, 2011, the Tohoku-Taiheiyou-Oki Earthquake occurred near the east coast of Honshu, Japan. This magnitude 9.0 earthquake and the subsequent tsunami caused significant damage to at least four of the six units of the Fukushima Daiichi nuclear power station as the result of a sustained loss of both the offsite and on-site power systems. Efforts to restore power to emergency equipment have been hampered or impeded by damage to the surrounding areas due to the tsunami and earthquake.

**ML110760432**

Units 1 through 3, which had been operating at the time of the earthquake, scrammed automatically, inserting their neutron absorbing control rods to ensure immediate shutdown of the fission process. Following the loss of electric power to normal and emergency core cooling systems and the subsequent failure of back-up decay heat removal systems, water injection into the cores of all three reactors was compromised, and reactor water levels could not be maintained. Tokyo Electric Power Company (TEPCO), the operator of the plant, resorted to injecting sea water and boric acid into the reactor vessels of these three units, in an effort to cool the fuel and ensure the reactors remained shutdown. However, the fuel in the reactor cores became partially uncovered. Hydrogen gas built up in Units 1 and 3 as a result of exposed, overheated fuel reacting with water. Following gas venting from the primary containment to relieve pressure, hydrogen explosions occurred in both units and damaged the secondary containments. It appears that primary containments for Units 1 and 3 remain functional, but the primary containment for Unit 2 may be damaged. TEPCO cut a hole in the side of the Unit 2 secondary containment to prevent hydrogen buildup following a sustained period when there was no water injection into the core.

In addition, Units 3 and 4 have low spent fuel pool (SFP) water levels. Efforts continue to supply seawater to the SFPs for Units 1 through 4 using various methods. At this time, the integrity of the SFPs for Units 3 and 4 is unknown.

Fukushima Daiichi Units 4 through 6 were shutdown for refueling outages at the time of the earthquake. The fuel assemblies for Unit 4 had been offloaded from the reactor core to the SFP. The SFPs for Units 5 and 6 appear to be intact, but the temperature of the pool water appears to be increasing. Emergency power is available to provide cooling water flow through the SFPs for Units 5 and 6.

The Japanese Government ordered an evacuation out to 20 km for the area surrounding Fukushima Daiichi. Residents out to 30 km were ordered to shelter in place.

The damage to Fukushima Daiichi nuclear power station appears to have been caused by initiating events outside of the design basis for the facilities.

## BACKGROUND

10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 2, "Design Bases for Protection against Natural Phenomena," or similar appropriate requirements in the licensing basis for a reactor facility, requires that structures, systems, and components (SSCs) important to safety be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these SSCs reflect: (1) appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena, and (3) the importance of the safety functions to be performed.

As a result of the terrorist events of September 11, 2001, the NRC issued EA-02-026, "Order for Interim Safeguards and Security Compensatory Measures" (the ICM Order) dated February 25, 2002. The ICM Order, which is designated as Safeguards Information (SGI), modified then-operating licenses for commercial power reactor facilities to require compliance with specified interim safeguards and security compensatory measures. Section B.5.b of the ICM Order requires licensees to adopt mitigation strategies using readily available resources to maintain or restore core cooling, containment, and SFP cooling capabilities to cope with the loss of large areas of the facility due to large fires and explosions from any cause, including beyond-design-basis aircraft impacts.

By letter, dated February 25, 2005, the NRC staff provided guidance for implementing Section B.5.b of the ICM Order. This guidance, designated as SGI, included best practices for mitigating losses of large areas of the plant and measures to mitigate fuel damage and minimize releases. Following issuance of the B.5.b Phase 1 Guidance, the NRC staff conducted inspections at operating reactor sites using Temporary Instruction (TI) 2515/164 (SGI) and subsequently TI 2515/168 (SGI) to ensure compliance with Section B.5.b of the ICM Order.

In December 2006, the Nuclear Energy Institute (NEI) issued NEI 06-12, Revision 2, "B.5.b Phase 2 & 3 Submittal Guideline." NEI 06-12 is designated for Official Use Only – Security Related Information (OUO-SRI). The NRC endorsed NEI 06-12, Revision 2, by letter dated December 22, 2006, also designated OUO-SRI, as an acceptable means for developing and implementing the mitigation strategies requirement in Section B.5.b of the ICM Order. NEI 06-12, Revision 2, provides guidance for implementing a set of strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities under the circumstances associated with the loss of a large area of the plant due to explosions or fire. NEI 06-12 provides guidance in the following areas:

- Adding make-up water to the SFP,
- Spraying water on the spent fuel,
- Enhanced initial command and control activities for challenges to core cooling and containment, and
- Enhanced response strategies for challenges to core cooling and containment.

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The B.5.b Phase 1 Guidance and NEI 06-12, Revision 2, were used by each licensee in preparing information submitted to the NRC that describes a plant specific approach to implementing mitigating strategies and supports each plant specific license condition. The NRC staff has completed its review of the information submitted by each licensee, as well as information obtained during prior NRC inspections, and has issued an OUO-SRI safety

evaluation (SE) that documents the bases for its approval of the license condition for each facility. The SE issued for each licensee includes regulatory guidance in Section 3.0 of Appendix A, "Phase 1 Assessment," that recites the generic B.5.b Phase 1 Guidance of Reference 3, as clarified in TI 2515/168, in a form that is designated OUO-SRI rather than SGI.

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NRC regulations at 10 CFR 50.63, "Loss of All Alternating Current Power," require that light-water-cooled nuclear power plants be capable of withstanding for a specified duration and recovering from a station blackout.

## DISCUSSION

The nuclear power industry has taken the actions listed below at each licensed reactor site. Additional information is available in the NEI Fact Sheet, "Industry Taking Action to Ensure Continued Safety at U.S. Nuclear Energy Plants," dated March 16, 2011, available at www.nei.org.

1. verification of the capability to mitigate conditions that result from severe adverse events, including the loss of significant operational and safety systems due to natural events, fires, aircraft impact and explosions
2. verification of the capability to mitigate a total loss of electric power to a nuclear power plant
3. verification of the capability to mitigate flooding and the impact of floods on systems inside and outside the plant
4. identification of the potential for loss of equipment functions during seismic events appropriate for the site and the development of mitigating strategies to address potential vulnerabilities

NRC assessment of the implications of beyond design-basis natural phenomena is continuing as more information becomes available. The NRC staff is currently developing a TI to guide staff in performing independent assessments of nuclear power plant readiness to address beyond design-basis natural phenomena under the Reactor Oversight Process. The NRC is considering additional generic communications and additional action including requesting operating plants to provide specific information relating to their facilities to enable the NRC staff to complete a regulatory assessment of beyond design basis phenomena.

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Laura A. Dudes, Director
Division of Construction Inspection,
and Operational Programs
Office of New Reactors

Timothy J. McGinty, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Technical Contact: Eric E. Bowman, NRR
301-415-2963
e-mail: Eric.Bowman@nrc.gov

Note: NRC generic communications may be found on the NRC public Web site, http://www.nrc.gov, under Electronic Reading Room/Document Collections.

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ADAMS Accession Number: ML110760432 * by e-mail

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| DATE | 03/17/2011 | 03/17/2011 | 03/17/2011 | 03/17/2011 | 03/17/2011 |
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| DATE | 03/18/2011 | 03/17/2011 | 03/17/2011 | | |

**OFFICIAL RECORD COPY**

**From:** Bowman, Eric
**To:** Taylor, Robert
**Cc:** McGinty, Tim; Quay, Theodore; Rosenberg, Stacey
**Subject:** RE: IN
**Date:** Friday, March 18, 2011 1:22:40 PM

Rob,

IRT your question on the exclusion of decommissioned reactors w/SFPs, it was based on the length of decay time since the fuel was moved to the SFPs when they decommissioned and their parallel exclusion from coverage under mitigating strategies requirements of the ICM Order, subsequent license conditions and 10 CFR 50.54(hh)(2), the latter group being a primary focus of the IN.

Thanks!

Eric

**From:** Bowman, Eric
**Sent:** Friday, March 18, 2011 12:14 PM
**To:** Taylor, Robert
**Subject:** IN

As requested.

Thanks!

*Eric E. Bowman*
Sr. Project Manager
Generic Communications & Power Uprate Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-2963
Eric.Bowman@nrc.gov

**From:** Bowman, Eric
**To:** Taylor, Robert
**Subject:** IN
**Date:** Friday, March 18, 2011 12:16:17 PM
**Attachments:** IN 11-xx B5b Earthquake.docx

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As requested.

Thanks!

*Eric E. Bowman*
Sr. Project Manager
Generic Communications & Power Uprate Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-2963
Eric.Bowman@nrc.gov

w/292

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, DC 20555-0001

NRC INFORMATION NOTICE 2011-05: TOHOKU-TAIHEIYOU-OKI EARTHQUAKE EFFECTS ON JAPANESE NUCLEAR POWER PLANTS

## ADDRESSEES

All holders of or applicants for operating licenses for nuclear power reactors under the provision of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

All holders of or applicants for a standard design certification, standard design approval, manufacturing license, limited work authorization, early site permits or combined license issued under 10 CFR Part 52, "Licenses, Certifications and Approvals for Nuclear Power Plants."

## PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of effects of the Tohoku-Taiheiyou-Oki Earthquake on nuclear power plants in Japan. The NRC expects that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. Suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

## DESCRIPTION OF CIRCUMSTANCES

The following summary of events is provided based on the best information available at this time. The situation in Japan regarding recovery efforts for the Fukushima Daiichi Nuclear Power Station continues to evolve on an hourly basis.

On March 11, 2011, the Tohoku-Taiheiyou-Oki Earthquake occurred near the east coast of Honshu, Japan. This magnitude 9.0 earthquake and the subsequent tsunami caused significant damage to at least four of the six units of the Fukushima Daiichi nuclear power station as the result of a sustained loss of both the offsite and on-site power systems. Efforts to restore power to emergency equipment have been hampered or impeded by damage to the surrounding areas due to the tsunami and earthquake.

**ML110760432**

Units 1 through 3, which had been operating at the time of the earthquake, scrammed automatically, inserting their neutron absorbing control rods to ensure immediate shutdown of the fission process. Following the loss of electric power to normal and emergency core cooling systems and the subsequent failure of back-up decay heat removal systems, water injection into the cores of all three reactors was compromised, and reactor water levels could not be maintained. Tokyo Electric Power Company (TEPCO), the operator of the plant, resorted to injecting sea water and boric acid into the reactor vessels of these three units, in an effort to cool the fuel and ensure the reactors remained shutdown. However, the fuel in the reactor cores became partially uncovered. Hydrogen gas built up in Units 1 and 3 as a result of exposed, overheated fuel reacting with water. Following gas venting from the primary containment to relieve pressure, hydrogen explosions occurred in both units and damaged the secondary containments. It appears that primary containments for Units 1 and 3 remain functional, but the primary containment for Unit 2 may be damaged. TEPCO cut a hole in the side of the Unit 2 secondary containment to prevent hydrogen buildup following a sustained period when there was no water injection into the core.

In addition, Units 3 and 4 have low spent fuel pool (SFP) water levels. Efforts continue to supply seawater to the SFPs for units 1 through 4 using various methods. At this time, the integrity of the SFPs for units 3 and 4 is unknown.

Fukushima Daiichi Units 4 through 6 were shutdown for refueling outages at the time of the earthquake. The fuel assemblies for Unit 4 had been offloaded from the reactor core to the SFP. The SFPs for Units 5 and 6 appear to be intact, but the temperature of the pool water appears to be increasing. Emergency power is available to provide cooling water flow through the SFPs for Units 5 and 6.

The Japanese Government ordered an evacuation out to 20 km for the area surrounding Fukushima Daiichi. Residents out to 30 km were ordered to shelter in place.

The damage to Fukushima Daiichi nuclear power station appears to have been caused by initiating events outside of the design basis for the facilities.

## BACKGROUND

10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 2, "Design Bases for Protection against Natural Phenomena," or similar appropriate requirements in the licensing basis for a reactor facility, requires that structures, systems, and components (SSCs) important to safety be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these SSCs reflect: (1) appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena, and (3) the importance of the safety functions to be performed.

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## DISCUSSION

The nuclear power industry has taken the actions listed below at each licensed reactor site. Additional information is available in the NEI Fact Sheet, "Industry Taking Action to Ensure Continued Safety at U.S. Nuclear Energy Plants," dated March 16, 2011, available at www.nei.org.

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Office of New Reactors

Timothy J. McGinty, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Technical Contact: Eric E. Bowman, NRR
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e-mail: Eric.Bowman@nrc.gov

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ADAMS Accession Number: ML110760432 * by e-mail

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| DATE | 03/17/2011 | 03/17/2011 | 03/17/2011 | 03/17/2011 | 03/17/2011 |
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| DATE | 03/18/2011 | 03/17/2011 | 03/17/2011 | | |

**OFFICIAL RECORD COPY**

**From:** Taylor, Robert MRR
**To:** Pace, Patti
**Subject:** Current OPA talking points
**Date:** Friday, March 18, 2011 3:36:00 PM
**Attachments:** QUAKE TP 3 18.docx

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Patti,

My understanding is that the Chairman requested the attached talking points. These have been approved by the Ops Center ET.

Regards,
Rob

w/293

Quake_TP_3_18.docx

# OPA

# TALKING POINTS

## JAPAN NUCLEAR SITUATION

**As of 3/18/2011 3:15p.m. EDT**

**Update: Addition of bullets on Information Notice And Detectable Levels of Radiation at Diablo Canyon**

- Based on calculations performed by NRC experts, we now believe that it is appropriate for U.S. residents within 50 miles of the Fukushima reactors to evacuate. Our recommendation is based on NRC guidelines for public safety that would be used in the United States under similar circumstances.

- The 10-mile EPZ reflects the area where projected doses from design basis accidents at nuclear power plants would not exceed the EPA's protective action guidelines, and we are confident that it would be adequate even for severe accidents. However, the 10-mile zone was always considered a base for emergency response that could be expanded if the situation warranted. The situation in Japan, with four reactors experiencing exceptional difficulties simultaneously, creates the need to expand the EPZ beyond the normal 10-mile radius.

  We have said from the beginning of this crisis that the NRC would analyze this situation for any lessons that can be derived to improve our oversight of U.S. nuclear power plants. Emergency planning will be part of that review.

- Given the results of the monitoring and distance between Japan and Hawaii, Alaska, U.S. Pacific Territories and the U.S. West Coast, the NRC expects the U.S. to avoid any harmful levels of radioactivity. The NRC is aware of various internet postings depicting modeled radiation plumes for the ongoing events at the nuclear power plants in Japan. All of the models the NRC has seen are based on generic assumptions regarding the potential radiation release from the plants and as such are unable to predict actual radiation levels away from the site. The NRC is working closely with our federal partners to monitor radiation releases from the Japanese nuclear power plants.

- [Only if specifically asked] The NRC is aware that Diablo Canyon nuclear power plant in California detected a very low level of radiation. The site believes that the source of the radiation is likely the Fukushimi Daiichi nuclear power plant in Japan. The amounts detected are barely detectable on the instruments and pose no danger to public health and safety. The NRC continues to believe, based on all available information, that no harmful levels of radiation will reach U.S. territory. This information has been shared with the U.S. Department of Energy and the U.S. Environmental Protection Agency. Additional questions regarding monitoring of the radioactive release should be referred to DOE at 202 586 4940.

- [Planned to be issued by COB; confirm before use] The NRC today issued an Information Notice to all of its operating nuclear power plants describing the effects of the March 11 earthquake and tsunami on Japanese nuclear power plants. The purpose of the Information Notice is to inform the plants of the most recent information available to the NRC. The NRC expects U.S. nuclear power plants will review the entire notice to determine how it applies to their facilities and consider actions, as appropriate.

- The NRC continues to work with other U.S. agencies to monitor radioactive releases from Japan and to predict their path.

- The Department of Energy has been designated the lead agency for communicating information to the States regarding monitoring of radiation heading toward or over the United States. The DOE's Lawrence Livermore National Laboratory (National Atmospheric Release Assessment Center) is monitoring weather patterns over the Pacific Ocean. The Environmental Protection Agency maintains air monitoring stations throughout the country and has reinforced its monitoring effort. DOE will provide aerial monitoring. Questions about this effort should be directed to DOE at 202 586 4940.

- The NRC is closely monitoring information about the spent fuel pools as well as radiation levels at the Japanese nuclear power plants. Given the totality of the situation, the NRC's recommendation for U.S. residents within 50 miles of the Fukushima reactors to evacuate remains unchanged. That recommendation was based on actual radiation levels in the nuclear complex.

- In accordance with established protocols, U.S. Customs and Border Protection (CBP) employs several types of radiation detection equipment in its operations at both air and sea ports, and uses this equipment, along with specific operational protocols, to resolve any security or safety risks that are identified with inbound travelers and cargo. Out of an abundance of caution, CBP has issued field guidance reiterating its operational protocols and directing field personnel to specifically monitor maritime and air traffic from Japan. CBP will continue to evaluate the potential risks posed by radiation contamination on inbound travelers and cargo and will adjust its detection and response protocols, in coordination with its interagency partners, as developments warrant.

- The Japanese government has formally asked for U.S. assistance in responding to nuclear power plant cooling issues triggered by an earthquake and tsunami on March 11. The NRC has eleven staff on the ground in Japan as part of the USAID team.

- The NRC is coordinating its actions with other federal agencies as part of the U.S. government response. The NRC's headquarters Operations Center was activated at the beginning of the event and has been monitoring the situation on a 24-hour basis ever since.

- The NRC is always looking to learn information that can be applied to U.S. reactors and we will analyze the information that comes from this incident. President Obama has directed the agency to conduct a comprehensive review of the safety of U.S. nuclear plants; the agency will do so.

- U.S. nuclear power plants are built to withstand environmental hazards, including earthquakes. Even those plants that are located outside of areas with extensive seismic activity are designed for safety in the event of such a natural disaster.

- The NRC requires that safety-significant structures, systems, and components be designed to take into account the most severe natural phenomena historically reported for the site and surrounding area. The NRC then adds a margin for error to account for the limitations on historical data. In other words, U.S. nuclear power plants are designed to be safe based on historical data to predict the area's maximum credible earthquake.

- In response to MSNBC report ranking US NPPs according to vulnerability to earthquakes: The NRC does not rank nuclear power plants according to their vulnerability to earthquakes. This "ranking" was developed by an MSNBC reporter using partial information and an even more partial understanding of how we evaluate plants for seismic risk. Each plant is evaluated individually according to the geology of its site, not by a "one-size-fits-all" model - therefore such rankings or comparisons are highly misleading.

| | |
|---|---|
| **From:** | Taylor, Robert |
| **To:** | Borchardt, Bill |
| **Subject:** | Updated Talking Points |
| **Date:** | Friday, March 18, 2011 3:25:00 PM |
| **Attachments:** | QUAKE TP 3 18.docx |

Bill,

I was asked to email these to you for your use. They are approved by the Ops Center ET.

Regards,
Rob

Quake_TP_3_18.docx

# OPA

# TALKING POINTS

## JAPAN NUCLEAR SITUATION

**As of 3/18/2011 3:15p.m. EDT**

**Update: Addition of bullets on Information Notice And Detectable Levels of Radiation at Diablo Canyon**

- Based on calculations performed by NRC experts, we now believe that it is appropriate for U.S. residents within 50 miles of the Fukushima reactors to evacuate. Our recommendation is based on NRC guidelines for public safety that would be used in the United States under similar circumstances.

- The 10-mile EPZ reflects the area where projected doses from design basis accidents at nuclear power plants would not exceed the EPA's protective action guidelines, and we are confident that it would be adequate even for severe accidents. However, the 10-mile zone was always considered a base for emergency response that could be expanded if the situation warranted. The situation in Japan, with four reactors experiencing exceptional difficulties simultaneously, creates the need to expand the EPZ beyond the normal 10-mile radius.

  We have said from the beginning of this crisis that the NRC would analyze this situation for any lessons that can be derived to improve our oversight of U.S. nuclear power plants. Emergency planning will be part of that review.

- Given the results of the monitoring and distance between Japan and Hawaii, Alaska, U.S. Pacific Territories and the U.S. West Coast, the NRC expects the U.S. to avoid any harmful levels of radioactivity. The NRC is aware of various internet postings depicting modeled radiation plumes for the ongoing events at the nuclear power plants in Japan. All of the models the NRC has seen are based on generic assumptions regarding the potential radiation release from the plants and as such are unable to predict actual radiation levels away from the site. The NRC is working closely with our federal partners to monitor radiation releases from the Japanese nuclear power plants.

- [Only if specifically asked] The NRC is aware that Diablo Canyon nuclear power plant in California detected a very low level of radiation. The site believes that the source of the radiation is likely the Fukushimi Daiichi nuclear power plant in Japan. The amounts detected are barely detectable on the instruments and pose no danger to public health and safety. The NRC continues to believe, based on all available information, that no harmful levels of radiation will reach U.S. territory. This information has been shared with the U.S. Department of Energy and the U.S. Environmental Protection Agency. Additional questions regarding monitoring of the radioactive release should be referred to DOE at 202 586 4940.

- [Planned to be issued by COB; confirm before use] The NRC today issued an Information Notice to all of its operating nuclear power plants describing the effects of the March 11 earthquake and tsunami on Japanese nuclear power plants. The purpose of the Information Notice is to inform the plants of the most recent information available to the NRC. The NRC expects U.S. nuclear power plants will review the entire notice to determine how it applies to their facilities and consider actions, as appropriate.

- The NRC continues to work with other U.S. agencies to monitor radioactive releases from Japan and to predict their path.

- The Department of Energy has been designated the lead agency for communicating information to the States regarding monitoring of radiation heading toward or over the United States. The DOE's Lawrence Livermore National Laboratory (National Atmospheric Release Assessment Center) is monitoring weather patterns over the Pacific Ocean. The Environmental Protection Agency maintains air monitoring stations throughout the country and has reinforced its monitoring effort. DOE will provide aerial monitoring. Questions about this effort should be directed to DOE at 202 586 4940.

- The NRC is closely monitoring information about the spent fuel pools as well as radiation levels at the Japanese nuclear power plants. Given the totality of the situation, the NRC's recommendation for U.S. residents within 50 miles of the Fukushima reactors to evacuate remains unchanged. That recommendation was based on actual radiation levels in the nuclear complex.

- In accordance with established protocols, U.S. Customs and Border Protection (CBP) employs several types of radiation detection equipment in its operations at both air and sea ports, and uses this equipment, along with specific operational protocols, to resolve any security or safety risks that are identified with inbound travelers and cargo. Out of an abundance of caution, CBP has issued field guidance reiterating its operational protocols and directing field personnel to specifically monitor maritime and air traffic from Japan. CBP will continue to evaluate the potential risks posed by radiation contamination on inbound travelers and cargo and will adjust its detection and response protocols, in coordination with its interagency partners, as developments warrant.

- The Japanese government has formally asked for U.S. assistance in responding to nuclear power plant cooling issues triggered by an earthquake and tsunami on March 11. The NRC has eleven staff on the ground in Japan as part of the USAID team.

- The NRC is coordinating its actions with other federal agencies as part of the U.S. government response. The NRC's headquarters Operations Center was activated at the beginning of the event and has been monitoring the situation on a 24-hour basis ever since.

- The NRC is always looking to learn information that can be applied to U.S. reactors and we will analyze the information that comes from this incident. President Obama has directed the agency to conduct a comprehensive review of the safety of U.S. nuclear plants; the agency will do so.

- U.S. nuclear power plants are built to withstand environmental hazards, including earthquakes. Even those plants that are located outside of areas with extensive seismic activity are designed for safety in the event of such a natural disaster.

- The NRC requires that safety-significant structures, systems, and components be designed to take into account the most severe natural phenomena historically reported for the site and surrounding area. The NRC then adds a margin for error to account for the limitations on historical data. In other words, U.S. nuclear power plants are designed to be safe based on historical data to predict the area's maximum credible earthquake.

- In response to MSNBC report ranking US NPPs according to vulnerability to earthquakes: The NRC does not rank nuclear power plants according to their vulnerability to earthquakes. This "ranking" was developed by an MSNBC reporter using partial information and an even more partial understanding of how we evaluate plants for seismic risk. Each plant is evaluated individually according to the geology of its site, not by a "one-size-fits-all" model - therefore such rankings or comparisons are highly misleading.

**From:** Bob Simmons (ASME)
**To:** Taylor, Robert
**Subject:** Official ASME Statement on Events in Japan
**Date:** Friday, March 18, 2011 7:29:41 PM

---

Dear ASME Members,

I'd like to share the official ASME statement on Japan that we will be releasing later today.

> **On behalf of our members, volunteers and staff worldwide, ASME expresses its heartfelt sympathies and concerns to all those affected by the historic earthquake and tsunami causing major widespread damage in Japan, and the unfolding events at the Fukushima Daiichi nuclear power station. This disaster is truly unprecedented in its scope and nature, particularly to Japan's transportation and energy infrastructure, including nuclear power, thermal power, hydro power, electric transmission, oil refining and beyond. ASME will be monitoring events as they continue to emerge and will be collaborating with our colleagues in Japan and elsewhere to understand the dimensions of these tragic events. We are deeply saddened by the loss of life and the scale of destruction, and we want to acknowledge the valiant and selfless efforts being made by our engineering colleagues in Japan to ensure public safety, along with the many other workers and officials who are heroically responding to this tragedy. Our thoughts and prayers are with the Japanese people at this difficult time.**

Your collective efforts on behalf of ASME during this time are greatly appreciated.

Bob Simmons,

ASME President



W/295

| | |
|---|---|
| **From:** | Thomas, Brian |
| **To:** | Cusumano, Victor; Hardies, Robert; Karwoski, Kenneth; Lupold, Timothy; McMurtray, Anthony; Mitchell, Matthew; Taylor, Robert |
| **Cc:** | Lubinski, John; Chuang, Tze-Jer; Jain, Bhagwat; Ma, John; Vera, Marieliz; Park, Sunwoo; Patel, Pravin; Tegeler, Bret; Thomas, Vaughn; Valentin, Milton |
| **Subject:** | Emailing: faqs-related-to-japan.pdf |
| **Date:** | Monday, March 21, 2011 8:39:19 AM |
| **Attachments:** | faqs-related-to-japan.pdf |

FYI, if you don't already have this.

U.S.NRC

United States Nuclear Regulatory Commission

*Protecting People and the Environment*

# NRC frequently asked questions related to the March 11, 2011 Japanese Earthquake and Tsunami

## List of Questions

**1) Can an earthquake and tsunami as large as happened in Japan also happen here?**

This earthquake occurred on a "subduction zone", which is the type of tectonic region that produces earthquakes of the largest magnitude. A subduction zone is a tectonic plate boundary where one tectonic plate is pushed under another plate. Subduction zone earthquakes are also required to produce the kind of massive tsunami seen in Japan. In the continental US, the only subduction zone is the Cascadia subduction zone which lies off the coast of northern California, Oregon and Washington. So, a continental earthquake and tsunami as large as in Japan could only happen there. The only nuclear plant near the Cascadia subduction zone is the Columbia Generating Station. This plant is located a large distance from the coast (approximately 225 miles) and the subduction zone (approximately 300 miles), so the ground motions estimated at the plant are far lower than those seen at the Fukushima plants. This distance also precludes the possibility of a tsunami affecting the plant. Outside of the Cascadia subduction zone, earthquakes are not expected to exceed a magnitude of approximatly 8. Magnitude is measured on a log scale and so a magnitude 9 earthquake is ten times larger than a magnitude 8 earthquake.

**2) Did the Japanese underestimate the size of the maximum credible earthquake and tsunami that could affect the plants?**

The magnitude of the earthquake was somewhat greater than was expected for that part of the subduction zone. However, the Japanese nuclear plants were recently reassessed using ground motion levels similar to those that are believed to have occurred at the sites. The ground motions against which the Japanese nuclear plants were reviewed were expected to result from earthquakes that were smaller, but were much closer to the sites. The NRC does not currently have information on the maximum tsunami height that was expected at the sites.

**3) How high was the tsunami at the Fukushima nuclear plants?**

The tsunami modeling team at the National Oceanic and Atmospheric Administration's Pacific Marine Environmental Lab have estimated the wave height just offshore to be approximately 8 meters in height at Fukushima Daiichi and approximately 7 meters in Fukushima Daini. This is based on recordings from NOAA's Deep-ocean Assessment and Reporting of Tsunamis (DART) buoys and a high resolution numerical model developed for the tsunami warning system. If plant recordings exist they were not yet provided to the NRC.

**4) Was the damage to the Japanese nuclear plants mostly from the earthquake or the tsunami?**

Because this event happened in Japan, it is hard for NRC staff to make the assessment necessary to understand exactly what happened at this time. In the nuclear plants there may have been some damage from the shaking, and the earthquake caused the loss of offsite power. However, the tsunami appears to have played a key role in the loss of other power sources at the site producing station blackout, which is a critical factor in the ongoing problems.

**5) Have any lessons for US nuclear plants been identified?**

The NRC is in the process of following and reviewing the event in real time. This will undoubtedly lead to the identification of issues that warrant further study. However, a complete

understanding of lessons learned will require more information than is currently available to NRC staff.

**6) Was there any damage to US reactors from either the earthquake or the resulting tsunami?**

No.

**7) How many US reactors are located in active earthquake zones?**

Although we often think of the US as having "active" and "non-active" earthquake zones, earthquakes can actually happen almost anywhere. Seismologists typically separate the US into low, moderate, and high seismicity zones. The NRC requires that every nuclear plant be designed for site-specific ground motions that are appropriate for their locations. In addition, the NRC has specified a minimum ground motion level to which nuclear plants must be designed.

**8) What level of earthquake hazard are the US reactors designed for?**

Each reactor is designed for a different ground motion that is determined on a site-specific basis. The existing nuclear plants were designed on a "deterministic" or "scenario earthquake" basis that accounted for the largest earthquakes expected in the area around the plant, without consideration of the likelihood of the earthquakes considered. New reactors are designed using probabilistic techniques that characterize both the ground motion levels and uncertainty at the proposed site. These probabilistic techniques account for the ground motions that may result from all potential seismic sources in the region around the site. Technically speaking, this is the ground motion with an annual frequency of occurrence of $1x10^{-4}$/year, but this can be thought of as the ground motion that occurs every 10,000 years on average. One important aspect is that probabilistic hazard and risk-assessment techniques account for beyond-design basis events. NRC's Generic Issue 199 (GI-199) project is using the latest probabilistic techniques used for new nuclear plants to review the safety of the existing plants. [see questions 16 to 21 for more information about GI-199]

**9) What magnitude earthquake are currently operating US nuclear plants designed to?**

Ground motion is a function of both the magnitude of an earthquake and the distance from the fault to the site. Nuclear plants, and in fact all engineered structures, are actually designed based on ground motion levels, not earthquake magnitudes. The existing nuclear plants were designed based on a "deterministic" or "scenario earthquake" basis that accounted for the largest earthquakes expected in the area around the plant. A margin is further added to the predicted ground motions to provide added robustness.

**10) Have events in Japan changed our perception of earthquake risk to the nuclear plants in the US?**

The NRC continues to determine that US nuclear plants are safe. This does not change the NRC's perception of earthquake hazard (i.e., ground motion levels) at US nuclear plants. It is too early to tell what the lessons from this earthquake are. The NRC will look closely at all aspects of response of the plants to the earthquake and tsunami to determine if any actions need to be taken in US nuclear plants and if any changes are necessary to NRC regulations.

**11) Can significant damage to a nuclear plant like we see in Japan happen in the US due to an earthquake? Are the Japanese nuclear plants similar to US nuclear plants?**

All US nuclear plants are built to withstand environmental hazards, including earthquakes and tsunamis. Even those nuclear plants that are located within areas with low and moderate seismic activity are designed for safety in the event of such a natural disaster. The NRC requires that safety-significant structures, systems, and components be designed to take into account even rare and extreme seismic and tsunami events. In addition to the design of the plants, significant effort goes into emergency response planning and accident management. This approach is called defense-in-depth.

The Japanese facilities are similar in design to some US facilities. However, the NRC has required modifications to the plants since they were built, including design changes to control hydrogen and pressure in the containment. The NRC has also required plants to have additional equipment and measures to mitigate damage stemming from large fires and explosions from a beyond-design-basis event. The measures include providing core and spent fuel pool cooling and an additional means to power other equipment on site.

**12) What is the likelihood of the design basis or "SSE" ground motions being exceeded over the life of a nuclear plant?**

The ground motions that are used as seismic design bases at US nuclear plants are called the Safe Shutdown Earthquake ground motion (SSE). In the mid to late 1990s, the NRC staff reviewed the potential for ground motions beyond the design basis as part of the Individual Plant Examination of External Events (IPEEE). From this review, the staff determined that seismic designs of operating nuclear plants in the US have adequate safety margins for withstanding earthquakes. Currently, the NRC is in the process of conducting GI-199 to again assess the resistance of US nuclear plants to earthquakes. Based on NRC's analyses to date, the probability of ground motions exceeding the SSE for the plants in the Central and Eastern United States is less than 2%, with values ranging from a low of 0.1% to a high of 6%.

It is important to remember that structures, systems and components are required to have "adequate margin," meaning that they must continue be able withstand shaking levels that are above the plant's design basis.

**13) Which reactors are along coastal areas that could be affected by a tsunami?**

Many nuclear plants are located in coastal areas that could potentially be affected by a tsunami. Two nuclear plants, Diablo Canyon and San Onofre, are on the Pacific Coast, which is known to have a tsunami hazard. Two nuclear plants on the Gulf Coast, South Texas and Crystal River, could also be affected by tsunami. There are many nuclear plants on the Atlantic Coast or on rivers that may be affected by a tidal bore resulting from a tsunami. These include St. Lucie, Turkey Point, Brunswick, Oyster Creek, Millstone, Pilgrim, Seabrook, Calvert Cliffs, Salem/Hope Creek, and Surry. Tsunami on the Gulf and Atlantic Coasts occur, but are very rare. Generally the flooding anticipated from hurricane storm surge exceeds the flooding expected from a tsunami for nuclear plants on the Atlantic and Gulf Coast. Regardless, all nuclear plants are designed to withstand a tsunami.

**14) What is magnitude anyway? What is the Richter Scale? What is intensity?**

An earthquake's magnitude is a measure of the strength of the earthquake as determined from seismographic observations. Magnitude is essentially an objective, quantitative measure of the size of an earthquake. The magnitude can be expressed in various ways based on seismographic records (e.g., Richter Local Magnitude, Surface Wave Magnitude, Body Wave Magnitude, and Moment Magnitude). Currently, the most commonly used magnitude measurement is the Moment Magnitude, Mw, which is based on the strength of the rock that ruptured, the area of the fault that ruptured, and the average amount of slip. Moment magnitude is, therefore, a direct measure of the energy released during an earthquake. Because of the logarithmic basis of the scale, each whole number increase in magnitude

represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology and was based on the behavior of a specific seismograph that was manufactured at that time. The instruments are no longer in use and the magnitude scale is, therefore, no longer used in the technical community. However, the Richter Scale is a term that is so commonly used by the public that scientists generally just answer questions about "Richter" magnitude by substituting moment magnitude without correcting the misunderstanding.

The intensity of an earthquake is a qualitative assessment of effects of the earthquake at a particular location. The intensity assigned is based on observed effects on humans, on human-built structures, and on the earth's surface at a particular location. The most commonly used scale in the US is the Modified Mercalli Intensity (MMI) scale, which has values ranging from I to XII in the order of severity. MMI of I indicates an earthquake that was not felt except by a very few, whereas MMI of XII indicates total damage of all works of construction, either partially or completely. While an earthquake has only one magnitude, intensity depends on the effects at each particular location.

**15) How do magnitude and ground motion relate to each other?**

The ground motion experienced at a particular location is a function of the magnitude of the earthquake, the distance from the fault to the location of interest, and other elements such as the geologic materials through which the waves pass.

**16) What is Generic Issue 199 about?**

GI-199 investigates the safety and risk implications of updated earthquake-related data and models. These data and models suggest that the probability for earthquake ground motion above the seismic design basis for some nuclear plants in the Central and Eastern United States, although is still low, is larger than previous estimates.

**17) Does GI-199 provide rankings of US nuclear plants in terms of safety?**

The NRC does not rank nuclear plants by seismic risk. The objective of the GI-199 Safety/Risk Assessment was to perform a conservative, screening-level assessment to evaluate if further investigations of seismic safety for operating reactors in the central and eastern US (CEUS) are warranted, consistent with NRC directives. The results of the GI-199 safety risk assessment

should not be interpreted as definitive estimates of plant-specific seismic risk because some analyses were very conservative making the calculated risk higher than in reality. The nature of the information used (both seismic hazard data and plant-level fragility information) make these estimates useful only as a screening tool.

**18) What are the current findings of GI-199?**

Currently operating nuclear plants in the US remain safe, with no need for immediate action. This determination is based on NRC staff reviews of updated seismic hazard information and the conclusions of the first stage of GI-199. Existing nuclear plants were designed with considerable margin to be able to withstand the ground motions from the "deterministic" or "scenario earthquake" that accounted for the largest earthquakes expected in the area around the plant. The results of the GI-199 assessment demonstrate that the probability of exceeding the design basis ground motion may have increased at some sites, but only by a relatively small amount. In addition, the probabilities of seismic core damage are lower than the guidelines for taking immediate action. Although there is not an immediate safety concern, the NRC is focused on assuring safety during even very rare and extreme events. Therefore, the NRC has determined that assessment of updated seismic hazards and plant performance should continue.

**19) What do you mean by "increased estimates of seismic hazards" at nuclear plant sites?**

*Seismic hazard* (earthquake hazard) represents the chance (or probability) that a specific level of ground motion could be observed or exceeded at a given location. Our estimates of seismic hazard at some Central and Eastern United States locations have changed based on results from recent research, indicating that earthquakes occurred more often in some locations than previously estimated. Our estimates of seismic hazard have also changed because the models used to predict the level of ground motion, as caused by a specific magnitude earthquake at a certain distance from a site, changed. The increased estimates of seismic hazard at some locations in the Central and Eastern United States were discussed in a memorandum to the Commission, dated July 26, 2006. (The memorandum is available in the NRC Agencywide Documents Access and Management System [ADAMS] under Accession No. ML052360044).

**20) Does the Seismic Core Damage represent a measurement of the risk of radiation release or only the risk of core damage (not accounting for additional containment)?**

Seismic core damage frequency is the probability of damage to the core resulting from a seismic initiating event. It does not imply either a meltdown or the loss of containment, which would be required for radiological release to occur. The likelihood of radiation release is far lower.

**21) Where can I get current information about Generic Issue 199?**

The public NRC Generic Issues Program (GIP) website (http://www.nrc.gov/about-nrc/regulatory/gen-issues.html) contains program information and documents, background and historical information, generic issue status information, and links to related programs. The latest Generic Issue Management Control System quarterly report, which has regularly updated GI-199 information, is publicly available at http://www.nrc.gov/reading-rm/doc-collections/generic-issues/quarterly/index.html. Additionally, the US Geological Survey provides data and results that are publicly available at http://earthquake.usgs.gov/hazards/products/conterminous/2008/.

**22) Could an accident sequence like the one at Japan's Fukushima Daiichi nuclear plants happen in the US?**

It is difficult to answer this question until we have a better understanding of the precise problems and conditions that faced the operators at Fukushima Daiichi. We do know, however, that Fukushima Daiichi Units 1-3 lost all offsite power and emergency diesel generators. This situation is called "station blackout." US nuclear power plants are designed to cope with a station blackout event that involves a loss of offsite power and onsite emergency power. The Nuclear Regulatory Commission's detailed regulations address this scenario. US nuclear plants are required to conduct a "coping" assessment and develop a strategy to demonstrate to the NRC that they could maintain the plant in a safe condition during a station blackout scenario. These assessments, proposed modifications to the plant, and operating procedures were reviewed and approved by the NRC. Several plants added additional AC power sources to comply with this regulation.

In addition, US nuclear plant designs and operating practices since the terrorist events of September 11, 2001, are designed to mitigate severe accident scenarios such as aircraft impact, which include the complete loss of offsite power and all on-site emergency power sources.

US nuclear plant designs include consideration of seismic events and tsunamis'. It is important not to extrapolate earthquake and tsunami data from one location of the world to another when evaluating these natural hazards. These catastrophic natural events are very region- and location-specific, based on tectonic and geological fault line locations.

**From:** Mendiola, Anthony
**To:** Taylor, Robert
**Cc:** Ward, Leonard
**Subject:** FW: TEPCO meeting at the US Embassy Monday.
**Date:** Monday, March 21, 2011 12:17:46 PM

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Fyi...

-----Original Message-----
From: Nakanishi, Tony
Sent: Monday, March 21, 2011 6:12 AM
To: Ruland, William; Mendiola, Anthony; Casto, Greg; Ulses, Anthony; Dennig, Robert
Subject: FW: TEPCO meeting at the US Embassy Monday.

The meeting should go for about 2 hrs, beginning at 10am JST (9pm your time...please confirm). I am forwarding this in case anyone on your team might be able to support.
Thanks,
Tony

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From: Nakanishi, Tony
Sent: Monday, March 21, 2011 5:47 AM
To: Peko, Damian; RST01 Hoc; Dorman, Dan; Casto, Chuck
Subject: RE: TEPCO meeting at the US Embassy Monday.

We called TEPCO to confirm the agenda for tomorrow. TEPCO will first discuss their analysis of salt accumulation and the experiments they performed on precipitation. TEPCO indicated that they would also like to pose a question on long-term cooling. Long-term cooling is a challenge for them and they would like our advice any methods they might employ. They are not expecting immediate feedback from us at the meeting but we should be prepared to fully understand their challenges and respond accordingly in short order. Any expertise in this regard (i.e., long term cooling) would be helpful to have on the call in addition to the seawater issue.

Thanks,
Tony

---

From: Peko, Damian [Damian.Peko@Nuclear.Energy.gov]
Sent: Monday, March 21, 2011 4:26 AM
To: '?? ?'
Cc: 'hoofc@state.gov'; Monninger, John; Nakanishi, Tony; satoh.takashi@tepco.co.jp
Subject: RE: TEPCO meeting at the US Embassy Monday.

Dear Kawano-san

The names have been input into our vi=sitor access system. Please noted hat you cannot bring a car into the Embassy compound unless it is cleared ahead of time. So if you want to drive in to the embassy, you need to send the licenes plate and the make of the car and the name of three driver. If you take a taxi, no information will be needed.

Best Regards

Damian Peko

-----Original Message-----
From: [mailto:kawano.akira@tepco.co.jp]
Sent: Monday, March 21, 2011 4:00 AM
To: Peko, Damian

W/297

Cc: 'hoofc@state.gov'; 'John.monninger@nrc.gov'; 'tony.nakanishi@nrc.gov'; satoh.takashi@tepco.co.jp
Subject: Re: TEPCO meeting at the US Embassy Monday.

Dear Mr.Damian Peko,

Thank you for all of your arrangement for tomorrow meeting.
I also appreciate for the Embassy of the U.S.A providing the convenience to use oversea telephone system.

Our participants for the meeting are as follows:

Toshihiro Bannai, NISA
Norihisa Yuuki, NISA
Syunichi Suzuki, TEPCO
junichi Hakii, TEPCO
Takashi Satoh, TEPCO
Akira Kawano, TEPCO

Warmest regards,

Akira Kawano
TEPCO

On Mon, 21 Mar 2011 03:25:36 -0400
"Peko, Damian" <Damian.Peko@Nuclear.Energy.gov> wrote:

> Dear Kawano-san
>
> I a sending you this email so you have the address to send the names of he NISA and TEPCO people who will be a the meeting we scheduled for 10:00 tomorrow. Please reply to this email with the names of the participants for this meeting.
>
> Best Regards
>
> Damian Peko

( )

:0240-32-2486( )
:kawano.akira@tepco.co.jp

Akira Kawano
Maintenance Director
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E-mail:kawano.akira@tepco.co.jp
URL:http://www.tepco.co.jp/fukushima1-np/index-j.html

**Nelson, Robert**

**From:** Nelson, Robert / NRR
**Sent:** Thursday, March 24, 2011 2:26 PM
**To:** Williams, Shawn
**Subject:** RE: Answers in our FAQs

Thanks

NELSON

---

**From:** Williams, Shawn / EDO
**Sent:** Thursday, March 24, 2011 2:21 PM
**To:** Nelson, Robert
**Subject:** RE: Answers in our FAQs

I walked over to Holly's cubicle.

We are using her suggestion, but restated the Question as:

"Can the disaster that initiated the Japanese nuclear crisis happen here in the United States?"

Now I think her proposal answers the question better:
The events that have occurred in Japan are the result of a combination of an extremely large earthquake followed by a massive tsunami. Based on the geology of the U.S., this combination of extreme events could only occur in one area of the U.S., and the single plant in that location is far inland and subject to significantly lower ground motion than that seen at the Fukushima plants. For these reasons, it is highly unlikely that a similar event could occur in the United States.

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**From:** Nelson, Robert
**Sent:** Thursday, March 24, 2011 2:14 PM
**To:** Williams, Shawn
**Subject:** FW: Answers in our FAQs

Lease respond to Holly & cc me.

NELSON

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**From:** Harrington, Holly / OPA
**Sent:** Thursday, March 24, 2011 2:12 PM
**To:** Nelson, Robert; Williams, Shawn
**Subject:** Answers in our FAQs

I'm stepping into this discussion because Scott is extremely tied up right now on other issues. If I understand the concern, the answer to the first Q pasted below could give the wrong impression and you prefer the wording in the second Q pasted below. From our standpoint, however, the answer to the second Q is much too complicated for the purposes of the FAQS that contain the first question. In other words, the first document is a very layman's high-level look at the disaster, while Annie's document is a much more detailed and specific one.



w/098

So I've used Annie's language in a layman's way to try and meet your concern. See my version in red below and let me know if that addresses your concern.

**Can the Japanese nuclear crisis happen here in the United States?**
The events that have occurred in Japan are the result of a combination of highly unlikely natural disasters. These include the fifth largest earthquake in recorded history and the resulting devastating tsunami. It is highly unlikely that a similar event could occur in the United States.

**1) Can an earthquake and tsunami as large as happened in Japan also happen here?**
This earthquake occurred on a "subduction zone", which is the type of tectonic region that produces earthquakes of the largest magnitude. A subduction zone is a tectonic plate boundary where one tectonic plate is pushed under another plate. Subduction zone earthquakes are also required to produce the kind of massive tsunami seen in Japan. In the continental US, the only subduction zone is the Cascadia subduction zone which lies off the coast of northern California, Oregon and Washington. So, a continental earthquake and tsunami as large as in Japan could only happen there. The only nuclear plant near the Cascadia subduction zone is the Columbia Generating Station. This plant is located a large distance from the coast (approximately 225 miles) and the subduction zone (approximately 300 miles), so the ground motions estimated at the plant are far lower than those seen at the Fukushima plants. This distance also precludes the possibility of a tsunami affecting the plant. Outside of the Cascadia subduction zone, earthquakes are not expected to exceed a magnitude of approximatly 8. Magnitude is measured on a log scale and so a magnitude 9 earthquake is approximately 32 times larger than a magnitude 8 earthquake.

**Can the Japanese nuclear crisis happen here in the United States?**
The events that have occurred in Japan are the result of a combination of an extremely large earthquake followed by a massive tsunami. Based on the geology of the U.S., this combination of extreme events could only occur in one area of the U.S., and the single plant in that location is far inland and subject to significantly lower ground motion that that see at the Fukushima plants. For these reasons, it is highly unlikely that a similar event could occur in the United States.

## Nelson, Robert

**From:** Nelson, Robert
**Sent:** Thursday, March 24, 2011 2:15 PM
**To:** Harrington, Holly
**Subject:** FW: Answers in our FAQs

Sorry, sent to wrong addressee

NELSON

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**From:** Nelson, Robert
**Sent:** Thursday, March 24, 2011 2:13 PM
**To:** Harrington, Holly
**Subject:** RE: Answers in our FAQs

Shawn – Please respond to Holly & cc me.

Thanks,

NELSON

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**From:** Harrington, Holly , OPA
**Sent:** Thursday, March 24, 2011 2:12 PM
**To:** Nelson, Robert; Williams, Shawn
**Subject:** Answers in our FAQs

I'm stepping into this discussion because Scott is extremely tied up right now on other issues. If I understand the concern, the answer to the first Q pasted below could give the wrong impression and you prefer the wording in the second Q pasted below. From our standpoint, however, the answer to the second Q is much too complicated for the purposes of the FAQS that contain the first question. In other words, the first document is a very layman's high-level look at the disaster, while Annie's document is a much more detailed and specific one.

So I've used Annie's language in a layman's way to try and meet your concern. See my version in red below and let me know if that addresses your concern.

**Can the Japanese nuclear crisis happen here in the United States?**
The events that have occurred in Japan are the result of a combination of highly unlikely natural disasters. These include the fifth largest earthquake in recorded history and the resulting devastating tsunami. It is highly unlikely that a similar event could occur in the United States.

**1) Can an earthquake and tsunami as large as happened in Japan also happen here?**
This earthquake occurred on a "subduction zone", which is the type of tectonic region that produces earthquakes of the largest magnitude. A subduction zone is a tectonic plate boundary where one tectonic plate is pushed under another plate. Subduction zone earthquakes are also required to produce the kind of massive tsunami seen in Japan. In the continental US, the only subduction zone is the Cascadia subduction zone which lies off the coast of northern California, Oregon and Washington. So, a continental earthquake and tsunami as large as in Japan could only happen there. The only nuclear plant near the Cascadia subduction zone is the Columbia Generating Station. This plant is located a large distance from the coast (approximately 225 miles) and the subduction zone (approximately 300 miles), so the ground motions estimated at the plant are far lower than those seen at the Fukushima plants. This distance also precludes the possibility of a tsunami affecting the plant. Outside of the Cascadia subduction zone,



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earthquakes are not expected to exceed a magnitude of approximatly 8. Magnitude is measured on a log scale and so a magnitude 9 earthquake is approximately 32 times larger than a magnitude 8 earthquake.

### Can the Japanese nuclear crisis happen here in the United States?

The events that have occurred in Japan are the result of a combination of an extremely large earthquake followed by a massive tsunami. Based on the geology of the U.S., this combination of extreme events could only occur in one area of the U.S., and the single plant in that location is far inland and subject to significantly lower ground motion that that see at the Fukushima plants. For these reasons, it is highly unlikely that a similar event could occur in the United States.

**Nelson, Robert**

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|---|---|
| **From:** | Nelson, Robert |
| **Sent:** | Thursday, March 24, 2011 9:43 AM |
| **To:** | Broaddus, Doug; Campbell, Stephen; Carlson, Robert; Chernoff, Harold; Kulesa, Gloria; Markley, Michael; Pascarelli, Robert; Salgado, Nancy; Simms, Sophonia; Wall, Scott |
| **Cc:** | Mahoney, Michael; Meighan, Sean; Giitter, Joseph; Howe, Allen |
| **Subject:** | FYI: New TI Related to Fukushima |

Issued yesterday; links below.

The objective of this TI is to independently assess the adequacy of actions taken by licensees in response to the Fukushima Daiichi nuclear station fuel damage event. The inspection results from this TI will be used to evaluate the industry's readiness for a similar event and to aid in determining whether additional regulatory actions by the U.S. Nuclear Regulatory Commission are warranted. Therefore, the intent of this TI is to be a high-level look at the industry's preparedness for events that may exceed the design basis for a plant. If necessary, a more specific follow-up inspection will be performed at a later date.

Inspection Manual Change Notice 11-003

TI 2515-183, "Followup to Fukushima Daiichi Nuclear Station Fuel Damage Event"

NELSON



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