

From: Brach, Bill
To: Williams, Shawn; Case, Michael; Camper, Larry; Lewis, Robert
Subject: Re: Your thoughts ...
Date: Friday, March 25, 2011 7:30:18 AM

Agree with Rob and Mike. If the 30 day quick review report is available for public then that Document could be a basis for the position sheet.
Bill

Sent from Blackberry

Bill Brach

(b)(6)

From: Williams, Shawn
To: Case, Michael; Brach, Bill; Camper, Larry; Lewis, Robert
Sent: Fri Mar 25 07:21:04 2011
Subject: RE: Your thoughts ...

Looks like both Rob and Mike think we should create a position sheet for this item. I'll assign NUSSC the lead for the position sheet and plan to issue the Green Ticket today.

From: Case, Michael
Sent: Thursday, March 24, 2011 5:02 PM
To: Williams, Shawn; Brach, Bill; Camper, Larry; Lewis, Robert
Subject: RE: Your thoughts ...

It's a reasonable question given the times.

From: Williams, Shawn
Sent: Thursday, March 24, 2011 4:27 PM
To: Brach, Bill; Camper, Larry; Lewis, Robert; Case, Michael
Subject: Your thoughts ...

I was about to send the below e-mail to my normal CSS distribution but I wanted to get your thoughts first...

I am wondering if you think I should assign an office to create a "Position Sheet" for Agenda Item 2, "Possible future implication on IAEA Safety Standards of the recent events in Japan" or if you agree with me, that it is too early and out of process.

All,

We just received the official 29th CSS Provisional Agenda (attached).

There are two additional Agenda Items from the draft version I previously provided.

Agenda Item 2: Possible future implication on IAEA Safety Standards of the recent events in Japan

AAAA/401

2.1 Presentations from the Japanese CSS member

2.2 IAEA Response

2.3 Future activities

Agenda Item 3: Feedback from the CNS review meeting (Position Sheet assigned to NRR)

I revised the Green Ticket to match the new Agenda and I am ready to issue the Green Ticket except, I have one question for the SSCs:

- (1) Concerning Agenda Item 2, the normal process is for the SSC's to first evaluate the issue (during their SSC meetings), and then bring forth their recommendations to the CSS. I am guessing an Action from the 29th CSS will be for this to happen. Given that, and given that it seems that the Agenda Item is mostly information on IAEA 's Japan response and future activities, and given that we really know little about the accident at this time, and given that we have a Task Force that will be evaluating the issues, I tend to think it is too early to assign an Office the lead to create a "Position Sheet." As background for this Agenda Item, I would include any proposals from the Task Force.

Do you think I should assign an office to create a "Position Sheet" for Agenda Item 2? If so, what office do you think should have the lead? Or is it too early as I propose.

From: D.Delattre@iaea.org [mailto:D.Delattre@iaea.org]

Sent: Thursday, March 24, 2011 11:38 AM

To: agonzale@sede.arn.gov.ar; (b)(6); carl-magnus.larsson@arpana.gov.au; Jean-Paul.Samain@wr-cs.be; lavinhas@cnen.gov.br; ramzi.jammal@cnsccs.gc.ca; Liu.hua@bbn.cn; (b)(6); Jukka.Laaksonen@stuk.fi; andre-claude.lacoste@asn.fr; Dieter.majer@bmu.bund.de; ssbajaj@aerb.gov.in; ilevanon@iaec.gov.il; nakamura-koichiro1@meti.go.jp; chyun@kins.re.kr; shakil@pnra.org; (b)(6); vbezz@gan.ru; gclapiss@nnr.co.za; agurgui@csn.es; Leif.Moberg@ssm.se; mykolaichuk@hq.snrc.gov.ua; mike.weightman@hse.gsi.gov.uk; Virgilio, Martin; lcdung@most.gov.vn; peter.faross@ec.europa.eu; claire.cousins@addenbrookes.nhs.uk; rmeserve@ciw.edu; uichiro.yoshimura@oecd.org; raja.dg@aelb.gov.my

Cc: TPather@nnr.co.za; thiagan@netactive.co.za; Geoff.Williams@arpana.gov.au; smm@gr.is; gmassera@arn.gob.ar; Geoffrey.Vaughan@hse.gsi.gov.uk; geoff_vaughan1@btopenworld.com; Fabien.FERON@asn.fr; Brach, Bill; RSwanepoel@nnr.co.za; ss.icrp@rogers.com; sci.sec@icrp.org; jean-luc.lachaume@asn.fr; Gail.Scowcroft@hse.gsi.gov.uk; marie-laure.peyrat@oecd.org; diana.heick@grs.de; dcc@csn.es; peng.jun@sepa.gov.cn; yujun@sepa.gov.cn; Williams, Shawn; Isabelle.FOREST@asn.fr; AstwoodHM@state.gov; Arnaud.ATGER@diplomatie.gouv.fr; (b)(6); audree.paquette@ssi.se; Len.Creswell@hse.gsi.gov.uk; I.Sokolova@gosnadzor.ru; hschang@kins.re.kr; Lasse.Reiman@stuk.fi; (b)(6); m.demcenko@vatesi.lt; paulikas@vatesi.lt; D.Flory@iaea.org; a.nilsson@iaea.org; P.Hahn@iaea.org; J.Lyons@iaea.org; K.Mrabit@iaea.org; P.Woodhouse@iaea.org; H.Abouyehia@iaea.org; A.Al-Khatibeh@iaea.org; E.Buglova@iaea.org; G.Caruso@iaea.org; R.CZARWINSKI@iaea.org; p.colgan@iaea.org; m.gregoric@iaea.org; M.Lipar@iaea.org; M.Modro@iaea.org; S.Samaddar@iaea.org; M.Vesterlind@iaea.org; G.Andrew@iaea.org; N.Castek@iaea.org; A.Boussaha@iaea.org; J.A.Casas-Zamora@iaea.org; P.Vincze@iaea.org; A.Meghzifene@iaea.org; S.Fesenko@iaea.org; T.Colgan@iaea.org; G.Siraky@iaea.org; jim.stewart@iaea.org; M.Svab@iaea.org; g.moore@iaea.org; K.K.Varley@iaea.org; D.Delves@iaea.org; K.E.Asfaw@iaea.org; B.Jeannin@iaea.org; E.Luraschi@iaea.org; F.Klimscha@iaea.org; M.Ch.Schirfeneder@iaea.org; W.Tonhauser@iaea.org; olivier.gupta@asn.fr; M.Gasparini@iaea.org;

D.Winfield@iaea.org; G.Bruno@iaea.org; C.Wong@unido.org; Y.Zhao@iaea.org; Y.Inoue@iaea.org
Subject: IAEA - Commission on Safety Standards - meeting from 25 to 27 May 2011 - message #1

Dear CSS members.

The next CSS meeting is planned from 25 to 27 May 2011 and I am pleased to inform you that the invitation letters are being prepared. For your convenience, I attach here an electronic version of the provisional agenda.

<<CSSagn29 rev3.doc>>

I have started to post last week on the CSS web site, i.e. more than two and a half months in advance to the meeting, the material for submission to you. You may find these at the following address: <http://www-ns.iaea.org/committees/css/> in the folder "CSS documents for comment". Other material for information is available in the folder "Documents provided by the Secretariat for information".

The only draft that still need to be posted is the draft safety requirement DS414 on Safety of Nuclear Power Plants: Design. It is currently under review by the NUSSC Chair in order to verify that changes proposed by the Technical Editors and agreed to by the Technical Officer don't affect the substance of the draft after its approval by the Committees. I intend to post the final draft at the latest on 29 March so as to comply with the eight weeks deadline.

Among the drafts, you will also find the draft safety requirement DS379 on Radiation Protection and Safety of Radiation Sources, the revised International BSS. You will note that on part will need to be updated taking into account the result of the ICRP deliberation on the exposure to the eye lenses. It is expected to receive the result in April 2011 and this will be mentioned to you as soon as we receive it.

You therefore have most of the material available for your review around nine weeks in advance to the meeting. I would appreciate it very much if, as agreed to be the standard practice, you also post your comments on the documents submitted for approval two weeks in advance to the meeting, i.e. by 6 May 2011. This will also allow you to see in advance the comments from other members and the responsible Technical Officers to take them into account and provide you, at the meeting, with their proposed answer for your consideration.

Please read the general information available on this CSS web page, as well as the instructions on how to use it, in particular on how to register, login and post comments on the documents submitted to you. I attach here again these instructions.

<<GuidanceontheuseoftheCSSmembersarea.doc>>

For your presentations on 8.1 (Topical discussion on the Use of Safety Standards) and 8.2 (Regulatory Issues), I would also appreciate it very much if you could send to me in advance to the meeting (also two weeks) your input for these two items, with a preference for separate papers for each of these items. I will upload them on the web site as soon as I receive them. In particular for the agenda item 8.1, I would appreciate if you could indicate recent use of IAEA safety standards for preparing regulatory documents or performing other regulatory activities.

For Mr Laaksonen, Vinhas and Virgilio who are CSS representatives at the Joint AdSec CSS task force, I confirm that the meeting of the task force will be held on 24 May 2011, starting at 8:30.

Finally, please don't hesitate to contact my Secretary Frances Klimscha for any assistance needed for the meeting arrangements. Her email address is f.klimscha@iaea.org. Her telephone is +43 1 26 00 22286. In this regard, I'd like to request that you confirm soon to her your participation at the next CSS

meeting as well as the name of any assistant at the meeting (one assistant normally according to the Terms of Reference).

Best regards.

Dominique Delattre

Scientific Secretary of the CSS

Head, Safety Standards and Application Unit]

This email message is intended only for the use of the named recipient. Information contained in this email message and its attachments may be privileged, confidential and protected from disclosure. If you are not the intended recipient, please do not read, copy, use or disclose this communication to others. Also please notify the sender by replying to this message and then delete it from your system.

Schaperow, Jason

From: Schaperow, Jason
Sent: Friday, March 25, 2011 3:14 PM
To: Hill, Brittain
Subject: RE: ACTION: Review slides for 3/28/11 Briefing to Rep. Hamilton

Thank you.

From: Hill, Brittain
Sent: Friday, March 25, 2011 2:18 PM
To: Schaperow, Jason
Cc: Gibson, Kathy; Santiago, Patricia; Tinkler, Charles
Subject: RE: ACTION: Review slides for 3/28/11 Briefing to Rep. Hamilton

Hi Jason – Thanks for taking a look at the slides. I agree with the need to add the bullet about dispersal on slide 9, and like the rearrangement and clarifications of text on 9-10. I've incorporated these changes, and will swap out the new pages for the printed ones early Monday morning. I'll also make the minor changes to slide 6, which seem more about phrasing and less about closing an information gap, and add that to the reprinting queue.

Thanks also for taking a careful look at the other slides (yep, I'd already caught the 2010 mistake). I will send the revised version over to Cathy right away. Unless Cathy has a pressing need for changes Monday morning, the attached should be the final version.

Thanks-
Britt

From: Schaperow, Jason
Sent: Friday, March 25, 2011 12:20 PM
To: Hill, Brittain
Cc: Gibson, Kathy; Santiago, Patricia; Tinkler, Charles
Subject: RE: ACTION: Review slides for 3/28/11 Briefing to Rep. Hamilton
Importance: High

Hi Britt,

I made some changes to the spent fuel pool slides, which are slides 6 through 11. My changes are shown in red in the attachment. If you are O.K. with my changes, please accept them by 1) changing the color of the changes from red to black and 2) sending me the final slides.

Also, I noticed that slide 4 lists an incorrect date for the Japanese accident. The accident happened in 2011, not 2010.

Thanks,
Jason

From: Hill, Brittain
Sent: Thursday, March 24, 2011 8:57 AM
To: Gibson, Kathy; Santiago, Patricia; Schaperow, Jason
Subject: ACTION: Review slides for 3/28/11 Briefing to Rep. Hamilton

These are a subset of the same slides we used to brief the Blue Ribbon Commission folks on 2/3/11. Given the current events in Japan, are there any slides that RES believes should be modified? Clearly, we are not

trying to incorporate new information about the Japan events into the slides, and I suspect that no changes are needed. Nevertheless, given our limited understanding of what has transpired the past weeks, are there any modifications that appear warranted?

Please let me know before COB Friday so that I will have sufficient time to incorporate changes and print copies for our use on Monday's briefing.

Thanks-
Britt

Brittain E. Hill, Ph.D.
Sr. Advisor for Repository Science
US Nuclear Regulatory Commission
MS EBB-2-B02, NMSS/HLWRS/TRD
Washington, DC 20555-0001

Ph (301) 492-3168; Fax (301) 492-3357;
Mobile: (b)(6) email: Brittain.Hill@nrc.gov

Raione, Richard

From: Kammerer, Annie
Sent: Friday, March 25, 2011 2:21 PM
To: 'Eric'; Jones, Henry
Cc: Raione, Richard; Chokshi, Nilesh; Flanders, Scott
Subject: RE: Tsunami Risk at Japanese Plants

Eric, this is mostly for the pacific and seismic sources.

-----Original Message-----

From: Eric [mailto:egeist@usgs.gov]
Sent: Friday, March 25, 2011 1:14 AM
To: Jones, Henry
Cc: Kammerer, Annie; Raione, Richard; Chokshi, Nilesh; Flanders, Scott
Subject: Re: Tsunami Risk at Japanese Plants

Dear Henry,

Annie may be a little over enthusiastic about PTHA in my opinion. We've been looking at the landslide component to PTHA and there are very significant hurdles to overcome, both in terms of the available data and the methodology. We started our work at about the beginning of the FY and is ongoing. I would estimate that we are a least 5 years away from having PTHA w/ landslides in a form that NRC can implement, IF geologic age dates from major landslides are obtained. I do think we can something about the probability of the PMT where we have age dates for the PMT source.

The PG&E report has many problems in terms of the modeling methodology, landslide tsunami parameterization, and estimation of mean return times of sources. However, there is some good data in the report that we could use for Diablo Canyon.

I'm not familiar with the USC PTHA specific to SONGS. Their previous PTHA work just dealt with seismogenic tsunamis -- I suspect that they are doing the same for SONGS, because there is little information about the offshore landslides. I'll be in the office tomorrow, if you want to talk by phone...Eric

On Mar 24, 2011, at 7:47 PM, Jones, Henry wrote:

> Richard is on board with me being the lead for the tsunami RG. I will get back to you tomorrow regarding my schedule for next week.
>
> Henry
> P.S. What is your new work at USGS on PTHA?
>
> _____
> From: Kammerer, Annie
> Sent: Thursday, March 24, 2011 10:21 PM
> To: Jones, Henry
> Cc: Raione, Richard; Eric; Jason Chaytor; Bruce Jaffe; Lynett, Patrick; Flanders, Scott; Chokshi, Nilesh

> Subject: RE: FW: Tsunami Risk at Japanese Plants

>

> Yes, we have a lot to talk about. The various pieces can easily be pulled together for 70% of an internal report. The other 30% (assessment of the existing plants) will require some work on our part, but it's doable.

>

> Honestly, I don't think there is general knowledge in the NRC of what we have been doing the last 4 years or so. I think people will be shocked and pleased, both with the fact that we put a document together, and also that we have such a great success story to tell!

>

> Diablo has published their PTHA as a draft PEER report, so it is out there. There has been work ongoing at the USC tsunami research program with regard to PTHA in the region around SONGS. We should reach out to find out what they can send us.

>

> Also, FYI, we have new work at USGS on PTHA and we just got a new contract to Vasily, who is the lead on the modeling NUREG that Pat is working on.

>

> Then we need to do the regulatory guide (which I think now even has a number).

>

> So, Henry, are you willing to be lead author and act as PM for this project? Rich, is that OK with you? How about if we sit down together next week and work up a TOC?

>

> Annie

>

>

> From: Jones, Henry

> Sent: Thursday, March 24, 2011 3:25 PM

> To: Kammerer, Annie

> Cc: Raione, Richard; Eric; Jason Chaytor; Bruce Jaffe; Lynett, Patrick; Flanders, Scott; Chokshi, Niles

> Subject: RE: FW: Tsunami Risk at Japanese Plants

>

> I concur. Already working on it and coordinating with USGS (Eric Geist, Jason Chaytor, Bruce Jaffe, Pat Lynett) because they have extensive experience working on actual safety reviews for nuclear power plants. Co-ordination with NOAA at least on paper.

>

> To date, USGS has completed the tsunami generating sources (Atlantic & Gulf) and paleo-tsunami deposit elements of your RES tsunami research plan. RES is also funding Pat Lynett to author a tsunami modeling NUREG. NRO/DSER is funding Pat Lynett/USGS/Woods Hole for tsunami confirmatory analysis for STP, CC, LC, TP and PSEG.

>

> Due to the ongoing high visibility of Diablo Canyon and SONGS, can someone provide a status on tsunami source generating research in the Pacific?

>

>

> Henry

>

> From: Kammerer, Annie
> Sent: Thursday, March 24, 2011 2:52 PM
> To: Jones, Henry; 'jchaytor@usgs.gov'
> Cc: 'bjaffe@usgs.gov'; 'egeist@usgs.gov'; 'plynett@tamu.edu'; Raione, Richard; 'Vasily.Titov@noaa.gov'
> Subject: Re: FW: Tsunami Risk at Japanese Plants
>
> I'm struck that one way we may be able to avoid the GI process (and the associated mound of regulatory paperwork), is to get out in front of it by putting together an internal white paper. Something like: "status of tsunami hazard assessment activities in the NRC and preliminary review of hazard at proposed and currently operating NPPs."
>
> It would actually reduce our workload over the long term and show a high level of leadership.
>
> I would propose that we actually present this as a document by NRC, USGS, NOAA and A&M. Led by NRO with co-ordination (and probably co-authorship by RES and NRR (NRR at least on paper).
>
> Of course this will probably be FOIAed. So, we should assume it will be public eventually.
>
> Thoughts?
>
> Cheers,
> Annie
>
> Sent from an NRC blackberry
> Annie Kammerer
> mobile (b)(6)
> bb (b)(6)
> annie.kammerer@nrc.gov
>
>

> From: Jones, Henry
> To: Jason Chaytor <jchaytor@usgs.gov>
> Cc: Bruce Jaffe <bjaffe@usgs.gov>; Eric <egeist@usgs.gov>; Lynett, Patrick <plynett@tamu.edu>; Raione, Richard; Kammerer, Annie
> Sent: Thu Mar 24 11:49:31 2011
> Subject: RE: FW: Tsunami Risk at Japanese Plants
> USGS:
>
> I had a conversation with Annie Kammerer yesterday. It seems to heading that way. She believes that this will be a NRC Generic Issue in the near future. Based on our pass experience with Katrina and the Canary Island tsunami, I agree with her. As in the aforementioned cases, there is extensive external pressure to address the issue.
>
> I am doing some preliminary work and will probably need the USGS tsunami team's (Eric, Pat, Jason and Bruce) assistance at some point.

>
> Annie:
>
> As always, thanks for keeping me informed. Please let me know how I can assist you.
>
> Henry
>
> From: Jason Chaytor [mailto:jchaytor@usgs.gov]
> Sent: Thursday, March 24, 2011 11:21 AM
> To: Jones, Henry
> Cc: Bruce Jaffe; Eric; Lynett, Patrick
> Subject: Re: FW: Tsunami Risk at Japanese Plants
>
>
> Interesting...and scary.
>
> Is the NRC planning to evaluate/reevaluate tsunami hazards to all operational US sites in the wake of the Japanese events?
>
> Jason
>

> Jason D. Chaytor, Ph.D
> U.S. Geological Survey
> USGS Woods Hole Coastal and Marine Science Center
> 384 Woods Hole Road
> Woods Hole, MA 02543-1598
> Phone: (508) 457-2351
> Fax: (508) 457-2310
> Email: jchaytor@usgs.gov
>
> From:
>
> "Jones, Henry" <Henry.Jones@nrc.gov>
>
> To:
>
> Eric <egeist@usgs.gov>, Bruce Jaffe <bjaaffe@usgs.gov>, "jchaytor@usgs.gov" <jchaytor@usgs.gov>, "Lynett, Patrick" <plynett@tamu.edu>
>
> Date:
>
> 03/24/2011 10:46 AM
>

> Subject:

>

> FW: Tsunami Risk at Japanese Plants

>

>

>

>

>

>

> FYI.

>

> From: Chaput, Peter

> Sent: Thursday, March 24, 2011 7:59 AM

> To: NRO_DSER_RHEB Distribution

> Subject: Tsunami Risk at Japanese Plants

>

> http://www.washingtonpost.com/world/japanese-nuclear-plants-evaluators-cast-aside-threat-of-tsunami/2011/03/22/AB7Rf2KB_print.html

>

>

> Pete(r) Chaput, PE

> Hydrologist

> U.S. Nuclear Regulatory Commission

> 11545 Rockville Pike, MS: T7 E18

> Rockville, MD 20852

> T: 301-415-6894

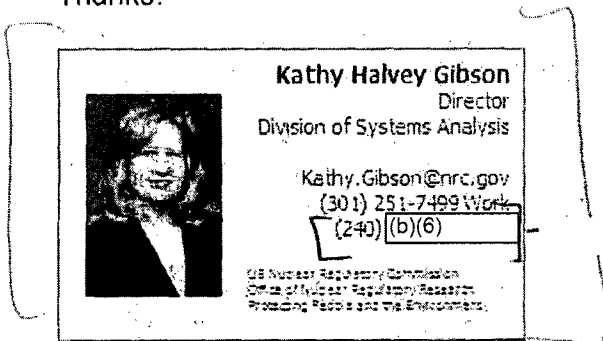
>

Lee, Richard

From: Gibson, Kathy
Sent: Friday, March 25, 2011 8:36 AM
To: Schaperow, Jason; Bush-Goddard, Stephanie; Elkins, Scott; Hoxie, Chris; Lee, Richard; Santiago, Patricia; Scott, Michael; Bajorek, Stephen; Boyd, Christopher; Rubin, Stuart; Sherbini, Sami; Tinkler, Charles; Voglewede, John; Zigh, Ghani
Subject: FW: QUESTION FROM JAPAN
Attachments: Kathy Halvey Gibson.vcf; image001.jpg

Anybody recall what Mike is referring to and can you send Richard a copy of the slides?

Thanks!



From: Scott, Michael
Sent: Friday, March 25, 2011 5:44 AM
To: Gibson, Kathy; Lee, Richard; Voglewede, John; Santiago, Patricia
Subject: QUESTION FROM JAPAN

I seem to remember someone sending out a slide show on hydrogen since I've been in RES. I can't remember who our expert was, but I need to get a copy of the slide show he or she had developed on the subject. Can any of you recall?

Thanks

Mike

AAAA/404

Lee, Richard

From: Basu, Sudhamay
Sent: Friday, March 25, 2011 10:16 AM
To: 'Farmer, Mitchell T.'; Lee, Richard; Tinkler, Charles; Gavrilas, Mirela
Subject: RE: Results of Nuclide Analysis

Sure Mitch.

From: Farmer, Mitchell T. [<mailto:farmer@anl.gov>]
Sent: Friday, March 25, 2011 10:08 AM
To: Lee, Richard; Tinkler, Charles; Basu, Sudhamay; Gavrilas, Mirela
Subject: FW: Results of Nuclide Analysis

Can you please forward to Randy (Sorry I had to go off line to get to work and had to drop off some stuff so here it is finally). I don't seem to have Randy's email.

My office is 630 252 4539 and cell is (b)(6) Am stepping out for a minute and will be back; my boss beckons.
Mitch

From: Grandy, Christopher
Sent: Friday, March 25, 2011 12:04 AM
To: Farmer, Mitchell T.
Cc: Taiwo, Temitope A.; Yang, Won Sik
Subject: FW: Results of Nuclide Analysis

They are also seeing Ru isotope in the seawater and in the air now.

Chris

From: Yang, Won Sik
Sent: Thursday, March 24, 2011 5:57 PM
To: Taiwo, Temitope A.
Cc: Grandy, Christopher
Subject: Results of Nuclide Analysis

Tem,

More results of nuclide analysis are in page 11 to 16. They have detected even La isotopes, indicating fuel melting according the correlation of group release and fuel temperature.

Won Sik

From: Taiwo, Temitope A.
Sent: Thursday, March 24, 2011 5:34 PM
To: Yang, Won Sik; Hoffman, Edward A.; Kim, Taek K.; Adduci, Joseph J.
Subject: FW: Check out these photos

FYI.

AAAA/405

• Temitope Taiwo
Argonne National Laboratory
9700 S. Cass Avenue,
Argonne, IL 60439-4842, U.S.A.
Taiwo@anl.gov
(630) 252 1387

From: Grandy, Christopher
Sent: Thursday, March 24, 2011 2:51 PM
To: Taiwo, Temitope A.; Sofu, Tanju; Seidensticker, Ralph W.; Farmer, Mitchell T.
Subject: Check out these photos

Lee, Richard

From: Basu, Sudhamay
Sent: Friday, March 25, 2011 12:56 PM
To: 'Gauntt, Randall O'; Farmer, Mitchell T.
Cc: Lee, Richard; Tinkler, Charles
Subject: RE: Results of Nuclide Analysis

Randy - An earlier communication was alluding to Ru airborne radionuclide. Wouldn't that be from SFP air oxidation?

From: Gauntt, Randall O [mailto:rogaunt@sandia.gov]
Sent: Friday, March 25, 2011 12:49 PM
To: Farmer, Mitchell T.
Cc: Lee, Richard; Basu, Sudhamay; Tinkler, Charles
Subject: RE: Results of Nuclide Analysis

I am looking at the count rates implied and they are in the range of $1E-3$ to $1E-5$ Bq/cc. This means one cc will give up a count to the detector every 1000 to 10,000 sec since 1 Bq is 1 disintegration/second. 1000 seconds is about 15 minutes. Am I getting this right?

Many readings are at the detection limit if I understand the chart.

If I am reading this right, these don't seem particularly high, but I haven't really processed this mentally yet.

On the other hand - the puddle reports from TEPCO do sound like significant levels. These are reported in the $1E5$ counts per second/cc and high on Cs and I. That sounds like release from fuel in a reactor - not so much for SFP I think as iodine would not be strong from SFP fuel.

Any comments from anyone else?

Someone please correct me if I am getting something way wrong.

Randy

From: Farmer, Mitchell T. [farmer@anl.gov]
Sent: Friday, March 25, 2011 9:48 AM
To: Gauntt, Randall O
Cc: 'Lee, Richard'; 'Basu, Sudhamay'; 'Tinkler, Charles'
Subject: FW: Results of Nuclide Analysis

Randy, please have a look. Data is the last few pages..
Mitch

From: Farmer, Mitchell T.
Sent: Friday, March 25, 2011 9:08 AM
To: 'Lee, Richard'; 'Tinkler, Charles'; 'Basu, Sudhamay'; Gavrilas, Mirela
Subject: FW: Results of Nuclide Analysis

Can you please forward to Randy (Sorry I had to go off line to get to work and had to drop off some stuff so here it is finally). I don't seem to have Randy's email.

My office is 630 252 4539 and cell is (b)(6) Am stepping out for a minute and will be back; my boss beckons.
Mitch

From: Grandy, Christopher
Sent: Friday, March 25, 2011 12:04 AM
To: Farmer, Mitchell T.
Cc: Taiwo, Temitope A.; Yang, Won Sik
Subject: FW: Results of Nuclide Analysis

They are also seeing Ru isotope in the seawater and in the air now.

Chris

From: Yang, Won Sik
Sent: Thursday, March 24, 2011 5:57 PM
To: Taiwo, Temitope A.
Cc: Grandy, Christopher
Subject: Results of Nuclide Analysis

Tem,

More results of nuclide analysis are in page 11 to 16. They have detected even La isotopes, indicating fuel melting according the correlation of group release and fuel temperature.

Won Sik

From: Taiwo, Temitope A.
Sent: Thursday, March 24, 2011 5:34 PM
To: Yang, Won Sik; Hoffman, Edward A.; Kim, Taek K.; Adduci, Joseph J.
Subject: FW: Check out these photos

FYI.

Temitope Taiwo
Argonne National Laboratory
9700 S. Cass Avenue,
Argonne, IL 60439-4842, U.S.A.
Taiwo@anl.gov
(630) 252 1387

From: Grandy, Christopher
Sent: Thursday, March 24, 2011 2:51 PM
To: Taiwo, Temitope A.; Sofu, Tanju; Seidensticker, Ralph W.; Farmer, Mitchell T.
Subject: Check out these photos

Lee, Richard

From: Schaperow, Jason
Sent: Friday, March 25, 2011 3:36 PM
To: Gibson, Kathy; Tinkler, Charles
Cc: Santiago, Patricia; Wagner, Katie; Lee, Richard
Subject: RE: 2005 NAS Study on Safety & Security of Spent Fuel Storage
Attachments: image001.jpg

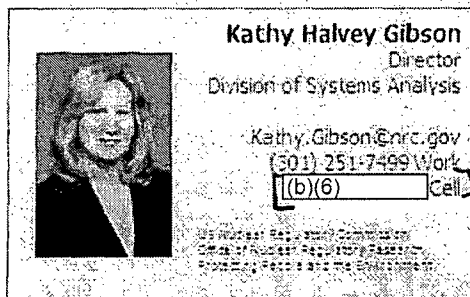
I imagine either one of us could support this. Any way we could put this off for a couple of weeks until after the Fukushima event is over?

Thanks,
Jason

From: Gibson, Kathy
Sent: Friday, March 25, 2011 2:21 PM
To: Tinkler, Charles; Schaperow, Jason
Cc: Santiago, Patricia; Wagner, Katie; Lee, Richard
Subject: FW: 2005 NAS Study on Safety & Security of Spent Fuel Storage

Which of you would support this? He's asking for Charlie, but Jason did the BRC briefings, so whichever of you will do this, please contact Mike Layton directly and let him know.

Thanks



From: Layton, Michael
Sent: Friday, March 25, 2011 2:16 PM
To: Gibson, Kathy; Scott, Michael
Cc: Brochman, Phil; Tinkler, Charles; Hogan, Rosemary; Correia, Richard; Evans, Michele; Uhle, Jennifer; Merzke, Daniel; Wastler, Sandra
Subject: 2005 NAS Study on Safety & Security of Spent Fuel Storage

Kathy/Mike,

We received an inquiry from one of the science advisors to DNDO Director Stern (see attached e-mail), asking for a copy of the classified NAS report on spent fuel storage. Recognizing the Commission's previous sensitivity to this report, I asked Dan Merzke to inquire with the DEDOs whether they thought the Commission might wish to weigh in releasing the report to DNDO.

Regardless of whether we release the report to DNDO or not, I invited Dr. Albert to come to NRC and receive a briefing on spent fuel storage and answer any of his questions. We can certainly handle the portion on dry storage security and such, but we would need assistance from Charlie Tinkler to discuss spent fuel pools and some of the studies the RES has undertaken since the 2005 NAS report.

We've not set a time for the briefing, but expect Dr. Albert would probable like something next week or the week of April 4. Since we've already developed a set of slide for the BRC briefings, I'd think we could use them for this briefing.

Can you let me know whether Charlie can support a briefing in this timeframe?

Many thanks,

MCL

Michael Layton
U.S. Nuclear Regulatory Commission
Deputy Director,
Division of Security Policy
Office of Nuclear Security and Incident Response

Office: 301.415.7440

BB: (b)(6)

Fax: 301.415.5373

Lee, Richard

From: Gauntt, Randall O [rogaunt@sandia.gov]
Sent: Friday, March 25, 2011 1:00 PM
To: Esmaili, Hossein
Cc: Lee, Richard
Subject: FW: MELCOR Inquiry
Attachments: image001.gif

Sorry - I forgot to copy you.
Randy

From: Gauntt, Randall O
Sent: Friday, March 25, 2011 10:57 AM
To: Mario Cesar Torres Alves
Subject: RE: MELCOR Inquiry

Dear Mr Alves,
I apologize for the web site not responding to your request.

We are happy to hear of your interest.

The MELCOR code is obtained by requesting from the U.S. Nuclear Regulatory Commission. The USNRC will then instruct Sandia to make the code available to you.

The code is distributed through membership in the NRC Cooperative Severe Accident Research Program (CSARP). If you are interested in using the code, I can also inform you that there is a training workshop to be held in September in Bethesda Maryland.

The NRC persons to contact about getting the code are:

Hossein Esmaili (hossein.esmaili@nrc.gov) phone number: +1 301 251 7554

or Richard Lee (richard.lee@nrc.gov)

Also there is a web page at the NRC: http://spot.infosyslabs.com:8080/nrccodes/how_to_obtain.html

Please let me know if there is anything else I can do to facilitate your needs.

best regards
Randall Gauntt
Manager Reactor Modeling and Analysis Department
(b)(6) (cell) -
+1 505 284 3989 (office)

From: Mario Cesar Torres Alves [malves@eletronuclear.gov.br]
Sent: Friday, March 25, 2011 10:46 AM
To: Gauntt, Randall O
Cc: Jorge Luiz Chapot; Joao Calixto Neto
Subject: MELCOR Inquiry

Dear Sir,

I am the Safety Analysis Manager of ELETRONUCLEAR, the Brazilian company responsible for the Brazilian NPPs Angra 1 and 2 and we have interests to have access to MELCOR Code. We have already sent an e-mail by web page SANDIA with this purpose but we didn't receive any answer till now.
Please, let me know how to proceed to obtain this code and the right to use it.

Sincerely,

Mario Cesar Torres Alves

Gerência de Análise de Segurança Nuclear - GSN.T

Tel.: +55 21 2588-7751 | fax +55 21 2588-7269

malves@eletronuclear.gov.br



AVISO Esta mensagem é destinada exclusivamente à(s) pessoa(s) indicada(s) como destinatário(s), podendo conter informações confidenciais, protegidas por lei. A transmissão incorreta da mensagem não acarreta a perda de sua confidencialidade. Caso esta mensagem tenha sido recebida por engano, solicitamos que seja devolvida ao remetente e apagada imediatamente de seu sistema. É vedado a qualquer pessoa que não seja destinatário usar, revelar, distribuir ou copiar, ainda que parcialmente, esta mensagem. -----

----- DISCLAIMER This message is destined exclusively to the intended receiver. It may contain confidential or legally protected information. The incorrect transmission of this message does not mean loss of its confidentiality. If this message is received by mistake, please send it back to the sender and delete it from your system immediately. It is forbidden to any person who is not the intended receiver to use, reveal, distribute, or copy any part of this message.

Lee, Richard

From: Lee, Richard
Sent: Friday, March 25, 2011 3:50 PM
To: 'powerss@crossnet.org'
Subject: FW: Reactor Safety Team Assessment 2000 EDT 3-24-2011
Attachments: 03-24-11 2000 RST Assessment Document.docx

Another one

From: Kelly, John E (NE) [<mailto:JohnE.Kelly@Nuclear.Energy.Gov>]
Sent: Friday, March 25, 2011 1:50 PM
To: DL-NITSolutions
Subject: FW: Reactor Safety Team Assessment 2000 EDT 3-24-2011

Integrated DOE-NRC-INPO report to Japan

From: Versluis, Rob
Sent: Thursday, March 24, 2011 10:28 PM
To: DL-NERT-All
Subject: Fw: Reactor Safety Team Assessment 2000 EDT 3-24-2011

Fyi
Rob Versluis +1-301-903-1890(o)(b)(6)

From: RST01 Hoc <RST01.Hoc@nrc.gov>
To: RST01 Hoc <RST01.Hoc@nrc.gov>; RST02 Hoc <RST02.Hoc@nrc.gov>; mossdj@inpo.org <mossdj@inpo.org>; Casto, Chuck <Chuck.Casto@nrc.gov>; Nakanishi, Tony <Tony.Nakanishi@nrc.gov>; Monninger, John <John.Monninger@nrc.gov>; Devercelly, Richard <Richard.Devercelly@nrc.gov>; Foster, Jack <Jack.Foster@nrc.gov>; Trapp, James <James.Trapp@nrc.gov>
Cc: RST03 Hoc <RST03.Hoc@nrc.gov>; INPOERCAssistance <INPOERCAssistance@inpo.org>; Ruland, William <William.Ruland@nrc.gov>; Versluis, Rob
Sent: Thu Mar 24 22:25:22 2011
Subject: Reactor Safety Team Assessment 2000 EDT 3-24-2011

All,

The reactor safety team has compiled its assessment report of conditions and recommendations at the damaged Fukushima Daiichi reactor plants.

Shortly after our completion of the attached report, the RST received a new update from JAIF with a time-date stamp of 2200 JDT 3/24/2011 (0900 EDT 3/24/2011), that indicates changes in their view of containment integrity in units One and Three, indicating the containment vessel integrity status as "Not Damaged". This information has not been factored into the assessment report, and the RST will be moving forward to review and evaluate this latest status report.

We request that our INPO addressee please forward this assessment to the EPRI staff who are involved in this event response activity.

If you have any comments or questions on this report, please contact the Reactor Safety Team at RST01.Hoc@nrc.gov.

John Thorp
RST Chronologist Evening Shift, 3/24/2011

Lee, Richard

From: Lee, Richard
Sent: Friday, March 25, 2011 3:58 PM
To: 'powerss@crossnet.org'
Subject: FW: Nuclear science group conference call - Friday, Saturday, and Sunday, 5:00pm EDT

Conference call in number.

From: Adams, Ian [mailto:Ian.Adams@Hq.Doe.Gov]
Sent: Thursday, March 24, 2011 7:25 PM
To: Adams, Ian; Aoki, Steven; Binkley, Steve; Budnitz, Bob; Sheron, Brian; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Peterson, Per; Rolando Szilard; Steve Fetter; Lee, Richard; Lee, Richard
Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley
Subject: Nuclear science group conference call - Friday, Saturday, and Sunday, 5:00pm EDT

Good evening,

Tomorrow's call will take place at 5:00pm EDT. I am proposing that this call also take place at 5:00pm EDT on Saturday and Sunday. On Monday, we'll move the call back to 6:00pm EDT.

Please let me know if these times work for you.

Thanks
Ian

Nuclear science group conference call schedule:

Friday 3/25: 5:00pm-6:00pm EDT
Saturday 3/26: 5:00pm-6:00pm EDT
Sunday 3/27: 5:00pm-6:00pm EDT
Monday 3/28: 6:00pm-7:00pm EDT

Conference call information:

Please dial into (b)(6)
No PIN is needed.

From: Adams, Ian
Sent: Thursday, March 24, 2011 5:11 PM
To: Adams, Ian; Aoki, Steven; Binkley, Steve; Budnitz, Bob; Sheron, Brian; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Peterson, Per; Rolando Szilard; Steve Fetter; Lee, Richard
Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley
Subject: RE: Nuclear science group conference call - Thursday 6:00pm EDT

Good afternoon,
Just a reminder, this call will take place tonight at 6:00pm EDT.

Tomorrow's call will take place at 5:00pm EDT.

Nuclear science group conference call schedule:

Thursday 3/24: 6:00pm-7:00pm EDT

Friday 3/25: 5:00pm-6:00pm EDT

Conference call information:

Please dial into

(b)(6)

No PIN is needed.

From: Adams, Ian

Sent: Thursday, March 24, 2011 9:22 AM

To: Adams, Ian; Aoki, Steven; Binkley, Steve; Budnitz, Bob; Sheron, Brian; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Peterson, Per; Rolando Szilard; Steve Fetter; Lee, Richard

Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley

Subject: Nuclear science group conference call - Thursday 6:00pm EDT

Good morning,

Today's conference call will be at 6:00pm EDT tonight. For tomorrow (Friday), please let me know if 5:00pm-6:00pm EDT works for you.

Nuclear science group conference call proposed schedule:

Thursday 3/24: 6:00pm-7:00pm EDT

Friday 3/25: 5:00pm-6:00pm EDT

Conference call information:

Please dial into

(b)(6)

No PIN is needed.

Additionally, I have attached this morning's Japan sit rep. This information should not be shared or further distributed.

Thanks

Ian

<< File: Japan_Earthquake_Response_03242011_0600b.pdf >> << File: SITREP_MAR24 0600.docx >>

From: Adams, Ian

Sent: Wednesday, March 23, 2011 10:48 AM

To: Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Brian Sheron; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter; Lee, Richard

Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley

Subject: RE: Nuclear science group conference call - Wednesday 6:00pm EDT

Good morning,

The daily nuclear science group conference call is confirmed for 6:00pm-7:00pm today.

Due to scheduling conflicts, Thursday's call will need to move. It will now take place 6:00pm-7:00pm, same as today's call time.

Thanks,
Ian

Nuclear science group conference call schedule:

Wednesday 3/23: 6:00pm-7:00pm EDT

Thursday 3/24: 6:00pm-7:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

From: Adams, Ian

Sent: Tuesday, March 22, 2011 7:04 PM

To: Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Brian Sheron; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter

Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley

Subject: Nuclear science group conference call - Wednesday

Good evening,

We need to change the time of tomorrow's call to later in the day. Please let me know if 6:00pm EDT Wednesday and 5:00pm EDT Thursday would work for you.

Thanks,
Ian

Nuclear science group conference call - proposed schedule:

Wednesday: 6:00pm-7:00pm EDT

Thursday: 5:00pm-6:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

From: LIA05 Hoc
Sent: Friday, March 25, 2011 9:09 AM
To: Ralston, Michelle
Subject: FW: FW Fukushima
Attachments: Fukuchima_eng_20110320.pps

We'll try this way. It opens fine up here.

Larry

Bonnie Sheffield Dayshift 0700-1500
Ken Wierman Nightshift 1500-2300
FEMA REP Liaison
NRC Operations Center
(301) 816-5187

*******FOR OFFICIAL USE ONLY*******
DO NOT RELEASE OUTSIDE OF THE FEDERAL FAMILY

From: LIA01 Hoc
Sent: Thursday, March 24, 2011 7:29 PM
To: LIA05 Hoc
Subject: FW: FW Fukushima

From: Hale, Jerry
Sent: Thursday, March 24, 2011 6:41 PM
To: LIA01 Hoc
Subject: FW: FW Fukushima

From: Cabbage, Amy
Sent: Thursday, March 24, 2011 5:05 PM
To: Tonacci, Mark; Galvin, Dennis; Baval, Bruce; Muniz, Adrian; Jessie, Janelle; Hale, Jerry; Anand, Raj; Govan, Tekia
Subject: FW Fukushima

The attached power point is interesting info. Includes dose data for anyone who is interested in those details

From: Santos, Daniel
Sent: Thursday, March 24, 2011 11:11 AM
To: Bergman, Thomas; Dixon-Herrity, Jennifer; Jung, Ian; Jackson, Terry; Norato, Michael; Jenkins, Ronaldo; Hawkins, Kimberly; Terao, David; Hsia, Anthony
Subject: FW: Nuclear Problems in Japan

This was forwarded to me by one of my MDEP counterparts.

From: Lojk, Robert [mailto:Robert.Lojk@cnscccsn.gc.ca]
Sent: Thursday, March 24, 2011 9:51 AM
To: Santos, Daniel
Subject: Nuclear Problems in Japan

Daniel:

In case you guys haven't seen this, Areva has done a good job illustrating the Japanese event.

See you in Vienna.

Saludos,

Bob
Robert Lojk, P. Eng.
Director, Systems Engineering Division
Canadian Nuclear Safety Commission
613 947 3992

(b)(6) (Cell)

The information contained in this e-mail is intended solely for the use of the named addressee. Access, copying, or re-use of the e-mail or any information contained therein by any other person is not authorized. If you are not the intended recipient, please notify us immediately by returning the e-mail to the originator.

Ce message est strictement réservé à l'usage du destinataire indiqué. Si vous n'êtes pas le destinataire de ce message, la consultation ou la reproduction même partielle de ce message et des renseignements qu'il contient est non autorisée. Si ce message vous a été transmis par erreur, veuillez en informer l'expéditeur en lui retournant ce message immédiatement.

Lee, Richard

From: Lee, Richard
Sent: Friday, March 25, 2011 5:03 PM
To: 'Adams, Ian'
Subject: RE: Nuclear science group conference call - Friday, Saturday, and Sunday, 5:00pm EDT

Thx, Ian.
Richard

From: Adams, Ian [mailto:Ian.Adams@Hq.Doe.Gov]
Sent: Friday, March 25, 2011 4:55 PM
To: Lee, Richard
Subject: RE: Nuclear science group conference call - Friday, Saturday, and Sunday, 5:00pm EDT

Sorry it was late – it just went out.

From: Lee, Richard (NRC)
Sent: Friday, March 25, 2011 4:47 PM
To: Adams, Ian
Subject: RE: Nuclear science group conference call - Friday, Saturday, and Sunday, 5:00pm EDT

Hi, Ian:

Is there any handout for today conference call.

Best regards,
Richard

From: Adams, Ian [mailto:Ian.Adams@Hq.Doe.Gov]
Sent: Thursday, March 24, 2011 7:25 PM
To: Adams, Ian; Aoki, Steven; Binkley, Steve; Budnitz, Bob; Sheron, Brian; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Peterson, Per; Rolando Szilard; Steve Fetter; Lee, Richard: Lee, Richard
Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley
Subject: Nuclear science group conference call - Friday, Saturday, and Sunday, 5:00pm EDT

Good evening,

Tomorrow's call will take place at 5:00pm EDT. I am proposing that this call also take place at 5:00pm EDT on Saturday and Sunday. On Monday, we'll move the call back to 6:00pm EDT.

Please let me know if these times work for you.

Thanks
Ian

Nuclear science group conference call schedule:

Friday 3/25: 5:00pm-6:00pm EDT
Saturday 3/26: 5:00pm-6:00pm EDT
Sunday 3/27: 5:00pm-6:00pm EDT

AAAA/412

Monday 3/28: 6:00pm-7:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

From: Adams, Ian

Sent: Thursday, March 24, 2011 5:11 PM

To: Adams, Ian; Aoki, Steven; Binkley, Steve; Budnitz, Bob; Sheron, Brian; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Peterson, Per; Rolando Szilard; Steve Fetter; Lee, Richard

Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley

Subject: RE: Nuclear science group conference call - Thursday 6:00pm EDT

Good afternoon,
Just a reminder, this call will take place tonight at 6:00pm EDT.

Tomorrow's call will take place at 5:00pm EDT.

Nuclear science group conference call schedule:

Thursday 3/24: 6:00pm-7:00pm EDT

Friday 3/25: 5:00pm-6:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

From: Adams, Ian

Sent: Thursday, March 24, 2011 9:22 AM

To: Adams, Ian; Aoki, Steven; Binkley, Steve; Budnitz, Bob; Sheron, Brian; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Peterson, Per; Rolando Szilard; Steve Fetter; Lee, Richard

Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley

Subject: Nuclear science group conference call - Thursday 6:00pm EDT

Good morning,

Today's conference call will be at 6:00pm EDT tonight. For tomorrow (Friday), please let me know if 5:00pm-6:00pm EDT works for you.

Nuclear science group conference call proposed schedule:

Thursday 3/24: 6:00pm-7:00pm EDT

Friday 3/25: 5:00pm-6:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

Additionally, I have attached this morning's Japan sit rep. This information should not be shared or further distributed.

Thanks
Ian

<< File: Japan_Earthquake_Response_03242011_0600b.pdf >> << File: SITREP_MAR24 0600.docx >>

From: Adams, Ian
Sent: Wednesday, March 23, 2011 10:48 AM
To: Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Brian Sheron; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter; Lee, Richard
Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley
Subject: RE: Nuclear science group conference call - Wednesday 6:00pm EDT

Good morning,

The daily nuclear science group conference call is confirmed for 6:00pm-7:00pm today.

Due to scheduling conflicts, Thursday's call will need to move. It will now take place 6:00pm-7:00pm, same as today's call time.

Thanks,
Ian

Nuclear science group conference call schedule:

Wednesday 3/23: 6:00pm-7:00pm EDT

Thursday 3/24: 6:00pm-7:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

From: Adams, Ian
Sent: Tuesday, March 22, 2011 7:04 PM
To: Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Brian Sheron; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter
Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley
Subject: Nuclear science group conference call - Wednesday

Good evening,

We need to change the time of tomorrow's call to later in the day. Please let me know if 6:00pm EDT Wednesday and 5:00pm EDT Thursday would work for you.

Thanks,
Ian

Nuclear science group conference call - proposed schedule:

Wednesday: 6:00pm-7:00pm EDT

Thursday: 5:00pm-6:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

Lee, Richard

From: Lee, Richard
Sent: Friday, March 25, 2011 5:16 PM
To: 'powerss@crossnet.org'
Subject: FW: Science council presentation, 3/25
Attachments: 0325 Sec Briefing1-1.pptx

Today VGs. We need chemist, chemistry, chemical,.... very badly!! Otherwise, Per is our expert chemist!!

From: Binkley, Steve [<mailto:Steve.Binkley@science.doe.gov>]
Sent: Friday, March 25, 2011 4:53 PM
To: 'david.hobbs@srnl.doe.gov'; Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Sheron, Brian; Brinkman, Bill; DAgestino, Thomas; Dick Garwin; Dick Garwin; Harold Denton; Harold McFarlane; Hurlbut, Brandon; John Grossenbacher; John Holdren; Kelly, John E (NE); Koonin, Steven; Lyons, Peter; Owens, Missy; Per Peterson; Phil Finck; Poneman, Daniel; Lee, Richard; Rolando Szilard; SCHU; Steve Fetter
Subject: FW: Science council presentation, 3/25

From: Kelly, John E (NE)
Sent: Friday, March 25, 2011 4:51 PM
To: Binkley, Steve
Subject: FW: Science council

From: Kelly, John E (NE)
Sent: Friday, March 25, 2011 4:42 PM
To: NITSolutions
Subject: Science council

slides for today

Dr. John E. Kelly
Deputy Assistant Secretary for Nuclear Reactor Technologies
NE-7
U.S. Department of Energy
1000 Independence Ave. SW
Washington, DC 20585
phone: 202-586-5458
fax: 202-586-0541
mobile: (b)(6)

AAAA/413

Lee, Richard

From: Gauntt, Randall O [rogaunt@sandia.gov]
Sent: Friday, March 25, 2011 5:53 PM
To: Humphries, Larry Laron; Goldmann, Andrew S
Cc: Esmaili, Hossein; Lee, Richard; Tinkler, Charles; kcw@dycoda.com; Mark Leonard
Subject: RE: MELCOR Inquiry

I have been having Andrew Goldmann assemble a timeline from several sources. The TEPCO website issues several updates a day.

randy

From: Humphries, Larry Laron [llhumph@sandia.gov]
Sent: Friday, March 25, 2011 2:02 PM
To: Gauntt, Randall O
Cc: 'Hossein Esmaili'
Subject: FW: MELCOR Inquiry

FYI

-----Original Message-----

From: Bacon, David P. [mailto:DAVID.P.BACON@saic.com]
Sent: Friday, March 25, 2011 01:30 PM Mountain Standard Time
To: Humphries, Larry Laron
Cc: Bacon, David
Subject: MELCOR Inquiry

Larry -

I support the National Center for Medical Intelligence (NCMI),
a production facility for the Defense Intelligence Agency (DIA).
The MELCOR code request system is down (spot.infosyslabs.com
does not respond). Is there a way to get MELCOR other than
the on-line system?

If you could reply to all, I will get this both at my NCMI address
(which I cannot access except from the building) and also at my
SAIC address, which I can get anywhere - including nights and
weekends.

Perhaps even better, have you by chance put together a timeline

AAAA/414

of events in Japan and your best estimate of the release rate
of various isotopes as a function of time over the past two weeks?
I know that the NRC provided a source term to DOE / NARAC, but
they have not provided it to anyone else, so we have been trying
to build such a history independently. If you have already done so,
we would love to collaborate with you.

Thanks in advance.

P.S. I expect that you have been as busy as we have been!

Regards,

David P Bacon

Director, Center for Atmospheric Physics

Science Applications International Corporation

SAIC

M/S 2-4-7

1710 SAIC Dr.

McLean, VA 22102

(703) 676-4594 Office

(b)(6)

Residence

(b)(6)

Mobile

david.p.bacon@saic.com

OMEGA Web: <http://vortex.saic.com> <<http://vortex.saic.com/>>

The laws of physics are the laws of physics. You don't have to like them, but you will obey them. Rear Adm. Arch Macy

Lee, Richard

From: Michael Corradini [corradini@engr.wisc.edu]
Sent: Saturday, March 26, 2011 4:14 PM
To: Lee, Richard
Subject: RE: mark 1 containment - drywell

call my home where i am working - (b)(6)

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 "Lee, Richard" <Richard.Lee@nrc.gov>:

> Mike:
>
> Do you have a cell number that I can reach you?
>
> Richard
>
> -----Original Message-----
> From: Michael Corradini [mailto:corradini@engr.wisc.edu]
> Sent: Saturday, March 26, 2011 4:08 PM
> To: Lee, Richard
> Subject: RE: mark 1 containment - drywell
>
> Dear Richard - My student is doing calcs with both CORQUENCH and
> CORCON within MELCOR. I attach his first effort and is doing more now.
> Mike
> --
>
> 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 "Lee, Richard" <Richard.Lee@nrc.gov>:
>
>> Mike:
>>
>> Mitch has a stand-alone model that has features that has not been
>> incorporated into MELCOR. The CORCON package has not been changed
>> for a long time.
>>
>> We are in the process of review it for over-hauled since the OECD
>> MCCI2 project has just been concluded.
>>

AAAA/415

>> Richard
>>
>> -----Original Message-----
>> From: Michael Corradini [mailto:corradini@engr.wisc.edu]
>> Sent: Saturday, March 26, 2011 10:01 AM
>> To: krrobb@wisc.edu
>> Cc: Farmer, Mitchell T.
>> Subject: RE: mark 1 containment - drywell
>>
>> Dear Kevin -
>>
>> Clearly, Mitch is the expert on this, but I think this is a great
>> start to help out his efforts. I had only one general comment at this
>> time. If both computer models are saying that melt attack continues
>> at with 100% melt, at what fraction of the total core (25%, 50% or
>> 75%?) would the melt attack stop and we'd get coolability? That would
>> one of the first parametrics, I'd do.
>>
>> Nice Job!
>>
>> Mike
>>
>> --
>>
>> 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 "Kevin Robb" <krrobb@wisc.edu>:
>>
>>> Hello,
>>> Attached is a First Stab at some simulations for Unit 1 CORQUENCH
>>> predicts crust anchoring MELCOR exhibits some interesting behavior
>>> that needs reviewed Both predict continued ablation after 5 days of
>>> simulated time Unit 2&3 will be more aggressive if there's more fuel
>>> but the same spreading area.
>>>
>>> I'm committed to an outreach event tomorrow until 3 or 4. I'll pick
>>> up again after that.
>>>
>>> Kevin
>>>
>>>
>>> On 03/25/11, Michael Corradini wrote:
>>>> we can do this within MELCOR too - kevin has done this for his
>>>> thesis work
>>>> --
>>>>
>>>> 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>:
>>>>
>>>> >Kevin,
>>>> >
>>>> >The containment volume is probably down to something like a few
>>>> 1000 m**3. If you could take the steaming rate and do some
>>>> parametrics on containment pressurization rate assumeing no
>>>> condensation that might be useful.
>>>> >Thanks
>>>> >Mitch
>>>> >
>>>> >-----Original Message-----
>>>> >From: Farmer, Mitchell T.
>>>> >Sent: Friday, March 25, 2011 7:02 AM
>>>> >To: 'corradini@cae.wisc.edu'; Basu, Sudhamay
>>>> >Cc: RICHARD Y LEE; binderJL@ornl.gov; Robb, Kevin Richard
>>>> >Subject: RE: mark 1 containment - drywell
>>>> >
>>>> >Hi Mike,
>>>> >
>>>> >If keving could run some corquench analysis I think that would be
>>>> good. Here is what I was going to do and if Kevin can do it that
>>>> would be nice.
>>>> >
>>>> >Unit 1, 1 dry, 1 wet (water there at t=0. Assume full core load
>>>> relocates into the 6 m dia. Pedestal and go from there. I'd assume
>>>> at least 90 % cladding oxidized. (Can't be much there). Decay
>>>> heat starting 14 days out.
>>>> >
>>>> >Unit 2, same thing.
>>>> >
>>>> >Maybe some parametrics on eruptions; this is siliceous. Kevin,
>>>> give me a call/eamil if you want to talk about specifics.
>>>> >Mitch
>>>> >
>>>> >
>>>> >
>>>> >-----Original Message-----
>>>> >From: Michael Corradini
>>>> >[mailto:corradini@engr.wisc.edu](javascript:main.compose()
>>>> >Sent: Friday, March 25, 2011 6:35 AM
>>>> >To: Basu, Sudhamay
>>>> >Cc: RICHARD Y LEE; Farmer, Mitchell T.
>>>> >Subject: RE: mark 1 containment - drywell
>>>> >
>>>> >mitch - we can help (kevin and i) as needed
>>>> >--
>>>> >
>>>> >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 "Basu, Sudhamay" <Sudhamay.Basu@nrc.gov>:
 >>>> >
 >>>> >>This morning's news about possible breach of the reactor vessel
 >>>> >>makes this exercise very timely. While steam explosion
 >>>> >>energetics is looked at, we also need to think about MCCI and
 >>>> >>ex-vessel coolability. I understand Mitch may be doing some calcs.
 >>>> >>
 >>>> >>From: Michael Corradini [corradini@engr.wisc.edu]
 >>>> >>Sent: Friday, March 25, 2011 12:00 AM
 >>>> >>To: RICHARD Y LEE
 >>>> >>Cc: Basu, Sudhamay
 >>>> >>Subject: Re: mark 1 containment - drywell
 >>>> >>
 >>>> >>Richard - Thanks for the schematic. I completed the nominal calcs.
 >>>> >>Weak explosion
 >>>> >>--
 >>>> >>
 >>>> >>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 "RICHARD Y LEE" (b)(6)
 >>>> >>
 >>>> >>>Mike:
 >>>> >>>
 >>>> >>>Please see if the attached figure provides dimension info. on
 >>>> >>>Fukushima.
 >>>> >>>
 >>>> >>>Richard
 >>>> >>>
 >>>> >>
 >>>> >>
 >>>> >>
 >>>> >>
 >>>> >>
 >>>> >
 >>>> >
 >>>> >
 >>>> >
 >>>> >
 >>>>
 >>>>
 >>>>
 >>>
 >>
 >>
 >>
 >
 >
 >

Lee, Richard

From: Lee, Richard
Sent: Saturday, March 26, 2011 12:12 PM
To: Gibson, Kathy
Subject: Re: Sharing info. with DOE Science Council

Kathy:

This is our anticipation of the next question after the MCCI.
We have a contract with Mike and the analysis is minor stuff.

Sent from nrc blackberry

(b)(6)

Richard Lee

----- Original Message -----

From: Gibson, Kathy
To: Lee, Richard
Sent: Sat Mar 26 10:36:30 2011
Subject: Re: Sharing info. with DOE Science Council

As a side note, did somebody ask us to do these calculations and who is paying for corradini's work?

----- Original Message -----

From: Lee, Richard
To: Gibson, Kathy
Sent: Sat Mar 26 09:09:19 2011
Subject: Sharing info. with DOE Science Council

Dear Kathy:

Sud and I had asked Mike Corradini to perform an assessment on Fuel coolant interaction analysis using the NRC TEXAS code. The base calculation (which Randy, Dana, Mike Salay, Sud and I) think could be perhaps the worst case scenario of melt (with stainless steel) coming out of one control rod drive (CRD) hole into a saturated pool of water about 6-7ft from the melt expelling from the CRD hole. The load calculated is not showing a problem in breaching the primary containment structure (for e.g, the liner - assuming that it is still in reasonable condition). Additional parametric studies are ongoing. I have provided the preliminary assessment to Mike Salay and Hossein already.

This is the case where the water did not completely flooded the reactor cavity. If the cavity is completely flooded, the FCI will not be an issue. I think, flooding the reactor cavity is being considered. I know MCCI analysis been carried out by Mitch Farmer (ANL) - which is a DOE directed analysis.

Your advise (and Brian Sheron one if you need to consult with him) is sought for us to share this FCI analysis with the Science Council through John Kelly This will give us some visibility on the pro-active analyses that are on-going at different labs directed by DOE.

Richard

AAAA/416

Lee, Richard

From: Lee, Richard
Sent: Saturday, March 26, 2011 3:31 PM
To: 'powerss@crossnet.org'
Subject: FW: Corrected NRC Reactor Safety Team Assessment 1400 EDT 3/25/11
Attachments: 03-25-11 1400 RST Assessment Document REV1 - 2030.docx

fyi

From: Kelly, John E (NE) [mailto:JohnE.Kelly@Nuclear.Energy.Gov]
Sent: Friday, March 25, 2011 10:56 PM
To: DL-NITSolutions
Subject: FW: Corrected NRC Reactor Safety Team Assessment 1400 EDT 3/25/11

NRC report

From: Versluis, Rob
Sent: Friday, March 25, 2011 10:39 PM
To: DL-NERT-All; 'rst01b.hoc@nrc.gov'
Subject: Fw: Corrected NRC Reactor Safety Team Assessment 1400 EDT 3/25/11

Rob Versluis +1-301-903-1890(o) (b)(6)

(m)

From: RST01 Hoc <RST01.Hoc@nrc.gov>
To: RST01 Hoc <RST01.Hoc@nrc.gov>; Huckaby, Thomas S.(INPO) <HuckabyTS@INPO.org>; Garchow, David F.(INPO) <GarchowDF@inpo.org>; jheishman@epri.com <jheishman@epri.com>; hernando.madronero@ge.com <hernando.madronero@ge.com>; GE.HitachiNuclearResponseTeam@ge.com <GE.HitachiNuclearResponseTeam@ge.com>; INPOERCTech <inpoerctech@inpo.org>; Ross-Lee, MaryJane <MaryJane.Ross-Lee@nrc.gov>; ET07 Hoc <ET07.Hoc@nrc.gov>; Hoc, PMT12 <PMT12.Hoc@nrc.gov>; HOO Hoc <HOO.Hoc@nrc.gov>; LIA11 Hoc <LIA11.Hoc@nrc.gov>; Versluis, Rob
Cc: Nakanishi, Tony <Tony.Nakanishi@nrc.gov>; Cook, William <William.Cook@nrc.gov>; Casto, Chuck <Chuck.Casto@nrc.gov>; Devercelly, Richard <Richard.Devercelly@nrc.gov>; Foster, Jack <Jack.Foster@nrc.gov>; Trapp, James <James.Trapp@nrc.gov>; Monninger, John <John.Monninger@nrc.gov>; Smith, Brooke <Brooke.Smith@nrc.gov>; Foggie, Kirk <Kirk.Foggie@nrc.gov>
Sent: Fri Mar 25 21:45:18 2011
Subject: Corrected NRC Reactor Safety Team Assessment 1400 EDT 3/25/11

All,

Please find attached a corrected version of the document that was sent out at 1500 EDT on 3/25/11. We're issuing this correction to put the document into the correct context.

The purpose of this document is to provide the NRC Reactor Safety Team's assessment and recommendations for the Fukushima-Daiichi reactors to the USNRC team in Japan. Our assessments and recommendations are based on the best available technical information from the organizations listed above. We acknowledge that the information may be preliminary and is subject to change.

If you have any questions regarding the revision, please call the RST via the HOOs at 301-816-5100.

Regards,

Brett Rini

AAAA/417

RST Coordinator

From: RST01 Hoc

Sent: Friday, March 25, 2011 3:01 PM

To: 'Huckaby, Thomas S.(INPO)'; Garchow, David F.(INPO); jheishman@epri.com; hernando.madronero@ge.com; GE.HitachiNuclearResponseTeam@ge.com; INPOERCTech; Ross-Lee, MaryJane; ET07 Hoc; Hoc, PMT12; HOO Hoc; LIA11 Hoc

Subject: NRC Reactor Safety Team Assessment 1400 EDT 3/25/11

All;

Please find the 1400 EDT NRC RST Assessment attached. I have included a red-line version to show changes, and a clean version.

Regards,
Eric Thomas
NRC RST

From: Stahl, Eric
Sent: Sunday, March 27, 2011 8:22 AM
To: LIA03 Hoc
Subject: RE: BB # Confirmation

Hi -

Yes, that number is correct.

Thanks,
Eric

From: LIA03 Hoc
Sent: Sunday, March 27, 2011 6:20 AM
To: Stahl, Eric
Subject: BB # Confirmation

Hi, Eric,
Is your International BB number (b)(6) Please confirm. Thanks!
Best,
Elizabeth

AAAA/418

Lee, Richard

From: Lee, Richard
Sent: Sunday, March 27, 2011 10:57 PM
To: danapowers@msn.org; dapower@sandia.gov
Subject: FW: Spent Fuel Pool Level Measurement

I certainly do not know what Brian is referring to.

From: SCHU [SCHU@hq.doe.gov]
Sent: Sunday, March 27, 2011 8:10 PM
To: Sheron, Brian; McFarlane, Harold
Cc: Larzelere, Alex; DL-NITSolutions
Subject: RE: Spent Fuel Pool Level Measurement

Can you tell us how they are measuring the levels, and whether the measurement can be done remotely and continuously? We need to figure out how to make those measurements in case one has to abandon ship for a few weeks. We also have to make sure that the spent fuel pools can be topped off remotely.

Steven Chu
Department of Energy
From: Sheron, Brian
Sent: Sunday, March 27, 2011 4:50 PM
To: McFarlane, Harold
Cc: Larzelere, Alex; DL-NITSolutions
Subject: RE: Spent Fuel Pool Level Measurement

I have also been told that they have SFP level measurement in several of the pools.

From: Harold Finley McFarlane [mailto:Harold.McFarlane@inl.gov]
Sent: Sunday, March 27, 2011 4:42 PM
To: Sheron, Brian
Cc: Larzelere, Alex; DL-NITSolutions
Subject: RE: Spent Fuel Pool Level Measurement

Brian,
Alex had to leave, but yes, the siphoning issue has to be addressed. We thought that suggesting simple methods that would be easy to implement with materials on hand or readily purchased. There is no attempt to engineer either system, since we assume that can be done on site once they assemble the materials.
harold

Harold F McFarlane
Deputy Associate Laboratory Director
Harold F McFarlane
Deputy Associate Laboratory Director
Idaho National Laboratory

PO Box 1625, Idaho Falls, ID 83415-3855 USA ID office: +1-208-526-3256 [mobile: (b)(6)]

(b)(6)

fax: +1-208-526-2930 email: harold.mcfarlane@inl.gov Technical Director, Generation-IV
International Forum US Dept. of Energy; Office of Nuclear Energy DOE office: +1-202-586-9175
DOE email: harold.mcfarlane@nuclear.energy.gov
"Sheron, Brian" <Brian.Sheron@nrc.gov>

03/27/2011 02:29 PM

AAAA/419

To

"Larzelere, Alex" <alex.larzelere@nuclear.energy.gov>, DL-NITsolutions <DL-NITsolutions@nnsa.doe.gov>

cc

Subject

RE: Spent Fuel Pool Level Measurement

The most likely scenario is that the bottom of the pool is filled with debris, so whatever is stuck into the pool can only be submerged to the level of the debris bed.

The water in the pool is highly radioactive. Won't it siphon back in the tube and contaminate the gauge?

From: Larzelere, Alex [mailto:alex.larzelere@nuclear.energy.gov]
Sent: Sunday, March 27, 2011 3:42 PM
To: DL-NITsolutions
Subject: Spent Fuel Pool Level Measurement

Everybody,

After some conversation with the Secretary today, it was decided that DOE would suggest two methods for measuring the water level in the SFP (dual hose and bubbler) to the Japanese. Attached is a write up of those two methods.

Please look this over in anticipation of the 5pm call and be ready with any comments, questions or edits.

Thanks,

Alex

Alex R. Larzelere
Director, Advanced Modeling and Simulation Office Office of Nuclear Energy (NE-71) U.S.
Department of Energy
202-586-1906
Alex.Larzelere@nuclear.energy.gov<mailto:Alex.Larzelere@nuclear.energy.gov>

[cid:image001.jpg@01CBECBB.1620D100]

Lee, Richard

From: Lee, Richard
Sent: Sunday, March 27, 2011 11:24 AM
To: rogaunt@sandia.gov
Subject: FW: source term question

Randy:

Please address the following inquiry.

Richard

From: Gibson, Kathy
Sent: Sunday, March 27, 2011 11:19 AM
To: Lee, Richard
Cc: Uhle, Jennifer; Sheron, Brian; Santiago, Patricia
Subject: Fw: source term question

I'm happy to see the Ops Center finally questioning the RASCAL source term.

Richard, does your staff or contractors have any insights to add to this question or realistic source terms in general for Fukushima?

----- Original Message -----

From: Santiago, Patricia
To: Gibson, Kathy; Elkins, Scott
Sent: Sun Mar 27 10:51:07 2011
Subject: Fw: source term question

Sent from an NRC BlackBerry

Patricia Santiago

(b)(6)

----- Original Message -----

From: Schaperow, Jason
To: Schaperow, Jason; Tinkler, Charles
Cc: (b)(6); Santiago, Patricia
Sent: Sun Mar 27 07:49:38 2011
Subject: source term question

I received a call this morning at 0600 from Lou Brandon from the NRC Operations Center. He asked whether it was reasonable to have a reduction in environmental release from 22% to 1% by delaying the start of drywell leakage by 23 hours. He gave the following background: They have done multiple RASCAL runs since the Fukushima accident started. They provided source terms for these runs to the White House. A White House adviser asked about the reduction from 22% to 1%.

Two of the calculations were as follows:

Case 1. Release NUREG-1465 source term into the drywell. Leak it from drywell to environment at 100%/day. The drywell leakage starts at the same time as core damage starts. Environmental release of cesium is 22%.

Case 2. Release NUREG-1465 source term into the drywell. Leak it from drywell to environment at 100%/day. The drywell leakage starts 23 hours after core damage starts. Environmental release of cesium is 1%. The 23-hour delay was the time between the start of

core damage at one of the Fukushima reactors and the time of the hydrogen burn in its reactor building.

NUREG-1150, App. B, page 53 states that "a release that starts a day or more after onset of core damage or 10 hours or more after vessel breach would be expected to have small releases. For a late release, the release fractions are noble gases (1.0), iodine (4.4E-3), cesium (8.6E-8)."

The RASCAL model for deposition in containment is as follows:

For $t=0$ to 1.75 hours, $\exp(-1.2t)$ - corresponds to a multiplication of the release of 0.12

For $t=1.75$ to 2.25 hours, $\exp(-0.64t)$ - corresponds to a multiplication of the release by .76

After 2.25 hours, $\exp(-0.15t)$ - corresponds to a multiplication of release by 0.038

I said that a reduction from 22% to 1% was not unreasonable for 23 hours delay in containment failure.

I asked whether the RASCAL model was based on NUREG/CR-6189, "A Simplified Model of Aerosol Removal by Natural Processes in Reactor Containments," D.A. Powers, July 1996. He said that it was based on NUREG-1150.

I said that that the time of the release from the containment is not necessarily the time of the hydrogen burn. The operators may have vented the containment into the reactor building much earlier. We would have a better basis for our release start time, if we could find out when the operators vented the containment.

Lee, Richard

From: Lee, Richard
Sent: Sunday, March 27, 2011 11:32 AM
To: (b)(6)
Subject: FW: source term question

fyi

From: Gibson, Kathy
Sent: Sunday, March 27, 2011 11:19 AM
To: Lee, Richard
Cc: Uhle, Jennifer; Sheron, Brian; Santiago, Patricia
Subject: Fw: source term question

I'm happy to see the Ops Center finally questioning the RASCAL source term.

Richard, does your staff or contractors have any insights to add to this question or realistic source terms in general for Fukushima?

----- Original Message -----

From: Santiago, Patricia
To: Gibson, Kathy; Elkins, Scott
Sent: Sun Mar 27 10:51:07 2011
Subject: Fw: source term question

Sent from an NRC BlackBerry
Patricia Santiago

(b)(6)

----- Original Message -----

From: Schaperow, Jason
To: Schaperow, Jason; Tinkler, Charles
Cc: (b)(6); Santiago, Patricia
Sent: Sun Mar 27 07:49:38 2011
Subject: source term question

I received a call this morning at 0600 from Lou Brandon from the NRC Operations Center. He asked whether it was reasonable to have a reduction in environmental release from 22% to 1% by delaying the start of drywell leakage by 23 hours. He gave the following background: They have done multiple RASCAL runs since the Fukushima accident started. They provided source terms for these runs to the White House. A White House adviser asked about the reduction from 22% to 1%.

Two of the calculations were as follows:

Case 1. Release NUREG-1465 source term into the drywell. Leak it from drywell to environment at 100%/day. The drywell leakage starts at the same time as core damage starts. Environmental release of cesium is 22%.

Case 2. Release NUREG-1465 source term into the drywell. Leak it from drywell to environment at 100%/day. The drywell leakage starts 23 hours after core damage starts. Environmental release of cesium is 1%. The 23-hour delay was the time between the start of core damage at one of the Fukushima reactors and the time of the hydrogen burn in its reactor building.

NUREG-1150, App. B, page 53 states that "a release that starts a day or more after onset of core damage or 10 hours or more after vessel breach would be expected to have small releases.

For a late release, the release fractions are noble gases (1.0), iodine ($4.4\text{E-}3$), cesium ($8.6\text{E-}8$)."

The RASCAL model for deposition in containment is as follows:

For $t=0$ to 1.75 hours, $\exp(-1.2t)$ - corresponds to a multiplication of the release of 0.12

For $t=1.75$ to 2.25 hours, $\exp(-0.64t)$ - corresponds to a multiplication of the release by .76

After 2.25 hours, $\exp(-0.15t)$ - corresponds to a multiplication of release by 0.038

I said that a reduction from 22% to 1% was not unreasonable for 23 hours delay in containment failure.

I asked whether the RASCAL model was based on NUREG/CR-6189, "A Simplified Model of Aerosol Removal by Natural Processes in Reactor Containments," D.A. Powers, July 1996. He said that it was based on NUREG-1150.

I said that that the time of the release from the containment is not necessarily the time of the hydrogen burn. The operators may have vented the containment into the reactor building much earlier. We would have a better basis for our release start time, if we could find out when the operators vented the containment.

Lee, Richard

From: Lee, Richard
Sent: Sunday, March 27, 2011 3:31 PM
To: 'Dana Powers'
Subject: FW: Nuclear science group conference call - Sunday, 5:00pm EDT

fyi

From: Adams, Ian [mailto:Ian.Adams@Hq.Doe.Gov]
Sent: Sunday, March 27, 2011 2:46 PM
To: Adams, Ian; Aoki, Steven; Binkley, Steve; Budnitz, Bob; Sheron, Brian; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Peterson, Per; Szilard, Ronaldo; Steve Fetter; Lee, Richard; Lee, Richard; Owens, Missy
Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6); Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley
Subject: Nuclear science group conference call - Sunday, 5:00pm EDT

Good afternoon,

Just a reminder, tonight's call will be at 5:00pm EDT.

Monday's call needs to shift slightly later – it will now be at 7:00pm EDT.
Tuesday's call will take place at 6:00pm EDT.

Please let me know if these times do not work for you.

Thanks,
Ian

Nuclear science group conference call schedule:

Sunday 3/27: 5:00pm-6:00pm EDT
Monday 3/28: 7:00pm-8:00pm EDT
Tuesday 3/29: 6:00pm-7:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

From: Adams, Ian
Sent: Thursday, March 24, 2011 7:25 PM
To: Adams, Ian; Aoki, Steven; Binkley, Steve; Budnitz, Bob; Sheron, Brian; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Peterson, Per; Rolando Szilard; Steve Fetter; Lee, Richard; Lee, Richard
Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6); Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley
Subject: Nuclear science group conference call - Friday, Saturday, and Sunday, 5:00pm EDT

Good evening,

Tomorrow's call will take place at 5:00pm EDT. I am proposing that this call also take place at 5:00pm EDT on Saturday and Sunday. On Monday, we'll move the call back to 6:00pm EDT.

Please let me know if these times work for you.

Thanks
Ian

Nuclear science group conference call schedule:

Friday 3/25: 5:00pm-6:00pm EDT
Saturday 3/26: 5:00pm-6:00pm EDT
Sunday 3/27: 5:00pm-6:00pm EDT
Monday 3/28: 6:00pm-7:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

From: Adams, Ian

Sent: Thursday, March 24, 2011 5:11 PM

To: Adams, Ian; Aoki, Steven; Binkley, Steve; Budnitz, Bob; Sheron, Brian; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Peterson, Per; Rolando Szilard; Steve Fetter; Lee, Richard

Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley

Subject: RE: Nuclear science group conference call - Thursday 6:00pm EDT

Good afternoon,
Just a reminder, this call will take place tonight at 6:00pm EDT.

Tomorrow's call will take place at 5:00pm EDT.

Nuclear science group conference call schedule:

Thursday 3/24: 6:00pm-7:00pm EDT
Friday 3/25: 5:00pm-6:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

From: Adams, Ian

Sent: Thursday, March 24, 2011 9:22 AM

To: Adams, Ian; Aoki, Steven; Binkley, Steve; Budnitz, Bob; Sheron, Brian; Garwin, Dick (EOP); Garwin, Dick (IBM); Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Peterson, Per; Rolando Szilard; Steve Fetter; Lee, Richard

Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley

Subject: Nuclear science group conference call - Thursday 6:00pm EDT

Good morning,

Today's conference call will be at 6:00pm EDT tonight. For tomorrow (Friday), please let me know if 5:00pm-6:00pm EDT works for you.

Nuclear science group conference call proposed schedule:

Thursday 3/24: 6:00pm-7:00pm EDT

Friday 3/25: 5:00pm-6:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

Additionally, I have attached this morning's Japan sit rep. This information should not be shared or further distributed.

Thanks

Ian

<< File: Japan_Earthquake_Response_03242011_0600b.pdf >> << File: SITREP_MAR24 0600.docx >>

From: Adams, Ian

Sent: Wednesday, March 23, 2011 10:48 AM

To: Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Brian Sheron; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter; Lee, Richard

Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley

Subject: RE: Nuclear science group conference call - Wednesday 6:00pm EDT

Good morning,

The daily nuclear science group conference call is confirmed for 6:00pm-7:00pm today.

Due to scheduling conflicts, Thursday's call will need to move. It will now take place 6:00pm-7:00pm, same as today's call time.

Thanks,

Ian

Nuclear science group conference call schedule:

Wednesday 3/23: 6:00pm-7:00pm EDT

Thursday 3/24: 6:00pm-7:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

From: Adams, Ian

Sent: Tuesday, March 22, 2011 7:04 PM

To: Adams, Ian; Aoki, Steven; Binkley, Steve; Bob Budnitz; Brian Sheron; Dick Garwin; Dick Garwin; Finck, Phillip; Grossenbacher, John (INL); Kelly, John E (NE); Koonin, Steven; Lyons, Peter; McFarlane, Harold; Per Peterson; Rolando Szilard; Steve Fetter

Cc: Narendra, Blake; Fitzgerald, Paige; (b)(6) Claxton, Dionne (CONTR); Chambers, Megan (S4); Smith, Haley

Subject: Nuclear science group conference call - Wednesday

Good evening,

We need to change the time of tomorrow's call to later in the day. Please let me know if 6:00pm EDT Wednesday and 5:00pm EDT Thursday would work for you.

Thanks,
Ian

Nuclear science group conference call - proposed schedule:

Wednesday: 6:00pm-7:00pm EDT

Thursday: 5:00pm-6:00pm EDT

Conference call information:

Please dial into (b)(6)

No PIN is needed.

Bensi, Michelle

From: Bensi, Michelle
Sent: Monday, March 28, 2011 2:44 PM
To: Kammerer, Annie
Subject: RE: status of documents
Attachments: March2011 Nuclear Event in Japan - Seismic Report Outline _v03_28_2011.docx

I have attached an idea for the outline for the revised document. Let me know your thoughts. Do you object to any of the additions I made based on recent emails? If not, I can go ahead and start working with the electronic document.

Thanks,
Shelby

From: Kammerer, Annie
Sent: Monday, March 28, 2011 1:46 PM
To: Bensi, Michelle
Subject: RE: status of documents

I'm doing hand edits and can provide you those as well.

Dr. Annie Kammerer, P.E.
US NRC/RES/DE
(301) 251-7695 Office

(b)(6)

From: Bensi, Michelle
Sent: Monday, March 28, 2011 9:49 AM
To: Kammerer, Annie
Subject: status of documents

Hi Annie,
Please let me know the status of the documents I have sent you. I can now begin work on the rearranging/editing/etc. of the large seismic Q&A document. However, I am not sure if you have a recent version that you've gone through and if you've made changes to it. For now, I will work on paper, but it would be more efficient if I can work electronically. However, I don't want to have multiple version of the document floating around.

Thanks,
Shelby

AAAA/423

1. **Forward**
2. **General Information (Background info; static info)**
 - 2.1. Ground motion
 - 2.2. Seismic Design
3. **Seismic Design of US nuclear plants (Static information)**
 - 3.1. **Power generation components**
 - 3.1.1. Ground shaking
 - 3.1.2. Tsunami
 - 3.1.3. Fire
 - 3.1.4. Flood
 - 3.1.5. Plant-specific questions
 - 3.1.5.1. SONGS
 - 3.1.5.2. Diablo Canyon
 - 3.1.5.3. Indian Point
 - 3.2. **Spent Fuel Pools**
 - 3.2.1. Ground shaking
 - 3.2.2. Tsunami
 - 3.2.3. Fire
 - 3.2.4. Flood
 - 3.3. **Fact Sheets**
 - 3.3.1. Summarization of NRC's regulatory framework for seismic safety
 - 3.3.1.1. High-level overview
 - 3.3.1.2. Policy-work version
 - 3.3.1.3. Cliff notes
 - 3.3.2. Summarization of NRC's regulatory framework for tsunami
 - 3.3.3. Summarization of NRC's regulatory framework for flooding
 - 3.3.4. Seismic considerations for US nuclear plants
 - 3.3.4.1. Seismic zones
 - 3.3.4.2. Seismicity of the Central and Eastern US
 - 3.3.4.3. Seismic Considerations of Western US nuclear plant sites
 - 3.3.4.4. US Portable Array Info
4. **Other design considerations (Static information)**
 - 4.1. **Other extreme events (hurricanes, flooding, blizzard, tornados)**
 - 4.2. **Extreme accident management**
 - 4.2.1. Defense-in-Depth
 - 4.2.2. Emergency Preparedness
 - 4.3. **Station Blackout**
 - 4.4. **Factsheets**
 - 4.4.1. B.5.b
 - 4.4.2. Station Blackout Rule
5. **Ongoing NRC activities related to seismic risk (static and dynamic portions)**
 - 5.1. GI-199
 - 5.2. SOARCA

5.3. Other programs

5.4. Factsheets

5.4.1. GI-199

6. March 11, 2011 Earthquake in Japan (dynamic information)

6.1. Information about the event

6.2. Information about Japanese NPP (including design)

6.2.1. Japanese design vs. demands from the EQ

6.3. Implications of events in Japan US Plants ("Could it happen here?" questions)

6.4. Implications of events in Japan on NRC activities ("What is the NRC going to do questions")

6.4.1. Seismic design of US plants

6.4.1.1. Ground-shaking

6.4.1.2. Tsunami

6.4.1.3. Fire

6.4.1.4. Flood

6.4.1.5. Plant-specific questions

6.4.1.5.1. Songs

6.4.1.5.2. Diablo Canyon

6.4.1.5.3. Indian Point

6.4.2. Other design considerations

6.5. Fact Sheets

6.5.1. Tsunami Assessment method for nuclear plants in Japan

6.5.2. Summarization for Seismological Information from Regional Instrumentation in Japan

7. Acronyms

8. Definitions

Lee, Richard

From: Lee, Richard
Sent: Monday, March 28, 2011 10:23 PM
To: Parks, Cecil V.
Subject: RE: Support for Japan - SFP Criticality Potential Update

Too late, I have already ask Rob Taylor to find out about the SS vs aluminum and combination of unborated and high density rack. You have been cc: in the e-mail. Please use the e-mail to ask more precise questions (whatever John comes up with) as needed.

From: Parks, Cecil V. [parkscv@ornl.gov]
Sent: Monday, March 28, 2011 10:17 PM
To: Lee, Richard
Subject: RE: Support for Japan - SFP Criticality Potential Update

John is going to handle asking those questions clearly in e-mail he is about to send out. One thing that I did not note was that if fresh water flooding did cause a criticality, I can not imagine much of a consequence.

-----Original Message-----

From: Lee, Richard [mailto:Richard.Lee@nrc.gov]
Sent: Monday, March 28, 2011 10:14 PM
To: Parks, Cecil V.
Subject: RE: Support for Japan - SFP Criticality Potential Update

Cecil:

Thanks for the info. Glad that he is await and not contributing to the increasing population in U.S.

I can asked (1) whether the racks are made of aluminum or SS, and (2) confirm the that unborated and high-density combination is been used in the pool . Frankly, I think one can continue to keep expressing concern on potential criticality without any clue what is happening in the pool.

Richard

From: Parks, Cecil V. [parkscv@ornl.gov]
Sent: Monday, March 28, 2011 9:38 PM
To: Lee, Richard
Cc: Aissa, Mourad; Wagner, John C.
Subject: RE: Support for Japan - SFP Criticality Potential Update

He started working on it 5 minutes ago when I called to wake him up. John and I have discussed. All of this info is consistent with what we have learned. However, one missing component is the rack material - SS or Aluminum? If aluminum, more likely to have damaged racks due to high temp. Concern is not with fresh fuel (lots of Gd loading) but with 1st batch fuel since that could be at peak reactivity due to burn-out of Gd. Other question for me is that we've heard they were high-density racks - but unborated and high-density?

If safety case based on same process followed by NRC, it is very hard to see circumstances where one would lose the 5% delta-k margin. Shifting racks and damaged fuel could potentially cause some increase in k, but hard to see 5%.

John is going to send a (I'm sure) better e-mail back to larger list of folks with these observations and questions.

Glad to see you are on e-mail so late at night:-)

Cecil

-----Original Message-----

From: Lee, Richard [mailto:Richard.Lee@nrc.gov]
Sent: Monday, March 28, 2011 9:25 PM
To: Parks, Cecil V.
Cc: Aissa, Mourad
Subject: FW: Support for Japan - SFP Criticality Potential Update
Importance: High

Hi, Cecil:

Is John working on this, or (b)(6)? Between now and Tuesday 10:00 am EST, there is 12 hours left for him to come up with an answer.

Richard

From: Carlson, Donald
Sent: Monday, March 28, 2011 9:13 PM
To: Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert
Subject: RE: Support for Japan - SFP Criticality Potential Update

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1st cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool. (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

Question: Do we now see a need to modify or expand the above technical opinion? If so, how?

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,
Don

Donald E. Carlson
NRO/ARP/ARB1
Cell: (b)(6)
Office: 301-415-0109

From: Taylor, Robert
Sent: Monday, March 28, 2011 6:59 PM
To: Carlson, Donald; Brown, Frederick
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated
Switching to fresh water injection on 3/29 Shutdown last November with 1/3 of the core offload being 1st cycle fuel
204 fresh fuel assemblies were present in the pool Japanese concerns that the racks may have shifted.
Fuel damage due to uncovering

Regards,
Rob

From: Carlson, Donald
Sent: Monday, March 28, 2011 6:23 PM
To: Taylor, Robert; Brown, Frederick
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John
Subject: RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI - When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,
Don

From: Taylor, Robert
Sent: Monday, March 28, 2011 5:59 PM
To: Carlson, Donald; Brown, Frederick
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

From: Carlson, Donald
Sent: Monday, March 28, 2011 1:07 PM
To: Brown, Frederick
Cc: Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher
Subject: RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----

From: Carlson, Donald
Sent: Monday, March 28, 2011 9:30 AM
To: Brown, Frederick
Cc: Taylor, Robert; Scott, Michael
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick
Sent: Sunday, March 27, 2011 9:11 PM
To: Carlson, Donald
Cc: Taylor, Robert; Scott, Michael
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,
Fred

Lee, Richard

From: Lee, Richard
Sent: Monday, March 28, 2011 11:11 AM
To: Wagner, Katie
Subject: FW: MELCOR Calculations for SFP #4

Please log in.
Thx.

From: Arndt, Steven
Sent: Monday, March 28, 2011 10:29 AM
To: Lee, Richard
Subject: Fw: MELCOR Calculations for SFP #4

Richard,

Sorry for not cc you on the below.

Sent from a NRC blackberry
Steven Arndt

(b)(6)

From: Arndt, Steven
To: Tinkler, Charles; Marksberry, Don; Schaperow, Jason
Sent: Mon Mar 28 10:02:44 2011
Subject: MELCOR Calculations for SFP #4

Folks,

I got a tasking from the ET/RST to run down the status of the MELCOR Calculations on Unit #4 SFP source term. There seems to be some confusion as to which calculation is being used. Can I get one of you on to call me around 11:00 AM in my office to discuss this. (301-415-6502)

Thanks,

Steven

AAAA/425

Lee, Richard

From: Lee, Richard
Sent: Monday, March 28, 2011 1:19 PM
To: Gavrilas, Mirela
Subject: RE: TASKING: NRR-DCI Salt Water Effects and Drywell Pressure

Thx, Mirela.
Richard

From: Gavrilas, Mirela
Sent: Monday, March 28, 2011 10:14 AM
To: Lee, Richard
Subject: FW: TASKING: NRR-DCI Salt Water Effects and Drywell Pressure

From: Gavrilas, Mirela
Sent: Monday, March 28, 2011 10:11 AM
To: Richards, Stuart
Cc: Hogan, Rosemary; Graves, Herman; Case, Michael; Pires, Jose; Csontos, Aladar; Tregoning, Robert
Subject: RE: TASKING: NRR-DCI Salt Water Effects and Drywell Pressure

Here's a bit of info merged between Jose and me.

NUREG/CR-5640 gives MK-I design pressures 0.38-0.42 MPa (55-61 psi). My book notes, however, that the Japanese increased containment free volume in some of their MK-Is. 0.40 MPa (58 psi) should be a good reference value.

Two pressures are of interest when considering venting: leakage pressure and rupture pressure. According to NUREG/CR-6920, the leakage pressure for the wetwell is around 0.8 MPa (116 psi) and for the drywell it is around 1.0 MPa (145 psi). The rupture pressure is about 1.0-1.2 MPa, which is consisted to 2.5-3x design pressure. Note that these pressures are also temperature dependent, but that dependency is weak until about 200 deg. C (400 deg. F).

While carbon steel is not highly vulnerable to cracking, the salt can increase the crevice/pitting corrosion so some degradation of the values listed above can be expected. The once you have the conditions for localized corrosion, the rate can be as high as 10 cm/year (4 in/year). The containment shell thickness for MK-Is varies from 0.75-1.75 in (1.9-4.5 cm) at various locations. NUREG/CR-5640 estimates that localized corrosion of up to 50% of the thickness reduces the leakage and rupture pressure by 10-20%.

In other words, at this point, using 0.8 MPa (116 psi) as leakage pressure and 1.0 MPa (145 psi) as rupture pressure in determining if and when to vent should be appropriate.

Please let us know if you would like us to further refine these numbers.

M.

From: Richards, Stuart
Sent: Monday, March 28, 2011 9:38 AM
To: Csontos, Aladar; Tregoning, Robert

AAA/426

Cc: Gavrilas, Mirela; Hogan, Rosemary; Graves, Herman; Case, Michael
Subject: RE: TASKING: NRR-DCI Salt Water Effects and Drywell Pressure

Rob/Al

We were looking at Mark I containment issues on Friday. NUREG-1150 (1990), on page 4-12, states that the Peach Bottom Mark I containment design pressure is 56 psig, and the estimated mean failure pressure is 148 psig.

Charlie Tinkler might know if the estimated mean failure pressure has changed in the last 20 years.

Fyi
Stu

From: Csontos, Aladar
Sent: Monday, March 28, 2011 7:46 AM
To: Tregoning, Robert; Case, Michael; Richards, Stuart
Cc: Gavrilas, Mirela; Hogan, Rosemary; Graves, Herman
Subject: Re: TASKING: NRR-DCI Salt Water Effects and Drywell Pressure

I've been in contact with NRR on both questions this AM. We are already ahead of the curve for question #1 as we ran some calcs last week. For question #2, we are unsure if they meant RPV and/or Containment structure. NRR has asked that we take a look at the RPV and Torus as well. I will coordinate with Rosemary's folks on an answer.

From: Tregoning, Robert
To: Case, Michael; Richards, Stuart
Cc: Csontos, Aladar; Gavrilas, Mirela; Hogan, Rosemary; Graves, Herman
Sent: Mon Mar 28 07:16:06 2011
Subject: FW: TASKING: NRR-DCI Salt Water Effects and Drywell Pressure

Mike/Stu:

Head's up that this came in this morning and they're looking for a response by COB today. There are two questions that are posed in email below: 1 related to saltwater corrosion and one related to containment design pressure. I'm presuming that Rosemary's branch should address the containment design pressure question (question 2 below) and am forwarding this for their consideration. We (DE and DCI) already put together some information on cracking due to salt water injection (question 1 below), but we'll compile and review that information again today before providing a response.

Rob

Robert Tregoning
Technical Advisor for Materials
US Nuclear Regulatory Commission
21 Church Street, M/S CS-5A24
Rockville, MD 20850
ph: 301-251-7662
mobile: (b)(6)
fax: 301-251-7425

From: RST01 Hoc
Sent: Monday, March 28, 2011 4:39 AM
To: Lubinski, John; Hardies, Robert; Klein, Paul; Tregoning, Robert; Csontos, Aladar

Cc: Sheron, Brian; Weber, Michael; Virgilio, Martin
Subject: FW: TASKING: NRR-DCI Salt Water Effects and Drywell Pressure

From: RST07 Hoc
Sent: Monday, March 28, 2011 4:25 AM
To: RST01 Hoc
Subject: TASKING: NRR-DCI Salt Water Effects and Drywell Pressure

Please pass on to John Lubinski, Paul Klein, Bob Hardies, Al Santos, and Rob Tregonig with a :CC to Brian Sheron, Mike Weber, and Marty Virgilio.

~~~~~

As a result of the need to inject saltwater into the Fukushima Daiichi Units 1-3 reactor pressure vessels, there are growing concerns regarding the effect of the salt in the seawater on the vessel internals. The three units are BWR-with Mark I containments (similar to Dresden –Unit 1 and Quad Cities - Units 2 and 3). The licensee (Tokyo Electric Power Company, TEPCO) ceased injection of seawater on March 25<sup>th</sup> for Units 1 and 3 and on March 26<sup>th</sup> on Unit 2 and are now using fresh water. For some time they were injecting borated seawater on Units 1 and 3. Boric acid injection began on Unit 2 with the freshwater injection.

The industry, the Department of Energy (DOE) and the Office of Naval Reactors has provided input (see attached) regarding the effects. For the most parts these assessments indicate no concern, in the short term (i.e. days), regarding any reactor pressure vessel (RPV) structural failures (i.e. welds, etc...) as a result of a corrosion mechanism. However, last night RES received the attached e-mail from a Berkley professor concerned that the chloride concentration could result in a high corrosion rate (0.8 cm/day in stainless).

It is our understanding that RES and DCI have already started looking at concerns related to salt accumulation and corrosion and we are looking for a response. The response should be sure to address the following questions:

Question #1: Provide an assessment of the timeframe (i.e. days, weeks, months) for which structural failures of RPV and torus components due to stress corrosion cracking should be a focus. The more specificity that can be provided the better.

Also, there is a concern regarding when to vent containment. There is core damage on the three units (Units 1-3). Pressure has been increasing .

Question #2: What is the maximum design pressure, per ASME Code requirements, the containment should be able to withstand (i.e. x% design bases pressure).

The RST is looking for a response by COB March 28, 2011.

Eva Brown, RST BWR Systems and Ops Analyst

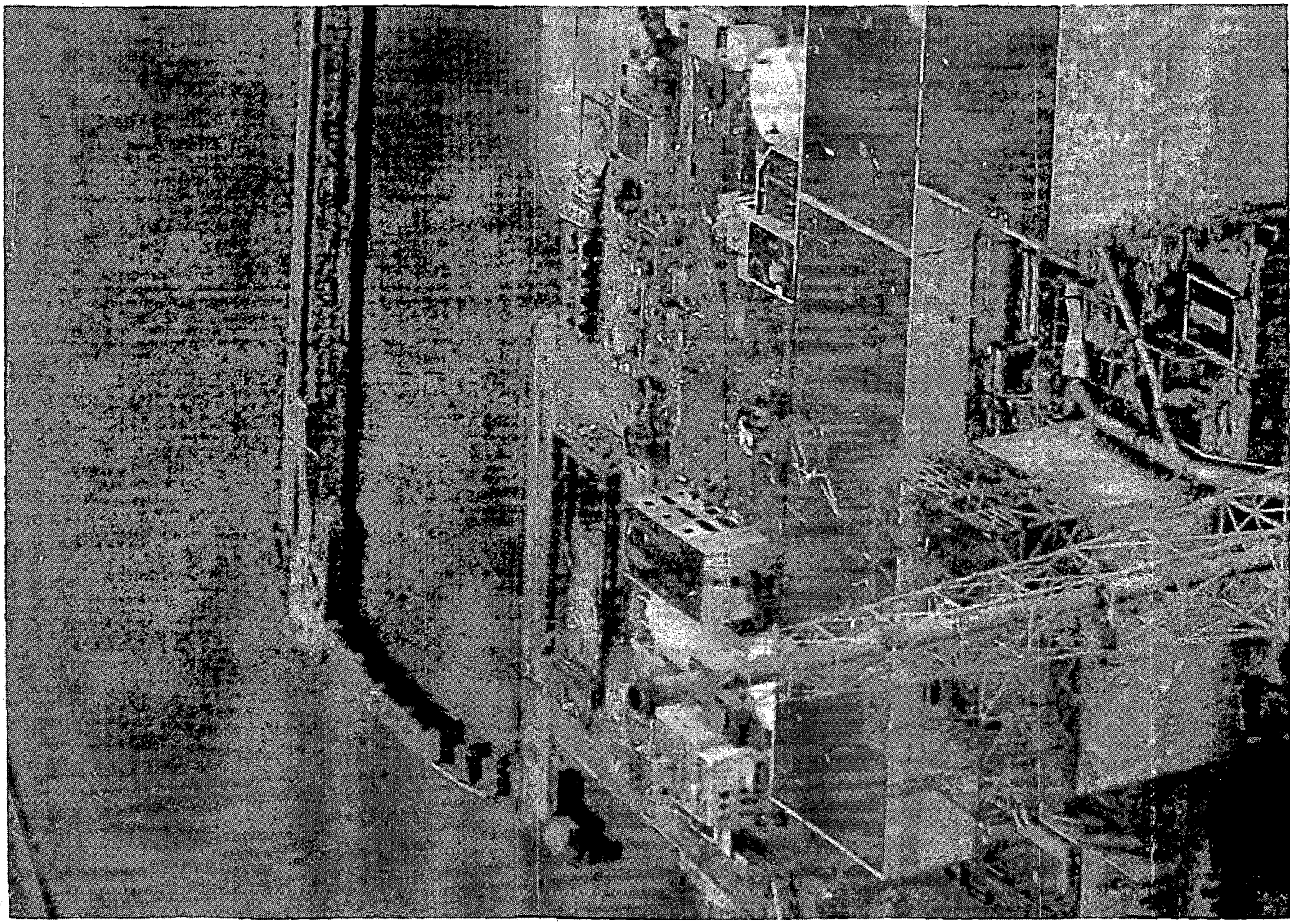
---

**From:** ET02 Hoc  
**Sent:** Wednesday, March 23, 2011 6:03 PM  
**To:** RST01 Hoc; RST12 Hoc  
**Subject:** FW: Fukushima Photos  
**Attachments:** IMG\_1434.JPG

---

**From:** Rick DeVercelly (b)(6)  
**Sent:** Wednesday, March 23, 2011 5:54 PM  
**To:** ET02 Hoc  
**Subject:** Fukushima Photos

AAAA/427



Lee, Richard

---

From: Parks, Cecil V. [parkscv@ornl.gov]  
Sent: Monday, March 28, 2011 10:17 PM  
To: Lee, Richard  
Subject: RE: Support for Japan - SFP Criticality Potential Update

John is going to handle asking those questions clearly in e-mail he is about to send out. One thing that I did not note was that if fresh water flooding did cause a criticality, I can not imagine much of a consequence.

-----Original Message-----

From: Lee, Richard [mailto:Richard.Lee@nrc.gov]  
Sent: Monday, March 28, 2011 10:14 PM  
To: Parks, Cecil V.  
Subject: RE: Support for Japan - SFP Criticality Potential Update

Cecil:

Thanks for the info. Glad that he is await and not contributing to the increasing population in U.S.

I can asked (1) whether the racks are made of aluminum or SS, and (2) confirm the that unborated and high-density combination is been used in the pool . Frankly, I think one can continue to keep expressing concern on potential criticality without any clue what is happening in the pool.

Richard

---

From: Parks, Cecil V. [parkscv@ornl.gov]  
Sent: Monday, March 28, 2011 9:38 PM  
To: Lee, Richard  
Cc: Aissa, Mourad; Wagner, John C.  
Subject: RE: Support for Japan - SFP Criticality Potential Update

He started working on it 5 minutes ago when I called to wake him up. John and I have discussed. All of this info is consistent with what we have learned. However, one missing component is the rack material - SS or Aluminum? If aluminum, more likely to have damaged racks due to high temp. Concern is not with fresh fuel (lots of Gd loading) but with 1st batch fuel since that could be at peak reactivity due to burn-out of Gd. Other question for me is that we've heard they were high-density racks - but unborated and high-density?

If safety case based on same process followed by NRC, it is very hard to see circumstances where one would lose the 5% delta-k margin. Shifting racks and damaged fuel could potentially cause some increase in k, but hard to see 5%.

John is going to send a (I'm sure) better e-mail back to larger list of folks with these observations and questions.

Glad to see you are on e-mail so late at night:-)

Cecil

-----Original Message-----

From: Lee, Richard [mailto:Richard.Lee@nrc.gov]  
Sent: Monday, March 28, 2011 9:25 PM

AAAA/428



To: Parks, Cecil V.  
Cc: Aissa, Mourad  
Subject: FW: Support for Japan - SFP Criticality Potential Update  
Importance: High

Hi, Cecil:

Is John working on this, or sleeping? Between now and Tuesday 10:00 am EST, there is 12 hours left for him to come up with an answer.

Richard

---

From: Carlson, Donald  
Sent: Monday, March 28, 2011 9:13 PM  
To: Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert  
Subject: RE: Support for Japan - SFP Criticality Potential Update

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1st cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool. (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

Question: Do we now see a need to modify or expand the above technical opinion? If so, how?

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

Donald E. Carlson  
NRO/ARP/ARB1

(b)(6)

Office: 301-415-0109

---

From: Taylor, Robert  
Sent: Monday, March 28, 2011 6:59 PM  
To: Carlson, Donald; Brown, Frederick

Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

(b)(6)

Info for consideration during the call:

Unit 4 racks are not borated  
Switching to fresh water injection on 3/29 Shutdown last November with 1/3 of the core offload being 1st cycle fuel  
204 fresh fuel assemblies were present in the pool Japanese concerns that the racks may have shifted.  
Fuel damage due to uncovering

Regards,  
Rob

---

From: Carlson, Donald  
Sent: Monday, March 28, 2011 6:23 PM  
To: Taylor, Robert; Brown, Frederick  
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
Subject: RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI - When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,  
Don

---

From: Taylor, Robert  
Sent: Monday, March 28, 2011 5:59 PM  
To: Carlson, Donald; Brown, Frederick

Cc: Scott, Michael; Wood, Kent; Ulises, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

From: Carlson, Donald  
Sent: Monday, March 28, 2011 1:07 PM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael; Wood, Kent; Ulises, Anthony; Yarsky, Peter; VanWert, Christopher  
Subject: RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----

From: Carlson, Donald  
Sent: Monday, March 28, 2011 9:30 AM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael  
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick

Sent: Sunday, March 27, 2011 9:11 PM

To: Carlson, Donald

Cc: Taylor, Robert; Scott, Michael

Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is

(b)(6)

Thanks,  
Fred

**Freeman, Eric**

---

**From:** Eric Freeman (b)(6)  
**Sent:** Monday, March 28, 2011 4:51 PM  
**To:** Freeman, Eric  
**Subject:** Fwd: ANS Technical Brief: MOX Fuel & Fukushima  
**Attachments:** ANS-Technical-Brief-MOX-Fukushima.pdf; ATT00001..htm

FYI

Eric E. Freeman

(b)(6)

Begin forwarded message:

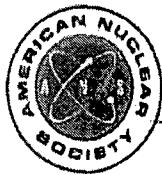
**From:** "ANS Broadcasts" <[broadcasts@ans.org](mailto:broadcasts@ans.org)>  
**Date:** March 26, 2011 3:44:54 AM EDT  
**To:** "Mr. Eric E. Freeman" (b)(6)  
**Subject:** ANS Technical Brief: MOX Fuel & Fukushima

The ANS Special Committee on Nuclear Non-Proliferation has prepared the attached Technical Brief on The Impact of Mixed Oxide Fuel Use on Accident Consequences at Fukushima Daiichi.

For additional Fukushima resources, visit the "Featured Content" box on the front page of the American Nuclear Society's website:

<http://www.ans.org/>

AAAA/429




## AMERICAN NUCLEAR SOCIETY

555 North Kensington Avenue  
La Grange Park, Illinois  
60526-5592 USA

Tel: 708 / 352-6611  
E-Mail: [NUCLEUS@ans.org](mailto:NUCLEUS@ans.org)  
<http://www.ans.org>  
Fax: 708 / 352-0499

Date: March 25, 2011

To: Joe Colvin  
ANS President

From: Michael (Mikey) Brady Raap   
Chair, ANS Professional Divisions Committee

Below please find the Technical Brief on The Impact of Mixed Oxide Fuel Use on Accident Consequences at Fukushima Daiichi. This Technical Brief contains factual information prepared by the ANS Special Committee on Nuclear Non-Proliferation.

### **The Impact of Mixed Oxide Fuel Use on Accident Consequences at Fukushima Daiichi**

#### **American Nuclear Society Technical Brief – March 2011**

#### **Conclusion**

Mixed Oxide (MOX) fuel has been used safely in nuclear power reactors for decades. The presence of a limited number of MOX fuel assemblies at Fukushima Daiichi Unit 3 has not had a significant impact on the ability to cool the reactor or on any radioactive releases from the site due to damage from the earthquake and tsunami.

#### **Summary**

At the time of the magnitude 9.0 earthquake, Fukushima Daiichi Unit 3 was operating with 32 mixed oxide (MOX) fuel assemblies and 516 low enriched uranium (LEU) fuel assemblies in its reactor core. In other words, less than 6% of the fuel in the Unit 3 core was MOX fuel. There were no other MOX fuel assemblies (new, in operation or used) at the Fukushima Daiichi plant at the time of the accident.

MOX fuel assemblies were loaded into Fukushima Daiichi Unit 3 for the first time in the fall of 2010. The MOX fuel had been used for less than five months at the time of the accident. Differences in initial fuel composition between MOX and LEU fuel can lead to differences in consequences (prompt fatalities and latent cancers) following a core damage event with releases to the environment.

There are indications that Fukushima Daiichi Unit 3 suffered damage to some of its core. The core damage resulted from a loss of core cooling due to damage to plant systems from the tsunami that followed the earthquake. The damage was not related to the presence of MOX fuel.

There have been no prompt fatalities as a result of radiation exposure from Fukushima Daiichi. Prompt evacuation has minimized radiation exposure to the public, so long-term public health consequences from radiation exposure are expected to be small. 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 can be concluded that MOX fuel has had and will have no perceptible impact on any consequences from the event.

## **Background**

It is important to note that while LEU fuel begins its useful life with no plutonium, as it is used in a light water reactor it builds up plutonium as a result of the nuclear reactions in the core. By the end of its useful life an LEU fuel assembly contains about 1% plutonium actually generates more power from plutonium than from uranium. All reactor cores contain plutonium; those cores loaded with some MOX fuel contain more.

Mixed oxide (MOX) fuel is comprised of a blend of uranium oxide and plutonium oxide. MOX fuel is predominantly uranium, with average concentrations of plutonium that range from 3-10%. The presence of plutonium produces modest changes in some physical characteristics of the fuel material such as thermal conductivity. However, MOX fuel and low-enriched uranium (LEU) fuel are fundamentally similar. Moreover, the physical dimensions and structural material of a MOX fuel assembly are essentially identical to that of a LEU fuel assembly. To the naked eye, a MOX fuel assembly and a LEU fuel assembly are identical.

Nuclear power plants have been generating electricity for use by the public since the 1950s, and over those years the industry has compiled an enviable safety record. Today over 400 reactors worldwide generate substantial amounts of emissions-free electricity. Dozens of those reactors currently generate power using a mixture of conventional LEU fuel assemblies and MOX fuel assemblies in their reactor cores. The majority of the fuel loaded into these reactors is LEU (60-70% or more), while the remainder (30-40% or less) is MOX. The use of MOX fuel allows the re-use of plutonium that was recovered during nuclear fuel recycling operations. The fabrication and use of MOX fuel has been carried out safely and efficiently on an industrial scale since the 1970s. Safety authorities in France, Belgium, Germany, Switzerland and Japan have all approved the use of MOX fuel in light water reactors using the same rigorous standards that are applied for the licensing of LEU fuel.

Safety is the cornerstone of nuclear power plant operations. Nuclear power plant operators perform safety analyses to determine how the plants will respond during various “what if” problem scenarios. Some of those scenarios involve extreme conditions coupled with multiple equipment failures that lead to estimates of damage to the fuel in the reactor core. Scenarios with significant damage to the reactor core are referred to as severe accidents, and such accidents can result in the calculated release of radionuclides to the environment. Severe accident consequences are the adverse public health effects – fatalities and latent cancers – that arise from the offsite release of radionuclides from a damaged reactor core.

When uranium or plutonium atoms split (fission), they release a relatively large amount of energy which is converted into heat and eventually electricity. The smaller atoms left behind after fission are referred to as fission products. In addition, some of the uranium and plutonium atoms in nuclear fuel assemblies absorb neutrons without fissioning, becoming even heavier atoms called actinides. Both fission products and actinides are radioactive, posing a health hazard if they are released to the environment. Using MOX fuel alters somewhat the “source term,” or mix of radionuclides in the core and available for release following a severe accident. The different source term between MOX fuel and LEU fuel leads to different calculated consequences following a postulated severe accident.

In November 1999 the Department of Energy published the Surplus Plutonium Disposition Environmental Impact Statement which documented, among other things, the consequences of four severe accident scenarios at three different reactors using some MOX fuel derived from weapons grade plutonium. Each reactor accident sequence was analyzed with two different reactor core assumptions: a reference case with all LEU fuel, and a second case with a mixed core of approximately 40% MOX fuel and the remainder LEU fuel. For each case the severe accident was assumed to progress in the same manner. Relative to the reference case with all LEU fuel, the offsite consequences to the public with the mixed MOX-LEU core ranged from 4% lower to 22% higher, depending on the reactor studied and the accident sequence. Most cases resulted in consequence increases of 10% or less. The differences between the consequences relate back to differences in the source term. The mixed MOX-LEU core consequences were generally higher because of the presence of more radioactive actinides in the MOX fuel at the time of the postulated accident. However, the differences were modest compared to the uncertainty associated with the consequence calculations for these extremely low probability events.

The type of plutonium used in MOX fuel can also impact severe accident consequences. The aforementioned analysis assumed weapons grade plutonium. If the calculations had been done for MOX fuel containing plutonium from recycled commercial nuclear fuel, as is the practice in Europe and Asia today, the difference between the all uranium cases and the 40% MOX fuel consequences would have been greater than cited above. This is again due primarily to the presence of more radioactive actinides in used “reactor grade” MOX fuel (with plutonium from recycled reactor fuel) than in used weapons grade MOX fuel (with plutonium from retired nuclear weapons).



Turning to the Fukushima Daiichi reactors in Japan, Unit 3 was using some reactor grade MOX fuel at the time of the March 2011 earthquake. Had it been using a 40% MOX fuel core, one could expect an increase in severe accident consequences on the order of 10% for weapons grade MOX. With a 40% reactor grade MOX core, and applying a bounding factor of four increase relative to weapons grade MOX, the overall increase in severe accident consequences would have been on the order of 40% relative to the all LEU fuel case. However, Unit 3 was loaded with only 32 MOX fuel assemblies during refueling operations in the fall of 2010. There are a total of 548 fuel assemblies in the Unit 3 reactor core, so this represents less than 6% of the total fuel in the core. The MOX fuel had been operating in Unit 3 for less than five months; fuel assemblies are typically used for a total of 3-4 years in reactor cores before being replaced by new fuel and discharged to used fuel pools. Therefore, the MOX fuel would have built up relatively few radioactive fission products and actinides at the time of the earthquake and subsequent damage to the reactor core. With these facts in mind – the low percentage of MOX fuel in the core and the short operation time for the MOX fuel – it is evident that the presence of MOX fuel at Fukushima Daiichi Unit 3 has had no significant impact on the offsite releases of radioactivity following the earthquake and tsunami.

Other than the 32 MOX fuel assemblies in the Unit 3 reactor core, at the time of the earthquake there were no other MOX fuel assemblies (new or used) at the Fukushima Daiichi plant. The problems encountered at Fukushima Daiichi reactors stem from plant damage due to the tsunami that followed the earthquake, not the use of MOX fuel in Unit 3.

It is also important to put the public health consequences from the event in perspective. There have been no prompt fatalities as a result of radiation exposure. Moreover, prompt evacuation has minimized the exposure of the population to radiation. At this point, the consequences of the event are expected to be small. MOX fuel effects, if any, would be a small change to an already small number.

In conclusion, MOX fuel has been used safely in nuclear power reactors for decades. The presence of a limited number of MOX fuel assemblies at Fukushima Daiichi Unit 3 has not had a significant impact on the ability to cool the reactor or on any radioactive releases from the site due to damage from the earthquake and tsunami.

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Monday, March 28, 2011 10:23 PM  
**To:** Taylor, Robert  
**Cc:** Wagner, Katie; Carlson, Donald; cvp@ornl.gov; Aissa, Mourad  
**Subject:** FW: Support for Japan - SFP Criticality Potential Update

**Importance:** High

Rob:

Please find out whether (1) the racks are made of aluminum or SS, and (2) unborated and high-density racks been used in the pool.

Thanks, Richard

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 9:13 PM  
**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1st cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool. (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

Question: Do we now see a need to modify or expand the above technical opinion? If so, how?

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

Donald E. Carlson  
NRO/ARP/ARB1

AAAA/430

Cell: (b)(6)  
Office: 301-415-0109

---

From: Taylor, Robert  
Sent: Monday, March 28, 2011 6:59 PM  
To: Carlson, Donald; Brown, Frederick  
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated  
Switching to fresh water injection on 3/29 Shutdown last November with 1/3 of the core offload being 1st cycle fuel  
204 fresh fuel assemblies were present in the pool Japanese concerns that the racks may have shifted.  
Fuel damage due to uncover

Regards,  
Rob

---

From: Carlson, Donald  
Sent: Monday, March 28, 2011 6:23 PM  
To: Taylor, Robert; Brown, Frederick  
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
Subject: RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI - When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,

Don

---

From: Taylor, Robert  
Sent: Monday, March 28, 2011 5:59 PM  
To: Carlson, Donald; Brown, Frederick  
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

From: Carlson, Donald  
Sent: Monday, March 28, 2011 1:07 PM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
Subject: RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----  
From: Carlson, Donald

Sent: Monday, March 28, 2011 9:30 AM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael  
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick  
Sent: Sunday, March 27, 2011 9:11 PM  
To: Carlson, Donald  
Cc: Taylor, Robert; Scott, Michael  
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,  
Fred

Lee, Richard

---

**From:** Lee, Richard  
**Sent:** Monday, March 28, 2011 10:25 PM  
**To:** Parks, Cecil V.  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

No, Katie is my group who keeps track of all RES/DSA action items. I did not cc: John. In your e-mail to Rob Taylor, please feel free to do so. If any clarification is needed, John can communicate with Rob (is 10:27 am there in Tokyo).

---

**From:** Parks, Cecil V. [parkscv@ornl.gov]  
**Sent:** Monday, March 28, 2011 10:24 PM  
**To:** Lee, Richard  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Did you cc the wrong "Wagner"?

-----Original Message-----

**From:** Lee, Richard [mailto:Richard.Lee@nrc.gov]  
**Sent:** Monday, March 28, 2011 10:23 PM  
**To:** Taylor, Robert  
**Cc:** Wagner, Katie; Carlson, Donald; Parks, Cecil V.; Aissa, Mourad  
**Subject:** FW: Support for Japan - SFP Criticality Potential Update  
**Importance:** High

Rob:

Please find out whether (1) the racks are made of aluminum or SS, and (2) unborated and high-density racks been used in the pool.

Thanks, Richard

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 9:13 PM  
**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1st cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less

consequence than an empty pool. (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

Question: Do we now see a need to modify or expand the above technical opinion? If so, how?

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

Donald E. Carlson

NRO/ARP/ARB1

Cell: (b)(6)

Office: 301-415-0109

---

From: Taylor, Robert

Sent: Monday, March 28, 2011 6:59 PM

To: Carlson, Donald; Brown, Frederick

Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

Subject: RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated

Switching to fresh water injection on 3/29 Shutdown last November with 1/3 of the core offload being 1st cycle fuel

204 fresh fuel assemblies were present in the pool Japanese concerns that the racks may have shifted.

Fuel damage due to uncovering

Regards,  
Rob

---

From: Carlson, Donald

Sent: Monday, March 28, 2011 6:23 PM

To: Taylor, Robert; Brown, Frederick

Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

Subject: RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI - When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,  
Don

---

From: Taylor, Robert  
Sent: Monday, March 28, 2011 5:59 PM  
To: Carlson, Donald; Brown, Frederick  
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

From: Carlson, Donald  
Sent: Monday, March 28, 2011 1:07 PM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
Subject: RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders



that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----

From: Carlson, Donald  
Sent: Monday, March 28, 2011 9:30 AM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael  
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick  
Sent: Sunday, March 27, 2011 9:11 PM  
To: Carlson, Donald  
Cc: Taylor, Robert; Scott, Michael  
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,  
Fred

**Lee, Richard**

---

**From:** Parks, Cecil V. [parkscv@ornl.gov]  
**Sent:** Monday, March 28, 2011 10:28 PM  
**To:** Lee, Richard  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Will do.

-----Original Message-----

**From:** Lee, Richard [mailto:Richard.Lee@nrc.gov]  
**Sent:** Monday, March 28, 2011 10:23 PM  
**To:** Parks, Cecil V.  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Too late, I have already ask Rob Taylor to find out about the SS vs aluminum and combination of unborated and high density rack. You have been cc: in the e-mail. Please use the e-mail to ask more precise questions (whatever John comes up with) as needed.

---

**From:** Parks, Cecil V. [parkscv@ornl.gov]  
**Sent:** Monday, March 28, 2011 10:17 PM  
**To:** Lee, Richard  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John is going to handle asking those questions clearly in e-mail he is about to send out. One thing that I did not note was that if fresh water flooding did cause a criticality, I can not imagine much of a consequence.

-----Original Message-----

**From:** Lee, Richard [mailto:Richard.Lee@nrc.gov]  
**Sent:** Monday, March 28, 2011 10:14 PM  
**To:** Parks, Cecil V.  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Cecil:

Thanks for the info. Glad that he is await and not contributing to the increasing population in U.S.

I can asked (1) whether the racks are made of aluminum or SS, and (2) confirm the that unborated and high-density combination is been used in the pool . Frankly, I think one can continue to keep expressing concern on potential criticality without any clue what is happening in the pool.

Richard

---

**From:** Parks, Cecil V. [parkscv@ornl.gov]  
**Sent:** Monday, March 28, 2011 9:38 PM  
**To:** Lee, Richard  
**Cc:** Aissa, Mourad; Wagner, John C.  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

He started working on it 5 minutes ago when I called to wake him up. John and I have discussed. All of this info is consistent with what we have learned. However, one missing

component is the rack material - SS or Aluminum? If aluminum, more likely to have damaged racks due to high temp. Concern is not with fresh fuel (lots of Gd loading) but with 1st batch fuel since that could be at peak reactivity due to burn-out of Gd. Other question for me is that we've heard they were high-density racks - but unborated and high-density?

If safety case based on same process followed by NRC, it is very hard to see circumstances where one would lose the 5% delta-k margin. Shifting racks and damaged fuel could potentially cause some increase in k, but hard to see 5%.

John is going to send a (I'm sure) better e-mail back to larger list of folks with these observations and questions.

Glad to see you are on e-mail so late at night:-)

Cecil

-----Original Message-----

From: Lee, Richard [mailto:Richard.Lee@nrc.gov]

Sent: Monday, March 28, 2011 9:25 PM

To: Parks, Cecil V.

Cc: Aissa, Mourad

Subject: FW: Support for Japan - SFP Criticality Potential Update

Importance: High

Hi, Cecil:

Is John working on this, or sleeping? Between now and Tuesday 10:00 am EST, there is 12 hours left for him to come up with an answer.

Richard

---

From: Carlson, Donald

Sent: Monday, March 28, 2011 9:13 PM

To: Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent;

VanWert, Christopher

Cc: Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert

Subject: RE: Support for Japan - SFP Criticality Potential Update

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1st cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool. (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

Question: Do we now see a need to modify or expand the above technical opinion? If so, how?

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

Donald E. Carlson

NRO/ARP/ARB1

Cell: (b)(6)

Office: 301-415-0109

---

From: Taylor, Robert

Sent: Monday, March 28, 2011 6:59 PM

To: Carlson, Donald; Brown, Frederick

Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

Subject: RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated

Switching to fresh water injection on 3/29 Shutdown last November with 1/3 of the core offload being 1st cycle fuel

204 fresh fuel assemblies were present in the pool Japanese concerns that the racks may have shifted.

Fuel damage due to uncovering

Regards,  
Rob

---

From: Carlson, Donald

Sent: Monday, March 28, 2011 6:23 PM

To: Taylor, Robert; Brown, Frederick

Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

Subject: RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI - When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,  
Don

---

From: Taylor, Robert  
Sent: Monday, March 28, 2011 5:59 PM  
To: Carlson, Donald; Brown, Frederick  
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

From: Carlson, Donald  
Sent: Monday, March 28, 2011 1:07 PM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
Subject: RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----

From: Carlson, Donald  
Sent: Monday, March 28, 2011 9:30 AM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael  
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick  
Sent: Sunday, March 27, 2011 9:11 PM  
To: Carlson, Donald  
Cc: Taylor, Robert; Scott, Michael  
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,  
Fred

**Lee, Richard**

---

**From:** Parks, Cecil V. [parkscv@ornl.gov]  
**Sent:** Monday, March 28, 2011 10:28 PM  
**To:** Lee, Richard  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

ok

-----Original Message-----

**From:** Lee, Richard [mailto:Richard.Lee@nrc.gov]  
**Sent:** Monday, March 28, 2011 10:25 PM  
**To:** Parks, Cecil V.  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

No, Katie is my group who keeps track of all RES/DSA action items. I did not cc: John. In your e-mail to Rob Taylor, please feel free to do so. If any clarification is needed, John can communicate with Rob (is 10:27 am there in Tokyo).

---

**From:** Parks, Cecil V. [parkscv@ornl.gov]  
**Sent:** Monday, March 28, 2011 10:24 PM  
**To:** Lee, Richard  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Did you cc the wrong "Wagner"?

-----Original Message-----

**From:** Lee, Richard [mailto:Richard.Lee@nrc.gov]  
**Sent:** Monday, March 28, 2011 10:23 PM  
**To:** Taylor, Robert  
**Cc:** Wagner, Katie; Carlson, Donald; Parks, Cecil V.; Aissa, Mourad  
**Subject:** FW: Support for Japan - SFP Criticality Potential Update  
**Importance:** High

Rob:

Please find out whether (1) the racks are made of aluminum or SS, and (2) unborated and high-density racks been used in the pool.

Thanks, Richard

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 9:13 PM  
**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1st cycle fuel

- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool. (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

Question: Do we now see a need to modify or expand the above technical opinion? If so, how?

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

Donald E. Carlson

NRO/ARP/ARB1

Cell: (b)(6)

Office: 301-415-0109

---

From: Taylor, Robert

Sent: Monday, March 28, 2011 6:59 PM

To: Carlson, Donald; Brown, Frederick

Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

Subject: RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated

Switching to fresh water injection on 3/29 Shutdown last November with 1/3 of the core offload being 1st cycle fuel

204 fresh fuel assemblies were present in the pool Japanese concerns that the racks may have shifted.

Fuel damage due to uncover

Regards,  
Rob

---

From: Carlson, Donald



Sent: Monday, March 28, 2011 6:23 PM  
To: Taylor, Robert; Brown, Frederick  
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
Subject: RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI - When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6). Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,  
Don

---

From: Taylor, Robert  
Sent: Monday, March 28, 2011 5:59 PM  
To: Carlson, Donald; Brown, Frederick  
Cc: Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
Subject: RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

From: Carlson, Donald  
Sent: Monday, March 28, 2011 1:07 PM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
Subject: RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----

From: Carlson, Donald  
Sent: Monday, March 28, 2011 9:30 AM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael  
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick  
Sent: Sunday, March 27, 2011 9:11 PM  
To: Carlson, Donald  
Cc: Taylor, Robert; Scott, Michael  
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,  
Fred

**Barto, Andrew**

---

**From:** Carlson, Donald  
**Sent:** Tuesday, March 29, 2011 7:25 AM  
**To:** Wood, Kent; Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Barto, Andrew; Rahimi, Meraj; Tripp, Christopher; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Kent,

I agree. Thank you for the clarification.

Don

---

**From:** Wood, Kent  
**Sent:** Tuesday, March 29, 2011 7:09 AM  
**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Barto, Andrew; Rahimi, Meraj; Tripp, Christopher; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential

All,

It would be incorrect to assume that the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety took a position one way or another with regard to the likelihood of an inadvertent criticality event in the Fukushima Daiichi spent fuel pools. The discussion was essentially a report by Don Carlson that he and others had responded to a question concerning the potential for an inadvertent criticality event in the SFPs. There was insufficient information in the discussion for the NCS TAG to evaluate.

Kent A. L. Wood  
Team Leader  
Spent Fuel Team (SFT)  
Reactor Systems Branch (SRXB)  
Division of Safety Systems (DSS)  
Office of Nuclear Reactor Regulation (NRR)  
301-415-4120

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 1:07 PM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
**Subject:** RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

**Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.**

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----

From: Carlson, Donald  
Sent: Monday, March 28, 2011 9:30 AM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael  
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick  
Sent: Sunday, March 27, 2011 9:11 PM  
To: Carlson, Donald  
Cc: Taylor, Robert; Scott, Michael  
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is

(b)(6)

Thanks,  
Fred

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Tuesday, March 29, 2011 8:05 AM  
**To:** Aissa, Mourad  
**Subject:** FW: Support for Japan - SFP Criticality Potential Update

FYI..

---

**From:** Ulises, Anthony  
**Sent:** Tuesday, March 29, 2011 7:58 AM  
**To:** 'wagnerjc@ornl.gov'; Taylor, Robert; Carlson, Donald; 'parkscv@ornl.gov'; 'hoppercm@ornl.gov'; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Yarsky, Peter; Giessner, John; 'gehinjc@ornl.gov'; 'muellerde@ornl.gov'; 'marshallwj@ornl.gov'; Nakanishi, Tony  
**Subject:** Re: Support for Japan - SFP Criticality Potential Update

Sorry for jumping in here late, but I have been out of pocket for a few days. What is the question that we are trying to address here? Are the Japanese considering an alternate to water to cover the pools?

Tony

Sent from NRC BlackBerry  
Anthony Ulises

(b)(6)

---

**From:** Wagner, John C. <wagnerjc@ornl.gov>  
**To:** Taylor, Robert; Carlson, Donald; Parks, Cecil V. <parkscv@ornl.gov>; Hopper, Calvin Mitchell <hoppercm@ornl.gov>; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulises, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C. <gehinjc@ornl.gov>; Mueller, Don <muellerde@ornl.gov>; Marshall, William BJ J. <marshallwj@ornl.gov>; Nakanishi, Tony  
**Sent:** Tue Mar 29 07:28:20 2011  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,

Yes, center-to-center pitch would be a good start. We have information on the complete inventory of the SFPs, including Unit 4 – see attached for some summary information. Our information indicates that the Unit 4 SFP has high-density racks, and makes us suspicious that Unit 4 SFP could have the same or similar high-density racks as are in the Unit 1-3 pools.

To be clear, I still suspect the likelihood of criticality is very small, as there should be significant reactivity margin in the system. However, the possibility that the Unit 4 SFP racks could have been uncovered for some period of time, the fact that we have received incorrect information on the racks previously, the fact that we have no information on the condition of the racks or the spent fuel, and that the other SFPs have Al-based racks, makes we want to proceed with caution.

I hope this is helpful

Best Regards,

AAAA/435

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]

**Sent:** Tuesday, March 29, 2011 6:01 AM

**To:** Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John,

Thanks for the consideration. We will stand fast until a consolidated position is reached.

I doubt we can get all of the information you (and I) would love to have. We will start small to see if we can get the center-to-center pitch in the racks. Note that the Daiichi SFPs are relatively low capacity in that they do not have as many assemblies in the pool as a typical US BWR. There is a common pool on-site where many of the spent fuel assemblies are moved. We understand that there Unit 4 pool had ~1000 assemblies in the pool. As such, it is possible that these are low-density racks.

We will try to ask for the center-to-center pitch tomorrow.

Regards,  
Rob

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]

**Sent:** Monday, March 28, 2011 11:32 PM

**To:** Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Don,

As you stated, the previous assessment was based on information at the time, which was that the SFPs all had high-density, borated SS racks. Given the high melting temperature of SS, we expected the neutron absorbers to remain effective up to temperatures at which concern about criticality would be overtaken by concerns related to significant release of radiation due to fuel damage.

We have since learned that the initial information on the racks was incorrect. Specifically, from EPRI and NEI we have the following information (received in the past 2 days):

*"-->Units 1, 2, 3 have both aluminum racks as well as borated aluminum racks.*

*Unit 4 has only non-borated stainless racks."*

This information is consistent with the information you have below.

**The above information raises questions/concerns**

- Available information suggests the Unit 4 SFP racks are high-density (no flux traps)
- Yet, based on our experience, high-density requires neutron absorber panels, e.g., Boral, borated SS, etc.
- So, we need more information on the Unit 4 SFP racks to full assess criticality potential there

- Concern is that the Unit 4 SFP racks may be similar to the Unit 1-3 SFP racks, i.e., borated Al (not SS), and that if the Unit 4 SFP racks were uncovered for some period of time, the neutron absorber effectiveness could be compromised. If this is the case, reflooding with un-borated water could very well be a PROBLEM.
- Another issue is that if the racks are truly SS without Boron, then some large spacing and/or flux traps would be required. Damage to the racks could decrease spacing, which would be a concern, particularly given the statement from below "Japanese concerns that the racks may have shifted".
- We do know that the Unit 4 SFP has >100 assemblies in the peak reactivity burnup range that are stored together.

Generally speaking, if the effectiveness of the racks is maintained (geometric separation of individual assemblies and absorption properties), we do not expect fuel degradation/reconfiguration to offset the inherent safety margins required by international standards and regulatory requirements for spent fuel pool criticality safety analyses, e.g., all assemblies at their peak reactivity, 0.05 margin in keff, and the various standard conservatisms in typical safety analyses (e.g., analyses based on most reactive lattice design, conservative depletion assumptions, ambient spent fuel pool water temperature, etc.).

So, coming back around to your specific question: **Do we now see a need to modify or expand the above technical opinion? If so, how?**

Answer: "yes" My revised position is the following:

"Given that the overall efficacy of the racks has been maintained, in terms of geometric separation of assemblies and neutron absorption characteristics, my opinion is that criticality in the spent fuel pools is very unlikely, particularly if boron is being used, and that the consequences of criticality in one of the spent fuel pools will not be significant in comparison to the consequences of the pool remaining empty/exposed. Provided the nuclear criticality safety analyses for the spent fuel pools were performed accurately and consistent with US Nuclear Regulatory Commission requirements and that the spent fuel racks were manufactured, installed and loaded consistent with the supporting nuclear criticality safety analyses, sufficient margin should be present to offset potential increases in reactivity associated with fuel reconfiguration. (Note: under normal circumstances, BWR spent fuel pools do not have borated water, and hence are designed and analyzed to be safe when flooded with un-borated water). If the efficacy of the racks is in question, I strongly suggest continued use of borated water until/unless the condition and design of the racks can be properly assessed. These are my personal/professional opinions, based on the information available to me at this time, and should be treated as such." Once I get input from others at ORNL, we will provide a collective position.

Note, depending on how hot the Unit 1-3 SFPs have been, I may have some concern about criticality in those pools since they utilize aluminum and borated aluminum racks.

#### Questions for you:

- 1) Can we get the design specifications for the SFP racks, particularly those in the Unit 4 SFP, ASAP?
- 2) Can we get the nuclear criticality safety analyses that was performed in support of the SFP rack licensing?
- 3) Can we get any photos or assessments of the condition of the spent fuel and spent fuel racks, particularly in Unit 4 SFP, ASAP? I was told video of the Unit 4 SFP (from a camera mounted on top of the fill pipe) would be available on 3/24, but I have yet to see it.

FYI – we have prepared a set of slides (attached) for the DOE related to this issue that has some additional information/basis that may be useful to you. These slides have yet to be provided to DOE and are likely to be revised to include the above, revised assessment pending review.

If you have any questions whatsoever, please do not hesitate to call me at any time – day or night – on my mobile number.

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Carlson, Donald [mailto:Donald.Carlson@nrc.gov]

**Sent:** Monday, March 28, 2011 9:14 PM

**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

**Importance:** High

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

**Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.** (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

**Question: Do we now see a need to modify or expand the above technical opinion? If so, how?**

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

Donald E. Carlson

NRO/ARP/ARB1

Cell: (b)(6)

Office: 301-415-0109

---

**From:** Taylor, Robert

**Sent:** Monday, March 28, 2011 6:59 PM



**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated  
Switching to fresh water injection on 3/29  
Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel  
204 fresh fuel assemblies were present in the pool  
Japanese concerns that the racks may have shifted.  
Fuel damage due to uncover

Regards,  
Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 6:23 PM  
**To:** Taylor, Robert; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI – When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6). Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,  
Don

---

**From:** Taylor, Robert  
**Sent:** Monday, March 28, 2011 5:59 PM  
**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 1:07 PM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
**Subject:** RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

**Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.**

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----  
**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 9:30 AM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael  
**Subject:** RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----  
**From:** Brown, Frederick  
**Sent:** Sunday, March 27, 2011 9:11 PM  
**To:** Carlson, Donald  
**Cc:** Taylor, Robert; Scott, Michael  
**Subject:** Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is [REDACTED] (b)(6)

Thanks,  
Fred

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Tuesday, March 29, 2011 8:10 AM  
**To:** 'Wagner, John C.'  
**Cc:** Aissa, Mourad; 'Parks, Cecil V.'  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Thanks, John. Sorry to wait you up to do this.  
Richard

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]  
**Sent:** Tuesday, March 29, 2011 7:30 AM  
**To:** Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

With attachment...

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
Phone: (865) 241-3570  
Mobile: (b)(6)

---

**From:** Wagner, John C.  
**Sent:** Tuesday, March 29, 2011 7:28 AM  
**To:** 'Taylor, Robert'; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,  
Yes, center-to-center pitch would be a good start. We have information on the complete inventory of the SFPs, including Unit 4 – see attached for some summary information. Our information indicates that the Unit 4 SFP has high-density racks, and makes us suspicious that Unit 4 SFP could have the same or similar high-density racks as are in the Unit 1-3 pools.

To be clear, I still suspect the likelihood of criticality is very small, as there should be significant reactivity margin in the system. However, the possibility that the Unit 4 SFP racks could have been uncovered for some period of time, the fact that we have received incorrect information on the racks previously, the fact that we have no information on the condition of the racks or the spent fuel, and that the other SFPs have Al-based racks, makes we want to proceed with caution.

I hope this is helpful

Best Regards,

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
Phone: (865) 241-3570  
Mobile: (b)(6)

---

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]  
**Sent:** Tuesday, March 29, 2011 6:01 AM  
**To:** Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John,

Thanks for the consideration. We will stand fast until a consolidated position is reached.

I doubt we can get all of the information you (and I) would love to have. We will start small to see if we can get the center-to-center pitch in the racks. Note that the Daiichi SFPs are relatively low capacity in that they do not have as many assemblies in the pool as a typical US BWR. There is a common pool on-site where many of the spent fuel assemblies are moved. We understand that there Unit 4 pool had ~1000 assemblies in the pool. As such, it is possible that these are low-density racks.

We will try to ask for the center-to-center pitch tomorrow.

Regards,  
Rob

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]  
**Sent:** Monday, March 28, 2011 11:32 PM  
**To:** Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Don,

As you stated, the previous assessment was based on information at the time, which was that the SFPs all had high-density, borated SS racks. Given the high melting temperature of SS, we expected the neutron absorbers to remain effective up to temperatures at which concern about criticality would be overtaken by concerns related to significant release of radiation due to fuel damage.

We have since learned that the initial information on the racks was incorrect. Specifically, from EPRI and NEI we have the following information (received in the past 2 days):

*"-->Units 1, 2, 3 have both aluminum racks as well as borated aluminum racks.*

*Unit 4 has only non-borated stainless racks."*

This information is consistent with the information you have below.

#### **The above information raises questions/concerns**

- Available information suggests the Unit 4 SFP racks are high-density (no flux traps)
- Yet, based on our experience, high-density requires neutron absorber panels, e.g., Boral, borated SS, etc.
- So, we need more information on the Unit 4 SFP racks to full assess criticality potential there

- Concern is that the Unit 4 SFP racks may be similar to the Unit 1-3 SFP racks, i.e., borated Al (not SS), and that if the Unit 4 SFP racks were uncovered for some period of time, the neutron absorber effectiveness could be compromised. If this is the case, reflooding with un-borated water could very well be a PROBLEM.
- Another issue is that if the racks are truly SS without Boron, then some large spacing and/or flux traps would be required. Damage to the racks could decrease spacing, which would be a concern, particularly given the statement from below "Japanese concerns that the racks may have shifted".
- We do know that the Unit 4 SFP has >100 assemblies in the peak reactivity burnup range that are stored together.

Generally speaking, if the effectiveness of the racks is maintained (geometric separation of individual assemblies and absorption properties), we do not expect fuel degradation/reconfiguration to offset the inherent safety margins required by international standards and regulatory requirements for spent fuel pool criticality safety analyses, e.g., all assemblies at their peak reactivity, 0.05 margin in keff, and the various standard conservatisms in typical safety analyses (e.g., analyses based on most reactive lattice design, conservative depletion assumptions, ambient spent fuel pool water temperature, etc.).

So, coming back around to your specific question: **Do we now see a need to modify or expand the above technical opinion? If so, how?**

Answer: "yes" My revised position is the following:

"Given that the overall efficacy of the racks has been maintained, in terms of geometric separation of assemblies and neutron absorption characteristics, my opinion is that criticality in the spent fuel pools is very unlikely, particularly if boron is being used, and that the consequences of criticality in one of the spent fuel pools will not be significant in comparison to the consequences of the pool remaining empty/exposed. Provided the nuclear criticality safety analyses for the spent fuel pools were performed accurately and consistent with US Nuclear Regulatory Commission requirements and that the spent fuel racks were manufactured, installed and loaded consistent with the supporting nuclear criticality safety analyses, sufficient margin should be present to offset potential increases in reactivity associated with fuel reconfiguration. (Note: under normal circumstances, BWR spent fuel pools do not have borated water, and hence are designed and analyzed to be safe when flooded with un-borated water). If the efficacy of the racks is in question, I strongly suggest continued use of borated water until/unless the condition and design of the racks can be properly assessed. These are my personal/professional opinions, based on the information available to me at this time, and should be treated as such." Once I get input from others at ORNL, we will provide a collective position.

Note, depending on how hot the Unit 1-3 SFPs have been, I may have some concern about criticality in those pools since they utilize aluminum and borated aluminum racks.

#### Questions for you:

- 1) Can we get the design specifications for the SFP racks, particularly those in the Unit 4 SFP, ASAP?
- 2) Can we get the nuclear criticality safety analyses that was performed in support of the SFP rack licensing?
- 3) Can we get any photos or assessments of the condition of the spent fuel and spent fuel racks, particularly in Unit 4 SFP, ASAP? I was told video of the Unit 4 SFP (from a camera mounted on top of the fill pipe) would be available on 3/24, but I have yet to see it.

FYI – we have prepared a set of slides (attached) for the DOE related to this issue that has some additional information/basis that may be useful to you. These slides have yet to be provided to DOE and are likely to be revised to include the above, revised assessment pending review.

If you have any questions whatsoever, please do not hesitate to call me at any time – day or night – on my mobile number.

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Carlson, Donald [mailto:Donald.Carlson@nrc.gov]

**Sent:** Monday, March 28, 2011 9:14 PM

**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

**Importance:** High

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

**Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.** (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

**Question: Do we now see a need to modify or expand the above technical opinion? If so, how?**

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

**Donald E. Carlson**

NRO/ARP/ARB1

Cell: (b)(6)

Office: 301-415-0109

---

**From:** Taylor, Robert

**Sent:** Monday, March 28, 2011 6:59 PM

**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated  
Switching to fresh water injection on 3/29  
Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel  
204 fresh fuel assemblies were present in the pool  
Japanese concerns that the racks may have shifted.  
Fuel damage due to uncovering

Regards,  
Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 6:23 PM  
**To:** Taylor, Robert; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI – When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,  
Don

---

**From:** Taylor, Robert  
**Sent:** Monday, March 28, 2011 5:59 PM  
**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,



I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 1:07 PM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
**Subject:** RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

**Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.**

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----

From: Carlson, Donald  
Sent: Monday, March 28, 2011 9:30 AM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael  
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick  
Sent: Sunday, March 27, 2011 9:11 PM  
To: Carlson, Donald  
Cc: Taylor, Robert; Scott, Michael  
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,  
Fred

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Tuesday, March 29, 2011 10:31 AM  
**To:** Aissa, Mourad  
**Subject:** RE: conf call?

Thx, Mourad  
Richard

---

**From:** Aissa, Mourad  
**Sent:** Tuesday, March 29, 2011 10:26 AM  
**To:** Lee, Richard  
**Subject:** RE: conf call?

Richard,  
I called Hossein earlier and asked if he heard about a conference call concerning SFP criticality at 10:00 am. He was not aware of this one, but he said they have a conference call at 11:00am that will address boron injection and he said that it would be good if I participated. It's a different issue and I am interested in getting involved. Therefore, I will be calling that conference call.  
Thanks  
Mourad

---

**From:** Lee, Richard  
**Sent:** Tuesday, March 29, 2011 10:16 AM  
**To:** Carlson, Donald  
**Cc:** Aissa, Mourad  
**Subject:** RE: conf call?

No. I thought you all plan to have a call between Op Center and the NRC team in Tokyo. May be I miss read the e-mail.

---

**From:** Carlson, Donald  
**Sent:** Tuesday, March 29, 2011 10:00 AM  
**To:** Lee, Richard  
**Cc:** Aissa, Mourad  
**Subject:** conf call?

Do you have any info about a conf call? Mourad is asking?

(b)(6)

**Donald E. Carlson**  
Senior Project Manager  
NRO/ARP/ARB1  
301-415-0109  
T6-F6/MS T6-E4

## Lee, Richard

---

**From:** Lee, Richard  
**Sent:** Tuesday, March 29, 2011 10:46 AM  
**To:** Aissa, Mourad  
**Subject:** FW: Support for Japan - SFP Criticality Potential Update  
**Attachments:** ORNL\_Fukushima-Criticality\_Notes.pptx

fyi

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]  
**Sent:** Monday, March 28, 2011 11:32 PM  
**To:** Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Don,

As you stated, the previous assessment was based on information at the time, which was that the SFPs all had high-density, borated SS racks. Given the high melting temperature of SS, we expected the neutron absorbers to remain effective up to temperatures at which concern about criticality would be overtaken by concerns related to significant release of radiation due to fuel damage.

We have since learned that the initial information on the racks was incorrect. Specifically, from EPRI and NEI we have the following information (received in the past 2 days):

*"-->Units 1, 2, 3 have both aluminum racks as well as borated aluminum racks.*

*Unit 4 has only non-borated stainless racks."*

This information is consistent with the information you have below.

### The above information raises questions/concerns

- Available information suggests the Unit 4 SFP racks are high-density (no flux traps)
- Yet, based on our experience, high-density requires neutron absorber panels, e.g., Boral, borated SS, etc.
- So, we need more information on the Unit 4 SFP racks to full assess criticality potential there
- Concern is that the Unit 4 SFP racks may be similar to the Unit 1-3 SFP racks, i.e., borated Al (not SS), and that if the Unit 4 SFP racks were uncovered for some period of time, the neutron absorber effectiveness could be compromised. If this is the case, reflooding with un-borated water could very well be a PROBLEM.
- Another issue is that if the racks are truly SS without Boron, then some large spacing and/or flux traps would be required. Damage to the racks could decrease spacing, which would be a concern, particularly given the statement from below "Japanese concerns that the racks may have shifted".
- We do know that the Unit 4 SFP has >100 assemblies in the peak reactivity burnup range that are stored together.

Generally speaking, if the effectiveness of the racks is maintained (geometric separation of individual assemblies and absorption properties), we do not expect fuel degradation/reconfiguration to offset the inherent safety margins required by international standards and regulatory requirements for spent fuel pool criticality safety analyses, e.g., all assemblies at their peak reactivity, 0.05 margin in keff, and the various standard conservatisms in typical safety analyses (e.g., analyses based on most reactive lattice design, conservative depletion assumptions, ambient spent fuel pool water temperature, etc.).

So, coming back around to your specific question: **Do we now see a need to modify or expand the above technical opinion? If so, how?**

Answer: "yes" My revised position is the following:

"Given that the overall efficacy of the racks has been maintained, in terms of geometric separation of assemblies and neutron absorption characteristics, my opinion is that criticality in the spent fuel pools is very unlikely, particularly if boron is being used, and that the consequences of criticality in one of the spent fuel pools will not be significant in comparison to the consequences of the pool remaining empty/exposed. Provided the nuclear criticality safety analyses for the spent fuel pools were performed accurately and consistent with US Nuclear Regulatory Commission requirements and that the spent fuel racks were manufactured, installed and loaded consistent with the supporting nuclear criticality safety analyses, sufficient margin should be present to offset potential increases in reactivity associated with fuel reconfiguration. (Note: under normal circumstances, BWR spent fuel pools do not have borated water, and hence are designed and analyzed to be safe when flooded with un-borated water). If the efficacy of the racks is in question, I strongly suggest continued use of borated water until/unless the condition and design of the racks can be properly assessed. These are my personal/professional opinions, based on the information available to me at this time, and should be treated as such." Once I get input from others at ORNL, we will provide a collective position.

Note, depending on how hot the Unit 1-3 SFPs have been, I may have some concern about criticality in those pools since they utilize aluminum and borated aluminum racks.

**Questions for you:**

- 1) Can we get the design specifications for the SFP racks, particularly those in the Unit 4 SFP, ASAP?
- 2) Can we get the nuclear criticality safety analyses that was performed in support of the SFP rack licensing?
- 3) Can we get any photos or assessments of the condition of the spent fuel and spent fuel racks, particularly in Unit 4 SFP, ASAP? I was told video of the Unit 4 SFP (from a camera mounted on top of the fill pipe) would be available on 3/24, but I have yet to see it.

FYI – we have prepared a set of slides (attached) for the DOE related to this issue that has some additional information/basis that may be useful to you. These slides have yet to be provided to DOE and are likely to be revised to include the above, revised assessment pending review.

If you have any questions whatsoever, please do not hesitate to call me at any time – day or night – on my mobile number.

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

**From:** Carlson, Donald [mailto:Donald.Carlson@nrc.gov]

**Sent:** Monday, March 28, 2011 9:14 PM

**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

**Importance:** High

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

**Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.** (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

**Question: Do we now see a need to modify or expand the above technical opinion? If so, how?**

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

Donald E. Carlson

NRO/ARP/ARB1

Cell: (b)(6)

Office: 301-415-0109

---

**From:** Taylor, Robert

**Sent:** Monday, March 28, 2011 6:59 PM

**To:** Carlson, Donald; Brown, Frederick

**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated  
Switching to fresh water injection on 3/29  
Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel  
204 fresh fuel assemblies were present in the pool  
Japanese concerns that the racks may have shifted.  
Fuel damage due to uncover

Regards,  
Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 6:23 PM  
**To:** Taylor, Robert; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI – When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,  
Don

---

**From:** Taylor, Robert  
**Sent:** Monday, March 28, 2011 5:59 PM  
**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 1:07 PM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
**Subject:** RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

**Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.**

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----

From: Carlson, Donald  
Sent: Monday, March 28, 2011 9:30 AM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael  
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick  
Sent: Sunday, March 27, 2011 9:11 PM  
To: Carlson, Donald  
Cc: Taylor, Robert; Scott, Michael  
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is

(b)(6)

Thanks,  
Fred



**Lee, Richard**

---

**From:** Wagner, John C. [wagnerjc@ornl.gov]  
**Sent:** Tuesday, March 29, 2011 10:03 PM  
**To:** Lee, Richard  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

You are most welcome! Anything for you, Richard ☺

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
Phone: (865) 241-3570  
Mobile: (b)(6)

---

**From:** Lee, Richard [mailto:Richard.Lee@nrc.gov]  
**Sent:** Tuesday, March 29, 2011 8:10 AM  
**To:** Wagner, John C.  
**Cc:** Aissa, Mourad; Parks, Cecil V.  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Thanks, John. Sorry to wait you up to do this.  
Richard

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]  
**Sent:** Tuesday, March 29, 2011 7:30 AM  
**To:** Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

With attachment...

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
Phone: (865) 241-3570  
Mobile: (b)(6)

---

**From:** Wagner, John C.  
**Sent:** Tuesday, March 29, 2011 7:28 AM  
**To:** Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,  
Yes, center-to-center pitch would be a good start. We have information on the complete inventory of the SFPs, including Unit 4 – see attached for some summary information. Our information indicates that the Unit 4 SFP has high-density racks, and makes us suspicious that Unit 4 SFP could have the same or similar high-density racks as are in the Unit 1-3 pools.

To be clear, I still suspect the likelihood of criticality is very small, as there should be significant reactivity margin in the system. However, the possibility that the Unit 4 SFP racks could have been uncovered for some period of time, the fact that we have received incorrect information on the racks previously, the fact that we have no information on the condition of the racks or the spent fuel, and that the other SFPs have AI-based racks, makes we want to proceed with caution.

I hope this is helpful

Best Regards,

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
Phone: (865) 241-3570  
Mobile: (b)(6)

---

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]  
**Sent:** Tuesday, March 29, 2011 6:01 AM  
**To:** Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John,

Thanks for the consideration. We will stand fast until a consolidated position is reached.

I doubt we can get all of the information you (and I) would love to have. We will start small to see if we can get the center-to-center pitch in the racks. Note that the Daiichi SFPs are relatively low capacity in that they do not have as many assemblies in the pool as a typical US BWR. There is a common pool on-site where many of the spent fuel assemblies are moved. We understand that there Unit 4 pool had ~1000 assemblies in the pool. As such, it is possible that these are low-density racks.

We will try to ask for the center-to-center pitch tomorrow.

Regards,  
Rob

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]  
**Sent:** Monday, March 28, 2011 11:32 PM  
**To:** Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Don,

As you stated, the previous assessment was based on information at the time, which was that the SFPs all had high-density, borated SS racks. Given the high melting temperature of SS, we expected the neutron absorbers to remain effective up to temperatures at which concern about criticality would be overtaken by concerns related to significant release of radiation due to fuel damage.

We have since learned that the initial information on the racks was incorrect. Specifically, from EPRI and NEI we have the following information (received in the past 2 days):

*"-->Units 1, 2, 3 have both aluminum racks as well as borated aluminum racks.*

*Unit 4 has only non-borated stainless racks."*

This information is consistent with the information you have below.

#### **The above information raises questions/concerns**

- Available information suggests the Unit 4 SFP racks are high-density (no flux traps)
- Yet, based on our experience, high-density requires neutron absorber panels, e.g., Boral, borated SS, etc.
- So, we need more information on the Unit 4 SFP racks to full assess criticality potential there
- Concern is that the Unit 4 SFP racks may be similar to the Unit 1-3 SFP racks, i.e., borated Al (not SS), and that if the Unit 4 SFP racks were uncovered for some period of time, the neutron absorber effectiveness could be compromised. If this is the case, reflooding with un-borated water could very well be a PROBLEM.
- Another issue is that if the racks are truly SS without Boron, then some large spacing and/or flux traps would be required. Damage to the racks could decrease spacing, which would be a concern, particularly given the statement from below "Japanese concerns that the racks may have shifted".
- We do know that the Unit 4 SFP has >100 assemblies in the peak reactivity burnup range that are stored together.

Generally speaking, if the effectiveness of the racks is maintained (geometric separation of individual assemblies and absorption properties), we do not expect fuel degradation/reconfiguration to offset the inherent safety margins required by international standards and regulatory requirements for spent fuel pool criticality safety analyses, e.g., all assemblies at their peak reactivity, 0.05 margin in keff, and the various standard conservatisms in typical safety analyses (e.g., analyses based on most reactive lattice design, conservative depletion assumptions, ambient spent fuel pool water temperature, etc.).

So, coming back around to your specific question: **Do we now see a need to modify or expand the above technical opinion? If so, how?**

Answer: "yes" My revised position is the following:

"Given that the overall efficacy of the racks has been maintained, in terms of geometric separation of assemblies and neutron absorption characteristics, my opinion is that criticality in the spent fuel pools is very unlikely, particularly if boron is being used, and that the consequences of criticality in one of the spent fuel pools will not be significant in comparison to the consequences of the pool remaining empty/exposed. Provided the nuclear criticality safety analyses for the spent fuel pools were performed accurately and consistent with US Nuclear Regulatory Commission requirements and that the spent fuel racks were manufactured, installed and loaded consistent with the supporting nuclear criticality safety analyses, sufficient margin should be present to offset potential increases in reactivity associated with fuel reconfiguration. (Note: under normal circumstances, BWR spent fuel pools do not have borated water, and hence are designed and analyzed to be safe when flooded with un-borated water). If the efficacy of the racks is in question, I strongly suggest continued use of borated water until/unless the condition and design of the racks can be properly assessed. These are my personal/professional opinions, based on the information available to me at this time, and should be treated as such." Once I get input from others at ORNL, we will provide a collective position.

Note, depending on how hot the Unit 1-3 SFPs have been, I may have some concern about criticality in those pools since they utilize aluminum and borated aluminum racks.

**Questions for you:**

- 1) Can we get the design specifications for the SFP racks, particularly those in the Unit 4 SFP, ASAP?
- 2) Can we get the nuclear criticality safety analyses that was performed in support of the SFP rack licensing?
- 3) Can we get any photos or assessments of the condition of the spent fuel and spent fuel racks, particularly in Unit 4 SFP, ASAP? I was told video of the Unit 4 SFP (from a camera mounted on top of the fill pipe) would be available on 3/24, but I have yet to see it.

FYI – we have prepared a set of slides (attached) for the DOE related to this issue that has some additional information/basis that may be useful to you. These slides have yet to be provided to DOE and are likely to be revised to include the above, revised assessment pending review.

If you have any questions whatsoever, please do not hesitate to call me at any time – day or night – on my mobile number.

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

[Mobile: (b)(6)]

---

**From:** Carlson, Donald [mailto:Donald.Carlson@nrc.gov]

**Sent:** Monday, March 28, 2011 9:14 PM

**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Uises, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

**Importance:** High

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

**Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.** (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

**Question: Do we now see a need to modify or expand the above technical opinion? If so, how?**

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

**Donald E. Carlson**

NRO/ARP/ARB1

Cell: (b)(6)

Office: 301-415-0109

---

**From:** Taylor, Robert

**Sent:** Monday, March 28, 2011 6:59 PM

**To:** Carlson, Donald; Brown, Frederick

**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated

Switching to fresh water injection on 3/29

Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel

204 fresh fuel assemblies were present in the pool

Japanese concerns that the racks may have shifted.

Fuel damage due to uncovering

Regards,  
Rob

---

**From:** Carlson, Donald

**Sent:** Monday, March 28, 2011 6:23 PM

**To:** Taylor, Robert; Brown, Frederick

**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

**Subject:** RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI – When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,

Don

---

**From:** Taylor, Robert  
**Sent:** Monday, March 28, 2011 5:59 PM  
**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 1:07 PM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
**Subject:** RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

**Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.**

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----  
**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 9:30 AM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael  
**Subject:** RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick

Sent: Sunday, March 27, 2011 9:11 PM

To: Carlson, Donald

Cc: Taylor, Robert; Scott, Michael

Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)?  
He would like to have a follow-up conversation on SFP criticality potential.

His cell is

(b)(6)

Thanks,  
Fred

## Rodriguez, Ricardo

---

**From:** Cook, Christopher  
**Sent:** Tuesday, March 29, 2011 7:50 AM  
**To:** Bauer, Laurel; Bieganousky, Wayne; Candelario, Luisette; Cruz, Zahira; Devlin, Stephanie; Graizer, Vladimir; Karas, Rebecca; Li, Yong; Martin, Karnisha; Munson, Clifford; Plaza-Toledo, Meralis; Rodriguez, Ricardo; Seber, Dogan; Stieve, Alice; Stirewalt, Gerry; Tabatabai, Sarah; Thompson, Jenise; Vega, Frankie; Wang, Weijun; Xi, Zuhun  
**Subject:** FW: Seismic Q&As March 28th 10pm update  
**Follow Up Flag:** Follow up  
**Flag Status:** Flagged  
**Categories:** Blue Category

Latest update of Seismic Q&A, please a follow-up saying this will be the last update for a while (please see Annie's below).

Chris



Seismic Questions  
for Incident...

---

**From:** Kammerer, Annie  
**Sent:** Monday, March 28, 2011 10:32 PM  
**To:** Kammerer, Annie; Hiland, Patrick; Skeen, David; Case, Michael; RST01 Hoc  
**Cc:** Howe, Allen; Nelson, Robert; Stutzke, Martin; Gitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Chokshi, Nilesh; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael; Orders, William; Santiago, Patricia; Snodderly, Michael; Baggett, Steven; Sosa, Belkys; Davis, Roger; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Boska, John; Ma, John; Tegeler, Bret; Patel, Pravin; Shams, Mohamed; Morris, Scott; Brenner, Eliot; Harrington, Holly; Seber, Dogan; Ledford, Joey; Johnson, Michael; Virgilio, Martin; Holahan, Vincent; Bergman, Thomas; Webb, Michael; Manoly, Kamal; Khanna, Meena; Screnci, Diane; Thomas, Eric; Nguyen, Quynh; Meighan, Sean; FOIA Response.hoc Resource; Bens, Michelle; 'rmtpactsu\_elnrc@ofda.gov'  
**Subject:** Seismic Q&As March 28th 10pm update

All,

It seems that some people actually missed getting the Q&As since I'm starting to get emails asking if I can do an update. Sorry it's been a while, for some reason my workload seems to have exploded...LOL. (Actually I really have no excuse as Shelby has been a compilling machine!). We've added several new sections including **ACRONYMS**, located near the back. (Thanks to Stephanie Devlin for pulling the acronyms together)

Now that the agency is moving out of the heart of the emergency response phase, and looking towards short, medium and long term actions and goals, our little seismic group has been discussing what to do with this document; and specifically how to make it useful beyond this event. We've discussed the fact that ever since the Kashiwazaki earthquake, we have recognized the need to develop a "generic" seismic Q&A document so that the agency can hit the ground running in cases such as this. It is obvious to us that we now have the guts of the document we've envisaged for years in one 140 page compilation; and it's time to make it happen!



So the next time you see this document (which won't be for a while), it will be radically transformed. We'll be putting all the "static" information in the front, and will be pulling the japan earthquake-specific information into a separate section. It will be more user friendly and will be easier to find any new information. It's unclear to us how long these updates will be useful, but we suspect, not much longer. So, now's the time to start wrapping it up and putting a bow on it...

We hope the new document will be worth the wait...

Dr. Annie Kammerer, P.E.

US NRC/RES/DE

301) 251-7695 Office

(b)(6)

Mobile

-----Original Message-----

From: Kammerer, Annie

Sent: Wednesday, March 23, 2011 3:15 AM

To: Kammerer, Annie; Hiland, Patrick; Skeen, David; Case, Michael; RST01 Hoc

Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Giitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Chokshi, Niles; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael; Orders, William; Santiago, Patricia; Snodderly, Michael; Baggett, Steven; Sosa, Belkys; Davis, Roger; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Boska, John; Ma, John; Tegeler, Bret; Patel, Pravin; Shams, Mohamed; Morris, Scott; Brenner, Eliot; Harrington, Holly; Seber, Dogan; Ledford, Joey; Johnson, Michael; Virgilio, Martin; Holahan, Vincent; Bergman, Thomas; Webb, Michael; Manoly, Kamal; Khanna, Meena; Screnci, Diane; Thomas, Eric; Nguyen, Quynh; Meighan, Sean; FOIA Response.hoc Resource; Bensi, Michelle

Subject: Seismic Q&As March 22th 10pm update

All,

Attached please find an updated set of Q&As. I also included some new Q&As for SONGS and Diablo Canyon, just in case anyone is interested.

This version has an expanded set of definitions and new sections on station blackout, spent fuel, flooding and some other topics. It also has fewer duplicate questions.

Let me also pass on a tidbit of info. According to TEPCO (via an NEI press release), the tsunami at Fukushima was 14 meters and the design tsunami level was 5.7 meters. The reactors and backup power sources were at 10 meters and at 13 meters. Ouch.

Cheers,

Annie

---

From: Kammerer, Annie

Sent: Sunday, March 20, 2011 11:00 PM

To: Kammerer, Annie; Hiland, Patrick; Skeen, David; Case, Michael; RST01 Hoc

Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Giitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Chokshi, Niles; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael; Orders, William; Santiago, Patricia; Snodderly, Michael; Baggett, Steven; Sosa, Belkys; Davis, Roger; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Boska, John; Ma, John; Tegeler, Bret; Patel, Pravin; Shams, Mohamed; Morris, Scott; Brenner, Eliot; Harrington, Holly; Seber, Dogan; Ledford, Joey;

Johnson, Michael; Virgilio, Martin; Holahan, Vincent; Bergman, Thomas; Webb, Michael; Manoly, Kamal; Khanna, Meena; Screnci, Diane; Thomas, Eric; Nguyen, Quynh; Meighan, Sean; FOIA Response.hoc Resource; Bensi, Michelle  
Subject: Seismic Q&As March 20th 8pm update

All,

Here's today's version. It includes updates on related topics for tomorrow's briefing. Also, some of the sections have been streamlined and some (though not all) of the answers have been updated.

The biggest news from the seismic team's perspective is that starting tomorrow a very bright young risk analyst (Michelle Bensi) who recently joined us from UC Berkeley (my beloved alma mater) will be helping with the compilation of this document. That will allow our team to spend more time cleaning and streamlining it; which inevitably will make it more user friendly...and shorter! Starting with tomorrow's version her name will start to show up on the front.

Best of luck to everyone with the briefing tomorrow!

Annie

From: Kammerer, Annie

Sent: Saturday, March 19, 2011 9:00 AM

To: Kammerer, Annie; Hiland, Patrick; Skeen, David; Case, Michael; RST01 Hoc

Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Giitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Chokshi, Niles; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael; Orders, William; Santiago, Patricia; Snodderly, Michael; Baggett, Steven; Sosa, Belkys; Davis, Roger; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Boska, John; Ma, John; Tegeler, Bret; Patel, Pravin; Shams, Mohamed; Morris, Scott; Brenner, Eliot; Harrington, Holly; Seber, Dogan; Ledford, Joey; Johnson, Michael; Virgilio, Martin; Holahan, Vincent; Bergman, Thomas; Webb, Michael; Manoly, Kamal; Khanna, Meena; Screnci, Diane; Thomas, Eric; Nguyen, Quynh; Meighan, Sean; FOIAResource.hoc@nrc.gov  
Subject: Seismic Q&As March 19th 8am update

All,

Here is today's updated version. Lot of new fact sheets have been prepared for various briefings and for Monday's public meeting!

However, the big news of the day is that we just sent off a 6 page, 22 question, much better edited version for a public Q&A set. It's all in OPA's capable hands now. I think it's pretty good...but then I'm biased.

Cheers,  
Annie

From: Kammerer, Annie

Sent: Friday, March 18, 2011 6:51 AM

To: Kammerer, Annie; Hiland, Patrick; Skeen, David; Case, Michael; RST01 Hoc

Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Giitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Chokshi, Niles; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael; Orders, William; Santiago, Patricia; Snodderly, Michael; Baggett, Steven; Sosa, Belkys; Davis, Roger; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Boska, John; Ma, John; Tegeler, Bret; Patel, Pravin; Shams, Mohamed; Morris, Scott; Brenner, Eliot; Harrington, Holly; Seber, Dogan; Ledford, Joey; Johnson, Michael; Virgilio, Martin; Holahan, Vincent; Bergman, Thomas; Webb, Michael; Manoly, Kamal; Khanna, Meena; Screnci, Diane; Thomas, Eric; Nguyen, Quynh; Meighan, Sean

Subject: RE: Seismic Q&As March 18th 5am update

All,

Please see the updated version of the Seismic Q&As.

Among today's highlights:

\*We added a Terms and Definitions section at the end of the document. (We know that an acronyms list would be helpful too, but it will have to wait a little) \*The "additional information" section has been split into tables, plots, and fact sheets \*A high-level draft fact sheet on NRC's seismic regulations has been added \*We added a section to track outstanding questions that have come in from congress. This will support those who get the tickets in the short terms (most likely NRR). The questions will be moved to the appropriate sections long term (as long as they are not duplicates.)

I'm sure we all agree this has been a crazy week!. We're hoping that the weekend workload is lighter (if only because we won't get as many email from in house) and we can clean up this document and fill in some of the missing answers in preparation for the news story changing. We're trying hard to get out in front of the next wave.

Cheers,  
Annie

---

From: Kammerer, Annie

Sent: Thursday, March 17, 2011 2:36 AM

To: Kammerer, Annie; Hiland, Patrick; Skeen, David; Case, Michael; RST01 Hoc

Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Giitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Chokshi, Nilesh; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Giitter, Joseph; Howe, Allen; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Munson, Clifford; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Murphy, Andrew; Pires, Jose; Hogan, Rosemary; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael; Orders, William; Santiago, Patricia; Snodderly, Michael; Baggett, Steven; Sosa, Belkys; Davis, Roger; Franovich, Mike; Castleman, Patrick; Sharkey, Jeffry; Boska, John; Ma, John; Tegeler, Bret; Patel, Pravin; Shams, Mohamed; Morris, Scott; Brenner, Eliot; Harrington, Holly; Seber, Dogan; Ledford, Joey; Johnson, Michael; Virgilio, Martin; Holahan, Vincent; Bergman, Thomas

Subject: Seismic Q&As March 17th 2am update All,

As promised, a sharepoint site has been set up where our friends in NRR will be posting the latest version of the Seismic Q&A document on an ongoing basis. If someone would prefer to use the sharepoint site, instead of being on this distribution list, please let me know...

<http://portal.nrc.gov/edo/nrr/NRR%20TA/FAQ%20Related%20to%20Events%20Occuring%20in%20Japan/Forms/AllItems.aspx>

This latest update has a number of new questions (not many with answers today, but we are working hard). A high priority question we are working on is "how many plants are near a mapped active fault". We're focusing on anything within 50 miles. We're also pulling relevant questions from the congressional inquiries we just received; and will also give these high priority to support any needs by NRR.

Many new figures and some draft fact sheets have added to the "additional information" section. These include the NRO half of a tsunami fact sheet...a description of the tsunami research is still to come from RES.

Some good news: Yesterday's version seems to have been widely forwarded around the agency. So, we are also starting to get some excellent questions from staff looking forward. This is allowing us to feel that we are finally getting out in front of things to a small degree. Also, our team has grown and we now have someone acting as source of seismic expertise for the 11pm to 7 am shift. This means that we now have seismic experts available to the RST and OPA at the Op Center 24 hours, with 2 people during the day. That extra support is allowing us to get this out at least an hour earlier today ☺

We are continuing to compile the questions that come in and update the seismic Q&A document. If you have suggested changes, or want to provide missing answers, please forward them to me for compilation.

This is a living document and will be updated daily in the foreseeable future.

Happy St. Paddy's Day. May the world (especially our friends in Japan) have the luck of the Irish today.

Cheers,  
Annie

Dr. Annie Kammerer, PE  
Senior Seismologist and Earthquake Engineer US Nuclear Regulatory Commission Office of Nuclear Regulatory Research  
Washington DC 20555

(b)(6)

mobil

BB

From: Kammerer, Annie  
Sent: Tuesday, March 15, 2011 3:41 AM  
To: Hiland, Patrick; Skeen, David  
Cc: Howe, Allen; Nelson, Robert; Stutzke, Martin; Giitter, Joseph; Rihm, Roger; McDermott, Brian; Hasselberg, Rick; Kammerer, Annie; Chokshi, Niles; Munson, Clifford; Cook, Christopher; Flanders, Scott; Ross-Lee, MaryJane; Brown, Frederick; Giitter, Joseph; Howe, Allen; Case, Michael; Ruland, William; Dudes, Laura; Karas, Rebecca; Ake, Jon; Munson, Clifford; Hogan, Rosemary; Uhle, Jennifer; Marshall, Michael; Uselding, Lara; Randall, John; Allen, Don; Burnell, Scott; Hayden, Elizabeth; Pires, Jose; Graves, Herman; Candra, Hernando; Murphy, Andrew; Murphy, Andrew; Pires, Jose; Hogan, Rosemary; Sheron, Brian; Dricks, Victor; Warnick, Greg; Reynoso, John; Lantz, Ryan; Markley, Michael  
Subject: latest version of Q&As

All,

This is the first draft of the seismic-specific Q&As. It is pretty rough and there are many answers still missing, but people have contributed a lot and we thought it may be useful for many people trying to answer questions coming in.

We are continuing to compile the questions that come in and update the seismic Q&A document. If you have suggested changes, or want to provide missing answers, please forward them to me for compilation.

This is a living document and will be updated daily in the foreseeable future.

Annie

Dr. Annie Kammerer, PE  
Senior Seismologist and Earthquake Engineer US Nuclear Regulatory Commission Office of Nuclear Regulatory Research  
Washington DC 20555

(b)(6)

mobil

BB

## Bensi, Michelle

---

**From:** Bensi, Michelle  
**Sent:** Wednesday, March 30, 2011 8:05 AM  
**To:** Kammerer, Annie  
**Subject:** RE: public FAQ  
**Attachments:** Frequently asked questions related to the March 11 2011 Earthquake and Tsunami 3-30-2011.docx

I found four very minor typos. If you haven't sent off the document to OPA, please see the attached document with the four typos tracked. But, like I said, they are very minor and you don't need to resend it to OPA if you already sent it.

---

**From:** Kammerer, Annie  
**Sent:** Tuesday, March 29, 2011 8:16 PM  
**To:** Bensi, Michelle  
**Cc:** Betancourt, Luis; Roche, Robert; Ake, Jon  
**Subject:** RE: public FAQ

Please see attached. Jon gave me some edits as well.

If no one sees any further necessary edits, this will go to OPA along with the Spanish translation.

Annie

Dr. Annie Kammerer, P.E.

US NRC/RES/DE

301) 251-7695 Office

(b)(6)

Mobile

---

**From:** Bensi, Michelle  
**Sent:** Tuesday, March 29, 2011 5:24 PM  
**To:** Kammerer, Annie  
**Subject:** public FAQ

The updated public FAQ document is attached for your review.  
The changes/additions that you requested have been made. I also found a couple typos that I corrected.

AAAA/441

# NRC frequently asked questions related to the March 11, 2011 Japanese Earthquake and Tsunami

---

**3-29-11 Version**

*Compiled by Annie Kammerer, Jon Ake, Cliff Munson, and Michelle Bensi for submission to OPA and NRR. We would appreciate getting an edited word file back to assure that the public comments and the internal document are consistent.*

## List of Questions

- 1) Can an earthquake and tsunami as large as happened in Japan also happen here? .....1
- 2) Did the Japanese underestimate the size of the maximum credible earthquake that could affect the plants?.....1
- 3) How high was the tsunami at the Fukushima nuclear plants? Was it higher than was expected?  
1
- 4) Was the damage to the Japanese nuclear plants mostly from the earthquake or the tsunami?..2
- 5) Have any lessons for US nuclear plants been identified? .....2
- 6) Was there any damage to US reactors from either the earthquake or the resulting tsunami?...2
- 7) Is radiation in the US expected to reach levels that are harmful to humans as a result of the events in Japan? .....2
- 8) How many US reactors are located in active earthquake zones?.....2
- 9) What level of earthquake hazard are the US reactors designed for? .....2
- 10) What magnitude earthquake are currently operating US nuclear plants designed to? .....3
- 11) Have the events in Japan changed our perception of earthquake risk to the nuclear plants in the US? .....3
- 12) Can significant damage to a nuclear plant like we saw in Japan happen in the US due to an earthquake? Are the Japanese nuclear plants similar to US nuclear plants? .....3
- 13) What is the likelihood of the design basis or "SSE" ground motions being exceeded over the life of a nuclear plant?.....4
- 14) Which reactors are located along coastal areas that could be affected by a tsunami? .....4
- 15) What is magnitude? What is the Richter Scale? What is intensity? .....4
- 16) How do magnitude and ground motion relate to each other?.....5
- 17) What is Generic Issue 199 about?.....5
- 18) Does GI-199 provide rankings of US nuclear plants in terms of safety? .....5
- 19) What are the current findings of GI-199? .....5
- 20) What do you mean by "increased estimates of seismic hazards" at nuclear plant sites?.....5
- 21) Does the Seismic Core Damage Frequency represent a measurement of the risk of radiation release or only the risk of core damage (not accounting for additional containment)? .....6
- 22) Where can I get current information about Generic Issue 199? .....6
- 23) Could an accident sequence like the one at Japan's Fukushima Daiichi nuclear plants happen in the US? .....6
- 24) Are the spent fuel pools designed to resist earthquake shaking? .....6

~~Draft - OUO~~

- 25) Does the NRC have a research program that studies seismic and tsunami issues? .....7



**1) Can an earthquake and tsunami as large as happened in Japan also happen here?**

The March 2011 Tohoku 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. Severe tsunamis like the one experienced in Japan are only produced by earthquakes occurring at this type of plate boundary. The only subduction zone that could affect the continental US is the Cascadia subduction zone, which lies off the coasts of Oregon, Washington, and the northernmost portion of California. Consequently, a continental earthquake and tsunami as large as the one experienced in Japan could only happen in that coastal region. The only nuclear plant near the Cascadia subduction zone is the Columbia Generating Station. This plant is located a large distance from both the coast (approximately 225 miles) and the offshore subduction zone. Because of the distance between the plant and the Cascadia subduction zone, the strength of ground motion expected at the plant is far lower than the ground motion experienced at the Fukushima plants during the Tohoku earthquake. The large distance between the Columbia Generating Station and the coast 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 approximately 8.25, which is significantly smaller than the magnitude of the Tohoku earthquake. Magnitude is measured on a log scale and thus a magnitude 9 earthquake produces about ten times stronger shaking and releases about 32 times more energy than a magnitude 8 earthquake. See Question (15) for additional information about earthquake magnitude.

**2) Did the Japanese underestimate the size of the maximum credible earthquake that could affect the plants?**

The magnitude of the Tohoku earthquake was somewhat greater than was expected for the part of the subduction zone on which the earthquake occurred. However, the Japanese nuclear plants were recently reassessed using ground motion levels similar to those that are believed to have occurred at the sites during the Tohoku earthquake. The ground motions against which the Japanese nuclear plants were reassessed were expected to result from earthquakes that were of smaller magnitude, but that were much closer to the sites.

**3) How high was the tsunami at the Fukushima nuclear plants? Was it higher than was expected?**

The tsunami modeling team at the National Oceanic and Atmospheric Administration's Pacific Marine Environmental Lab have estimated the wave height just offshore (at the 5 meter bathymetric line) to be approximately 8 meters in height at Fukushima Daiichi and approximately 7 meters ~~in at~~ Fukushima Daini. This estimate 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.

A recent estimate released by TEPCO indicates that the tsunami water at the Fukushima Daiichi site reached a height of 14 meters. The report also indicates that the design basis tsunami height was 5.7 meters and that the emergency diesel generators were located 10-13 meters above sea level. This data was provided by TEPCO and has not been confirmed by the NRC. Because a tsunami will rise up as it comes ashore, water level estimates of 8 meters offshore and 14 meters onshore appear to be consistent.

**4) Was the damage to the Japanese nuclear plants mostly from the earthquake or the tsunami?**

Because this event occurred in Japan, it will be hard for NRC staff to understand exactly what happened until comprehensive assessments can be performed. Preliminary information suggests that important safety systems performed their required function in the period between the occurrence of the earthquake and the impact of the tsunami. It appears that the emergency diesel generators successfully started once offsite power was lost. Therefore, the tsunami appears to have played a key role in the loss of backup power sources at the site (including the diesel generators), ultimately resulting in a condition known as station blackout. The station blackout was a critical factor in the problems experienced at Fukushima Daiichi nuclear plant.

**5) Have any lessons for US nuclear plants been identified?**

The NRC is in the process of following and reviewing the events in real time. This review will undoubtedly lead to the identification of issues that warrant further study. 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) Is radiation in the US expected to reach levels that are harmful to humans as a result of the events in Japan?**

No.

**8) 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. However, the boundaries between the zones are not well defined and depend on the interpretation of the various seismic sources. The United States Geological Survey (USGS) provides an interpretation of seismic hazard in the US. The USGS Earthquake Hazards Program website provides information about earthquakes in the US and around the world: <http://earthquake.usgs.gov/>. USGS also provides earthquake hazard maps and data: <http://earthquake.usgs.gov/hazards/products/>.

In the US, there are approximately 9 nuclear plants located in moderate seismicity zones and two plants located in high seismicity zones. These numbers may vary slightly depending on the scientific interpretation of earthquake hazard that is used. The NRC requires that every nuclear plant be designed for site-specific earthquake ground motions that are appropriate for its location. In addition, the NRC has specified a minimum ground motion level to which nuclear plants must be designed.

**9) What level of earthquake hazard are the US reactors designed for?**

Each reactor is designed for a ground motion level that is determined on a site-specific basis. The existing nuclear plants were designed using a "deterministic" or "scenario earthquake" approach that accounted for the largest earthquakes expected in the area around the plant, without consideration of the likelihood of the earthquakes occurring. New reactors are designed using probabilistic techniques that characterize both the ground motion levels and associated uncertainty in the assessment of the seismic hazard 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, new

nuclear plants are designed for the ground motion with an annual frequency of occurrence of  $1 * 10^{-4}$ /year. This can be thought of as the ground motion that occurs every 10,000 years, on average. One important aspect associated with the use of probabilistic seismic hazard and other risk-assessment techniques is that they account for beyond-design basis events. NRC's Generic Issue 199 (GI-199) project is using state-of-the-art probabilistic techniques to review the seismic safety of the existing plants. [see questions (17) to (22) for more information about GI-199]

**10) What magnitude earthquake are currently operating US nuclear plants designed to?**

Ground motion is a function of the magnitude of an earthquake, the distance from the earthquake source to the site, and other geologic characteristics. Nuclear plants, and in fact all engineered structures, are designed based on *ground motion* levels, not earthquake magnitudes. The existing nuclear plants were designed using a "deterministic" or "scenario earthquake" approach 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 additional robustness.

**11) Have the 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. The events transpiring in Japan following the Tohoku earthquake do not change the NRC's perception of earthquake hazard (i.e. ground motion levels) at US nuclear plants. It is too early to identify the lessons that may be learned from the Tohoku earthquake. The NRC will look closely at all aspects of the response of the Fukushima 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.

**12) Can significant damage to a nuclear plant like we saw 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 nuclear plants that are located in areas with low and moderate seismic activity are designed for safety in the event of such natural disasters. In addition to the design of the plants, significant effort is devoted to emergency response planning and severe accident management. This approach is called defense-in-depth.

The Japanese facilities at Fukushima are similar in design to some US facilities. However, the NRC has required modifications to US plants since they were designed and built. Examples of these modifications include design changes to control hydrogen and pressure in the containment. The NRC also requires plants to have additional equipment and measures in place to mitigate damage stemming from large fires and explosions resulting 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.

In addition, the NRC instituted a rule in the 1980s that required nuclear plants to further assure that a loss of both offsite and onsite emergency AC power systems (a condition known as a station blackout) would not adversely affect public health and safety. As a result of this rule, all plants have (1) established station blackout coping and recovery procedures; (2) completed training for these procedures; (3) implemented modifications as necessary to cope with a station blackout; and (4) ensured a 4-16 hour coping capability. Subsequently, studies conducted by the NRC have shown that the hardware and procedures that have been implemented to meet the station blackout requirements have resulted in a significant risk reduction and have further enhanced defense-in-depth.

**13) What is the likelihood of the design basis or "SSE" ground motions being exceeded over the life of a nuclear plant?**

The ground motion that is used as the seismic design basis at US nuclear plants is called the Safe Shutdown Earthquake ground motion (SSE). It is important to remember that structures, systems and components are required to have "adequate margin," meaning that they must be able to withstand shaking levels that are above the plant's design basis. 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 preliminary analyses to date, the mean probability of ground motions exceeding the SSE over the life of the plant, for the plants in the Central and Eastern United States, is less than about 1%.

**14) Which reactors are located 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 the tsunami level appropriate for their site as well as other natural hazards such as earthquakes and hurricanes.

**15) What is magnitude? 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,  $M_w$ , 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 corresponds to a tenfold increase in measured wave amplitude and about 32 times more energy.

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. Like moment magnitude, the Richter Scale is a logarithmic scale.

The intensity of an earthquake is a qualitative assessment of the effects of the earthquake at a particular location. The intensity is assigned 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, it produces a range of intensities that depend on the effects at each particular location.

**16) 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 seismic waves pass.

**17) What is Generic Issue 199 about?**

GI-199 investigates the safety and risk implications of updated earthquake-related data and models on existing nuclear plants. For some nuclear plants in the Central and Eastern United States, these updated data and models suggest that there has been a slight increase in the estimated probability that the earthquake ground motion experienced at the site during a future earthquake could exceed the seismic design basis. While the updated data and models suggest that this probability has increased slightly relative to previous estimates, it is important to understand that, overall, this probability remains low.

**18) 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 evaluate whether 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 conservative. The nature of the information used in the analyses makes these estimates useful only as a screening tool.

**19) 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 safety/risk assessment 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," which 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 even during very rare and extreme events. Therefore, the NRC has determined that assessment of updated seismic hazards and plant performance should continue. GI-199 originally focused on the 96 reactors located in the Central and Eastern United States. As a result of the Tohoku earthquake, the NRC has expanded the scope of the next stage of the GI-199 assessment activities to include all 104 operating reactors.

**20) 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 experienced at a site during an earthquake have improved. 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). It is important to note that it is not the underlying seismic hazard that has changed, but rather our scientific ability to understand and assess the hazard that has improved.

**21) Does the Seismic Core Damage Frequency 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 is necessary for radiological release to occur. The likelihood of radiation release is far lower than the core damage frequency.

**22) 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/>.

**23) 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." The Nuclear Regulatory Commission's detailed regulations address this scenario. US nuclear plants are designed to cope with a station blackout event that involves a loss of offsite power and onsite emergency power. In addition to design features, US nuclear plants are required to conduct a "coping" assessment, perform modifications if necessary, 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. Additional information about the NRC's station blackout rule is contained in question (12).

In addition, in response to the terrorist events of September 11, 2001, the NRC issued an Interim Compensatory Measures (ICM) Order requiring licensees to take certain actions to mitigate severe accident scenarios such as aircraft impact. These scenarios include the complete loss of offsite power and all on-site emergency power sources.

**24) Are the spent fuel pools designed to resist earthquake shaking?**

Spent fuel pools are constructed of reinforced concrete, several feet thick, with a stainless steel liner to prevent leakage and maintain water quality. Due to their configuration, spent fuel pools are inherently structurally-rugged and are designed to the same seismic requirements and ground motion levels as the nuclear plant.

**25) Does the NRC have a research program that studies seismic and tsunami issues?**

There is an extensive seismic and structural research program ongoing at the NRC. The Office of Nuclear Regulatory Research has several ongoing projects related to seismic hazard assessment for the Central and Eastern US. Research topics include seismic source characterization, development of improved ground motion prediction equations, and development of practical procedures to standardize the application of probabilistic seismic hazard assessment to nuclear plants. The Office of Nuclear Regulatory Research also manages a tsunami research program that focuses on bringing state-of-the-art technical advances to the NRC regulatory process. Key focus areas of the program include landslide-induced tsunami, development of probabilistic methods of tsunami hazard assessment, and development of technical bases for new NRC guidance. Though the tsunami research program focuses on topics related specifically to nuclear facilities, more general scientific advances in assessment of tsunami hazard on the Atlantic Coast of the US has resulted from collaboration between NRC staff, the US Geological Survey (USGS), and the National Oceanic and Atmospheric Administration (NOAA). Information about the above programs and other NRC research activities can be found in NUREG-1925, which is available online at: <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1925/r1/>.

**From:** Marksberry, Don  
**To:** Tinkler, Charles  
**Cc:** Drouin, Mary; Lee, Richard; Coyne, Kevin; Demoss, Gary; Appignani, Peter; Coe, Doug; Correia, Richard; Esmaili, Hossein; Schaperow, Jason; Helton, Donald; Kuritzky, Alan  
**Subject:** RE: Request for Ops Center RTS support  
**Date:** Wednesday, March 30, 2011 2:42:11 PM

---

Charlie

Richard indicated that you have the lead for the RST request from Fred Brown (below). Doug Coe assigned Mary Drouin as the DRA point of contact for assisting you with item #2. Please contact Mary at your convenience.

Don

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 10:37 AM  
**To:** Tinkler, Charles; Kuritzky, Alan  
**Cc:** Katie Wagner; Coyne, Kevin; Marksberry, Don; Esmaili, Hossein; Salay, Michael  
**Subject:** FW: Request for Ops Center RTS support  
**Importance:** High

For your action. Thx.

**From:** Gibson, Kathy  
**Sent:** Wednesday, March 30, 2011 7:37 AM  
**To:** Lee, Richard  
**Subject:** Fw: Request for Ops Center RTS support

---

**From:** Arndt, Steven  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Sent:** Wed Mar 30 07:33:07 2011  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis in this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry  
Steven Arndt

(b)(6)

---

**From:** Skeen, David  
**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc,

AAAA/442



PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
**Sent:** Tue Mar 29 23:43:46 2011  
**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

**From:** RST06 Hoc  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc  
**Sent:** Tue Mar 29 23:01:43 2011  
**Subject:** RE: Request for Ops Center RTS support

Please see below.

**From:** Brown, Frederick  
**Sent:** Tuesday, March 29, 2011 10:56 PM  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc  
**Subject:** Request for Ops Center RTS support  
**Importance:** High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not

quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

**Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.**

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles. ¼ core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

**From:** Marksberry, Don  
**To:** Drouin, Mary  
**Cc:** Correia, Richard; Esmaili, Hossein; Tinkler, Charles; Coe, Doug  
**Subject:** RE: Request for Ops Center RTS support  
**Date:** Wednesday, March 30, 2011 8:46:09 PM

---

Mary

The assessment recommendation is being finalized by the RST/industry and should be sent to the site team tonight. We should have a final copy in the morning; otherwise, we can provide you a draft hard copy. Also, Hossein is on mid shift today and should have current status in the morning. I can help set you up in the morning.

Don

---

**From:** Drouin, Mary  
**Sent:** Wednesday, March 30, 2011 6:47 PM  
**To:** Tinkler, Charles; Marksberry, Don  
**Cc:** Lee, Richard; Coyne, Kevin; Demoss, Gary; Appignani, Peter; Coe, Doug; Correia, Richard; Esmaili, Hossein; Schaperow, Jason; Helton, Donald; Kuritzky, Alan  
**Subject:** RE: Request for Ops Center RTS support

Charlie,

Should have something for you tomorrow around noon, but do you or someone have the "the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments" that Fred references?

Tks, mary

---

**From:** Tinkler, Charles  
**Sent:** Wednesday, March 30, 2011 3:57 PM  
**To:** Marksberry, Don  
**Cc:** Drouin, Mary; Lee, Richard; Coyne, Kevin; Demoss, Gary; Appignani, Peter; Coe, Doug; Correia, Richard; Esmaili, Hossein; Schaperow, Jason; Helton, Donald; Kuritzky, Alan  
**Subject:** RE: Request for Ops Center RTS support

Don

I just saw Doug Coe in the Op Center PMT. He raised this issue in our conversation.

It is my understanding after talking to him that DRA (Mary Drouin) has the lead for item #2 (generation of event trees) and I am to assist her as needed.

---

**From:** Marksberry, Don  
**Sent:** Wednesday, March 30, 2011 2:42 PM  
**To:** Tinkler, Charles  
**Cc:** Drouin, Mary; Lee, Richard; Coyne, Kevin; Demoss, Gary; Appignani, Peter; Coe, Doug; Correia, Richard; Esmaili, Hossein; Schaperow, Jason; Helton, Donald; Kuritzky, Alan  
**Subject:** RE: Request for Ops Center RTS support

Charlie

AAAA/443

Richard indicated that you have the lead for the RST request from Fred Brown (below). Doug Coe assigned Mary Drouin as the DRA point of contact for assisting you with item #2. Please contact Mary at your convenience.

Don

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 10:37 AM  
**To:** Tinkler, Charles; Kuritzky, Alan  
**Cc:** Katie Wagner; Coyne, Kevin; Marksberry, Don; Esmaili, Hossein; Salay, Michael  
**Subject:** FW: Request for Ops Center RTS support  
**Importance:** High

For your action. Thx.

**From:** Gibson, Kathy  
**Sent:** Wednesday, March 30, 2011 7:37 AM  
**To:** Lee, Richard  
**Subject:** Fw: Request for Ops Center RTS support

**From:** Arndt, Steven  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Sent:** Wed Mar 30 07:33:07 2011  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis in this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry  
Steven Arndt

(b)(6)

**From:** Skeen, David  
**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
**Sent:** Tue Mar 29 23:43:46 2011  
**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

**From:** RST06 Hoc  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc  
**Sent:** Tue Mar 29 23:01:43 2011  
**Subject:** RE: Request for Ops Center RTS support

Please see below.

---

**From:** Brown, Frederick  
**Sent:** Tuesday, March 29, 2011 10:56 PM  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc  
**Subject:** Request for Ops Center RTS support  
**Importance:** High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we

recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles. ¼ core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

**From:** Kuritzky, Alan  
**To:** Correia, Richard  
**Subject:** RE: Request for Ops Center RTS support  
**Date:** Wednesday, March 30, 2011 3:04:49 PM

---

This was from before. You can ignore it.

Thanks,  
Alan

---

**From:** Correia, Richard  
**Sent:** Wednesday, March 30, 2011 3:02 PM  
**To:** Kuritzky, Alan  
**Subject:** RE: Request for Ops Center RTS support

Sure Alan. Or was this email sent before I met you & Doug in his office?

Richard Correia, PE  
Director, Division of Risk Analysis  
Office of Nuclear Regulatory Research  
US NRC

[richard.correia@nrc.gov](mailto:richard.correia@nrc.gov)

---

**From:** Kuritzky, Alan  
**Sent:** Wednesday, March 30, 2011 1:14 PM  
**To:** Correia, Richard  
**Subject:** FW: Request for Ops Center RTS support  
**Importance:** High

Rich,

I am going to stop by to talk to you about this email (I don't know if anyone else has forwarded this to you, but you were not on the distribution as far as I could tell). I suspect it came to me because I am acting for Kevin today.

Alan

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 10:37 AM  
**To:** Tinkler, Charles; Kuritzky, Alan  
**Cc:** Katie Wagner; Coyne, Kevin; Marksberry, Don; Esmaili, Hossein; Salay, Michael  
**Subject:** FW: Request for Ops Center RTS support  
**Importance:** High

For your action. Thx.

---

**From:** Gibson, Kathy  
**Sent:** Wednesday, March 30, 2011 7:37 AM  
**To:** Lee, Richard  
**Subject:** Fw: Request for Ops Center RTS support

AAAA/444

**From:** Arndt, Steven  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Sent:** Wed Mar 30 07:33:07 2011  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis in this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry  
Steven Arndt

(b)(6)

**From:** Skeen, David  
**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
**Sent:** Tue Mar 29 23:43:46 2011  
**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

**From:** RST06 Hoc  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc  
**Sent:** Tue Mar 29 23:01:43 2011  
**Subject:** RE: Request for Ops Center RTS support

Please see below.

**From:** Brown, Frederick  
**Sent:** Tuesday, March 29, 2011 10:56 PM  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc  
**Subject:** Request for Ops Center RTS support  
**Importance:** High



Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

~~Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.~~

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary

containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles.  $\frac{1}{4}$  core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

**From:** Gibson, Kathy  
**To:** RST06 Hoc; Ruland, William; Arndt, Steven; Skeen, David; Cheok, Michael; Coe, Doug  
**Cc:** Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Scott, Michael; Tinkler, Charles; Cool, Donald; Correia, Richard  
**Subject:** Re: Request for Ops Center RTS support  
**Date:** Wednesday, March 30, 2011 6:05:22 PM

---

First, I can't tell who "me" is. Suggest if you are using an HOC email address you first say who you are.

Second, RES has the lead for both items, DSA (me) for the first one and DRA (Doug Coe) for the second one. I added Rich Correia to the distribution as he is our new DRA division director and Doug Coe's father passed away so he is gone.

Richard Lee is our POC with the Ops Center. Charlie Tinkler is the staff person working the first item and Mary Druin is working the second item.

Let us know (preferably via Richard) if you need anything else.

---

**From:** RST06 Hoc  
**To:** Ruland, William; Arndt, Steven; Skeen, David; Cheok, Michael; Gibson, Kathy; Coe, Doug  
**Cc:** Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Scott, Michael; Tinkler, Charles; Cool, Donald  
**Sent:** Wed Mar 30 17:35:33 2011  
**Subject:** RE: Request for Ops Center RTS support

Just noticed that I'm not even on the distribution. Please add me. Thanks.

---

**From:** RST06 Hoc  
**Sent:** Wednesday, March 30, 2011 5:34 PM  
**To:** Ruland, William; Arndt, Steven; Skeen, David; Cheok, Michael; Gibson, Kathy; Coe, Doug  
**Cc:** Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Scott, Michael; Tinkler, Charles; Cool, Donald  
**Subject:** RE: Request for Ops Center RTS support

Thanks Bill. You must be a fan of other tired, old, acts too – Cher maybe?

Before responding, can I ask that whomever has stepped-up to take the lead for this do a respond-all to let us know?

Objective for first question (energetic release potential): this information is important to the Ambassador in Japan and the US military command that would be responsible for movement of US citizens who were ordered to be evacuated from any locations in the Pacific. In fact, the Pacific Command asked the same question of the NRC at today's Deputies Meeting that is attended by the Chairman. The answer to this question may also impact when we as the NRC ramp down our activities? **We should attempt to address this by Friday (4/1).**

Objective for the second question is to support multiple questions/actions. There have been many requests of the PMT for "realistic" dose models. The RST Assessment document (original e-mail was supposed to have it attached, but I've added to this incase it did not go out the first time) also contains recommended actions for the Japanese to consider. These recommendations are based on the SAMGS, which all are intended to protect primary containment. Since primary containment

AAAA/445

is damaged on at least two units, we need to assess whether there may be new considerations/priorities that are not captured by the SAMGs. Also, the product of this effort helps us better clarify the assessment of potential energetic releases, along with identifying the best strategies to ensure that they don't happen. **This item does not have as short a deliverable date unless the PMT has one that I'm not aware of, but is still very significant in terms of our recommendations. Can we complete by Monday (4/4)?**

Of course, my request should be seen as the start of a process, and that others should add to it in order to shape into an end product that goes beyond, or corrects, the vision that I started with.

Fred

---

**From:** Ruland, William  
**Sent:** Wednesday, March 30, 2011 10:36 AM  
**To:** Arndt, Steven; Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Subject:** RE: Request for Ops Center RTS support

Great thinking! I've always been a Fred Brown fan! For my benefit, what are the objectives for this task and by when do we need to get the answers?

Regarding the core damage percentages, I understand that they were early numbers. Are we yet in a position to revise them?

Bill

---

**From:** Arndt, Steven  
**Sent:** Wednesday, March 30, 2011 7:33 AM  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis in this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry  
Steven Arndt

(b)(6)

---

**From:** Skeen, David  
**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
**Sent:** Tue Mar 29 23:43:46 2011  
**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

**From:** RST06 Hoc  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc  
**Sent:** Tue Mar 29 23:01:43 2011  
**Subject:** RE: Request for Ops Center RTS support

Please see below.

---

**From:** Brown, Frederick  
**Sent:** Tuesday, March 29, 2011 10:56 PM  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc  
**Subject:** Request for Ops Center RTS support  
**Importance:** High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a

difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

**Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.**

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles. ¼ core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 8:25 AM  
**To:** Aissa, Mourad  
**Subject:** FW: Support for Japan - SFP Criticality Potential Update

Don't you think I am nice to him?

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]  
**Sent:** Tuesday, March 29, 2011 10:03 PM  
**To:** Lee, Richard  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

You are most welcome! Anything for you, Richard ☺

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
Phone: (865) 241-3570  
Mobile: (b)(6)

---

**From:** Lee, Richard [mailto:Richard.Lee@nrc.gov]  
**Sent:** Tuesday, March 29, 2011 8:10 AM  
**To:** Wagner, John C.  
**Cc:** Aissa, Mourad; Parks, Cecil V.  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Thanks, John. Sorry to wait you up to do this.  
Richard

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]  
**Sent:** Tuesday, March 29, 2011 7:30 AM  
**To:** Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

With attachment...

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
Phone: (865) 241-3570  
Mobile: (b)(6)

---

**From:** Wagner, John C.  
**Sent:** Tuesday, March 29, 2011 7:28 AM  
**To:** Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.;

Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,

Yes, center-to-center pitch would be a good start. We have information on the complete inventory of the SFPs, including Unit 4 – see attached for some summary information. Our information indicates that the Unit 4 SFP has high-density racks, and makes us suspicious that Unit 4 SFP could have the same or similar high-density racks as are in the Unit 1-3 pools.

To be clear, I still suspect the likelihood of criticality is very small, as there should be significant reactivity margin in the system. However, the possibility that the Unit 4 SFP racks could have been uncovered for some period of time, the fact that we have received incorrect information on the racks previously, the fact that we have no information on the condition of the racks or the spent fuel, and that the other SFPs have AI-based racks, makes we want to proceed with caution.

I hope this is helpful

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]

**Sent:** Tuesday, March 29, 2011 6:01 AM

**To:** Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John,

Thanks for the consideration. We will stand fast until a consolidated position is reached.

I doubt we can get all of the information you (and I) would love to have. We will start small to see if we can get the center-to-center pitch in the racks. Note that the Daiichi SFPs are relatively low capacity in that they do not have as many assemblies in the pool as a typical US BWR. There is a common pool on-site where many of the spent fuel assemblies are moved. We understand that there Unit 4 pool had ~1000 assemblies in the pool. As such, it is possible that these are low-density racks.

We will try to ask for the center-to-center pitch tomorrow.

Regards,  
Rob

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]

**Sent:** Monday, March 28, 2011 11:32 PM

**To:** Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.

**Subject:** RE: Support for Japan - SFP Criticality Potential Update



Don,

As you stated, the previous assessment was based on information at the time, which was that the SFPs all had high-density, borated SS racks. Given the high melting temperature of SS, we expected the neutron absorbers to remain effective up to temperatures at which concern about criticality would be overtaken by concerns related to significant release of radiation due to fuel damage.

We have since learned that the initial information on the racks was incorrect. Specifically, from EPRI and NEI we have the following information (received in the past 2 days):

*"-->Units 1, 2, 3 have both aluminum racks as well as borated aluminum racks.*

*Unit 4 has only non-borated stainless racks."*

This information is consistent with the information you have below.

#### **The above information raises questions/concerns**

- Available information suggests the Unit 4 SFP racks are high-density (no flux traps)
- Yet, based on our experience, high-density requires neutron absorber panels, e.g., Borated, borated SS, etc.
- So, we need more information on the Unit 4 SFP racks to fully assess criticality potential there
- Concern is that the Unit 4 SFP racks may be similar to the Unit 1-3 SFP racks, i.e., borated Al (not SS), and that if the Unit 4 SFP racks were uncovered for some period of time, the neutron absorber effectiveness could be compromised. If this is the case, reflooding with un-borated water could very well be a PROBLEM.
- Another issue is that if the racks are truly SS without Boron, then some large spacing and/or flux traps would be required. Damage to the racks could decrease spacing, which would be a concern, particularly given the statement from below "Japanese concerns that the racks may have shifted".
- We do know that the Unit 4 SFP has >100 assemblies in the peak reactivity burnup range that are stored together.

Generally speaking, if the effectiveness of the racks is maintained (geometric separation of individual assemblies and absorption properties), we do not expect fuel degradation/reconfiguration to offset the inherent safety margins required by international standards and regulatory requirements for spent fuel pool criticality safety analyses, e.g., all assemblies at their peak reactivity, 0.05 margin in keff, and the various standard conservatisms in typical safety analyses (e.g., analyses based on most reactive lattice design, conservative depletion assumptions, ambient spent fuel pool water temperature, etc.).

So, coming back around to your specific question: **Do we now see a need to modify or expand the above technical opinion? If so, how?**

Answer: "yes" My revised position is the following:

"Given that the overall efficacy of the racks has been maintained, in terms of geometric separation of assemblies and neutron absorption characteristics, my opinion is that criticality in the spent fuel pools is very unlikely, particularly if boron is being used, and that the consequences of criticality in one of the spent fuel pools will not be significant in comparison to the consequences of the pool remaining empty/exposed. Provided the nuclear criticality safety analyses for the spent fuel pools were performed accurately and consistent with US Nuclear Regulatory Commission requirements and that the spent fuel racks were manufactured, installed and loaded consistent with the supporting nuclear criticality safety analyses, sufficient margin should be present to offset potential increases in reactivity associated with fuel reconfiguration. (Note: under normal circumstances, BWR spent fuel pools do not have borated water, and hence are designed and analyzed to be safe when flooded with un-borated water). If the efficacy of the racks is in question, I strongly suggest continued use of borated water until/unless the

condition and design of the racks can be properly assessed. These are my personal/professional opinions, based on the information available to me at this time, and should be treated as such." Once I get input from others at ORNL, we will provide a collective position.

Note, depending on how hot the Unit 1-3 SFPs have been, I may have some concern about criticality in those pools since they utilize aluminum and borated aluminum racks.

**Questions for you:**

- 1) Can we get the design specifications for the SFP racks, particularly those in the Unit 4 SFP, ASAP?
- 2) Can we get the nuclear criticality safety analyses that was performed in support of the SFP rack licensing?
- 3) Can we get any photos or assessments of the condition of the spent fuel and spent fuel racks, particularly in Unit 4 SFP, ASAP? I was told video of the Unit 4 SFP (from a camera mounted on top of the fill pipe) would be available on 3/24, but I have yet to see it.

FYI – we have prepared a set of slides (attached) for the DOE related to this issue that has some additional information/basis that may be useful to you. These slides have yet to be provided to DOE and are likely to be revised to include the above, revised assessment pending review.

If you have any questions whatsoever, please do not hesitate to call me at any time – day or night – on my mobile number.

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Carlson, Donald [mailto:Donald.Carlson@nrc.gov]

**Sent:** Monday, March 28, 2011 9:14 PM

**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

**Importance:** High

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

**Statement:** Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool. (The statement

also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

**Question: Do we now see a need to modify or expand the above technical opinion? If so, how?**

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

**Donald E. Carlson**

NRO/ARP/ARB1

Cell: (b)(6)

Office: 301-415-0109

---

**From:** Taylor, Robert

**Sent:** Monday, March 28, 2011 6:59 PM

**To:** Carlson, Donald; Brown, Frederick

**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated

Switching to fresh water injection on 3/29

Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel

204 fresh fuel assemblies were present in the pool

Japanese concerns that the racks may have shifted.

Fuel damage due to uncover

Regards,  
Rob

---

**From:** Carlson, Donald

**Sent:** Monday, March 28, 2011 6:23 PM

**To:** Taylor, Robert; Brown, Frederick

**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

**Subject:** RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI – When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,  
Don

---

**From:** Taylor, Robert  
**Sent:** Monday, March 28, 2011 5:59 PM  
**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 1:07 PM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
**Subject:** RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

**Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.**

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----  
From: Carlson, Donald

Sent: Monday, March 28, 2011 9:30 AM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael  
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick  
Sent: Sunday, March 27, 2011 9:11 PM  
To: Carlson, Donald  
Cc: Taylor, Robert; Scott, Michael  
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)?  
He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,  
Fred

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 8:29 AM  
**To:** Esmaili, Hossein; 'Gauntt, Randy (home)'; 'Randy Gauntt (SNL)'; Salay, Michael  
**Subject:** FW: Request for Ops Center RTS support

fyi

---

**From:** Gibson, Kathy  
**Sent:** Wednesday, March 30, 2011 7:37 AM  
**To:** Lee, Richard  
**Subject:** Fw: Request for Ops Center RTS support

---

**From:** Arndt, Steven  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Sent:** Wed Mar 30 07:33:07 2011  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis in this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry  
Steven Arndt

(b)(6)

---

**From:** Skeen, David  
**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
**Sent:** Tue Mar 29 23:43:46 2011  
**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

**From:** RST06 Hoc  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc

**Sent:** Tue Mar 29 23:01:43 2011

**Subject:** RE: Request for Ops Center RTS support

Please see below.

---

**From:** Brown, Frederick

**Sent:** Tuesday, March 29, 2011 10:56 PM

**To:** Cheok, Michael; Gibson, Kathy

**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc

**Subject:** Request for Ops Center RTS support

**Importance:** High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles.  $\frac{1}{4}$  core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.



Lee, Richard

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 10:37 AM  
**To:** Tinkler, Charles; Kuritzky, Alan  
**Cc:** 'Katie Wagner'; Coyne, Kevin; Marksberry, Don; Esmaili, Hossein; Salay, Michael  
**Subject:** FW: Request for Ops Center RTS support

**Importance:** High

For your action. Thx.

---

**From:** Gibson, Kathy  
**Sent:** Wednesday, March 30, 2011 7:37 AM  
**To:** Lee, Richard  
**Subject:** Fw: Request for Ops Center RTS support

---

**From:** Arndt, Steven  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Sent:** Wed Mar 30 07:33:07 2011  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis in this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry  
Steven Arndt

(b)(6)

---

**From:** Skeen, David  
**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
**Sent:** Tue Mar 29 23:43:46 2011  
**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

**From:** RST06 Hoc  
**To:** Cheok, Michael; Gibson, Kathy

**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc  
**Sent:** Tue Mar 29 23:01:43 2011  
**Subject:** RE: Request for Ops Center RTS support

Please see below.

---

**From:** Brown, Frederick  
**Sent:** Tuesday, March 29, 2011 10:56 PM  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc  
**Subject:** Request for Ops Center RTS support  
**Importance:** High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spay plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles.  $\frac{1}{4}$  core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

---

**From:** LIA05 Hoc  
**Sent:** Wednesday, March 30, 2011 5:11 PM  
**To:** FOIA Response.hoc Resource  
**Subject:** FW: FW Fukushima

Bonnie Sheffield Dayshift 0700-1500  
Ken Wierman Nightshift 1500-2300  
FEMA REP Liaison  
NRC Operations Center  
(301) 816-5187

~~\*\*\*\*\*FOR OFFICIAL USE ONLY\*\*\*\*\*~~

~~DO NOT RELEASE OUTSIDE OF THE FEDERAL FAMILY~~

---

**From:** Ralston, Michelle [mailto:Michelle.Ralston@dhs.gov]  
**Sent:** Friday, March 25, 2011 8:53 AM  
**To:** LIA05 Hoc  
**Subject:** RE: FW Fukushima

Larry,

This has only an error message in Notepad attached.

Respectfully,

Michelle Ralston, MS, PMI  
Public Affairs, Stakeholder Outreach & Campaign Planning  
Professional Services & Integration  
Technological Hazards Division  
Protection & National Preparedness  
DHS/FEMA  
1800 South Bell Street, Rm. 828  
Arlington, VA 22202  
(202) 212-2310 desk  
(b)(6) Blackberry  
(703) 305-0837 facsimile

---

**From:** prvs=05881ecbf=LIA05.Hoc@nrc.gov [mailto:prvs=05881ecbf=LIA05.Hoc@nrc.gov] **On Behalf Of** LIA05 Hoc  
**Sent:** Friday, March 25, 2011 8:31 AM  
**To:** Ralston, Michelle  
**Subject:** RE: FW Fukushima

Not sure who/whom was responsible for this but wanted to share.

Larry

AAA/449

Bonnie Sheffield Dayshift 0700-1500  
Ken Wierman Nightshift 1500-2300  
FEMA REP Liaison  
NRC Operations Center  
(301) 816-5187

~~\*\*\*\*\*FOR OFFICIAL USE ONLY\*\*\*\*\*~~

~~DO NOT RELEASE OUTSIDE OF THE FEDERAL FAMILY~~

**From:** Ralston, Michelle [mailto:Michelle.Ralston@dhs.gov]  
**Sent:** Friday, March 25, 2011 8:25 AM  
**To:** LIA05 Hoc  
**Subject:** RE: FW Fukushima

No, I did not. Please forward, if possible. Thank you!

Respectfully,

Michelle Ralston, MS, PMI  
Public Affairs, Stakeholder Outreach & Campaign Planning  
Professional Services & Integration  
Technological Hazards Division  
Protection & National Preparedness  
DHS/FEMA  
1800 South Bell Street, Rm. 828  
Arlington, VA 22202  
(202) 212-2310 desk  

(b)(6) Blackberry

  
(703) 305-0837 facsimile

**From:** prvs=05881ecbf=LIA05.Hoc@nrc.gov [mailto:prvs=05881ecbf=LIA05.Hoc@nrc.gov] **On Behalf Of** LIA05 Hoc  
**Sent:** Friday, March 25, 2011 8:08 AM  
**To:** Ralston, Michelle  
**Subject:** RE: FW Fukushima

Did you ever get the attachment? I found it and can forward on if necessary.

LB

Larry Broockerd Dayshift 0700-1500  
Ken Wierman Nightshift 1500-2300  
FEMA REP Liaison  
NRC Operations Center  
(301) 816-5187

~~\*\*\*\*\*FOR OFFICIAL USE ONLY\*\*\*\*\*~~

~~DO NOT RELEASE OUTSIDE OF THE FEDERAL FAMILY~~

**From:** Ralston, Michelle [mailto:Michelle.Ralston@dhs.gov]  
**Sent:** Friday, March 25, 2011 6:46 AM

**To:** LIA05 Hoc; Dan Feighert; Andrew Seward; Harry Sherwood; John Simpson; Steve Horwitz; Tim Greten; Vanessa E. Quinn  
**Subject:** RE: FW Fukushima

I'm sorry there is no Power Point attached. Thanks.

Respectfully,

Michelle Ralston, MS, PMI  
Public Affairs, Stakeholder Outreach & Campaign Planning  
Professional Services & Integration  
Technological Hazards Division  
Protection & National Preparedness  
DHS/FEMA  
1800 South Bell Street, Rm. 828  
Arlington, VA 22202  
(202) 212-2310 desk  

(b)(6)

 Blackberry  
(703) 305-0837 facsimile

---

**From:** prvs=0573bcf4e=LIA05.Hoc@nrc.gov [mailto:prvs=0573bcf4e=LIA05.Hoc@nrc.gov] **On Behalf Of** LIA05 Hoc  
**Sent:** Thursday, March 24, 2011 7:31 PM  
**To:** Dan Feighert; Andrew Seward; Harry Sherwood; John Simpson; Michelle Ralston; Steve Horwitz; Tim Greten; Vanessa E. Quinn  
**Subject:** FW: FW Fukushima

This is a great power point on the accident.

Bonnie Sheffield Dayshift 0700-1500  
Ken Wierman Nightshift 1500-2300  
FEMA REP Liaison  
NRC Operations Center  
(301) 816-5187

~~\*\*\*\*\*FOR OFFICIAL USE ONLY\*\*\*\*\*~~  
~~DO NOT RELEASE OUTSIDE OF THE FEDERAL FAMILY~~

---

**From:** LIA01 Hoc  
**Sent:** Thursday, March 24, 2011 7:29 PM  
**To:** LIA05 Hoc  
**Subject:** FW: FW Fukushima

---

**From:** Hale, Jerry  
**Sent:** Thursday, March 24, 2011 6:41 PM  
**To:** LIA01 Hoc  
**Subject:** FW: FW Fukushima

**From:** Cabbage, Amy  
**Sent:** Thursday, March 24, 2011 5:05 PM  
**To:** Tonacci, Mark; Galvin, Dennis; Baval, Bruce; Muniz, Adrian; Jessie, Janelle; Hale, Jerry; Anand, Raj; Govan, Tekia  
**Subject:** FW Fukushima

The attached power point is interesting info. Includes dose data for anyone who is interested in those details

**From:** Santos, Daniel  
**Sent:** Thursday, March 24, 2011 11:11 AM  
**To:** Bergman, Thomas; Dixon-Herrity, Jennifer; Jung, Ian; Jackson, Terry; Norato, Michael; Jenkins, Ronaldo; Hawkins, Kimberly; Terao, David; Hsia, Anthony  
**Subject:** FW: Nuclear Problems in Japan

This was forwarded to me by one of my MDEP counterparts.

**From:** Lojk, Robert [mailto: (b)(6)]  
**Sent:** Thursday, March 24, 2011 9:51 AM  
**To:** Santos, Daniel  
**Subject:** Nuclear Problems in Japan

Daniel:

In case you guys haven't seen this, Areva has done a good job illustrating the Japanese event.

See you in Vienna.

Saludos,

Bob  
Robert Lojk, P. Eng.  
Director, Systems Engineering Division  
Canadian Nuclear Safety Commission  
613 947 3992

(b)(6)

(Cell)

\*\*\*\*\*  
The information contained in this e-mail is intended solely for the use of the named addressee. Access, copying, or re-use of the e-mail or any information contained therein by any other person is not authorized. If you are not the intended recipient, please notify us immediately by returning the e-mail to the originator.

Ce message est strictement réservé à l'usage du destinataire indiqué. Si vous n'êtes pas le destinataire de ce message, la consultation ou la reproduction même partielle de ce message et des renseignements qu'il contient est non autorisée. Si ce message vous a été transmis par erreur, veuillez en informer l'expéditeur en lui retournant ce message immédiatement.  
\*\*\*\*\*

**From:** Raione, Richard  
**To:** Johnson, Michael; Holahan, Gary  
**Cc:** Flanders, Scott; Chokshi, Niles  
**Subject:** Groundwater - Japan  
**Date:** Wednesday, March 30, 2011 10:45:51 AM

---

As you know, groundwater /surface water contamination has become a topic of interest with the current situation in Japan.

I wanted you to know that I would be happy to volunteer to go to Japan to assist in this capacity.

I have almost 30 years of experience in this field and was elected this past January as the Vice-Chair for the Federal Subcommittee on Hydrology ( I will be the Chair starting in October).

I am also a current and licensed professional geologist in 19 states

Please keep me in mind should this type of expertise be needed, thank you.

Richard Raione, PG, CPG, CGWP  
US NRC, Office of New Reactors  
Chief, Hydrologic Engineering Branch  
301-415-7190

cell: (b)(6)  
fax: 301-415-5397

[richard.raione@nrc.gov](mailto:richard.raione@nrc.gov)

AAAA/450



**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 10:41 AM  
**To:** Aissa, Mourad  
**Subject:** FW: Support for Japan - SFP Criticality Potential Update

Mourad:

Please track.  
Richard

---

**From:** Taylor, Robert  
**Sent:** Wednesday, March 30, 2011 10:25 AM  
**To:** 'wagnerjc@ornl.gov'; Carlson, Donald; 'parkscv@ornl.gov'; 'hoppercm@ornl.gov'; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; 'gehinjc@ornl.gov'; 'muellerde@ornl.gov'; 'marshallwj@ornl.gov'; Nakanishi, Tony  
**Subject:** Re: Support for Japan - SFP Criticality Potential Update

John,

TEPCO confirmed our previous understanding that the Unit 4 racks are SS without any neutron absorber panels. Tepco again stated that the unit 1-3 racks are AI with boron. I believe something is being lost in translation and expect that they mean the racks are SS with borated AI panels.

Tepco said they would get back to us regarding the center-to-center pitch tomorrow.

Thanks for your help.

Regards,  
Rob

Sent from an NRC BlackBerry  
Robert Taylor

(b)(6)

---

**From:** Wagner, John C. <wagnerjc@ornl.gov>  
**To:** Taylor, Robert; Carlson, Donald; Parks, Cecil V. <parkscv@ornl.gov>; Hopper, Calvin Mitchell <hoppercm@ornl.gov>; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C. <gehinjc@ornl.gov>; Mueller, Don <muellerde@ornl.gov>; Marshall, William BJ J. <marshallwj@ornl.gov>; Nakanishi, Tony  
**Sent:** Tue Mar 29 07:28:20 2011  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,

Yes, center-to-center pitch would be a good start. We have information on the complete inventory of the SFPs, including Unit 4 – see attached for some summary information. Our information indicates that the Unit 4 SFP has high-density racks, and makes us suspicious that Unit 4 SFP could have the same or similar high-density racks as are in the Unit 1-3 pools.

To be clear, I still suspect the likelihood of criticality is very small, as there should be significant reactivity margin in the system. However, the possibility that the Unit 4 SFP racks could have been uncovered for some period of time, the fact that we have received incorrect information on the racks previously, the fact

that we have no information on the condition of the racks or the spent fuel, and that the other SFPs have Al-based racks, makes we want to proceed with caution.

I hope this is helpful

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]

**Sent:** Tuesday, March 29, 2011 6:01 AM

**To:** Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John,

Thanks for the consideration. We will stand fast until a consolidated position is reached.

I doubt we can get all of the information you (and I) would love to have. We will start small to see if we can get the center-to-center pitch in the racks. Note that the Daiichi SFPs are relatively low capacity in that they do not have as many assemblies in the pool as a typical US BWR. There is a common pool on-site where many of the spent fuel assemblies are moved. We understand that there Unit 4 pool had ~1000 assemblies in the pool. As such, it is possible that these are low-density racks.

We will try to ask for the center-to-center pitch tomorrow.

Regards,  
Rob

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]

**Sent:** Monday, March 28, 2011 11:32 PM

**To:** Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Don,

As you stated, the previous assessment was based on information at the time, which was that the SFPs all had high-density, borated SS racks. Given the high melting temperature of SS, we expected the neutron absorbers to remain effective up to temperatures at which concern about criticality would be overtaken by concerns related to significant release of radiation due to fuel damage.

We have since learned that the initial information on the racks was incorrect. Specifically, from EPRI and NEI we have the following information (received in the past 2 days):

*"-->Units 1, 2, 3 have both aluminum racks as well as borated aluminum racks.*

*Unit 4 has only non-borated stainless racks."*

This information is consistent with the information you have below.

### **The above information raises questions/concerns**

- Available information suggests the Unit 4 SFP racks are high-density (no flux traps)
- Yet, based on our experience, high-density requires neutron absorber panels, e.g., Boral, borated SS, etc.
- So, we need more information on the Unit 4 SFP racks to fully assess criticality potential there
- Concern is that the Unit 4 SFP racks may be similar to the Unit 1-3 SFP racks, i.e., borated Al (not SS), and that if the Unit 4 SFP racks were uncovered for some period of time, the neutron absorber effectiveness could be compromised. If this is the case, reflooding with un-borated water could very well be a PROBLEM.
- Another issue is that if the racks are truly SS without Boron, then some large spacing and/or flux traps would be required. Damage to the racks could decrease spacing, which would be a concern, particularly given the statement from below "Japanese concerns that the racks may have shifted".
- We do know that the Unit 4 SFP has >100 assemblies in the peak reactivity burnup range that are stored together.

Generally speaking, if the effectiveness of the racks is maintained (geometric separation of individual assemblies and absorption properties), we do not expect fuel degradation/reconfiguration to offset the inherent safety margins required by international standards and regulatory requirements for spent fuel pool criticality safety analyses, e.g., all assemblies at their peak reactivity, 0.05 margin in keff, and the various standard conservatisms in typical safety analyses (e.g., analyses based on most reactive lattice design, conservative depletion assumptions, ambient spent fuel pool water temperature, etc.).

So, coming back around to your specific question: **Do we now see a need to modify or expand the above technical opinion? If so, how?**

Answer: "yes" My revised position is the following:

"Given that the overall efficacy of the racks has been maintained, in terms of geometric separation of assemblies and neutron absorption characteristics, my opinion is that criticality in the spent fuel pools is very unlikely, particularly if boron is being used, and that the consequences of criticality in one of the spent fuel pools will not be significant in comparison to the consequences of the pool remaining empty/exposed. Provided the nuclear criticality safety analyses for the spent fuel pools were performed accurately and consistent with US Nuclear Regulatory Commission requirements and that the spent fuel racks were manufactured, installed and loaded consistent with the supporting nuclear criticality safety analyses, sufficient margin should be present to offset potential increases in reactivity associated with fuel reconfiguration. (Note: under normal circumstances, BWR spent fuel pools do not have borated water, and hence are designed and analyzed to be safe when flooded with un-borated water). If the efficacy of the racks is in question, I strongly suggest continued use of borated water until/unless the condition and design of the racks can be properly assessed. These are my personal/professional opinions, based on the information available to me at this time, and should be treated as such." Once I get input from others at ORNL, we will provide a collective position.

Note, depending on how hot the Unit 1-3 SFPs have been, I may have some concern about criticality in those pools since they utilize aluminum and borated aluminum racks.

### **Questions for you:**

- 1) Can we get the design specifications for the SFP racks, particularly those in the Unit 4 SFP, ASAP?
- 2) Can we get the nuclear criticality safety analyses that was performed in support of the SFP rack licensing?

- 3) Can we get any photos or assessments of the condition of the spent fuel and spent fuel racks, particularly in Unit 4 SFP, ASAP? I was told video of the Unit 4 SFP (from a camera mounted on top of the fill pipe) would be available on 3/24, but I have yet to see it.

FYI – we have prepared a set of slides (attached) for the DOE related to this issue that has some additional information/basis that may be useful to you. These slides have yet to be provided to DOE and are likely to be revised to include the above, revised assessment pending review.

If you have any questions whatsoever, please do not hesitate to call me at any time – day or night – on my mobile number.

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Carlson, Donald [mailto:Donald.Carlson@nrc.gov]

**Sent:** Monday, March 28, 2011 9:14 PM

**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

**Importance:** High

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

**Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.** (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

**Question: Do we now see a need to modify or expand the above technical opinion? If so, how?**

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

Donald E. Carlson

NRO/ARP/ARB1

Cell: (b)(6)

Office: 301-415-0109

---

**From:** Taylor, Robert

**Sent:** Monday, March 28, 2011 6:59 PM

**To:** Carlson, Donald; Brown, Frederick

**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated

Switching to fresh water injection on 3/29

Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel

204 fresh fuel assemblies were present in the pool

Japanese concerns that the racks may have shifted.

Fuel damage due to uncover

Regards,

Rob

---

**From:** Carlson, Donald

**Sent:** Monday, March 28, 2011 6:23 PM

**To:** Taylor, Robert; Brown, Frederick

**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

**Subject:** RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI – When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,

Don

---

**From:** Taylor, Robert

**Sent:** Monday, March 28, 2011 5:59 PM

**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 1:07 PM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
**Subject:** RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

**Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.**

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----  
**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 9:30 AM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael  
**Subject:** RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----  
**From:** Brown, Frederick  
**Sent:** Sunday, March 27, 2011 9:11 PM  
**To:** Carlson, Donald

Cc: Taylor, Robert; Scott, Michael  
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)?  
He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,  
Fred

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 11:21 AM  
**To:** Esmaili, Hossein  
**Subject:** FW: Request for Ops Center RTS support

Hossein:

Did Charlie and Jason provide any in the pass week?

Richard

---

**From:** Gibson, Kathy  
**Sent:** Wednesday, March 30, 2011 11:02 AM  
**To:** Lee, Richard  
**Cc:** Tinkler, Charles  
**Subject:** Fw: Request for Ops Center RTS support

Do they not know that we have been providing source term information for the past several weeks (that haven't been used to my knowledge)?

---

**From:** Ruland, William  
**To:** Arndt, Steven; Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Sent:** Wed Mar 30 10:35:52 2011  
**Subject:** RE: Request for Ops Center RTS support

Great thinking! I've always been a Fred Brown fan! For my benefit, what is the objectives for this task and by when do we need to get the answers?

Regarding the core damage percentages, I understand that they were early numbers. Are we yet in a position to revise them?

Bill

---

**From:** Arndt, Steven  
**Sent:** Wednesday, March 30, 2011 7:33 AM  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis is this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry

Steven Arndt

(b)(6)

EX 6

AAAA/452



**From:** Skeen, David  
**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
**Sent:** Tue Mar 29 23:43:46 2011  
**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

**From:** RST06 Hoc  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc  
**Sent:** Tue Mar 29 23:01:43 2011  
**Subject:** RE: Request for Ops Center RTS support

Please see below.

---

**From:** Brown, Frederick  
**Sent:** Tuesday, March 29, 2011 10:56 PM  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc  
**Subject:** Request for Ops Center RTS support  
**Importance:** High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of

these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles.  $\frac{1}{4}$  core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

Lee, Richard

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 12:39 PM  
**To:** 'Dana Powers'  
**Subject:** FW: MOX vs UO2 Pu  
**Attachments:** image008.png; image001.png; image009.png; image010.png

Dana: For your info.

Hence, I think we should just make up some bullets on the release one before we get us and they need the answer in 1 hr.

Richard

---

**From:** Parks, Cecil V. [mailto:parkscv@ornl.gov]  
**Sent:** Wednesday, March 30, 2011 11:59 AM  
**To:** Aissa, Mourad  
**Cc:** Lee, Richard; Gauld, Ian C.; Broadhead, Bryan L.; Wagner, John C.  
**Subject:** FW: MOX vs UO2 Pu

Late I know, but thought you would have interest in these if something comes up later.

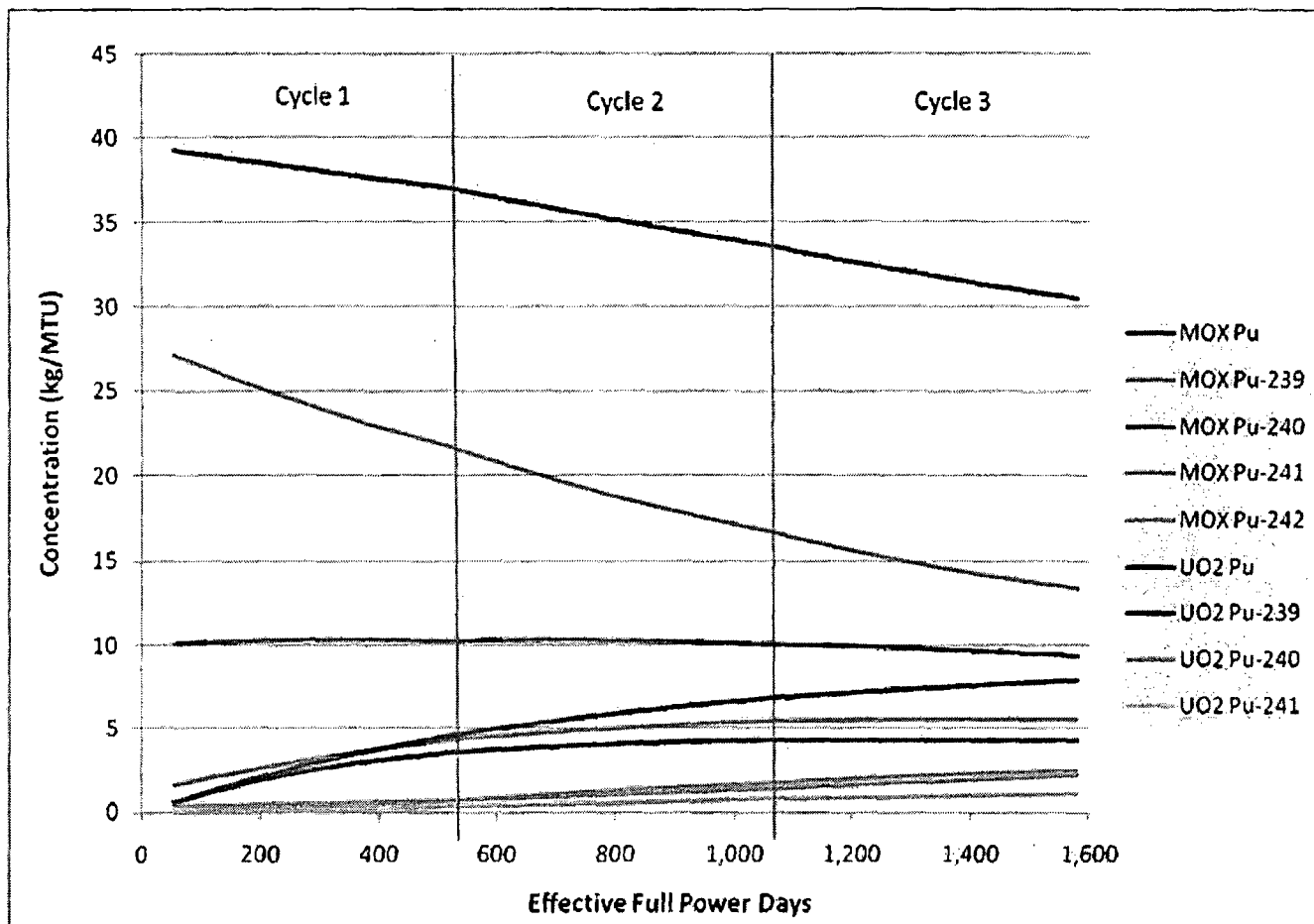
---

**From:** Broadhead, Bryan L.  
**Sent:** Wednesday, March 30, 2011 9:29 AM  
**To:** Wagner, John C.  
**Cc:** Parks, Cecil V.  
**Subject:** RE: MOX vs UO2 Pu

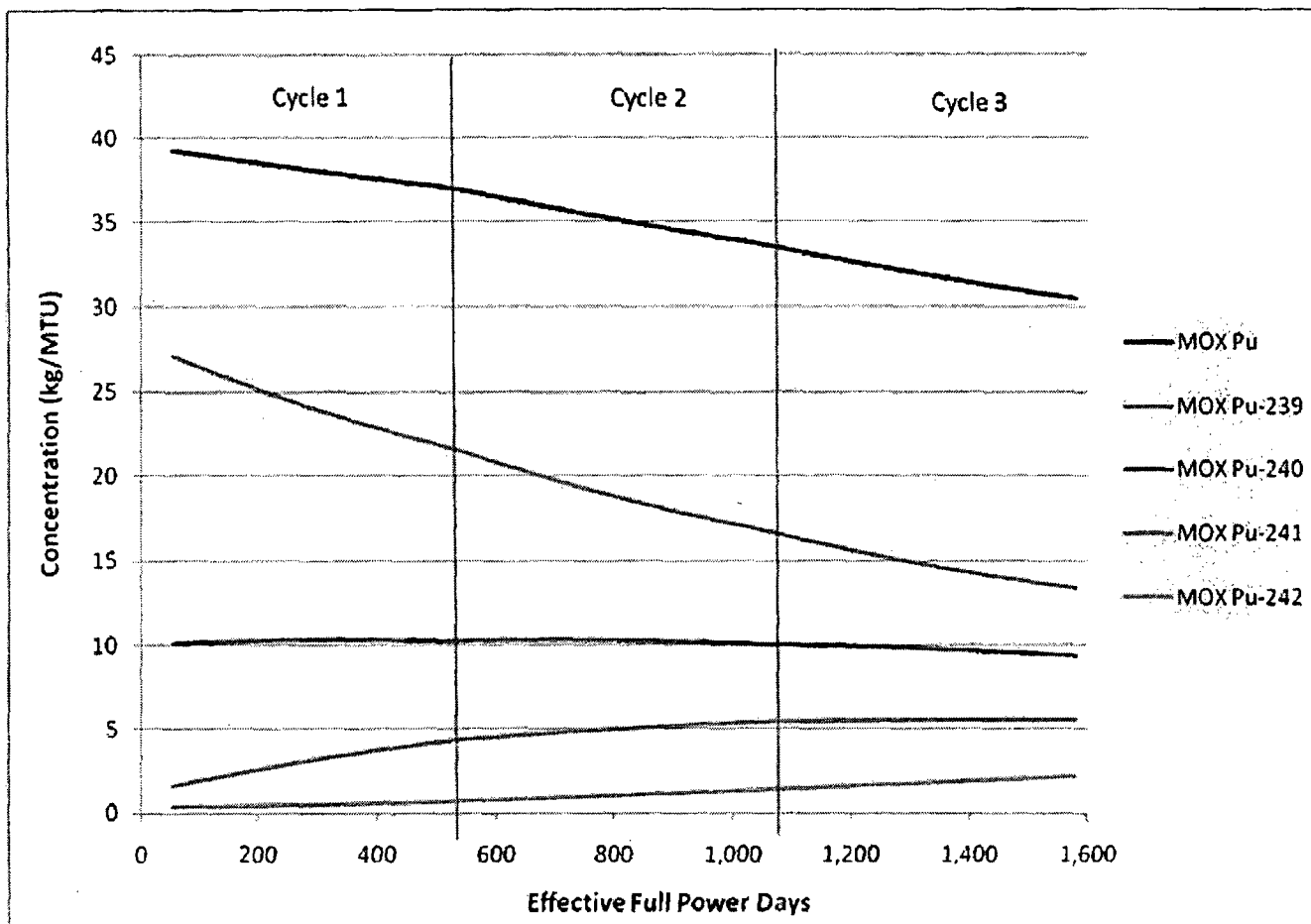
Here are the results presented several different ways.

All on same plot

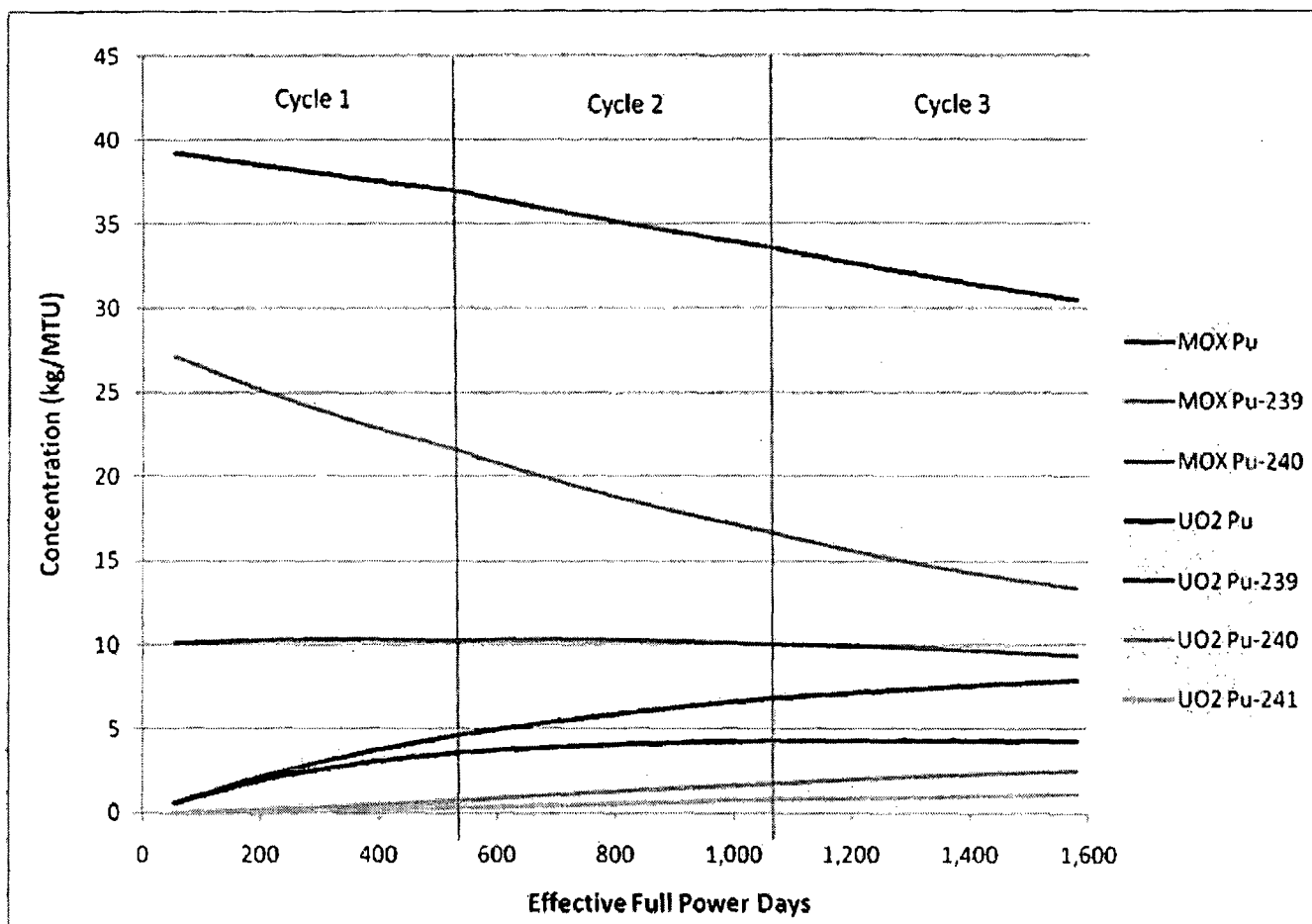
AAAA/453



MOX only



All UO2 with top 3 MOX



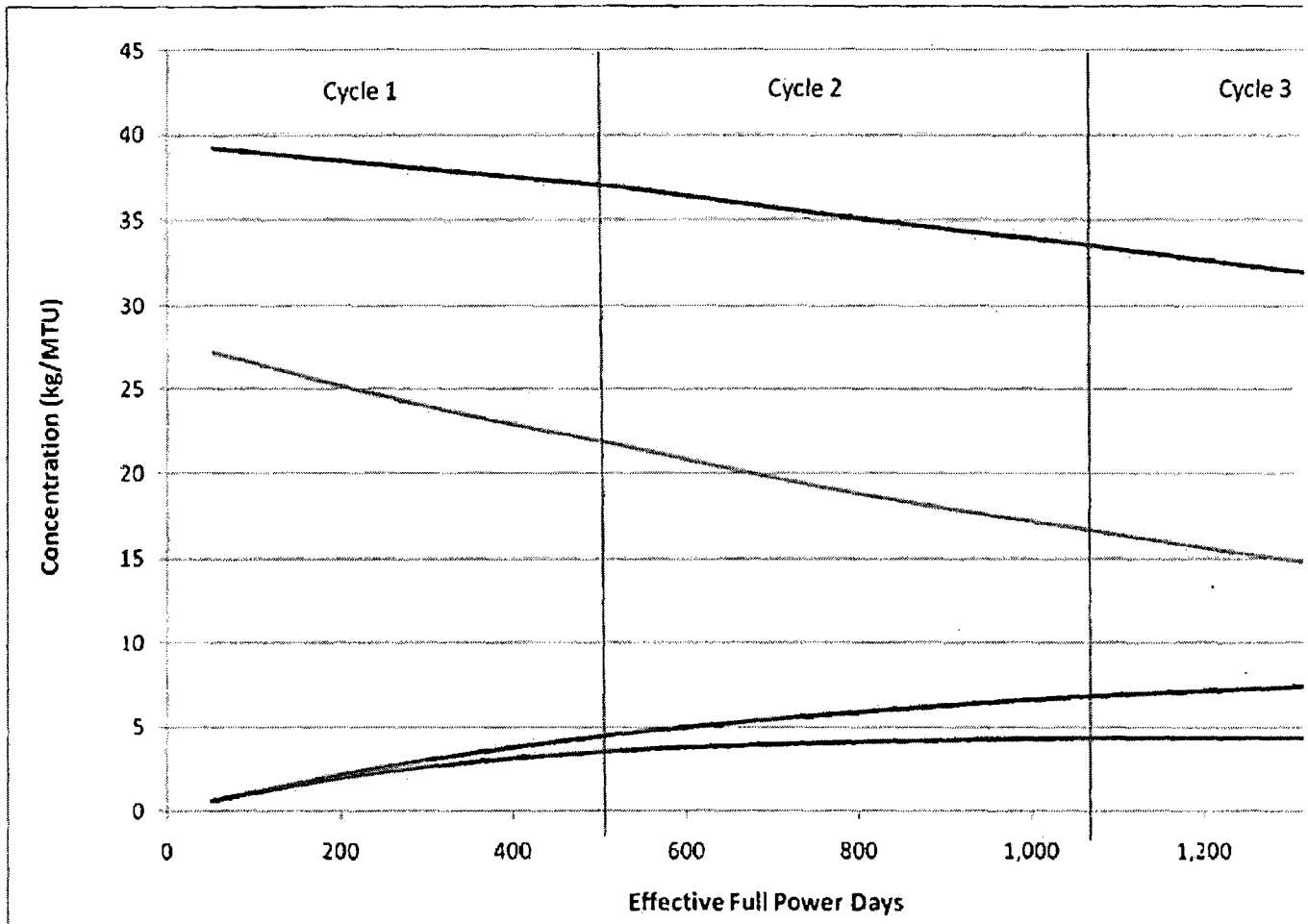
**From:** Wagner, John C.  
**Sent:** Tuesday, March 29, 2011 9:56 PM  
**To:** Broadhead, Bryan L.  
**Cc:** Parks, Cecil V.  
**Subject:** RE: MOX vs UO2 Pu

Thanks Bryan. The blue and red curves are presumably total Pu. Do you have a plot that shows all the significant Pu isotopes separately?

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
 Phone: (865) 241-3570  
 Mobile: (b)(6)

**From:** Broadhead, Bryan L.  
**Sent:** Tuesday, March 29, 2011 4:51 PM  
**To:** Wagner, John C.  
**Cc:** Parks, Cecil V.  
**Subject:** MOX vs UO2 Pu

The plot gives the total Pu and Pu-239 concentrations versus Full Power Days under identical operating parameters. The assumptions are that the initial MOX contains 4% Pu/Initial Heavy Metal. This assumption directly affects the initial inventory of plutonium (i.e. 40 kg for 4%, 30 kg for 3%, 20 kg for 2% etc).



Bryan L. Broadhead, Ph.D.  
Nuclear Security Modeling Group  
Reactor and Nuclear Systems Division  
Oak Ridge National Laboratory  
P.O. Box 2008  
Oak Ridge, TN 37831-6170  
(865)576-4476  
(865)574-9619 FAX  
[broadheadbl@ornl.gov](mailto:broadheadbl@ornl.gov)

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 12:46 PM  
**To:** Wagner, Katie  
**Subject:** FW: Request for Ops Center RTS support

**Importance:** High

Charlie – (1)  
Alan/Kevin – (2)

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 10:37 AM  
**To:** Tinkler, Charles; Kuritzky, Alan  
**Cc:** 'Katie Wagner'; Coyne, Kevin; Marksberry, Don; Esmaili, Hossein; Salay, Michael  
**Subject:** FW: Request for Ops Center RTS support  
**Importance:** High

For your action. Thx.

---

**From:** Gibson, Kathy  
**Sent:** Wednesday, March 30, 2011 7:37 AM  
**To:** Lee, Richard  
**Subject:** Fw: Request for Ops Center RTS support

---

**From:** Arndt, Steven  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Sent:** Wed Mar 30 07:33:07 2011  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis is this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry  
Steven Arndt

(b)(6)

---

**From:** Skeen, David  
**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
**Sent:** Tue Mar 29 23:43:46 2011  
**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.



I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

**From:** RST06 Hoc

**To:** Cheok, Michael; Gibson, Kathy

**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc

**Sent:** Tue Mar 29 23:01:43 2011

**Subject:** RE: Request for Ops Center RTS support

Please see below.

---

**From:** Brown, Frederick

**Sent:** Tuesday, March 29, 2011 10:56 PM

**To:** Cheok, Michael; Gibson, Kathy

**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc

**Subject:** Request for Ops Center RTS support

**Importance:** High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles.  $\frac{1}{4}$  core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 12:51 PM  
**To:** Wagner, Katie  
**Subject:** FW: Request for Ops Center RTS support

#58 and #60 are the same.

---

**From:** Tinkler, Charles  
**Sent:** Wednesday, March 30, 2011 12:22 PM  
**To:** Gibson, Kathy; Lee, Richard  
**Cc:** Uhle, Jennifer; Schaperow, Jason; Esmaili, Hossein; Helton, Donald  
**Subject:** RE: Request for Ops Center RTS support

Update:

Just completed phone conversation with Tony Huffert indicates that the Fred Brown (RST) request is the same as the PMT request. So we will be addressing both and try to coordinate RST with PMT. Apparently the deadline for this estimate is the coming weekend per the White House.

We will take a look at this but right now our first priority is responding to a very similar request this morning from the PMT (which they say originated from the NRC delegation at the Tokyo US embassy). They want a "pessimistic" source term for future releases from Unit 1 reactor and Unit 4 spent fuel pool.

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 10:37 AM  
**To:** Tinkler, Charles; Kuritzky, Alan  
**Cc:** Katie Wagner; Coyne, Kevin; Marksberry, Don; Esmaili, Hossein; Salay, Michael  
**Subject:** FW: Request for Ops Center RTS support  
**Importance:** High

For your action. Thx.

---

**From:** Gibson, Kathy  
**Sent:** Wednesday, March 30, 2011 7:37 AM  
**To:** Lee, Richard  
**Subject:** Fw: Request for Ops Center RTS support

---

**From:** Arndt, Steven  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Sent:** Wed Mar 30 07:33:07 2011  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis in this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry

✓ Steven Arndt

(b)(6)

---

**From:** Skeen, David

**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy

**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven

**Sent:** Tue Mar 29 23:43:46 2011

**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

**From:** RST06 Hoc

**To:** Cheok, Michael; Gibson, Kathy

**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc

**Sent:** Tue Mar 29 23:01:43 2011

**Subject:** RE: Request for Ops Center RTS support

Please see below.

---

**From:** Brown, Frederick

**Sent:** Tuesday, March 29, 2011 10:56 PM

**To:** Cheok, Michael; Gibson, Kathy

**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc

**Subject:** Request for Ops Center RTS support

**Importance:** High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with

significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles. ¼ core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

---

**From:** Evans, Michele  
**Sent:** Wednesday, March 30, 2011 5:28 AM  
**To:** Foster, Jack; LIA03 Hoc; LIA02 Hoc  
**Subject:** Re: OUO- TRANSITION REPORT FOR MARCH 29, 0700 - 1500

Please provide Jack the return checklist. Thanks.

Sent from an NRC Blackberry  
Michele Evans

---

**From:** Foster, Jack  
**To:** Evans, Michele  
**Sent:** Wed Mar 30 03:54:08 2011  
**Subject:** FW: OUO- TRANSITION REPORT FOR MARCH 29, 0700 - 1500

Michelle,

I don't recall receiving a return checklist...

**Return Checklist.** Michele Evans had one suggested amendment. The change was made and the document was sent to Michele Evans for concurrence and for distribution to the travelers coming back. Email document to travelers coming back to U.S as requested by Michele Evans (on LIA02 Desktop). Update 3/28 1300: After confirming changes with Michele Evans, sent checklist to travelers already returned and those returning this week.

Jack

---

**From:** LIA02 Hoc  
**Sent:** Tuesday, March 29, 2011 3:22 PM  
**To:** OIP Distribution; Liaison Japan  
**Cc:** LIA03 Hoc; LIA02 Hoc; 'ShafferMR@state.gov'; Bloom, Steven; Rosales-Cooper, Cindy; LIA08 Hoc; LIA06 Hoc; LIA07 Hoc  
**Subject:** OUO- TRANSITION REPORT FOR MARCH 29, 0700 - 1500

~~OFFICIAL USE ONLY~~

## **TRANSITION REPORT FOR MARCH 29, 0700 - 1500**

*Jill and Karen to Nancy and Gerri*

### **UPDATES DURING SHIFT**

- **IAEA All Member States Meeting:** Received request from the ET director, Mike Webber to coordinate with Mark Shaffer in Vienna to determine the topic and/or agenda for this meeting, which was called by the DG. The ET would like to know what will be communicated by the DG to member states and what might be asked of member states at this meeting. Email communicating this request was sent to Jen Schwartzman with cc to Mark Shaffer by 0700-1500 shift on 3/29. Communicate any information received to the LT director to be communicated to the ET director on duty. Action follow up pending response by Jen or Mark.
- **Re-Entry guidance:** Forwarded final re-entry guidance to NRC team in Japan and requested they forward to the Ambassador per our instructions from NSC. Action is closed.

- **3<sup>rd</sup> Team of NRC Travelers:** Per Michele Evans a third team of NRC travelers is being considered however, no names or dates have been decided as yet. Action: Pending notification from Michele Evans. Remember to inform Jason Kozal (NRC-embedded at USAID) once a decision has been reached.
- **DHS Request:** Received request from DHS/Stern (to Cyndi Jones) on 3/28 at 1912. Stern wants to know "does NRC have access to IAEA Measured Data on ENAC (not the Japanese data)". PMT was unable to provide a response as to whether or not they use the IAEA data and ENAC search showed only Japanese data. Responded back to Cyndi Jones at 2141 with that information and inquired if anyone else would have access to IAEA information within the PMT. At 2:11am, Mark Shaffer asked that Jennifer Schwartzman brief LIA02 (and Cyndi Jones) regarding the ongoing discussion between Warren Stern and Ambassador Davies on the topic noted in the recent transition log. Action follow-up pending Cyndi's response.
- **IAEA Coordination.** 3/28 at 1850, DEDO/Virgilio requested information on IAEA's role as the clearinghouse for assistance. He indicated that Margie said IAEA accepted the role. He would like to know the next steps for implementation and how it will be accomplished. Sent Margie and Mark Schaffer an email requesting information. Jen Schwartzman responded that DOD has the lead for US-Interagency logistics (Margie is aware of this) and that IAEA has not agreed to be a clearinghouse, however, they have agreed to play a significant role (Jen's email response with more information is in the Inbox from 3/28 at 1937. Follow up with Margie on 3/29 and advise the ET and DEDO/Virgilio of the next steps.
- **Request from RST and PMT** to keep them updated on who is currently in Japan on NRC team. 3/28, 1300. Updated list provided, minus PII, to RST and PMT.
- **Sent** a request to returned travelers/travelers about to return to confirm their status, and to provide them with updated returned traveler checklist at 1300. Received responses from R.DeVercelly. Action: Update list as travelers respond. Update: Received response from D. Emche that Chuck Casto will return 4/12 and John Monniger 4/5 at 2107.
- **Return Checklist.** Michele Evans had one suggested amendment. The change was made and the document was sent to Michele Evans for concurrence and for distribution to the travelers coming back. Email document to travelers coming back to U.S as requested by Michele Evans (on LIA02 Desktop). Update 3/28 1300. After confirming changes with Michele Evans, sent checklist to travelers already returned and those returning this week.
- **NRC Health Unit request:** Dr. Cadoux (and Jeanne Dempsey) has contacted LIA02/LIA03 via Jen Schwartzman to discuss the situation with KI. The NRC team members were given KI before they left. At this time the guidance is to not take the KI while on duty in Tokyo. However, due to the still-fluid nature of the environmental hazards posed by radioactive isotopes, there still exists a possibility that KI could be required at some point. Jen has responded to Jeanne that should it become necessary to have the NRC team take the KI, the LIA02/LIA03 international liaisons would be responsible for receiving the advice from ADM/Dr. Cadoux and to get the information to the team immediately.

#### FUTURE ACTIONS/OPEN ITEMS

- **Coordination of IAEA and U.S. Efforts.** It appears that DoD (Navy) is taking a logistical leadership role in coordinating efforts for the U.S. government. This information will need to be coordinated with both the IAEA international coordinating team as well as the INPO representative. NRC is interested in knowing what other countries are providing in support to Japan. Email was sent to NRC IAEA Attache' and NRC IAEA desk officer to pursue a path forward. Action: Attache' and desk officer will report if they need anything further from the LT. ET may inquire about path forward.
- **Emche Blackberry Voicemail Problems.** Forwarded directions from TSC to Danielle on how to access her voicemail. She tried them but it still did not work properly. She will call the CSC Monday morning. Her BB number is confirmed. Emailed Eric to confirm his BB number. Action: A heads up regarding the continuing voice mail problems was sent to CSC. Danielle will call CSC Monday. The Monday teams should stay tuned in case Danielle needs further assistance. Update 3/29, 4:08 AM: We still have IT issues, (for D. Emche, no voice mail, although she's ready to give up and stop reporting this). Update 3/29: Based upon emails between Danielle and CSC they are working to find a time for a call with AT&T to troubleshoot the issues since the instructions provided are still not working. Problem not solved.

- **Laptop IT/Citrix issues:** Update 3/29, 4:08 AM: We still have IT issues, (for D. Emche, no voice mail, although she's ready to give up and stop reporting this). A bigger issue is with citrix for a few laptops here. Robert Heard and Karen Jackson have been contacted. Update 3/29 10AM: Met with OIS to discuss the laptop issues. They stated that several of the laptops that went out from headquarters were configured generically so that anyone could use them. OIS said they would provide a list to LIA02 and LIA03 showing which laptops were generically configured. OIS said they could reconfigure the ones that are currently tied to a user from headquarters. Any laptops that went from the regions to Japan are outside the scope of what they can reconfigure. Along with the list OIS is to provide any instructions for users in Japan needed to assist them with reconfiguration efforts. They requested one point of contact on the ground in Japan. I informed them that LIA02 or 03 would pass all information along to Danielle Emche and instruct Danielle to contact the CSC before 10am Japan time with any questions or issues following the reconfiguration instructions. **UPDATE:** 3/29 2:35pm – List plus instructions from OIS have been received and forwarded to Danielle Emche with instructions to call CSC with questions before 10am Japan time (9pm EDT). **Action:** None (be prepared to provide assistance pending further complications from the team in Japan).
- **Request for meteorological data.** PMT notified LIA02/03 of their need for meteorological data. **Action:** If you receive meteorological communications which do not already have PMT on distribution, please ensure PMT is cc'ed on the email (send to PMT02 and PMT12) and walk a hard copy back to the meteorologists.
- **Japan Relief Team.**
  - **Dosimetry:** LIA03 sent an email to LiaisonJapan (original team) asking for them to email back their dosimetry numbers. The initial team sent over was in such a rush that the Headquarters Radiation Safety Officer, John O'Donnell, never recorded which dosimeter was assigned to which staff member. If dosimeter numbers (on the back) are received directly to the international liaison desks they should be forwarded to John O'Donnell and entered into a word document on LIA03.
  - Cris Brown has advised that, rather than asking the relief team to carry additional satellite phones to Japan, the current team should turn ownership of the two satellite phones already over there to a new member of the relief team. The travelers have been advised to work with the current team to determine who should take ownership, then provide that name to Cris Brown and LIA02/LIA03. **Action:** When name is provided, ensure that Cris Brown has it.
- **Request from U.S. Forces Japan.** LT Director received a request for specific reactor information from USFJ in preparation for a bilateral. International liaisons gave NRC team in Japan a heads up that the request had come in. LT Director replied to the request indicating that we have a team in Japan and that, rather than duplicate the requests the USG is making of the Japanese, it would be more efficient for USFJ to coordinate with us. LIA02 and 03 were provided as email addresses for USFJ to communicate with.
- **IAEA Coordination.** The ET had tasked us with understanding the role of the IAEA's Incident and Emergency Centre (IEC) and what the extent of their role is if Japan does not make a formal request to them under the Assistance Convention. We suggested that the IEC serve as a clearinghouse, keeping track of all requests for assistance from Japan, all offers to assist from other countries, who has provided what, and whether it satisfies the requests. We have told the LT Director that OIP will keep the ET informed of developments on this issue. **Action:** We need to talk to Margie about how she'd like us to proceed with responding to IAEA's request. Continue to follow this and expect questions from ET and LT Director. **Update 3/28: M. Shaffer has confirmed that Japan has not requested assistance under the Convention.**
- **Translators.** 24/7 translation coverage has been suspended due to both projected decreasing demand and funding issues. **Action:** PMT has asked that we identify any Japanese speakers at NRC (e.g. foreign assignees) who can assist if an urgent translation is needed. PMT is comfortable understanding the monitoring data as the fields in the tables are repetitive. Email request sent to Steve D./Charlotte/Mary C.
- **Daily calls with UK/France/Canada.** Calls will take place at 0930 with RST and PMT to discuss reactor-related and radiation-related information, respectively, with regulatory representatives from



these three countries. Everyone should call into the HOO to be connected. Call will not occur over the weekend. The new number to call into for the RST call is (b)(6) and the pin is (b)(6).

- **Daily NRC Japan Team – RST/PMT Call.** Next call scheduled for 0300. RST and PMT have been notified of the call and international liaison should plan on participating (Brooke and Kirk don't necessarily participate). All parties should call into **301-816-5120** and use pass-code (b)(6).
- **21:30 Interagency Call.** Call (202) 647-1512 and ask for the Interagency call bridge.
- **Deputies Committee Decisions and Action Items:** **Action:** Annette will be sending us the meeting summaries when she gets them. They need to be placed in the White House file and then search for NRC actions and update the running list. Forward to the LT Director and Coordinator.
- **RST Recommendations:** In reference to the white paper that the RST is writing containing technical recommendations for the Japanese (which will need interagency and consortium stakeholder concurrence), Chuck Casto relayed that Ambassador Roos wants to attach the final recommendations to a document from DOS and submit it to the Japanese side. The ET said that this was not a good idea. Following the call, Chuck Casto did touch base with the Ambassador, who still wants to proceed. The Chairman will probably talk to the Ambassador about this issue in due course. **No action required, just be aware in case the issue comes up.**
- **Tech Issues for New Team Members in Tokyo:** The newly arrived team members have questions about how to access citrix and re-assign laptops. In addition, due to sign on problems, some may be locked out or need to have something re-set. A call was placed to NRCs 24 IT group for resolution of the issues. Follow service tag 91JMNL1 for resolution of their issues.

#### DAILY ACTIONS/REMINDERS

- International updates must be sent to LIA07 (to be put in the HOO Status Update) before the end of every shift as well as posted on the LT status board (different than the LT Log).
- 11 PM – 7 AM shift is responsible for the summary call with Kirk and Brooke, scheduled daily at 0500 EST unless rescheduled, and subsequent write-up of one-pager for Margie. Margie reminds us that the write-up should not contain technical details, which are already captured in other reports, and should be marked "Official Use Only – Foreign Government Information."
- The 11pm-7am shift is responsible for sending all emails from the previous day to the FOIA email address. Open new email, copy previous day's emails as an attachment and send to [FOIA.Response.hoc@nrc.gov](mailto:FOIA.Response.hoc@nrc.gov).
- Kirk, Brooke, Danielle and Eric requested that the international team to sit in on calls with the ET and team leader (Chuck or Dan) to take notes and provide a short summary of what was discussed via email.
- Prior to any international call you set up, please make sure you contact the HOOs to let them know that you are going to have an international call.
- Reminder to Keep Mark Shaffer in-the-loop at [shaffermr@state.gov](mailto:shaffermr@state.gov), regardless of time of day, regardless of whether he is in the office or asleep. Especially cc Mark on all communication to IAEA.
- **Sanitary wipes now available.** **Action:** Please wipe the keyboards, mice and phones before you leave.

~~OFFICIAL USE ONLY~~

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 5:58 PM  
**To:** Gibson, Kathy  
**Cc:** Tinkler, Charles  
**Subject:** RE: Request for Ops Center RTS support

Charlie for (1) and Mary Dourin (DRA per Doug Cole) on (2)

---

**From:** Gibson, Kathy  
**Sent:** Wednesday, March 30, 2011 5:49 PM  
**To:** Lee, Richard; Tinkler, Charles  
**Subject:** Fw: Request for Ops Center RTS support  
**Importance:** High

Do we have the lead?

---

**From:** RST06 Hoc  
**To:** Ruland, William; Arndt, Steven; Skeen, David; Cheok, Michael; Gibson, Kathy; Coe, Doug  
**Cc:** Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Scott, Michael; Tinkler, Charles; Cool, Donald  
**Sent:** Wed Mar 30 17:35:33 2011  
**Subject:** RE: Request for Ops Center RTS support

Just noticed that I'm not even on the distribution. Please add me. Thanks.

---

**From:** RST06 Hoc  
**Sent:** Wednesday, March 30, 2011 5:34 PM  
**To:** Ruland, William; Arndt, Steven; Skeen, David; Cheok, Michael; Gibson, Kathy; Coe, Doug  
**Cc:** Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Scott, Michael; Tinkler, Charles; Cool, Donald  
**Subject:** RE: Request for Ops Center RTS support

Thanks Bill. You must be a fan of other tired, old, acts too – Cher maybe?

Before responding, can I ask that whomever has stepped-up to take the lead for this do a respond-all to let us know?

Objective for first question (energetic release potential): this information is important to the Ambassador in Japan and the US military command that would be responsible for movement of US citizens who were ordered to be evacuated from any locations in the Pacific. In fact, the Pacific Command asked the same question of the NRC at today's Deputies Meeting that is attended by the Chairman. The answer to this question may also impact when we as the NRC ramp down our activities? **We should attempt to address this by Friday (4/1).**

Objective for the second question is to support multiple questions/actions. There have been many requests of the PMT for "realistic" dose models. The RST Assessment document (original e-mail was supposed to have it attached, but I've added to this incase it did not go out the first time) also contains recommended actions for the Japanese to consider. These recommendations are based on the SAMGS, which all are intended to protect primary containment. Since primary containment is damaged on at least two units, we need to assess whether there may be new considerations/priorities that are not captured by the SAMGs. Also, the product of this effort helps us better clarify the assessment of potential energetic releases, along with identifying the best strategies to ensure that they don't happen.

This item does not have as short a deliverable date unless the PMT has one that I'm not aware of, but is still very significant in terms of our recommendations. Can we complete by Monday (4/4)?

Of course, my request should be seen as the start of a process, and that others should add to it in order to shape into an end product that goes beyond, or corrects, the vision that I started with.

Fred

---

**From:** Ruland, William  
**Sent:** Wednesday, March 30, 2011 10:36 AM  
**To:** Arndt, Steven; Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Subject:** RE: Request for Ops Center RTS support

Great thinking! I've always been a Fred Brown fan! For my benefit, what is the objectives for this task and by when do we need to get the answers?

Regarding the core damage percentages, I understand that they were early numbers. Are we yet in a position to revise them?

Bill

---

**From:** Arndt, Steven  
**Sent:** Wednesday, March 30, 2011 7:33 AM  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis in this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry  
Steven Arndt

(b)(6)

---

**From:** Skeen, David  
**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
**Sent:** Tue Mar 29 23:43:46 2011  
**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

**From:** RST06 Hoc  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc  
**Sent:** Tue Mar 29 23:01:43 2011  
**Subject:** RE: Request for Ops Center RTS support

Please see below.

---

**From:** Brown, Frederick  
**Sent:** Tuesday, March 29, 2011 10:56 PM  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc  
**Subject:** Request for Ops Center RTS support  
**Importance:** High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles.  $\frac{1}{4}$  core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

**From:** Marksberry, Don  
**To:** Drouin, Mary  
**Cc:** Correia, Richard  
**Subject:** FW: Not Final  
**Date:** Thursday, March 31, 2011 7:01:05 AM  
**Attachments:** 03-30-11 2200 RST Assessment Document REV 1 .docx

---

Mary, Please note that is NOT final as of 10 pm last night, but it was sent over to the site Team. I will know more in the morning.

Rich, FYI.

don

---

**From:** RST08 Hoc  
**Sent:** Wednesday, March 30, 2011 10:06 PM  
**To:** Marksberry, Don; Tinkler, Charles  
**Cc:** Lee, Richard  
**Subject:** FW: Not Final

This is the document that was sent to Japan. The recommendation is to follow SAMGs and flood the containment for all units.

I will probably not be in early in the morning. You can send to Mary and others if they want to start working on their event trees ..

hossein

**From:** RST01 Hoc  
**Sent:** Wednesday, March 30, 2011 9:37 PM  
**To:** Scott, Michael  
**Cc:** (b)(6)

(b)(6)

**Subject:** Not Final

Mike,

We do not have all the concurrences.

We will attempt to get the final concurrence in the morning.

Fred Brown  
RST on-shift Director

AAAA/458

Attachment 03-30-11 2200 RST Assessment Document REV 1 .docx (42586 Bytes) cannot be converted to PDF format.

**From:** Siu, Nathan  
**To:** Correia, Richard  
**Subject:** Re: 0430 EDT (March 31, 2011) USNRC Earthquake/Tsunami Status Update  
**Date:** Thursday, March 31, 2011 12:51:03 PM

---

Thanks Rich. Interesting discussions here. I think Kevin may have given you a quick rundown. Will fill you in when I get back.

Sent from NRC BlackBerry  
Nathan Siu

(b)(6)

---

**From:** Correia, Richard  
**To:** Barnes, Valerie; Hudson, Daniel; Nicholson, Thomas; Siu, Nathan; Stutzke, Martin; Beasley, Benjamin; Coe, Doug; Coyne, Kevin; Demoss, Gary; Ott, William; Peters, Sean; Salley, MarkHenry  
**Sent:** Thu Mar 31 10:09:22 2011  
**Subject:** FW: 0430 EDT (March 31, 2011) USNRC Earthquake/Tsunami Status Update

FYI but PLEASE remember this is Official Use Only...

Richard Correia, PE  
Director, Division of Risk Analysis  
Office of Nuclear Regulatory Research  
US NRC

[richard.correia@nrc.gov](mailto:richard.correia@nrc.gov)

---

**From:** LIA07 Hoc  
**Sent:** Thursday, March 31, 2011 4:32 AM  
**To:** LIA07 Hoc  
**Subject:** 0430 EDT (March 31, 2011) USNRC Earthquake/Tsunami Status Update

Attached, please find a 0430 EDT, March 31, 2011 status update from the US Nuclear Regulatory Commission's Emergency Operations Center regarding the impacts of the earthquake/tsunami.

This update contains new clarifying information regarding the Unit 4 spent fuel pool that is less optimistic than information shared earlier today.

Please note that this information is "~~Official Use Only~~" and is only being shared within the federal family.

Please call the Headquarters Operations Officer at 301-816-5100 with questions.

-Jim

Jim Anderson  
Executive Briefing Team Coordinator  
Office of Nuclear Security and Incident Response

AAAA/459



US Nuclear Regulatory Commission  
LIA07.HQC@nrc.gov (Operations Center)  
james.anderson@nrc.gov

**From:** Tinkler, Charles  
**To:** Drouin, Mary; Marksberry, Don  
**Cc:** Lee, Richard; Coyne, Kevin; Demoss, Gary; Appignani, Peter; Coe, Doug; Correia, Richard; Esmaili, Hossein; Schaperow, Jason; Helton, Donald; Kuritzky, Alan; Schaperow, Jason; Gibson, Kathy; Scott, Michael  
**Subject:** RE: Request for Ops Center RTS support  
**Date:** Thursday, March 31, 2011 7:54:16 AM

---

Mary-

I have seen Donnie Harrison's name mentioned in e-mails as working on item # 2 (generation of event trees) also. He undoubtedly would be better fit for that item than me, Perhaps, RES (you) should coordinate with him? I am working with Jason Schaperow on item # 1, development of a source term for the PMT

---

**From:** Drouin, Mary  
**Sent:** Wednesday, March 30, 2011 6:48 PM  
**To:** Tinkler, Charles; Marksberry, Don  
**Cc:** Lee, Richard; Coyne, Kevin; Demoss, Gary; Appignani, Peter; Coe, Doug; Correia, Richard; Esmaili, Hossein; Schaperow, Jason; Helton, Donald; Kuritzky, Alan  
**Subject:** RE: Request for Ops Center RTS support  
**Importance:** High

Charlie,

Should have something for you tomorrow around noon, but do you or someone have the "the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments" that Fred references?

Tks, mary

---

**From:** Tinkler, Charles  
**Sent:** Wednesday, March 30, 2011 3:57 PM  
**To:** Marksberry, Don  
**Cc:** Drouin, Mary; Lee, Richard; Coyne, Kevin; Demoss, Gary; Appignani, Peter; Coe, Doug; Correia, Richard; Esmaili, Hossein; Schaperow, Jason; Helton, Donald; Kuritzky, Alan  
**Subject:** RE: Request for Ops Center RTS support

Don

I just saw Doug Coe in the Op Center PMT. He raised this issue in our conversation.

It is my understanding after talking to him that DRA (Mary Drouin) has the lead for item #2 (generation of event trees) and I am to assist her as needed.

---

**From:** Marksberry, Don  
**Sent:** Wednesday, March 30, 2011 2:42 PM  
**To:** Tinkler, Charles  
**Cc:** Drouin, Mary; Lee, Richard; Coyne, Kevin; Demoss, Gary; Appignani, Peter; Coe, Doug; Correia, Richard; Esmaili, Hossein; Schaperow, Jason; Helton, Donald; Kuritzky, Alan  
**Subject:** RE: Request for Ops Center RTS support

Charlie

AAAA/460

Richard indicated that you have the lead for the RST request from Fred Brown (below). Doug Coe assigned Mary Drouin as the DRA point of contact for assisting you with item #2. Please contact Mary at your convenience.

Don

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 10:37 AM  
**To:** Tinkler, Charles; Kuritzky, Alan  
**Cc:** Katie Wagner; Coyne, Kevin; Marksberry, Don; Esmaili, Hossein; Salay, Michael  
**Subject:** FW: Request for Ops Center RTS support  
**Importance:** High

For your action. Thx.

---

**From:** Gibson, Kathy  
**Sent:** Wednesday, March 30, 2011 7:37 AM  
**To:** Lee, Richard  
**Subject:** Fw: Request for Ops Center RTS support

---

**From:** Arndt, Steven  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Sent:** Wed Mar 30 07:33:07 2011  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis in this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry  
Steven Arndt

(b)(6)

---

**From:** Skeen, David  
**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
**Sent:** Tue Mar 29 23:43:46 2011  
**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

**From:** RST06 Hoc  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc  
**Sent:** Tue Mar 29 23:01:43 2011  
**Subject:** RE: Request for Ops Center RTS support

Please see below.

---

**From:** Brown, Frederick  
**Sent:** Tuesday, March 29, 2011 10:56 PM  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc  
**Subject:** Request for Ops Center RTS support  
**Importance:** High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units'

containments.

Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles. ¼ core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

**From:** Demoss, Gary  
**To:** Cheok, Michael; Coe, Doug; Correia, Richard  
**Cc:** Drouin, Mary; Harrison, Donnie  
**Subject:** FW: Request for Ops Center RTS support  
**Date:** Thursday, March 31, 2011 12:13:44 PM

---

Doug, Mike, Rich,

We are confused about who is doing what here, and have been unable to track Donnie down. We are ready to support or lead this work, as necessary. In fact, Mary has gotten a good start at drawing Event Sequence Diagrams, which are a similar but probably a bit more useful tool than Event Trees.

I'm hoping we can establish a clear lead and roles, and I suggest that we define a 'customer' so that we can make sure the work is useful. Please help us out here to avoid duplication or conflicting work.

Gary

---

**From:** Drouin, Mary  
**Sent:** Thursday, March 31, 2011 12:02 PM  
**To:** Demoss, Gary  
**Subject:** FW: Request for Ops Center RTS support

---

**From:** Drouin, Mary  
**Sent:** Thursday, March 31, 2011 10:44 AM  
**To:** Coe, Doug  
**Subject:** RE: Request for Ops Center RTS support

Doug,

Email says Donnie is taking the lead for #2, should I stop and wait to see what helps he needs? Should both he and I be working on this "independently" right now?

Tks, mary

---

**From:** Coe, Doug  
**Sent:** Thursday, March 31, 2011 10:42 AM  
**To:** Drouin, Mary  
**Subject:** FW: Request for Ops Center RTS support

Mary – here's the email regarding Donnie's engagement on this

---

**From:** Cheok, Michael  
**Sent:** Wednesday, March 30, 2011 6:05 PM  
**To:** RST06 Hoc; Ruland, William; Arndt, Steven; Skeen, David; Gibson, Kathy; Coe, Doug  
**Cc:** Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Scott, Michael; Tinkler, Charles; Cool, Donald; Harrison, Donnie; Lee, Samson; Tate, Travis; Parillo, John  
**Subject:** RE: Request for Ops Center RTS support

AAAA/461

The first question will need SOARCA/PRA Level II expertise – so RES/DSA (Kathy's staff) would be optimal (Kathy was not in the office today, and I will discuss this with her and/or Mike Scott tomorrow). NRR/DRA can support with John Parillo or someone else in our accident dose branch.

NRR/DRA (Donnie Harrison will be POC) can take the lead on Question 2 and will work with RES/DRA and RES/DSA on a response.

**From:** RST06 Hoc

**Sent:** Wednesday, March 30, 2011 5:34 PM

**To:** Ruland, William; Arndt, Steven; Skeen, David; Cheok, Michael; Gibson, Kathy; Coe, Doug

**Cc:** Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Scott, Michael; Tinkler, Charles; Cool, Donald

**Subject:** RE: Request for Ops Center RTS support

Thanks Bill. You must be a fan of other tired, old, acts too – Cher maybe?

Before responding, can I ask that whomever has stepped-up to take the lead for this do a respond-all to let us know?

Objective for first question (energetic release potential): this information is important to the Ambassador in Japan and the US military command that would be responsible for movement of US citizens who were ordered to be evacuated from any locations in the Pacific. In fact, the Pacific Command asked the same question of the NRC at today's Deputies Meeting that is attended by the Chairman. The answer to this question may also impact when we as the NRC ramp down our activities? **We should attempt to address this by Friday (4/1).**

Objective for the second question is to support multiple questions/actions. There have been many requests of the PMT for "realistic" dose models. The RST Assessment document (original e-mail was supposed to have it attached, but I've added to this incase it did not go out the first time) also contains recommended actions for the Japanese to consider. These recommendations are based on the SAMGS, which all are intended to protect primary containment. Since primary containment is damaged on at least two units, we need to assess whether there may be new considerations/priorities that are not captured by the SAMGs. Also, the product of this effort helps us better clarify the assessment of potential energetic releases, along with identifying the best strategies to ensure that they don't happen. **This item does not have as short a deliverable date unless the PMT has one that I'm not aware of, but is still very significant in terms of our recommendations. Can we complete by Monday (4/4)?**

Of course, my request should be seen as the start of a process, and that others should add to it in order to shape into an end product that goes beyond, or corrects, the vision that I started with.

Fred

**From:** Ruland, William  
**Sent:** Wednesday, March 30, 2011 10:36 AM  
**To:** Arndt, Steven; Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Subject:** RE: Request for Ops Center RTS support

Great thinking! I've always been a Fred Brown fan! For my benefit, what is the objectives for this task and by when do we need to get the answers?

Regarding the core damage percentages, I understand that they were early numbers. Are we yet in a position to revise them?

Bill

---

**From:** Arndt, Steven  
**Sent:** Wednesday, March 30, 2011 7:33 AM  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis in this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry  
Steven Arndt

(b)(6)

---

**From:** Skeen, David  
**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
**Sent:** Tue Mar 29 23:43:46 2011  
**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

**From:** RST06 Hoc  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc  
**Sent:** Tue Mar 29 23:01:43 2011



**Subject:** RE: Request for Ops Center RTS support

Please see below.

---

**From:** Brown, Frederick

**Sent:** Tuesday, March 29, 2011 10:56 PM

**To:** Cheok, Michael; Gibson, Kathy

**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc

**Subject:** Request for Ops Center RTS support

**Importance:** High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

~~Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.~~

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary

containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles.  $\frac{1}{4}$  core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

**From:** Marksberry, Don  
**To:** Correia, Richard  
**Cc:** Demoss, Gary  
**Subject:** RE: Request for Ops Center RST support  
**Date:** Thursday, March 31, 2011 7:09:35 AM

---

Rich

It looks like RES will eventually need a single POC with the RST so that they don't have to figure out who can do what. In the mean time, I can coordinate DRA support with Richard Lee and keep supporters from DRA as well as RES responders on the RST (including Charlie Tinkler, et. al) informed. What do you think?

Don

---

**From:** Correia, Richard  
**Sent:** Wednesday, March 30, 2011 7:53 PM  
**To:** Marksberry, Don  
**Subject:** FW: Request for Ops Center RTS support

FYI  
Rich Correia, PE  
Director  
Division of Risk Analysis  
RES  
US NRC

---

**From:** Cheok, Michael  
**Sent:** Wednesday, March 30, 2011 6:16 PM  
**To:** Gibson, Kathy; Correia, Richard  
**Cc:** Coe, Doug; Lee, Samson; Tate, Travis; Harrison, Donnie; Parillo, John  
**Subject:** FW: Request for Ops Center RTS support

Kathy – thanks. I tried to call earlier, someone said you were not in.

Your plan sound good. NRR/DRA can support as you see fit. (Rich – please call if we can be of help)

Mike

**From:** Gibson, Kathy  
**Sent:** Wednesday, March 30, 2011 6:05 PM  
**To:** RST06 Hoc; Ruland, William; Arndt, Steven; Skeen, David; Cheok, Michael; Coe, Doug  
**Cc:** Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Scott, Michael; Tinkler, Charles; Cool, Donald; Correia, Richard  
**Subject:** Re: Request for Ops Center RTS support

First, I can't tell who "me" is. Suggest if you are using an HOC email address you first say who you are.

Second, RES has the lead for both items, DSA (me) for the first one and DRA (Doug Coe) for the second one. I added Rich Correia to the distribution as he is our new DRA division director and Doug Coe's father passed away so he is gone.

Richard Lee is our POC with the Ops Center. Charlie Tinkler is the staff person working the first item and Mary Druin is working the second item.

Let us know (preferably via Richard) if you need anything else.

AAAA/462

---

From: RST06 Hoc

To: Ruland, William; Arndt, Steven; Skeen, David; Cheok, Michael; Gibson, Kathy; Coe, Doug  
Cc: Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Scott, Michael; Tinkler, Charles; Cool, Donald  
Sent: Wed Mar 30 17:35:33 2011  
Subject: RE: Request for Ops Center RTS support  
Just noticed that I'm not even on the distribution. Please add me. Thanks.

From: RST06 Hoc

Sent: Wednesday, March 30, 2011 5:34 PM  
To: Ruland, William; Arndt, Steven; Skeen, David; Cheok, Michael; Gibson, Kathy; Coe, Doug  
Cc: Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Scott, Michael; Tinkler, Charles; Cool, Donald  
Subject: RE: Request for Ops Center RTS support

Thanks Bill. You must be a fan of other tired, old, acts too – Cher maybe?

Before responding, can I ask that whomever has stepped-up to take the lead for this do a respond-all to let us know?

Objective for first question (energetic release potential): this information is important to the Ambassador in Japan and the US military command that would be responsible for movement of US citizens who were ordered to be evacuated from any locations in the Pacific. In fact, the Pacific Command asked the same question of the NRC at today's Deputies Meeting that is attended by the Chairman. The answer to this question may also impact when we as the NRC ramp down our activities? We should attempt to address this by Friday (4/1).

Objective for the second question is to support multiple questions/actions. There have been many requests of the PMT for "realistic" dose models. The RST Assessment document (original e-mail was supposed to have it attached, but I've added to this incase it did not go out the first time) also contains recommended actions for the Japanese to consider. These recommendations are based on the SAMGS, which all are intended to protect primary containment. Since primary containment is damaged on at least two units, we need to assess whether there may be new considerations/priorities that are not captured by the SAMGs. Also, the product of this effort helps us better clarify the assessment of potential energetic releases, along with identifying the best strategies to ensure that they don't happen. This item does not have as short a deliverable date unless the PMT has one that I'm not aware of, but is still very significant in terms of our recommendations. Can we complete by Monday (4/4)?

Of course, my request should be seen as the start of a process, and that others should add to it in order to shape into an end product that goes beyond, or corrects, the vision that I started with.

Fred

From: Ruland, William

Sent: Wednesday, March 30, 2011 10:36 AM  
To: Arndt, Steven; Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
Cc: Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
Subject: RE: Request for Ops Center RTS support

Great thinking! I've always been a Fred Brown fan! For my benefit, what is the objectives for this task and by when do we need to get the answers?

Regarding the core damage percentages, I understand that they were early numbers. Are we yet in a position to revise them?

Bill

From: Arndt, Steven  
Sent: Wednesday, March 30, 2011 7:33 AM  
To: Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
Cc: Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
Subject: Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis in this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry  
Steven Arndt

(b)(6)

---

From: Skeen, David  
To: RST06 Hoc; Cheok, Michael; Gibson, Kathy  
Cc: Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
Sent: Tue Mar 29 23:43:46 2011  
Subject: Re: Request for Ops Center RTS support  
Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

From: RST06 Hoc  
To: Cheok, Michael; Gibson, Kathy  
Cc: Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc  
Sent: Tue Mar 29 23:01:43 2011  
Subject: RE: Request for Ops Center RTS support  
Please see below.

From: Brown, Frederick  
Sent: Tuesday, March 29, 2011 10:56 PM  
To: Cheok, Michael; Gibson, Kathy  
Cc: Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc  
Subject: Request for Ops Center RTS support  
Importance: High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).

2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles. ¼ core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

**From:** Cheok, Michael  
**To:** Correia, Richard  
**Cc:** Coe, Doug; Gibson, Kathy; Drouin, Mary; Demoss, Gary  
**Subject:** RE: Request for Ops Center RTS support  
**Date:** Thursday, March 31, 2011 1:04:17 PM

---

Yes – Mary should be lead. I was not aware of the tasks that were ongoing in RES when I wrote my e-mail. Apologies for the confusion. I have since informed the RST that RES has the lead.

Mike

---

**From:** Correia, Richard  
**Sent:** Thursday, March 31, 2011 12:34 PM  
**To:** Cheok, Michael  
**Cc:** Coe, Doug; Gibson, Kathy; Coe, Doug; Drouin, Mary  
**Subject:** FW: Request for Ops Center RTS support

Mike,

I would recommend we have Mary Drouin (RES/DRA) can take the lead for Q2 and coordinate with Donnie Harrison, if you agree.

Richard Correia, PE  
Director, Division of Risk Analysis  
Office of Nuclear Regulatory Research  
US NRC

[richard.correia@nrc.gov](mailto:richard.correia@nrc.gov)

---

**From:** Tinkler, Charles  
**Sent:** Thursday, March 31, 2011 7:54 AM  
**To:** Drouin, Mary; Marksberry, Don  
**Cc:** Lee, Richard; Coyne, Kevin; Demoss, Gary; Appignani, Peter; Coe, Doug; Correia, Richard; Esmaili, Hossein; Schaperow, Jason; Helton, Donald; Kuritzky, Alan; Schaperow, Jason; Gibson, Kathy; Scott, Michael  
**Subject:** RE: Request for Ops Center RTS support

Mary-

I have seen Donnie Harrison's name mentioned in e-mails as working on item # 2 (generation of event trees) also. He undoubtedly would be better fit for that item than me. Perhaps, RES (you) should coordinate with him? I am working with Jason Schaperow on item # 1, development of a source term for the PMT

---

**From:** Drouin, Mary  
**Sent:** Wednesday, March 30, 2011 6:48 PM  
**To:** Tinkler, Charles; Marksberry, Don  
**Cc:** Lee, Richard; Coyne, Kevin; Demoss, Gary; Appignani, Peter; Coe, Doug; Correia, Richard; Esmaili, Hossein; Schaperow, Jason; Helton, Donald; Kuritzky, Alan  
**Subject:** RE: Request for Ops Center RTS support  
**Importance:** High

AAAA/463

Charlie,

Should have something for you tomorrow around noon, but do you or someone have the "the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments" that Fred references?

Tks, mary

---

**From:** Tinkler, Charles  
**Sent:** Wednesday, March 30, 2011 3:57 PM  
**To:** Marksberry, Don  
**Cc:** Drouin, Mary; Lee, Richard; Coyne, Kevin; Demoss, Gary; Appignani, Peter; Coe, Doug; Correia, Richard; Esmaili, Hossein; Schaperow, Jason; Helton, Donald; Kuritzky, Alan  
**Subject:** RE: Request for Ops Center RTS support

Don

I just saw Doug Coe in the Op Center PMT. He raised this issue in our conversation.

It is my understanding after talking to him that DRA (Mary Drouin) has the lead for item #2 (generation of event trees) and I am to assist her as needed.

---

**From:** Marksberry, Don  
**Sent:** Wednesday, March 30, 2011 2:42 PM  
**To:** Tinkler, Charles  
**Cc:** Drouin, Mary; Lee, Richard; Coyne, Kevin; Demoss, Gary; Appignani, Peter; Coe, Doug; Correia, Richard; Esmaili, Hossein; Schaperow, Jason; Helton, Donald; Kuritzky, Alan  
**Subject:** RE: Request for Ops Center RTS support

Charlie

Richard indicated that you have the lead for the RST request from Fred Brown (below). Doug Coe assigned Mary Drouin as the DRA point of contact for assisting you with item #2. Please contact Mary at your convenience.

Don

---

**From:** Lee, Richard  
**Sent:** Wednesday, March 30, 2011 10:37 AM  
**To:** Tinkler, Charles; Kuritzky, Alan  
**Cc:** Katie Wagner; Coyne, Kevin; Marksberry, Don; Esmaili, Hossein; Salay, Michael  
**Subject:** FW: Request for Ops Center RTS support  
**Importance:** High

For your action. Thx.

**From:** Gibson, Kathy



**Sent:** Wednesday, March 30, 2011 7:37 AM  
**To:** Lee, Richard  
**Subject:** Fw: Request for Ops Center RTS support

---

**From:** Arndt, Steven  
**To:** Skeen, David; RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael  
**Sent:** Wed Mar 30 07:33:07 2011  
**Subject:** Re: Request for Ops Center RTS support

I agree with Dave, this should be done out side of the Op Center. A group of RES folks are already doing some analysis in this area (DRA and DSA) to support the PMT. We should task them to do this and provide them with additional resources if needed.

Sent from a NRC blackberry  
Steven Arndt

(b)(6)

---

**From:** Skeen, David  
**To:** RST06 Hoc; Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Arndt, Steven  
**Sent:** Tue Mar 29 23:43:46 2011  
**Subject:** Re: Request for Ops Center RTS support

Good thought, Fred.

I think this would be a worthwhile task, and I think we need a small group of severe accident experts to discuss the potential worst case outcomes for each scenario.

I believe this effort should be conducted outside of the RST, on the normal day shift, with either NRR or RES taking the lead to put a team together to develop the potential outcomes.

Please let me know if you need any support from NRR/DE. We could potentially offer Steve Arndt to support.

---

**From:** RST06 Hoc  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; RST01 Hoc  
**Sent:** Tue Mar 29 23:01:43 2011  
**Subject:** RE: Request for Ops Center RTS support

Please see below.

---

**From:** Brown, Frederick  
**Sent:** Tuesday, March 29, 2011 10:56 PM  
**To:** Cheok, Michael; Gibson, Kathy  
**Cc:** Ruland, William; Dudes, Laura; Uhle, Jennifer; Hiland, Patrick; Hackett, Edwin; Skeen, David; RST01 Hoc; Hoc, PMT12; McDermott, Brian; Coe, Doug; Scott, Michael; Brown, Frederick; RST01 Hoc

**Subject:** Request for Ops Center RTS support  
**Importance:** High

Mike, Kathy

First, I'm not sure that you two are the right folks to ask, but I know that you'll know where this should go.

I'd like to have folks with the right skill set look at two issues (the two are inter-related, but the first may be easier to give a quick answer to without the work that the second will take):

- 1) Given the known, or assumed, status of the three units and four pools, what realistic scenarios exist for energetic dispersion of high quantities of radioactive material that would result in mobile plumes? The point of this question is that there are many clear scenarios that present significant near-area radiological challenges, but given the time since shutdown (for the operating units) and age of much of the fuel (in the SFPs) what are the remaining scenarios of concern with respect to more distant locations (Tokyo with a large concentration of US citizens, Alaska, Hawaii, etc).
- 2) Given the assumed condition of the three units and four pools, can we generate basic event trees for the coming weeks/months? The point would be to identify key success criteria and to help identify key decision points/risk factors to be balanced (qualitative not quantitative analysis). For instance, take two units, each with significant core damage and prior release of volatile fission products, each with primary and secondary containment failure, but one with an intact RPV and the other with a breach of RPV - would there be a difference in potential releases that would lead to different strategies for flooding the primary containment of these two units? This question will make more sense if you look at the assumed conditions below and the attached assessment document where we recommend that TEPCO utilize the SAMG recommendation to flood all 3 units' containments.

~~Note that the intent is to limit this activity to hours and days, not weeks or years. Once we validate the concept of this evaluation, we can turn it over to US industry for further action/development.~~

Assumed status (slightly different than the status in the attached assessment):

Unit 1 Rx: Shutdown 3/11. 70% core damage. Cooling with 30 gpm. Significant salt deposits in vessel, core spray plugged. Primary pressure 65 psig. Drywell pressure 25 psig. Secondary containment destroyed. Containment has been vented at least once since fuel damage occurred. Attempting to establish Nitrogen purge prior to resuming venting.

Unit 2 Rx: Shutdown 3/11. 30% core damage. Significant salt deposits in vessel/drywell. Assumed RPV breach, with at least some core ex-vessel that occurred approximately 3/15. Primary containment breached in the torus. Secondary containment breached. Significant release of volatile fission products has occurred through both airborne release and also via water drainage out of the Rx building.

Unit 3 Rx: same assumptions as Unit 2, but do not assume RPV failure and location of primary containment breach may be the drywell.

SFP 1: 292 bundles. Pool intact. All fuel at least 12 years old. No secondary containment. Rubble on top of pool. Water can be added through external spray. Now at saturation temperature.

SFP 2: 587 bundles. Pool intact. Water added to the point of pool over-flow. Pool had reached saturation temperature at one time.

SFP 3: 548 bundles.  $\frac{1}{4}$  core offload previous refueling. No checker boarding of hotter fuel. Structural damage to pool area suspected. Pool leakage possible. External addition of water has been made repeatedly, but flooding of pool may not be possible due to damage.

SFP 4: 1331 bundles. Full core offload about 120 days ago. No checker boarding of hotter fuel. Structural damage to pool area is known to exist, and structure may not support a full pool weight load. Pool leakage likely, requiring addition of water periodically. Pool was likely dry enough to have cladding/water reaction which produced enough hydrogen to lead to catastrophic explosion that destroyed secondary containment.

**Barto, Andrew**

---

**From:** Wood, Kent  
**Sent:** Thursday, March 31, 2011 4:51 PM  
**To:** Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update  
**Attachments:** ORNL\_Fukushima-Criticality\_Notes\_31Mar2011.pptx; Shika U1 ICE June 18 1999 070417E\_Rinkai\_Kaiseki.pdf

All,

I've recently heard that the Fukushima Daiichi Unit 3 SFP is or may be dry. And has been for some time.

If that is the case the borated aluminum that is reported to be in those racks is probably damaged by the heat. It may be completely melted away. As shown in that attached slides that would increase keff by about 30% in a flooded SFP. (This figure is consistent with other analyses I've seen.)

A typical BWR "***SFP criticality safety analyses were properly performed consistent with the SFP criticality safety requirements of the U.S. Nuclear Regulatory Commission***" would use a limiting lattice to demonstrate that peak reactivity, i.e. after depletion of most of the Gadolina, the SFP keff would be essentially 0.945 at a 95% probability with a 95% confidence level. If present any installed neutron absorber would be included in the analysis. We should all know that there are some conservatism/margin in those analyses (1) there is probably some margin between the peak reactivity of the 'limiting lattice' and the peak reactivity of the 'actual lattice', (2) the 'limiting lattice' would be something the license would allow the licensee to have in its SFP and so the delta between 'limiting lattice' and a maximum 'actual lattice' may not be all that large, (3) not all fuel assemblies in the SFP will be at the point of peak reactivity, only those whose have only had one cycle of use in the reactor would reasonably be at their peak reactivity, (4) the 'limiting lattice' fresh fuel with its gadolina will have a reactivity 12-14%  $\Delta keff$  below the peak, 'actual lattice' (5) I usually estimate that 2<sup>nd</sup> cycle fuel assemblies will have reactivity probably a little less than the poisoned fresh probably 15-18%  $\Delta keff$  below the peak.

However, I would not estimate that those analyses have 30% margin. Adding 30%  $\Delta keff$  to the SFP rack and you are looking at a potential criticality event even in the 2<sup>nd</sup> burned fuel assemblies. It would probably only take four, certainly no more than six to start. A big question would be whether or not the moderator temperature coefficient is positive or negative, I've seen unpoisoned PWR racks have a positive MTC (I've not seen any MTC analysis for unpoisoned BWR racks).

I'm attaching a report on an inadvertent criticality event that Japan had at Shika U1. They had a criticality BWR because three control rods came partially out of the core during a refueling outage. That was a small volume under a full refueling pool. A criticality event in the Fukushima Daiichi U3 SFP would likely be larger and at least initially without any appreciable water as a shield. The criticality would continue until either boron was injected or the water boiled off. Once the fuel assemblies are uncovered, again, they will have a new higher decay heat load and source term, open to the atmosphere.

If the U3 SFP is currently dry and has been for some time one must consider how much worse the fuel can get if it is left dry.

Bottom line, if the U3 SFP is dry, they should not reflood the U3 SFP with unborated water unless they are certain the poison is intact.

Kent A. L. Wood  
Team Leader

AAAA/464

Spent Fuel Team (SFT)  
Reactor Systems Branch (SRXB)  
Division of Safety Systems (DSS)  
Office of Nuclear Reactor Regulation (NRR)  
301-415-4120

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]  
**Sent:** Thursday, March 31, 2011 10:27 AM  
**To:** Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,

Thanks for sharing this! Please see revised slide packet that includes analyses (by Don Mueller) that shows keff as a function of pitch for a representative design basis safety model. These analyses indicate that the rack dimensions you provided are believable from a criticality safety perspective for un-borated racks. Additional information/observations are included in the slides.

Main issue, in my mind, for the U4 SFP is preservation of the assembly separation, which is the key to sub-criticality in the UF SFP rack designs (as we understand them to be).

Call if you have questions.

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
Phone: (865) 241-3570  
Mobile: (b)(6) ex 6

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]  
**Sent:** Thursday, March 31, 2011 1:44 AM  
**To:** Taylor, Robert; Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

We just realized that the pitch is different between the E-W direction and N-S directions. The numbers below are correct for the E-W direction. In the N-S direction, the pitch is slightly larger, 194mm.

**From:** Taylor, Robert  
**Sent:** Thursday, March 31, 2011 1:28 AM  
**To:** 'Wagner, John C.'; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John, Don, and others,

We have received hardcopy drawings of the spent fuel racks in Unit 4. As we read them, it looks like each cell is 152mm across and the center-to-center pitch is 168.5mm. They are high-density.

Rob

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]

**Sent:** Tuesday, March 29, 2011 7:30 AM

**To:** Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

With attachment...

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

ex b

---

**From:** Wagner, John C.

**Sent:** Tuesday, March 29, 2011 7:28 AM

**To:** Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,

Yes, center-to-center pitch would be a good start. We have information on the complete inventory of the SFPs, including Unit 4 – see attached for some summary information. Our information indicates that the Unit 4 SFP has high-density racks, and makes us suspicious that Unit 4 SFP could have the same or similar high-density racks as are in the Unit 1-3 pools.

To be clear, I still suspect the likelihood of criticality is very small, as there should be significant reactivity margin in the system. However, the possibility that the Unit 4 SFP racks could have been uncovered for some period of time, the fact that we have received incorrect information on the racks previously, the fact that we have no information on the condition of the racks or the spent fuel, and that the other SFPs have Al-based racks, makes we want to proceed with caution.

I hope this is helpful

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

ex b

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]

**Sent:** Tuesday, March 29, 2011 6:01 AM

**To:** Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John,

Thanks for the consideration. We will stand fast until a consolidated position is reached.

I doubt we can get all of the information you (and I) would love to have. We will start small to see if we can get the center-to-center pitch in the racks. Note that the Daiichi SFPs are relatively low capacity in that they do not have as many assemblies in the pool as a typical US BWR. There is a common pool on-site where many of the spent fuel assemblies are moved. We understand that there Unit 4 pool had ~1000 assemblies in the pool. As such, it is possible that these are low-density racks.

We will try to ask for the center-to-center pitch tomorrow.

Regards,

Rob

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]

**Sent:** Monday, March 28, 2011 11:32 PM

**To:** Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Don,

As you stated, the previous assessment was based on information at the time, which was that the SFPs all had high-density, borated SS racks. Given the high melting temperature of SS, we expected the neutron absorbers to remain effective up to temperatures at which concern about criticality would be overtaken by concerns related to significant release of radiation due to fuel damage.

We have since learned that the initial information<sup>6</sup> on the racks was incorrect. Specifically, from EPRI and NEI we have the following information (received in the past 2 days):

*"-->Units 1, 2, 3 have both aluminum racks as well as borated aluminum racks.*

*Unit 4 has only non-borated stainless racks."*

This information is consistent with the information you have below.

#### **The above information raises questions/concerns**

- Available information suggests the Unit 4 SFP racks are high-density (no flux traps)
- Yet, based on our experience, high-density requires neutron absorber panels, e.g., Boral, borated SS, etc.
- So, we need more information on the Unit 4 SFP racks to full assess criticality potential there
- Concern is that the Unit 4 SFP racks may be similar to the Unit 1-3 SFP racks, i.e., borated Al (not SS), and that if the Unit 4 SFP racks were uncovered for some period of time, the neutron absorber

effectiveness could be compromised. If this is the case, reflooding with un-borated water could very well be a PROBLEM.

- Another issue is that if the racks are truly SS without Boron, then some large spacing and/or flux traps would be required. Damage to the racks could decrease spacing, which would be a concern, particularly given the statement from below "Japanese concerns that the racks may have shifted".
- We do know that the Unit 4 SFP has >100 assemblies in the peak reactivity burnup range that are stored together.

Generally speaking, if the effectiveness of the racks is maintained (geometric separation of individual assemblies and absorption properties), we do not expect fuel degradation/reconfiguration to offset the inherent safety margins required by international standards and regulatory requirements for spent fuel pool criticality safety analyses, e.g., all assemblies at their peak reactivity, 0.05 margin in keff, and the various standard conservatisms in typical safety analyses (e.g., analyses based on most reactive lattice design, conservative depletion assumptions, ambient spent fuel pool water temperature, etc.).

So, coming back around to your specific question: **Do we now see a need to modify or expand the above technical opinion? If so, how?**

Answer: "yes" My revised position is the following:

"Given that the overall efficacy of the racks has been maintained, in terms of geometric separation of assemblies and neutron absorption characteristics, my opinion is that criticality in the spent fuel pools is very unlikely, particularly if boron is being used, and that the consequences of criticality in one of the spent fuel pools will not be significant in comparison to the consequences of the pool remaining empty/exposed. Provided the nuclear criticality safety analyses for the spent fuel pools were performed accurately and consistent with US Nuclear Regulatory Commission requirements and that the spent fuel racks were manufactured, installed and loaded consistent with the supporting nuclear criticality safety analyses, sufficient margin should be present to offset potential increases in reactivity associated with fuel reconfiguration. (Note: under normal circumstances, BWR spent fuel pools do not have borated water, and hence are designed and analyzed to be safe when flooded with un-borated water). If the efficacy of the racks is in question, I strongly suggest continued use of borated water until/unless the condition and design of the racks can be properly assessed. These are my personal/professional opinions, based on the information available to me at this time, and should be treated as such." Once I get input from others at ORNL, we will provide a collective position.

Note, depending on how hot the Unit 1-3 SFPs have been, I may have some concern about criticality in those pools since they utilize aluminum and borated aluminum racks.

#### Questions for you:

- 1) Can we get the design specifications for the SFP racks, particularly those in the Unit 4 SFP, ASAP?
- 2) Can we get the nuclear criticality safety analyses that was performed in support of the SFP rack licensing?
- 3) Can we get any photos or assessments of the condition of the spent fuel and spent fuel racks, particularly in Unit 4 SFP, ASAP? I was told video of the Unit 4 SFP (from a camera mounted on top of the fill pipe) would be available on 3/24, but I have yet to see it.

FYI – we have prepared a set of slides (attached) for the DOE related to this issue that has some additional information/basis that may be useful to you. These slides have yet to be provided to DOE and are likely to be revised to include the above, revised assessment pending review.



If you have any questions whatsoever, please do not hesitate to call me at any time – day or night – on my mobile number.

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6) *ok b*

**From:** Carlson, Donald [mailto:Donald.Carlson@nrc.gov]

**Sent:** Monday, March 28, 2011 9:14 PM

**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

**Importance:** High

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

**Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.** (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

**Question: Do we now see a need to modify or expand the above technical opinion? If so, how?**

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

**Donald E. Carlson**

NRO/ARP/ARB1

Cell: (b)(6) *ok b*

Office: 301-415-0109

---

**From:** Taylor, Robert

**Sent:** Monday, March 28, 2011 6:59 PM

**To:** Carlson, Donald; Brown, Frederick

**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 [Passcode (b)(6)] ex 6

Info for consideration during the call:

Unit 4 racks are not borated  
Switching to fresh water injection on 3/29  
Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel  
204 fresh fuel assemblies were present in the pool  
Japanese concerns that the racks may have shifted.  
Fuel damage due to uncover

Regards,  
Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 6:23 PM  
**To:** Taylor, Robert; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI – When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) ex 6 Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,  
Don

---

**From:** Taylor, Robert  
**Sent:** Monday, March 28, 2011 5:59 PM  
**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 1:07 PM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
**Subject:** RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

**Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.**

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----  
**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 9:30 AM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael  
**Subject:** RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----  
**From:** Brown, Frederick  
**Sent:** Sunday, March 27, 2011 9:11 PM  
**To:** Carlson, Donald  
**Cc:** Taylor, Robert; Scott, Michael  
**Subject:** Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6) ex b

Thanks,  
Fred

## Lee, Richard

---

**From:** Mueller, Don [muellerde@ornl.gov]  
**Sent:** Thursday, March 31, 2011 2:30 PM  
**To:** Taylor, Robert  
**Cc:** Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher; Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,

Do we know or can we find out how thick the steel is and how many layers there are between cells in a Unit 4 rack module?

From the dimensions you provided, there could be either a single 1.65 cm thick plate between adjacent cells in E-W direction or there might be two thinner steel plates. There likely are two steel plates between modules in the N-S direction.

Thanks,

Don

Don Mueller  
Sr. R&D Staff  
Nuclear Data and Criticality Safety  
Reactor and Nuclear Systems Division  
Oak Ridge National Laboratory  
(865) 576-4121 office  
(b)(6) cell

---

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]  
**Sent:** Thursday, March 31, 2011 1:44 AM  
**To:** Taylor, Robert; Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

We just realized that the pitch is different between the E-W direction and N-S directions. The numbers below are correct for the E-W direction. In the N-S direction, the pitch is slightly larger, 194mm.

---

**From:** Taylor, Robert  
**Sent:** Thursday, March 31, 2011 1:28 AM  
**To:** 'Wagner, John C.'; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John, Don, and others,

AAAA/465

We have received hardcopy drawings of the spent fuel racks in Unit 4. As we read them, it looks like each cell is 152mm across and the center-to-center pitch is 168.5mm. They are high-density.

Rob

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]  
**Sent:** Tuesday, March 29, 2011 7:30 AM  
**To:** Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

With attachment...

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
Phone: (865) 241-3570  
Mobile: (b)(6) Ex 6

---

**From:** Wagner, John C.  
**Sent:** Tuesday, March 29, 2011 7:28 AM  
**To:** 'Taylor, Robert'; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,

Yes, center-to-center pitch would be a good start. We have information on the complete inventory of the SFPs, including Unit 4 – see attached for some summary information. Our information indicates that the Unit 4 SFP has high-density racks, and makes us suspicious that Unit 4 SFP could have the same or similar high-density racks as are in the Unit 1-3 pools.

To be clear, I still suspect the likelihood of criticality is very small, as there should be significant reactivity margin in the system. However, the possibility that the Unit 4 SFP racks could have been uncovered for some period of time, the fact that we have received incorrect information on the racks previously, the fact that we have no information on the condition of the racks or the spent fuel, and that the other SFPs have Al-based racks, makes we want to proceed with caution.

I hope this is helpful

Best Regards,

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
Phone: (865) 241-3570  
Mobile: (b)(6) Ex 6

---

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]

**Sent:** Tuesday, March 29, 2011 6:01 AM

**To:** Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John,

Thanks for the consideration. We will stand fast until a consolidated position is reached.

I doubt we can get all of the information you (and I) would love to have. We will start small to see if we can get the center-to-center pitch in the racks. Note that the Daiichi SFPs are relatively low capacity in that they do not have as many assemblies in the pool as a typical US BWR. There is a common pool on-site where many of the spent fuel assemblies are moved. We understand that there Unit 4 pool had ~1000 assemblies in the pool. As such, it is possible that these are low-density racks.

We will try to ask for the center-to-center pitch tomorrow.

Regards,  
Rob

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]

**Sent:** Monday, March 28, 2011 11:32 PM

**To:** Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Don,

As you stated, the previous assessment was based on information at the time, which was that the SFPs all had high-density, borated SS racks. Given the high melting temperature of SS, we expected the neutron absorbers to remain effective up to temperatures at which concern about criticality would be overtaken by concerns related to significant release of radiation due to fuel damage.

We have since learned that the initial information on the racks was incorrect. Specifically, from EPRI and NEI we have the following information (received in the past 2 days):

*"-->Units 1, 2, 3 have both aluminum racks as well as borated aluminum racks.*

*Unit 4 has only non-borated stainless racks."*

This information is consistent with the information you have below.

**The above information raises questions/concerns**

- Available information suggests the Unit 4 SFP racks are high-density (no flux traps)
- Yet, based on our experience, high-density requires neutron absorber panels, e.g., Boral, borated SS, etc.
- So, we need more information on the Unit 4 SFP racks to full assess criticality potential there
- Concern is that the Unit 4 SFP racks may be similar to the Unit 1-3 SFP racks, i.e., borated Al (not SS), and that if the Unit 4 SFP racks were uncovered for some period of time, the neutron absorber effectiveness could be compromised. If this is the case, reflooding with un-borated water could very well be a PROBLEM.

- Another issue is that if the racks are truly SS without Boron, then some large spacing and/or flux traps would be required. Damage to the racks could decrease spacing, which would be a concern, particularly given the statement from below "Japanese concerns that the racks may have shifted".
- We do know that the Unit 4 SFP has >100 assemblies in the peak reactivity burnup range that are stored together.

Generally speaking, if the effectiveness of the racks is maintained (geometric separation of individual assemblies and absorption properties), we do not expect fuel degradation/reconfiguration to offset the inherent safety margins required by international standards and regulatory requirements for spent fuel pool criticality safety analyses, e.g., all assemblies at their peak reactivity, 0.05 margin in keff, and the various standard conservatisms in typical safety analyses (e.g., analyses based on most reactive lattice design, conservative depletion assumptions, ambient spent fuel pool water temperature, etc.).

So, coming back around to your specific question: **Do we now see a need to modify or expand the above technical opinion? If so, how?**

Answer: "yes" My revised position is the following:

"Given that the overall efficacy of the racks has been maintained, in terms of geometric separation of assemblies and neutron absorption characteristics, my opinion is that criticality in the spent fuel pools is very unlikely, particularly if boron is being used, and that the consequences of criticality in one of the spent fuel pools will not be significant in comparison to the consequences of the pool remaining empty/exposed. Provided the nuclear criticality safety analyses for the spent fuel pools were performed accurately and consistent with US Nuclear Regulatory Commission requirements and that the spent fuel racks were manufactured, installed and loaded consistent with the supporting nuclear criticality safety analyses, sufficient margin should be present to offset potential increases in reactivity associated with fuel reconfiguration. (Note: under normal circumstances, BWR spent fuel pools do not have borated water, and hence are designed and analyzed to be safe when flooded with un-borated water). If the efficacy of the racks is in question, I strongly suggest continued use of borated water until/unless the condition and design of the racks can be properly assessed. These are my personal/professional opinions, based on the information available to me at this time, and should be treated as such." Once I get input from others at ORNL, we will provide a collective position.

Note, depending on how hot the Unit 1-3 SFPs have been, I may have some concern about criticality in those pools since they utilize aluminum and borated aluminum racks.

#### **Questions for you:**

- 1) Can we get the design specifications for the SFP racks, particularly those in the Unit 4 SFP, ASAP?
- 2) Can we get the nuclear criticality safety analyses that was performed in support of the SFP rack licensing?
- 3) Can we get any photos or assessments of the condition of the spent fuel and spent fuel racks, particularly in Unit 4 SFP, ASAP? I was told video of the Unit 4 SFP (from a camera mounted on top of the fill pipe) would be available on 3/24, but I have yet to see it.

FYI – we have prepared a set of slides (attached) for the DOE related to this issue that has some additional information/basis that may be useful to you. These slides have yet to be provided to DOE and are likely to be revised to include the above, revised assessment pending review.

If you have any questions whatsoever, please do not hesitate to call me at any time – day or night – on my mobile number.



Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Carlson, Donald [mailto:Donald.Carlson@nrc.gov]

**Sent:** Monday, March 28, 2011 9:14 PM

**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

**Importance:** High

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

**Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.** (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

**Question: Do we now see a need to modify or expand the above technical opinion? If so, how?**

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

**Donald E. Carlson**

NRO/ARP/ARB1

Cell: (b)(6)

Office: 301-415-0109

---

**From:** Taylor, Robert

**Sent:** Monday, March 28, 2011 6:59 PM

**To:** Carlson, Donald; Brown, Frederick

**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated  
Switching to fresh water injection on 3/29  
Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel  
204 fresh fuel assemblies were present in the pool  
Japanese concerns that the racks may have shifted.  
Fuel damage due to uncover

Regards,  
Rob

---

**From:** Carlson, Donald

**Sent:** Monday, March 28, 2011 6:23 PM

**To:** Taylor, Robert; Brown, Frederick

**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

**Subject:** RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI – When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,  
Don

---

**From:** Taylor, Robert

**Sent:** Monday, March 28, 2011 5:59 PM

**To:** Carlson, Donald; Brown, Frederick

**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John

**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 1:07 PM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
**Subject:** RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

**Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.**

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----

From: Carlson, Donald  
Sent: Monday, March 28, 2011 9:30 AM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael  
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick  
Sent: Sunday, March 27, 2011 9:11 PM  
To: Carlson, Donald  
Cc: Taylor, Robert; Scott, Michael  
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)? He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,  
Fred

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Thursday, March 31, 2011 5:53 PM  
**To:** Aissa, Mourad  
**Subject:** FW: Support for Japan - SFP Criticality Potential Update

fyi

---

**From:** Carlson, Donald  
**Sent:** Thursday, March 31, 2011 5:47 PM  
**To:** Wood, Kent; Wagner, John C.; Taylor, Robert; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Kent and all,

Thank you, Kent.

I have forwarded Kent's message to RST01. I would propose that Kent become the staff POC henceforth.

Again, I really think the Ops Center RST should be supported by a practicing pool criticality expert. Would you like to volunteer for the job, Kent?

(Note: Pools are not my job and never have been. The RST nevertheless called on me for advice. They should have called on Kent.)

I would that Kent's information is not inconsistent with the following entries in today's RST update table:

Unit 1 Pool:

292 bundles (GEH); **Temp & level:** unconfirmed, White smoke emitting (TEPCo 0630 JDT 3/29) Plan to spray water into SFP using concrete pump truck starting 3/29 (IAEA 0400 GMT 3/29)

Unit 2 Pool:

587 bundles (GEH); **Temp:** 46°C (INPO 3/30); **Level:** pool may be overflowing, based on observations of water in adjacent areas (NRC site team); Fresh water injection via fuel pool cooling system periodically (TEPCO 3/30). White smoke emitting as of 0800 3/26 (NISA) – confirmed (TEPCo 3/29);

Unit 3 Pool:

514 bundles (GEH) – damage suspected (JAIF 3/28); **Temp:** unconfirmed; **Level:** low – fresh water spray periodically (TEPCo 3/29). White smoke emitting as of 0630 3/29 (NISA).

Unit 4 Pool:

1331 bundles in SFP (GEH & NISA) **Temp & Level:** low level -, Fresh water is expected to begin injection for 4-5 hrs. on 3/31 via the "Giraffe" (INPO 3/30). Receiving external power & dist. panels connected. (IAEA 3/27). Secondary contain: severe damage from H<sub>2</sub> explosion. White smoke confirmed 0630 3/29 (NISA).

Unit 5 Pool:

946 bundles (JAIF); **Temp:** 37.2°C ↓ (JAIF 3/30); Injection via normal makeup (IAEA 3/27)

Unit 6 Pool:

- 876 bundles (GEH); Temp 26.5°C ↑ (JAIF 3/30); Injection via normal makeup (IAEA 3/27)

Common Pool:

6,000 bundles (GEH) maintained at 32.2°C ↓ (INPO 3/30); normal cooling started 1805 JDT 3/24/2011 (NISA)

Thanks again, Kent.

Don

---

**From:** Wood, Kent

**Sent:** Thursday, March 31, 2011 4:51 PM

**To:** Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

All,

I've recently heard that the Fukushima Daiichi Unit 3 SFP is or may be dry. And has been for some time.

If that is the case the borated aluminum that is reported to be in those racks is probably damaged by the heat. It may be completely melted away. As shown in that attached slides that would increase keff by about 30% in a flooded SFP. (This figure is consistent with other analyses I've seen.)

A typical BWR "***SFP criticality safety analyses were properly performed consistent with the SFP criticality safety requirements of the U.S. Nuclear Regulatory Commission***" would use a limiting lattice to demonstrate that peak reactivity, i.e. after depletion of most of the Gadolina, the SFP keff would be essentially 0.945 at a 95% probability with a 95% confidence level. If present any installed neutron absorber would be included in the analysis. We should all know that there are some conservatism/margin in those analyses (1) there is probably some margin between the peak reactivity of the 'limiting lattice' and the peak reactivity of the 'actual lattice', (2) the 'limiting lattice' would be something the license would allow the licensee to have in its SFP and so the delta between 'limiting lattice' and a maximum 'actual lattice' may not be all that large, (3) not all fuel assemblies in the SFP will be at the point of peak reactivity, only those whose have only had one cycle of use in the reactor would reasonably be at their peak reactivity, (4) the 'limiting lattice' fresh fuel with its gadolina will have a reactivity 12-14% Δkeff below the peak, 'actual lattice' (5) I usually estimate that 2<sup>nd</sup> cycle fuel assemblies will have reactivity probably a little less than the poisoned fresh probably 15-18% Δkeff below the peak.

However, I would not estimate that those analyses have 30% margin. Adding 30% Δkeff to the SFP rack and you are looking at a potential criticality event even in the 2<sup>nd</sup> burned fuel assemblies. It would probably only take four, certainly no more than six to start. A big question would be whether or not the moderator temperature coefficient is positive or negative, I've seen unpoisoned PWR racks have a positive MTC (I've not seen any MTC analysis for unpoisoned BWR racks).

I'm attaching a report on an inadvertent criticality event that Japan had at Shika U1. They had a criticality BWR because three control rods came partially out of the core during a refueling outage. That was a small volume under a full refueling pool. A criticality event in the Fukushima Daiichi U3 SFP would likely be larger and at least initially without any appreciable water as a shield. The criticality would continue until either boron was injected or the water boiled off. Once the fuel assemblies are uncovered, again, they will have a new higher decay heat load and source term, open to the atmosphere.

- If the U3 SFP is currently dry and has been for some time one must consider how much worse the fuel can get if it is left dry.

Bottom line, if the U3 SFP is dry, they should not reflood the U3 SFP with unborated water unless they are certain the poison is intact.

Kent A. L. Wood  
Team Leader  
Spent Fuel Team (SFT)  
Reactor Systems Branch (SRXB)  
Division of Safety Systems (DSS)  
Office of Nuclear Reactor Regulation (NRR)  
301-415-4120

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]  
**Sent:** Thursday, March 31, 2011 10:27 AM  
**To:** Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,

Thanks for sharing this! Please see revised slide packet that includes analyses (by Don Mueller) that shows keff as a function of pitch for a representative design basis safety model. These analyses indicate that the rack dimensions you provided are believable from a criticality safety perspective for un-borated racks. Additional information/observations are included in the slides.

Main issue, in my mind, for the U4 SFP is preservation of the assembly separation, which is the key to sub-criticality in the UF SFP rack designs (as we understand them to be).

Call if you have questions.

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
Phone: (865) 241-3570  
Mobile: (b)(6)

---

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]  
**Sent:** Thursday, March 31, 2011 1:44 AM  
**To:** Taylor, Robert; Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

We just realized that the pitch is different between the E-W direction and N-S directions. The numbers below are correct for the E-W direction. In the N-S direction, the pitch is slightly larger, 194mm.

---

**From:** Taylor, Robert

**Sent:** Thursday, March 31, 2011 1:28 AM

**To:** 'Wagner, John C.'; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John, Don, and others,

We have received hardcopy drawings of the spent fuel racks in Unit 4. As we read them, it looks like each cell is 152mm across and the center-to-center pitch is 168.5mm. They are high-density.

Rob

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]

**Sent:** Tuesday, March 29, 2011 7:30 AM

**To:** Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

With attachment...

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Wagner, John C.

**Sent:** Tuesday, March 29, 2011 7:28 AM

**To:** 'Taylor, Robert'; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,

Yes, center-to-center pitch would be a good start. We have information on the complete inventory of the SFPs, including Unit 4 – see attached for some summary information. Our information indicates that the Unit 4 SFP has high-density racks, and makes us suspicious that Unit 4 SFP could have the same or similar high-density racks as are in the Unit 1-3 pools.

To be clear, I still suspect the likelihood of criticality is very small, as there should be significant reactivity margin in the system. However, the possibility that the Unit 4 SFP racks could have been uncovered for some period of time, the fact that we have received incorrect information on the racks previously, the fact that we have no information on the condition of the racks or the spent fuel, and that the other SFPs have Al-based racks, makes we want to proceed with caution.

I hope this is helpful

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]

**Sent:** Tuesday, March 29, 2011 6:01 AM

**To:** Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John,

Thanks for the consideration. We will stand fast until a consolidated position is reached.

I doubt we can get all of the information you (and I) would love to have. We will start small to see if we can get the center-to-center pitch in the racks. Note that the Daiichi SFPs are relatively low capacity in that they do not have as many assemblies in the pool as a typical US BWR. There is a common pool on-site where many of the spent fuel assemblies are moved. We understand that there Unit 4 pool had ~1000 assemblies in the pool. As such, it is possible that these are low-density racks.

We will try to ask for the center-to-center pitch tomorrow.

Regards,  
Rob

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]

**Sent:** Monday, March 28, 2011 11:32 PM

**To:** Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Don,

As you stated, the previous assessment was based on information at the time, which was that the SFPs all had high-density, borated SS racks. Given the high melting temperature of SS, we expected the neutron absorbers to remain effective up to temperatures at which concern about criticality would be overtaken by concerns related to significant release of radiation due to fuel damage.

We have since learned that the initial information on the racks was incorrect. Specifically, from EPRI and NEI we have the following information (received in the past 2 days):

*"-->Units 1, 2, 3 have both aluminum racks as well as borated aluminum racks.*

*Unit 4 has only non-borated stainless racks."*

This information is consistent with the information you have below.

**The above information raises questions/concerns**



- Available information suggests the Unit 4 SFP racks are high-density (no flux traps)
- Yet, based on our experience, high-density requires neutron absorber panels, e.g., Boral, borated SS, etc.
- So, we need more information on the Unit 4 SFP racks to fully assess criticality potential there
- Concern is that the Unit 4 SFP racks may be similar to the Unit 1-3 SFP racks, i.e., borated Al (not SS), and that if the Unit 4 SFP racks were uncovered for some period of time, the neutron absorber effectiveness could be compromised. If this is the case, reflooding with un-borated water could very well be a PROBLEM.
- Another issue is that if the racks are truly SS without Boron, then some large spacing and/or flux traps would be required. Damage to the racks could decrease spacing, which would be a concern, particularly given the statement from below "Japanese concerns that the racks may have shifted".
- We do know that the Unit 4 SFP has >100 assemblies in the peak reactivity burnup range that are stored together.

Generally speaking, if the effectiveness of the racks is maintained (geometric separation of individual assemblies and absorption properties), we do not expect fuel degradation/reconfiguration to offset the inherent safety margins required by international standards and regulatory requirements for spent fuel pool criticality safety analyses, e.g., all assemblies at their peak reactivity, 0.05 margin in keff, and the various standard conservatisms in typical safety analyses (e.g., analyses based on most reactive lattice design, conservative depletion assumptions, ambient spent fuel pool water temperature, etc.).

So, coming back around to your specific question: **Do we now see a need to modify or expand the above technical opinion? If so, how?**

Answer: "yes" My revised position is the following:

"Given that the overall efficacy of the racks has been maintained, in terms of geometric separation of assemblies and neutron absorption characteristics, my opinion is that criticality in the spent fuel pools is very unlikely, particularly if boron is being used, and that the consequences of criticality in one of the spent fuel pools will not be significant in comparison to the consequences of the pool remaining empty/exposed. Provided the nuclear criticality safety analyses for the spent fuel pools were performed accurately and consistent with US Nuclear Regulatory Commission requirements and that the spent fuel racks were manufactured, installed and loaded consistent with the supporting nuclear criticality safety analyses, sufficient margin should be present to offset potential increases in reactivity associated with fuel reconfiguration. (Note: under normal circumstances, BWR spent fuel pools do not have borated water, and hence are designed and analyzed to be safe when flooded with un-borated water). If the efficacy of the racks is in question, I strongly suggest continued use of borated water until/unless the condition and design of the racks can be properly assessed. These are my personal/professional opinions, based on the information available to me at this time, and should be treated as such." Once I get input from others at ORNL, we will provide a collective position.

Note, depending on how hot the Unit 1-3 SFPs have been, I may have some concern about criticality in those pools since they utilize aluminum and borated aluminum racks.

#### Questions for you:

- 1) Can we get the design specifications for the SFP racks, particularly those in the Unit 4 SFP, ASAP?
- 2) Can we get the nuclear criticality safety analyses that was performed in support of the SFP rack licensing?
- 3) Can we get any photos or assessments of the condition of the spent fuel and spent fuel racks, particularly in Unit 4 SFP, ASAP? I was told video of the Unit 4 SFP (from a camera mounted on top of the fill pipe) would be available on 3/24, but I have yet to see it.

FYI – we have prepared a set of slides (attached) for the DOE related to this issue that has some additional information/basis that may be useful to you. These slides have yet to be provided to DOE and are likely to be revised to include the above, revised assessment pending review.

If you have any questions whatsoever, please do not hesitate to call me at any time – day or night – on my mobile number.

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Carlson, Donald [mailto:Donald.Carlson@nrc.gov]

**Sent:** Monday, March 28, 2011 9:14 PM

**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

**Importance:** High

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

**Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.** (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

**Question: Do we now see a need to modify or expand the above technical opinion? If so, how?**

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

**Donald E. Carlson**

NRO/ARP/ARB1

Cell: (b)(6)

Office: 301-415-0109

---

**From:** Taylor, Robert  
**Sent:** Monday, March 28, 2011 6:59 PM  
**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated  
Switching to fresh water injection on 3/29  
Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel  
204 fresh fuel assemblies were present in the pool  
Japanese concerns that the racks may have shifted.  
Fuel damage due to uncovering

Regards,  
Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 6:23 PM  
**To:** Taylor, Robert; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI – When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) Or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,  
Don

---

**From:** Taylor, Robert  
**Sent:** Monday, March 28, 2011 5:59 PM  
**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 1:07 PM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
**Subject:** RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

**Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.**

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----

From: Carlson, Donald  
Sent: Monday, March 28, 2011 9:30 AM  
To: Brown, Frederick  
Cc: Taylor, Robert; Scott, Michael  
Subject: RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----

From: Brown, Frederick  
Sent: Sunday, March 27, 2011 9:11 PM  
To: Carlson, Donald  
Cc: Taylor, Robert; Scott, Michael  
Subject: Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)?  
He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,  
Fred

Lee, Richard

---

**From:** Lee, Richard  
**Sent:** Thursday, March 31, 2011 5:53 PM  
**To:** Aissa, Mourad  
**Subject:** FW: Support for Japan - SFP Criticality Potential Update  
**Attachments:** ORNL\_Fukushima-Criticality\_Notes\_31Mar2011.pptx; Shika U1 ICE June 18 1999 070417E\_Rinkai\_Kaiseki.pdf

fyi

---

**From:** Wood, Kent  
**Sent:** Thursday, March 31, 2011 4:51 PM  
**To:** Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

All,

I've recently heard that the Fukushima Daiichi Unit 3 SFP is or may be dry. And has been for some time.

If that is the case the borated aluminum that is reported to be in those racks is probably damaged by the heat. It may be completely melted away. As shown in that attached slides that would increase keff by about 30% in a flooded SFP. (This figure is consistent with other analyses I've seen.)

A typical BWR "***SFP criticality safety analyses were properly performed consistent with the SFP criticality safety requirements of the U.S. Nuclear Regulatory Commission***" would use a limiting lattice to demonstrate that peak reactivity, i.e. after depletion of most of the Gadolina, the SFP keff would be essentially 0.945 at a 95% probability with a 95% confidence level. If present any installed neutron absorber would be included in the analysis. We should all know that there are some conservatism/margin in those analyses (1) there is probably some margin between the peak reactivity of the 'limiting lattice' and the peak reactivity of the 'actual lattice', (2) the 'limiting lattice' would be something the license would allow the licensee to have in its SFP and so the delta between 'limiting lattice' and a maximum 'actual lattice' may not be all that large, (3) not all fuel assemblies in the SFP will be at the point of peak reactivity, only those whose have only had one cycle of use in the reactor would reasonably be at their peak reactivity, (4) the 'limiting lattice' fresh fuel with its gadolina will have a reactivity 12-14%  $\Delta$ keff below the peak, 'actual lattice' (5) I usually estimate that 2<sup>nd</sup> cycle fuel assemblies will have reactivity probably a little less than the poisoned fresh probably 15-18%  $\Delta$ keff below the peak.

However, I would not estimate that those analyses have 30% margin. Adding 30%  $\Delta$ keff to the SFP rack and you are looking at a potential criticality event even in the 2<sup>nd</sup> burned fuel assemblies. It would probably only take four, certainly no more than six to start. A big question would be whether or not the moderator temperature coefficient is positive or negative, I've seen unpoisoned PWR racks have a positive MTC (I've not seen any MTC analysis for unpoisoned BWR racks).

I'm attaching a report on an inadvertent criticality event that Japan had at Shika U1. They had a criticality BWR because three control rods came partially out of the core during a refueling outage. That was a small volume under a full refueling pool. A criticality event in the Fukushima Daiichi U3 SFP would likely be larger and at least initially without any appreciable water as a shield. The criticality would continue until either boron was injected or the water boiled off. Once the fuel assemblies are uncovered, again, they will have a new higher decay heat load and source term, open to the atmosphere.

If the U3 SFP is currently dry and has been for some time one must consider how much worse the fuel can get if it is left dry.

Bottom line, if the U3 SFP is dry, they should not reflood the U3 SFP with unborated water unless they are certain the poison is intact.

Kent A. L. Wood  
Team Leader  
Spent Fuel Team (SFT)  
Reactor Systems Branch (SRXB)  
Division of Safety Systems (DSS)  
Office of Nuclear Reactor Regulation (NRR)  
301-415-4120

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]  
**Sent:** Thursday, March 31, 2011 10:27 AM  
**To:** Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,

Thanks for sharing this! Please see revised slide packet that includes analyses (by Don Mueller) that shows keff as a function of pitch for a representative design basis safety model. These analyses indicate that the rack dimensions you provided are believable from a criticality safety perspective for un-borated racks. Additional information/observations are included in the slides.

Main issue, in my mind, for the U4 SFP is preservation of the assembly separation, which is the key to sub-criticality in the UF SFP rack designs (as we understand them to be).

Call if you have questions.

**John C. Wagner, PhD**  
Oak Ridge National Laboratory  
Phone: (865) 241-3570  
Mobile: (b)(6)

---

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]  
**Sent:** Thursday, March 31, 2011 1:44 AM  
**To:** Taylor, Robert; Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher  
**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony  
**Subject:** RE: Support for Japan - SFP Criticality Potential Update

We just realized that the pitch is different between the E-W direction and N-S directions. The numbers below are correct for the E-W direction. In the N-S direction, the pitch is slightly larger, 194mm.

---

**From:** Taylor, Robert

**Sent:** Thursday, March 31, 2011 1:28 AM

**To:** 'Wagner, John C.'; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John, Don, and others,

We have received hardcopy drawings of the spent fuel racks in Unit 4. As we read them, it looks like each cell is 152mm across and the center-to-center pitch is 168.5mm. They are high-density.

Rob

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]

**Sent:** Tuesday, March 29, 2011 7:30 AM

**To:** Wagner, John C.; Taylor, Robert; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

With attachment...

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Wagner, John C.

**Sent:** Tuesday, March 29, 2011 7:28 AM

**To:** 'Taylor, Robert'; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Rob,

Yes, center-to-center pitch would be a good start. We have information on the complete inventory of the SFPs, including Unit 4 – see attached for some summary information. Our information indicates that the Unit 4 SFP has high-density racks, and makes us suspicious that Unit 4 SFP could have the same or similar high-density racks as are in the Unit 1-3 pools.

To be clear, I still suspect the likelihood of criticality is very small, as there should be significant reactivity margin in the system. However, the possibility that the Unit 4 SFP racks could have been uncovered for some period of time, the fact that we have received incorrect information on the racks previously, the fact that we have no information on the condition of the racks or the spent fuel, and that the other SFPs have AI-based racks, makes we want to proceed with caution.



I hope this is helpful

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Taylor, Robert [mailto:Robert.Taylor@nrc.gov]

**Sent:** Tuesday, March 29, 2011 6:01 AM

**To:** Wagner, John C.; Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.; Nakanishi, Tony

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

John,

Thanks for the consideration. We will stand fast until a consolidated position is reached.

I doubt we can get all of the information you (and I) would love to have. We will start small to see if we can get the center-to-center pitch in the racks. Note that the Daiichi SFPs are relatively low capacity in that they do not have as many assemblies in the pool as a typical US BWR. There is a common pool on-site where many of the spent fuel assemblies are moved. We understand that there Unit 4 pool had ~1000 assemblies in the pool. As such, it is possible that these are low-density racks.

We will try to ask for the center-to-center pitch tomorrow.

Regards,

Rob

---

**From:** Wagner, John C. [mailto:wagnerjc@ornl.gov]

**Sent:** Monday, March 28, 2011 11:32 PM

**To:** Carlson, Donald; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert; Gehin, Jess C.; Mueller, Don; Marshall, William BJ J.

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

Don,

As you stated, the previous assessment was based on information at the time, which was that the SFPs all had high-density, borated SS racks. Given the high melting temperature of SS, we expected the neutron absorbers to remain effective up to temperatures at which concern about criticality would be overtaken by concerns related to significant release of radiation due to fuel damage.

We have since learned that the initial information on the racks was incorrect. Specifically, from EPRI and NEI we have the following information (received in the past 2 days):

*"-->Units 1, 2, 3 have both aluminum racks as well as borated aluminum racks.*

*Unit 4 has only non-borated stainless racks."*

This information is consistent with the information you have below.

**The above information raises questions/concerns**

- Available information suggests the Unit 4 SFP racks are high-density (no flux traps)
- Yet, based on our experience, high-density requires neutron absorber panels, e.g., Boral, borated SS, etc.
- So, we need more information on the Unit 4 SFP racks to full assess criticality potential there
- Concern is that the Unit 4 SFP racks may be similar to the Unit 1-3 SFP racks, i.e., borated Al (not SS), and that if the Unit 4 SFP racks were uncovered for some period of time, the neutron absorber effectiveness could be compromised. If this is the case, reflooding with un-borated water could very well be a PROBLEM.
- Another issue is that if the racks are truly SS without Boron, then some large spacing and/or flux traps would be required. Damage to the racks could decrease spacing, which would be a concern, particularly given the statement from below "Japanese concerns that the racks may have shifted".
- We do know that the Unit 4 SFP has >100 assemblies in the peak reactivity burnup range that are stored together.

Generally speaking, if the effectiveness of the racks is maintained (geometric separation of individual assemblies and absorption properties), we do not expect fuel degradation/reconfiguration to offset the inherent safety margins required by international standards and regulatory requirements for spent fuel pool criticality safety analyses, e.g., all assemblies at their peak reactivity, 0.05 margin in keff, and the various standard conservatisms in typical safety analyses (e.g., analyses based on most reactive lattice design, conservative depletion assumptions, ambient spent fuel pool water temperature, etc.).

So, coming back around to your specific question: **Do we now see a need to modify or expand the above technical opinion? If so, how?**

Answer: "yes" My revised position is the following:

"Given that the overall efficacy of the racks has been maintained, in terms of geometric separation of assemblies and neutron absorption characteristics, my opinion is that criticality in the spent fuel pools is very unlikely, particularly if boron is being used, and that the consequences of criticality in one of the spent fuel pools will not be significant in comparison to the consequences of the pool remaining empty/exposed. Provided the nuclear criticality safety analyses for the spent fuel pools were performed accurately and consistent with US Nuclear Regulatory Commission requirements and that the spent fuel racks were manufactured, installed and loaded consistent with the supporting nuclear criticality safety analyses, sufficient margin should be present to offset potential increases in reactivity associated with fuel reconfiguration. (Note: under normal circumstances, BWR spent fuel pools do not have borated water, and hence are designed and analyzed to be safe when flooded with un-borated water). If the efficacy of the racks is in question, I strongly suggest continued use of borated water until/unless the condition and design of the racks can be properly assessed. These are my personal/professional opinions, based on the information available to me at this time, and should be treated as such." Once I get input from others at ORNL, we will provide a collective position.

Note, depending on how hot the Unit 1-3 SFPs have been, I may have some concern about criticality in those pools since they utilize aluminum and borated aluminum racks.

#### Questions for you:

- 1) Can we get the design specifications for the SFP racks, particularly those in the Unit 4 SFP, ASAP?
- 2) Can we get the nuclear criticality safety analyses that was performed in support of the SFP rack licensing?
- 3) Can we get any photos or assessments of the condition of the spent fuel and spent fuel racks, particularly in Unit 4 SFP, ASAP? I was told video of the Unit 4 SFP (from a camera mounted on top of the fill pipe) would be available on 3/24, but I have yet to see it.

FYI – we have prepared a set of slides (attached) for the DOE related to this issue that has some additional information/basis that may be useful to you. These slides have yet to be provided to DOE and are likely to be revised to include the above, revised assessment pending review.

If you have any questions whatsoever, please do not hesitate to call me at any time – day or night – on my mobile number.

Best Regards,

**John C. Wagner, PhD**

Oak Ridge National Laboratory

Phone: (865) 241-3570

Mobile: (b)(6)

---

**From:** Carlson, Donald [mailto:Donald.Carlson@nrc.gov]

**Sent:** Monday, March 28, 2011 9:14 PM

**To:** Wagner, John C.; Parks, Cecil V.; Hopper, Calvin Mitchell; Lee, Richard; Wood, Kent; VanWert, Christopher

**Cc:** Scott, Michael; Ulses, Anthony; Yarsky, Peter; Giessner, John; Taylor, Robert

**Subject:** RE: Support for Japan - SFP Criticality Potential Update

**Importance:** High

All,

Rob Taylor (NRC/NRR, on Cc) called from Japan to revisit the Unit 4 pool criticality issue. He provides the following details:

- Unit 4 racks are not borated
- Switching to unborated fresh water injection on 3/29
- Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel
- 204 fresh fuel assemblies were present in the pool
- Japanese concerns that the racks may have shifted
- Fuel damage due to uncover

Our NRC+ORNL technical opinion as of March 19 was as follows:

**Statement: Criticality is very unlikely for any likely configuration in the SFP, especially if boron is being added.**

**Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.** (The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is not possible without water.)

That opinion may have been based in part on a preliminary understanding that the Unit 4 SFP had low-density racks of borated stainless steel.

**Question: Do we now see a need to modify or expand the above technical opinion? If so, how?**

Responses or questions provided by 10:00am EST Tuesday would be especially appreciated.

As always, your help and advice is deeply appreciated.

Best regards,  
Don

Donald E. Carlson

NRO/ARP/ARB1

Cell: (b)(6)

Office: 301-415-0109

---

**From:** Taylor, Robert  
**Sent:** Monday, March 28, 2011 6:59 PM  
**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

The RST has given us their bridge line for a call at 2000 EST.

301-816-5120 Passcode (b)(6)

Info for consideration during the call:

Unit 4 racks are not borated  
Switching to fresh water injection on 3/29  
Shutdown last November with 1/3 of the core offload being 1<sup>st</sup> cycle fuel  
204 fresh fuel assemblies were present in the pool  
Japanese concerns that the racks may have shifted.  
Fuel damage due to uncovering

Regards,  
Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 6:23 PM  
**To:** Taylor, Robert; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Rob,

It would be helpful to get some confirmation/clarification on which pools are of most concern and their respective rack designs and fuel loadings.

The core off-load in the Unit 4 pool was the main concern when we provided the technical opinion over a week ago, with the preliminary understanding that those racks were of borated stainless steel and not high-density.

FYI – When I call your cell phone number, AT&T says more information is needed, then asks to enter the number again to leave a voice message, and then says the voice mailbox has not been set up.

My cell phone number is (b)(6) or I can plan to report to the RST at 2000 EDT or 0530 EST. Please let me know how I can best help.

Thanks,  
Don

---

**From:** Taylor, Robert  
**Sent:** Monday, March 28, 2011 5:59 PM  
**To:** Carlson, Donald; Brown, Frederick  
**Cc:** Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher; Giessner, John  
**Subject:** RE: Support for Japan - SFP Criticality Potential

Don,

I missed your call last night. The cell number works but isn't my normal blackberry number so I don't know if the message is set up correctly. I would still like to chat briefly to ensure we are still aligned on this issue. Can we set up something for 0900 JST (2000 EDT) or 1830 JST (0530 EST)

Rob

---

**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 1:07 PM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael; Wood, Kent; Ulses, Anthony; Yarsky, Peter; VanWert, Christopher  
**Subject:** RE: Support for Japan - SFP Criticality Potential

All,

Pending contact with Rob Taylor in Japan, here is a quick recap of the statement we made when asked over a week ago to advise on SFP criticality concerns:

**Statement: Criticality is very unlikely for any likely configuration in the SFPs, especially if boron is being added. Moreover, if criticality were to occur, it would be of much less consequence than an empty pool.**

- This statement was based in part on a preliminary understanding that the plants' SFPs have low-density racks made of borated stainless steel. The statement also included reminders that the water in BWR SFPs is generally not borated and that criticality is physically impossible without water.

- The statement was drafted and concurred on by ORNL (John Wagner, Cecil Parks, Calvin Hopper), NRC/RES (Richard Lee), and NRC/NRO (Don Carlson) and provided to the Hoc Reactor Safety Team.

- The statement was also discussed briefly last week at a meeting of the NRC Interoffice Technical Advisory Group (TAG) for Nuclear Criticality Safety. The TAG meeting was attended by Kent Wood (NRR) and Chris VanWert (NRO) in their respective roles for reviewing SFP criticality safety at existing reactors and new reactors.

Don

-----Original Message-----  
**From:** Carlson, Donald  
**Sent:** Monday, March 28, 2011 9:30 AM  
**To:** Brown, Frederick  
**Cc:** Taylor, Robert; Scott, Michael  
**Subject:** RE: Support for Japan

Fred,

That phone number doesn't work.

Don

-----Original Message-----  
**From:** Brown, Frederick  
**Sent:** Sunday, March 27, 2011 9:11 PM  
**To:** Carlson, Donald  
**Cc:** Taylor, Robert; Scott, Michael  
**Subject:** Support for Japan

Don,

Can you please call Rob Taylor in Japan (noting the time difference, please call very early on day shift or in the evening)?  
He would like to have a follow-up conversation on SFP criticality potential.

His cell is (b)(6)

Thanks,  
Fred

## OIP\_ITServices Resource

---

**From:** Schwartzman, Jennifer  
**Sent:** Friday, April 22, 2011 10:21 AM  
**To:** OIP\_ITServices Resource  
**Subject:** FW: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

-----Original Message-----

**From:** Shaffer, Mark R [mailto:ShafferMr@state.gov]  
**Sent:** Sunday, March 13, 2011 1:41 AM  
**To:** Schwartzman, Jennifer; LIA02 Hoc  
**Subject:** Fw: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

From DOE Tokyo...

----- Original Message -----

**From:** Thomas, Elena A  
**To:** Scheland, Mark DL; Kessler, Kurt G; Buck, Christopher L; Paton, William J; Shaffer, Mark R  
**Cc:** Zubarev, Jill E; 'lisa.hilliard@wins.org' <lisa.hilliard@wins.org>  
**Sent:** Sun Mar 13 01:35:03 2011  
**Subject:** Fw: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

FYI, below is an update from our DOE-Tokyo office.

----- Original Message -----

**From:** Carlson, Nicholas <Nicholas.Carlson@nnsa.doe.gov>  
**To:** Thomas, Elena <Elena.Thomas@nnsa.doe.gov>; Zubarev, Jill <Jill.Zubarev@nnsa.doe.gov>; Hilliard, Lisa <(b)(6)> Schoenbauer, Martin J (Beijing); Buzzard, Christine M; Awan, Riaz X (Sofia - DOE); Leach, Wayne <Wayne.Leach@nnsa.doe.gov>  
**Sent:** Sat Mar 12 19:07:02 2011  
**Subject:** Fw: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

Not good. Lots of confusion. Hope rumors of meltdown are untrue.

Ron and Uchida-san are working on very little sleep but doing a fabulous job.

----- Original Message -----

**From:** Koichi Uchida <(b)(6)>  
**To:** 'Koichi Uchida' <(b)(6)>; Lyons, Peter; Connery, Joyce; Cherry, Ron; Aoki, Steven; Poneman, Daniel; DAgostino, Thomas; Mustin, Tracy; Carlson, Nicholas; Alldridge, David; Hoffman, Patricia; Koonin, Steven; Miller, Neile; Krol, Joseph; Johnson, Shane; Kelly, John E (NE); McGinnis, Edward; NITOPS  
**Cc:** Duncan, Aleshia; OConnor, Rod; Bryan, William; Williams, Melvin; Hurlbut, Brandon; Anderson, Margot; Mueller, Stephanie; LaVera, Damien; Reynolds, Tom; Hunsaker, Christopher; Koontz, Thomas; Leistikow, Dan  
**Sent:** Sat Mar 12 17:40:08 2011

Subject: RE: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

NHK TV reported at 6:39 on Mar 13th : TEPCO reported GOJ that Fukushima Dai-ichi (Fukushima-1) Reactor No.3 has lost the cooling capability at 2:44.

As same as Fukushima-1 Reactor No.1, TEPCO will start releasing radiation steam from Reactor No.3.

Now, currently reactors with troubles are total 6 as below.

Fukushima Dai-ichi (it means No.1) NPP  
Reactor No.1 (BWR, 460 MWe)  
Reactor No.2 (BWR 784 MWe)  
Reactor No.3 (BWR 784 MWe)

Fukushima Dai-ni (it means No.2) NPP  
Reactor No.1 (BWR 1100 MWe)  
Reactor No.2 (BWR 1100 MWe)  
Reactor No.4 (BWR 1100 MWe)

Details of reactors are in IAEA web.

<http://www.iaea.org/cgi-bin/db.page.pl/pris.powrea.htm?country=JP&sort=&sortlong=Alphabetic>

Uchida  
DOE Tokyo

-----Original Message-----

From: Koichi Uchida [mailto:(b)(6)]

Sent: Saturday, March 12, 2011 11:51 PM

To: 'Koichi Uchida'; 'Lyons, Peter'; 'Connery, Joyce'; 'Cherry, Ron'; 'Aoki, Steven'; 'Poneman, Daniel'; 'D'Agostino, Thomas'; 'Mustin, Tracy'; 'Carlson, Nicholas'; 'Alldridge, David'; 'Hoffman, Patricia'; 'Koonin, Steven'; 'Miller, Neile'; 'Krol, Joseph'; 'Johnson, Shane'; 'Kelly, John E (NE)'; 'McGinnis, Edward'; 'NITOPS'  
Cc: 'Duncan, Aleshia'; 'O'Connor, Rod'; 'Bryan, William'; 'Williams, Melvin'; 'Hurlbut, Brandon'; 'Anderson, Margot'; 'Mueller, Stephanie'; 'LaVera, Damien'; 'Reynolds, Tom'; 'Hunsaker, Christopher'; 'Koontz, Thomas'; 'Leistikow, Dan'

Subject: RE: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

NHK news reported that Fukushima Prefectural Government announced three evacuees were found exposed by radiation (particular levels were not announced.)

When Fukushima Pref. Gov picked three from total 90 evacuees (patients and hospital employees) at a hospital in Futaba-machi, where is about 3 km North from Fukushima Dai-ichi NPP, they have found all of them were exposed at levels that decontamination should be necessary. However their health conditions are fine.

When the explosion was occurred at Fukushima Dai-ichi, Reactor No.1 at around 15:30 today, all of 90 evacuees were waiting Self Defense Force's helicopter transportation to the hospital in a high school grounds near the NPP.

uchida

-----Original Message-----

From: Koichi Uchida [mailto:(b)(6)]



Sent: Saturday, March 12, 2011 9:06 PM

To: 'Koichi Uchida'; 'Lyons, Peter'; 'Connery, Joyce'; 'Cherry, Ron'; 'Aoki, Steven'; 'Poneman, Daniel'; 'D'Agostino, Thomas'; 'Mustin, Tracy'; 'Carlson, Nicholas'; 'Alldridge, David'; 'Hoffman, Patricia'; 'Koonin, Steven'; 'Miller, Neile'; 'Krol, Joseph'; 'Johnson, Shane'; 'Kelly, John E (NE)'; 'McGinnis, Edward'; 'NITOPS'  
Cc: 'Duncan, Aleshia'; 'O'Connor, Rod'; 'Bryan, William'; 'Williams, Melvin'; 'Hurlbut, Brandon'; 'Anderson, Margot'; 'Mueller, Stephanie'; 'LaVera, Damien'; 'Reynolds, Tom'; 'Hunsaker, Christopher'; 'Koontz, Thomas'; 'Leistikow, Dan'  
Subject: RE: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

Prime Minister Kan made a press conference from 20:32, but he deferred Chief Cabinet Secretary Edano to speak about the details of Fukushima Dai-ichi Reactor No.1.

CCS Edano confirmed that only walls of reactor building were exploded at 15:35, but the pressure vessel was remained undestroyed.

He said TEPCO confirmed sound condition of the vessel.

He said the explosion was made by hydrogen leaked from water of the reactor and pooled between the contained vessel and the reactor building.

He added, to secure the safety, TEPCO has decided to fill sea water and boron into the pressure vessel and METI Minister Kaieda approved the measure.

Uchida  
DOE Tokyo

-----Original Message-----

From: Koichi Uchida [mailto:(b)(6)]  
Sent: Saturday, March 12, 2011 8:21 PM  
To: 'Koichi Uchida'; 'Lyons, Peter'; 'Connery, Joyce'; 'Cherry, Ron'; 'Aoki, Steven'; 'Poneman, Daniel'; 'D'Agostino, Thomas'; 'Mustin, Tracy'; 'Carlson, Nicholas'; 'Alldridge, David'; 'Hoffman, Patricia'; 'Koonin, Steven'; 'Miller, Neile'; 'Krol, Joseph'; 'Johnson, Shane'; 'Kelly, John E (NE)'; 'McGinnis, Edward'; 'NITOPS'  
Cc: 'Duncan, Aleshia'; 'O'Connor, Rod'; 'Bryan, William'; 'Williams, Melvin'; 'Hurlbut, Brandon'; 'Anderson, Margot'; 'Mueller, Stephanie'; 'LaVera, Damien'; 'Reynolds, Tom'; 'Hunsaker, Christopher'; 'Koontz, Thomas'; 'Leistikow, Dan'  
Subject: RE: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

NHK reported Prime Minister Kan would make an official announcement on Fukushima NPPs from 20:30, i.e. in 10 minutes time.

Uchida

-----Original Message-----

From: Koichi Uchida [mailto:(b)(6)]  
Sent: Saturday, March 12, 2011 8:18 PM  
To: 'Koichi Uchida'; 'Lyons, Peter'; 'Connery, Joyce'; 'Cherry, Ron'; 'Aoki, Steven'; 'Poneman, Daniel'; 'D'Agostino, Thomas'; 'Mustin, Tracy'; 'Carlson, Nicholas'; 'Alldridge, David'; 'Hoffman, Patricia'; 'Koonin, Steven'; 'Miller, Neile'; 'Krol, Joseph'; 'Johnson, Shane'; 'Kelly, John E (NE)'; 'McGinnis, Edward'; 'NITOPS'  
Cc: 'Duncan, Aleshia'; 'O'Connor, Rod'; 'Bryan, William'; 'Williams, Melvin'; 'Hurlbut, Brandon'; 'Anderson, Margot'; 'Mueller, Stephanie'; 'LaVera, Damien'; 'Reynolds, Tom'; 'Hunsaker, Christopher'; 'Koontz, Thomas'; 'Leistikow, Dan'  
Subject: RE: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

I am sorry I only found You Tube, but the original is from NHK World.

<http://www3.nhk.or.jp/nhkworld/>

uchida

-----Original Message-----

From: Koichi Uchida [mailto: (b)(6)]

Sent: Saturday, March 12, 2011 8:10 PM

To: 'Koichi Uchida'; 'Lyons, Peter'; 'Connery, Joyce'; 'Cherry, Ron'; 'Aoki, Steven'; 'Poneman, Daniel'; 'D'Agostino, Thomas'; 'Mustin, Tracy'; 'Carlson, Nicholas'; 'Alldridge, David'; 'Hoffman, Patricia'; 'Koonin, Steven'; 'Miller, Neile'; 'Krol, Joseph'; 'Johnson, Shane'; 'Kelly, John E (NE)'; 'McGinnis, Edward'; 'NITOPS'  
Cc: 'Duncan, Aleshia'; 'O'Connor, Rod'; 'Bryan, William'; 'Williams, Melvin'; 'Hurlbut, Brandon'; 'Anderson, Margot'; 'Mueller, Stephanie'; 'LaVera, Damien'; 'Reynolds, Tom'; 'Hunsaker, Christopher'; 'Koontz, Thomas'; 'Leistikow, Dan'

Subject: RE: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

[http://www.youtube.com/watch?v=pr\\_qds1ACTM](http://www.youtube.com/watch?v=pr_qds1ACTM)

The picture after the blast is in the above.

uchida

-----Original Message-----

From: Koichi Uchida [mailto: (b)(6)]

Sent: Saturday, March 12, 2011 8:08 PM

To: 'Lyons, Peter'; 'Connery, Joyce'; 'Cherry, Ron'; 'Aoki, Steven'; 'Poneman, Daniel'; 'D'Agostino, Thomas'; 'Mustin, Tracy'; 'Carlson, Nicholas'; 'Alldridge, David'; 'Hoffman, Patricia'; 'Koonin, Steven'; 'Miller, Neile'; 'Krol, Joseph'; 'Johnson, Shane'; 'Kelly, John E (NE)'; 'McGinnis, Edward'; 'NITOPS'  
Cc: 'Duncan, Aleshia'; 'O'Connor, Rod'; 'Bryan, William'; 'Williams, Melvin'; 'Hurlbut, Brandon'; 'Anderson, Margot'; 'Mueller, Stephanie'; 'LaVera, Damien'; 'Reynolds, Tom'; 'Hunsaker, Christopher'; 'Koontz, Thomas'; 'Leistikow, Dan'

Subject: RE: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

Dr. Lyons

No.

So far only NHK TV is showing the pictures before and after, but from the picture after the blast, I can see only frames of the reactor building.

UCHIDA

-----Original Message-----

From: Lyons, Peter [mailto:Peter.Lyons@Nuclear.Energy.gov]

Sent: Saturday, March 12, 2011 7:30 PM

To: Connery, Joyce; (b)(6); Cherry, Ron; Aoki, Steven; Poneman, Daniel; D'Agostino, Thomas; Mustin, Tracy; Carlson, Nicholas; Alldridge, David; Hoffman, Patricia; Koonin, Steven; Miller, Neile; Krol, Joseph; Johnson, Shane; Kelly, John E (NE); McGinnis, Edward; NITOPS  
Cc: Duncan, Aleshia; O'Connor, Rod; Bryan, William; Williams, Melvin; Hurlbut, Brandon; Anderson, Margot; Mueller, Stephanie; LaVera, Damien; Reynolds, Tom; Hunsaker, Christopher; Koontz, Thomas; Leistikow, Dan  
Subject: Re: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

Uchida

Can you tell from photos if containment building is still standing??

Pete

----- Original Message -----

From: Connery, Joyce

To: (b)(6) Lyons, Peter; Cherry, Ron; Aoki, Steven; Poneman, Daniel; DAgostino, Thomas; Mustin, Tracy; Carlson, Nicholas; Alldridge, David; Hoffman, Patricia; Koonin, Steven; Miller, Neile; Krol, Joseph; Johnson, Shane; Kelly, John E (NE); McGinnis, Edward; NITOPS  
Cc: Duncan, Aleshia; OConnor, Rod; Bryan, William; Williams, Melvin; Hurlbut, Brandon; Anderson, Margot; Mueller, Stephanie; LaVera, Damien; Reynolds, Tom; Hunsaker, Christopher; Koontz, Thomas; Leistikow, Dan  
Sent: Sat Mar 12 05:26:14 2011  
Subject: Re: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

Uchida,

We still have no confirmation as to where the explosion took place, correct?

----- Original Message -----

From: Koichi Uchida (b)(6)

To: Lyons, Peter; Cherry, Ron; Connery, Joyce; Aoki, Steven; Poneman, Daniel; DAgostino, Thomas; Mustin, Tracy; Carlson, Nicholas; Alldridge, David; Hoffman, Patricia; Koonin, Steven; Miller, Neile; Krol, Joseph; Johnson, Shane; Kelly, John E (NE); McGinnis, Edward; NITOPS  
Cc: Duncan, Aleshia; OConnor, Rod; Bryan, William; Williams, Melvin; Hurlbut, Brandon; Anderson, Margot; Mueller, Stephanie; LaVera, Damien; Reynolds, Tom; Hunsaker, Christopher; Koontz, Thomas; Leistikow, Dan  
Sent: Sat Mar 12 05:23:46 2011  
Subject: RE: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

No news on the details of the explosion were announced by anyone; i.e. Chief Cabinet Secretary, NISA nor TEPCO.

Uchida

-----Original Message-----

From: Lyons, Peter [mailto:Peter.Lyons@Nuclear.Energy.gov]

Sent: Saturday, March 12, 2011 6:55 PM

To: Cherry, Ron; Connery, Joyce; Aoki, Steven; Poneman, Daniel; DAgostino, Thomas; Mustin, Tracy; Carlson, Nicholas; Alldridge, David; Hoffman, Patricia; Koonin, Steven; Miller, Neile; Krol, Joseph; Johnson, Shane; Kelly, John E (NE); McGinnis, Edward; NITOPS

Cc: Duncan, Aleshia; OConnor, Rod; Bryan, William; Williams, Melvin; Hurlbut, Brandon; Anderson, Margot; Mueller, Stephanie; LaVera, Damien; Reynolds, Tom; Hunsaker, Christopher; Koontz, Thomas; Leistikow, Dan; (b)(6)

Subject: Re: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

I see no further downside now to use of sea water to cool whatever is left of the core and I don't see why it wasn't done earlier.

I presume both pressure vessel and containment were destroyed, but is there any info to suggest pressure vessel is still intact? If so, I think pouring anything on the vessel or its remnants is wise.

----- Original Message -----

From: Cherry, Ron

To: Lyons, Peter; Connery, Joyce; Aoki, Steven; Poneman, Daniel; DAgostino, Thomas; Mustin, Tracy; Carlson, Nicholas; Alldridge, David; Hoffman, Patricia; Koonin, Steven; Miller, Neile; Krol, Joseph; Johnson, Shane; Kelly, John E (NE); McGinnis, Edward; NITOPS  
Cc: Duncan, Aleshia; OConnor, Rod; Bryan, William; Williams, Melvin; Hurlbut, Brandon; Anderson, Margot; Mueller, Stephanie; LaVera, Damien; Reynolds, Tom; Hunsaker, Christopher; Koontz, Thomas; Leistikow, Dan; (b)(6)  
Sent: Sat Mar 12 04:50:04 2011  
Subject: Re: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

Pete,

I'm on a conference call with the interagency task force and raised this question. US Forces Japan advised that the Seventh Fleet is aware of the concern and advising its assets to avoid the plume area.

The GOJ earlier said using seawater to cool the core was the last resort. Question on the conference call was is that still an option and if so, at this point is there any downside.

Thanks.

Ron

This has been sent from my Blackberry

----- Original Message -----

From: Lyons, Peter <Peter.Lyons@Nuclear.Energy.gov>  
To: Cherry, Ronald C; Connery, Joyce <Joyce.Connery@hq.doe.gov>; Aoki, Steven <Steven.Aoki@nnsa.doe.gov>; Poneman, Daniel <Daniel.Poneman@hq.doe.gov>; DAgostino, Thomas <Thomas.DAgostino@nnsa.doe.gov>; Mustin, Tracy <Tracy.Mustin@nnsa.doe.gov>; Carlson, Nicholas <Nicholas.Carlson@nnsa.doe.gov>; Alldridge, David <David.Alldridge@NNSA.Doe.Gov>; Hoffman, Patricia <Pat.Hoffman@hq.doe.gov>; Koonin, Steven <Steven.Koonin@science.doe.gov>; Miller, Neile <Neile.Miller@NNSA.doe.gov>; Krol, Joseph <Joseph.Krol@nnsa.doe.gov>; Johnson, Shane <SHANE.JOHNSON@nuclear.energy.gov>; Kelly, John E (NE) <JohnE.Kelly@Nuclear.Energy.Gov>; McGinnis, Edward <Edward.McGinnis@Nuclear.Energy.Gov>; NITOPS <NITOPS@nnsa.doe.gov>  
Cc: Duncan, Aleshia <Aleshia.Duncan@nuclear.energy.gov>; OConnor, Rod <Rod.OConnor@hq.doe.gov>; Bryan, William; Williams, Melvin <Melvin.Williams@Hq.Doe.Gov>; Hurlbut, Brandon <Brandon.Hurlbut@hq.doe.gov>; Anderson, Margot <Margot.Anderson@hq.doe.gov>; Mueller, Stephanie <Stephanie.Mueller@hq.doe.gov>; LaVera, Damien <Damien.LaVera@nnsa.doe.gov>; Reynolds, Tom <Tom.Reynolds@hq.doe.gov>; Hunsaker, Christopher <Christopher.Hunsaker@nnsa.doe.gov>; Koontz, Thomas <Thomas.Koontz@nnsa.doe.gov>; Leistikow, Dan <Dan.Leistikow@hq.doe.gov>; (b)(6)

Sent: Sat Mar 12 04:40:40 2011

Subject: Re: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

Ron

Have offshore assets (Reagan, etc) been advised to move out of the plume area?

Pete

----- Original Message -----

From: Cherry, Ron  
To: Connery, Joyce; Aoki, Steven; Lyons, Peter; Poneman, Daniel; DAgostino, Thomas; Mustin, Tracy; Carlson, Nicholas; Alldridge, David; Hoffman, Patricia; Koonin, Steven; Miller, Neile; Krol, Joseph; Johnson, Shane; Kelly, John E (NE); McGinnis, Edward; NITOPS  
Cc: Duncan, Aleshia; OConnor, Rod; Bryan, William; Williams, Melvin; Hurlbut, Brandon; Anderson, Margot; Mueller, Stephanie; LaVera, Damien; Reynolds, Tom; Hunsaker, Christopher; Koontz, Thomas; Leistikow, Dan; Koichi Uchida <(b)(6)>  
Sent: Sat Mar 12 01:39:52 2011

Subject: FW: Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

News is reporting cesium and iodine were detected at Fukushima -1 and NISA estimates that melting of fuel and fuel cladding may have begun. We're looking for a statement.

NISA through MOFA has asked for US Forces Japan to help transport cooling water.

Navy radiation experts are being looped in here -- see email below. I'll be on a conference call with USFJ on this issue in a few moments.

This email is UNCLASSIFIED

-----Original Message-----

From: (b)(6) [mailto:(b)(6)]  
Sent: Saturday, March 12, 2011 3:17 PM  
To: Toko, Kenichiro (Ken); Cipullo, Timothy L; Cherry, Ronald C; Young, Joseph M; Walcott, Naomi  
Cc: (b)(6)  
Subject: E-Mail To Connect Everyone

The Cc's on this e-mails are U.S. Navy Nuclear Reactors/Radiological Control experts...

-----Original Message-----

From: Zumwalt, James P  
Sent: Saturday, March 12, 2011 3:23 PM  
To: Kimura, Ayako; Fuller, Matthew G; Basalla, Suzanne I; Kelley, Karen D (IO/Tokyo); Quade, Christopher P; Toko, Kenichiro (Ken); Young, Joseph M; Miyazaki, Yumiko; Luke, Robert S  
Cc: Cipullo, Timothy L; Wall, Marc M; Walcott, Naomi; Cherry, Ronald C  
Subject: RE: Joe / Ken ---- Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission

Thanks Aya -- Looping in Tim, Naomi, Marc and Ron who are working this nuclear issue.

SBU

This email is UNCLASSIFIED

James P. Zumwalt  
Deputy Chief of Mission  
U.S. Embassy, Tokyo  
1-10-5 Akasaka  
Minato ku Tokyo 107-8420  
(b)(6)

<http://tokyo.usembassy.gov/zb主blog/e/zb主blog-email.html>

-----Original Message-----

From: Kimura, Ayako  
Sent: Saturday, March 12, 2011 3:03 PM  
To: Kimura, Ayako; Roos, John; Fuller, Matthew G; Basalla, Suzanne I; Zumwalt, James P; Kelley, Karen D (IO/Tokyo); Quade, Christopher P; Toko, Kenichiro (Ken); Young, Joseph M; Miyazaki, Yumiko; Luke, Robert S  
Subject: Joe / Ken ---- Official Request for USFJ support to transport cooling water to Fukushima plant RE: Radioactive Cesium detected near Fukushima plan No. t: nuke safety commission  
Importance: High

Joe Ken -- I know you guys are on the phone

MOFA Tamaura is trying to reach you. MOFA got an official request from Nuclear and Industrial Safety Agency for assistance from USFJ to transfer cooling water to the Fukushima Plant. Details are still very sketchy. MOFA will provide as soon as they have. MOFA asked us to give a heads up to USFJ.

Aya Kimura  
Political-Military Affairs Unit  
U.S. Embassy, Tokyo  
Tel: +81 3 3224 5913  
Fax: +81 3 3224 5290  
Cell: (b)(6)  
E-mail: KimuraAX@state.gov

-----Original Message-----

From: Kimura, Ayako  
Sent: Saturday, March 12, 2011 2:30 PM  
To: Kimura, Ayako; Roos, John; Fuller, Matthew G; Basalla, Suzanne I; Zumwalt, James P; Kelley, Karen D (IO/Tokyo); Quade, Christopher P; Toko, Kenichiro (Ken); Young, Joseph M; Miyazaki, Yumiko; Luke, Robert S  
Subject: Radioactive Cesium detected near Fukushima plant No. 1: nuke safety commission

NHK and other broadcasters are reporting as breaking news (as of 2:30pm)

-----  
Japan finds radioactive material leak at quake-hit Fukushima plant --- TOKYO, March 12, Kyodo

Radiation rose to an unusually high level in and near Tokyo Electric Power Co.'s Fukushima No. 1 nuclear plant Saturday following the powerful earthquake that hit northern Japan the previous day, the nuclear safety agency said, making it the first case of an external leak of radioactive substances since the disaster.

While the agency denied the radiation amount will pose an immediate threat to the health of nearby residents, the impact of the quake appeared to widen as the agency added the area close to the Fukushima No. 2 nuclear plant as a zone that requires evacuation.

Given the adjacent No. 2 plant also has quake-triggered malfunctions, the operator of the two plants in Fukushima Prefecture is set to release pressure in containers housing their reactors under an unprecedented government order, so as to avoid the plants sustaining damage and losing their critical containment function.

But the action would involve the release of steam that would likely include radioactive materials.

The amount of radiation reached around 1,000 times the normal level in the control room of the No. 1 reactor of the Fukushima No. 1 plant, the Nuclear and Industrial Safety Agency said.

The agency also said radiation has been measured at more than eight times the normal level near the main gate of the plant.

The authorities expanded the evacuation area for residents in the vicinity of the No. 1 plant from a 3-kilometer radius to 10 km on the orders of Prime Minister Naoto Kan, who visited the facility.

The government also declared that the Fukushima No. 2 plant is under a state of atomic-power emergency, in addition to the No. 1 plant, and expanded the evacuation area to include the vicinity of the No. 2 plant.

The instruction covers residents living in a radius of 3 kilometers of the Fukushima No. 2 plant. Those living in a radius of 3-10 kilometers of the plant have also been advised to stay inside. ==Kyodo

SBU  
This email is UNCLASSIFIED

Aya Kimura  
Political-Military Affairs Unit  
U.S. Embassy, Tokyo  
Tel: +81 3 3224 5913  
Fax: +81 3 3224 5290  
Cell: (b)(6)  
E-mail: KimuraAX@state.gov

-----Original Message-----

From: Kimura, Ayako  
Sent: Saturday, March 12, 2011 2:26 PM  
To: Roos, John; Fuller, Matthew G; Basalla, Suzanne I; Zumwalt, James P; Kelley, Karen D (IO/Tokyo);  
Quade, Christopher P; Toko, Kenichiro (Ken); Young, Joseph M; Miyazaki, Yumiko  
Subject: Gen Field will attend the press briefing

SBU

This email is UNCLASSIFIED-----Original Message-----

From: Toko, Kenichiro (Ken)  
Sent: Saturday, March 12, 2011 2:12 PM  
To: Kimura, Ayako  
Subject: RE: GOJ Requests for Assistance- Updates as of 1230 JST 12MAR2011

Gen Field will attend the press briefing.

SBU

This email is UNCLASSIFIED

## OIP\_ITServices Resource

---

**From:** Schwartzman, Jennifer  
**Sent:** Friday, April 22, 2011 10:27 AM  
**To:** OIP\_ITServices Resource  
**Subject:** FW: Earthquake in Japanese: update of affected nuclear facilities

-----Original Message-----

**From:** Shaffer, Mark R [<mailto:ShafferMr@state.gov>]  
**Sent:** Sunday, March 13, 2011 2:13 PM  
**To:** LIA02 Hoc  
**Cc:** Schwartzman, Jennifer  
**Subject:** Fw: Earthquake in Japanese: update of affected nuclear facilities

Janice / Brooke,

Attached is information from the Japanese Mission here in Vienna.

Please confirm receipt of this e-mail. I want to make sure you are getting the information that I'm sending. I thought me last two communications solicited a response from you but I haven't received anything? I am still unable to read the one communication that you sent many hours ago, and I didn't hear back about providing Canada with information.????

----- Original Message -----

**From:** KANEKO TOSHIO <[kaneko.toshio@mofa.go.jp](mailto:kaneko.toshio@mofa.go.jp)>  
**To:** Shaffer, Mark R; Thomas, Elena A  
**Cc:** EBATA YASUYUKI <[yasuyuki.ebata@mofa.go.jp](mailto:yasuyuki.ebata@mofa.go.jp)>; KIYOURA TAKASHI <[takashi.kiyoura@mofa.go.jp](mailto:takashi.kiyoura@mofa.go.jp)>; MURATA SHINICHI <[shinichi.murata-2@mofa.go.jp](mailto:shinichi.murata-2@mofa.go.jp)>  
**Sent:** Sun Mar 13 13:55:44 2011  
**Subject:** FW: Earthquake in Japanese: update of affected nuclear facilities

Dear All

As per strong requests by our Mission to Tokyo last night, the Cabinet Office begins to post English statements made by the Chief Cabinet Secretary regarding the earthquake and affected nuclear facilities in Japan. Now some of statements are available at the Cabinet Office website.

<http://www.kantei.go.jp/foreign/topics/2011/earthquake2011tohoku.html>

Best Regards,

Yas

\*\*\*\*\*

Yasuyuki EBATA

First Secretary

Permanent Mission of Japan

to the International Organizations in Vienna Donau-City Strasse 6, A-1220 Vienna Austria Tel +43-1-260-6350

Mobile (b)(6)

\*\*\*\*\*



---

**From:** PMT01 Hoc  
**Sent:** Friday, April 01, 2011 12:23 PM  
**To:** Hoc, PMT12; PMT09 Hoc  
**Subject:** FW: Radiation data by MEXT  
**Attachments:** (English)20110401\_18.pdf; (English)20110401\_19..pdf; (English)20110401\_20.pdf;  
(English)20110401\_21.pdf; (English)20110401\_22.pdf; (English)20110401\_23.pdf;  
(unofficial)(English)20110401\_18.pdf

-----Original Message-----

**From:** LIA02 Hoc  
**Sent:** Friday, April 01, 2011 11:31 AM  
**To:** PMT01 Hoc; PMT02 Hoc  
**Subject:** FW: Radiation data by MEXT

PMT,  
This is from MEXT and is in English :-) I hope that it's helpful!

-Jenny

-----Original Message-----

**From:** eda@mext.go.jp [mailto:eda@mext.go.jp]  
**Sent:** Friday, April 01, 2011 10:22 AM

**To:** (b)(6)

(b)(6)

**Cc:** saigai03@mext.go.jp; akasaka@mext.go.jp; senami@mext.go.jp  
**Subject:** Radiation data by MEXT

AAAA/ 470

Dear Sir,

Please see attached the document.

Sincerely yours,

Kei EDA

EOC, Ministry of Education, Culture, Sports, Science & Technology (MEXT), Japan

|    | Prefecture            | Fallout        |                |                                                           |
|----|-----------------------|----------------|----------------|-----------------------------------------------------------|
|    |                       | I-131          | Cs-137         | Remarks                                                   |
| 1  | Hokkaido(Sapporo)     | Not Detectable | Not Detectable |                                                           |
| 2  | Aomori(Aomori)        | Not Detectable | Not Detectable |                                                           |
| 3  | Iwate(Morioka)        | 25.7           | 21.9           |                                                           |
| 4  | Miyagi                | -              | -              | Not be measured because of the earthquake disaster damage |
| 5  | Akita(Akita)          | Not Detectable | Not Detectable |                                                           |
| 6  | Yamagata(Yamagata)    | -              | -              | On Setting up the equipment                               |
| 7  | Fukushima (Fukushima) | -              | -              | Measurements arrived, though it had delayed.              |
| 8  | Ibaraki(Hitachinaka)  | 74             | 26             |                                                           |
| 9  | Tochigi(Utsunomiya)   | -              | -              | Measurements arrived, though it had delayed.              |
| 10 | Gunma(Maebashi)       | 7.0            | 4.7            |                                                           |
| 11 | Saitama(Saitama)      | 18             | 25             |                                                           |
| 12 | Chiba(Ichihara)       | 39             | 76             |                                                           |
| 13 | Tokyo(Shinjuku)       | 38             | 26             |                                                           |
| 14 | Kanagawa(Chigasaki)   | 13             | 5.9            |                                                           |
| 15 | Niigata(Niigata)      | Not Detectable | Not Detectable |                                                           |
| 16 | Toyama(Imizu)         | Not Detectable | Not Detectable |                                                           |
| 17 | Ishikawa(Kanazawa)    | Not Detectable | Not Detectable |                                                           |
| 18 | Fukui(Fukui)          | Not Detectable | Not Detectable |                                                           |
| 19 | Yamanashi(Kofu)       | Not Detectable | 2.9            |                                                           |
| 20 | Ngano(Nagano)         | Not Detectable | Not Detectable |                                                           |
| 21 | Gifu(Kakamigahara)    | -              | -              | Measurements arrived, though it had delayed.              |
| 22 | Shizuoka(Omaezaki)    | Not Detectable | 3.4            |                                                           |
| 23 | Aichi(Nagoya)         | Not Detectable | Not Detectable |                                                           |
| 24 | Mie(Yokkaichi)        | Not Detectable | Not Detectable |                                                           |
| 25 | Shiga(Otsu)           | Not Detectable | Not Detectable |                                                           |
| 26 | Kyoto(Kyoto)          | Not Detectable | Not Detectable |                                                           |
| 27 | Osaka(Osaka)          | Not Detectable | Not Detectable |                                                           |
| 28 | Hyogo(Kobe)           | Not Detectable | Not Detectable |                                                           |
| 29 | Nara(Nara)            | Not Detectable | Not Detectable |                                                           |
| 30 | Wakayama(Wakayama)    | Not Detectable | Not Detectable |                                                           |
| 31 | Tottori(Tohhaku)      | Not Detectable | Not Detectable |                                                           |
| 32 | Shimane(Matsue)       | Not Detectable | Not Detectable |                                                           |
| 33 | Okayama(Okayama)      | Not Detectable | Not Detectable |                                                           |
| 34 | Hiroshima(Hiroshima)  | Not Detectable | Not Detectable |                                                           |
| 35 | Yamaguchi(Yamaguchi)  | Not Detectable | Not Detectable |                                                           |
| 36 | Tokushima(Tokushima)  | Not Detectable | Not Detectable |                                                           |
| 37 | Kagawa(Takamatsu)     | Not Detectable | Not Detectable |                                                           |
| 38 | Ehime(Yawatahama)     | Not Detectable | Not Detectable |                                                           |
| 39 | Kochi(Kochi)          | Not Detectable | Not Detectable |                                                           |
| 40 | Fukuoka(Dazaifu)      | Not Detectable | Not Detectable |                                                           |
| 41 | Saga(Saga)            | Not Detectable | Not Detectable |                                                           |
| 42 | Nagasaki(Ohmura)      | Not Detectable | Not Detectable |                                                           |
| 43 | Kumamoto(Uto)         | Not Detectable | Not Detectable |                                                           |
| 44 | Oita(Oita)            | Not Detectable | Not Detectable |                                                           |
| 45 | Miyazaki(Miyazaki)    | Not Detectable | Not Detectable |                                                           |
| 46 | Kagoshima(Kagoshima)  | Not Detectable | Not Detectable |                                                           |
| 47 | Okinawa(Nanjo)        | Not Detectable | Not Detectable |                                                           |

\*The table was made by MEXT, based on the reports from prefectures

# Readings of the radiation rate with the cooperation of universities

Upper column: Reading of the integrated dose(24h)  
Lower column: the reference value which was calculated as the number per one hour

| Prefecture | Monitoring Point | City           | 3/31~4/1                                       |
|------------|------------------|----------------|------------------------------------------------|
| Hokkaido   | 1                | Muroran City   | $1 \mu\text{Sv}$<br>( $0.04 \mu\text{Sv/h}$ )  |
|            | 2                | Obihiro City   | $1 \mu\text{Sv}$<br>( $0.04 \mu\text{Sv/h}$ )  |
|            | 3                | Asahikawa City | $1 \mu\text{Sv}$<br>( $0.04 \mu\text{Sv/h}$ )  |
|            | 4                | Kitami City    | $2 \mu\text{Sv}$<br>( $0.08 \mu\text{Sv/h}$ )  |
|            | 5                | Kushiro City   | $1 \mu\text{Sv}$<br>( $0.04 \mu\text{Sv/h}$ )  |
|            | 6                | Hakodate City  | $1 \mu\text{Sv}$<br>( $0.04 \mu\text{Sv/h}$ )  |
| Aomori     | 7                | Hirosaki City  | $2 \mu\text{Sv}$<br>( $0.08 \mu\text{Sv/h}$ )  |
|            | 8                | Hachinohe City | $1 \mu\text{Sv}$<br>( $0.04 \mu\text{Sv/h}$ )  |
| Miyagi     | 9                | Sendai City    | $3 \mu\text{Sv}$<br>( $0.1 \mu\text{Sv/h}$ )   |
| Yamagata   | 10               | Yonezawa City  | $3 \mu\text{Sv}$<br>( $0.1 \mu\text{Sv/h}$ )   |
|            | 11               | Tsuruoka City  | $2 \mu\text{Sv}$<br>( $0.08 \mu\text{Sv/h}$ )  |
| Fukushima  | 12               | Fukushima City | $12 \mu\text{Sv}$<br>( $0.50 \mu\text{Sv/h}$ ) |
| Ibaraki    | 13               | Tsukuba City   | $5 \mu\text{Sv}$<br>( $0.2 \mu\text{Sv/h}$ )   |
| Tochigi    | 14               | Oyama City     | $2 \mu\text{Sv}$<br>( $0.08 \mu\text{Sv/h}$ )  |
| Gunma      | 15               | Kiryu City     | $2 \mu\text{Sv}$<br>( $0.08 \mu\text{Sv/h}$ )  |
| Chiba      | 16               | Chiba City     | $4 \mu\text{Sv}$<br>( $0.2 \mu\text{Sv/h}$ )   |
|            | 17               | Kisarazu City  | $5 \mu\text{Sv}$<br>( $0.2 \mu\text{Sv/h}$ )   |
| Tokyo      | 18               | Bunkyo Ward    | $4 \mu\text{Sv}$<br>( $0.2 \mu\text{Sv/h}$ )   |
|            | 19               | Fuchu City     | $3 \mu\text{Sv}$<br>( $0.1 \mu\text{Sv/h}$ )   |
|            | 20               | Meguro Ward    | $3 \mu\text{Sv}$<br>( $0.1 \mu\text{Sv/h}$ )   |
|            | 21               | Minato Ward    | $2 \mu\text{Sv}$<br>( $0.08 \mu\text{Sv/h}$ )  |
|            | 22               | Hachioji City  | $3 \mu\text{Sv}$<br>( $0.1 \mu\text{Sv/h}$ )   |
| Kanagawa   | 23               | Yokohama City  | $2 \mu\text{Sv}$<br>( $0.08 \mu\text{Sv/h}$ )  |
| Niigata    | 24               | Nagaoka City   | —                                              |
| Nagano     | 25               | Matsumoto City | $2 \mu\text{Sv}$<br>( $0.08 \mu\text{Sv/h}$ )  |
|            | 26               | Ueda City      | $2 \mu\text{Sv}$<br>( $0.08 \mu\text{Sv/h}$ )  |

\* We have measured the integrated dose(24h) from around 2PM to the next  
\* Readings of lower column are the reference value because of the lower  
\* “—” in the column indicates that “now setting up for measuring”.

## Readings at Monitoring Post out of 20 Km Zone of Fukushima Dai-ichi NPP

As of 19:00 April 1, 2011  
Ministry of Education, Culture, Sports, Science  
and Technology (MEXT)

○Monitoring Outputs by MEXT \*Boldface and underlined readings are new.

- \* 1 measured by Geiger-Müller counter
- \* 2 measured by ionization chamber type survey meter
- \* 3 measured by NaI scintillator detector
- \* 4 variation range of the measuring data in measuring

| Monitoring Post<br>(length from NPP)           | Monitoring Time       | Reading (unit : $\mu\text{Sv/h}$ ) | 測定位置                                                | Weather        | Reading by                        |
|------------------------------------------------|-----------------------|------------------------------------|-----------------------------------------------------|----------------|-----------------------------------|
| Reading Point 【1】 (About60KmnorthWest)         | 2011/4/1 8:48         | 2.7 *2                             | N: 37° 44' 12.6"<br>E: 140° 28' 02.9"               | No Rain        | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【2】 (About55KmnorthWest)         | 2011/4/1 9:18         | 3.8 *2                             | N: 37° 41' 03.5"<br>E: 140° 33' 08.2"               | No Rain        | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【3】 (About45KmnorthWest)         | 2011/4/1 10:14        | 3.3 *2                             | N: 37° 45' 12.6"<br>E: 140° 44' 05.5"               | No Rain        | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【5】 (About45Kmnorth)             | 2011/4/1 11:12        | 0.8 *2                             | N: 37° 47' 04.8"<br>E: 140° 55' 16.4"               | No Rain        | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【6】 (About45Kmnorth)             | 2011/4/1 11:34        | 1.0 *2                             | N: 37° 42' 02.7"<br>E: 140° 58' 00.0"               | No Rain        | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【7】 (About45Kmnorth)             | 2011/4/1 11:43        | 1.1 *2                             | N: 37° 41' 13.6"<br>E: 140° 57' 16.0"               | No Rain        | JAEA (Japan Atomic Energy Agency) |
| Reading Point <b>【10】</b> (About40KmnorthWest) | <b>2011/4/1 16:03</b> | <b>1.6 *2</b>                      | N: <b>37° 35' 00.1"</b><br>E: <b>140° 35' 00.0"</b> | <b>No Rain</b> | <b>MEXT</b>                       |
| Reading Point 【12】 (About40KmnorthWest)        | 2011/4/1 11:39        | 0.5 *2                             | N: 37° 25' 14.9"<br>E: 140° 35' 12.3"               | No Rain        | MEXT                              |
| Reading Point 【13】 (About40KmnorthWest)        | 2011/4/1 11:53        | 0.5 *2                             | N: 37° 26' 06.0"<br>E: 140° 37' 05.8"               | No Rain        | MEXT                              |
| Reading Point 【14】 (About35KmnorthWest)        | 2011/4/1 12:06        | 0.2 *2                             | N: 37° 26' 02.6"<br>E: 140° 38' 13.8"               | No Rain        | MEXT                              |
| Reading Point 【15】 (About35KmnorthWest)        | 2011/4/1 12:19        | 0.6 *2                             | N: 37° 26' 15.0"<br>E: 140° 40' 14.8"               | No Rain        | MEXT                              |
| Reading Point 【20】 (About45KmnorthWest)        | 2011/4/1 10:37        | 0.6 *2                             | N: 37° 29' 06.7"<br>E: 140° 34' 15.1"               | No Rain        | MEXT                              |

- \* 1 measured by Geiger-Müller counter  
 \* 2 measured by ionization chamber type survey meter  
 \* 3 measured by NaI scintillator detector  
 \* 4 variation range of the measuring data in measuring

| Monitoring Post<br>(length from NPP)        | Monitoring Time | Reading (unit : $\mu\text{Sv} / \text{h}$ ) | 測定位置                                  | Weather | Reading by-                       |
|---------------------------------------------|-----------------|---------------------------------------------|---------------------------------------|---------|-----------------------------------|
| Reading Point 【21】 (About30KmWestNorthWest) | 2011/4/1 11:09  | 2.3 *2                                      | N: 37° 30' 08.0"<br>E: 140° 42' 02.4" | No Rain | MEXT                              |
| Reading Point 【22】 (About30KmWestNorthWest) | 2011/4/1 11:00  | 0.6 *2                                      | N: 37° 30' 11.5"<br>E: 140° 39' 08.0" | No Rain | MEXT                              |
| Reading Point 【23】 (About30KmWestNorthWest) | 2011/4/1 10:48  | 0.6 *2                                      | N: 37° 30' 05.3"<br>E: 140° 34' 11.3" | No Rain | MEXT                              |
| Reading Point 【31】 (About30KmWestNorthWest) | 2011/4/1 10:33  | 15.4 *2                                     | N: 37° 33' 30.0"<br>E: 140° 44' 54.0" | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【32】 (About30KmNorthWest)     | 2011/4/1 10:56  | 36.2 *2                                     | N: 37° 35' 30.0"<br>E: 140° 45' 54.0" | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【33】 (About30KmNorthWest)     | 2011/4/1 11:22  | 18.2 *2                                     | N: 37° 36' 30.0"<br>E: 140° 45' 54.0" | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【34】 (About30KmNorthWest)     | 2011/4/1 13:02  | 5.8 *2                                      | N: 37° 33' 00.8"<br>E: 140° 44' 07.0" | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【36】 (About40KmNorthWest)     | 2011/4/1 10:08  | 5.7 *2                                      | N: 37° 36' 18.8"<br>E: 140° 40' 07.9" | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【37】 (About50kmNorthWest)     | 2011/4/1 9:57   | 4.6 *2                                      | N: 37° 45' 06.7"<br>E: 140° 41' 29.2" | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【38】 (About35kmSouth)         | 2011/4/1 11:37  | 1.0 *2                                      | N: 37° 07' 30.7"<br>E: 140° 57' 06.4" | No Rain | MEXT                              |
| Reading Point 【39】 (About45kmNorth)         | 2011/4/1 10:53  | 1.3 *2                                      | N: 37° 45' 52.7"<br>E: 140° 51' 47.1" | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【51】 (About40KmSouthWest)     | 2011/4/1 13:45  | 0.3 *3                                      | N: : : :<br>E: : : : "                | No Rain | Fukushima Pref.                   |
| Reading Point 【51】 (About40KmSouthWest)     | 2011/4/1 10:42  | 0.3 *3                                      | N: : : :<br>E: : : : "                | No Rain | Fukushima Pref.                   |
| Reading Point 【52】 (About40KmWest)          | 2011/4/1 14:23  | 0.3 *3                                      | N: : : :<br>E: : : : "                | No Rain | Fukushima Pref.                   |
| Reading Point 【52】 (About40KmWest)          | 2011/4/1 12:05  | 0.3 *3                                      | N: : : :<br>E: : : : "                | No Rain | Fukushima Pref.                   |
| Reading Point 【61】 (About40KmNorthWest)     | 2011/4/1 14:59  | 6.1 *3                                      | N: : : :<br>E: : : : "                | No Rain | Fukushima Pref.                   |
| Reading Point 【61】 (About40KmNorthWest)     | 2011/4/1 12:46  | 7.1 *3                                      | N: : : :<br>E: : : : "                | No Rain | Fukushima Pref.                   |
| Reading Point 【62】 (About40KmNorthWest)     | 2011/4/1 15:15  | 7.4 *3                                      | N: : : :<br>E: : : : "                | No Rain | Fukushima Pref.                   |

- \* 1 measured by Geiger-Müller counter
- \* 2 measured by ionization chamber type survey meter
- \* 3 measured by NaI scintillator detector
- \* 4 variation range of the measuring data in measuring

| Monitoring Post<br>(length from NPP)    | Monitoring Time | Reading (unit : $\mu\text{Sv} / \text{h}$ ) | 測定位置                   | Weather | Reading by-                            |
|-----------------------------------------|-----------------|---------------------------------------------|------------------------|---------|----------------------------------------|
| Reading Point 【62】 (About40KmNorthWest) | 2011/4/1 12:34  | 7.7 *3                                      | N: : : :<br>E: : : : " | No Rain | Fukushima Pref.                        |
| Reading Point 【63】 (About45KmNorthWest) | 2011/4/1 15:49  | 3.2 *3                                      | N: : : :<br>E: : : : " | No Rain | Fukushima Pref.                        |
| Reading Point 【63】 (About45KmNorthWest) | 2011/4/1 11:13  | 2.8 *3                                      | N: : : :<br>E: : : : " | No Rain | Fukushima Pref.                        |
| Reading Point 【71】 (About25KmSouth)     | 2011/4/1 8:31   | 2.5 *2                                      |                        | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【72】 (About30KmSouth)     | 2011/4/1 12:42  | 1.6 *2                                      |                        | No Rain | MEXT                                   |
| Reading Point 【72】 (About30KmSouth)     | 2011/4/1 9:11   | 0.8 *2                                      |                        | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【73】 (About35KmSouth)     | 2011/4/1 11:57  | 1.4 *2                                      |                        | No Rain | MEXT                                   |
| Reading Point 【73】 (About35KmSouth)     | 2011/4/1 9:27   | 0.7 *2                                      |                        | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【74】 (About35KmSouth)     | 2011/4/1 11:08  | 0.2 *2                                      |                        | No Rain | MEXT                                   |
| Reading Point 【74】 (About35KmSouth)     | 2011/4/1 9:55   | 0.3 *2                                      |                        | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【75】 (About45KmSouth)     | 2011/4/1 10:30  | 0.8 *2                                      |                        | No Rain | MEXT                                   |
| Reading Point 【75】 (About45KmSouth)     | 2011/4/1 7:00   | 0.8 *2                                      |                        | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【76】 (About25KmSouthWest) | 2011/4/1 11:03  | 0.6 *2                                      |                        | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【77】 (About25KmSouthWest) | 2011/4/1 10:45  | 2.2 *2                                      |                        | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【78】 (About45KmNorthWest) | 2011/4/1 7:47   | 0.8 *2                                      |                        | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【79】 (About30KmNorthWest) | 2011/4/1 12:26  | 16.5 *2                                     |                        | No Rain | JAEA (Japan Atomic Energy Agency)      |
| Reading Point 【79】 (About30KmNorthWest) | 2011/4/1 9:56   | 15.5 *2                                     |                        | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【80】 (About25KmNorth)     | 2011/4/1 12:33  | 0.7 *2                                      |                        | No Rain | JAEA (Japan Atomic Energy Agency)      |

- \* 1 measured by Geiger-Müller counter
- \* 2 measured by ionization chamber type survey meter
- \* 3 measured by NaI scintillator detector
- \* 4 variation range of the measuring data in measuring

| Monitoring Post<br>(length from NPP)        | Monitoring Time | Reading (unit : $\mu\text{Sv} / \text{h}$ ) | 測定位置                                  | Weather | Reading by*                            |
|---------------------------------------------|-----------------|---------------------------------------------|---------------------------------------|---------|----------------------------------------|
| Reading Point 【80】 (About25Kmnorth)         | 2011/4/1 12:02  | 0.7 *2                                      |                                       | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【81】 (About30KmnorthWest)     | 2011/4/1 8:34   | 34.5 *2                                     |                                       | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【83】 (About20KmnorthWest)     | 2011/4/1 12:47  | 70.9 *2                                     |                                       | No Rain | JAEA (Japan Atomic Energy Agency)      |
| Reading Point 【83】 (About20KmnorthWest)     | 2011/4/1 10:11  | 60.5 *2                                     |                                       | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【84】 (About40kmSouthWest)     | 2011/4/1 9:50   | 0.5 *2                                      |                                       | No Rain | MEXT                                   |
| Reading Point 【85】 (About60kmNorthWest)     | 2011/4/1 14:00  | 1.0 *2                                      | N: 37° 42' 45.0"<br>E: 140° 22' 59.0" | No Rain | Ministry of Defense                    |
| Reading Point 【85】 (About60kmNorthWest)     | 2011/4/1 6:00   | 0.3 *2                                      | N: 37° 42' 45.0"<br>E: 140° 22' 59.0" | No Rain | Ministry of Defense                    |
| Reading Point 【86】 (About55kmWest)          | 2011/4/1 14:00  | 1.1 *2                                      | N: 37° 23' 57.0"<br>E: 140° 19' 35.0" | No Rain | Ministry of Defense                    |
| Reading Point 【86】 (About55kmWest)          | 2011/4/1 6:00   | 1.3 *2                                      | N: 37° 23' 57.0"<br>E: 140° 19' 35.0" | No Rain | Ministry of Defense                    |
| Reading Point 【87】 (About30kmWestSouthWest) | 2011/4/1 14:00  | 1.2 *2                                      | N: 37° 23' 57.0"<br>E: 140° 19' 35.0" | No Rain | Ministry of Defense                    |
| Reading Point 【87】 (About30kmWestSouthWest) | 2011/4/1 6:00   | 1.0 *2                                      | N: 37° 23' 57.0"<br>E: 140° 19' 35.0" | No Rain | Ministry of Defense                    |



## Readings at Monitoring Post out of 20 Km Zone of Fukushima Dai-ichi NPP

As of 19:00 April 1, 2011  
Ministry of Education, Culture, Sports, Science  
and Technology (MEXT)

○Monitoring Outputs by MEXT \*Boldface and underlined readings are new.

- \* 1 measured by Geiger-Müller counter
- \* 2 measured by ionization chamber type survey meter
- \* 3 measured by NaI scintillator detector
- \* 4 variation range of the measuring data in measuring

| Monitoring Post<br>(length from NPP)           | Monitoring Time       | Reading (unit : $\mu\text{Sv} / \text{h}$ ) | Weather        | Reading by                        |
|------------------------------------------------|-----------------------|---------------------------------------------|----------------|-----------------------------------|
| Reading Point 【1】 (About60KmNorthWest)         | 2011/4/1 8:48         | 2.7 *2                                      | No Rain        | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【2】 (About55KmNorthWest)         | 2011/4/1 9:18         | 3.8 *2                                      | No Rain        | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【3】 (About45KmNorthWest)         | 2011/4/1 10:14        | 3.3 *2                                      | No Rain        | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【5】 (About45KmNorth)             | 2011/4/1 11:12        | 0.8 *2                                      | No Rain        | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【6】 (About45KmNorth)             | 2011/4/1 11:34        | 1.0 *2                                      | No Rain        | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【7】 (About45KmNorth)             | 2011/4/1 11:43        | 1.1 *2                                      | No Rain        | JAEA (Japan Atomic Energy Agency) |
| Reading Point <b>【10】</b> (About40KmNorthWest) | <b>2011/4/1 16:03</b> | <b>1.6 *2</b>                               | <b>No Rain</b> | <b>MEXT</b>                       |
| Reading Point 【12】 (About40KmWest)             | 2011/4/1 11:39        | 0.5 *2                                      | No Rain        | MEXT                              |
| Reading Point 【13】 (About40KmWest)             | 2011/4/1 11:53        | 0.5 *2                                      | No Rain        | MEXT                              |
| Reading Point 【14】 (About35KmWest)             | 2011/4/1 12:06        | 0.2 *2                                      | No Rain        | MEXT                              |
| Reading Point 【15】 (About35KmWest)             | 2011/4/1 12:19        | 0.6 *2                                      | No Rain        | MEXT                              |

- \* 1 measured by Geiger-Müller counter
- \* 2 measured by ionization chamber type survey meter
- \* 3 measured by NaI scintillator detector
- \* 4 variation range of the measuring data in measuring

| Monitoring Post<br>(length from NPP)        | Monitoring Time | Reading (unit : $\mu\text{Sv} / \text{h}$ ) | Weather | Reading by                        |
|---------------------------------------------|-----------------|---------------------------------------------|---------|-----------------------------------|
| Reading Point 【20】 (About45KmNorthWest)     | 2011/4/1 10:37  | 0.6 *2                                      | No Rain | MEXT                              |
| Reading Point 【21】 (About30KmWestNorthWest) | 2011/4/1 11:09  | 2.3 *2                                      | No Rain | MEXT                              |
| Reading Point 【22】 (About30KmWestNorthWest) | 2011/4/1 11:00  | 0.6 *2                                      | No Rain | MEXT                              |
| Reading Point 【23】 (About30KmWestNorthWest) | 2011/4/1 10:48  | 0.6 *2                                      | No Rain | MEXT                              |
| Reading Point 【31】 (About30KmWestNorthWest) | 2011/4/1 10:33  | 15.4 *2                                     | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【32】 (About30KmNorthWest)     | 2011/4/1 10:56  | 36.2 *2                                     | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【33】 (About30KmNorthWest)     | 2011/4/1 11:22  | 18.2 *2                                     | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【34】 (About30KmNorthWest)     | 2011/4/1 13:02  | 5.8 *2                                      | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【36】 (About40KmNorthWest)     | 2011/4/1 10:08  | 5.7 *2                                      | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【37】 (About50kmNorthWest)     | 2011/4/1 9:57   | 4.6 *2                                      | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【38】 (About35kmSouth)         | 2011/4/1 11:37  | 1.0 *2                                      | No Rain | MEXT                              |
| Reading Point 【39】 (About45kmNorth)         | 2011/4/1 10:53  | 1.3 *2                                      | No Rain | JAEA (Japan Atomic Energy Agency) |
| Reading Point 【51】 (About40KmSouthWest)     | 2011/4/1 13:45  | 0.3 *3                                      | No Rain | Fukushima Pref.                   |
| Reading Point 【51】 (About40KmSouthWest)     | 2011/4/1 10:42  | 0.3 *3                                      | No Rain | Fukushima Pref.                   |
| Reading Point 【52】 (About40KmWest)          | 2011/4/1 14:23  | 0.3 *3                                      | No Rain | Fukushima Pref.                   |
| Reading Point 【52】 (About40KmWest)          | 2011/4/1 12:05  | 0.3 *3                                      | No Rain | Fukushima Pref.                   |
| Reading Point 【61】 (About40KmNorthWest)     | 2011/4/1 14:59  | 6.1 *3                                      | No Rain | Fukushima Pref.                   |

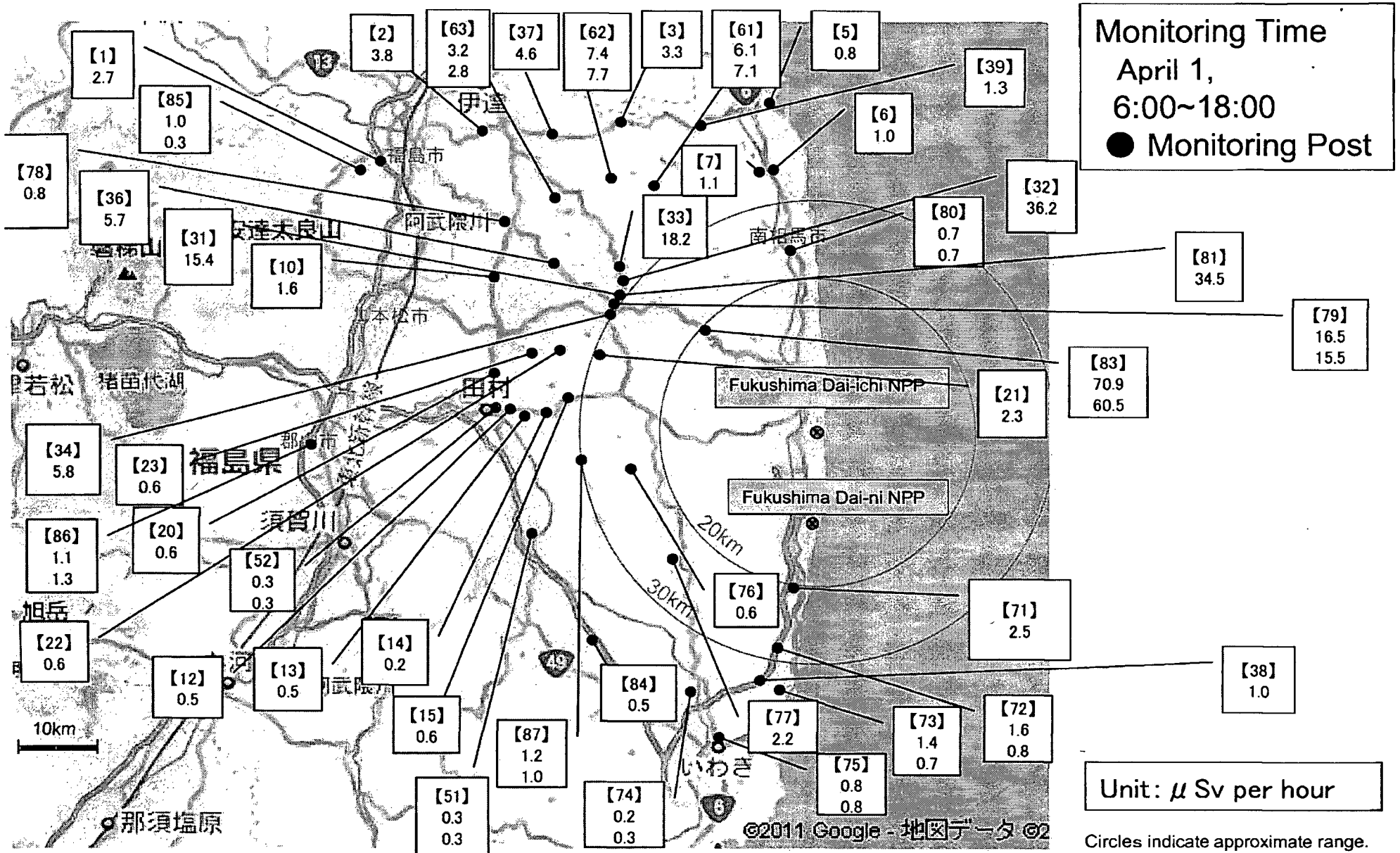
- \* 1 measured by Geiger-Müller counter
- \* 2 measured by ionization chamber type survey meter
- \* 3 measured by NaI scintillator detector
- \* 4 variation range of the measuring data in measuring

| Monitoring Post<br>(length from NPP)    | Monitoring Time | Reading (unit : $\mu\text{Sv} / \text{h}$ ) | Weather | Reading by                             |
|-----------------------------------------|-----------------|---------------------------------------------|---------|----------------------------------------|
| Reading Point 【61】 (About40KmNorthWest) | 2011/4/1 12:46  | 7.1 <sup>*3</sup>                           | No Rain | Fukushima Pref.                        |
| Reading Point 【62】 (About40KmNorthWest) | 2011/4/1 15:15  | 7.4 <sup>*3</sup>                           | No Rain | Fukushima Pref.                        |
| Reading Point 【62】 (About40KmNorthWest) | 2011/4/1 12:34  | 7.7 <sup>*3</sup>                           | No Rain | Fukushima Pref.                        |
| Reading Point 【63】 (About45KmNorthWest) | 2011/4/1 15:49  | 3.2 <sup>*3</sup>                           | No Rain | Fukushima Pref.                        |
| Reading Point 【63】 (About45KmNorthWest) | 2011/4/1 11:13  | 2.8 <sup>*3</sup>                           | No Rain | Fukushima Pref.                        |
| Reading Point 【71】 (About25KmSouth)     | 2011/4/1 8:31   | 2.5 <sup>*2</sup>                           | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【72】 (About30KmSouth)     | 2011/4/1 12:42  | 1.6 <sup>*2</sup>                           | No Rain | MEXT                                   |
| Reading Point 【72】 (About30KmSouth)     | 2011/4/1 9:11   | 0.8 <sup>*2</sup>                           | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【73】 (About35KmSouth)     | 2011/4/1 11:57  | 1.4 <sup>*2</sup>                           | No Rain | MEXT                                   |
| Reading Point 【73】 (About35KmSouth)     | 2011/4/1 9:27   | 0.7 <sup>*2</sup>                           | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【74】 (About35KmSouth)     | 2011/4/1 11:08  | 0.2 <sup>*2</sup>                           | No Rain | MEXT                                   |
| Reading Point 【74】 (About35KmSouth)     | 2011/4/1 9:55   | 0.3 <sup>*2</sup>                           | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【75】 (About45KmSouth)     | 2011/4/1 10:30  | 0.8 <sup>*2</sup>                           | No Rain | MEXT                                   |
| Reading Point 【75】 (About45KmSouth)     | 2011/4/1 7:00   | 0.8 <sup>*2</sup>                           | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【76】 (About25KmSouthWest) | 2011/4/1 11:03  | 0.6 <sup>*2</sup>                           | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【77】 (About25KmSouthWest) | 2011/4/1 10:45  | 2.2 <sup>*2</sup>                           | No Rain | Police ( counter NBC operations unit ) |
| Reading Point 【78】 (About45KmNorthWest) | 2011/4/1 7:47   | 0.8 <sup>*2</sup>                           | No Rain | Police ( counter NBC operations unit ) |

- \* 1 measured by Geiger-Müller counter
- \* 2 measured by ionization chamber type survey meter
- \* 3 measured by NaI scintillator detector
- \* 4 variation range of the measuring data in measuring

| Monitoring Post<br>(length from NPP)        | Monitoring Time       | Reading (unit : $\mu\text{Sv} / \text{h}$ ) | Weather        | Reading by                             |
|---------------------------------------------|-----------------------|---------------------------------------------|----------------|----------------------------------------|
| Reading Point 【79】 (About30KmNorthWest)     | 2011/4/1 12:26        | 16.5 *2                                     | No Rain        | JAEA (Japan Atomic Energy Agency)      |
| Reading Point 【79】 (About30KmNorthWest)     | 2011/4/1 9:56         | 15.5 *2                                     | No Rain        | Police ( counter NBC operations unit ) |
| Reading Point 【80】 (About25KmNorth)         | 2011/4/1 12:33        | 0.7 *2                                      | No Rain        | JAEA (Japan Atomic Energy Agency)      |
| Reading Point 【80】 (About25KmNorth)         | 2011/4/1 12:02        | 0.7 *2                                      | No Rain        | Police ( counter NBC operations unit ) |
| Reading Point 【81】 (About30KmWestNorthWest) | 2011/4/1 8:34         | 34.5 *2                                     | No Rain        | Police ( counter NBC operations unit ) |
| Reading Point 【83】 (About20KmNorthWest)     | 2011/4/1 12:47        | 70.9 *2                                     | No Rain        | JAEA (Japan Atomic Energy Agency)      |
| Reading Point 【83】 (About20KmNorthWest)     | 2011/4/1 10:11        | 60.5 *2                                     | No Rain        | Police ( counter NBC operations unit ) |
| Reading Point 【84】 (About40kmSouthWest)     | 2011/4/1 9:50         | 0.5 *2                                      | No Rain        | MEXT                                   |
| Reading Point 【85】 (About60kmNorthWest)     | <u>2011/4/1 14:00</u> | <u>1.0 *2</u>                               | <u>No Rain</u> | <u>Ministry of Defense</u>             |
| Reading Point 【85】 (About60kmNorthWest)     | 2011/4/1 6:00         | 0.3 *2                                      | No Rain        | Ministry of Defense                    |
| Reading Point 【86】 (About55kmWest)          | <u>2011/4/1 14:00</u> | <u>1.1 *2</u>                               | <u>No Rain</u> | <u>Ministry of Defense</u>             |
| Reading Point 【86】 (About55kmWest)          | 2011/4/1 6:00         | 1.3 *2                                      | No Rain        | Ministry of Defense                    |
| Reading Point 【87】 (About30kmWestSouthWest) | <u>2011/4/1 14:00</u> | <u>1.2 *2</u>                               | <u>No Rain</u> | <u>Ministry of Defense</u>             |
| Reading Point 【87】 (About30kmWestSouthWest) | 2011/4/1 6:00         | 1.0 *2                                      | No Rain        | Ministry of Defense                    |

# Readings at Monitoring Post out of Fukushima Dai-ichi NPP



2011/4/1 19:00

## Monitoring data at Ibaraki prefecture

 $\mu\text{Sv/h}$ 

| Date and Time | JAEA nuclear science<br>research institute<br>(Tokai-village in Ibaraki-<br>prefecture) | JAEA Nuclear fuel cycle<br>engineering laboratory<br>(Tokai-village in Ibaraki-<br>prefecture) | Yayoi in Tokyo University<br>(Tokai-village in Ibaraki-<br>prefecture) |
|---------------|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 2011/4/1      |                                                                                         |                                                                                                |                                                                        |
| 0:00          | 1.44                                                                                    | 0.84                                                                                           | 1.12                                                                   |
| 1:00          | 1.43                                                                                    | 0.84                                                                                           | 1.24                                                                   |
| 2:00          | 1.44                                                                                    | 0.84                                                                                           | 1.19                                                                   |
| 3:00          | 1.43                                                                                    | 0.84                                                                                           | 1.16                                                                   |
| 4:00          | 1.43                                                                                    | 0.84                                                                                           | 1.28                                                                   |
| 5:00          | 1.42                                                                                    | 0.84                                                                                           | 1.19                                                                   |
| 6:00          | 1.42                                                                                    | 0.84                                                                                           | 1.25                                                                   |
| 7:00          | 1.42                                                                                    | 0.84                                                                                           | 1.21                                                                   |
| 8:00          | 1.42                                                                                    | 0.83                                                                                           | 1.21                                                                   |
| 9:00          | 1.41                                                                                    | 0.83                                                                                           | 1.13                                                                   |
| 10:00         | 1.40                                                                                    | 0.82                                                                                           | 1.21                                                                   |
| 11:00         | 1.40                                                                                    | 0.81                                                                                           | 1.15                                                                   |
| 12:00         | 1.39                                                                                    | 0.81                                                                                           | 1.22                                                                   |
| 13:00         | 1.39                                                                                    | 0.81                                                                                           | 1.16                                                                   |
| 14:00         | 1.39                                                                                    | 0.80                                                                                           | 1.17                                                                   |
| 15:00         | 1.39                                                                                    | 0.80                                                                                           | 1.19                                                                   |
| 16:00         | 1.39                                                                                    | 0.80                                                                                           | 1.18                                                                   |
| 17:00         | 1.38                                                                                    | 0.80                                                                                           | 1.22                                                                   |
| 18:00         | 1.38                                                                                    | 0.80                                                                                           |                                                                        |

※The readings are measured once every hour from March 24th.

The readings of JAEA nuclear science research institute and JAEA Nuclear fuel cycle engineering laboratory

JAEA nuclear science research institute

<http://erms.jaea.go.jp/Chart.htm>

JAEA Nuclear fuel cycle engineering laboratory

[http://www.jaea.go.jp/04/ztokai/kankyo/realtime/tbl\\_10mStPo01.html](http://www.jaea.go.jp/04/ztokai/kankyo/realtime/tbl_10mStPo01.html)

Reading of environmental radioactivity level by prefecture

2011.4.1 19:00

( $\mu$  Sv/h)

|    | Prefecture(City)     | 3/31  |       |       |       |       |       |       | 4/1   |       |       |       |       |       |       | Usual Value Band |
|----|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------------------|
|    |                      | 17-18 | 18-19 | 19-20 | 20-21 | 21-22 | 22-23 | 23-24 | 0-1   | 1-2   | 2-3   | 3-4   | 4-5   | 5-6   | 6-7   |                  |
| 1  | Hokkaido(Sapporo)    | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.02~0.105       |
| 2  | Aomori(Aomori)       | 0.026 | 0.026 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.028 | 0.017~0.102      |
| 3  | Iwate(Morioka)       | 0.026 | 0.029 | 0.027 | 0.026 | 0.026 | 0.026 | 0.027 | 0.027 | 0.027 | 0.027 | 0.028 | 0.027 | 0.027 | 0.028 | 0.014~0.084      |
| 4  | Miyagi(Sendai)       | 0.088 | 0.086 | 0.086 | 0.085 | 0.085 | 0.084 | 0.083 | 0.083 | 0.083 | 0.082 | 0.082 | 0.081 | 0.080 | 0.081 | 0.0176~0.0513    |
| 5  | Akita(Akita)         | 0.035 | 0.035 | 0.035 | 0.035 | 0.035 | 0.036 | 0.036 | 0.036 | 0.036 | 0.037 | 0.037 | 0.037 | 0.037 | 0.037 | 0.022~0.086      |
| 6  | Yamagata(Yamagata)   | 0.063 | 0.063 | 0.063 | 0.063 | 0.063 | 0.063 | 0.063 | 0.064 | 0.064 | 0.064 | 0.064 | 0.063 | 0.064 | 0.064 | 0.025~0.082      |
| 7  | Fukushima(Futaba)    |       |       |       |       |       |       |       |       |       |       |       |       |       |       | 0.037~0.071      |
| 8  | Ibaraki(Mito)        | 0.195 | 0.194 | 0.194 | 0.194 | 0.194 | 0.193 | 0.193 | 0.193 | 0.192 | 0.193 | 0.192 | 0.191 | 0.192 | 0.191 | 0.036~0.056      |
| 9  | Tochigi(Utsunomiya)  | 0.092 | 0.092 | 0.092 | 0.092 | 0.092 | 0.092 | 0.092 | 0.092 | 0.092 | 0.092 | 0.092 | 0.092 | 0.092 | 0.092 | 0.030~0.067      |
| 10 | Gunma(Maebashi)      | 0.055 | 0.055 | 0.054 | 0.054 | 0.054 | 0.054 | 0.054 | 0.054 | 0.054 | 0.055 | 0.055 | 0.055 | 0.055 | 0.055 | 0.017~0.045      |
| 11 | Saitama(Saitama)     | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.079 | 0.079 | 0.079 | 0.080 | 0.080 | 0.080 | 0.031~0.060      |
| 12 | Chiba(Ishihara)      | 0.072 | 0.071 | 0.071 | 0.070 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.070 | 0.071 | 0.071 | 0.022~0.044      |
| 13 | Tokyo(Shinjyuku)     | 0.099 | 0.099 | 0.099 | 0.098 | 0.098 | 0.098 | 0.098 | 0.098 | 0.098 | 0.098 | 0.098 | 0.098 | 0.098 | 0.098 | 0.028~0.079      |
| 14 | Kanagawa(Chigasaki)  | 0.073 | 0.070 | 0.069 | 0.068 | 0.068 | 0.068 | 0.068 | 0.068 | 0.068 | 0.068 | 0.068 | 0.068 | 0.068 | 0.068 | 0.035~0.069      |
| 15 | Niigata(Niigata)     | 0.048 | 0.048 | 0.048 | 0.048 | 0.048 | 0.048 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.048 | 0.031~0.153      |
| 16 | Toyama(Imizu)        | 0.048 | 0.049 | 0.048 | 0.048 | 0.048 | 0.048 | 0.049 | 0.049 | 0.049 | 0.050 | 0.049 | 0.050 | 0.049 | 0.050 | 0.029~0.147      |
| 17 | Ishikawa(Kanazawa)   | 0.047 | 0.047 | 0.048 | 0.048 | 0.048 | 0.048 | 0.048 | 0.048 | 0.048 | 0.048 | 0.048 | 0.048 | 0.048 | 0.048 | 0.0291~0.1275    |
| 18 | Fukui(Fukui)         | 0.045 | 0.046 | 0.046 | 0.046 | 0.046 | 0.046 | 0.047 | 0.046 | 0.047 | 0.046 | 0.047 | 0.047 | 0.047 | 0.047 | 0.032~0.097      |
| 19 | Yamanashi(Kofu)      | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.045 | 0.045 | 0.045 | 0.045 | 0.045 | 0.040~0.064      |
| 20 | Nagano(Nagano)       | 0.047 | 0.046 | 0.045 | 0.045 | 0.045 | 0.045 | 0.046 | 0.046 | 0.046 | 0.047 | 0.047 | 0.047 | 0.048 | 0.048 | 0.0299~0.0974    |
| 21 | Gifu(Kakamigahara)   | 0.060 | 0.060 | 0.060 | 0.060 | 0.061 | 0.061 | 0.061 | 0.061 | 0.062 | 0.062 | 0.062 | 0.062 | 0.063 | 0.063 | 0.057~0.110      |
| 22 | Shizuoka(Shizuoka)   | 0.042 | 0.041 | 0.041 | 0.041 | 0.041 | 0.040 | 0.040 | 0.040 | 0.040 | 0.041 | 0.041 | 0.041 | 0.041 | 0.040 | 0.0281~0.0765    |
| 23 | Aichi(Nagoya)        | 0.039 | 0.039 | 0.039 | 0.039 | 0.039 | 0.040 | 0.040 | 0.040 | 0.041 | 0.041 | 0.041 | 0.042 | 0.042 | 0.042 | 0.035~0.074      |
| 24 | Mie(Yokkaichi)       | 0.046 | 0.046 | 0.046 | 0.046 | 0.046 | 0.046 | 0.046 | 0.046 | 0.046 | 0.046 | 0.046 | 0.046 | 0.047 | 0.047 | 0.0416~0.0789    |
| 25 | Shiga(Otsu)          | 0.033 | 0.033 | 0.033 | 0.033 | 0.033 | 0.033 | 0.033 | 0.034 | 0.035 | 0.035 | 0.035 | 0.036 | 0.036 | 0.037 | 0.031~0.061      |
| 26 | Kyoto(Kyoto)         | 0.038 | 0.038 | 0.038 | 0.038 | 0.038 | 0.038 | 0.038 | 0.039 | 0.039 | 0.039 | 0.039 | 0.039 | 0.040 | 0.040 | 0.033~0.087      |
| 27 | Osaka(Osaka)         | 0.043 | 0.043 | 0.042 | 0.042 | 0.043 | 0.043 | 0.042 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 | 0.044 | 0.044 | 0.042~0.061      |
| 28 | Hyogo(Kobe)          | 0.037 | 0.037 | 0.037 | 0.037 | 0.037 | 0.037 | 0.038 | 0.038 | 0.038 | 0.038 | 0.037 | 0.037 | 0.038 | 0.038 | 0.035~0.076      |
| 29 | Nara(Nara)           | 0.047 | 0.047 | 0.048 | 0.048 | 0.048 | 0.048 | 0.048 | 0.049 | 0.049 | 0.049 | 0.049 | 0.050 | 0.050 | 0.050 | 0.046~0.08       |
| 30 | Wakayama(Wakayama)   | 0.032 | 0.032 | 0.032 | 0.032 | 0.032 | 0.032 | 0.033 | 0.033 | 0.033 | 0.033 | 0.033 | 0.033 | 0.033 | 0.034 | 0.031~0.056      |
| 31 | Tottori(Tohhaku)     | 0.063 | 0.063 | 0.063 | 0.063 | 0.064 | 0.064 | 0.063 | 0.063 | 0.064 | 0.064 | 0.064 | 0.064 | 0.064 | 0.064 | 0.036~0.11       |
| 32 | Shimane(Matsue)      | 0.037 | 0.037 | 0.037 | 0.037 | 0.037 | 0.038 | 0.038 | 0.039 | 0.039 | 0.039 | 0.040 | 0.040 | 0.040 | 0.040 | 0.033~0.079      |
| 33 | Okayama(Okayama)     | 0.049 | 0.048 | 0.049 | 0.049 | 0.049 | 0.049 | 0.050 | 0.050 | 0.051 | 0.051 | 0.051 | 0.051 | 0.051 | 0.052 | 0.043~0.104      |
| 34 | Hiroshima(Hiroshima) | 0.046 | 0.046 | 0.047 | 0.047 | 0.047 | 0.047 | 0.048 | 0.048 | 0.048 | 0.049 | 0.049 | 0.049 | 0.049 | 0.049 | 0.035~0.069      |
| 35 | Yamaguchi(Yamaguchi) | 0.091 | 0.092 | 0.092 | 0.092 | 0.092 | 0.092 | 0.093 | 0.093 | 0.094 | 0.095 | 0.094 | 0.094 | 0.095 | 0.096 | 0.084~0.128      |
| 36 | Tokushima(Tokushima) | 0.038 | 0.038 | 0.038 | 0.038 | 0.038 | 0.038 | 0.038 | 0.039 | 0.039 | 0.039 | 0.039 | 0.039 | 0.039 | 0.040 | 0.037~0.067      |
| 37 | Kagawa(Takamatsu)    | 0.059 | 0.062 | 0.063 | 0.063 | 0.064 | 0.066 | 0.068 | 0.069 | 0.070 | 0.070 | 0.071 | 0.067 | 0.069 | 0.071 | 0.051~0.077      |
| 38 | Ehime(Matsuyama)     | 0.047 | 0.047 | 0.047 | 0.048 | 0.048 | 0.048 | 0.049 | 0.049 | 0.049 | 0.049 | 0.050 | 0.050 | 0.050 | 0.050 | 0.045~0.074      |
| 39 | Kochi(Kochi)         | 0.025 | 0.025 | 0.025 | 0.025 | 0.026 | 0.026 | 0.026 | 0.026 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.023~0.076      |
| 40 | Fukuoka(Dazaifu)     | 0.036 | 0.036 | 0.036 | 0.036 | 0.037 | 0.036 | 0.036 | 0.037 | 0.037 | 0.037 | 0.037 | 0.037 | 0.038 | 0.038 | 0.034~0.079      |
| 41 | Saga(Saga)           | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.037~0.086      |
| 42 | Nagasaki(Ohmura)     | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.027~0.069      |
| 43 | Kumamoto(Uto)        | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.028 | 0.027 | 0.027 | 0.028 | 0.028 | 0.029 | 0.029 | 0.029 | 0.029 | 0.021~0.067      |
| 44 | Oita(Oita)           | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.051 | 0.051 | 0.051 | 0.051 | 0.051 | 0.048~0.085      |
| 45 | Miyazaki(Miyazaki)   | 0.026 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.0243~0.0664    |
| 46 | Kagoshima(Kagoshima) | 0.035 | 0.034 | 0.034 | 0.035 | 0.035 | 0.035 | 0.035 | 0.035 | 0.036 | 0.036 | 0.036 | 0.036 | 0.036 | 0.036 | 0.0306~0.0943    |
| 47 | Okinawa(Uruma)       | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.0133~0.0575    |

\*Figures for Miyagi Prefecture are measured by transportable monitoring post.

\*Refer to other title "Readings at Monitoring Post out of 20 Km Zone of Fukushima Dai-ichi NPP" for the datas in Fukushima. It could not be measured by Monitoring Post since the radiation level around it is so high.

\*Blanks are caused by device maintenance, but the area was measured by Monitoring Posts.

\*These figures are estimated as 1  $\mu$  Gy/h=1  $\mu$  Sv/h.

\*The table was made by MEXT, based on the reports from prefectures.

## Reading of environmental radioactivity level by prefecture

2011.4.1 19:00

(μSv/h)

|    | Prefecture(City)     | 4/1   |       |       |       |       |       |       |       |       |       | Usual Value Band |
|----|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------------------|
|    |                      | 7-8   | 8-9   | 9-10  | 10-11 | 11-12 | 12-13 | 13-14 | 14-15 | 15-16 | 16-17 |                  |
| 1  | Hokkaido(Sapporo)    | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.02~0.105       |
| 2  | Aomori(Aomori)       | 0.028 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.017~0.102      |
| 3  | Iwate(Morioka)       | 0.027 | 0.027 | 0.027 | 0.026 | 0.026 | 0.026 | 0.026 | 0.025 | 0.026 | 0.025 | 0.014~0.084      |
| 4  | Miyagi(Sendai)       | 0.082 | 0.087 | 0.091 | 0.092 | 0.091 | 0.091 | 0.091 | 0.091 | 0.090 | 0.088 | 0.0176~0.0513    |
| 5  | Akita(Akita)         | 0.036 | 0.036 | 0.036 | 0.035 | 0.035 | 0.035 | 0.035 | 0.035 | 0.035 | 0.035 | 0.022~0.086      |
| 6  | Yamagata(Yamagata)   | 0.064 | 0.063 | 0.063 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.025~0.082      |
| 7  | Fukushima(Futaba)    |       |       |       |       |       |       |       |       |       |       | 0.037~0.071      |
| 8  | Ibaraki(Mito)        | 0.192 | 0.191 | 0.190 | 0.189 | 0.189 | 0.189 | 0.189 | 0.188 | 0.188 | 0.188 | 0.036~0.056      |
| 9  | Tochigi(Utsunomiya)  | 0.091 | 0.091 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.089 | 0.089 | 0.089 | 0.030~0.067      |
| 10 | Gunma(Maebashi)      | 0.055 | 0.054 | 0.054 | 0.054 | 0.053 | 0.053 | 0.053 | 0.053 | 0.053 | 0.052 | 0.017~0.045      |
| 11 | Saitama(Saitama)     | 0.080 | 0.079 | 0.079 | 0.079 | 0.078 | 0.078 | 0.078 | 0.078 | 0.077 | 0.078 | 0.031~0.060      |
| 12 | Chiba(Ishihara)      | 0.070 | 0.070 | 0.069 | 0.069 | 0.069 | 0.069 | 0.068 | 0.068 | 0.068 | 0.068 | 0.022~0.044      |
| 13 | Tokyo(Shinjyuku)     | 0.098 | 0.099 | 0.099 | 0.099 | 0.098 | 0.098 | 0.098 | 0.097 | 0.097 | 0.097 | 0.028~0.079      |
| 14 | Kanagawa(Chigasaki)  | 0.068 | 0.067 | 0.067 | 0.067 | 0.067 | 0.066 | 0.067 | 0.066 | 0.066 | 0.066 | 0.035~0.069      |
| 15 | Niigata(Niigata)     | 0.048 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.046 | 0.046 | 0.046 | 0.046 | 0.031~0.153      |
| 16 | Toyama(Imizu)        | 0.050 | 0.049 | 0.049 | 0.049 | 0.049 | 0.048 | 0.048 | 0.048 | 0.048 | 0.048 | 0.029~0.147      |
| 17 | Ishikawa(Kanazawa)   | 0.048 | 0.048 | 0.048 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.0291~0.1275    |
| 18 | Fukui(Fukui)         | 0.047 | 0.047 | 0.046 | 0.045 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.045 | 0.032~0.097      |
| 19 | Yamanashi(Kohu)      | 0.045 | 0.045 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.043 | 0.044 | 0.040~0.064      |
| 20 | Nagano(Nagano)       | 0.048 | 0.047 | 0.046 | 0.046 | 0.046 | 0.046 | 0.045 | 0.046 | 0.045 | 0.045 | 0.0299~0.0974    |
| 21 | Gifu(Kakamigahara)   | 0.063 | 0.063 | 0.062 | 0.062 | 0.061 | 0.061 | 0.060 | 0.060 | 0.060 | 0.060 | 0.057~0.110      |
| 22 | Shizuoka(Shizuoka)   | 0.040 | 0.040 | 0.042 | 0.043 | 0.043 | 0.044 | 0.043 | 0.042 | 0.042 | 0.041 | 0.0281~0.0765    |
| 23 | Aichi(Nagoya)        | 0.043 | 0.043 | 0.043 | 0.041 | 0.040 | 0.040 | 0.039 | 0.039 | 0.039 | 0.039 | 0.035~0.074      |
| 24 | Mie(Yokkaichi)       | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.046 | 0.046 | 0.046 | 0.046 | 0.0416~0.0789    |
| 25 | Shiga(Otsu)          | 0.037 | 0.036 | 0.035 | 0.035 | 0.034 | 0.033 | 0.032 | 0.032 | 0.032 | 0.032 | 0.031~0.061      |
| 26 | Kyoto(Kyoto)         | 0.040 | 0.040 | 0.039 | 0.038 | 0.038 | 0.038 | 0.038 | 0.037 | 0.037 | 0.037 | 0.033~0.087      |
| 27 | Osaka(Osaka)         | 0.044 | 0.043 | 0.043 | 0.043 | 0.042 | 0.042 | 0.042 | 0.042 | 0.042 | 0.042 | 0.042~0.061      |
| 28 | Hyogo(Kobe)          | 0.039 | 0.038 | 0.037 | 0.037 | 0.037 | 0.036 | 0.037 | 0.037 | 0.037 | 0.037 | 0.035~0.076      |
| 29 | Nara(Nara)           | 0.050 | 0.049 | 0.048 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.047 | 0.046~0.08       |
| 30 | Wakayama(Wakayama)   | 0.033 | 0.033 | 0.033 | 0.032 | 0.032 | 0.032 | 0.032 | 0.031 | 0.032 | 0.031 | 0.031~0.056      |
| 31 | Tottori(Tohhaku)     | 0.064 | 0.064 | 0.063 | 0.063 | 0.063 | 0.063 | 0.063 | 0.063 | 0.063 | 0.063 | 0.036~0.11       |
| 32 | Shimane(Matsue)      | 0.040 | 0.040 | 0.039 | 0.038 | 0.038 | 0.037 | 0.037 | 0.037 | 0.036 | 0.037 | 0.033~0.079      |
| 33 | Okayama(Okayama)     | 0.052 | 0.051 | 0.050 | 0.050 | 0.050 | 0.049 | 0.049 | 0.049 | 0.049 | 0.048 | 0.043~0.104      |
| 34 | Hiroshima(Hiroshima) | 0.050 | 0.050 | 0.049 | 0.048 | 0.047 | 0.047 | 0.046 | 0.046 | 0.046 | 0.046 | 0.035~0.069      |
| 35 | Yamaguchi(Yamaguchi) | 0.096 | 0.096 | 0.094 | 0.094 | 0.093 | 0.093 | 0.092 | 0.091 | 0.091 | 0.092 | 0.084~0.128      |
| 36 | Tokushima(Tokushima) | 0.039 | 0.039 | 0.039 | 0.038 | 0.038 | 0.038 | 0.038 | 0.038 | 0.038 | 0.038 | 0.037~0.067      |
| 37 | Kagawa(Takamastu)    | 0.058 | 0.058 | 0.064 | 0.066 | 0.067 | 0.054 | 0.058 | 0.062 | 0.054 | 0.054 | 0.051~0.077      |
| 38 | Ehime(Matsuyama)     | 0.050 | 0.049 | 0.049 | 0.048 | 0.048 | 0.047 | 0.047 | 0.047 | 0.046 | 0.047 | 0.045~0.074      |
| 39 | Kochi(Kochi)         | 0.027 | 0.027 | 0.027 | 0.026 | 0.025 | 0.024 | 0.024 | 0.024 | 0.024 | 0.024 | 0.023~0.076      |
| 40 | Fukuoka(Dazaifu)     | 0.038 | 0.037 | 0.037 | 0.037 | 0.036 | 0.036 | 0.036 | 0.036 | 0.036 | 0.036 | 0.034~0.079      |
| 41 | Saga(Saga)           | 0.041 | 0.041 | 0.041 | 0.041 | 0.040 | 0.040 | 0.040 | 0.040 | 0.039 | 0.040 | 0.037~0.086      |
| 42 | Nagasaki(Matsuyama)  | 0.029 | 0.029 | 0.030 | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.029 | 0.027~0.069      |
| 43 | Kumamoto(Uto)        | 0.029 | 0.029 | 0.029 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.027 | 0.027 | 0.021~0.067      |
| 44 | Oita(Oita)           | 0.051 | 0.051 | 0.052 | 0.050 | 0.050 | 0.051 | 0.051 | 0.050 | 0.050 | 0.050 | 0.048~0.085      |
| 45 | Miyazaki(Miyazaki)   | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.026 | 0.026 | 0.026 | 0.026 | 0.026 | 0.0243~0.0664    |
| 46 | Kagoshima(Kagoshima) | 0.036 | 0.036 | 0.035 | 0.035 | 0.034 | 0.034 | 0.034 | 0.034 | 0.034 | 0.034 | 0.0306~0.0943    |
| 47 | Okinawa(Uruma)       | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.020 | 0.021 | 0.021 | 0.0133~0.0575    |

\*Figures for Miyagi Prefecture are measured by transportable monitoring post.

\*Refer to other title "Readings at Monitoring Post out of 20 Km Zone of Fukushima Dai-ichi NPP" for the datas in Fukushima. It could not be measured by

\*Blanks are caused by device maintenance, but the area was measured by Monitoring Posts.

\*These figures are estimated as 1 μGy/h=1 μSv/h.

\*The table was made by MEXT, based on the reports from prefectures.



**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Friday, April 01, 2011 3:55 PM  
**To:** Powers, Dana A  
**Subject:** FW: Framing  
**Attachments:** Accident management strategies.ppt

For you review.

---

**From:** Kelly, John E (NE) [mailto:JohnE.Kelly@Nuclear.Energy.Gov]  
**Sent:** Friday, April 01, 2011 3:53 PM  
**To:** DL-NITsolutions  
**Cc:** 'ellisjo@inpo.org'; 'mortensengk@inpo.org'  
**Subject:** Framing

Attached is slide deck that we're developing to frame how the work of our team and science experts is addressing the variety of accident management response strategies. This is a draft, but wanted to share for comment. Note that we have many more analyses that we have in our log.

John

Dr. John E. Kelly  
Deputy Assistant Secretary for Nuclear Reactor Technologies  
NE-7  
U.S. Department of Energy  
1000 Independence Ave. SW  
Washington, DC 20585  
phone: 202-586-5458  
fax: 202-586-0541

mobile

(b)(6)

ex 6

AAAA/471

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Friday, April 01, 2011 3:55 PM  
**To:** 'Kelly, John E (NE)'  
**Subject:** RE: Framing

John:

When you have a minute, please give me a call at 301-251-7526.

Thx, Richard

---

**From:** Kelly, John E (NE) [<mailto:JohnE.Kelly@Nuclear.Energy.Gov>]  
**Sent:** Friday, April 01, 2011 3:53 PM  
**To:** DL-NITSolutions  
**Cc:** 'ellisjo@inpo.org'; 'mortensengk@inpo.org'  
**Subject:** Framing

Attached is slide deck that we're developing to frame how the work of our team and science experts is addressing the variety of accident management response strategies. This is a draft, but wanted to share for comment. Note that we have many more analyses that we have in our log.

John

Dr. John E. Kelly  
Deputy Assistant Secretary for Nuclear Reactor Technologies  
NE-7  
U.S. Department of Energy  
1000 Independence Ave. SW  
Washington, DC 20585  
phone: 202-586-5458  
fax: 202-586-0541  
mobile: (b)(6) ex 6

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Friday, April 01, 2011 4:05 PM  
**To:** Sheron, Brian  
**Subject:** RE: Framing

Thx, I got it from John.

---

**From:** Sheron, Brian  
**Sent:** Friday, April 01, 2011 3:59 PM  
**To:** Lee, Richard  
**Subject:** FW: Framing

---

**From:** Kelly, John E (NE) [<mailto:JohnE.Kelly@Nuclear.Energy.Gov>]  
**Sent:** Friday, April 01, 2011 3:53 PM  
**To:** DL-NITSolutions  
**Cc:** 'ellisjo@inpo.org'; 'mortensengk@inpo.org'  
**Subject:** Framing

Attached is slide deck that we're developing to frame how the work of our team and science experts is addressing the variety of accident management response strategies. This is a draft, but wanted to share for comment. Note that we have many more analyses that we have in our log.  
John

Dr. John E. Kelly  
Deputy Assistant Secretary for Nuclear Reactor Technologies  
NE-7  
U.S. Department of Energy  
1000 Independence Ave. SW  
Washington, DC 20585  
phone: 202-586-5458  
fax: 202-586-0541  
mobile: (b)(6) ex 6

DI

AAAA/473

**From:** LIA08 Hoc  
**Sent:** Saturday, April 02, 2011 12:37 AM  
**To:** RST01 Hoc; PMT07 Hoc; PMT03 Hoc; HOO Hoc  
**Cc:** LIA06 Hoc  
**Subject:** Latest Version of the Recurring Meetings and Actions List  
**Attachments:** Reoccurring Daily Actions and Calls Rev 22.docx

Version 22 is attached... please share this with your teams.

Thanks,

Rani

LT Coordinator

AAAA/474

## Reoccurring Daily Actions and Calls

| -Time (EDT)                                                                                                                                                   | Description                                                                                           | Lead Team                                        | Action/Purpose of the Call                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 0230                                                                                                                                                          | Input for SIT REP                                                                                     | All Team Directors                               | Submit input to EBT Coordinator                                                                                                             |
| 0300                                                                                                                                                          | RST/PMT call with Japan Team                                                                          | RST/PMT<br>(arranged by the HQQ)<br>(b)(6)       | Daily update for Site Team and HQ (convenient time for the Site Team)                                                                       |
| 0430                                                                                                                                                          | Status update & 2 pager/Sit Rep<br>(BRIEFING ONLY-not a call)                                         | All Team Directors                               | Provide input to EBT Coordinator for development of Agency briefing documents                                                               |
| 0600                                                                                                                                                          | One Pager                                                                                             | ET, Response Advisor                             | Provide input to EBT Coordinator                                                                                                            |
| 0600                                                                                                                                                          | Congressional Update                                                                                  | Taken From Status Update                         |                                                                                                                                             |
| 0715                                                                                                                                                          | Chairman's Brief<br>(Canceled for Saturday, April 2 <sup>nd</sup> and Sunday, April 3 <sup>rd</sup> ) | ET                                               | Update chairman and staff during turnover                                                                                                   |
|                                                                                                                                                               | Deputy Secretaries (as scheduled)                                                                     | ET                                               | White House lead (- <i>Chairman participates</i> )<br>-Interagency discussion                                                               |
| 0830<br>Saturday,<br>April 2 <sup>nd</sup> and<br>Sunday, April<br>3 <sup>rd</sup>                                                                            | TAs & CAs briefing                                                                                    | ET<br>** (arranged by HQQ)<br>(b)(6)             | ET Director lead<br>-briefed Commission TAs and ODs                                                                                         |
| 0900                                                                                                                                                          | RST Status Call with INPO                                                                             | RST                                              | Update status of Reactors and SFPs                                                                                                          |
| 0930                                                                                                                                                          | UK/Canada/France Call                                                                                 | RST/PMT<br>** (arranged by HQQ)<br>Bridge (b)(6) | Information Exchange. Focused on Operational issues<br>(Combining PMT call from 1400 for Dose issues. Starting 3/28)                        |
| (NOTE:<br>Moved to<br>0830<br>Saturday,<br>April 2 <sup>nd</sup> and<br>Sunday, April<br>3 <sup>rd</sup> )<br>1000 (formerly<br>conducted at<br>715 and 8 pm) | TAs & CAs briefing                                                                                    | ET<br>** (arranged by HQQ)<br>(b)(6)             | ET Director lead<br>-briefed Commission TAs and ODs                                                                                         |
| 1100<br>M/W/F                                                                                                                                                 | ESF8-(Public Health & Medical Services)                                                               | LT<br>(Conference number provided by HHS)        | HHS Secretarys Operations Center lead<br>-Interagency discussion NOTE call will be held on M/W/F schedule only – no calls on Tues or Thurs. |
| 1100                                                                                                                                                          | Technical Coordination with                                                                           | RST                                              | Technical discussion                                                                                                                        |

## Reoccurring Daily Actions and Calls

|      |                                                                                  |                                                                                  |                                                                                                                                                                                                                              |
|------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | Industry Consortium                                                              | (arranged by HOO)<br>800-772-3842 (6543)                                         |                                                                                                                                                                                                                              |
| 1100 | Radiological Status & Implications Call <i>(new call proposed to start 3/28)</i> | Arranged by NEI                                                                  | "Radiological Status & Implications" call between NRC, NEI, EPA, DOE, OSTP. NEI or OSTP will set up the bridge line.                                                                                                         |
| 1230 | NTAG teleconference (chaired by NSS)                                             | PMT Director to lead                                                             | Nuclear Technical Advisory Group –email sent out daily with phone # and pass code                                                                                                                                            |
| 1400 | USAID<br>Starting 4/5 call will be on Tuesdays only<br>(b)(6) Password (b)(6)    | LT/OCA                                                                           | USAID lead NOTE-this call only on Tues and Thurs now<br>-Interagency discussion: Starting 4/5 call will be on Tuesdays only.<br>Federal pre-coordination takes place at 1:45 and then the 2pm call with Congressional staff. |
| 1400 | NARAC                                                                            | PMT<br>** (arranged by HOO)                                                      | DOE lead<br>-Interagency discussion of dose models-                                                                                                                                                                          |
| 1400 | Advisory Team                                                                    | White House/PMT                                                                  | Call with the White House to help with coordination and ensure PMT/White House is aware of current information<br>Call: (b)(6) Pin: (b)(6)<br>(b)(6) Pin #: (b)(6) #                                                         |
| 1500 | One Pager                                                                        | ET, Response Advisor                                                             | Provide Input to EBT Coordinator                                                                                                                                                                                             |
| 1500 | Congressional call                                                               | OCA &<br>NRC Go-To Team<br>(Leeds, M. Johnson, Sherron, B. Boger, etc)<br>(b)(6) | OCA lead -Audience is Congressional staff who have or are near a plant; Oversight committees; House & Senate leadership                                                                                                      |
| 1515 | Chairman's brief                                                                 | ET<br>(arranged by HOO)                                                          |                                                                                                                                                                                                                              |
| 1600 | Input to Status Update                                                           | All Team Directors                                                               | Provide input to EBT Coordinator                                                                                                                                                                                             |
| 1700 | PACOM J2 call                                                                    | RST                                                                              | May not reoccur daily-call done as needed                                                                                                                                                                                    |
| 1700 | HHS call with 50 states and federal partners                                     | LT/State Liaison                                                                 | Meeting occurs each Tuesday and Thursday evening, as organized by HHS (N. Natarajan). HHS provides bridge line day of call                                                                                                   |
| 1700 | DOE Science Panel                                                                | RES                                                                              | Brian Sheron and Richard Lee, out of the box solutions.                                                                                                                                                                      |
| 1700 | RST/PMT call with Japan Team                                                     | RST/PMT<br>(arranged by the HOO)<br>(b)(6)                                       | Daily update for Site Team and HQ (convenient time for the Site Team)                                                                                                                                                        |
| 1800 | Status update & 2 pager/Sit Rep<br>(BRIEFING ONLY-not a call)                    | EBT                                                                              | EBT developed agency briefing documents                                                                                                                                                                                      |
| 1830 | Chairman's Call with Chuck Casto                                                 | Chairman/Chuck                                                                   | Brief on status                                                                                                                                                                                                              |

## Reoccurring Daily Actions and Calls

|                        |                                                    |                                              |                                                                                                      |
|------------------------|----------------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------|
|                        | <b>(Canceled for Sunday, April 3<sup>rd</sup>)</b> |                                              |                                                                                                      |
| 1900                   | Call with Vince Holahan PACCOM                     | PMT                                          | Status of Radiological Conditions<br>Vince Direct Line – (b)(6) if no answer<br>(b)(6) or SWO (b)(6) |
| 2000                   | HHS Call with Pacific                              | HHS                                          | Meeting occurs each Wed. evening. Call in (b)(6)<br>(b)(6) is the passcode. PMT to participate       |
| 2000 re-initiated 3/29 | Call with Industry Consortium (daily)              | ET<br>*** (arranged by HOO)<br>(b)(6) (XXXX) | ET Led High-level discussions with industry and NRC Site Team                                        |
| 2100                   | PMT call with Japan Team                           | PMT<br>(arranged by the HOO)<br>(b)(6)       | Daily update for Site Team and HQ (convenient time for the Site Team)                                |
| 2130                   | DOS                                                | ET<br>** (arranged by HOO)                   | DOS lead<br>Interagency discussion                                                                   |
| 2200                   | One Pager                                          | ET, Response Advisor                         | Provide Input to EBT Coordinator                                                                     |
| 2200                   | One pager                                          | EBT                                          | Update chairman via email using one-pager                                                            |

**From:** Hayden, Elizabeth  
**To:** LIA08 Hoc; Hasselberg, Rick  
**Cc:** Alter, Peter; RST06 Hoc; RST01 Hoc; LIA06 Hoc  
**Subject:** Re: Japan nuclear accident  
**Date:** Sunday, April 03, 2011 7:59:18 PM

---

Thanks. We will be happy to do that. We do not anticipate a deluge of ideas at this time.  
Beth Hayden  
Office of Public Affairs

---

**From:** LIA08 Hoc  
**To:** Hasselberg, Rick; Hayden, Elizabeth  
**Cc:** Alter, Peter; RST06 Hoc; RST01 Hoc; LIA06 Hoc  
**Sent:** Fri Apr 01 23:33:25 2011  
**Subject:** RE: Japan nuclear accident

Since the Liaison Team facilitates coordination among Federal, commercial and international parties, the LT would not be in a position to consider suggestions and contemplate their merit. While the RST may have some very limited time and resources to review emails from the public, my recommendation is to send any suggestions and offers of assistance to [inpoercassistance@inpo.org](mailto:inpoercassistance@inpo.org), an email account that was set up by INPO for just this kind of input.  
Rani  
Liaison Team Coordinator

**From:** RST01 Hoc  
**Sent:** Friday, April 01, 2011 6:23 PM  
**To:** Hasselberg, Rick; Hayden, Elizabeth  
**Cc:** LIA08 Hoc; Alter, Peter; RST06 Hoc  
**Subject:** RE: Japan nuclear accident  
**Importance:** High

Rick & Beth:

Rick & Elizabeth:

**PLEASE DO NOT SEND THESE E-MAILS TO THE RST!!!**

The RST is still very much involved with INPO, ANS, NEI, the U.S. Navy, GE-H, the NRC team in Japan, and other groups. The Japanese units are in a very fragile state right now and we are actively working to help bring the units to a stable state. We do not have the time or staffing to read and respond to multiple e-mails from concerned citizens.

I suggest you have a knowledgeable member of the OPA sort the e-mails first to separate the wheat from the chaff and prepare and send a standard reply to

AAAA/ 475



the senders. You can forward any e-mails that present new or outstanding ideas and we will look at them -- **but do not send all the e-mails to the RST.**

Thank you,  
RST Coordinator

-----Original Message-----

From: Hasselberg, Rick  
Sent: Friday, April 01, 2011 5:06 PM  
To: Hayden, Elizabeth  
Cc: LIA08 Hoc; RST01 Hoc; Alter, Peter  
Subject: RE: Japan nuclear accident

Beth,

Please send them to both RST01.hoc and to LIA08.hoc. thanks!

Rick

-----Original Message-----

From: Hayden, Elizabeth  
Sent: Friday, April 01, 2011 3:40 PM  
To: Hasselberg, Rick  
Cc: Ash, Darren  
Subject: FW: Japan nuclear accident

Rick,

Due to the large volume of e-mails and phone calls OPA received immediately after the Fukushima event, we were not doing anything with suggestions for resolving the problems going on in Japan. Now that the volume has eased quite a bit, I was thinking that OPA might respond to e-mails like the one below thanking them for their ideas and telling them we have forwarded them to the appropriate staff working the Japan event.

Could we forward these e-mails to you for those suggestions/ideas that appear reasonable and realistic? You would not be expected to respond back since we would have already done that.

Beth Hayden

-----Original Message-----

From: Lonnie Reed [mailto:(b)(6)]

Sent: Monday, March 28, 2011 8:46 PM

To: DataQuality Resource

Subject: Japan nuclear accident

Hello,

I do not know specifically who to address my comment.

It seems from news reports that Japan is having trouble locating a place to store radioactive water from the plant. Why not use empty oil supertankers to hold the contaminated water. It beats releasing it to the open ocean.

Please forward my suggestion to anyone who may find the suggestion helpful.

Best regards,

Lonnie Reed

(b)(6)

**From:** [ANS.HOC@nrc.gov](mailto:ANS.HOC@nrc.gov)  
**Subject:** ACTION: Commissioners Assistants Briefing Notification  
**Date:** Sunday, April 03, 2011 8:27:02 AM  
**Attachments:** [USNRC Earthquake-Tsunami Update.040311 0430EDT.pdf](#)

---

There will be a Commissioners Assistants Briefing given by the NRC HQ at 0830 EDT concerning the Reactor Events in Japan. Call (b)(6) approximately 5 minutes before the scheduled start time. When prompted, enter security code (b)(6). You may call 301-816-5164 at this time and follow the voice prompts if you do not wish to receive this notification from our Automatic Notification System.

AAA/476

**From:** [ANS.HOC@nrc.gov](mailto:ANS.HOC@nrc.gov)  
**Subject:** ACTION: Commissioners Assistants Briefing Notification  
**Date:** Sunday, April 03, 2011 7:19:05 AM  
**Attachments:** [HOC Watch Bill April 3-9 2011.pdf](#)

---

There will be a Commissioners Assistants Briefing given by the NRC HQ at 0830 EDT concerning the Reactor Events in Japan. Call (b)(6) approximately 5 minutes before the scheduled start time. When prompted, enter security code (b)(6). You may call 301-816-5164 at this time and follow the voice prompts if you do not wish to receive this notification from our Automatic Notification System.

AAAA/477

**From:** Brenner, Eliot  
**To:** Hayden, Elizabeth  
**Subject:** Photos  
**Date:** Monday, April 04, 2011 4:02:04 PM

---

I just sent were from press conference after japanese "side event."

Eliot Brenner

Director, Office of Public Affairs

US Nuclear Regulatory Commission

Protecting People and the Environment

301 415 8200

C: (b)(6)

Sent from my Blackberry

AAAA/479

**From:** Hayden, Elizabeth  
**To:** Brenner, Eliot  
**Subject:** RE: IMG-20110404-00021.jpg  
**Date:** Monday, April 04, 2011 6:08:00 PM

---

We're working on posting a photo of the chairman and one of Borchardt (in a collage) for the web tomorrow by noon. I just put up the Science Fair photo to try to get away from "Japan all the time."

Talked to Matt to give him our role in the Bechtel equipment and then gave him the numbers of Michelle and Charlene to get a more detailed story on the status of the equipment.

Beth Hayden  
Senior Advisor  
Office of Public Affairs  
U.S. Nuclear Regulatory Commission  
--- Protecting People and the Environment  
301-415-8202  
elizabeth.hayden@nrc.gov

-----Original Message-----

From: Brenner, Eliot  
Sent: Monday, April 04, 2011 3:01 PM  
To: Hayden, Elizabeth  
Subject: IMG-20110404-00021.jpg

Eliot Brenner  
Director, Office of Public Affairs  
US Nuclear Regulatory Commission  
Protecting People and the Environment  
301.415.8200  
C: (b)(6)  
Sent from my Blackberry

AAAA/480

**From:** Clark, Theresa  
**To:** Hayden, Elizabeth  
**Subject:** RE: IMG-20110404-00026.jpg  
**Date:** Monday, April 04, 2011 4:27:38 PM

---

Yes but she is actually not in Vienna. Andrea Jones (and others) are giving me information from Vienna. I have a draft based on what they told me already (press event after the side event) but am waiting for comments from them.

-----Original Message-----

From: Hayden, Elizabeth  
Sent: Monday, April 04, 2011 4:26 PM  
To: Clark, Theresa  
Subject: RE: IMG-20110404-00026.jpg

Was one of them Jennifer Schwartzman?

Beth Hayden  
Senior Advisor  
Office of Public Affairs  
U.S. Nuclear Regulatory Commission  
--- Protecting People and the Environment  
301-415-8202  
elizabeth.hayden@nrc.gov

-----Original Message-----

From: Clark, Theresa  
Sent: Monday, April 04, 2011 3:51 PM  
To: Hayden, Elizabeth  
Subject: RE: IMG-20110404-00026.jpg

Thanks. I wrote a draft based on what I thought it showed and shot it over to a couple of the team members in Vienna. I should be able to hear back in time to get it posted on your schedule.

--

Theresa Valentine Clark  
Technical Assistant  
Division of Safety Systems and Risk Assessment  
U.S. NRC Office of New Reactors  
T-10F10 | 301-415-4048  
Theresa.Clark@nrc.gov

-----Original Message-----

From: Hayden, Elizabeth  
Sent: Monday, April 04, 2011 3:38 PM  
To: Clark, Theresa  
Subject: FW: IMG-20110404-00026.jpg

Please work with OIP to develop a caption for this photo of the Chairman at the CNS. I would like to post it by noon tomorrow.

Beth Hayden  
Senior Advisor  
Office of Public Affairs  
U.S. Nuclear Regulatory Commission  
--- Protecting People and the Environment

AAAR/481

301-415-8202  
elizabeth.hayden@nrc.gov

-----Original Message-----

From: Brenner, Eliot  
Sent: Monday, April 04, 2011 3:04 PM  
To: Hayden, Elizabeth  
Subject: IMG-20110404-00026.jpg

Eliot Brenner  
Director, Office of Public Affairs  
US Nuclear Regulatory Commission  
Protecting People and the Environment  
301 415 8200  
C: (b)(6)  
Sent from my Blackberry



**From:** Hayden, Elizabeth  
**To:** Clark, Theresa  
**Subject:** RE: IMG-20110404-00026.jpg  
**Date:** Monday, April 04, 2011 4:00:00 PM

---

Fine. thanks

Beth Hayden  
Senior Advisor  
Office of Public Affairs  
U.S. Nuclear Regulatory Commission  
--- Protecting People and the Environment  
301-415-8202  
elizabeth.hayden@nrc.gov

-----Original Message-----

From: Clark, Theresa  
Sent: Monday, April 04, 2011 3:51 PM  
To: Hayden, Elizabeth  
Subject: RE: IMG-20110404-00026.jpg

Thanks. I wrote a draft based on what I thought it showed and shot it over to a couple of the team members in Vienna. I should be able to hear back in time to get it posted on your schedule.

--

Theresa Valentine Clark  
Technical Assistant  
Division of Safety Systems and Risk Assessment  
U.S. NRC Office of New Reactors  
T-10F10 | 301-415-4048  
Theresa.Clark@nrc.gov

-----Original Message-----

From: Hayden, Elizabeth  
Sent: Monday, April 04, 2011 3:38 PM  
To: Clark, Theresa  
Subject: FW: IMG-20110404-00026.jpg

Please work with OIP to develop a caption for this photo of the Chairman at the CNS. I would like to post it by noon tomorrow.

Beth Hayden  
Senior Advisor  
Office of Public Affairs  
U.S. Nuclear Regulatory Commission  
--- Protecting People and the Environment  
301-415-8202  
elizabeth.hayden@nrc.gov

-----Original Message-----

From: Brenner, Eliot  
Sent: Monday, April 04, 2011 3:04 PM  
To: Hayden, Elizabeth  
Subject: IMG-20110404-00026.jpg

AAA/482

Eliot Brenner  
Director, Office of Public Affairs  
US Nuclear Regulatory Commission  
Protecting People and the Environment  
301 415 8200

C: [REDACTED] (b)(6)

Sent from my Blackberry

**From:** Wald, Matthew  
**To:** Hayden, Elizabeth  
**Subject:** Beth, could you phone me when you have a moment  
**Date:** Monday, April 04, 2011 1:28:32 PM

---

Regarding the design mentioned by Eliot, below. Thanks.

Matthew L. Wald  
Washington Bureau  
The New York Times  
1627 Eye St NW, Suite 700  
Washington, DC 20006  
202-862-0363  
cell: (b)(6)  
fax: 202-318-0057

<http://www.nytimes.com/info/nuclear-energy/>  
twitter: mattwaldnyt

---

**From:** Brenner, Eliot [mailto:Eliot.Brenner@nrc.gov]  
**Sent:** Monday, April 04, 2011 11:57 AM  
**To:** Wald, Matthew  
**Subject:** Re: You in Japan?

In Vienna at IAEA/CNS listening to GOJ explain what they know abt reactors. Unsure re navy. Perhaps beth can track down on deep background.

Can tell you nrc engineers dreamed up potential pumping device to raise seawater (or water) to reactor level. It was drawn as a crude sketch and given to bechtel which did formal design, had it built in australia and flown in by aussie AF. Beth can help there and give you bechtel contact and #.

Eliot  
Eliot Brenner  
Director, Office of Public Affairs  
US Nuclear Regulatory Commission  
Protecting People and the Environment  
301 415 8200  
C: (b)(6)  
Sent from my Blackberry

---

**From:** Wald, Matthew <mattwald@nytimes.com>  
**To:** Brenner, Eliot  
**Sent:** Mon Apr 04 12:50:29 2011  
**Subject:** You in Japan?

A utility company engineer who was in close contact with some of the NRC folks who man the emergency center tells me that in the hours after the tsunami, the NRC engineers told Tepco that it would need diesel-driven pumps, fire hoses and portable diesel generators, and that all of these were available from a US Navy base in Japan, which would deliver them within hours, if asked. But Tepco didn't ask.

AAA# / 483

Can you share anything about this?

--- Matt

Matthew L. Wald  
Washington Bureau  
The New York Times  
1627 Eye St NW, Suite 700  
Washington, DC 20006  
202-862-0363  
cell: (b)(6)  
fax: 202-318-0057

<http://www.nytimes.com/info/nuclear-energy/>  
twitter: mattwaldnyt

## Bensi, Michelle

---

**From:** Bensi, Michelle  
**Sent:** Monday, April 04, 2011 11:55 AM  
**To:** Kammerer, Annie  
**Subject:** RE: question about citation

Thanks Annie.

Is that the same place you get the estimates of 8 meters offshore at Daiichi and 7 meters at Daini? (Note: The time series plots show different number: 6.1 and 5.5 meters)

Can you forward me the email(s) so I can cite the communication with all required info (e.g. date)?

Thanks,

Shelby

---

**From:** Kammerer, Annie  
**Sent:** Sunday, April 03, 2011 4:16 PM  
**To:** Bensi, Michelle  
**Subject:** Re: question about citation

Personal communication with Vasily Titov.

Cheers,  
Annie

Sent from an NRC blackberry  
Annie Kammerer

mobile (b)(6)

bb (b)(6)

[annie.kammerer@nrc.gov](mailto:annie.kammerer@nrc.gov)

---

**From:** Bensi, Michelle  
**To:** Kammerer, Annie  
**Sent:** Fri Apr 01 14:29:29 2011  
**Subject:** question about citation

Hi Annie,

Sorry to bug you. I know you are back to "normal work," but I have a quick question.

In the seismic Q&A document, the following info is included related to wave amplitude. Where did this info come from? I see that the header says NOAA, but I wasn't able to track down the figures on the NOAA website. I need to include references for everything in the final version of the document.

Thanks!

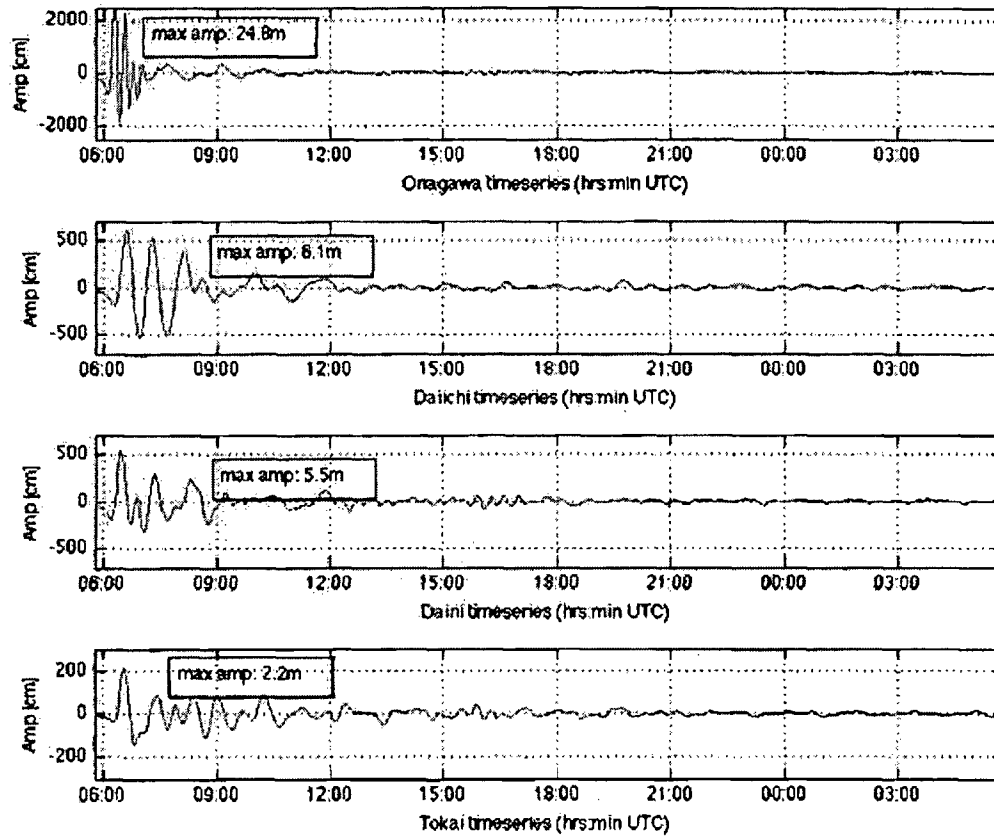
Shelby

### Plot of Tsunami Wave Heights at 5 Meter Bathymetry Offshore at the Japanese Plants (NOAA)

These are results from high-resolution models run by PMEL NOAA staff, who do modeling for the tsunami warning system. While the available bathymetry and topography data used in the model are not of the highest quality at that location, NOAA has confidence in the results, which show good comparisons between model flooding estimates and inundation observations inferred from satellite images. DART measurements are used in the modeling. The images show model time series very close to a shoreline, at about 5m depth. The runup heights (maximum elevation of flooded

area) may be different from these amplitudes at shoreline (can be higher or lower, depending on the topographic profile). According to TEPCO, the wave height onshore at the Fukushima plant was 14 meters high.

#### Offshore wave amplitudes, scaled to the coastline



**Michelle (Shelby) Bensi, Ph.D.**

Reliability and Risk Engineer

Nuclear Regulatory Commission

Office of Nuclear Regulatory Research

Division of Risk Analysis

Operating Experience and Generic Issues Branch

**From:** Mitlyng, Viktoria  
**To:** Brenner, Eliot; Hayden, Elizabeth; Harrington, Holly  
**Subject:** RE: Morris Daily Herald article - Vika featured  
**Date:** Monday, April 04, 2011 12:59:37 PM

---

Thanks!

**From:** Brenner, Eliot  
**Sent:** Monday, April 04, 2011 11:59 AM  
**To:** Mitlyng, Viktoria; Hayden, Elizabeth; Harrington, Holly  
**Subject:** Re: Morris Daily Herald article - Vika featured

Very nice.  
Eliot Brenner  
Director, Office of Public Affairs  
US Nuclear Regulatory Commission  
Protecting People and the Environment  
301 415 8200

C: (b)(6)  
Sent from my BlackBerry

---

**From:** Mitlyng, Viktoria  
**To:** Hayden, Elizabeth; Brenner, Eliot; Harrington, Holly  
**Sent:** Mon Apr 04 12:55:10 2011  
**Subject:** Morris Daily Herald article - Vika featured

This feature made the front page of the Morris Daily Herald Friday:

## Morris Daily Herald (IL)

April 1, 2011

**Section:** Local

## Recalling Chernobyl

*Jo Ann Hustis [jhustis@morrisdailyherald.com](mailto:jhustis@morrisdailyherald.com)*

As a journalist born and raised in Russia, Viktoria **Mitlyng** interviewed and wrote about first responders to the Chernobyl nuclear disaster of 1986. "I had the honor of spending a significant amount of time with the firefighters who were involved in still trying to put out fires later on as the situation developed," she said Wednesday.

"The initial brigade of firefighters was from the plant. Three of those who died had bodies so radioactive they had to be buried in lead coffins."

The most serious accident in the history of the nuclear industry to date, the explosion took place on April 26, 1986, at Unit 4 of the Chernobyl Nuclear Power Station. The plant was located in the former Ukrainian Republic of the Soviet Union.

The explosion ruptured the reactor vessel. The fire that followed burned a good 10 days, and forced large amounts of radioactive materials into the environment. About 116,000 people near the plant were evacuated that spring and summer. They were followed later by another 220,000 evacuees.

AAAA/485



The cloud from the burning reactor spread numerous types of radioactive materials like iodine-131 and caesium radionuclides over much of Europe. Iodine-131 has an eight-day half-life and mostly disintegrated within weeks. Caesium-137 has a 30-year half-life, and can still be measured in the soil and some foods in parts of Europe.

Viktoria's family lived about 100 miles from the town of Chernobyl. She was in school when the accident occurred. She returned to Russia after the Soviet Union fell apart, and was invited by the Moscow Times, an English language daily, to work at the newspaper in Moscow. She wrote a lot about post-Soviet politics, and many of her pieces received worldwide distribution.

She began on the news desk, then was assigned a feature page to fill with what she pleased, as she was a native Russian who spoke the language and knew the country and many, many people.

"I got in touch with what the Russians and Chernobylites called the Chernobyl Liquidators. This was the term they used for the thousands of people who responded to the disaster, from the first group of firefighters — the first wave or crew who went onto the roof of the turbine building that was on fire, and the roof of Reactor No. 3, to make sure there would not be another explosion," she said.

Reactor No. 4 had blown in the disaster. Reactor No. 2 was adjacent to No. 4. The first wave of firefighter crews were company workers. They were fighting fires on the building in efforts to prevent another explosion or accident at Reactor No. 2.

"The original crews went onto this hot tar roof. It was a highly radioactive environment. The crews weren't suited up — they didn't have decontamination suits on, or have breathing apparatuses," Viktoria said.

"They were not protected in any way. They just went onto the roofs and put out the fires. They died of acute radiation poisoning. Some of them collapsed on the roof, and some were taken to the hospital. The end result is a number of firefighters died of acute radiation poisoning."

Plant personnel were sent into an exclusion area not open to the public. Certain workers were told to clean up basically what had happened at the reactor. They were to remove the radioactive debris near the reactor.

"It was a huge explosion. There were huge pieces of graphite on the ground emitting radiation, and they needed to be removed. Some folks were sent in to build shelters for the cleanup crews. Others were working to build sarcophagi around the reactors," she said.

"There were thousands of these people, but the Soviets did not keep records, so we don't know how many. But I have seen where about 70,000 or so were involved in the cleanup."

The second wave of firefighters came from Pripyat, others from the town of Chernobyl, and from Kiev, about 60 miles distant from the reactors. Viktoria worked with members of the crews from Chernobyl.

"At the time they went, they had no idea of what they were going into," she said. "They didn't know how severe the accident was, or how much danger they were in. But they knew if it wasn't a kamikaze mission, they were putting their health on the line because it was an accident at a nuclear power plant."

The stories she wrote from the interviews went to a number of different publications, including the New York Times and Chicago Tribune.

Reliable information about the Chernobyl plant and the release and spread of radioactive material was unavailable to citizens of the Soviet Union at first, and was inadequate for years after. This led to widespread public distrust of official information and wrong attribution of many other health conditions to radiation exposure.

Today, Viktoria lives in America with her husband and children. Professionally, she serves as senior communications spokesman for the Nuclear Regulatory Commission's Region 3 at Lisle, Ill.

"I don't mean to put on my NRC shoes, but the major reason I took the job with the NRC is that I believe being informed and having opportunity to demand information from your government is your first line of defense," she said.

"The people in Chernobyl were exposed to radiation for a day and a half without their knowledge. Their children played on radioactive streets and didn't know it. Here, I feel like I work for an agency where if there is a safety violation, it's made public. We are required to report it. The public here has a right to know and be informed.

"I come from a country where no one knew anything, while the government sat and sat on this information because it was an embarrassment to the Soviet Union. The citizens had no access to anything that has to do with nuclear. There was not a system for providing any kind of information. Evacuation plans? There were none. There was no evacuation plan, no escape route. The government just told you to leave."

Copyright 2011, Morris Daily Herald (IL). All Rights Reserved.

Viktoria Mitlyng  
Office of Public Affairs  
US Nuclear Regulatory Commission  
Region III  
Lisle, IL 60532  
Tel 630/829-9662  
Fax 630/515-1026  
e-mail: [viktoria.mitlyng@nrc.gov](mailto:viktoria.mitlyng@nrc.gov)

**From:** Jean.GAUVAIN@oecd.org  
**To:** karina.debeule@fanc.fgov.be; aurele.gervais@cnsc-ccsn.gc.ca; deniz.yueksel@bmu.bund.de; besenyei@haea.gov.hu; marli.vogels@minvrom.nl; anne.marit.ostreng@nrpa.no; Risto.Isaksson@stuk.fi; anneli.hallgren@ssm.se; lise.roberts@hse.gsi.gov.uk  
**Cc:** yhhah@kims.re.kr; Emmanuel.BOUCHOT@asn.fr; stanislaw.janikowski@paa.gov.pl; camelia.liutiev@cncan.ro; brafferty@rpil.ie; dagmar.zemanova@uid.gov.sk; mcle@csn.es; Hayden, Elizabeth  
**Subject:** REMINDER: NEA/CNRA - 12th WGPC Special questionnaire : still 9 answers missing  
**Date:** Monday, April 04, 2011 12:13:17 PM

---

Dear WGPC colleagues,

On behalf of the WGPC Chair I would like to remind that, during the last meeting and upon a suggestion from France, we started to fill a table with the answers to the few questions below regarding quick communication after the Fukushima event. During the meeting week we could collect answers from 8 countries but 9 other are missing.

We hope that now the pressure on your shoulders has decreased and that you can find a few minutes to answer those questions ASAP.

In the mean time we are completing the Summary Records that could be ready soon.

Thank you for your cooperation

Jean Gauvain - NEA/NSD - Phone +33 1 45 24 10 52 - Mobile (b)(6)

**From:** GAUVAIN Jean, NEA/SURN  
**Sent:** Friday, March 18, 2011 18:28  
**To:** 'add-cnra-wgpc@oecd-nea.org'  
**Subject:** NEA/CNRA - 12th WGPC meeting - Highlights + Special questionnaire for answer ASAP

Dear WGPC Members,

[.....]

I would like to draw you attention on the expectation from the Chair that each NRO provide ASAP the answer to the 4 FOLLOWING QUESTIONS:

- What were the topics of interest (about situation in Japan and situation in your country) for the media and the public contacting your NRO?
- What were the main communication actions taken by your NRO (activation of Emergency Center, press release, use of website, use of social media, press conference, hearing with Authorities ...)?
- What were the main elements of NRO messages to the public and the media?
- What were the main difficulties or challenges for the NRO communication?

[.....]

Finally, the Chair will suggest to the June CNRA that an **extraordinary meeting be organised end September 2011** to draw the lessons from the crisis with respect to national and international NRO communication.

Best Regards

Jean Gauvain - NEA/NSD - Phone +33 1 45 24 10 52 - Mobile (b)(6)

AAAA/486

**From:** Akstulewicz, Brenda  
**To:** Hayden, Elizabeth  
**Subject:** RE: JACZKO remarks at side event  
**Date:** Monday, April 04, 2011 10:43:03 AM

---

Will do, giving to Holly for review.

**From:** Hayden, Elizabeth  
**Sent:** Monday, April 04, 2011 10:42 AM  
**To:** Akstulewicz, Brenda  
**Subject:** FW: JACZKO remarks at side event  
**Importance:** High

Not surprising, hold the speech until 1:30 pm –the exact time is not critical.

*Beth*

**From:** Brenner, Eliot  
**Sent:** Monday, April 04, 2011 9:51 AM  
**To:** Hayden, Elizabeth  
**Subject:** RE: JACZKO remarks at side event

correct. actually, better make it 1:30 p.m. EDT because the japanese will be talking for the first hour.

eliot

---

**From:** Hayden, Elizabeth  
**Sent:** Monday, April 04, 2011 9:40 AM  
**To:** Brenner, Eliot  
**Subject:** RE: JACZKO remarks at side event

I assume that is 12:30 pm our time (6:30 pm Vienna your time).

*Beth Hayden*  
*Senior Advisor*  
*Office of Public Affairs*  
*U.S. Nuclear Regulatory Commission*  
*--- Protecting People and the Environment*  
*301-415-8202*  
*elizabeth.hayden@nrc.gov*

**From:** Brenner, Eliot  
**Sent:** Monday, April 04, 2011 6:09 AM  
**To:** Hayden, Elizabeth  
**Cc:** Loyd, Susan; Batkin, Joshua  
**Subject:** Fw: JACZKO remarks at side event

These can be posted at 1230pm barring any word beforehand from me that he has decided to screw around with these.

Eliot

AAAA/487

Eliot Brenner  
Director, Office of Public Affairs  
US Nuclear Regulatory Commission  
Protecting People and the Environment  
301 415 8200

C: (b)(6)

Sent from my Blackberry

---

**From:** Brenner, Eliot  
**To:** Brenner, Eliot; 'Shaffer, Mark R' <ShafferMr@state.gov>; 'R.Morgart@iaea.org' <R.Morgart@iaea.org>  
**Cc:** Doane, Margaret; Marshall, Michael  
**Sent:** Mon Apr 04 05:16:41 2011  
**Subject:** RE: JACZKO remarks at side event

Please use this version. I found a typo and dropped word in the title area. Can't take me anywhere.

---

**From:** Brenner, Eliot  
**Sent:** Monday, April 04, 2011 5:14 AM  
**To:** 'Shaffer, Mark R'; 'R.Morgart@iaea.org'  
**Cc:** Doane, Margaret; Marshall, Michael  
**Subject:** JACZKO remarks at side event

OK, I found the remarks, and they are attached. If DG Flory wants a title by which to refer to these remarks, I would suggest: The United States Perspective on Fukushima Daiichi.

FYI, they run about 11 minutes. I would like to have copies available for the media at the evening press event but am unsure how to accomplish that.  
Please advise at some point. Not an immediate need.

Eliot Brenner  
PR guy for the NRC

**From:** Burnell, Scott  
**To:** Hayden, Elizabeth  
**Cc:** Harrington, Holly  
**Subject:** RE: ACTION: Commissioners Assistants Briefing Notification  
**Date:** Monday, April 04, 2011 9:48:09 AM

---

I'm OK calling in.

**From:** Hayden, Elizabeth  
**Sent:** Monday, April 04, 2011 9:45 AM  
**To:** Burnell, Scott  
**Cc:** Harrington, Holly  
**Subject:** FW: ACTION: Commissioners Assistants Briefing Notification

Scott,

If you can't call in at 10 am, please ask Holly if she would do the honors. I will be tying to slay the 2013 budget monster at 10 am.

*Beth*

**From:** ANS.HOC@nrc.gov [mailto:ANS.HOC@nrc.gov]  
**Sent:** Monday, April 04, 2011 8:54 AM  
**Subject:** ACTION: Commissioners Assistants Briefing Notification

This is the Headquarters Operations Officer. There will be a Commissioners Assistants Briefing given by Executive Team at 1000 EDT on 4/4/11 concerning the Japanese events. Call (b)(6) approximately 5 minutes before the scheduled start time. When prompted, enter the security code (b)(6) repeat (b)(6). For clarification, please contact the Headquarters Operations Officer at 301-816-5100.

AAA/488

**From:** Hayden, Elizabeth  
**To:** Brenner, Eliot  
**Subject:** RE: JACZKO remarks at side event  
**Date:** Monday, April 04, 2011 9:40:00 AM

---

I assume that is 12:30 pm our time (6:30 pm Vienna your time).

*Beth Hayden  
Senior Advisor  
Office of Public Affairs  
U.S. Nuclear Regulatory Commission  
--- Protecting People and the Environment  
301-415-8202  
elizabeth.hayden@nrc.gov*

**From:** Brenner, Eliot  
**Sent:** Monday, April 04, 2011 6:09 AM  
**To:** Hayden, Elizabeth  
**Cc:** Loyd, Susan; Batkin, Joshua  
**Subject:** Fw: JACZKO remarks at side event

These can be posted at 1230pm barring any word beforehand from me that he has decided to screw around with these.

Eliot  
Eliot Brenner  
Director, Office of Public Affairs  
US Nuclear Regulatory Commission  
Protecting People and the Environment  
301 415 8200  
C: (b)(6)  
Sent from my Blackberry

---

**From:** Brenner, Eliot  
**To:** Brenner, Eliot; 'Shaffer, Mark R' <ShafferMr@state.gov>; 'R.Morgart@iaea.org' <R.Morgart@iaea.org>  
**Cc:** Doane, Margaret; Marshall, Michael  
**Sent:** Mon Apr 04 05:16:41 2011  
**Subject:** RE: JACZKO remarks at side event

Please use this version. I found a typo and dropped word in the title area. Can't take me anywhere.

**From:** Brenner, Eliot  
**Sent:** Monday, April 04, 2011 5:14 AM  
**To:** 'Shaffer, Mark R'; 'R.Morgart@iaea.org'  
**Cc:** Doane, Margaret; Marshall, Michael  
**Subject:** JACZKO remarks at side event

OK, I found the remarks, and they are attached. If DG Flory wants a title by which to refer to these remarks, I would suggest: The United States Perspective on Fukushima Daiichi.

FYI, they run about 11 minutes. I would like to have copies available for the media at the

AAA/489

evening press event but an unsure how to accomplish that.  
Please advise at some point. Not an immediate need.

Eliot Brenner  
PR guy for the NRC



**From:** [ANS.HOC@nrc.gov](mailto:ANS.HOC@nrc.gov)  
**Subject:** ACTION: Commissioners Assistants Briefing Notification  
**Date:** Monday, April 04, 2011 8:54:09 AM  
**Attachments:** [NRC Status Update 4.04.11--0430.pdf](#)

---

This is the Headquarters Operations Officer. There will be a Commissioners Assistants Briefing given by Executive Team at 1000 EDT on 4/4/11 concerning the Japanese events. Call (b)(6) approximately 5 minutes before the scheduled start time. When prompted, enter the security code (b)(6); repeat (b)(6). For clarification, please contact the Headquarters Operations Officer at 301-816-5100.

AAAA/490

**From:** Hudson, Sharon on behalf of Dyer, Jim  
**To:** Brown, Milton; Golder, Jennifer; Allwein, Russell; Smolik, George; Murray, Heather; Schmidt, Rebecca; Poole, Brooke; Burns, Stephen; Doane, Margaret; Brenner, Eliot; Vietti-Cook, Annette; Decker, David; Warner, MaryAnn; Jacobs-Baynard, Elizabeth; Kasputys, Clare; Shnayder, Yana; McDevitt, Joan; Hayden, Elizabeth; Joosten, Sandy; Powell, Marlon; Belmore, Nancy; Pulley, Deborah; Kreuter, Jane; Akstulewicz, Brenda; Wright, Darlene  
**Cc:** Barnes, Robin; Dembek, Stephen  
**Subject:** FY 2013 Policy Support Product Line Budget Submissions; Dial in 800-779-9286; passcode: (b)(6)  
**Start:** Monday, April 04, 2011 10:00:00 AM  
**End:** Monday, April 04, 2011 11:00:00 AM  
**Location:** CFO-TWFFN-09A01-25p

---

When: Monday, April 04, 2011 10:00 AM-11:00 AM (GMT-05:00) Eastern Time (US & Canada).  
Where: CFO-TWFFN-09A01-25p

Note: The GMT offset above does not reflect daylight saving time adjustments.

\*~\*~\*~\*~\*~\*~\*~\*~\*

800-779-9286

Participant passcode: (b)(6)

AAAA/491

**From:** Brenner, Eliot  
**To:** Hayden, Elizabeth  
**Subject:** Camera  
**Date:** Monday, April 04, 2011 4:19:40 AM

---

I will be using the camera in my blackberry to try to get some shots of jaczko at a special japan-related evening session and a subsequent press conference. (Translation: I left our camera in the room!) Should have it with me tomorrow for the US country presentation and can ship other pictures.

Eliot  
Eliot Brenner  
Director, Office of Public Affairs  
US Nuclear Regulatory Commission  
Protecting People and the Environment  
301 415 8200  
C: (b)(6)  
Sent from my Blackberry

AAAA/492

**From:** Janbergs, Holly  
**To:** Hayden, Elizabeth  
**Subject:** RE: Japan nuclear accident  
**Date:** Monday, April 04, 2011 10:32:23 AM

---

Do you want me to handle all inquiries this way - tell them thank you and it's been forwarded - or do you want me to continue handling some myself? I'm not sure I can identify possibly reasonable suggestions from the pile, but I can at least separate out those that are a bit out there.

-----Original Message-----

From: Hayden, Elizabeth  
Sent: Friday, April 01, 2011 5:14 PM  
To: Hasselberg, Rick  
Cc: Janbergs, Holly; Harrington, Holly; Bonaccorso, Amy  
Subject: RE: Japan nuclear accident

Will do. Thanks

Beth

-----Original Message-----

From: Hasselberg, Rick  
Sent: Friday, April 01, 2011 5:06 PM  
To: Hayden, Elizabeth  
Cc: LIA08 Hoc; RST01 Hoc; Alter, Peter  
Subject: RE: Japan nuclear accident

Beth,

Please send them to both RST01.hoc and to LIA08.hoc. thanks!

Rick

-----Original Message-----

From: Hayden, Elizabeth  
Sent: Friday, April 01, 2011 3:40 PM  
To: Hasselberg, Rick  
Cc: Ash, Darren  
Subject: FW: Japan nuclear accident

Rick,

Due to the large volume of e-mails and phone calls OPA received immediately after the Fukushima event, we were not doing anything with suggestions for resolving the problems going on in Japan. Now that the volume has eased quite a bit, I was thinking that OPA might respond to e-mails like the one below thanking them for their ideas and telling them we have forwarded them to the appropriate staff working the Japan event.

Could we forward these e-mails to you for those suggestions/ideas that appear reasonable and realistic? You would not be expected to respond back since we would have already done that.

Beth Hayden

-----Original Message-----

From: Lonnie Reed [REDACTED] (b)(6)  
Sent: Monday, March 28, 2011 8:46 PM

AAAA/493

To: DataQuality Resource  
Subject: Japan nuclear accident

Hello,  
I do not know specifically who to address my comment.

It seems from news reports that Japan is having trouble locating a place to store radioactive water from the plant. Why not use empty oil supertankers to hold the contaminated water. It beats releasing it to the open ocean.

Please forward my suggestion to anyone who may find the suggestion helpful.

Best regards,  
Lonnie Reed

(b)(6)

**From:** Hayden, Elizabeth  
**To:** Janbergs, Holly  
**Subject:** RE: Japan nuclear accident  
**Date:** Monday, April 04, 2011 2:27:00 PM

---

Print out the reasonable ones and put them in a blue folder on my desk and I can review them quickly.

Beth Hayden  
Senior Advisor  
Office of Public Affairs  
U.S. Nuclear Regulatory Commission  
--- Protecting People and the Environment  
301-415-8202  
elizabeth.hayden@nrc.gov

-----Original Message-----

From: Janbergs, Holly  
Sent: Monday, April 04, 2011 10:32 AM  
To: Hayden, Elizabeth  
Subject: RE: Japan nuclear accident

Do you want me to handle all inquiries this way - tell them thank you and it's been forwarded - or do you want me to continue handling some myself? I'm not sure I can identify possibly reasonable suggestions from the pile, but I can at least separate out those that are a bit out there.

-----Original Message-----

From: Hayden, Elizabeth  
Sent: Friday, April 01, 2011 5:14 PM  
To: Hasselberg, Rick  
Cc: Janbergs, Holly; Harrington, Holly; Bonaccorso, Amy  
Subject: RE: Japan nuclear accident

Will do. Thanks

Beth

-----Original Message-----

From: Hasselberg, Rick  
Sent: Friday, April 01, 2011 5:06 PM  
To: Hayden, Elizabeth  
Cc: LIA08 Hoc; RST01 Hoc; Alter, Peter  
Subject: RE: Japan nuclear accident

Beth,

Please send them to both RST01.hoc and to LIA08.hoc. thanks!

Rick

-----Original Message-----

From: Hayden, Elizabeth  
Sent: Friday, April 01, 2011 3:40 PM  
To: Hasselberg, Rick  
Cc: Ash, Darren  
Subject: FW: Japan nuclear accident

AAAA/494

Rick,

Due to the large volume of e-mails and phone calls OPA received immediately after the Fukushima event, we were not doing anything with suggestions for resolving the problems going on in Japan. Now that the volume has eased quite a bit, I was thinking that OPA might respond to e-mails like the one below thanking them for their ideas and telling them we have forwarded them to the appropriate staff working the Japan event.

Could we forward these e-mails to you for those suggestions/ideas that appear reasonable and realistic? You would not be expected to respond back since we would have already done that.

Beth Hayden

-----Original Message-----

From: Lonnie Reed [REDACTED] (b)(6)

Sent: Monday, March 28, 2011 8:46 PM

To: DataQuality Resource

Subject: Japan nuclear accident

Hello,

I do not know specifically who to address my comment.

It seems from news reports that Japan is having trouble locating a place to store radioactive water from the plant. Why not use empty oil supertankers to hold the contaminated water. It beats releasing it to the open ocean.

Please forward my suggestion to anyone who may find the suggestion helpful.

Best regards,  
Lonnie Reed

[REDACTED] (b)(6)

**From:** Nguyen, Quynh  
**To:** Oesterle, Eric; Burnell, Scott; Markley, Michael  
**Cc:** Harrington, Holly; Hayden, Elizabeth; Anderson, Brian; Meighan, Sean  
**Subject:** RE: FYI: NRR Comm Team SitRep - 3/31  
**Date:** Monday, April 04, 2011 2:18:45 PM  
**Attachments:** image001.png

---

Scott,

The Q&A Team's database is the new and improved method (and most definitely more eloquent!).

I'm going to delete the Brenner folder.

Quynh

---

**From:** Oesterle, Eric  
**Sent:** Friday, April 01, 2011 11:25 AM  
**To:** Burnell, Scott; Nelson, Robert  
**Cc:** Harrington, Holly; Hayden, Elizabeth; Anderson, Brian; Nguyen, Quynh; Meighan, Sean  
**Subject:** RE: FYI: NRR Comm Team SitRep - 3/31

Scott,

The SharePoint folder that you are referring to is on the NRR TA SharePoint page and only contains documents dated 3/16/11. The Q&As that we in NRR DORL have been sending to you requesting OPA approval have developed after 3/16/11. I'm thinking the "Eliot Brenner" folder that you are referring to has probably been overtaken by events and have been superseded by NRR's development of the Q&A database in NELSONs link below. I'll ask Quynh to confirm my assessment....Quynh? We have not been using the "Eliot Brenner" folder for the NRR Q&A database. Are you suggesting that perhaps we should or use something like it?

*Eric*

Eric R. Oesterle  
NRR Communications Team  
Senior Policy Analyst (NRO/DNRL)  
U.S. Nuclear Regulatory Commission  
301-415-1365

---

**From:** Burnell, Scott  
**Sent:** Friday, April 01, 2011 11:00 AM  
**To:** Nelson, Robert; Oesterle, Eric  
**Cc:** Harrington, Holly; Hayden, Elizabeth; Anderson, Brian  
**Subject:** RE: FYI: NRR Comm Team SitRep - 3/31

Bob, Eric;

Just a couple of clarifying points –

You're e-mailing me with all requests to approve documents, correct? Apparently there's some sort of Sharepoint folder that says "awaiting Eliot Brenner's approval" or something, and that's causing confusion.

AAA/495



If you're coming directly to me (or Beth or Holly or Brian) for OPA concurrence on these documents, I would think having a folder labeled "for OPA approval" would work better.

Your thoughts? Thanks.

Scott

**From:** Nelson, Robert

**Sent:** Thursday, March 31, 2011 3:15 PM

**To:** Leeds, Eric; Grobe, Jack; Boger, Bruce; LIA06 Hoc; Steger (Tucci), Christine; Landau, Mindy; Roberts, Darrell; Kennedy, Kriss; Lara, Julio; Croteau, Rick; Burnell, Scott; Bahadur, Sher; Blount, Tom; Brown, Frederick; Cheok, Michael; Evans, Michele; Ferrell, Kimberly; Galloway, Melanie; Giitter, Joseph; Givvines, Mary; Hiland, Patrick; Holian, Brian; Howe, Allen; Lee, Samson; Lubinski, John; McGinty, Tim; Quay, Theodore; Ruland, William; Skeen, David; Thomas, Brian; Westreich, Barry

**Cc:** Burkhardt, Janet; Orf, Tracy; Broaddus, Doug; Campbell, Stephen; Carlson, Robert; Chernoff, Harold; Kulesa, Gloria; Markley, Michael; Pascarelli, Robert; Salgado, Nancy; Simms, Sophonia; Wall, Scott; Guzman, Richard; Lyon, Fred; Meighan, Sean; Nguyen, Quynh; Oesterle, Eric; Polickoski, James; Tam, Peter; Thomas, Eric

**Subject:** FYI: NRR Comm Team SitRep - 3/31

1. NRR Q&A database is up & running. **Try it, you'll like it!** Link:

<http://portal.nrc.gov/edo/nrr/dorl/japan/Shared%20Documents/Questions%20and%20Answers.aspx>

All have read access. Updates limited to selected NRR/DORL staff. Suggested additional Qs & As should be sent to Mike Markley & Eric Oesterle

Kudos to Mike Markley, Tracey Orf, Eric Oesterle & Janet Burkhardt for their ingenuity, creativity and efforts to envision and develop this tool in a very short period of time while managing the overall NRR Q&A process.

2. Met with Mindy Landau and her staff to coordinate communication activities.
3. Updated/developed 3 EPZ Qs & As; added to the database.
4. Continued to work with Eric Leeds on NGA presentation for 4/4.
5. Heads-Up: We got another expansive FOIA, this one from Greenpeace.
6. Short turnaround green tickets are beginning to impact licensing activities. Details to follow in e-mail with narrower distribution.

*Robert Nelson*

Robert A. Nelson

NRR External Communications Coordinator, Japan Event

Deputy Director


Division of Operating Reactor Licensing

Office of Nuclear Reactor Regulation



E-mail: [robert.nelson@nrc.gov](mailto:robert.nelson@nrc.gov) | Office: (301) 415-1453 | Cell: (b)(6) | Fax: (301) 415-2102

PS I turn 61 on Sunday

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

**From:** Brenner, Eliot  
**To:** Hayden, Elizabeth  
**Subject:** FW: Press Briefing by JP and int'l officials on Japan, April 4, 2011  
**Date:** Monday, April 04, 2011 4:26:56 PM

---

summary of press conference by Iaea so you know what went on.

eliot

---

**From:** Hall-Godfrey, Jennifer J [Hall-GodfreyJJ@state.gov]  
**Sent:** Monday, April 04, 2011 4:23 PM  
**To:** Hall-Godfrey, Jennifer J  
**Subject:** Fw: Press Briefing by JP and int'l officials on Japan, April 4, 2011

Chairman Jaczko put in a marathon session, doing back-to-back evening Fukushima briefings with member states and the press. His remarks focused on U.S. support for Japan, U.S. domestic safety review, and support for international safety discussions. Summary from the press briefing below. Journalists appeared to pick up on his statement that U.S. nuclear power plants are safe. Journalists were keen to question Japanese regulatory officials present, and appreciative of Agency efforts to convene the briefing.  
Sent from my BlackBerry.

---

**From:** Bednarzek, Wolfgang A  
**To:** Vienna UNVIE Americans - No Internet Addresses  
**Sent:** Mon Apr 04 22:03:47 2011  
**Subject:** Press Briefing by JP and int'l officials on Japan, April 4, 2011

---

**From:** Wolfgang Bednarzek [redacted] (b)(6)  
**To:** Bednarzek, Wolfgang A; simon.morgan@afp.com <simon.morgan@afp.com>  
**Sent:** Mon Apr 04 22:00:25 2011  
**Subject:** Expert Briefing Japan, April 4, 2011

### **Press Briefing**

#### **IAEA Press Room**

**April 4, 2011**

Koichiro Nakamura, NISA

Shinichi Kawarada, MEXT

Gregory Jaczko, NRC

Jukka Laaksonen, WENRA

Andrej Stritar, ENSREG

Denis Flory, IAEA

AAA/496

Start 20:43

**Flory**, I would like to explain, how the panel was chosen. The panel members were chosen along firsthand information and initial safety measures in Japan and US. US has the same sort of nuclear reactors as Japan. The EU was added in its character as laboratory for stress tests also with issues like harmonizing stress tests and harmonizing safety.

**Nakamura**, (1.50) thank you etc., during the session I explained the current situation at the Fukushima Daichi power station, specifically the question of the specific events covering unit 1 to 3, and the measures we have taken and also I explained the situation at the spent fuel pools from Unit 1 to 4. As far as environmental monitoring goes I explained what measurements we came up with. In the concluding remarks I mentioned that we would like to gather all possible expertise from home and abroad to overcome this serious accident. Also the Future we would like to analyze all the causes and specific measures taken and this information will be used to improve the safety measures. So during that whole process I would like to provide all information in a transparent manner.

During the second part of the session I explained that the immediate safety measures taken for the other nuclear power plants. So on 30 March the NISA notified the operators urging them to improve safety measures. Even in the wake of the Tsunami we made efforts to avoid loss of all AC power and avoid damage of all reactors and spent fuel pools. NISA urged the operators to take all safety measures.

**Kawarada**, (7.40), I explained about offsite monitoring activities. In the area within 20 to 40 km radius we have conducting very active monitoring activities and made all data public. As for the monitoring of the ocean we have done that 30 km off the Fukushima Daichi Nuclear Power Plant. Also we have been conducting the aerial monitoring by aircraft. Besides the monitoring activities at the vicinity of the power plants we have been conducting throughout Japan using the monitoring posts placed throughout Japan and publishing the data.

**Jaczko**, we have tremendous sympathy for the people of Japan struggling with the effects of the disaster. NRC has dispatched a group of technical experts to communicate with JP colleagues and provide advice, part of larger team to help with a very difficult situation. Because of similarities of design and of possibilities of similar disasters in US we ask question. We believe US plants are safe, but we are a learning organization and we are looking into additional possible measures. Short term quick look review, 90 days, then longer review with more indepth info. The efforts to address the situation are really international. We try to provide good communications with each other, effective and efficient. The IAEA has an important role to play to facilitate this information sharing. I want to commend DG Amano for June Conference announcement and we are pleased to

support this. Good regulatory systems can ensure plants operate safely.

**Laaksonen** (13.20) We just completed European review in response to Fukushima accident, separately in each country, started soon after the accident, second one peer review on European level, both processes are "stress tests". What do we mean by this, defined by targeted reassessment of safety of nuclear power plants in light of Fukushima incident. Will be based on existing engineering judgement how nuclear power plants will behave in challenging information. Aim not public confirmation, rather finding further safety improvement measures. Results will have provision for technical and organizational measures for each country. It's very plant specific, plants are different, hazards, too.

**Stritar** (16.00), I am the chair of the ENSEG, we were charged by the EU Council to prepare stress test. We have initiated very tight cooperation with WENRA. Two weeks ago technical work started, to be finished in a month or so, 12 May ENSEG regular meeting, stress test results expected, to be handed over to Commission. It is of course our main principle that we should improve. We must learn lessons and improve in all possible ways. (18.00)

#### **Q&A**

**Jahn, AP**, to Japanese members of the panel, in this meeting, did you provide new information?

**Nakamura**, I should say there was new information. As for the Tsunami TEPCO had certain assumptions how the Tsunami could hit. The assumption was 5,7 meters. Against that assumption the actual height, although not officially published, was 14 meters. This information was provided during this meeting.

**Jahn**, thank you, but I would like to repose the question, was there more info beyond that

**Jaczko**, (21.30) we have had reps in Tokyo in Industry and also in NISA, and the purpose is get information, a lot of information I saw today was consistent with this information. It takes time to get information. Good information assessment takes time and we need to invest time in this.

**Laaksonen**, we feel that we got a very accurate picture, there were no surprises from today. As an expert we can distinguish credible from non-credible information, and the info we have been receiving is sure good information.

**Stritar**, concurs, got from today a nicely organized presentation, did not receive more but better presented information

**Tirone, Bloomberg**, (ca. 23.00) clarification for Nakamura, question Jaczko. What do we know about neutron absorbers in spent fuel ponds. What was the date when boric acid was mixed with seawater, is TEPCO doing continuing monitoring of Neutron. Are NRC experts categorically eliminating re-criticality?

**Nakamura**, boric acid was injected, defers to TEPCO

**TEPCO official**, to the reactor core it has been injected, but not to the spent fuel pool. To the spent fuel we could steadily inject water, so far not detected neutrons.

**Jaczko**, we don't have any evidence of recriticality, our focus is helping the Japanese colleagues

**Laakonen**, you don't need to monitor neutron to see re-criticality, full spectrum of fission products will be seen by spectrometer.

***Dahl, Reuters*** (26:50), dumping of low radioactive water, how much water is planned to be dumped, for how long.

**Nakamura**, (27.25), when I am here in Vienna I get the latest data from Japan, according to this data. This is the report from TEPCO. As you know there are stagnant water with high activity in Unit 2. In order for us to restore this water in a stable manner, we need to move it into the centralized waste storage. In that dumping place there is already the contaminated water of 10.000 tons. We need to further discharge this water which is low level radioactive. On top of that in Unit 5, 6 there are underground water accumulated with low radioactivity, but water in drain pit of unit 5 and 6 needs to be removed as well. This ground water 1500 ton plus another 10.000 tons, total to discharge 11500 tons. This fact has been recorded from TEPCO to NISA and we concluded that this measure is indispensable to avoid more serious risk.

***Dahl, Reuters***, how long will this take

**Nakamura** (32.00) I haven't heard how long it will take.

***EFE***, what does low level radiation mean for the general public, and where will this water end up, does this affect the Philippines or other countries in the Pacific. Are TEPCO open for help from France or Germany?

**Nakamura** (33.37), regarding the low level waste, we haven't a specific numbers for this. We are making the estimations what sort of impact to the environment when we discharge the water. If these low level of radioactive waste water is discharged we are making estimations of the impact, specifically assuming that people eat fish and seaweed every day. We expect a 0.6 Millisievert per year threshold is taken into account. Based upon the regulatory law for reactors the threshold is 1 Millisievert per year, so we don't see a problem with the discharge. We have been contacting the Ocean monitoring, we continue to monitor and try to increase points and frequency of monitoring. We instructed TEPCO to strengthen monitoring activities.

**Laaksonen**, when we talk about such discharge, we have to understand, that seawater has a lot of radioactivity already. The total radioactivity will not be raised. You can detect

certain radionuclide in Fish or other foodstuff, but it won't damage. We have experience from Baltic Sea after Chernobyl, we know what happened there and we don't see any radioactivity in the Fish or other sea products.

Nakamura (39.45) and to your second question about the overseas assistance. For example a country like the US, specifically NRC, we have received assistance and support and expertise provided from the very beginning of the accident. As Chairman Jaczko said, we have been accepting such support. Also, France, specifically AREVA provided us with radioactive gear and other equipment. From Germany we got I think concrete pumping vehicle which is used for injecting water into the spent fuel pool. AS you know, we have taken support and cooperation from IAEA and we have also been provided from many countries help, e.g. from governments and institutions and from private companies.

*China Central Television*, (43.10), what are the criteria for Japanese government how to choose assistance from other countries. The IAEA DG says frequently he can only suggest, how does Japan judge what advice to take. Also, please provide a conclusion, lessons learned one month after the accident.

Kawarada (44.50), as you pointed we were offered various suggestions and proposals from IAEA and other countries, and we are very open to accept, but we as Japanese government have to take the decision taking into account offers.

Nakamura (45.55), as you pointed out, in the wake of the earthquake and Tsunami, a certain period elapsed, the cause of the accident was more severe than our assumptions, during this period we have taken various measures in order to maintain cooling functions, specifically U1 to 3, and also for spent fuel pools U1 to 4. In the meantime we switched from the seawater injection to the freshwater injection and used fire extinguishing line that we switched over to power operated motors. We have made progress in this regard and we have now stable cooling functions, so these units are now under control. We should of course apply the cold shut down to all reactors and as far as the spent fuel pool goes we would like to put the SFP into long term stability. For that end we need to restore the cooling system for all reactors – therefore the need to restore all power supply. The restauration of power, the power is now running to the main power center, and in order to restore cooling system function we first have to establish the health of the equipment, including pumps and other equipment. Of course It will take a long time to proceed with the entire process, specifically the power is now in the central control room, however there is no power or lighting on the site. The workers have to work under high levels of radiation. And lots of debris is hindering work. On top of that we have experienced several times per day aftershocks. All this makes our work very difficult and why it has been taking a very long time. (53.02) We have to ensure the long time stability and SFP's. At the same time we have to seal to avoid radioactive material release.

Flory (54.50), we all know that this accident should not have happened, something had not

done in the very beginning, but we can learn lessons from this. Everyday I see data which does not make sense, because the measurement systems probably have been changed during the accident. We start the process of learning today, in a more formal way on June 20. Again there will be many issues addressed – design, mitigation, emergency preparedness, safety standards. We do not have the answers today.

**MacLaughlin, Platts**, DG Amano mentioned he wanted to send an expert Mission to evaluate the situation. Has the JP government agreed to do this? Mr. Jaczko you said you believed US power plants are safe. Mr. Laakonen and Mr. Stritar, can you say the same about EU power plants?

**Nakamura**, (57.10), I understand the offer of a IAEA review mission. Having said that I am not aware of the details. Discussions within the Japanese government are underway. However I like to add the General Comment from myself. IAEA is such an advanced institution with high expertise and transparency. It is very important to have evaluation and assessment by the IAEA and/or the expert group organized by the IAEA.

**Laakonen**, I cannot speak on behalf of other regulators. I am confident Finland plants are safe.

**Stritar**, this is an important question, and this is maybe how the stress tests are misunderstood. The question is not are plants safe. They would not be licensed if they were not safe. The question is to make them even safer.

**End: 21:45**



**Lee, Richard**

---

**From:** Phillip J Finck [Phillip.Finck@inl.gov]  
**Sent:** Monday, April 04, 2011 5:30 PM  
**To:** Richard L Garwin  
**Cc:** DL-NITsolutions  
**Subject:** Re: Fw: Cooling Fukushima Daiichi reactors through the steel head of the drywell?

Nam is working on it right now

Phillip J. Finck, Associate Laboratory Director  
Nuclear Science & Technology  
Idaho National Laboratory

Telephone: 208-526-9447

Cell Phone: (b)(6)

Ex 2

Fax Number: 208-526-2930

Richard L Garwin <rlg2@us.ibm.com>

To DL-NITsolutions <DL-NITsolutions@nnsa.doe.gov>

cc

04/04/2011 03:29 PM

Subject Fw: Cooling Fukushima Daiichi reactors through the steel head of the drywell?

Earlier communications on this point, folks.

Dick Garwin

----- Forwarded by Richard L Garwin/Watson/Contr/IBM on 04/04/2011 05:10 PM -----

**From:** Richard L Garwin/Watson/Contr/IBM  
**To:** Nam T Dinh <Nam.Dinh@inl.gov>, <phillip.finck@inl.gov>  
**Cc:** "Peterson, Per" <peter@nuc.berkeley.edu>  
**Date:** 04/04/2011 12:26 PM  
**Subject:** Cooling Fukushima Daiichi reactors through the steel head of the drywell?

---

Dear Nam Dinh and Phillip Finck,

In my 03/31/2011 email to Steve Chu's "science group," I observed that "removal of the refueling plug and flooding of the top of the steel drywell liner is a real possibility. But needs to analyze the heat transfer impedance by a permanent gas bubble in the drywell."

So I am asking you or others at INL to carry out such a preliminary analysis. I have a good deal of experience in this field, because in the 1950s I published some work on "thermal rectifiers" which actually pertained to the temperature range below 2 degrees Kelvin, using superfluid helium. But my analogy in the presentations was to the ordinary pressure cooker, or lidded saucepan, in which heating from below transferred heat very effectively from the water and steam to the lid, but heating from above would simply melt the lid.

In the case of the steel containment liner of the BWR, we certainly have heating to generate steam, but the question is the

impedance presented by a hydrogen bubble to the condensation of steam on the inside of the lid of the containment liner.

Evidently one could remove the concrete refueling plugs, and that space is intended to be flooded with water, so that is not, in principle, a problem. Any openings in the rubber seal could be plugged by shredded polyethylene garbage bags, which would then be held in place by the hydrostatic pressure in the refueling well. And the steam from that pool will be clean and could perfectly well be vented to the atmosphere.

But the question is what needs to be done to vent any permanent gas. Is there a valve at the top of the liner dome?

If there is no valve, I can envision boring a hole with a sealed tool, and threading in such a valve that could be controlled mechanically or preferably pneumatically/hydraulically from the outside.

Now that TEPCO really seems to be moving on procuring 10,000 ton tanks and barges, perhaps they would be receptive to an analysis of long-term cooling through the metal containment dome.

I look forward to anything you can provide me/us on this score.

Thanks very much.

Dick Garwin

\*\*\*\*\*

----- Forwarded by Richard L Garwin/Watson/Contr/IBM on 04/04/2011 11:04 AM -----

From: Richard L Garwin/Watson/Contr/IBM

To: Bob Budnitz <rbudnitz@lbl.gov>, "Adams, Ian" <Ian.Adams@Hq.Doe.Gov>

Cc: "Brinkman, Bill" <Bill.Brinkman@science.doe.gov>, "Narendra, Blake" <Blake.Narendra@nnsa.doe.gov>, "Hurlbut, Brandon" <Brandon.Hurlbut@Hq.Doe.Gov>, "Sheron, Brian" <Brian.Sheron@nrc.gov>, "Butnitz, Bob" <(b)(6)>, "Smith, Haley" <Haley.Smith@Hq.Doe.Gov>, "McFarlane, Harold" <harold.mcfarlane@inl.gov>, "Adams, Ian" <Ian.Adams@Hq.Doe.Gov>, "Kelly, John E (NE)" <JohnE.Kelly@Nuclear.Energy.Gov>, "Grossenbacher, John (INL)" <john.grossenbacher@inl.gov>, "Pitzer, Karrie S." <(b)(6)>, "Chambers, Megan (S4)" <Megan.Chambers@science.doe.gov>, "Owens, Missy" <Missy.Owens@Hq.Doe.Gov>, "Miller, Neile" <Neile.Miller@nnsa.doe.gov>, "Fitzgerald, Paige" <Paige.Fitzgerald@Hq.Doe.Gov>, "Peterson, Per" <peterson@nuc.berkeley.edu>, "Lyons, Peter" <Peter.Lyons@Nuclear.Energy.Gov>, "Finck, Phillip" <phillip.finck@inl.gov>, <(b)(6)>, "Lee, Richard (NRC)" <Richard.Lee@nrc.gov>, "Budnitz, Bob" <RBudnitz@lbl.gov>, "Szilard, Ronaldo" <ronaldo.szilard@inl.gov>, <(b)(6)>, "Aoki, Steven" <Steven.Aoki@nnsa.doe.gov>, "Binkley, Steve" <Steve.Binkley@science.doe.gov>, "Mustin, Tracy" <Tracy.Mustin@nnsa.doe.gov>

Date: 03/31/2011 06:04 PM

Subject: RE: Nuclear science group call - Today at 4:00pm EDT

---

The Millstone-1 BWR refueling plugs just lie in place, according to this response from Millstone.

So removal of the plug and flooding of the top of the steel drywell liner is a real possibility. But need to analyze the heat transfer impedance by a permanent gas bubble in the drywell.

Dick Garwin

\*\*\*\*\*

----- Forwarded by Richard L Garwin/Watson/Contr/IBM on 03/31/2011 06:03 PM -----

From: Skip J Jordan <skip.j.jordan@dom.com>

To: Richard L Garwin/Watson/Contr/IBM@IBMUS

Cc: Jeff D Semancik <jeff.d.semancik@dom.com>, "SChu@hq.doe.gov" <SChu@hq.doe.gov>

Date: 03/31/2011 05:42 PM

Subject: RE: Urgent question.

Dick,

The shield plugs above the reactor head were interlocking and stepped out slightly in diameter to fit into place. The Refueling Deck crane on the 108 foot level was capable of removing the shield blocks.

**From:** Richard L Garwin [<mailto:rlg2@us.ibm.com>]  
**Sent:** Thursday, March 31, 2011 4:51 PM  
**To:** Skip J Jordan (Generation - 6)  
**Cc:** Jeff D Semancik (Generation - 4); SChu@hq.doe.gov  
**Subject:** Urgent question.

Skip, regarding the shield plug above the reactor head. These need to be removed for refueling; are they bolted down or can they just be lifted by the main crane (or a massive construction crane)?

Thanks very much.

Dick Garwin

**From:** RST01 Hoc  
**To:** Hayden, Elizabeth  
**Cc:** RST09 Hoc; RST08 Hoc  
**Subject:** RE: Request for comment - WSJ  
**Date:** Monday, April 04, 2011 8:58:13 AM

---

We don't have any information on the level of radioactivity or the decision for release.

Assuming the news reports are correct, we would presume that it is lower level radioactivity water to allow room for higher level radioactivity water to be collected.

-----Original Message-----

From: Hayden, Elizabeth  
Sent: Monday, April 04, 2011 8:22 AM  
To: RST01 Hoc  
Subject: FW: Request for comment - WSJ

Do we have any knowledge of the level of radioactivity of this water or whether the U.S. Govt/NRC was consulted with regard to TEPCO's decision to release this water? We likely will not comment on this action, but I would like to know what we know about it and any health impacts expected.

Beth Hayden  
Senior Advisor  
Office of Public Affairs  
U.S. Nuclear Regulatory Commission  
--- Protecting People and the Environment  
301-415-8202  
elizabeth.hayden@nrc.gov

-----Original Message-----

From: Brenner, Eliot  
Sent: Monday, April 04, 2011 8:14 AM  
To: Power, Stephen  
Cc: Hayden, Elizabeth  
Subject: RE: Request for comment - WSJ

I am in Vienna with the boss. I doubt that we would comment on a decision by a foreign government on how to handle its own crisis, but I will pass this on to Beth who is holding down the fort.

Eliot

---

From: Power, Stephen [Stephen.Power@wsj.com]  
Sent: Monday, April 04, 2011 8:01 AM  
To: Brenner, Eliot  
Subject: Request for comment - WSJ

Is it possible to get a comment from NRC on Tepco's decision to dump radioactive water in the ocean? Was the US gov't consulted on this?

I'm at (b)(6) Thanks.

SP

DJ Tepco to Release Radioactive Water into Ocean TOKYO (Dow Jones)--Tokyo Electric Power Co. (9501.TO), the operator of the quake-hit Fukushima Daiichi nuclear complex, said Monday that it will release 11,500 tons of low-level radioactive water into the Pacific Ocean, as part of an effort to speed

AAAA/488

up the draining of the nuclear facility. The Nuclear and Industrial Safety Agency, Japan's nuclear watchdog, endorsed the plan, saying it is "an inevitable measure." Under the plan, Tepco will release 10,000 tons of low-level radioactive water that has flooded a radioactive waste processing facility at the plant following the magnitude 9.0 earthquake and tsunami on March 11. Tepco wants to drain the facility and use it to store highly radioactive water currently in the basement of the turbine building at the plant's No. 2 reactor. Tepco will also release a total of 1,500 tons of water that has been collected underneath Reactors Nos. 5-6 through seepage. Such water is normally pumped out to prevent it from reaching the reactor buildings, but has been left to accumulate in the aftermath of the earthquake. -By Mitsuru Obe, Dow Jones Newswires; 813-6269-2785; mitsuru.ob@dowjones.com (END) Dow Jones Newswires April 04, 2011 05:23 ET (09:23 GMT)\_\_\_\_\_

-----  
Sent using BlackBerry

**From:** Hayden, Elizabeth  
**To:** RST01 Hoc  
**Subject:** RE: Request for comment - WSJ  
**Date:** Monday, April 04, 2011 9:13:00 AM

---

Thank you.

Beth Hayden  
Senior Advisor  
Office of Public Affairs  
U.S. Nuclear Regulatory Commission  
--- Protecting People and the Environment  
301-415-8202  
elizabeth.hayden@nrc.gov

-----Original Message-----

From: RST01 Hoc  
Sent: Monday, April 04, 2011 8:58 AM  
To: Hayden, Elizabeth  
Cc: RST09 Hoc; RST08 Hoc  
Subject: RE: Request for comment - WSJ

We don't have any information on the level of radioactivity or the decision for release.

Assuming the news reports are correct, we would presume that it is lower level radioactivity water to allow room for higher level radioactivity water to be collected.

-----Original Message-----

From: Hayden, Elizabeth  
Sent: Monday, April 04, 2011 8:22 AM  
To: RST01 Hoc  
Subject: FW: Request for comment - WSJ

Do we have any knowledge of the level of radioactivity of this water or whether the U.S. Govt/NRC was consulted with regard to TEPCO's decision to release this water? We likely will not comment on this action, but I would like to know what we know about it and any health impacts expected.

Beth Hayden  
Senior Advisor  
Office of Public Affairs  
U.S. Nuclear Regulatory Commission  
--- Protecting People and the Environment  
301-415-8202  
elizabeth.hayden@nrc.gov

-----Original Message-----

From: Brenner, Eliot  
Sent: Monday, April 04, 2011 8:14 AM  
To: Power, Stephen  
Cc: Hayden, Elizabeth  
Subject: RE: Request for comment - WSJ

I am in Vienna with the boss. I doubt that we would comment on a decision by a foreign government on how to handle its own crisis, but I will pass this on to Beth who is holding down the fort.

Eliot

AAAA/499

From: Power, Stephen [Stephen.Power@wsj.com]  
Sent: Monday, April 04, 2011 8:01 AM  
To: Brenner, Eliot  
Subject: Request for comment - WSJ

Is it possible to get a comment from NRC on Tepco's decision to dump radioactive water in the ocean?  
Was the US gov't consulted on this?

I'm at (b)(6) Thanks.

SP

DJ Tepco to Release Radioactive Water into Ocean TOKYO (Dow Jones)--Tokyo Electric Power Co. (9501.TO), the operator of the quake-hit Fukushima Daiichi nuclear complex, said Monday that it will release 11,500 tons of low-level radioactive water into the Pacific Ocean, as part of an effort to speed up the draining of the nuclear facility. The Nuclear and Industrial Safety Agency, Japan's nuclear watchdog, endorsed the plan, saying it is "an inevitable measure." Under the plan, Tepco will release 10,000 tons of low-level radioactive water that has flooded a radioactive waste processing facility at the plant following the magnitude 9.0 earthquake and tsunami on March 11. Tepco wants to drain the facility and use it to store highly radioactive water currently in the basement of the turbine building at the plant's No. 2 reactor. Tepco will also release a total of 1,500 tons of water that has been collected underneath Reactors Nos. 5-6 through seepage. Such water is normally pumped out to prevent it from reaching the reactor buildings, but has been left to accumulate in the aftermath of the earthquake. -By Mitsuru Obe, Dow Jones Newswires; 813-6269-2785; mitsuru.ob@dowjones.com (END) Dow Jones Newswires April 04, 2011 05:23 ET (09:23 GMT)

-----  
Sent using BlackBerry

**Lee, Richard**

---

**From:** Lee, Richard  
**Sent:** Monday, April 04, 2011 4:26 PM  
**To:** Gibson, Kathy  
**Subject:** RE: N2 inerting of the Fukushima drywell  
**Attachments:** image001.jpg

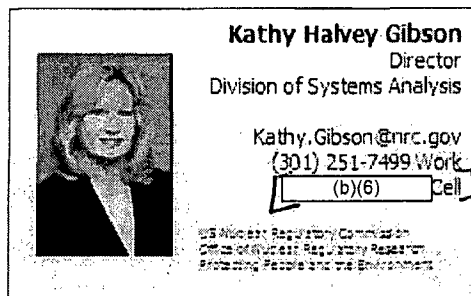
I did not inform Op Center formally. Should I?

Indirectly, I told Hossein, Mike Salay, Jason, Charlie, Don Helton and Don Marksberry. Hossein who will be on duty today (from 3:00-11:00pm) and will inform the RST.

---

**From:** Gibson, Kathy  
**Sent:** Monday, April 04, 2011 1:42 PM  
**To:** Lee, Richard  
**Subject:** RE: N2 inerting of the Fukushima drywell

Does the Ops Center know?



---

**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).

AAAA/500