From: Brandon, Lou
Sent: Wednesday, March 16, 2011 2:55 AM
To: PMT09 Hoc
Subject: FW: Fukushima question

-----Original Message-----
From: Grose, Andy M.E. CIV [mailto:(b)(6)]
Sent: Tuesday, March 15, 2011 3:17 PM
To: Brandon, Lou
Cc: PMT09 Hoc; PMT02 Hoc; PMT11 Hoc; Witzel, Mark Lt Col/USAF; Meris, Ronald CIV
Subject: RE: Fukushima question

Lou,

(b)(5)

>>-----Original Message-----
>>From: Nasstrom, John S. [mailto:Nasstrom1@llnl.gov]
>>Sent: Sunday, March 13, 2011 11:23
>>To: (b)(6)
>>Cc: 'narac@llnl.gov'
>>Subject: RE: Japan

>>
>>Michael,
>>

(b)(5)

>>
>>NARAC
>>
>>-----Original Message-----
>>From: (b)(6)
>>[mailto: (b)(6)
>>Sent: Sunday, March 13, 2011 6:49 AM
>>To: narac-web-spt@aquinas.llnl.gov
>>Subject: Japan
>>
>>[Request from Michael Phillips (phillips2) through the IMAAC web.
>>Please respond in a timely manner.]
>>
>>
>>If you have anything on the Japan Reactors, may I have access.

(b)(5)

Let me know if you have any further questions. We have a product that we have been sending out to our DoD customers about every 6-9 hours; not sure if they have been distributed outside DoD or not, but I can check if you'd like.

Andy

****
Andy Grose, Ph.D.
DTRA RD-ISR
8725 John J. Kingman Rd. MSC 6201
Fort Belvoir, VA 22060-6201
(703) 767-4260 (DSN 427-)

(b)(6)

****

-----Original Message-----
From: Brandon, Lou [mailto:Lou.Brandon@nrc.gov]
Sent: Tuesday, March 15, 2011 8:14 AM
To: Grose, Andy M.E. CIV
Cc: PMT09 Hoc; PMT02 Hoc; PMT11 Hoc
Subject: Fukushima question

Andy,

(b)(5)

(b)(5)

I'm going off shift until 11 PM, but any insights can be shared with our Protective Measures Teams at the email addresses copied.

Thanks.

Lou

Lou Brandon, CHP

PMT and RASCAL Program Manager

NRC, NSIR, Incident Response

Mail Stop: T4A43

Washington, DC 20555-0001

301-415-8013

From: Brandon, Lou
Sent: Wednesday, March 16, 2011 2:52 AM
To: PMT09 Hoc
Subject: FW: Advisory Team Conference Call - March 14, 2011 - 2:00 PM (EDT)

From: OLaughlin, Colleen [mailto:OLaughlin@nv.doe.gov]
Sent: Tuesday, March 15, 2011 1:26 PM
To: 'ron.graham@fsis.usda.gov'; 'cym3@cdc.gov'; 'gfn6@cdc.gov'; 'jva2@cdc.gov'; 'asa4@cdc.gov'; Brandon, Lou; 'mdb7@cdc.gov'; 'brozowski.george@epa.gov'; 'ozl6@cdc.gov'; 'pac4@cdc.gov'; 'james.cherniack@fda.hhs.gov'; 'Gordon.s.cleveland@aphis.usda.gov'; 'ccc8@cdc.gov'; 'william.cunningham@fda.hhs.gov'; 'decair.sara@epa.gov'; 'gyf7@cdc.gov'; 'rachel.evans@fda.hhs.gov'; 'rjf8@cdc.gov'; 'goodman.roger@epa.gov'; 'patricia.hansen@fda.hhs.gov'; 'scotty.hargrave@fda.hhs.gov'; 'ezh7@cdc.gov'; 'vinetta.howardking@fda.hhs.gov'; 'jablonowski.eugene@epa.gov'; 'John.Jensen@dm.usda.gov'; 'terri.jones@fda.hhs.gov'; 'ldk4@cdc.gov'; 'liles.darrell@epa.gov'; 'wgl0@cdc.gov'; 'Scott.Lough@ams.usda.gov'; 'carmen.maher@fda.hhs.gov'; Mena, Rajah M (NST); 'emorriso@ora.fda.gov'
Cc: CMHT (HQ); NITOPS (HQ)
Subject: Re: Advisory Team Conference Call - March 14, 2011 - 2:00 PM (EDT)

An interagency plan to share plume models is being worked and has to be approved up the chain of command. Please stand by.
Colleen O'Laughlin from BB

From: OLaughlin, Colleen
To: 'ron.graham@fsis.usda.gov' <ron.graham@fsis.usda.gov>; 'cym3@cdc.gov' <cym3@cdc.gov>; 'gfn6@cdc.gov' <gfn6@cdc.gov>; 'jva2@cdc.gov' <jva2@cdc.gov>; 'asa4@cdc.gov' <asa4@cdc.gov>; 'lkb1@nrc.gov' <lkb1@nrc.gov>; 'mdb7@cdc.gov' <mdb7@cdc.gov>; 'brozowski.george@epa.gov' <brozowski.george@epa.gov>; 'ozl6@cdc.gov' <ozl6@cdc.gov>; 'pac4@cdc.gov' <pac4@cdc.gov>; 'james.cherniack@fda.hhs.gov' <james.cherniack@fda.hhs.gov>; 'Gordon.s.cleveland@aphis.usda.gov' <Gordon.s.cleveland@aphis.usda.gov>; 'ccc8@cdc.gov' <ccc8@cdc.gov>; 'william.cunningham@fda.hhs.gov' <william.cunningham@fda.hhs.gov>; 'decair.sara@epa.gov' <decair.sara@epa.gov>; 'gyf7@cdc.gov' <gyf7@cdc.gov>; 'rachel.evans@fda.hhs.gov' <rachel.evans@fda.hhs.gov>; 'rjf8@cdc.gov' <rjf8@cdc.gov>; 'goodman.roger@epa.gov' <goodman.roger@epa.gov>; 'patricia.hansen@fda.hhs.gov' <patricia.hansen@fda.hhs.gov>; 'scotty.hargrave@fda.hhs.gov' <scotty.hargrave@fda.hhs.gov>; 'ezh7@cdc.gov' <ezh7@cdc.gov>; 'vinetta.howardking@fda.hhs.gov' <vinetta.howardking@fda.hhs.gov>; 'jablonowski.eugene@epa.gov' <jablonowski.eugene@epa.gov>; 'John.Jensen@dm.usda.gov' <John.Jensen@dm.usda.gov>; 'terri.jones@fda.hhs.gov' <terri.jones@fda.hhs.gov>; 'ldk4@cdc.gov' <ldk4@cdc.gov>; 'liles.darrell@epa.gov' <liles.darrell@epa.gov>; 'wgl0@cdc.gov' <wgl0@cdc.gov>; 'Scott.Lough@ams.usda.gov' <Scott.Lough@ams.usda.gov>; 'carmen.maher@fda.hhs.gov' <carmen.maher@fda.hhs.gov>; Mena, Rajah M (NST); 'emorriso@ora.fda.gov' <emorriso@ora.fda.gov>
Cc: CMHT (HQ); NITOPS (HQ)
Sent: Tue Mar 15 10:14:48 2011
Subject: Re: Advisory Team Conference Call - March 14, 2011 - 2:00 PM (EDT)

Please see response from NIT ops.

All products will be distributed through the NIT, not through CMWeb. A new product is pending. Our leadership is coordinating an interagency NARAC distribution plan.

Colleen O'Laughlin from BB

From: OLaughlin, Colleen
To: 'ron.graham@fsis.usda.gov' <ron.graham@fsis.usda.gov>; 'cym3@cdc.gov' <cym3@cdc.gov>; 'gfn6@cdc.gov' <gfn6@cdc.gov>; 'jva2@cdc.gov' <jva2@cdc.gov>; 'asa4@cdc.gov' <asa4@cdc.gov>; 'lkb1@nrc.gov' <lkb1@nrc.gov>; 'mdb7@cdc.gov' <mdb7@cdc.gov>; 'brozowski.george@epa.gov' <brozowski.george@epa.gov>; 'ozl6@cdc.gov' <ozl6@cdc.gov>; 'pac4@cdc.gov' <pac4@cdc.gov>; 'james.cherniack@fda.hhs.gov' <james.cherniack@fda.hhs.gov>; 'Gordon.s.cleveland@aphis.usda.gov' <Gordon.s.cleveland@aphis.usda.gov>; 'ccc8@cdc.gov' <ccc8@cdc.gov>; 'william.cunningham@fda.hhs.gov' <william.cunningham@fda.hhs.gov>; 'decair.sara@epa.gov' <decair.sara@epa.gov>; 'gyf7@cdc.gov' <gyf7@cdc.gov>; 'rachel.evans@fda.hhs.gov' <rachel.evans@fda.hhs.gov>; 'rjf8@cdc.gov' <rjf8@cdc.gov>; 'goodman.roger@epa.gov' <goodman.roger@epa.gov>; 'patricia.hansen@fda.hhs.gov' <patricia.hansen@fda.hhs.gov>; 'scotty.hargrave@fda.hhs.gov' <scotty.hargrave@fda.hhs.gov>; 'ezh7@cdc.gov' <ezh7@cdc.gov>; 'vinetta.howardking@fda.hhs.gov' <vinetta.howardking@fda.hhs.gov>; 'jablonowski.eugene@epa.gov' <jablonowski.eugene@epa.gov>; 'John.Jensen@dm.usda.gov' <John.Jensen@dm.usda.gov>; 'terri.jones@fda.hhs.gov' <terri.jones@fda.hhs.gov>; 'ldk4@cdc.gov' <ldk4@cdc.gov>; 'liles.darrell@epa.gov' <liles.darrell@epa.gov>; 'wgl0@cdc.gov' <wgl0@cdc.gov>; 'Scott.Lough@ams.usda.gov' <Scott.Lough@ams.usda.gov>; 'carmen.maher@fda.hhs.gov' <carmen.maher@fda.hhs.gov>; Mena, Rajah M (NST); 'emorriso@ora.fda.gov' <emorriso@ora.fda.gov>
Cc: CMHT (HQ)
Sent: Tue Mar 15 09:30:40 2011
Subject: Re: Advisory Team Conference Call - March 14, 2011 - 2:00 PM (EDT)

They are probably trying to evaluate who are the responders/support team of this response. Once that is clear access will not be a problem.
Colleen O'Laughlin from BB

From: Graham, Ron <Ron.Graham@fsis.usda.gov>
To: Miller, Charles W. (CDC/ONDIEH/NCEH) <cym3@cdc.gov>; Evans, Lynn (CDC/ONDIEH/NCEH) <gfn6@cdc.gov>; Anderson, Jeri L. (CDC/NIOSH/DSHEFS) <jva2@cdc.gov>; Ansari, Armin (CDC/ONDIEH/NCEH) <asa4@cdc.gov>; Brandon, Lou (NRC) <lkb1@nrc.gov>; Brooks, Michael (ATSDR/DHAC/SRAB) <mdb7@cdc.gov>; Brozowski, George (EPA) <brozowski.george@epa.gov>; Buzzell, Jennifer (CDC/ONDIEH/NCEH) <ozl6@cdc.gov>; Charp, Paul (ATSDR/DHAC/SRAB) <pac4@cdc.gov>; Cherniack, James J. (FDA/ORA/NE-FO) <james.cherniack@fda.hhs.gov>; Cleveland, Gordon (USDA) <gordon.s.cleveland@aphis.usda.gov>; Connell, Carol (ATSDR/DHAC/SRAB) <ccc8@cdc.gov>; Cunningham, William C. (FDA/CFSAN) <william.cunningham@fda.hhs.gov>; DeCair, Sara (EPA) <decair.sara@epa.gov>; Dixon, John E. (CDC/ONDIEH/NCEH) <gyf7@cdc.gov>; Evans, Rachel T. (FDA/ORA/CE-FO) <rachel.evans@fda.hhs.gov>; Funk, Renee (CDC/NIOSH/OD) <rjf8@cdc.gov>; Goodman, Roger (EPA) <goodman.roger@epa.gov>; Hansen, Patricia A. (FDA/CFSAN) <patricia.hansen@fda.hhs.gov>; Hargrave, Scotty L. (FDA/ORA/SW-FO) <scotty.hargrave@fda.hhs.gov>; Hornsby-Myers, Jennifer (CDC/NIOSH/OD) <ezh7@cdc.gov>; Howard King, Vinetta M. (FDA/OC/OCTC) <vinetta.howardking@fda.hhs.gov>; Jablonowski, Gene (EPA) <jablonowski.eugene@epa.gov>; Jensen, John (USDA) <john.jensen@dm.usda.gov>; Jones, Terri L. (FDA/ORA/P-FO) <terri.jones@fda.hhs.gov>; Keith, Sam (ATSDR/DTEM/ATB) <ldk4@cdc.gov>; Liles, Darrell (EPA) <liles.darrell@epa.gov>; Lotz, William G. (Greg) (CDC/NIOSH/DART) <wgl0@cdc.gov>; Lough, Scott (USDA) <Scott.Lough@ams.usda.gov>; Maher, Carmen T. (FDA/OC/OCS) <carmen.maher@fda.hhs.gov>; Mena, Rajah M (NST); Morrison, Ellen F. (FDA/OC/OCTC) <emorriso@ora.fda.gov>; Nemhauser, Jeffrey B. (CDC/ONDIEH/NCEH) <jfn1@cdc.gov>; Noska, Mike (FDA) <michael.noska@fda.hhs.gov>; OLaughlin, Colleen; Pavek, John (USDA) <john.pavek@wdc.usda.gov>; Pemberton, Wendy J (NST); Petch, Peter (USDA) <peter.a.petch@aphis.usda.gov>; Russo, Mark R. (FDA/OC/OCTC) <mark.russo@fda.hhs.gov>; Sincek, Jeffrey A. (FDA/ORA/CE-FO) <jeffrey.sincek@fda.hhs.gov>; Smallwood, Karen R. (FDA/ORA/SE-FO) <karen.smallwood@fda.hhs.gov>; Tupin, Ed (EPA) <tupin.edward@epa.gov>; Veal, Lee (EPA) <veal.lee@epa.gov>; Whitcomb, Robert C. (CDC/ONDIEH/NCEH) <byw3@cdc.gov>; Wiley, Albert (ORAU) <albert.wiley@orise.orau.gov>
Cc: OLaughlin, Colleen
Sent: Tue Mar 15 09:25:49 2011
Subject: RE: Advisory Team Conference Call - March 14, 2011 - 2:00 PM (EDT)

I just tried get to the Japan information on CM Web...there is a note explaining that you have to contact DOE to gain access. After I contacted DOE I was told they are evaluating who should have access to the information. (b)(5)

(b)(5)

Ron Graham
Senior Food Defense Analyst
Food Defense Assessment Staff
Office of Data Integration and Food Protection
Food Safety and Inspection Service
US Department of Agriculture

Room 409, 3rd Floor
901 D Street, Southwest
Washington, DC 20024

Email: ron.graham@fsis.usda.gov
Office: 202-690-6450
BB: (b)(6)
Fax: 202-690 6459

From: Miller, Charles W. (CDC/ONDIEH/NCEH) [mailto:cym3@cdc.gov]
Sent: Monday, March 14, 2011 12:15 PM
To: Evans, Lynn (CDC/ONDIEH/NCEH); Anderson, Jeri L. (CDC/NIOSH/DSHEFS); Ansari, Armin (CDC/ONDIEH/NCEH); Brandon, Lou (NRC); Brooks, Michael (ATSDR/DHAC/SRAB); Brozowski, George (EPA); Buzzell, Jennifer (CDC/ONDIEH/NCEH); Charp, Paul (ATSDR/DHAC/SRAB); Cherniack, James J. (FDA/ORA/NE-FO); Cleveland, Gordon (USDA); Connell, Carol (ATSDR/DHAC/SRAB); Cunningham, William C. (FDA/CFSAN); DeCair, Sara (EPA); Dixon, John E. (CDC/ONDIEH/NCEH); Evans, Rachel T. (FDA/ORA/CE-FO); Funk, Renee (CDC/NIOSH/OD); Goodman, Roger (EPA); Graham, Ron; Hansen, Patricia A. (FDA/CFSAN); Hargrave, Scotty L. (FDA/ORA/SW-FO); Hornsby-Myers, Jennifer (CDC/NIOSH/OD); Howard King, Vinetta M. (FDA/OC/OCTC); Jablonowski, Gene (EPA); Jensen, John (USDA); Jones, Terri L. (FDA/ORA/P-FO); Keith, Sam (ATSDR/DTEM/ATB); Liles, Darrell (EPA); Lotz, William G. (Greg) (CDC/NIOSH/DART); Lough, Scott (USDA); Maher, Carmen T. (FDA/OC/OCS); Mena, RaJah (DOE/FRMAC); Morrison, Ellen F. (FDA/OC/OCTC); Nemhauser, Jeffrey B. (CDC/ONDIEH/NCEH); Noska, Mike (FDA); O'Laughlin, Colleen (DOE/FRMAC); Pavek, John (USDA); Pemberton, Wendy (DOE/FRMAC); Petch, Peter (USDA); Russo, Mark R. (FDA/OC/OCTC); Sincek, Jeffrey A. (FDA/ORA/CE-FO); Smallwood, Karen R. (FDA/ORA/SE-FO); Tupin, Ed (EPA); Veal, Lee (EPA); Whitcomb, Robert C. (CDC/ONDIEH/NCEH); Wiley, Albert (ORAU)
Subject: RE: Advisory Team Conference Call - March 14, 2011 - 2:00 PM (EDT)

Please see the attached, which I prepared for the Director of the National Center for Environmental Health this morning.

REMINDER: Everyone is cautioned against using data you may find available to speculate on current and future conditions in Japan and elsewhere. There will be more discussion on this during the Advisory Team call at 2:00 PM (EDT) today.

Charles W. Miller, Ph.D.
Chief, Radiation Studies Branch
Division of Environmental Hazards and Health Effects
National Center for Environmental Health
Centers for Disease Control & Prevention; MS:F58
4770 Buford Highway NE
Atlanta, GA 30341-3717

Phone: 770-488-3725
FAX: 770-488-1539
CMiller1@cdc.gov

From: Evans, Lynn (CDC/ONDIEH/NCEH)
Sent: Monday, March 14, 2011 12:08 PM
To: Anderson, Jeri L. (CDC/NIOSH/DSHEFS); Ansari, Armin (CDC/ONDIEH/NCEH); Brandon, Lou (NRC); Brooks, Michael (ATSDR/DHAC/SRAB); Brozowski, George (EPA); Buzzell, Jennifer (CDC/ONDIEH/NCEH); Charp, Paul

(ATSDR/DHAC/SRAB); Cherniack, James J. (FDA/ORA/NE-FO); Cleveland, Gordon (USDA); Connell, Carol (ATSDR/DHAC/SRAB); Cunningham, William C. (FDA/CFSAN); DeCair, Sara (EPA); Dixon, John E. (CDC/ONDIEH/NCEH); Evans, Lynn (CDC/ONDIEH/NCEH); Evans, Rachel T. (FDA/ORA/CE-FO); Funk, Renee (CDC/NIOSH/OD); Goodman, Roger (EPA); Graham, Ron (USDA); Hansen, Patricia A. (FDA/CFSAN); Hargrave, Scotty L. (FDA/ORA/SW-FO); Hornsby-Myers, Jennifer (CDC/NIOSH/OD); Howard King, Vinetta M. (FDA/OC/OCTC); Jablonowski, Gene (EPA); Jensen, John (USDA); Jones, Terri L. (FDA/ORA/P-FO); Keith, Sam (ATSDR/DTEM/ATB); Liles, Darrell (EPA); Lotz, William G. (Greg) (CDC/NIOSH/DART); Lough, Scott (USDA); Maher, Carmen T. (FDA/OC/OCS); Mena, RaJah (DOE/FRMAC); Miller, Charles W. (CDC/ONDIEH/NCEH); Morrison, Ellen F. (FDA/OC/OCTC); Nemhauser, Jeffrey B. (CDC/ONDIEH/NCEH); Noska, Mike (FDA); O'Laughlin, Colleen (DOE/FRMAC); Pavek, John (USDA); Pemberton, Wendy (DOE/FRMAC); Petch, Peter (USDA); Russo, Mark R. (FDA/OC/OCTC); Sincek, Jeffrey A. (FDA/ORA/CE-FO); Smallwood, Karen R. (FDA/ORA/SE-FO); Tupin, Ed (EPA); Veal, Lee (EPA); Whitcomb, Robert C. (CDC/ONDIEH/NCEH); Wiley, Albert (ORAU)
Subject: Advisory Team Conference Call - March 14, 2011 - 2:00 PM (EDT)
Importance: High

The Advisory Team for Environment, Food and Health (Advisory Team) will have a conference call at 2:00 PM (EDT), today, March 14, 2011. The purpose of this call is to discuss the conditions resulting from the earthquakes in Japan.

Please use the following call-in numbers:

Advisory Team Conference Call
March 14, 2011
2:00 PM (EDT
Phone number: 866-561-4509
Pass code: (b)(6)

NOTICE: Everyone is cautioned against using data you may find available to speculate on current and future conditions in Japan and elsewhere. There will be more discussion on this during the Advisory Team call at 2:00 PM (EDT) today.

Thanks!
Lynn

D. Lynn Evans, MS
CAPT, USPHS
Centers for Disease Control and Prevention
NCEH/EHHE/Radiation Studies Branch
Mail Stop F58
4770 Buford Highway NE
Atlanta, GA 30341-3717
Phone: (770) 488-3656
Fax: (770) 488-1539
Email: gfn6@cdc.gov

Status of Nuclear Reactor Situation in Japan

March 14, 2011 @ 0845 EDT

Reactor Status

- Multiple commercial nuclear power plants in Japan were adversely impacted last week by the major earthquake and resulting tsunami
    1. Loss of offsite power
    2. Loss of backup power
    3. Loss of cooling capacity
- As a result, Japanese authorites are having difficulty cooling the reactor core and keeping it covered with water
- Complete failure of core cooling could potentially result in the melting of the core
- Japan reactor design is very similar to US reactor design, including a containment vessel for the core - NOT like Chernobyl
- The Fukushima Dai-ichi Nuclear Power Station, site of six power units, is the focus of current concern
- Unit 1
    1. Venting has been occurring since last week to release containment pressure and reduce buildup of hydrogen (hydrogen build up is caused by the radiolytical decompostion of water)
    2. On Saturday (Atlanta time), an explosion occurred in the building surrounding the containment structure
    3. The containment vessel remained intact
    4. Low level radiation detected inside and outside reactor building
    5. Evacuations and Potassium Iodide (KI) distribution were initiated
    6. The utility is pouring salt water and a boron mixture into the reactor in an attempt to keep it cool and under control
- Unit 3
    1. Venting of reactor containment began over the weekend
    2. At approximately 11:01am on March 14, Japanese time, a hydrogen explosion occurred in the reactor building
    3. The containment vessel is reportedly still intact
    4. The utility is pouring salt water and a boron mixture into the reactor in an attempt to keep it cool and under control
- Unit 2
    1. Venting of containment is underway
    2. Core cooling has be disrupted
    3. The core is reportedly partially uncovered

Offsite Status

- Prevailing winds are currently carrying the bulk of the vented material out over open ocean and not populated areas, but forecast indicate that may change in the next few hours

- Residents within 20 km of the site are being evacuated
- All evacuees are reportedly being monitored as the evacuate, and some contamination has been reported
- As of 1830 March 13th local time: 180, 226 people evacuated

Potential Impact on US

- IF a major release occurs, the plume MAY reach portions of the U.S. within 2 – 5 days
- Will be similar to fallout from nuclear weapons testing during the Cold War
- NOT expected to be a major public health problem
    1. Precipitation events will bring material to ground
    2. Primary potential impact will be on food stuffs (milk, Leafy vegetables)
- Will see an increasing need for public risk communication

CDC Response

- Radiation Studies Branch closely monitoring events in Japan
- Responding to information requests from press and others
- Maintaining contact and coordination with HHS, DOE, and international partners
- Advisory Team for Environment, Food, and Health being notified

From: DTRA Operations Center <(b)(6)>
Sent: Wednesday, March 16, 2011 2:34 AM
To:

(b)(6)

Subject: FW: (~~FOUO~~) RFI-216U 0600Z 16MAR2011 Update
Attachments: RFI_216U_0600Z_16MAR2011_rev2.PPT

ALCON,

Attached is update to RFI 216U: 0600Z 16 Mar 2011.

V/r
Mr. Chris Seigfreid
DTRA Opeations Center
SAIC, Controller
703-767-2116

From: DTRA Reachback (b)(6)
Sent: Wednesday, March 16, 2011 2:19 AM
To: 'DTRA Operations Center'
Cc: 'Reachback, DTRA'
Subject: (~~FOUO~~) RFI-216U 0600Z 16MAR2011 Update

Ops:

The 0600Z update for RFI-216U is attached. Please review and release.

Thank you.

Respectfully,

S. Hatton

Defense Threat Reduction Agency

(703) 767-3448, (DSN 427-)

Unclass: (b)(6)

SIPR (b)(6)

JWICS: (b)(6)

R&D Enterprise

Innovation & Systems Engineering Office

Reachback Division

Planning: Model of a Nuclear Reactor Incident in Japan as a Result of an Earthquake – Update 0600Z 16MAR2011

RFI – 216U

16MAR2011

Requestor: USFJ

As of 0610Z 16MAR11

R&D Enterprise
Innovation & Systems Engineering Office
Reachback Division
(703) 767-3448, DSN 427-

Possible Release – Situational Details Unknown

Request Summary

- **(~~FOUO~~) Request data**
  - **Requestor:** (b)(6)
  - **Contact:** (b)(6)
  - **Request: A model of a nuclear incident at the Fukushima Daiichi nuclear power facilities in Japan.**

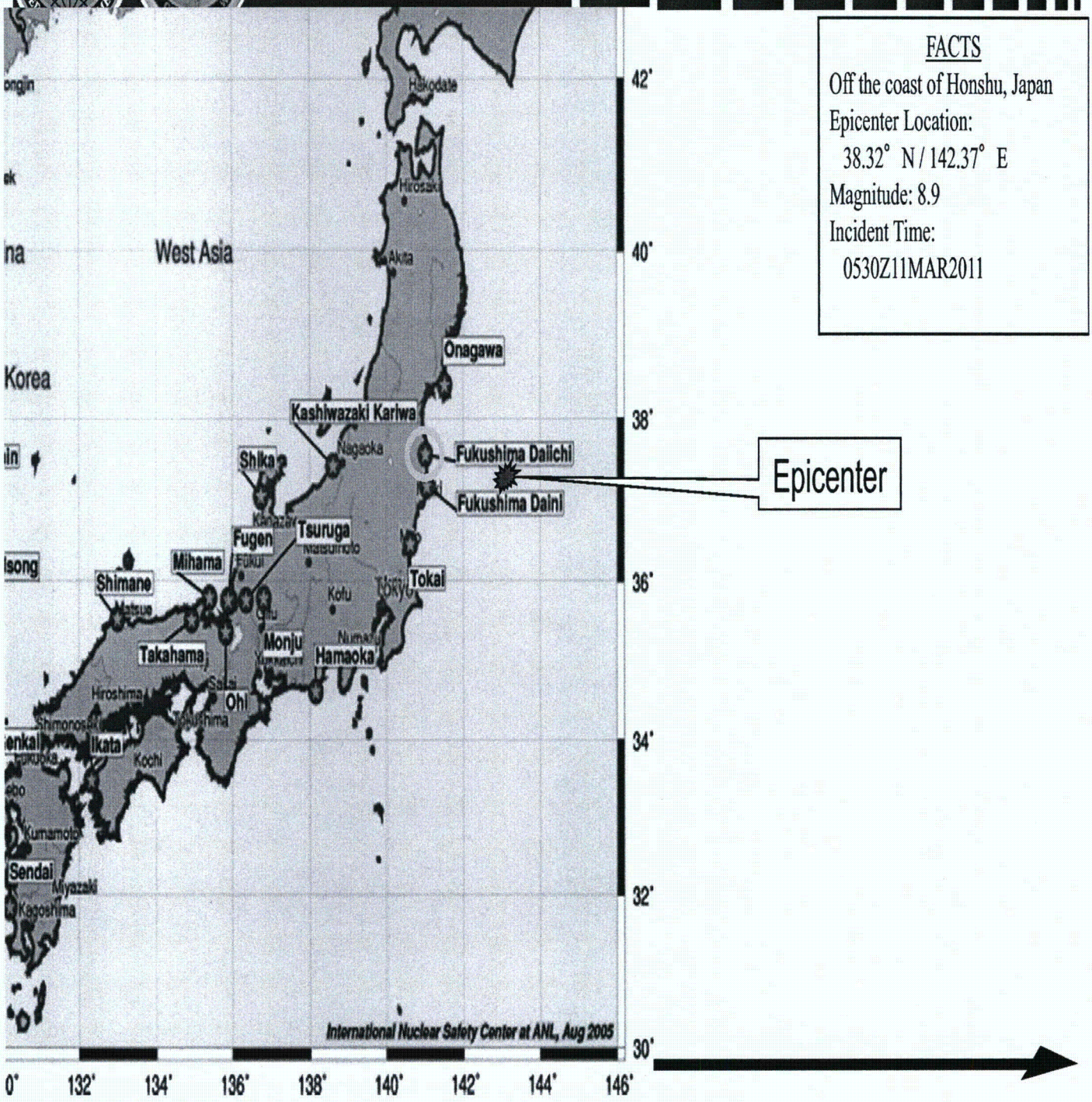
- **(~~FOUO~~) Solution**
  - **Summary: Air isotope concentrations and dose rates are provided**
  - **Employment: Real World**
  - **Reachback: Team**

Location: Fukushima Daiichi, Japan Latitude: 37.42139° N Longitude: 141.0325° E
Release Time: 2100Z Date: 16MAR2011
Hazard: Accident at nuclear facility in Japan
Weather: Global Numerical Weather Prediction: 0.5° ×0.5° resolution GFS from NCEP
Comments: This is a periodic update. We will continue to update this product with any additional information that becomes available. Models indicate no impact on Yokota AB or Misawa AB during this period of interest. These are not shown for clarity.

Possible Release – Situational Details Unknown

Nuclear Power Plants

SCOPING PURPOSES ONLY



FACTS

Off the coast of Honshu, Japan

Epicenter Location:

38.32° N / 142.37° E

Magnitude: 8.9

Incident Time:

0530Z11MAR2011

As of 0610Z 16MAR11

Fukushima Daiichi-1 Status

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following tsunami
- As of 2200 JST 14MAR2011, it is reported that sea water is being injected
- Containment described as "functional"
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building
- Sea water is being injected with reported stable cooling
- The spent fuel pool level is unknown
- High radiation levels reduced to 600 mSv/hr (60 mrem/hr) at 0600Z 15MAR2011 at site gate

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Fukushima Daiichi-2 Status

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- Reactor Core Isolation Cooling (RCIC) has failed
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building
- Sea water injection restarted with reports of non-stable conditions
- There are reports of a loud sound at Unit 2 in the vicinity of the suppression chamber. It is reported at 1130Z 15MAR2011 that containment is intact (better than previously thought)
- High radiation levels reduced to 600 mSv/hr (60 mrem/hour) at 0600Z 15MAR2011 at site gate (same gate for all units)
- The spent fuel pool level is unknown

Source: USNRC Emergency Operations Center Status Update, 2330Z 15MAR2011

Fukushima Daiichi-3 Status

- Core damage due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following the tsunami
- Sea water is being injected with reported stable cooling
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building roof
- Primary containment described as "functional"
- There is no spent fuel pool information
- High radiation levels reduced to 600 mSv/hr (60 mrem/hour) at 0600Z 15MAR2011 at site gate (same gate for all units)

Source: USNRC Emergency Operations Center Status Update, 2330Z 15MAR2011

Fukushima Daiichi-4 Status

- First fire in the reactor building was a small generator lube oil fire. IAEA reports that fire was put out at 0200 15MAR2011
- High radiation levels reduced to 600 mSv/hr (60 mrem/hour) at 0600Z 15MAR2011 at site gate (same gate for all units)
- Second fire began 2045Z 14MAR2011 in reactor building. Reports indicate that this fire is not yet contained. TEPCO is determining whether to use helicopter or fire truck to fight fire. Fuel reported to be uncovered
- Radiation level in the area of unit 4 reported to be 30R/hr following second fire
- There is a possible water loss from the spent fuel pool and operators are having difficulty providing adequate cooling and water level to the pool
- There are reports of possible hydrogen explosion due to uncovered fuel in the spent fuel pool (awaiting visual confirmation)
- High radiation dose rates measured between units 3 and 4, source is suspected to be the partially uncovered Unit 4 fuel pool

Source: USNRC Emergency Operations Center Status Update, 2330Z 15MAR2011

Status of additional reactors

- Fukushima Daiici-5, and -6
  - The reactors are stable
  - Spent fuel pools are reported to be heating up

- Daini-1, -2, -3, and -4
  - All units have stable offsite power
  - All units are reported to be in cold shutdown with stable water level
  - Latest TEPCO reports do not mention any problems with the ultimate heat sink

- Onagawa-1, -2, and -3
  - All units are shutdown and stable
  - The fire in the turbine building has been extinguished

Source: USNRC Emergency Operations Center Status Update, 2330Z 15MAR2011

Possible Release – Situational Details Unknown

Fukushima Daiichi DTRA Modeling Assumptions

Most Likely

- **Scenario: some core damage; primary containment building integrity intact; venting occurring to reduce core temperature and pressure**

- Continuous Release – Steam released for decay heat removal
- HPAC –Release Assumptions:
  - ✓ Shut down time of reactor concurrent with earthquake
  - ✓ Continuous Small Release starting at 2100Z
  - ✓ NFAC Reactor Accident
    - ✓ Containment monitor reading: 10 R/hr (unconfirmed)
    - ✓ Sprayers: Off (unconfirmed)
    - ✓ Filters: On (unconfirmed)
  - ✓ Weather 40 km GFS

Fukushima Daiichi DTRA Modeling

- **Summary of Models Provided in this Briefing**

- Assumption – Fukushima Daiichi #1, 2, and #3 suffered damage resulting in a continuous release/leak of a small portion of its inventory. Release occurs consistently throughout times shown in this product. (Precise details of this release are highly uncertain and time-varying)

Possible Release – Situational Details Unknown

Fukushima Daiichi (Impacts) – Most Likely

Assumed Core Damage & Venting

- Weather
  - Surface winds in the vicinity of the power plant are currently from the NW through N and gusty. Northwesterly (offshore) winds between 15-25 kts are forecasted for Wednesday (16MAR). **This means that any possible release through Wednesday will move to the SE and later to E**

- Japanese national government instructed evacuation for local residents within a 20km radius of the site boundary and sheltering in place out to 30km for residents who stayed behind. IAEA confirms a no fly zone out to 30km around Fukushima Daiichi plant.
  - Operations in the area of the facility should include monitoring equipment.

- As core pressure and temperature lower and stabilize, radiation levels will lower accordingly.

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 2100Z 16MAR2011 (Far)

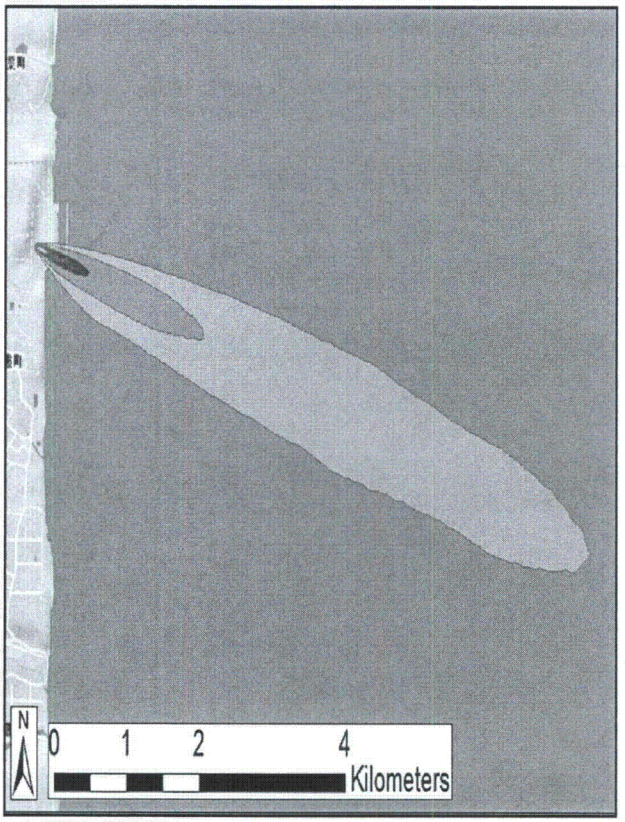
GFS Forecast valid @ 2100Z 16MAR2011 From 1800Z 15MAR2011 Run

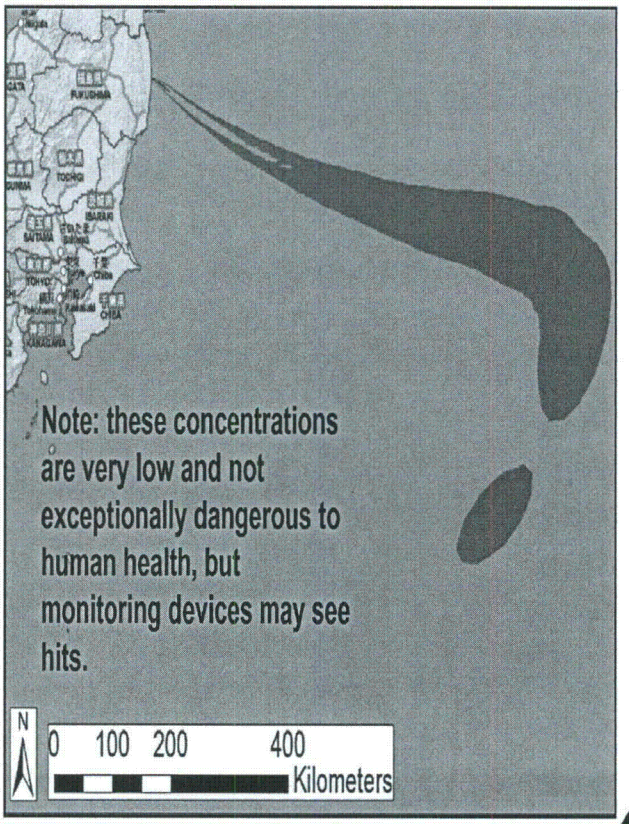
ALLEXTEFF(Rate) RTH Radiation Field 16-Mar-11 21:00:00Z	REM/hr
1 urem/hr	1.0E-06
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 16MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 16-Mar-11 21:00:00Z	Ci/m3
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





As of 0610Z 16MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0300Z 17MAR2011 (Far)

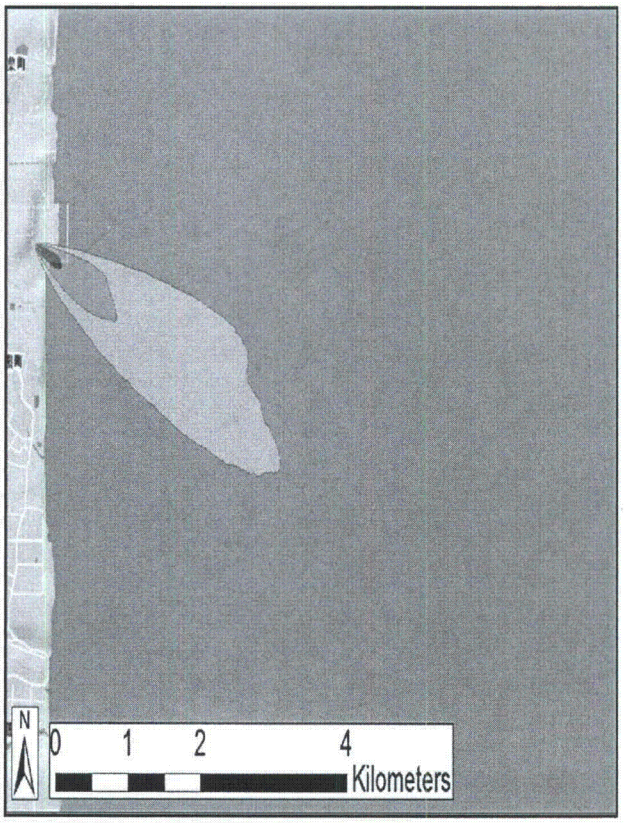
GFS Forecast valid @ 2100Z 16MAR2011 From 1800Z 15MAR2011 Run

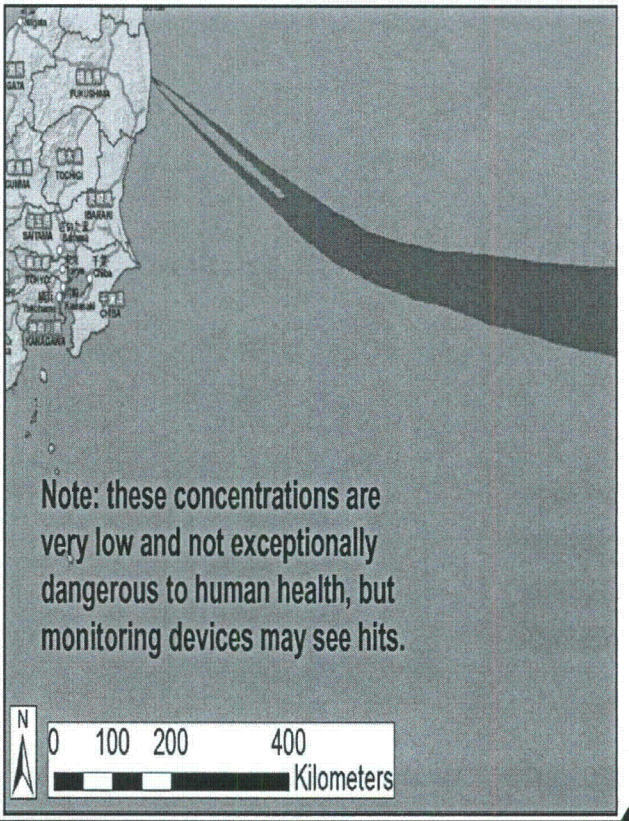
ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 03:00:00Z	REM/hr
1 urem/hr	1.0E-06
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 16MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 17-Mar-11 03:00:00Z	Ci/m3
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





As of 0610Z 16MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0900Z 17MAR2011 (Far)

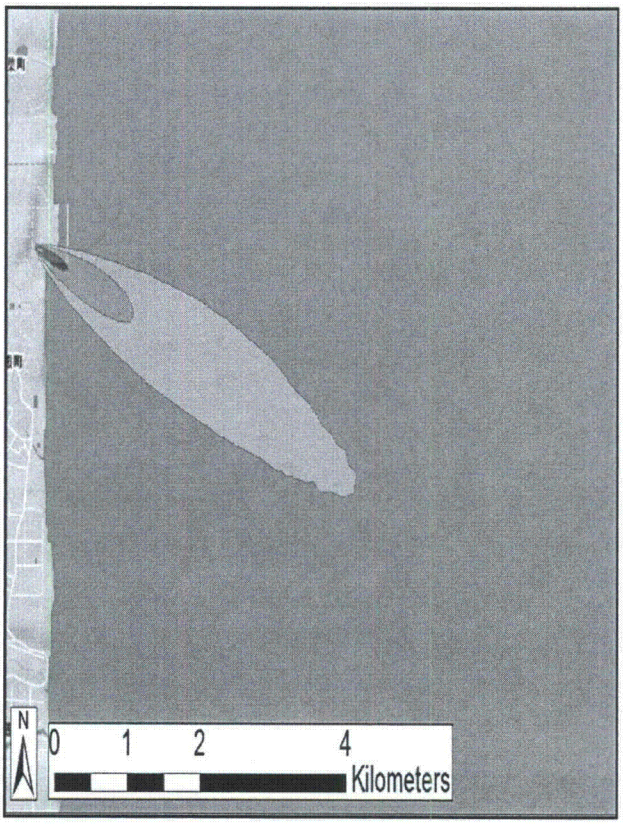
GFS Forecast valid @ 0300Z 17MAR2011 From 1800Z 15MAR2011 Run

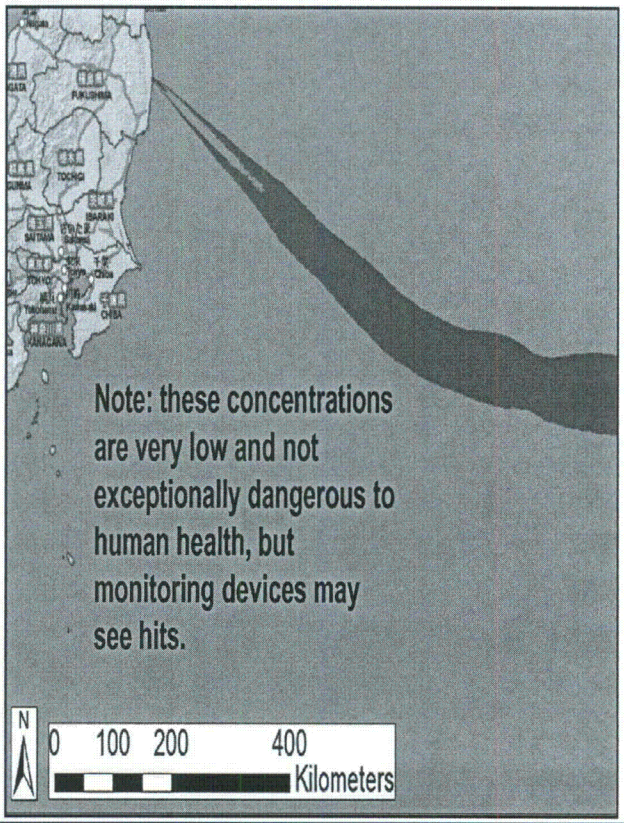
ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 09:00:00Z	REM/hr
1 urem/hr	1.0E-06
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 16MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 17-Mar-11 09:00:00Z	Ci/m3
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





As of 0610Z 16MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 1500Z 17MAR2011 (Far)

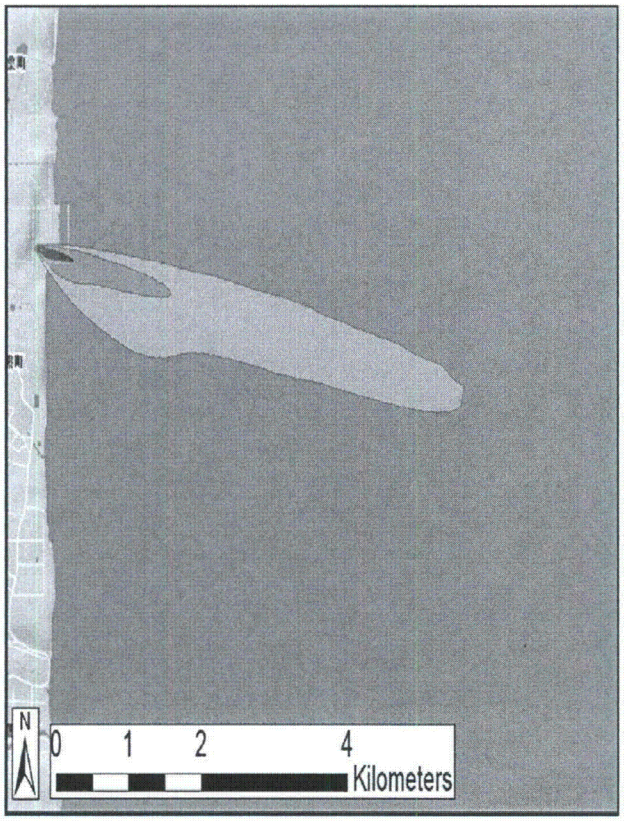
GFS Forecast valid @ 0900Z 17MAR2011 From 1800Z 15MAR2011 Run

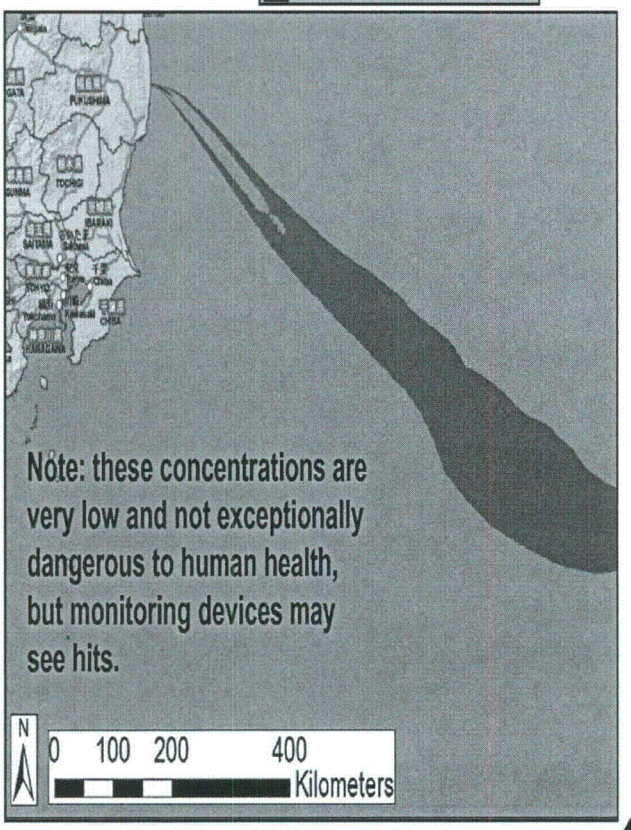
ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 15:00:00Z	REM/hr
1 urem/hr	1.0E-06
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 16MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 17-Mar-11 15:00:00Z	Ci/m3
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 2100Z 17MAR2011 (Far)

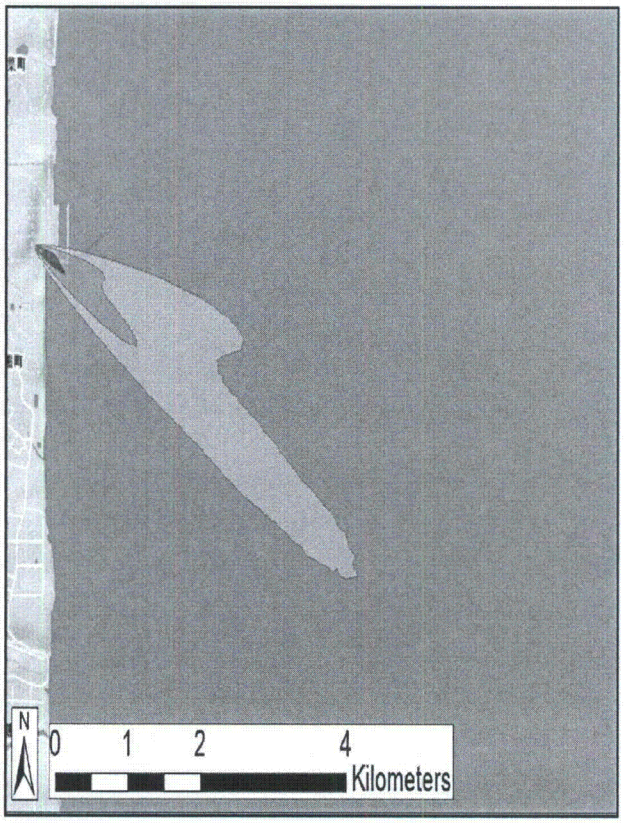
GFS Forecast valid @ 1500Z 17MAR2011 From 1800Z 15MAR2011 Run

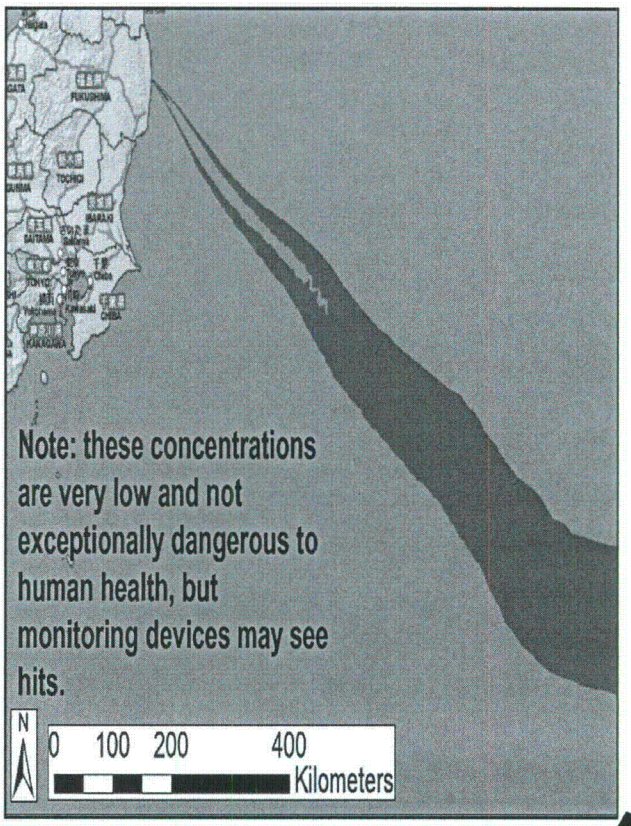
ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 21:00:00Z	REM/hr
1 urem/hr	1.0E-06
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 16MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 17-Mar-11 21:00:00Z	Ci/m3
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





As of 0610Z 16MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0300Z 18MAR2011 (Far)

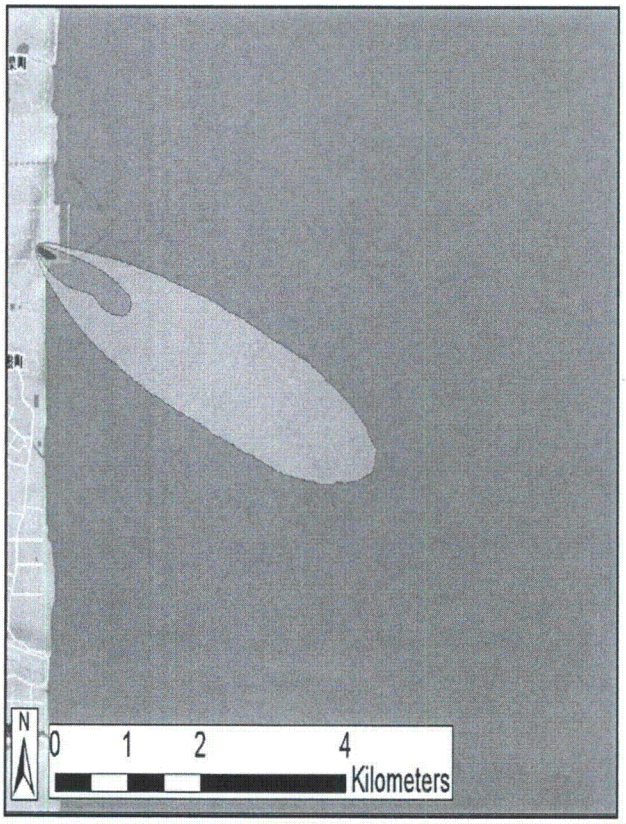
GFS Forecast valid @ 2100Z 17MAR2011 From 1800Z 15MAR2011 Run

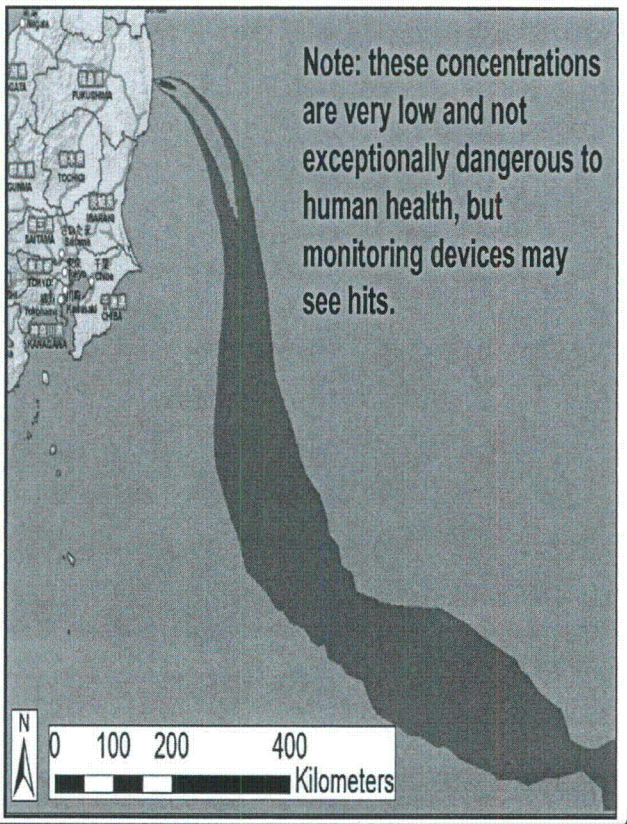
ALLEXTEFF(Rate) RTH Radiation Field 18-Mar-11 03:00:00Z	REM/hr
1 urem/hr	1.0E-06
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 16MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 18-Mar-11 03:00:00Z	Ci/m3
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





Note: these concentrations are very low and not exceptionally dangerous to human health, but monitoring devices may see hits.

As of 0610Z 16MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0300Z 18MAR2011 (Far)

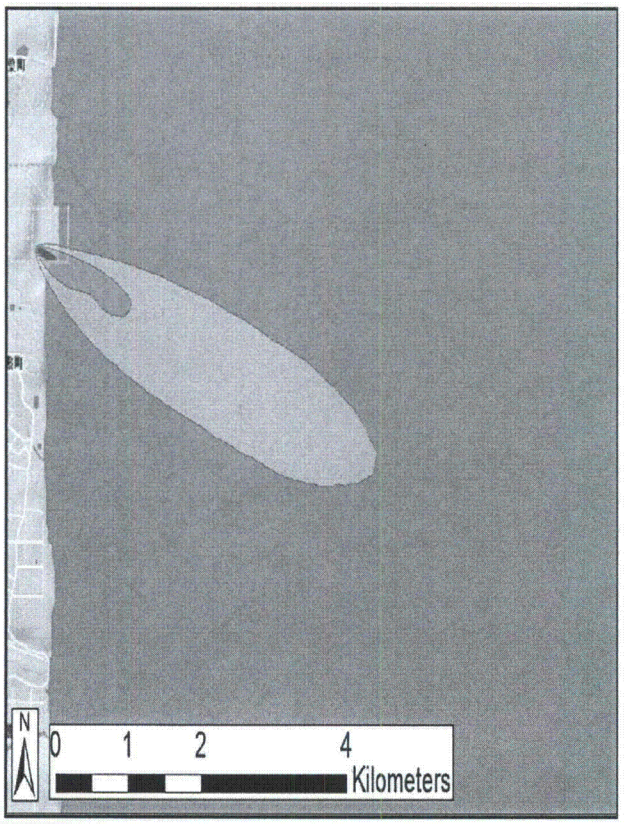
GFS Forecast valid @ 0300Z 18MAR2011 From 1800Z 15MAR2011 Run

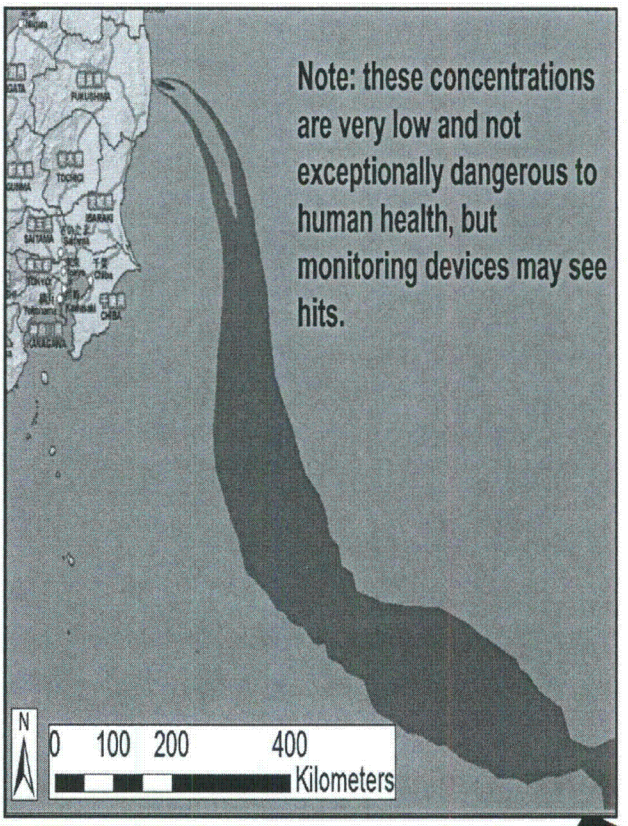
ALLEXTEFF(Rate) RTH Radiation Field 18-Mar-11 09:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 16MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 18-Mar-11 09:00:00Z	Ci/m3
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





Note: these concentrations are very low and not exceptionally dangerous to human health, but monitoring devices may see hits.

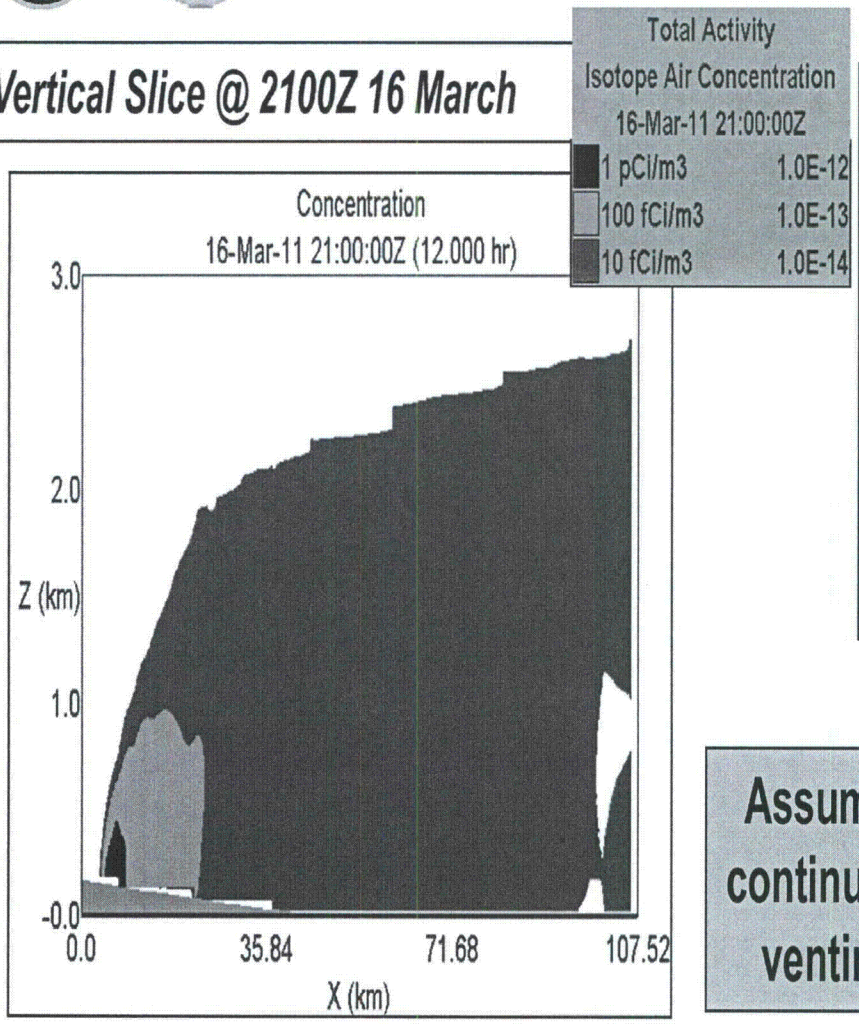
As of 0610Z 16MAR11

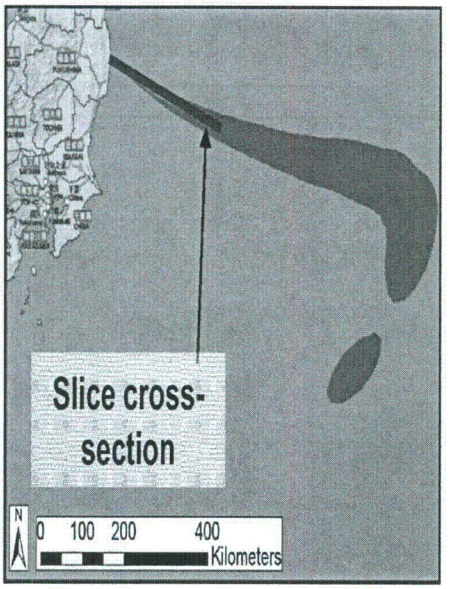
Possible Release – Situational Details Unknown

Fukushima Daiichi

Most Likely Release Scenario

Vertical Slice @ 2100Z 16 March





Note: The plume will change shape and structure as a function of time – slices at other times were similar or smaller. Higher concentrations were generally at or below 1 km elevation, lower concentrations up to approx 2.8 km.

Assumes continuous venting

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 16MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Backup: Radiation Unit Conversions

- Activity
  - 1 Curie (Ci) = 3.7×10^{10} Becquerels (Bq) = 3.7×10^{10} disintegrations/sec
  - Activity is a measure of atomic disintegrations per second.
  - Exponentially decays with age and is relative to specific radio-nuclide and age.
- Exposure or Dose Rate
  - 1 Gray (Gy) = 100 centi-Gray (cGy)
  - 1 centi-Gray (cGy) = 1 radiation absorbed dose unit (rad)
  - Dose is a measure of the energy deposited into a given mass.
  - Exposure when integrated over a time combined with an estimate of human tissue damage yields dose. Radiation detectors usually display instantaneous dose rate (e.g., cGy/hr, rad/hr).
- Dose Equivalent
  - 1 Sievert (Sv) = 100 centi-Sievert (cSv)
  - 1 centi-Sievert (cSv) = 1 Roentgen Equivalent to Man (REM)
  - An equivalent measurement or estimation of possible damage from ionizing radiation to human tissue. Dose Equivalent varies with type of human tissue exposed, ingestion, shielding, time, radiation type and energy.
- Exposure
  - 1 roentgen (R) = 2.58 * 10^-4 Coulombs (C) per kg (in air)
  - Used to measure x and gamma ray radiation. 1 R ~ 1 rad ~ 1 rem for x and gamma.

Possible Release – Situational Details Unknown

Backup: Radiation Exposure Reference

Exposure	cGy / Rad / REM / cSv	Reference
Cross Country Civilian Flight (cosmic radiation)	0.004	
Medical X-Ray (Chest)	0.01	Mettler FA, et al: Effective Doses in Radiology and Diagnostic Nuclear Medicine, 2008
Mammogram	0.4	Mettler FA, et al: Effective Doses in Radiology and Diagnostic Nuclear Medicine, 2008
CT (Chest, Abdomen, and Pelvis)	1.8	Mettler FA, et al: Effective Doses in Radiology and Diagnostic Nuclear Medicine, 2008
Chernobyl Evacuation Zone	10	
Hiroshima Survivor Inside Structure	78	
Nagasaki Survivor Inside Structure	156	
Average Background Annual Exposure in U.S. (Total)	0.62	NCRP No. 160 (2006)

U.S. Civilian Standards	cGy / Rad / REM / cSv	
Maximum Annual Public Exposure	0.1	(10 CFR 20.1301)
Maximum Radiation Worker Annual Dose	5	(10 CFR 20.1201)
General Emergency	1	(NUREG-0654/FEMA REP 1)
Protective Actions (shelter or evacuate)	1.0-5.0	(EPA 400-R-92-001, 1992)
Evacuation required	5	(EPA 400-R-92-001, 1992)
1st Responder Dose Protecting valuable property 1	10	(EPA 400-R-92-001, 1992)
1st Responder Dose Lifesaving or protection of large populations 1	25	(EPA 400-R-92-001, 1992)
Maximum 1st Responder Dose	25	(EPA 400-R-92-001, 1992)

Military OEG*	cGy / Rad / REM / cSv	
Wartime high-priority missions, to include life-saving	125	NATO STANAG-2473, 3 May 2000; USAFRRI, SP 03-1, April 2003
Operations other than war based on mission priorities and risk analysis	75	NATO STANAG-2473, 3 May 2000; USAFRRI, SP 03-1, April 2003

Note: Sieverts=Grays and Rad=REM for beta and gamma radiation as the Quality Factor is one.

[1]FEMA: Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents

From: PMT09 Hoc
Sent: Wednesday, March 16, 2011 1:50 AM
To: Miller, Chris
Subject: DOE Assets
Attachments: Doc10.doc

DOE aerial measurement system can provide useful information that helps officials understand the event that has occurred, refine protective actions, and characterize the fallout.

Fixed wing aircraft aerial measuring system

- Can rapidly map residual fall out pattern and intensity of contaminated materials that may have deposited after plume passage
  - Can define expanded evacuation and sheltering areas for both plume and post plume phase
  - Can obtain isotopic information which also helps to refine the source term as well as protective action guidelines.
  - Can identify areas of concern for agricultural products and potential food embargos
  - Dose rate values over the Fukushima site and offsite

From: Pilgrim, Gary T. CONTRACTOR <(b)(6)> on behalf of DTRA Operations Center <(b)(6)>

Sent: Tuesday, March 15, 2011 4:58 PM

To:

(b)(6)

Subject: FW: RFI-216U Update

Attachments: RFI_216U_1500Z_15MAR2011_rev0.pdf

Attached is the 15 March 2011 1500Z update.

V/R

Mr. Gary Pilgrim
Operations Center Support
phone: 703.767.2116
Unclas: (b)(6)
Sipr: (b)(6)

-----Original Message-----
From: DTRA Reachback [mailto: (b)(6)
Sent: Tuesday, March 15, 2011 4:38 PM
To: DTRA Operations Center
Cc: Reachback
Subject: RFI-216U Update

Ops:
Please review and release the update product to the requestors. Thank you.

Reachback

Planning: Model of a Nuclear Reactor Incident in Japan as a Result of an Earthquake – Update 1500Z 15 MAR

RFI – 216U

15MAR2011

Requestor: USFJ

As of 20300Z 15MAR11

R&D Enterprise
Innovation & Systems Engineering Office
Reachback Division
(703) 767-3448, DSN 427-

Possible Release – Situational Details Unknown

Request Summary

- **(~~FOUO~~) Request data**
  - **Requestor:** (b)(6)
  - **Contact:** (b)(6)
  - **Request: A model of a nuclear incident at the Fukushima Daiichi – 1 and -3 nuclear power plant in Japan.**

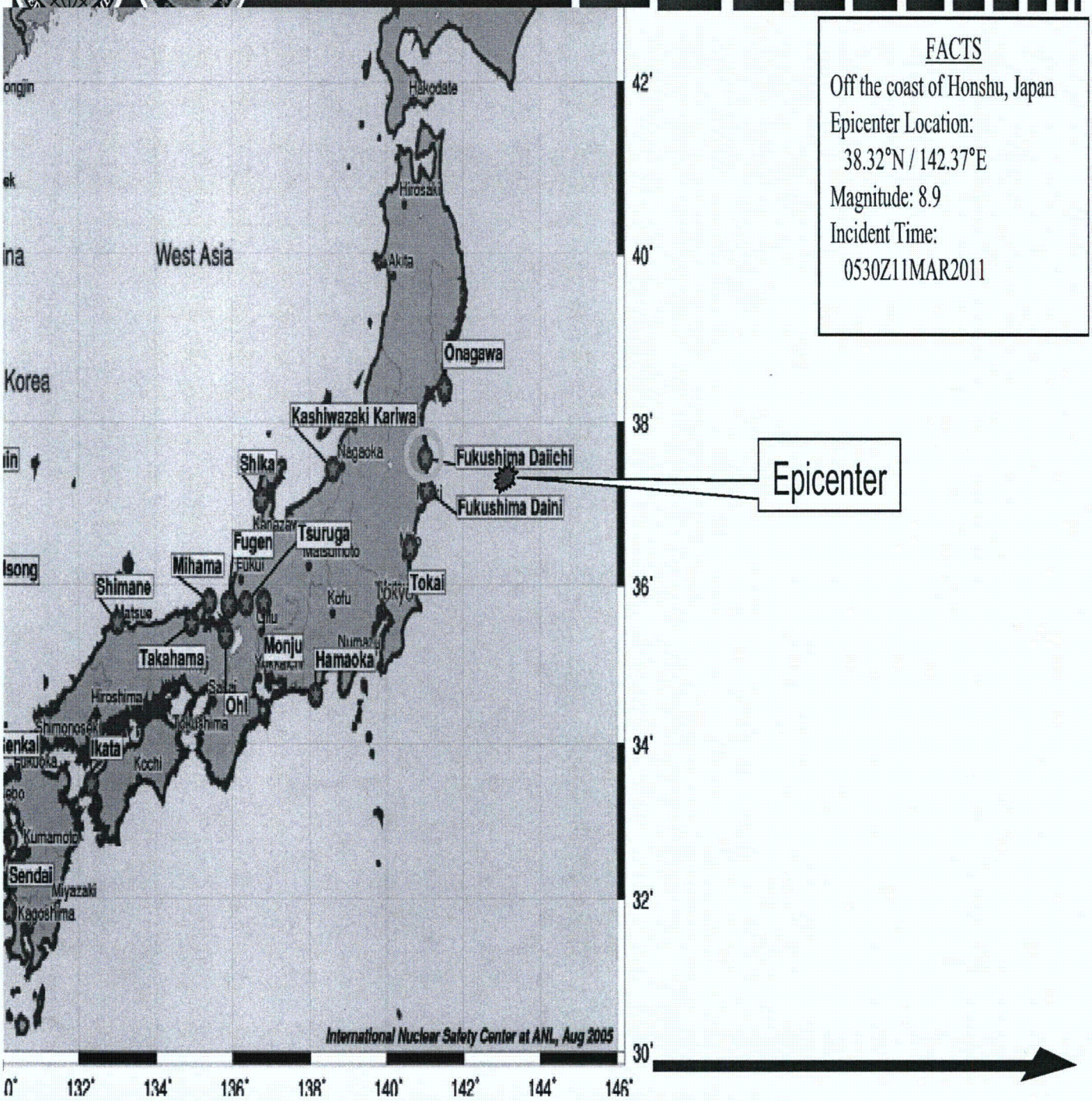
Location: Fukushima Daiichi, Japan Latitude: 37.42139° N Longitude: 141.0325° E
Time: 1500Z Date: 15MAR2011
Hazard: Accident at nuclear facility in Japan
Weather: Global Numerical Weather Prediction: 0.5°×0.5° resolution GFS from NCEP
Comments: This is a periodic update. We will continue to update this product with any additional information that becomes available.

- **(~~FOUO~~) Solution**
  - **Summary: Integrated dose plots provided on the following slides**
  - **Employment: Real World**
  - **Reachback: Team**

Possible Release – Situational Details Unknown

Nuclear Power Plants

SCOPING PURPOSES ONLY



FACTS

Off the coast of Honshu, Japan

Epicenter Location:
38.32°N / 142.37°E

Magnitude: 8.9

Incident Time:
0530Z11MAR2011

As of 2030Z 15MAR11

Fukushima Daiichi-1 Status

- Partial core damage from exposed fuel
- As of 2200 March 14, Japan time, sea water is being injected
- The reactor is described as "more stable"
- Suspected pipe broken and release to Containment which is believed "functional"
- Hydrogen explosion has damaged reactor building roof
- **Due to days of cool-down and injection of sea water, it will never be possible to produce power at the reactor (now unusable), but there is no further risk of total meltdown as long as core remains covered with seawater**

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Fukushima Daiichi-2 Status

- RCIC has failed
- Coolant was stopped for quite some time so core damage is assumed. Core was most likely totally uncovered for some time.
- *Large hydrogen explosion on 14 Mar*
- *Suspected leak from containment*

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Fukushima Daiichi-3 Status

- Condition described as essentially the same as Unit 1
- As of 2200 March 14, Japan time, sea water is being injected
- Hydrogen explosion has damaged reactor building roof
- Containment described as "functional"
- Alternate methods to inject water into the core are being investigated.
- Due to days of cool-down and injection of sea water, it will never be possible to produce power at the reactor (now unusable), but there is no further risk of total meltdown as long as core remains covered with seawater

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Status of additional reactors

- Fukushima Daiichi-4, -5, and -6 and Daini-1, -2, -3, and -4
  - The reactors are shut down
  - Sufficient level of reactor coolant to ensure safety is maintained
  - Tokyo Electric Power Company (TEPCO) does not believe that there is any reactor coolant leakage inside the reactor containment vessel

- Onagawa
  - At 2145 CET 13MAR2011, IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary have returned to normal background levels

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Possible Release – Situational Details Unknown

Fukushima Daiichi DTRA Modeling Assumptions

Most Likely

- **Scenario: some core damage; primary containment building integrity intact; venting occurring to reduce core temperature and pressure**

- Continuous Release – Steam released for decay heat removal
- HPAC –Release Assumptions:
  - ✓ Shut down time of reactor concurrent with earthquake
  - ✓ Continuous Small Release starting at 09Z
  - ✓ NFAC Reactor Accident
    - ✓ Containment monitor reading: 10 R/hr (unconfirmed)
    - ✓ Sprayers: Off (unconfirmed)
    - ✓ Filters: On (unconfirmed)
  - ✓ Weather 40 km GFS

Fukushima Daiichi DTRA Modeling

- **Summary of Models Provided in this Briefing**

- Assumption – Fukushima Daiichi #1, 2, and #3 suffered damage resulting in a continuous release/leak of a small portion of its inventory. Release occurs consistently throughout times shown in this product. (Precise details of this release are highly uncertain and time-varying)

Possible Release – Situational Details Unknown

Fukushima Daiichi (Impacts) – Most Likely

Assumed Core Damage & Venting

- Weather
  - Surface winds in the vicinity of the power plant are currently NNE. Northwesterly (offshore) winds between 10-20 kts are forecasted for Wednesday (16MAR). **This means that any possible release through Wednesday will move to the S and later to SE**

- Japan has evacuated out to 20 km around site; ground operations should carefully monitor conditions within this zone.
- Operations in the area of the facility should include monitoring equipment.
- Air operations minimally impacted, but coordination with local authorities recommended
- Radiation hazard is above background. Level of concern should be less than 0.1 Rem integrated dose (see worst case in next slides)
- **As core pressure and temperature lower and stabilize, radiation levels will lower accordingly.**

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0300Z 16MAR2011 (Far);

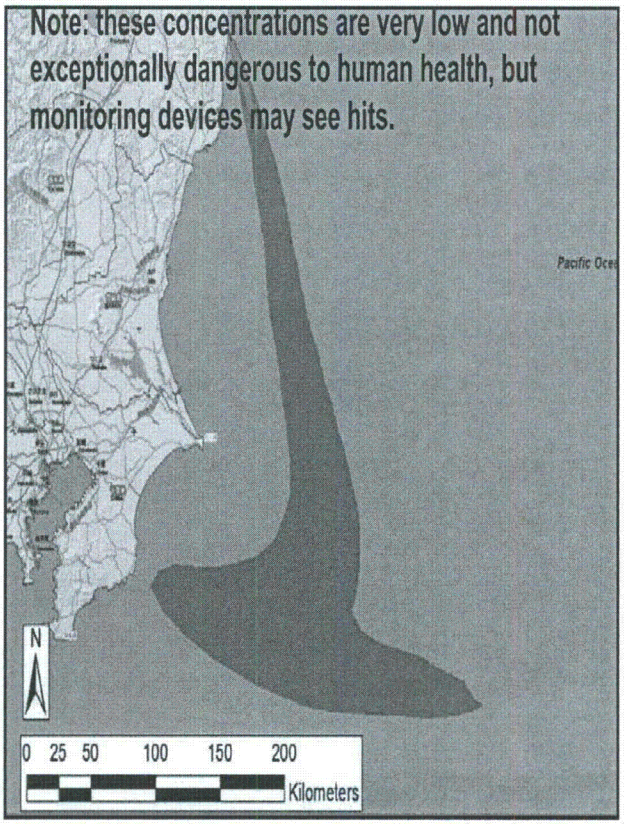
GFS Forecast valid @ 0300Z 16MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 16-Mar-11 03:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139°N/ 141.0325°E
1500Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 16-Mar-11 03:00:00Z	Ci/m3
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0900Z 16MAR2011 (Far);

GFS Forecast valid @ 0900Z 16MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 16-Mar-11 09:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139°N/ 141.0325°E
1500Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 16-Mar-11 0900Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
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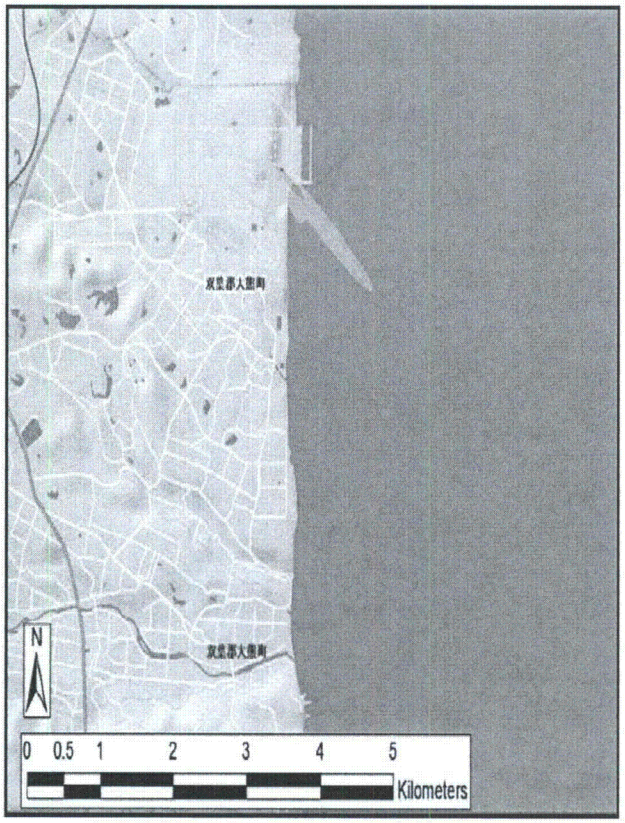
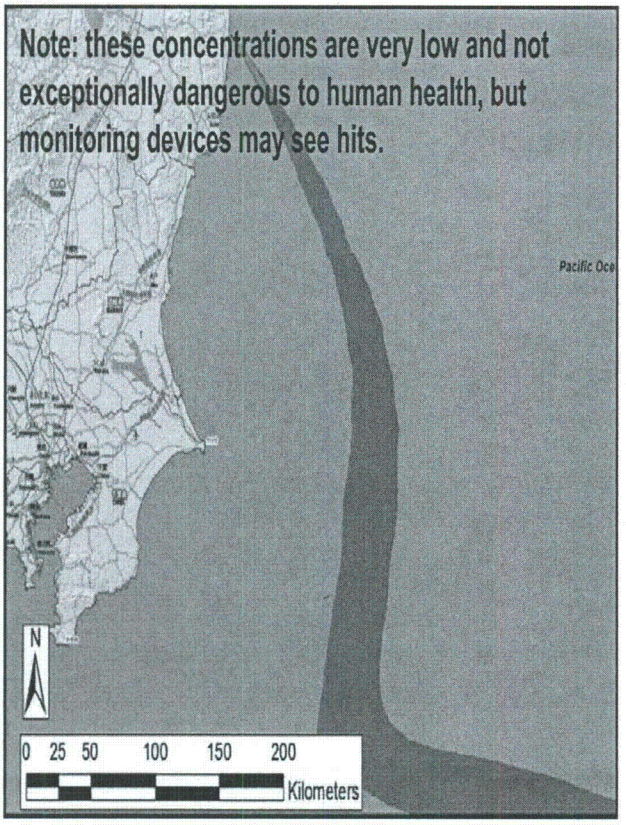




As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 1500Z 16MAR2011 (Far);

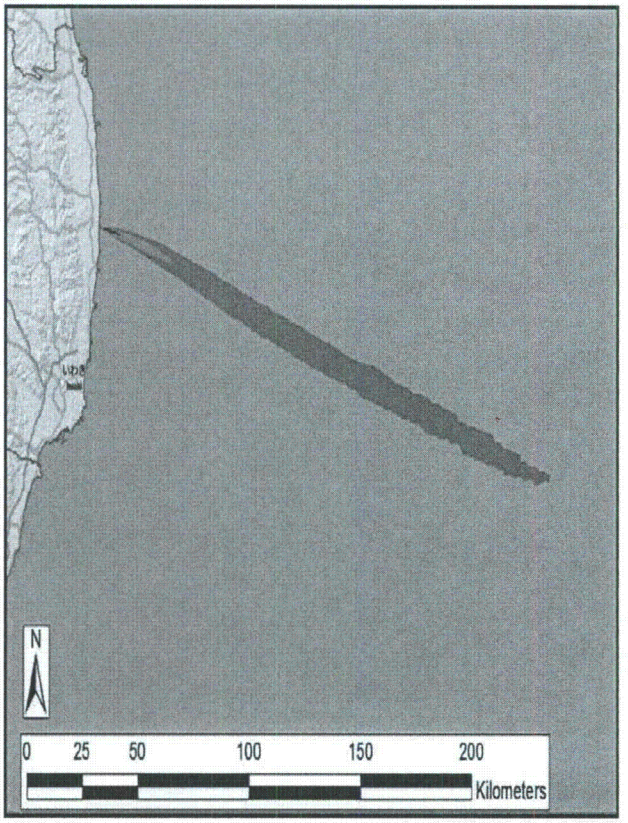
GFS Forecast valid @ 1500Z 16MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 16-Mar-11 15:00:00Z	REM/hr
1 urem/hr	1.0E-06
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139°N/ 141.0325°E
1500Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 16-Mar-11 1500Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 2100Z 16MAR2011 (Far);

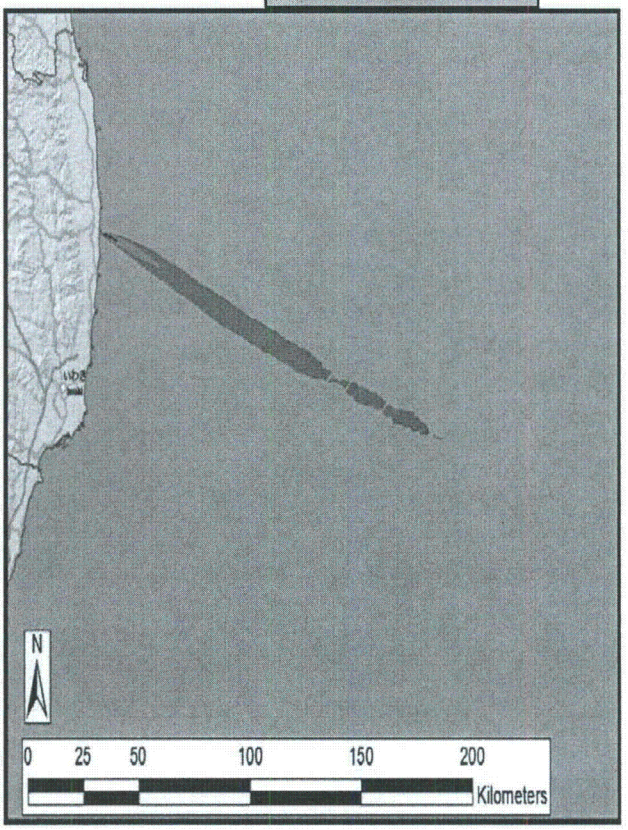
GFS Forecast valid @ 2100Z 16MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 16-Mar-11 21:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139°N/ 141.0325°E
0900Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 16-Mar-11 21:00:00Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0300Z 17MAR2011 (Far);

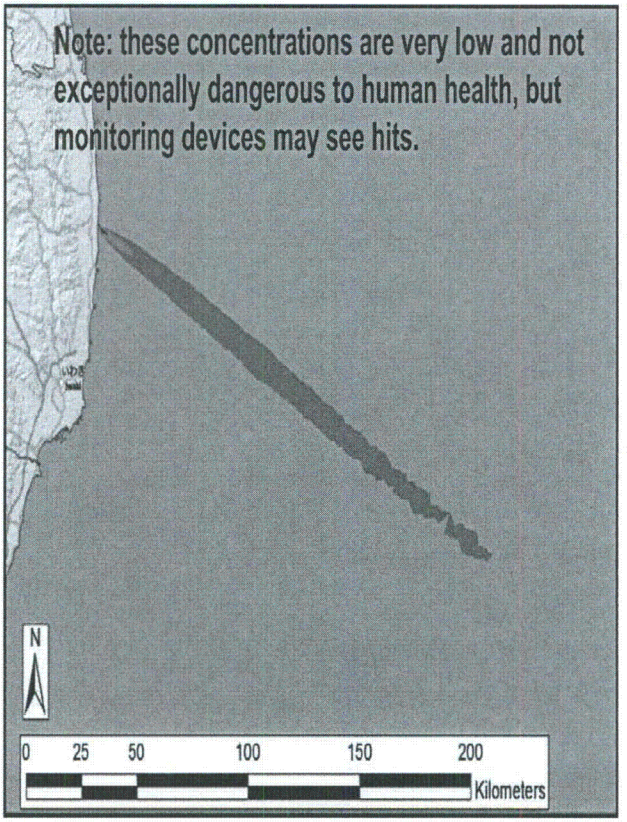
GFS Forecast valid @ 0300Z 17MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 03:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139°N/ 141.0325°E
0900Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 17-Mar-11 0300Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0900Z 17MAR2011 (Far);

GFS Forecast valid @ 0900Z 17MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 09:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139°N/ 141.0325°E
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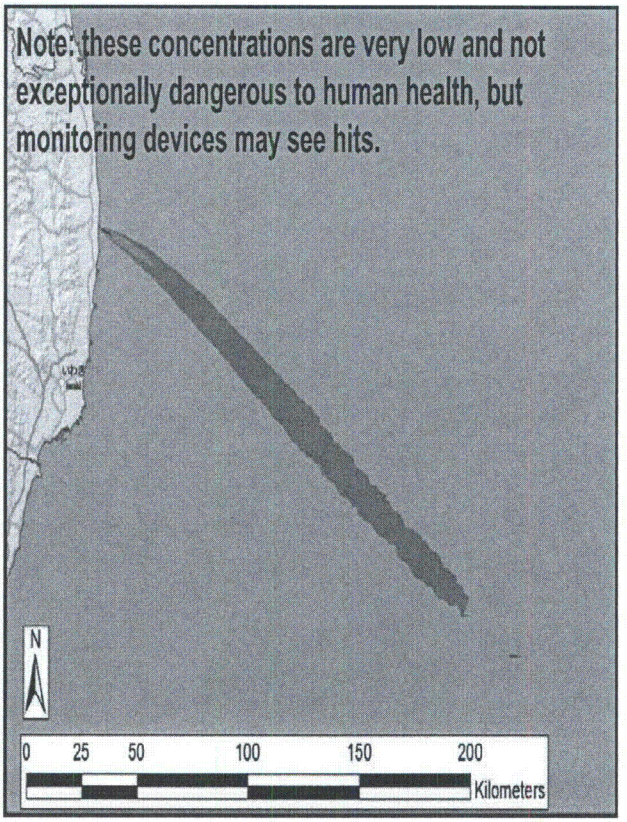
Total Activity Isotope Air Concentration 17-Mar-11 0900Z	uCi/mL
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 1500Z 17MAR2011 (Far);

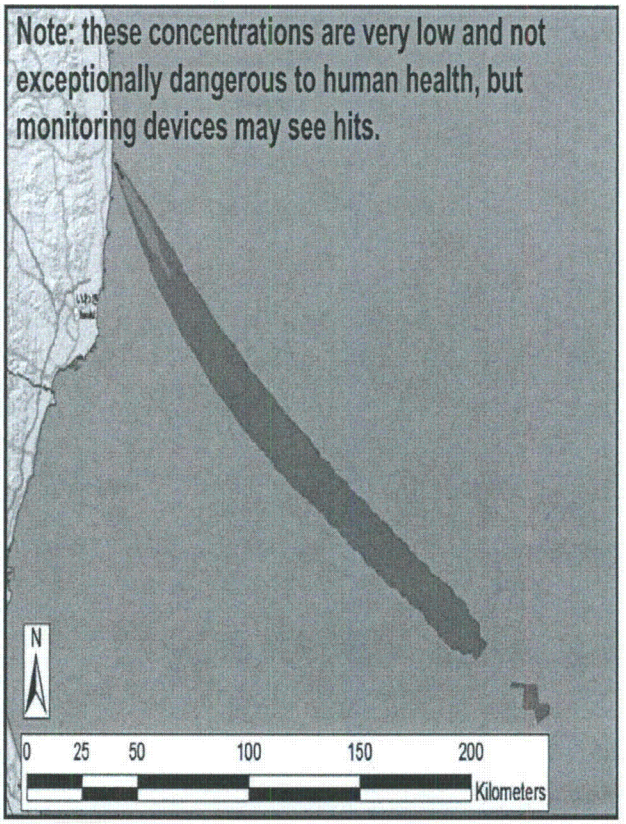
GFS Forecast valid @ 0900Z 17MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 09:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139°N/ 141.0325°E
1500Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 17-Mar-11 15:00:00Z	Ci/m3
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 2100Z 17MAR2011 (Far);

GFS Forecast valid @ 0900Z 17MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 21:00:00Z	REM/hr
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139°N/ 141.0325°E
1500Z 15MAR2011
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Weather: 40 km GFS
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Static Population Estimates:
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10 pCi/m3	1.0E-11
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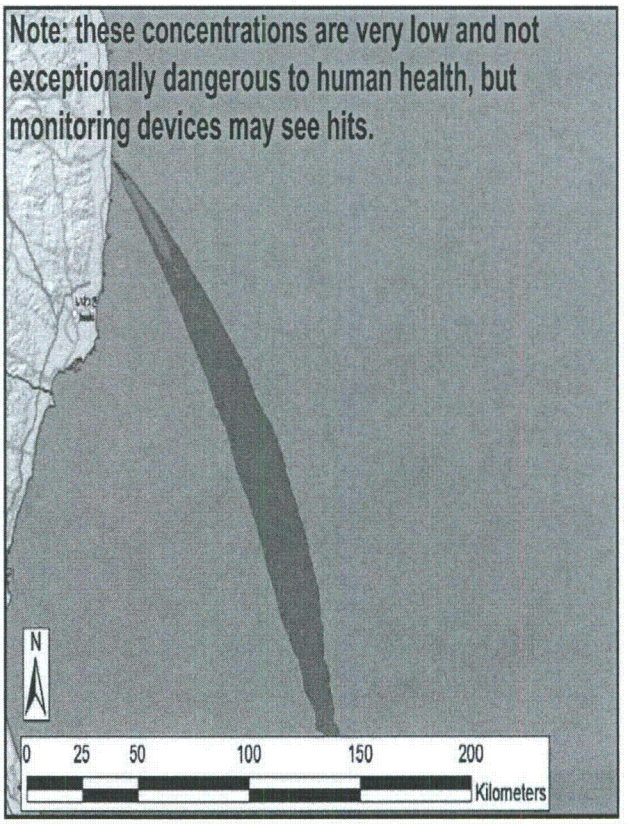
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Backup: Radiation Unit Conversions

- Activity
  - 1 Curie (Ci) = 3.7×10^{10} Becquerels (Bq) = 3.7×10^{10} disintegrations/sec
  - Activity is a measure of atomic disintegrations per second.
  - Exponentially decays with age and is relative to specific radio-nuclide and age.
- Exposure or Dose Rate
  - 1 Gray (Gy) = 100 centi-Gray (cGy)
  - 1 centi-Gray (cGy) = 1 radiation absorbed dose unit (rad)
  - Dose is a measure of the energy deposited into a given mass.
  - Exposure when integrated over a time combined with an estimate of human tissue damage yields dose. Radiation detectors usually display instantaneous dose rate (e.g., cGy/hr, rad/hr).
- Dose Equivalent
  - 1 Sievert (Sv) = 100 centi-Sievert (cSv)
  - 1 centi-Sievert (cSv) = 1 Roentgen Equivalent to Man (REM)
  - An equivalent measurement or estimation of possible damage from ionizing radiation to human tissue. Dose Equivalent varies with type of human tissue exposed, ingestion, shielding, time, radiation type and energy.
- Exposure
  - 1 roentgen (R) = 2.58 * 10^-4 Coulombs (C) per kg (in air)
  - Used to measure x and gamma ray radiation. 1 R ~ 1 rad ~ 1 rem for x and gamma.

Possible Release – Situational Details Unknown

Backup: Radiation Exposure Reference

Exposure	cGy / Rad / REM / cSv	Reference
Cross Country Civilian Flight (cosmic radiation)	0.004	
Medical X-Ray (Chest)	0.01	Mettler FA, et al: Effective Doses in Radiology and Diagnostic Nuclear Medicine, 2008
Mammogram	0.4	Mettler FA, et al: Effective Doses in Radiology and Diagnostic Nuclear Medicine, 2008
CT (Chest, Abdomen, and Pelvis)	1.8	Mettler FA, et al: Effective Doses in Radiology and Diagnostic Nuclear Medicine, 2008
Chernobyl Evacuation Zone	10	
Hiroshima Survivor Inside Structure	78	
Nagasaki Survivor Inside Structure	156	
Average Background Annual Exposure in U.S. (Total)	0.62	NCRP No. 160 (2006)

U.S. Civilian Standards	cGy / Rad / REM / cSv	
Maximum Annual Public Exposure	0.1	(10 CFR 20.1301)
Maximum Radiation Worker Annual Dose	5	(10 CFR 20.1201)
General Emergency	1	(NUREG-0654/FEMA REP 1)
Protective Actions (shelter or evacuate)	1.0-5.0	(EPA 400-R-92-001, 1992)
Evacuation required	5	(EPA 400-R-92-001, 1992)
1st Responder Dose Protecting valuable property 1	10	(EPA 400-R-92-001, 1992)
1st Responder Dose Lifesaving or protection of large populations 1	25	(EPA 400-R-92-001, 1992)
Maximum 1st Responder Dose	25	(EPA 400-R-92-001, 1992)

Military OEG*	cGy / Rad / REM / cSv	
Wartime high-priority missions, to include life-saving	125	NATO STANAG-2473, 3 May 2000; USAFRRI, SP 03-1, April 2003
Operations other than war based on mission priorities and risk analysis	75	NATO STANAG-2473, 3 May 2000; USAFRRI, SP 03-1, April 2003

Note: Sieverts=Grays and Rad=REM for beta and gamma radiation as the Quality Factor is one.

[1]FEMA: Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents

~~For Official Use Only~~

Possible Release – Situational Details Unknown

Planning: Model of a Nuclear Reactor Incident in Japan as a Result of an Earthquake – Update 1500Z 15 MAR

RFI – 216U

15MAR2011

Requestor: USFJ

As of 20300Z 15MAR11

R&D Enterprise
Innovation & Systems Engineering Office
Reachback Division
(703) 767-3448, DSN 427-

~~For Official Use Only~~

Possible Release – Situational Details Unknown

Request Summary

- **(~~FOUO~~) Request data**
  - **Requestor:** (b)(6)
  - **Contact:** (b)(6)
  - **Request: A model of a nuclear incident at the Fukushima Daiichi – 1 and -3 nuclear power plant in Japan.**

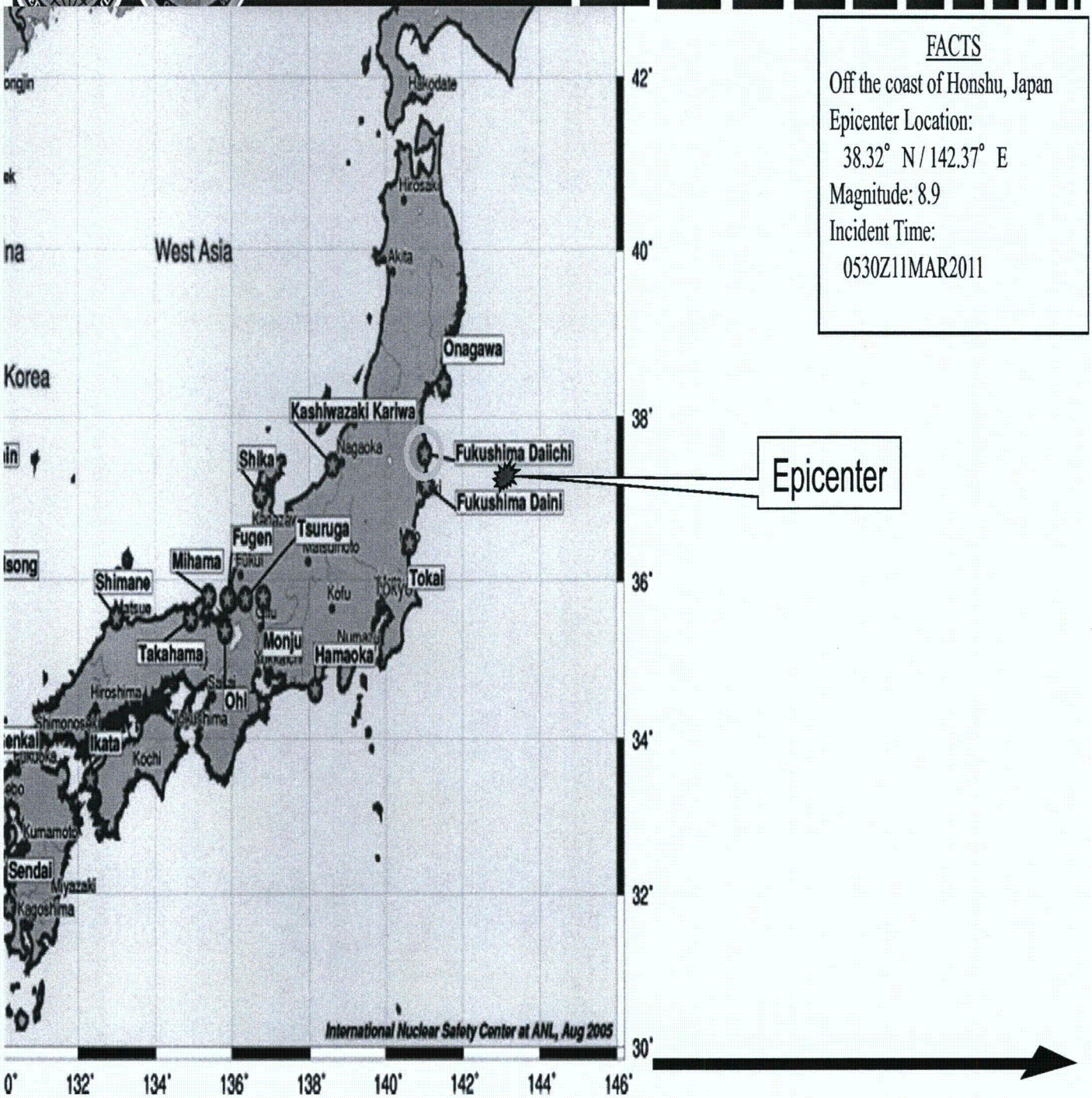
Location: Fukushima Daiichi, Japan Latitude: 37.42139° N Longitude: 141.0325° E
Time: 1500Z Date: 15MAR2011
Hazard: Accident at nuclear facility in Japan
Weather: Global Numerical Weather Prediction: 0.5° x 0.5° resolution GFS from NCEP
Comments: This is a periodic update. We will continue to update this product with any additional information that becomes available.

- **(~~FOUO~~) Solution**
  - **Summary: Integrated dose plots provided on the following slides**
  - **Employment: Real World**
  - **Reachback: Team**

Possible Release – Situational Details Unknown

Nuclear Power Plants

SCOPING PURPOSES ONLY



FACTS

Off the coast of Honshu, Japan
Epicenter Location:
38.32° N / 142.37° E
Magnitude: 8.9
Incident Time:
0530Z11MAR2011

As of 2030Z 15MAR11

Fukushima Daiichi-1 Status

- Partial core damage from exposed fuel
- As of 2200 March 14, Japan time, sea water is being injected
- The reactor is described as "more stable"
- Suspected pipe broken and release to Containment which is believed "functional"
- Hydrogen explosion has damaged reactor building roof
- **Due to days of cool-down and injection of sea water, it will never be possible to produce power at the reactor (now unusable), but there is no further risk of total meltdown as long as core remains covered with seawater**

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Fukushima Daiichi-2 Status

- RCIC has failed
- Coolant was stopped for quite some time so core damage is assumed. Core was most likely totally uncovered for some time.
- *Large hydrogen explosion on 14 Mar*
- *Suspected leak from containment*

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Fukushima Daiichi-3 Status

- Condition described as essentially the same as Unit 1
- As of 2200 March 14, Japan time, sea water is being injected
- Hydrogen explosion has damaged reactor building roof
- Containment described as "functional"
- Alternate methods to inject water into the core are being investigated.
- Due to days of cool-down and injection of sea water, it will never be possible to produce power at the reactor (now unusable), but there is no further risk of total meltdown as long as core remains covered with seawater

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Status of additional reactors

- Fukushima Daiichi-4, -5, and -6 and Daini-1, -2, -3, and -4
  - The reactors are shut down
  - Sufficient level of reactor coolant to ensure safety is maintained
  - Tokyo Electric Power Company (TEPCO) does not believe that there is any reactor coolant leakage inside the reactor containment vessel

- Onagawa
  - At 2145 CET 13MAR2011, IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary have returned to normal background levels

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Possible Release – Situational Details Unknown

Fukushima Daiichi DTRA Modeling Assumptions

Most Likely

- **Scenario: some core damage; primary containment building integrity intact; venting occurring to reduce core temperature and pressure**

- Continuous Release – Steam released for decay heat removal
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    - ✓ Containment monitor reading: 10 R/hr (unconfirmed)
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    - ✓ Filters: On (unconfirmed)
  - ✓ Weather 40 km GFS

Fukushima Daiichi DTRA Modeling

- **Summary of Models Provided in this Briefing**

- Assumption – Fukushima Daiichi #1, 2, and #3 suffered damage resulting in a continuous release/leak of a small portion of its inventory. Release occurs consistently throughout times shown in this product. (Precise details of this release are highly uncertain and time-varying)

Possible Release – Situational Details Unknown

Fukushima Daiichi (Impacts) – Most Likely

Assumed Core Damage & Venting

- Weather
  - Surface winds in the vicinity of the power plant are currently NNE. Northwesterly (offshore) winds between 10-20 kts are forecasted for Wednesday (16MAR). **This means that any possible release through Wednesday will move to the S and later to SE**

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- Operations in the area of the facility should include monitoring equipment.
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Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0300Z 16MAR2011 (Far);

GFS Forecast valid @ 0300Z 16MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate)
RTH Radiation Field
16-Mar-11 03:00:00Z

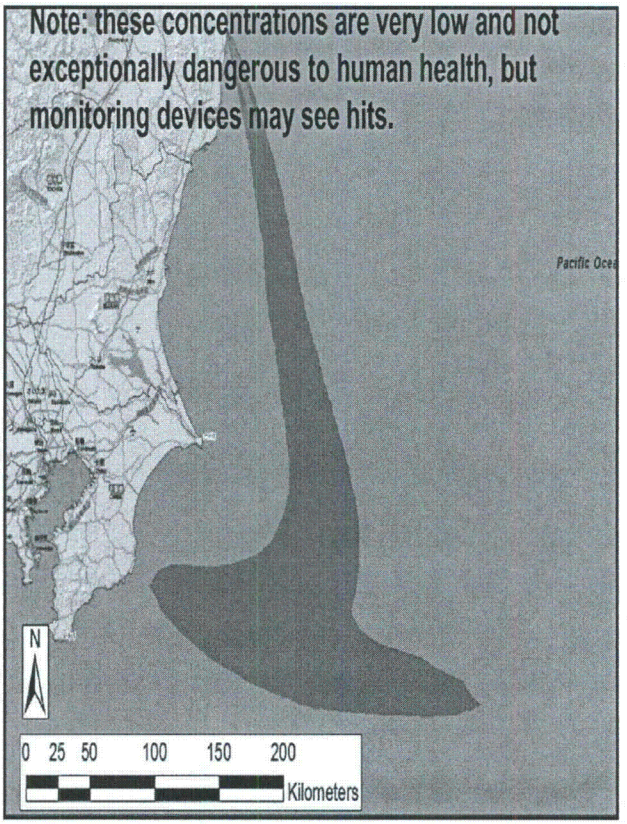
	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
1500Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity
Isotope Air Concentration
16-Mar-11 03:00:00Z

	Ci/m3
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0900Z 16MAR2011 (Far);

GFS Forecast valid @ 0900Z 16MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 16-Mar-11 09:00:00Z	REM/hr
100 nrem/hr	1.0E-07
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FACTS

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37.42139° N/ 141.0325° E
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LandScan 2009

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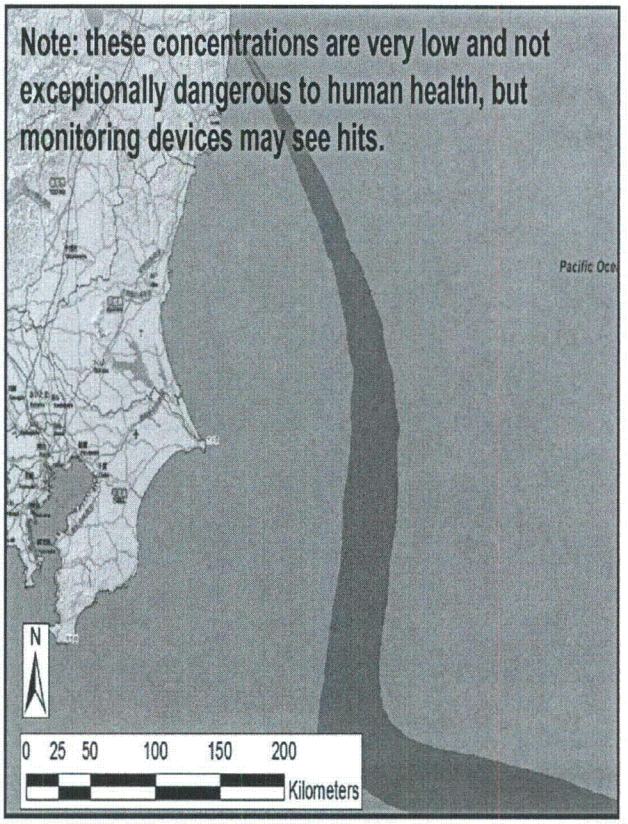
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 1500Z 16MAR2011 (Far);

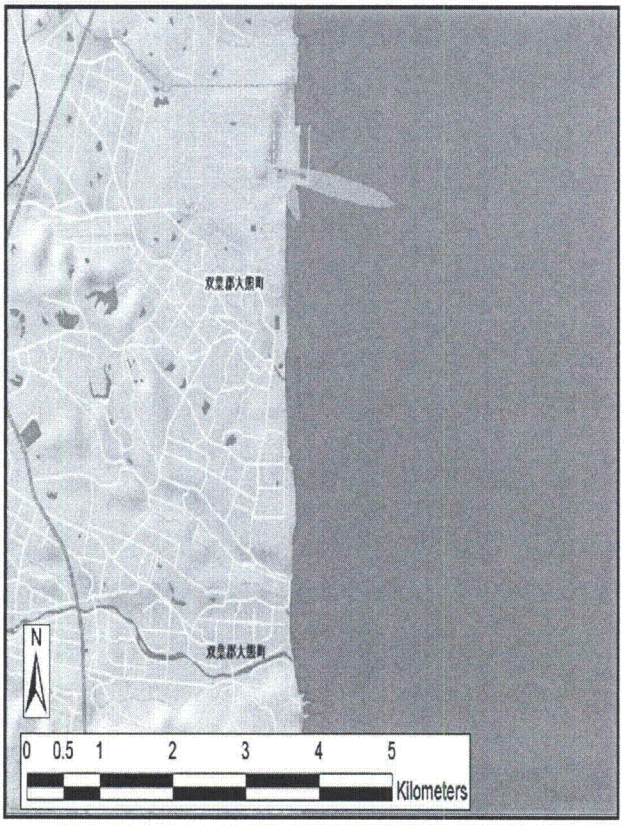
GFS Forecast valid @ 1500Z 16MAR2011 From 0600Z 15MAR2011 Run

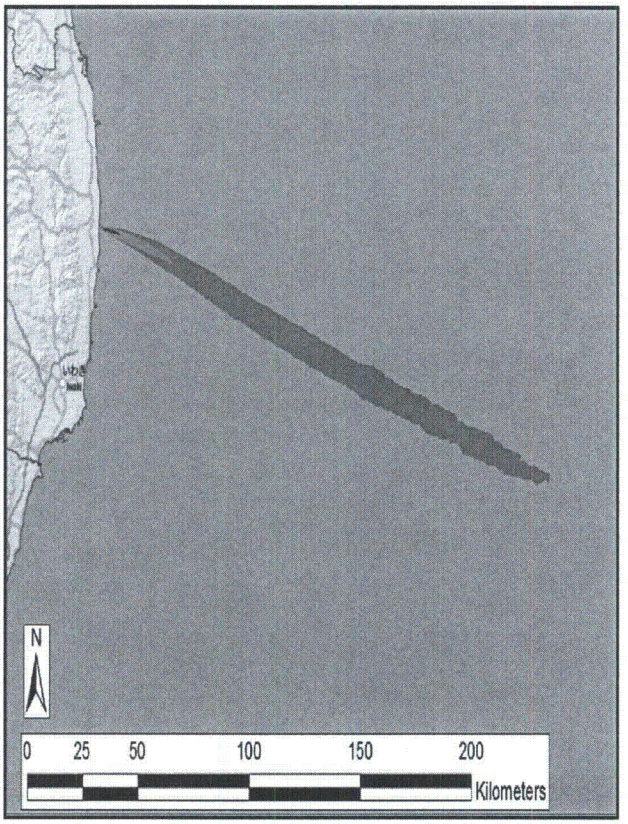
ALLEXTEFF(Rate) RTH Radiation Field 16-Mar-11 15:00:00Z	REM/hr
1 urem/hr	1.0E-06
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
1500Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 16-Mar-11 1500Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 2100Z 16MAR2011 (Far);

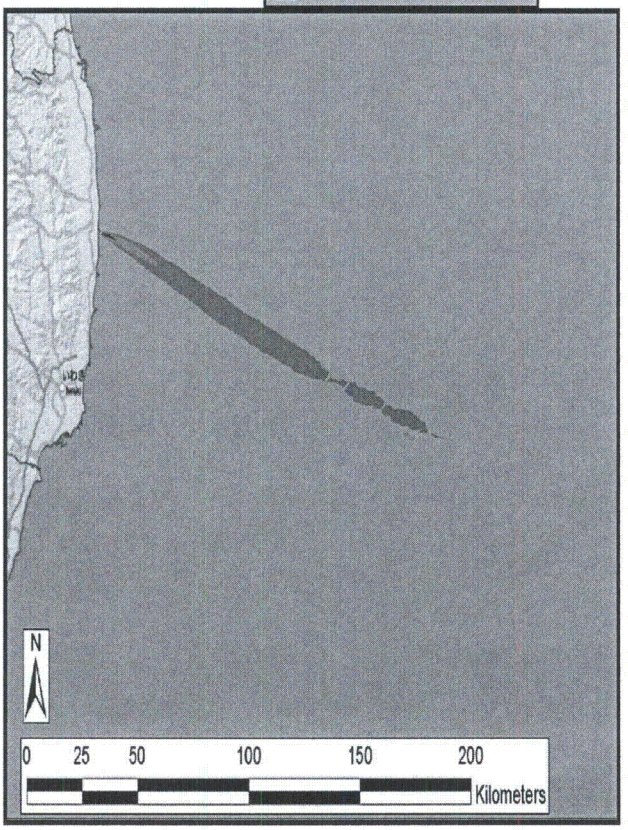
GFS Forecast valid @ 2100Z 16MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 16-Mar-11 21:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 16-Mar-11 21:00:00Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0300Z 17MAR2011 (Far);

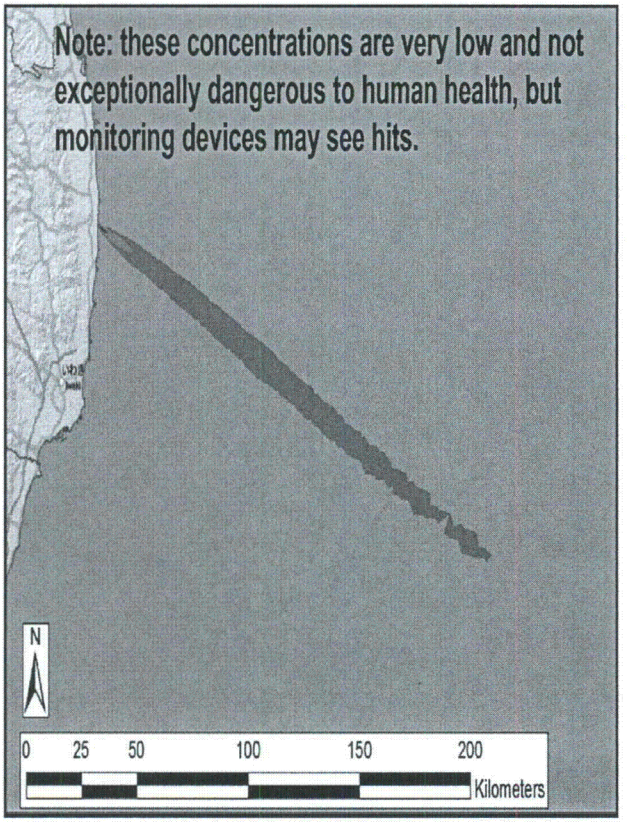
GFS Forecast valid @ 0300Z 17MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 03:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 17-Mar-11 0300Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0900Z 17MAR2011 (Far);

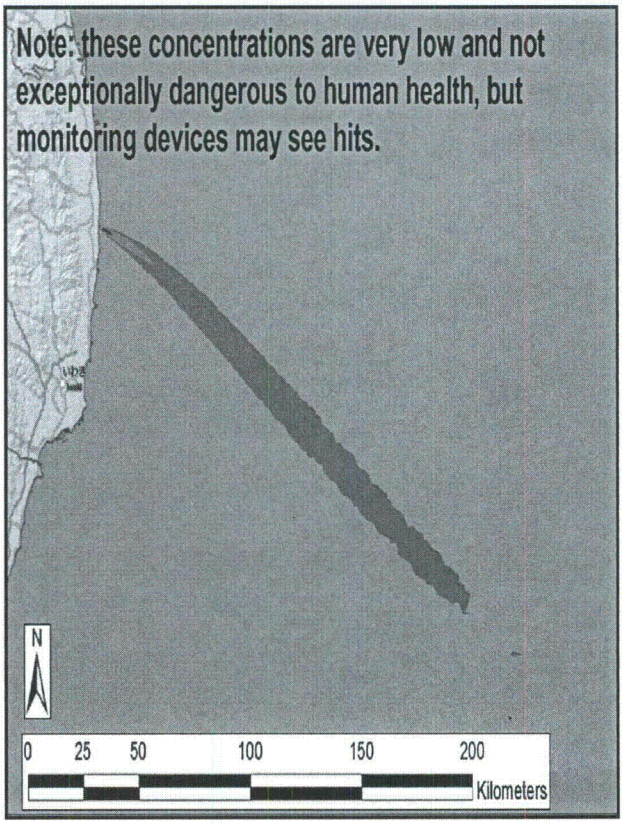
GFS Forecast valid @ 0900Z 17MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 09:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 17-Mar-11 0900Z	uCi/mL
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 1500Z 17MAR2011 (Far);

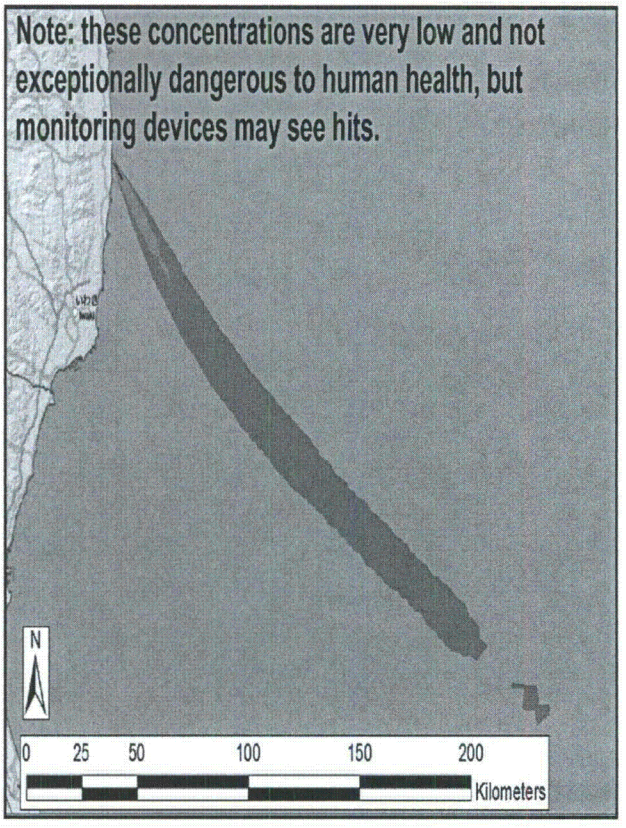
GFS Forecast valid @ 0900Z 17MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 09:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
1500Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 17-Mar-11 15:00:00Z	Ci/m3
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 2100Z 17MAR2011 (Far);

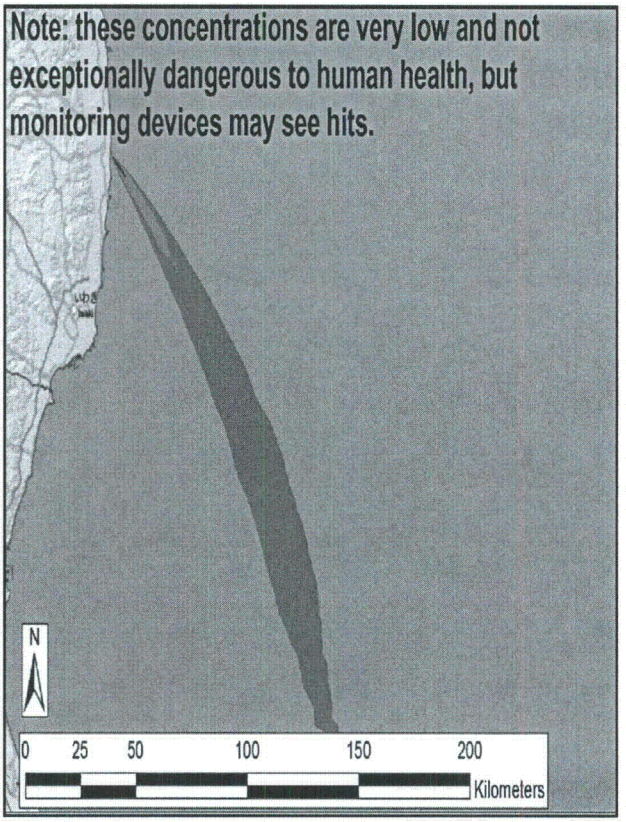
GFS Forecast valid @ 0900Z 17MAR2011 From 0600Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 21:00:00Z	REM/hr
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
1500Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 17-Mar-11 21:00:00Z	Ci/m3
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14



As of 2030Z 15MAR11

Backup: Radiation Unit Conversions

- Activity
  - 1 Curie (Ci) = 3.7×10^{10} Becquerels (Bq) = 3.7×10^{10} disintegrations/sec
  - Activity is a measure of atomic disintegrations per second.
  - Exponentially decays with age and is relative to specific radio-nuclide and age.
- Exposure or Dose Rate
  - 1 Gray (Gy) = 100 centi-Gray (cGy)
  - 1 centi-Gray (cGy) = 1 radiation absorbed dose unit (rad)
  - Dose is a measure of the energy deposited into a given mass.
  - Exposure when integrated over a time combined with an estimate of human tissue damage yields dose. Radiation detectors usually display instantaneous dose rate (e.g., cGy/hr, rad/hr).
- Dose Equivalent
  - 1 Sievert (Sv) = 100 centi-Sievert (cSv)
  - 1 centi-Sievert (cSv) = 1 Roentgen Equivalent to Man (REM)
  - An equivalent measurement or estimation of possible damage from ionizing radiation to human tissue. Dose Equivalent varies with type of human tissue exposed, ingestion, shielding, time, radiation type and energy.
- Exposure
  - 1 roentgen (R) = 2.58 * 10^-4 Coulombs (C) per kg (in air)
  - Used to measure x and gamma ray radiation. 1 R ~ 1 rad ~ 1 rem for x and gamma.

Possible Release – Situational Details Unknown

Backup: Radiation Exposure Reference

Exposure	cGy / Rad / REM / cSv	Reference
Cross Country Civilian Flight (cosmic radiation)	0.004	
Medical X-Ray (Chest)	0.01	Mettler FA, et al: Effective Doses in Radiology and Diagnostic Nuclear Medicine, 2008
Mammogram	0.4	Mettler FA, et al: Effective Doses in Radiology and Diagnostic Nuclear Medicine, 2008
CT (Chest, Abdomen, and Pelvis)	1.8	Mettler FA, et al: Effective Doses in Radiology and Diagnostic Nuclear Medicine, 2008
Chernobyl Evacuation Zone	10	
Hiroshima Survivor Inside Structure	78	
Nagasaki Survivor Inside Structure	156	
Average Background Annual Exposure in U.S. (Total)	0.62	NCRP No. 160 (2006)

U.S. Civilian Standards	cGy / Rad / REM / cSv	
Maximum Annual Public Exposure	0.1	(10 CFR 20.1301)
Maximum Radiation Worker Annual Dose	5	(10 CFR 20.1201)
General Emergency	1	(NUREG-0654/FEMA REP 1)
Protective Actions (shelter or evacuate)	1.0-5.0	(EPA 400-R-92-001, 1992)
Evacuation required	5	(EPA 400-R-92-001, 1992)
1st Responder Dose Protecting valuable property 1	10	(EPA 400-R-92-001, 1992)
1st Responder Dose Lifesaving or protection of large populations 1	25	(EPA 400-R-92-001, 1992)
Maximum 1st Responder Dose	25	(EPA 400-R-92-001, 1992)

Military OEG*	cGy / Rad / REM / cSv	
Wartime high-priority missions, to include life-saving	125	NATO STANAG-2473, 3 May 2000; USAFRRI, SP 03-1, April 2003
Operations other than war based on mission priorities and risk analysis	75	NATO STANAG-2473, 3 May 2000; USAFRRI, SP 03-1, April 2003

Note: Sieverts=Grays and Rad=REM for beta and gamma radiation as the Quality Factor is one.

[1]FEMA: Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents

From: Pilgrim, Gary T. CONTRACTOR <(b)(6)> on behalf of DTRA Operations Center <(b)(6)>

Sent: Tuesday, March 15, 2011 1:27 PM

To:

(b)(6)

Subject: FW: RFI-216U_Revised

Attachments: RFI_216U_0900Z_15MAR2011_rev1.PPT

Attached is the revised update for RFI 216 15March11 0900Z.

Mr. Gary Pilgrim
Operations Center Support
phone: 703.767.2116

Unclas: (b)(6)
Sipr: (b)(6)

-----Original Message-----
From: DTRA Reachback (b)(6)
Sent: Tuesday, March 15, 2011 1:02 PM
To: DTRA Operations Center
Cc: Reachback
Subject: RFI-216U_Revised

Ops:

Please release the revised product (March 15, 2011 0900Z)to the requestors. Thank you.

Respectfully,

Defense Threat Reduction Agency

COM: (703) 767-3448, (DSN 427-)

STE: 427-2138

NIPR: (b)(6)

SIPR: (b)(6)

JWICS: (b)(6)

R&D Enterprise

Innovation & Systems Engineering Office

Reachback Division

Planning: Model of a Nuclear Reactor Incident in Japan as a Result of an Earthquake – Update 0300Z 15 MAR

RFI – 216U

15MAR2011

Requestor: USFJ

As of 1650Z 15MAR11

R&D Enterprise
Innovation & Systems Engineering Office
Reachback Division
(703) 767-3448, DSN 427-

Possible Release – Situational Details Unknown

Request Summary

- **(~~FOUO~~) Request data**
  - **Requestor:** (b)(6)
  - **Contact:** (b)(6)
  - **Request: A model of a nuclear incident at the Fukushima Daiichi – 1 and -3 nuclear power plant in Japan.**

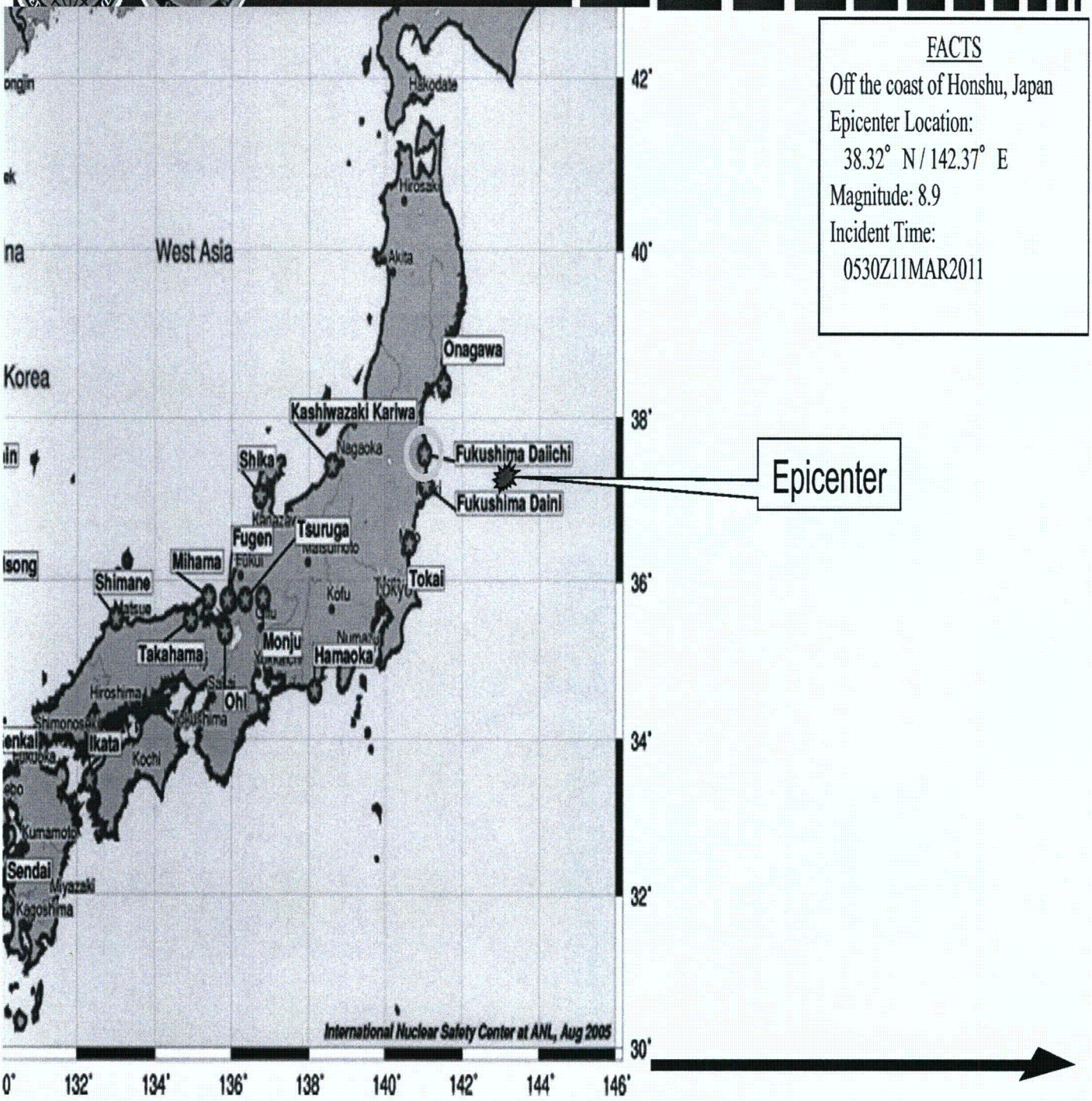
Location: Fukushima Daiichi, Japan Latitude: 37.42139° N Longitude: 141.0325° E
Time: 0900Z Date: 15MAR2011
Hazard: Accident at nuclear facility in Japan
Weather: Global Numerical Weather Prediction: 0.5° ×0.5° resolution GFS from NCEP
Comments: This is a periodic update. We will continue to update this product with any additional information that becomes available.

- **(~~FOUO~~) Solution**
  - **Summary: Integrated dose plots provided on the following slides**
  - **Employment: Real World**
  - **Reachback: Team**

Possible Release – Situational Details Unknown

Nuclear Power Plants

SCOPING PURPOSES ONLY



FACTS

Off the coast of Honshu, Japan

Epicenter Location:

38.32° N / 142.37° E

Magnitude: 8.9

Incident Time:

0530Z11MAR2011

As of 1650Z 15MAR11

Fukushima Daiichi-1 Status

- Partial core damage from exposed fuel
- As of 2200 March 14, Japan time, sea water is being injected
- The reactor is described as "more stable"
- Suspected pipe broken and release to Containment which is believed "functional"
- Hydrogen explosion has damaged reactor building roof
- **Due to days of cool-down and injection of sea water, it will never be possible to produce power at the reactor (now unusable), but there is no further risk of total meltdown as long as core remains covered with seawater**

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Fukushima Daiichi-2 Status

- RCIC has failed
- Coolant was stopped for quite some time so core damage is assumed. Core was most likely totally uncovered for some time.
- *Large hydrogen explosion on 14 Mar*
- *Suspected leak from containment*

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Fukushima Daiichi-3 Status

- Condition described as essentially the same as Unit 1
- As of 2200 March 14, Japan time, sea water is being injected
- Hydrogen explosion has damaged reactor building roof
- Containment described as "functional"
- Alternate methods to inject water into the core are being investigated.
- Due to days of cool-down and injection of sea water, it will never be possible to produce power at the reactor (now unusable), but there is no further risk of total meltdown as long as core remains covered with seawater

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Status of additional reactors

- Fukushima Daiichi-4, -5, and -6 and Daini-1, -2, -3, and -4
  - The reactors are shut down
  - Sufficient level of reactor coolant to ensure safety is maintained
  - Tokyo Electric Power Company (TEPCO) does not believe that there is any reactor coolant leakage inside the reactor containment vessel
  - Fire in spent fuel pool extinguished on 14Mar
- Onagawa
  - At 2145 CET 13MAR2011, IAEA reported that Japanese authorities had informed it that radioactivity levels at the site boundary have returned to normal background levels

Source: USNRC Emergency Operations Center Status Update, 1730Z 14MAR2011

Possible Release – Situational Details Unknown

Fukushima Daiichi DTRA Modeling Assumptions

Most Likely

- **Scenario: some core damage; primary containment building integrity intact; venting occurring to reduce core temperature and pressure**

- Continuous Release – Steam released for decay heat removal
- HPAC –Release Assumptions:
  - ✓ Shut down time of reactor concurrent with earthquake
  - ✓ Continuous Small Release starting at 09Z
  - ✓ NFAC Reactor Accident
    - ✓ Containment monitor reading: 10 R/hr (unconfirmed)
    - ✓ Sprayers: Off (unconfirmed)
    - ✓ Filters: On (unconfirmed)
  - ✓ Weather 40 km GFS

Fukushima Daiichi DTRA Modeling

- **Summary of Models Provided in this Briefing**

- Assumption – Fukushima Daiichi #1, 2, and #3 suffered damage resulting in a continuous release/leak of a small portion of its inventory. Release occurs consistently throughout times shown in this product. (Precise details of this release are highly uncertain and time-varying)

Possible Release – Situational Details Unknown

Fukushima Daiichi (Impacts) – Most Likely

Assumed Core Damage & Venting

- Weather
  - Surface winds in the vicinity of the power plant are currently NNE. Scattered rain and snow showers are forecasted for central and southern Japan for 15MAR. Northwesterly (offshore) winds between 10-20 kts are forecasted for Wednesday (16MAR). **This means that any possible release through Wednesday will move to the S and later to SE**
- Japan has evacuated out to 20 km around site; ground operations should carefully monitor conditions within this zone.
- Operations in the area of the facility should include monitoring equipment.
- Air operations minimally impacted, but coordination with local authorities recommended
- Radiation hazard is above background. Level of concern should be less than 0.1 Rem integrated dose (see worst case in next slides)
- **As core pressure and temperature lower and stabilize, radiation levels will lower accordingly.**

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 2100Z 15MAR2011 (Far);

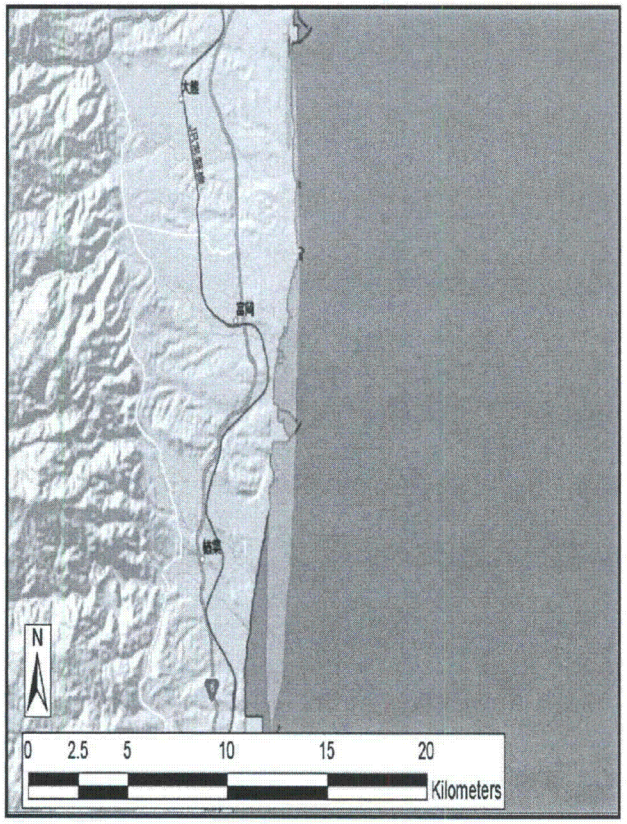
GFS Forecast valid @ 2100Z 15MAR2011 From 0000Z 15MAR2011 Run

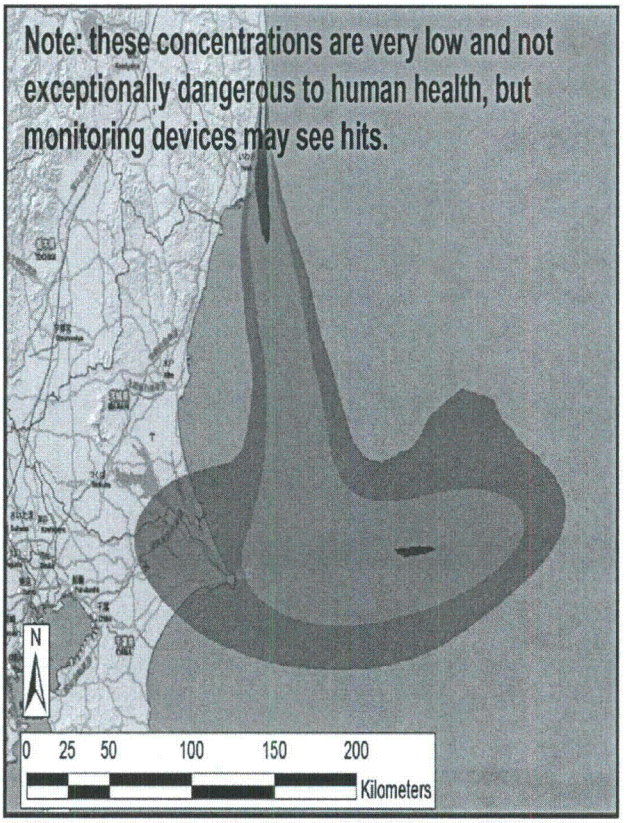
ALLEXTEFF(Rate) RTH Radiation Field 15-Mar-11 21:00:00Z	REM/hr
1 urem/hr	1.0E-06
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 15-Mar-11 2100Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





As of 1650Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0300Z 16MAR2011 (Far);

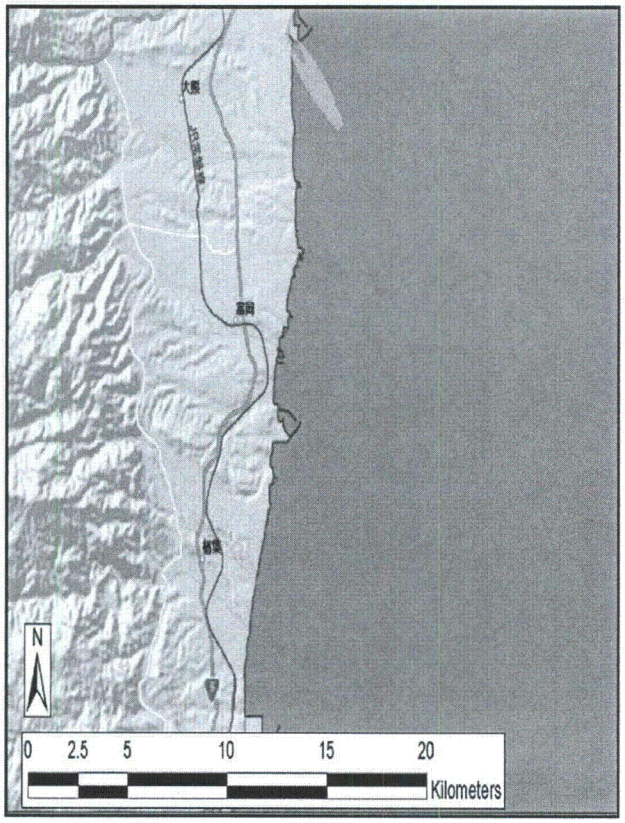
GFS Forecast valid @ 0300Z 16MAR2011 From 0000Z 15MAR2011 Run

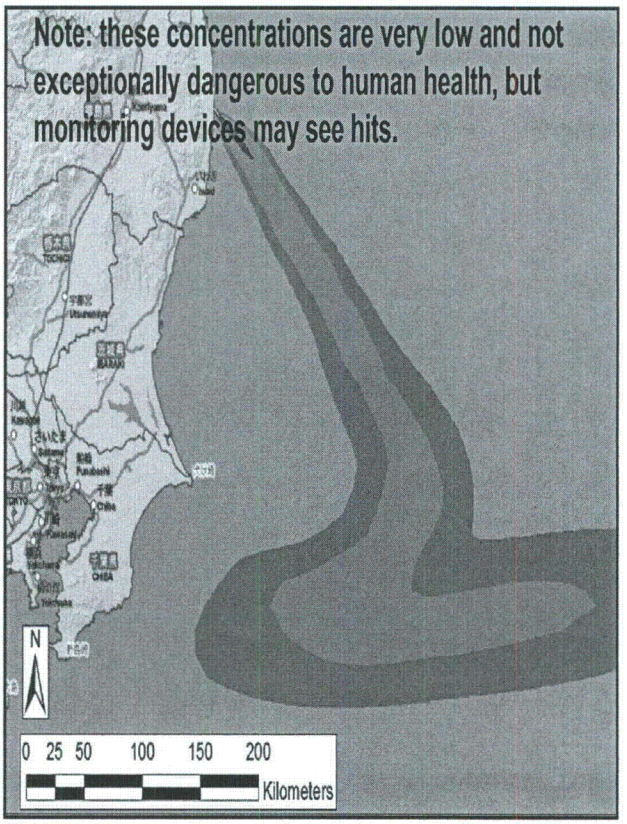
ALLEXTEFF(Rate) RTH Radiation Field 16-Mar-11 03:00:00Z (18.000 hr)	REM/hr
1 urem/hr	1.0E-06
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 16-Mar-11 0300Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





As of 1650Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0900Z 16MAR2011 (Far);

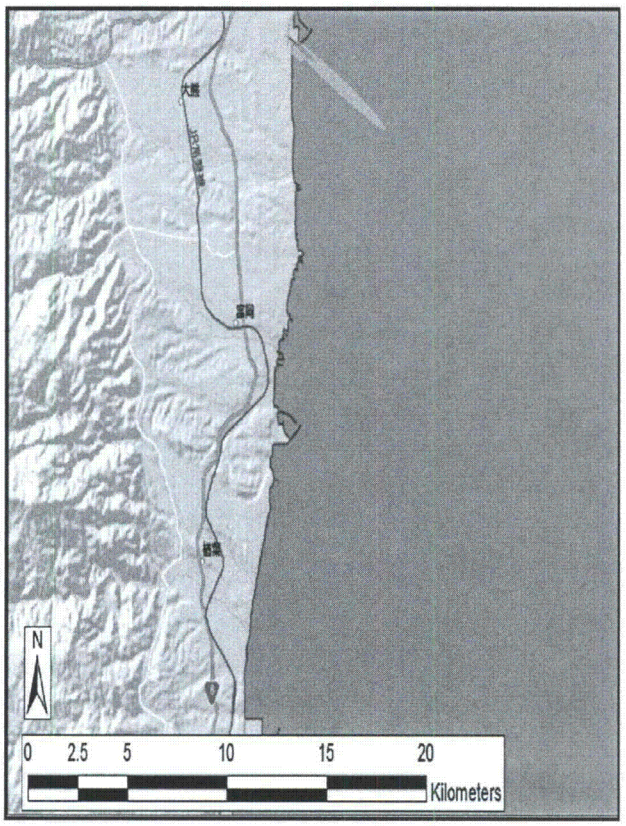
GFS Forecast valid @ 0900Z 16MAR2011 From 0000Z 15MAR2011 Run

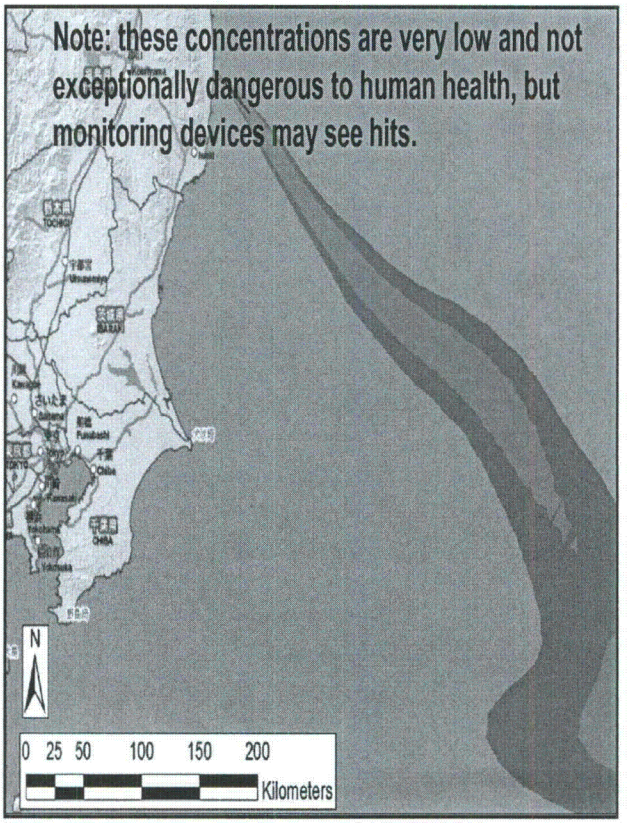
ALLEXTEFF(Rate) RTH Radiation Field 16-Mar-11 09:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 16-Mar-11 0900Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





As of 1650Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 1500Z 16MAR2011 (Far);

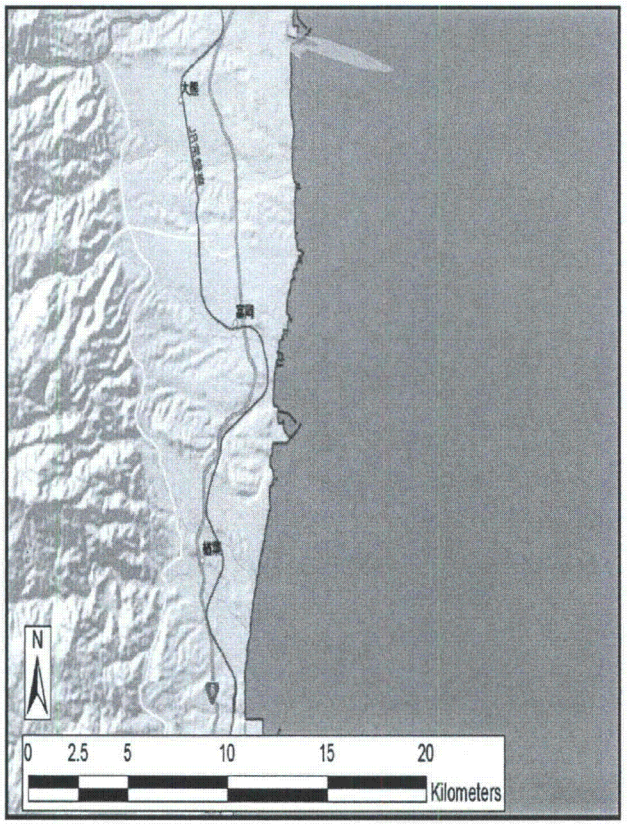
GFS Forecast valid @ 1500Z 16MAR2011 From 0000Z 15MAR2011 Run

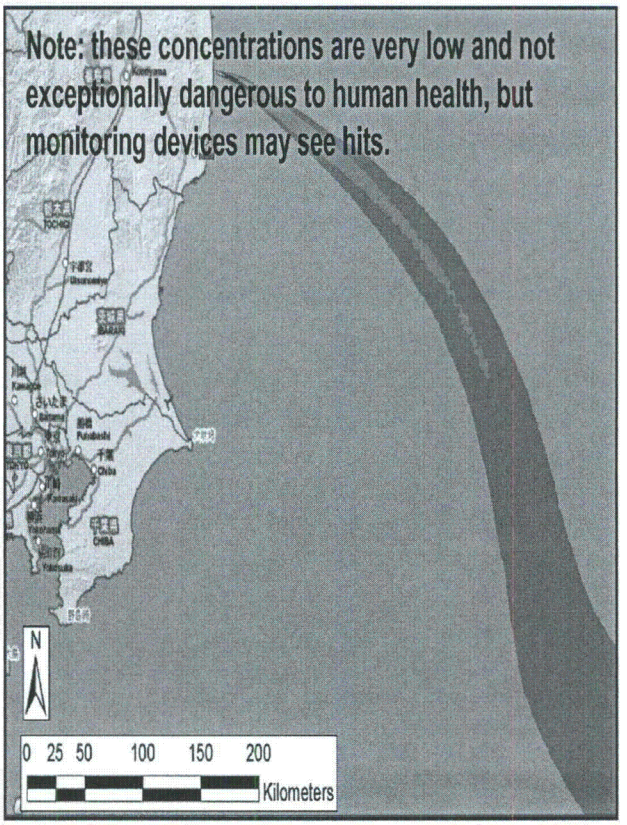
ALLEXTEFF(Rate) RTH Radiation Field 16-Mar-11 15:00:00Z	REM/hr
1 urem/hr	1.0E-06
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 16-Mar-11 1500Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





As of 1650Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 2100Z 16MAR2011 (Far);

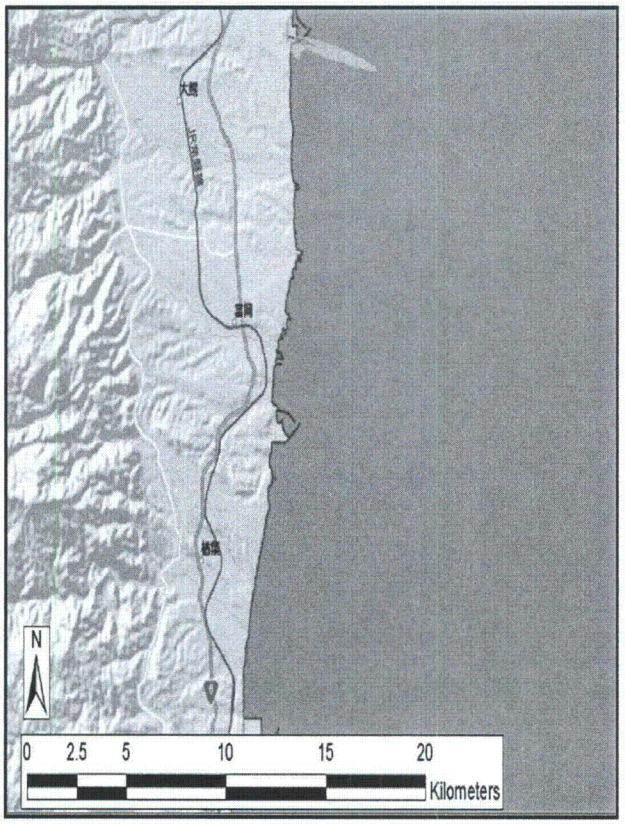
GFS Forecast valid @ 2100Z 16MAR2011 From 0000Z 15MAR2011 Run

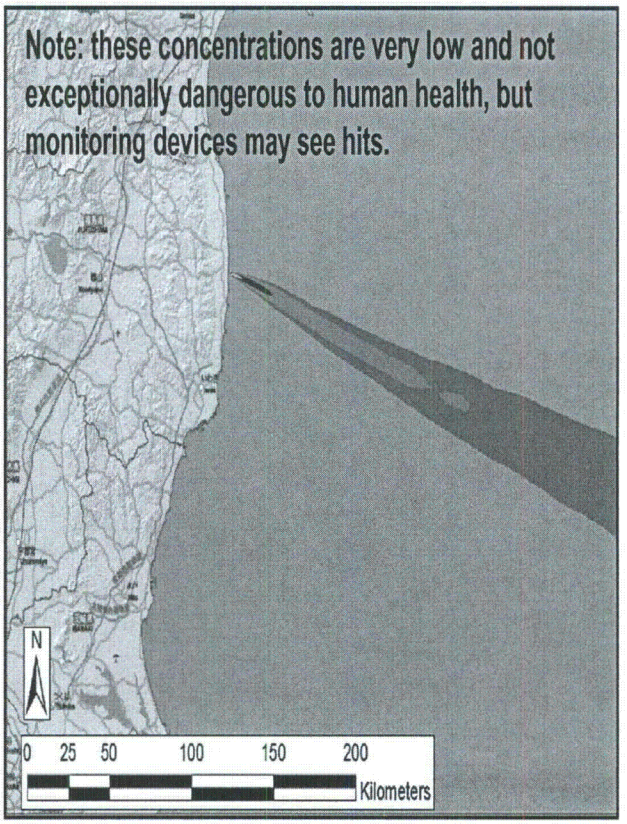
ALLEXTEFF(Rate) RTH Radiation Field 16-Mar-11 21:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

FACTS

Fukushima Daiichi
37.42139° N/ 141.0325° E
0900Z 15MAR2011
Type: Nuclear Facility Accident
Weather: 40 km GFS
Model: HPAC 5.0 SP1
Static Population Estimates:
LandScan 2009

Total Activity Isotope Air Concentration 16-Mar-11 21:00:00Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





As of 1650Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0300Z 17MAR2011 (Far);

GFS Forecast valid @ 0300Z 17MAR2011 From 0000Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 03:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

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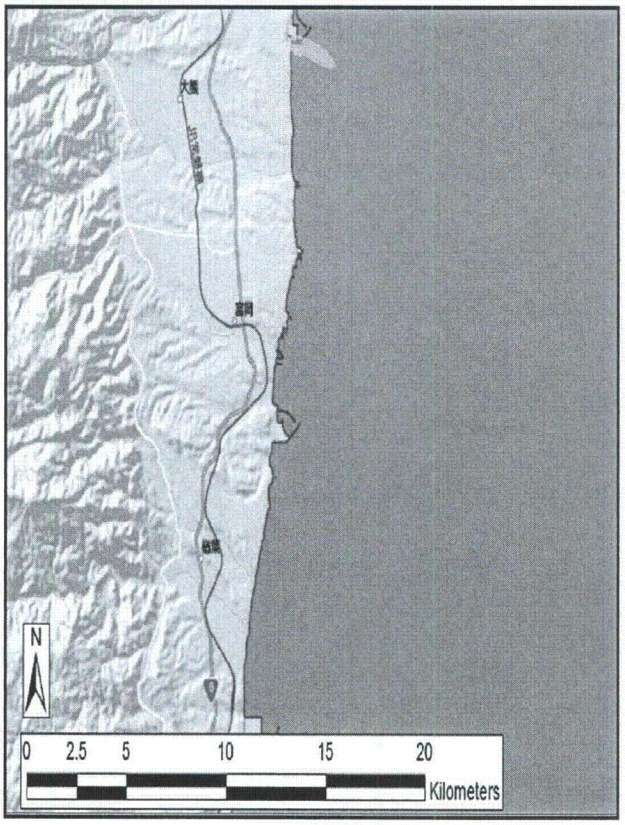
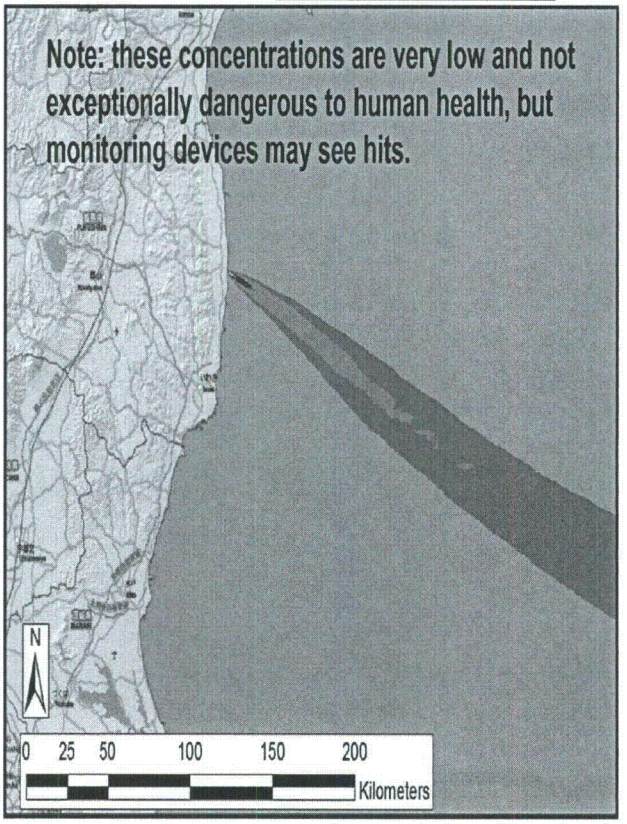
LandScan 2009

Total Activity Isotope Air Concentration 17-Mar-11 0300Z	uCi/mL
10 nCi/m3	1.0E-08
1 nCi/m3	1.0E-09
100 pCi/m3	1.0E-10
10 pCi/m3	1.0E-11
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





As of 1650Z 15MAR11

Possible Release – Situational Details Unknown

Fukushima Daiichi – Plume at 0900Z 17MAR2011 (Far);

GFS Forecast valid @ 0900Z 17MAR2011 From 0000Z 15MAR2011 Run

ALLEXTEFF(Rate) RTH Radiation Field 17-Mar-11 09:00:00Z	REM/hr
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

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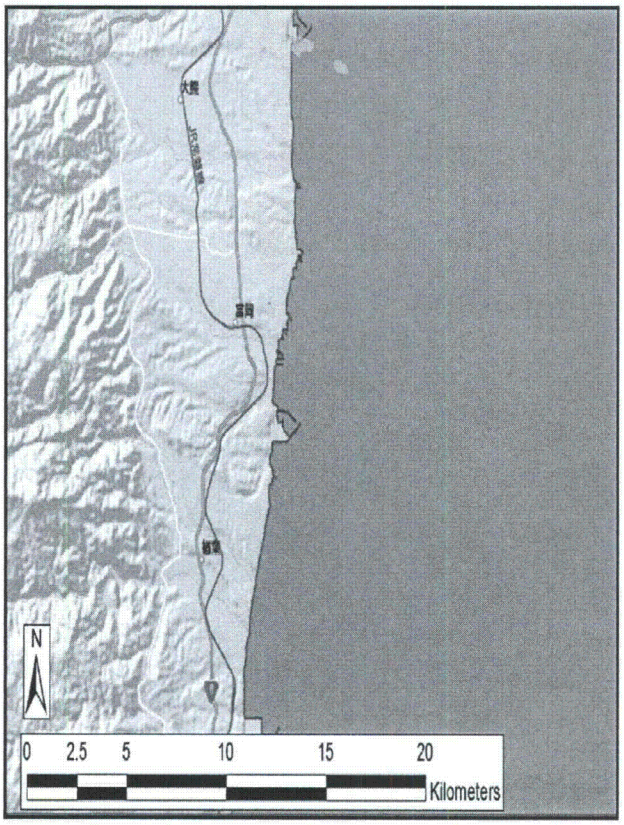
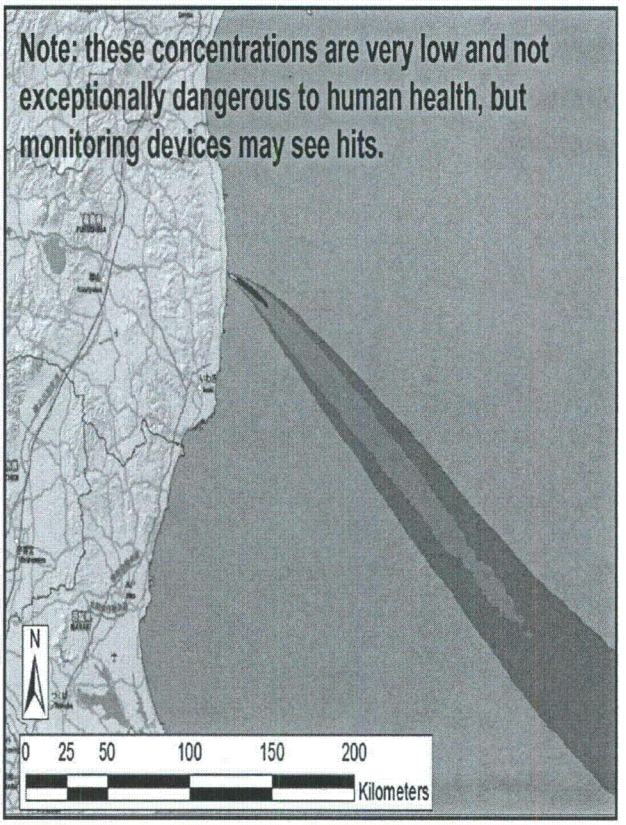
1 pCi/m3	1.0E-12
100 fCi/m3	1.0E-13
10 fCi/m3	1.0E-14





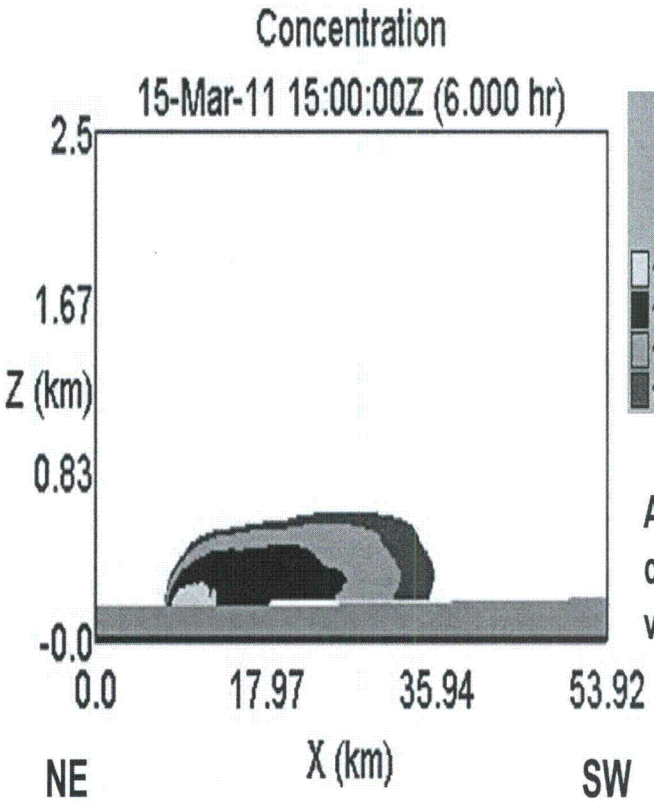
As of 1650Z 15MAR11

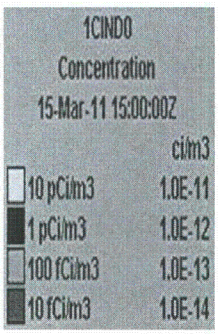
Possible Release – Situational Details Unknown

Fukushima Daiichi-1

Most Likely Release Scenario

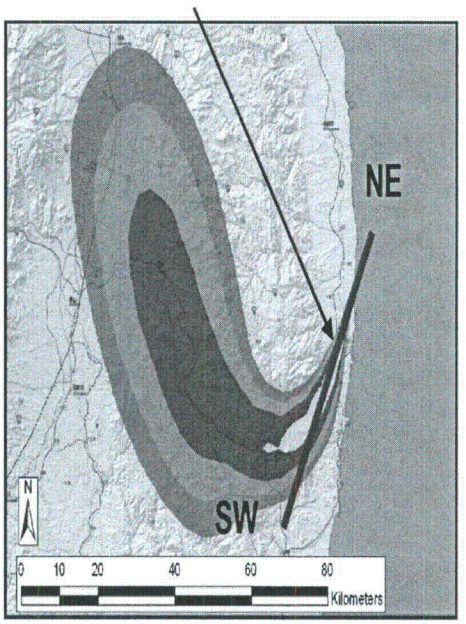
Vertical Slice @ 0900Z 15 March





Assumes continuous venting

Slice cross-section



Note: The plume will change shape and structure as a function of time – slices at other times were similar or smaller. Higher concentrations were generally at or below 1 km elevation, lower concentrations up to approx 1 km or a little above.

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Backup: Radiation Unit Conversions

- Activity
  - 1 Curie (Ci) = 3.7×10^{10} Becquerels (Bq) = 3.7×10^{10} disintegrations/sec
  - Activity is a measure of atomic disintegrations per second.
  - Exponentially decays with age and is relative to specific radio-nuclide and age.
- Exposure or Dose Rate
  - 1 Gray (Gy) = 100 centi-Gray (cGy)
  - 1 centi-Gray (cGy) = 1 radiation absorbed dose unit (rad)
  - Dose is a measure of the energy deposited into a given mass.
  - Exposure when integrated over a time combined with an estimate of human tissue damage yields dose. Radiation detectors usually display instantaneous dose rate (e.g., cGy/hr, rad/hr).
- Dose Equivalent
  - 1 Sievert (Sv) = 100 centi-Sievert (cSv)
  - 1 centi-Sievert (cSv) = 1 Roentgen Equivalent to Man (REM)
  - An equivalent measurement or estimation of possible damage from ionizing radiation to human tissue. Dose Equivalent varies with type of human tissue exposed, ingestion, shielding, time, radiation type and energy.
- Exposure
  - 1 roentgen (R) = 2.58 * 10^-4 Coulombs (C) per kg (in air)
  - Used to measure x and gamma ray radiation. 1 R ~ 1 rad ~ 1 rem for x and gamma.

Possible Release – Situational Details Unknown

Backup: Radiation Exposure Reference

Exposure	cGy / Rad / REM / cSv	Reference
Cross Country Civilian Flight (cosmic radiation)	0.004	
Medical X-Ray (Chest)	0.01	Mettler FA, et al: Effective Doses in Radiology and Diagnostic Nuclear Medicine, 2008
Mammogram	0.4	Mettler FA, et al: Effective Doses in Radiology and Diagnostic Nuclear Medicine, 2008
CT (Chest, Abdomen, and Pelvis)	1.8	Mettler FA, et al: Effective Doses in Radiology and Diagnostic Nuclear Medicine, 2008
Chernobyl Evacuation Zone	10	
Hiroshima Survivor Inside Structure	78	
Nagasaki Survivor Inside Structure	156	
Average Background Annual Exposure in U.S. (Total)	0.62	NCRP No. 160 (2006)

U.S. Civilian Standards	cGy / Rad / REM / cSv	
Maximum Annual Public Exposure	0.1	(10 CFR 20.1301)
Maximum Radiation Worker Annual Dose	5	(10 CFR 20.1201)
General Emergency	1	(NUREG-0654/FEMA REP 1)
Protective Actions (shelter or evacuate)	1.0-5.0	(EPA 400-R-92-001, 1992)
Evacuation required	5	(EPA 400-R-92-001, 1992)
1st Responder Dose Protecting valuable property 1	10	(EPA 400-R-92-001, 1992)
1st Responder Dose Lifesaving or protection of large populations 1	25	(EPA 400-R-92-001, 1992)
Maximum 1st Responder Dose	25	(EPA 400-R-92-001, 1992)

Military OEG*	cGy / Rad / REM / cSv	
Wartime high-priority missions, to include life-saving	125	NATO STANAG-2473, 3 May 2000; USAFRRI, SP 03-1, April 2003
Operations other than war based on mission priorities and risk analysis	75	NATO STANAG-2473, 3 May 2000; USAFRRI, SP 03-1, April 2003

Note: Sieverts=Grays and Rad=REM for beta and gamma radiation as the Quality Factor is one.

[1]FEMA: Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents