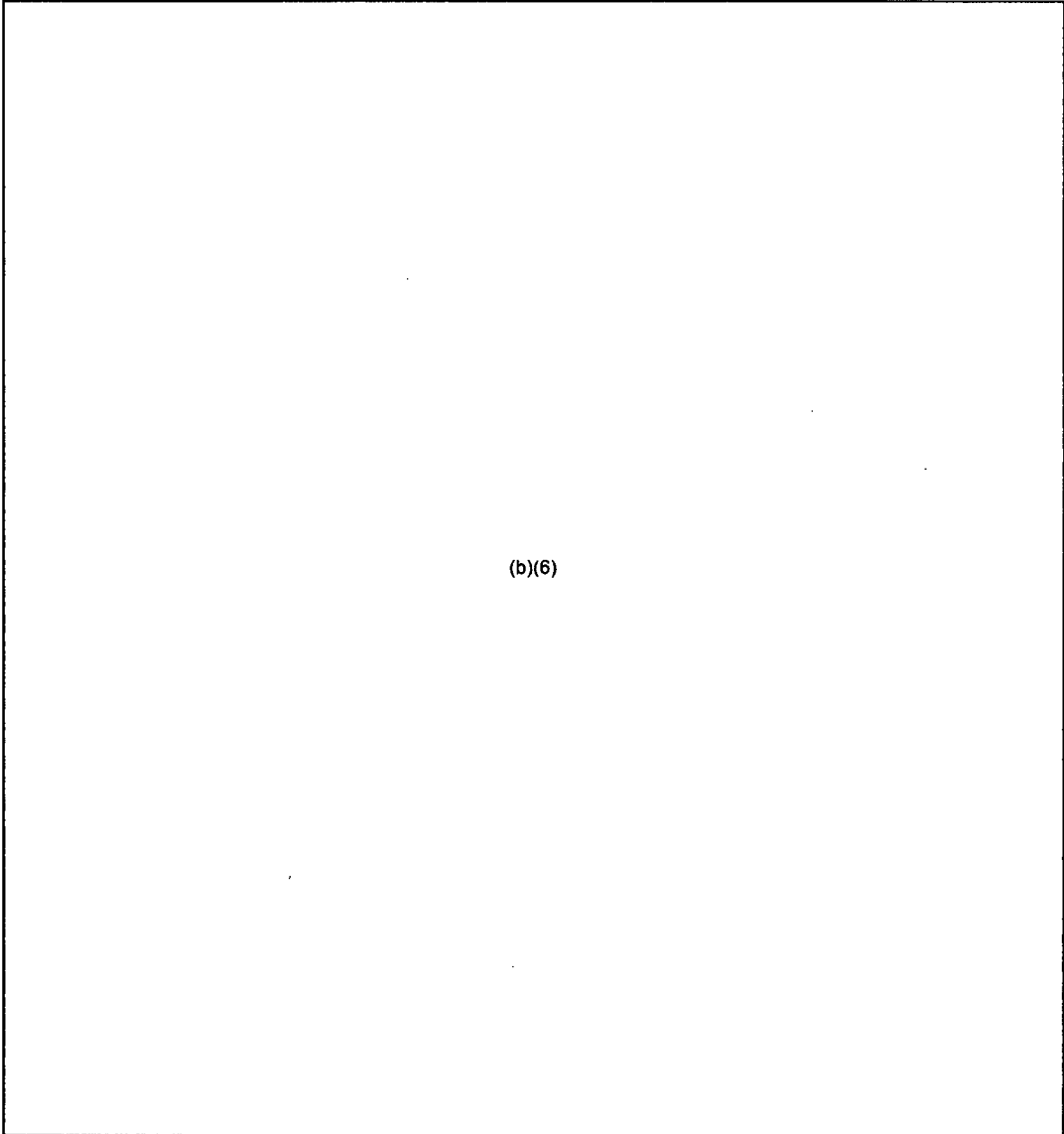

From: Langford, Christian CONTRACTOR <(b)(6)> on
behalf of DTRA Operations Center <(b)(6)>
Sent: Friday, March 18, 2011 12:14 AM
To:



Subject: RFI 216U 0300Z 18MAR2011
Attachments: RFI_216U_0300Z_18MAR2011.PPT

All,

Attached is the latest product for RFI 216.

DTRA Operations Center
703-767-2003
DSN 427-2003

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Possible Release – Situational Details Unknown

Planning:
**Model of a Nuclear Reactor Incident in
Japan as a Result of an Earthquake –
Update 0300Z 18MAR2011**

RFI – 216U

17MAR2011

Requestor: USFJ

As of 0345Z 18MAR11

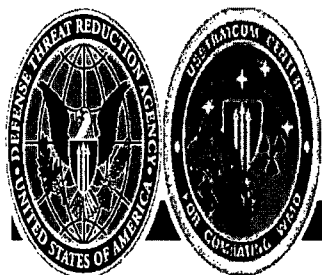


Distribution: Limited to DoD and authorized contractors. Further distribution contact DTRA.
Derived From: USFJ
Reason: E.O. 12958 sections 1.4 (e), (g) and (h).

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

CV 2643 of 3058



Request Summary

• (FOUO) Request data

• Requestor: [Redacted] (b)(6)

• Contact: [Redacted] (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: 0300Z Date: 18MAR2011
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.

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Possible Release – Situational Details Unknown



Nuclear Power Plants

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FACTS

Off the coast of Honshu, Japan

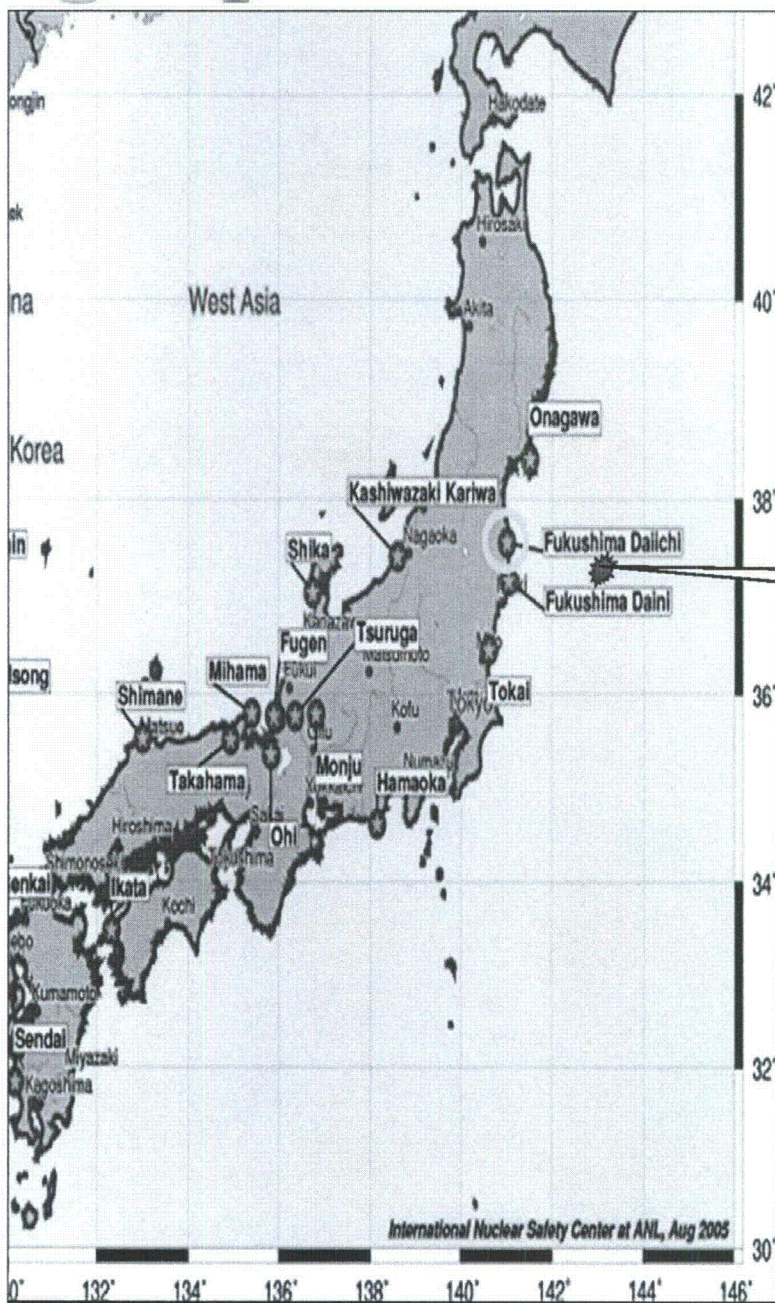
Epicenter Location:

38.32° N / 142.37° E

Magnitude: 9.0

Incident Time:

0530Z11MAR2011



As of 0345Z 18MAR11

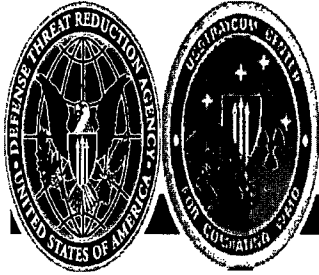
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CV 2645 of 3058

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Possible Release – Situational Details Unknown



Fukushima Daiichi Nuclear Power Plant

- Highest reading at fence was 60 mrem/hr at 0600Z 15MAR2011.
- Reduction of dose rates after the peak at 0122Z 15MAR2011 (400 mSv/hr in area surrounding unit 3).
- 30 mSv/hr between Units 2 and 3, and 100 mSv/hr surrounding Unit 4.
- Offsite dose measured in Tokai on the coast 100 km NE of Tokyo on 2245Z 14MAR2011 was 5 μ Sv/hr.

Source: IAEA Reporting at 1740Z 15MAR2011 (From NRC Update 2100Z 17MAR2011)

As of 0345Z 18MAR11

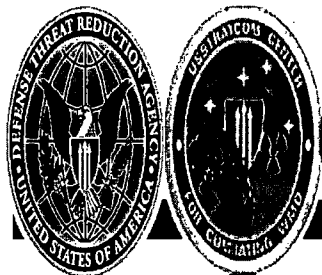
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4

CV 2646 of 3058

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Possible Release – Situational Details Unknown



Fukushima Daiichi-1 Status

- Core damage occurred due to insufficient cooling water caused by loss of offsite power and onsite diesel generators following tsunami.
- Primary Containment described as “functional”. Secondary Containment: Visual is lost.
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building (secondary containment)
- The spent fuel pool level is unknown.
- High radiation levels reduced to 1.5-10 mSv/hr (0.15-1 rem/hr) at 1400Z 16MAR2011 at site gate.
- Sea water inject is considered sufficient by the World Association of Nuclear Operators to cool core.

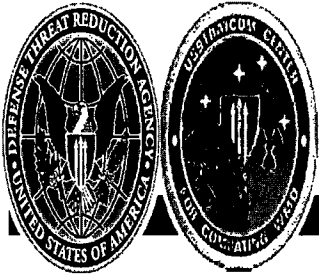
Source: USNRC Emergency Operations Center Status Update, 2100Z 17MAR2011

As of 0345Z 18MAR11

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CV 2647 of 3058



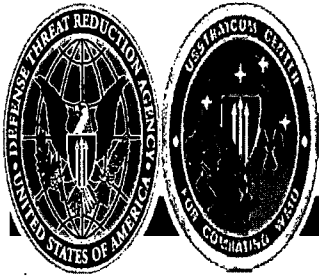
Fukushima Daiichi-2 Status

- 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.
- Primary containment has some damage.
- Secondary containment: Cut hole to reduce hydrogen gas buildup
- The spent fuel pool level is unknown. Some water is available as evidenced by steam emanating from hole.
- Sea water inject is considered sufficient by World Association of Nuclear Operators to cool core.
- High radiation levels reduced to 1.5-10 mSv/hr (0.15-1 rem/hr) at 1400Z 16MAR2011 at site gate (same gate for all units).

Source: USNRC Emergency Operations Center Status Update, 2100Z 17MAR2011

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Possible Release – Situational Details Unknown



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 inject is considered sufficient by World Association of Nuclear Operators to cool core.
- Hydrogen explosion from overheated fuel-water reaction has damaged reactor building.
- Primary Containment has some damage. Secondary Containment: visual has been lost.
- The spent fuel level is possibly drained – some evidence of steam.
- High radiation levels reduced to 1.5-10 mSv/hr (0.15-1 rem/hr) at 1400Z 16MAR2011 at site gate (same gate for all units).
- Dumping water with helicopter suspended as of 0820Z.

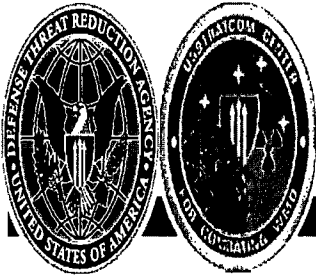
Source: USNRC Emergency Operations Center Status Update, 2100Z 17MAR2011

As of 0345Z 18MAR11

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7

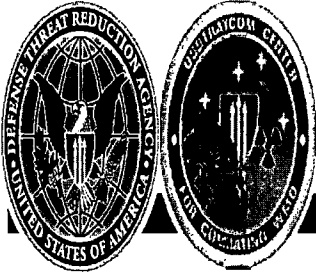
CV 2649 of 3058



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 0200Z 15MAR2011.
- High radiation levels reduced to 1.5-10 mSv/hr (0.15-1 rem/hr) at 1400Z 16MAR2011 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. Fuel reported to be uncovered.
- Radiation levels outside Unit 4 reported to be 30 R/hr following second fire.
- High radiation dose rates measured between Units 3 and 4, source is suspected to be the partially uncovered Unit 4 spent fuel pool.
- The spent fuel pool's ability to retain water is in doubt. No steam – likely dry.
- Damage to fuel rods suspected according to the Japan Atomic Industrial Forum (JAIF).
- Dumping water from helicopters has been suspended as of 0820Z.

Source: USNRC Emergency Operations Center Status Update, 2100Z 17MAR2011



Status of additional reactors

- Fukushima Daiichi-5, and -6
 - The reactors are defueled
 - Spent fuel pools are reported to be heating up
 - A/C power available from Unit 6 diesel generator
- 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

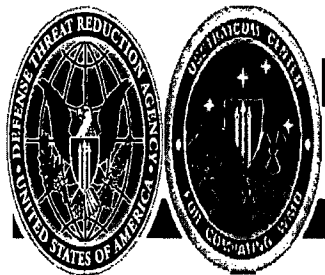
Source: USNRC Emergency Operations Center Status Update, 2300Z 16MAR2011

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Possible Release – Situational Details Unknown

Fukushima Daiichi DTRA Modeling Assumptions

Most Likely

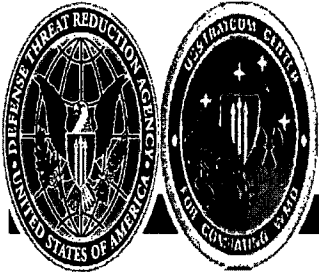


- **Scenario: some core damage; primary containment building integrity intact; venting occurring to reduce core temperature and pressure**

- Continuous Release – Steam released for decay heat removal
- HPAC –Release Assumptions:
 - ✓ Shut down time of reactor concurrent with earthquake
 - ✓ Continuous Small Release starting at 0300Z
 - ✓ NFAC Reactor Accident
 - ✓ Containment monitor reading adjusted to measured value and to replicate the reported high radiation levels at site gate.
 - ✓ Sprayers: Off (unconfirmed)
 - ✓ Filters: On (unconfirmed)
 - ✓ Weather 40 km GFS from NCEP run at 18Z 17March

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Possible Release – Situational Details Unknown



Fukushima Daiichi DTRA Modeling

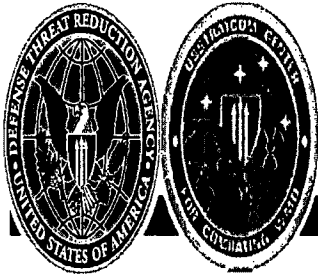
- **Summary of Models Provided in this Briefing**
- Assumption – Fukushima Daiichi #1, 2, and #3 suffered damage resulting in a continuous release/leak of a small portion of its inventory. Release occurs consistently throughout times shown in this product. (Precise details of this release are highly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

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Fukushima Daiichi (Impacts) – Most Likely

Assumed Core Damage & Venting



- Weather

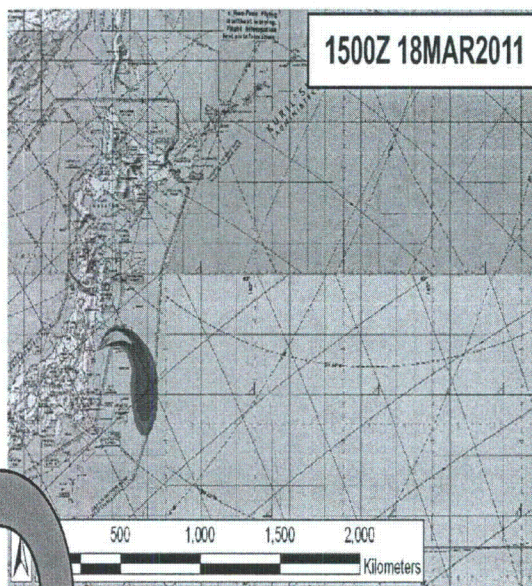
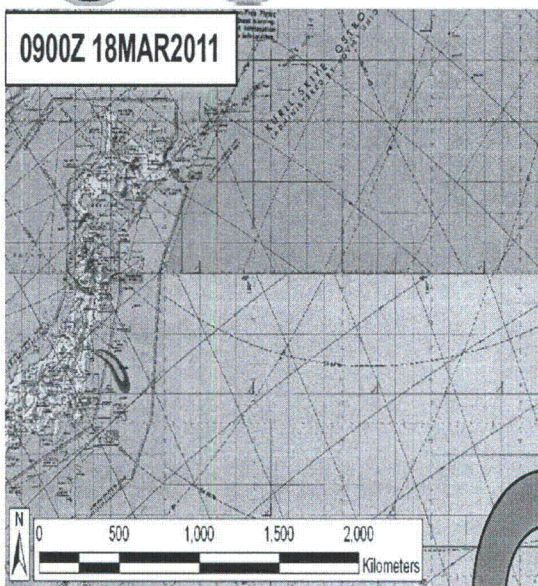
- Surface winds in the vicinity of the power plant are currently from the NW-W at 10-15 mph. NW - SW (offshore) winds are forecasted early Friday (18Mar). **This means that any possible release through Friday is forecasted to move offshore.**
- Japanese national government instructed evacuation for local 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.
- Releases from spent fuel pools being evaluated

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Possible Release – Situational Details Unknown

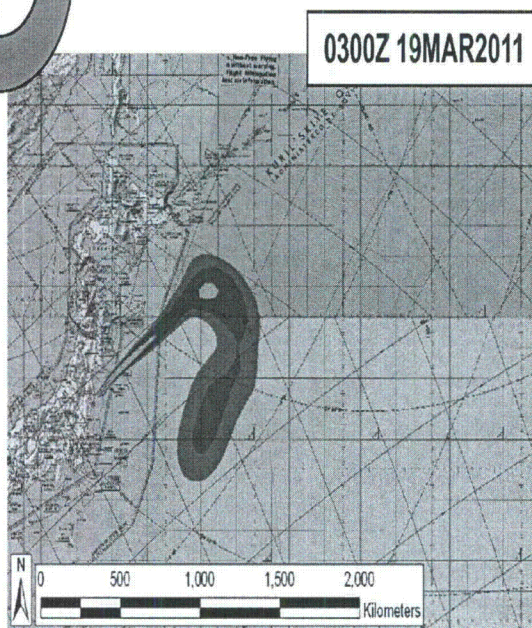
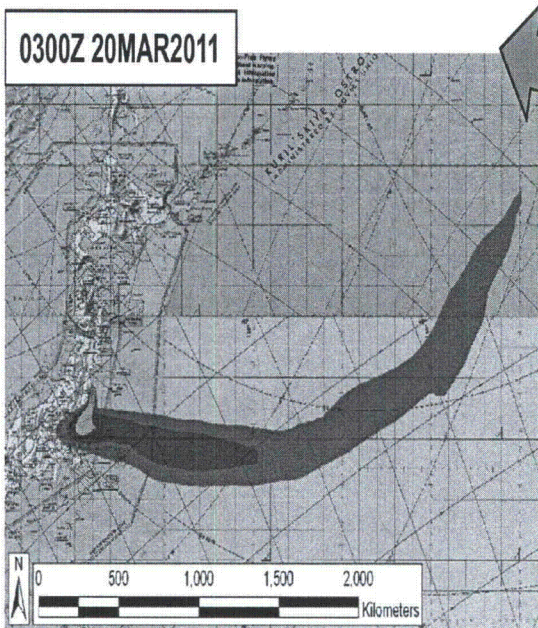
Isotope Air Concentration - Fukushima

GFS Forecast valid @ 18Z 17MAR2011



Total Activity
Isotope Air Concentration

	uCi/m ³
10 mCi/m ³	0.01
1 mCi/m ³	0.001
100 uCi/m ³	1.0E-04
10 uCi/m ³	1.0E-05
1 uCi/m ³	1.0E-06
100 nCi/m ³	1.0E-07
10 nCi/m ³	1.0E-08
1 nCi/m ³	1.0E-09



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

As of 0345Z 18MAR11

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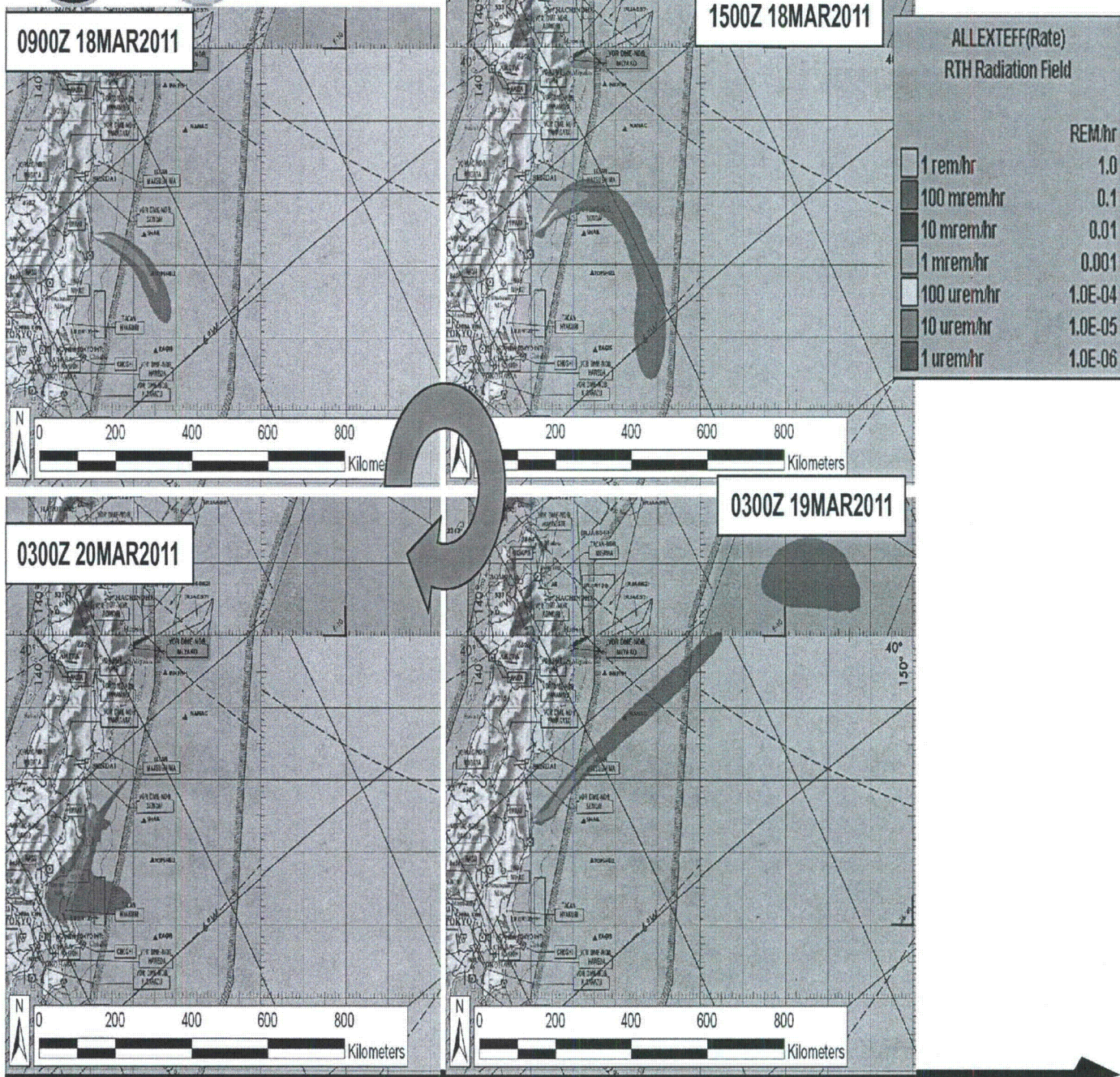
13

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Possible Release – Situational Details Unknown

All External Surface Dose Rate - Fukushima

GFS Forecast valid @ 18Z 17MAR2011



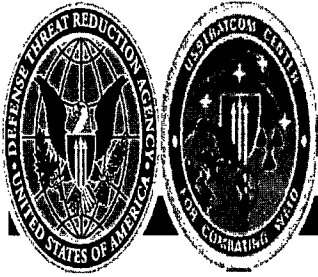
As of 0345Z 18MAR11

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14

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Possible Release - Situational Details Unknown



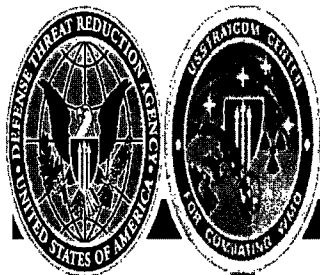
Fukushima Daiichi

VERTICAL SLICES TO FOLLOW

As of 0345Z 18MAR11

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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 rays.

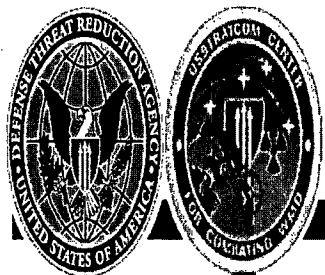
Note: 1 Sievert = 1 Gray and 1 Rad = 1 REM for beta and gamma radiation as the Quality Factor is 1.

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

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Backup: Radiation Exposure Reference



Exposure Received (mRem)		
Average Background Radiation for 1 hour	0.071	NCRP Report No. 160, 2009
A single cross country flight	4	
A single chest x-ray	10	Mettler, FA, et al, <i>Effective Doses in Radiological and Diagnostic Medicine, 2008</i>
Average background radiation annually	620	NCRP Report No. 160, 2009
A single mammogram study	400	Mettler, FA, et al, <i>Effective Doses in Radiological and Diagnostic Medicine, 2008</i>
A single CT scan	1,800	Mettler, FA, et al, <i>Effective Doses in Radiological and Diagnostic Medicine, 2008</i>
Chernobyl evacuation zone	10,000	
Hiroshima survivor inside structure	78,000	
Nagasaki survivor inside structure	156,000	

Exposure Limit (mRem)		
Maximum public exposure annually ¹	100	10CFR20.1201
Maximum radiation worker dose annually	5,000	10CFR20.1201
General emergency	1,000	NUREG-0654/FEMA REP1
Evacuation required	1,000	EPA 400-R-92-001, 1992
1 st Responder dose protecting valuable property ²	10,000	EPA 400-R-92-001, 1992
1 st Responder dose lifesaving or protection of large populations ²	25,000	EPA 400-R-92-001, 1992
Maximum 1 st Responder dose	25,000	EPA 400-R-92-001, 1992

¹This number represents the exposure allowed in excess of the expected annual background radiation exposure of 620 mRem

²FEMA: Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) incidents.

From: PMT09 Hoc
Sent: Thursday, March 17, 2011 9:10 PM
To: LIA01 Hoc; LIA11 Hoc
Subject: Followup with AID

As one follow up from (b)(5) early afternoon Thursday, March 17, 2011, there was confusion about the information provided on a "19 plume of radioactive gas" south of the facility along the Japanese coast.

PMT followed up with NOAA and determined that the correct information was that JAMA has issued a notice for aircraft on the potential for radiation within 19 miles (30 km) of the site.

Since this was misunderstood here in the NRC Operations Center ET room, it would be good to follow up with AID folks to be sure that the correct information is available if other questions arise. I had attempted to contact Mike or Jason, but was unable to do so.

DACool, PMT Director.

From: Adgerson, Shamark CONTRACTOR <(b)(6)> on behalf of DTRA Operations Center <(b)(6)>
Sent: Thursday, March 17, 2011 5:49 PM
Subject: FW: RFI 216U 2100Z update
Attachments: RFI_216U_1800Z_17MAR2011.PPT

All,

Attached the 2100Z update to RFI 216U. Please take note of the new "Containment monitor reading" on slide 10.

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

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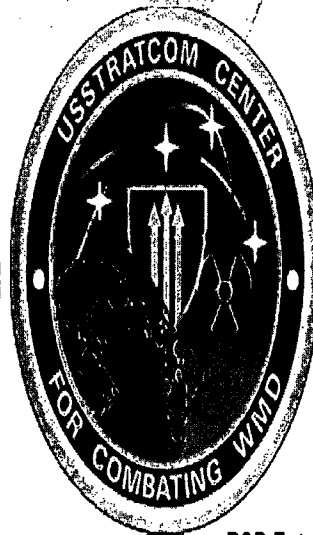
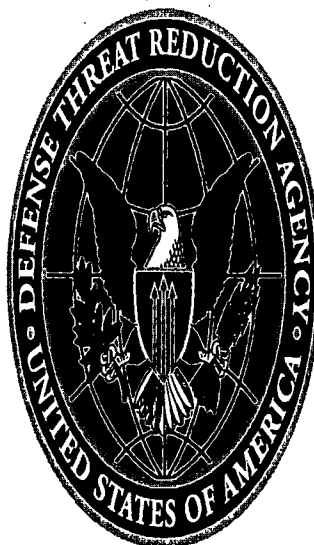
**Planning:
Model of a Nuclear Reactor Incident in
Japan as a Result of an Earthquake –
Update 2100Z 17MAR2011**

RFI – 216U

17MAR2011

Requestor: USFJ

As of 2100Z 17MAR11

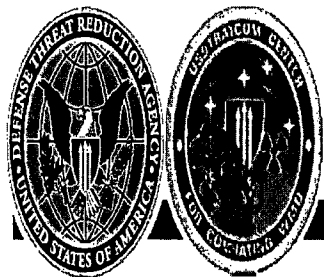


Distribution: Limited to DoD and authorized contractors. Further distribution contact DTRA.
Derived From: USFJ
Reason: E.O. 12958 sections 1.4 (e), (g) and (h).

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

CV 2662 of 3058



Request Summary

• (FOUO) Request data

• Requestor: [Redacted] (b)(6)

• Contact: [Redacted] (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: 1800Z Date: 17MAR2011
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.
Models indicate no impact on Yokota AB or Misawa AB during this period of interest. These are not shown for clarity.

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Possible Release – Situational Details Unknown



Nuclear Power Plants

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FACTS

Off the coast of Honshu, Japan

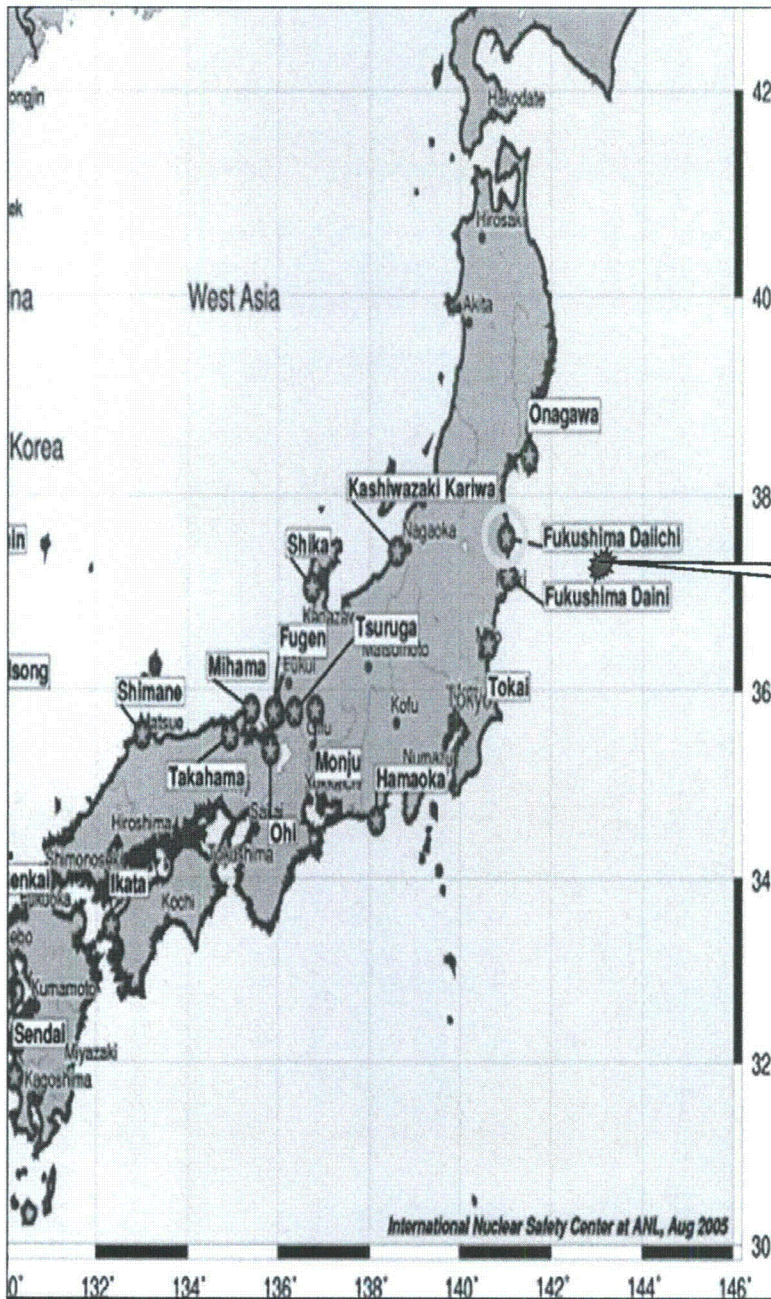
Epicenter Location:

38.32° N / 142.37° E

Magnitude: 9.0

Incident Time:

0530Z11MAR2011



As of 2100Z 17MAR11

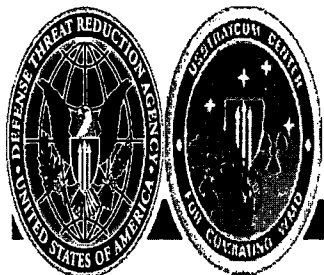
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CV 2664 of 3058

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Possible Release – Situational Details Unknown



Fukushima Daiichi Nuclear Power Plant

- Highest reading at fence was 60 mrem/hr at 0600Z 15MAR2011.
- Reduction of dose rates after the peak at 0122Z 15MAR2011 (400 mSv/hr in area surrounding unit 3).
- 30 mSv/hr between Units 2 and 3, and 100 mSv/hr surrounding Unit 4.
- Offsite dose measured in Tokai on the coast 100 km NE of Tokyo on 2245Z 14MAR2011 was 5 μ Sv/hr.

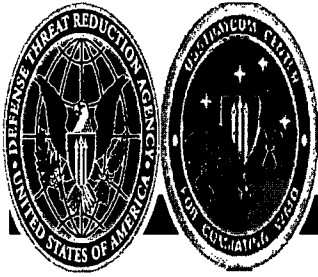
Source: IAEA Reporting at 1740Z 15MAR2011 (From NRC Update 2300Z 16MAR2011)

As of 2100Z 17MAR11

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4

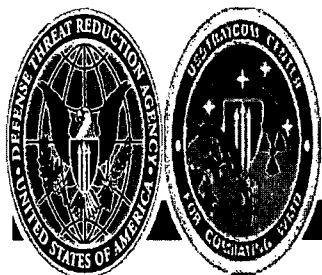
CV 2665 of 3058



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 with reported stable cooling.
- Containment described as “functional”.
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building (secondary containment)
- The spent fuel pool level is unknown.
- High radiation levels reduced to 1.5-10 mSv/hr (0.15-1 rem/hr) at 1400Z 16MAR2011 at site gate.
- Core cooling is via the core spray header.

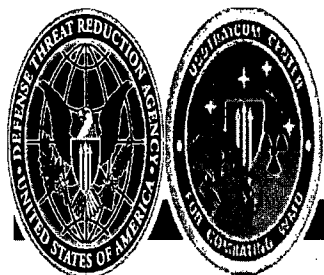
Source: USNRC Emergency Operations Center Status Update, 1100Z 17MAR2011



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.
- Secondary containment: Cut hole to reduce hydrogen gas buildup
- The spent fuel pool level is unknown. Some water is available as evidenced by steam emanating from hole.
- Sea water injection restarted with core cooling reported as not stable.
- Primary containment is intact.
- High radiation levels reduced to 1.5-10 mSv/hr (0.15-1 rem/hr) at 1400Z 16MAR2011 at site gate (same gate for all units).
- Spent fuel pool level is unknown. Some water is evidenced by steam.

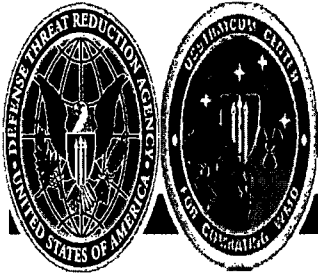
Source: USNRC Emergency Operations Center Status Update, 1100Z 17MAR2011



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.
- Primary containment described as “functional”
- The spent fuel level is possibly drained – some evidence of steam.
- High radiation levels reduced to 1.5-10 mSv/hr (0.15-1 rem/hr) at 1400Z 16MAR2011 at site gate (same gate for all units).
- Water cannon should be onsite as of 0800Z.

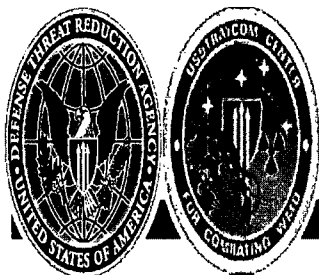
Source: USNRC Emergency Operations Center Status Update, 1100Z 17MAR2011



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 0200Z 15MAR2011.
- High radiation levels reduced to 1.5-10 mSv/hr (0.15-1 rem/hr) at 1400Z 16MAR2011 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. Fuel reported to be uncovered.
- Radiation levels outside Unit 4 reported to be 30 R/hr following second fire.
- High radiation dose rates measured between Units 3 and 4, source is suspected to be the partially uncovered Unit 4 spent fuel pool.
- The spent fuel pool's ability to retain water is in doubt. No steam – likely dry.

Source: USNRC Emergency Operations Center Status Update, 1100Z 17MAR2011



Status of additional reactors

- Fukushima Daiichi-5, and -6
 - The reactors are defueled
 - Spent fuel pools are reported to be heating up
 - A/C power available from Unit 6 diesel generator
- 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

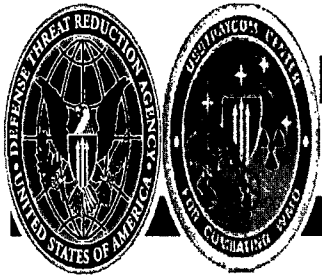
Source: USNRC Emergency Operations Center Status Update, 2300Z 16MAR2011

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Possible Release – Situational Details Unknown

Fukushima Daiichi DTRA Modeling Assumptions

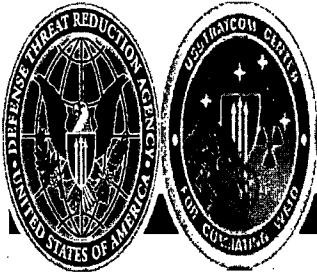
Most Likely



- **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 1800Z
 - ✓ NFAC Reactor Accident
 - ✓ Containment monitor reading: **10,000,000 R/hr (unconfirmed)**, tried to replicate the reported high radiation levels at site gate and computed and reported 375 R/hr from helicopter at 100 meters above spent fuel pools.
 - ✓ Sprayers: Off (unconfirmed)
 - ✓ Filters: On (unconfirmed)
 - ✓ Weather 40 km GFS from NCEP run at 12Z 17March

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Possible Release – Situational Details Unknown



Fukushima Daiichi DTRA Modeling

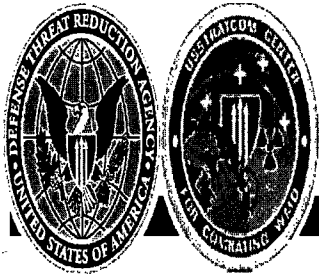
- **Summary of Models Provided in this Briefing**
- Assumption – Fukushima Daiichi #1, 2, and #3 suffered damage resulting in a continuous release/leak of a small portion of its inventory. Release occurs consistently throughout times shown in this product. (Precise details of this release are highly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

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Possible Release – Situational Details Unknown

Fukushima Daiichi (Impacts) – Most Likely

Assumed Core Damage & Venting



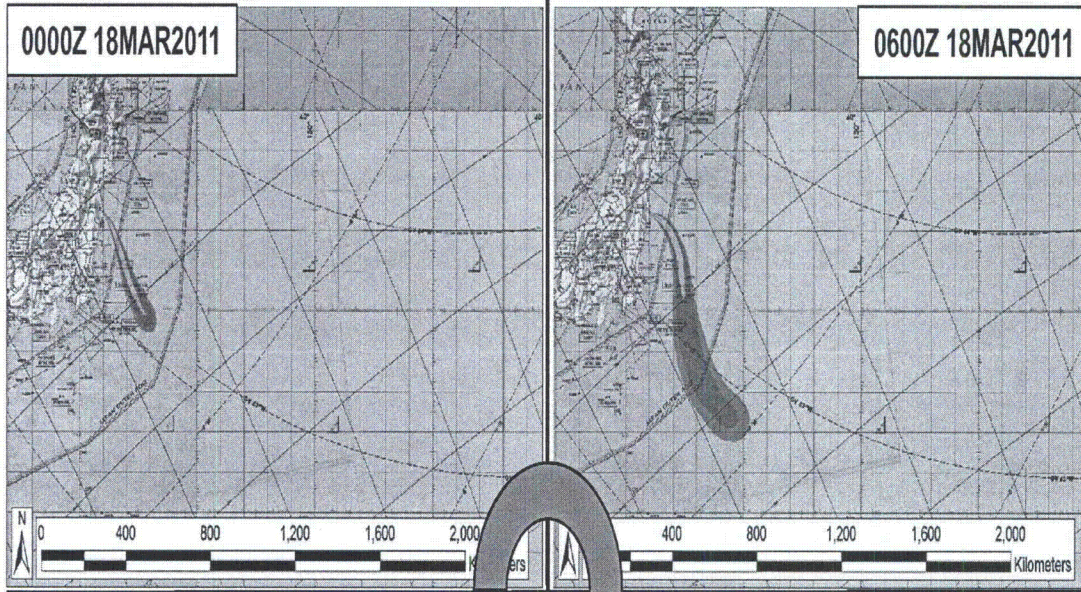
- Weather
 - Surface winds in the vicinity of the power plant are currently from the NNW at 10-15 mph. Northwesternly (offshore) winds are forecasted early Friday (18Mar). **This means that any possible release through Friday is forecasted to move offshore.**
- Japanese national government instructed 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.
- Releases from spent fuel pools being evaluated

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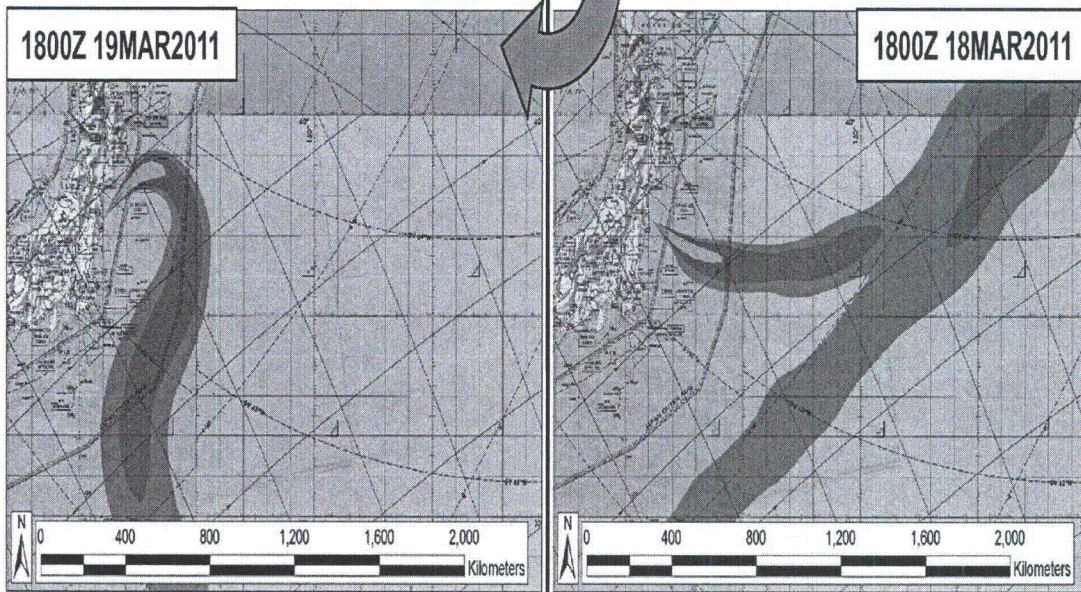
Possible Release – Situational Details Unknown

Isotope Air Concentration - Fukushima

GFS Forecast valid @ 12Z 17MAR2011



Total Activity	
Isotope Air Concentration	
	uCi/ml
10 mCi/m ³	0.01
1 mCi/m ³	0.001
100 uCi/m ³	1.0E-04
10 uCi/m ³	1.0E-05
1 uCi/m ³	1.0E-06
100 nCi/m ³	1.0E-07
10 nCi/m ³	1.0E-08
1 nCi/m ³	1.0E-09



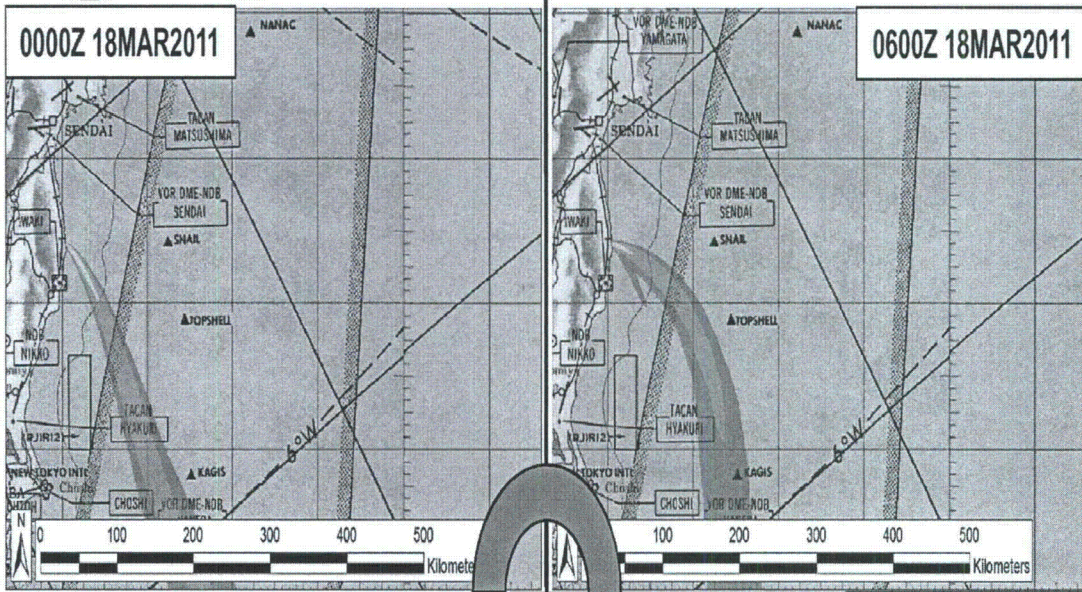
Note: these concentrations are very low and not exceptionally dangerous to human health, but monitoring devices may see hits.

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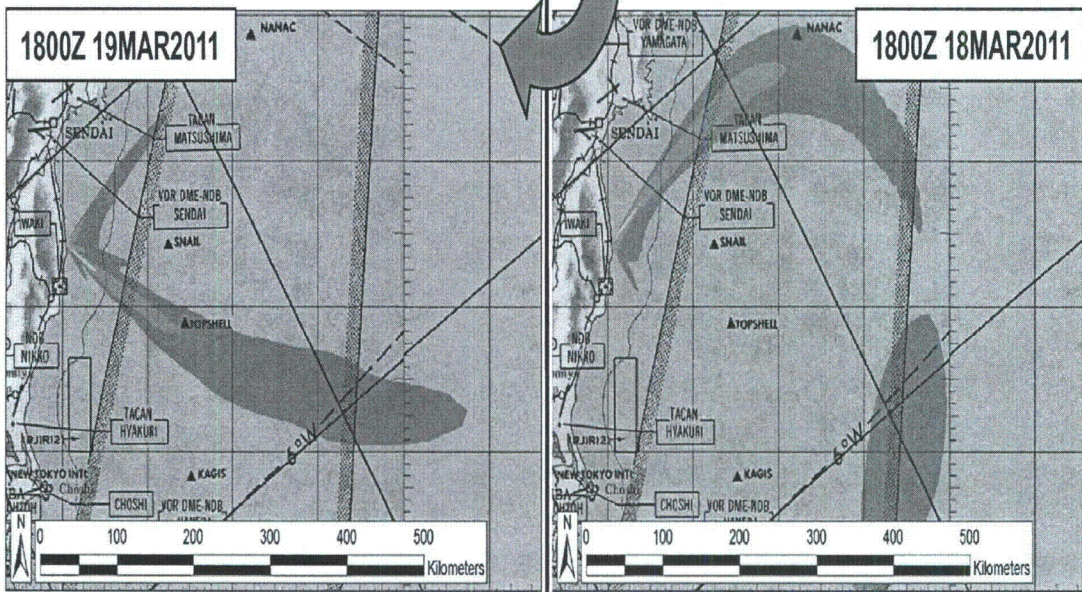
Possible Release – Situational Details Unknown

All External Surface Dose Rate - Fukushima

GFS Forecast valid @ 12Z 17MAR2011



ALLEXTEFF(Rate) RTH Radiation Field	
	REM/hr
1 rem/hr	1.0
100 mrem/hr	0.1
10 mrem/hr	0.01
1 mrem/hr	0.001
100 urem/hr	1.0E-04
10 urem/hr	1.0E-05
1 urem/hr	1.0E-06



As of 2100Z 17MAR11

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14

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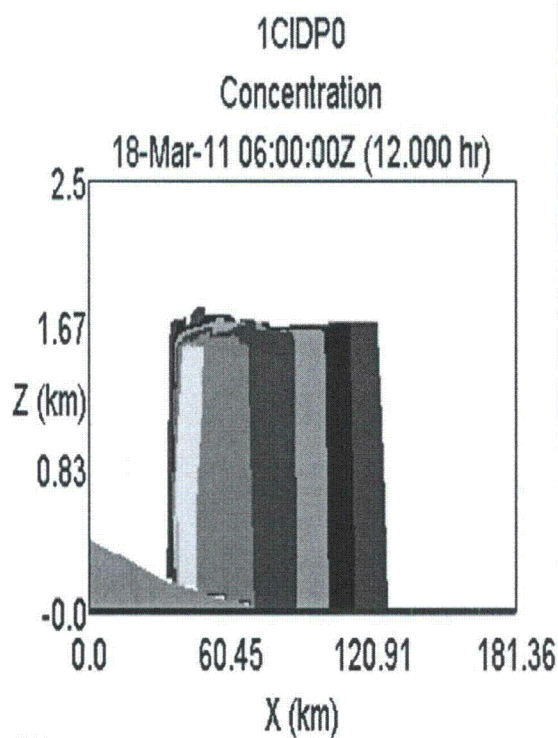
Possible Release – Situational Details Unknown

Fukushima Daiichi

Most Likely Release Scenario

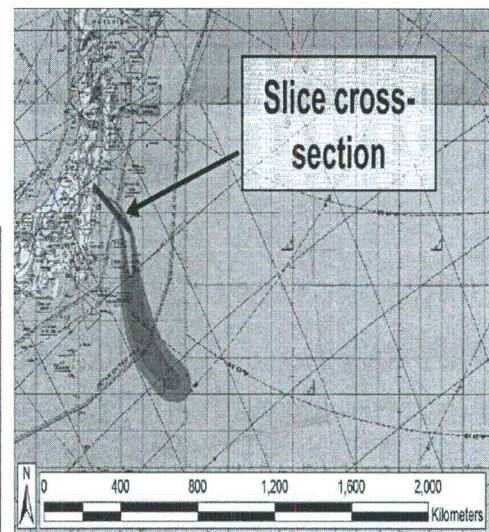


**Vertical Slice Through Highest Part of Plume
@ 0600Z 18 March**



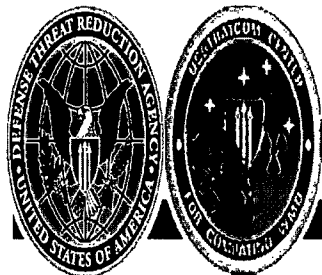
Total Activity	
Isotope	Air Concentration
10 mCi/m ³	0.01
1 mCi/m ³	0.001
100 uCi/m ³	1.0E-04
10 uCi/m ³	1.0E-05
1 uCi/m ³	1.0E-06
100 nCi/m ³	1.0E-07
10 nCi/m ³	1.0E-08
1 nCi/m ³	1.0E-09

**Assumes
continuous
venting**



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 2.0 km.

FACTS
 Fukushima Daiichi
 37.42139° N / 141.0325° E
 1800Z 17MAR2011
 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 rays.

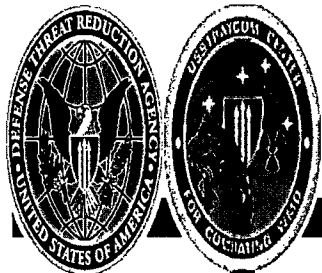
Note: 1 Sievert = 1 Gray and 1 Rad = 1 REM for beta and gamma radiation as the Quality Factor is 1.

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

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Possible Release – Situational Details Unknown

Backup: Radiation Exposure Reference



Exposure Received (mRem)		
Average Background Radiation for 1 hour	0.071	NCRP Report No.160, 2009
A single cross country flight	4	
A single chest x-ray	10	Mettler, FA, et al, <i>Effective Doses in Radiological and Diagnostic Medicine, 2008</i>
Average background radiation annually	620	NCRP Report No.160, 2009
A single mammogram study	400	Mettler, FA, et al, <i>Effective Doses in Radiological and Diagnostic Medicine, 2008</i>
A single CT scan	1,800	Mettler, FA, et al, <i>Effective Doses in Radiological and Diagnostic Medicine, 2008</i>
Chernobyl evacuation zone	10,000	
Hiroshima survivor inside structure	78,000	
Nagasaki survivor inside structure	156,000	

Exposure Limit (mRem)		
Maximum public exposure annually ¹	100	10CFR20.1201
Maximum radiation worker dose annually	5,000	10CFR20.1201
General emergency	1,000	NUREG-0654/FEMA REP1
Evacuation required	1,000	EPA 400-R-92-001, 1992
1 st Responder dose protecting valuable property ²	10,000	EPA 400-R-92-001, 1992
1 st Responder dose lifesaving or protection of large populations ²	25,000	EPA 400-R-92-001, 1992
Maximum 1 st Responder dose	25,000	EPA 400-R-92-001, 1992

¹This number represents the exposure allowed in excess of the expected annual background radiation exposure of 620 mRem

²FEMA: Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) incidents.

To: Hoc, PMT12
Subject: FW: PMT IRSN_UK_CNCS Conf call 3_17_11 CJones notes
Attachments: PMT MARCH 16th NRC press release assumptions.doc; PMT IRSN_UK_CNCS Conf call 3_17_11.doc

FYI- Your PMT copy (Copies are also on the M:\Japan drive

From: PMT09 Hoc
Sent: Thursday, March 17, 2011 4:38 PM
To: LIA02 Hoc; LIA03 Hoc
Subject: PMT IRSN_UK_CNCS Conf call 3_17_11 CJones notes

Jen, Nancy

Here is my QUICK the summary of the call and the document that we said we would sent to the regulators and the call (once we get the UK source term, etc.)

Please cc the PMT12 account when this is emailed out to the folks on the call today.
We need their emails too,...

thanks
Cyndi

Conference call with HSE, CNSC, IRSN, ASN & NRC
March 17, 2011
1400 EDT

Conference call with OIP (J. Schwartzman), UK regulator (HSE); Canada (Canadian Nuclear Safety Commission (CNSC)); and IRSN and ASN (French regulators and technical agency), NRC PMT Director (Jones) discussed the contents of the 3/16/11 NRC press release and source term. The UK indicated that they would be sending over their source term information and estimates for the Japanese Event via email and would welcome the US 1-pager (attached) discussing NRC's estimates and source term estimate assumptions for the March 16, 2011, NRC Press release. Canada stated that their estimates were in agreement with the US NRC estimates. Jones stated that USNRC and USDOE had reached alignment on the source term and were using the same source term in their estimates and dose projections. Jones also answered a question with respect to the UK inquiry on estimated release fractions used in the models. Jones stated that NUREG-1465 was used for the RASCAL code runs which provides source term (core uncovered) release fractions. The IRSN asked if anyone on the call had information or research (document) on spent fuel pools and simulated damage to spent fuel pools (once drained of water); all indicated they would check with their respective research offices and get back via email with the results.

IRSN stated that they do not have any actual monitoring data from Japan and instead developed a simulation using source data estimates for Units 1-3 at the Fukushima NPPs. IRSN stated that they plan to put this entire simulation, involving a video simulating what may have happened, on their IRSN website (publically available) in the next 6-12 hours (to be on their website on 3/18/11). IRSN stated that this simulated data shows that for a 1-yr child, the estimated thyroid dose in Tokyo would be between 0.1-1 mSv thyroid uptake (inhalation only), and for adults would be in the range of 0.01-0.1 mSv. Other participants on the call (US, Canada, and UK) stressed to the French that these estimates appeared to be extremely high for a child *inhalation* dose. We stressed to the IRSN that great care should be given in providing the assumptions or providing a notice at the front of the simulation that this is not based on any actual data or real time monitoring, but is just a simulation.

From: Hoc, PMT12
Sent: Thursday, March 17, 2011 4:31 PM
To: PMT09 Hoc
Subject: MARCH 16th press release assumptoins (6)
Attachments: MARCH 16th press release assumptoins (6).doc

Discussion of the MARCH 16, 2011 PRESS RELEASE DOSE ASSESSMENT ASSUMPTIONS

There are two dose assessments attached to the March 16th press release. Both assessments are worst case hypothetical, computer model analyses of consequences for releases from the Fukushima site. The first assessment assumed a Unit 2 reactor 100% core melt as an unfiltered release from a totally failed containment and actual meteorological conditions during early morning hours of the date indicated. The low dispersion characteristics included low wind speeds, relatively stable air, and light precipitation.

The second assessment represented multiple unit failures: 1) Unit 2 with 33% reactor core damage; 2) Unit 3 spent fuel pool with 50% damage (with 180 bundles of spent fuel discharged 105 days ago) ; and 3) Unit 4 spent fuel pool with 100% damage (with 550 bundles of spent fuel discharged 30 days ago) . To account for the combined inventories of the three units, the staff adjusted the reactor power level, fuel burnup and number of assemblies in the calculation. The meteorological conditions for the second assessment also assumed actual conditions, but no precipitation, greater wind speeds, and less stable atmospheric conditions, result in greater atmospheric dispersion. In addition, the source term included two additional days of decay before release. For the multi-unit assessment, the increased decay time before release and the greater atmospheric dispersion significantly reduced the resultant dose estimate.

Although the dose projections for the first assessment are somewhat higher than the second assessment, the differences in the modeling assumptions did not affect the overall conclusion that protective action guides would be exceeded beyond fifty miles. Both assessments are highly speculative, given the lack of actual (representative) site data and assumed no mitigation of the current situation at the time of the press release.

Although there is postulated reactor core damage in Unit 1 and Unit 3, the primary containment structure is reported to be intact.

From: PMT09 Hoc
Sent: Thursday, March 17, 2011 4:27 PM
To: Jones, Cynthia; Schwartzman, Jennifer
Subject: Quick summary of IRSN Call
Attachments: Doc1.doc

For our files

From: Adgerson, Shamark CONTRACTOR <(b)(6)> on behalf of DTRA Operations Center <(b)(6)>
Sent: Thursday, March 17, 2011 2:37 PM
Subject: FW: RFI 0216U 1500Z update
Attachments: RFI_216U_1500Z_17MAR2011_rev1.PPT

Attached is the requested updated analysis.

Thanks,

Shamark Adgerson
SAIC/DTRA Operations Center
(703)-767-2116

(b)(6)

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

From: DTRA Reachback <(b)(6)>
Sent: Thursday, March 17, 2011 11:08 AM
To: DTRA Operations Center
Cc: Reachback
Subject: RFI 0216U 1500Z update

Ops,

Attached is the 1500Z update to RFI 0216U.

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

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Possible Release – Situational Details Unknown

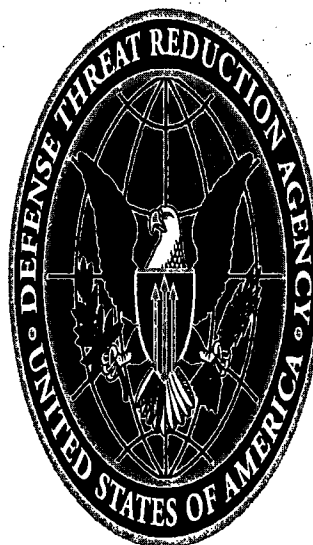
Planning:
Model of a Nuclear Reactor Incident in
Japan as a Result of an Earthquake –
Update 1500Z 17MAR2011

RFI – 216U

17MAR2011

Requestor: USFJ

As of 1500Z 17MAR11

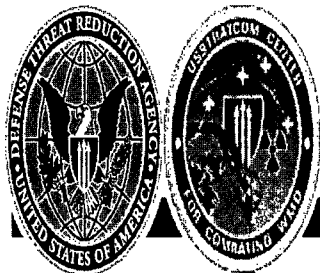


Distribution: Limited to DoD and authorized contractors. Further distribution contact DTRA.
Derived From: USFJ
Reason: E.O. 12958 sections 1.4 (e), (g) and (h).

~~For Official Use Only~~

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

CV 2686 of 3058



Request Summary

• (FOUO) Request data

• Requestor: [Redacted] (b)(6)

• Contact: [Redacted] (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: 1200Z Date: 17MAR2011
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.
Models indicate no impact on Yokota AB or Misawa AB during this period of interest. These are not shown for clarity.

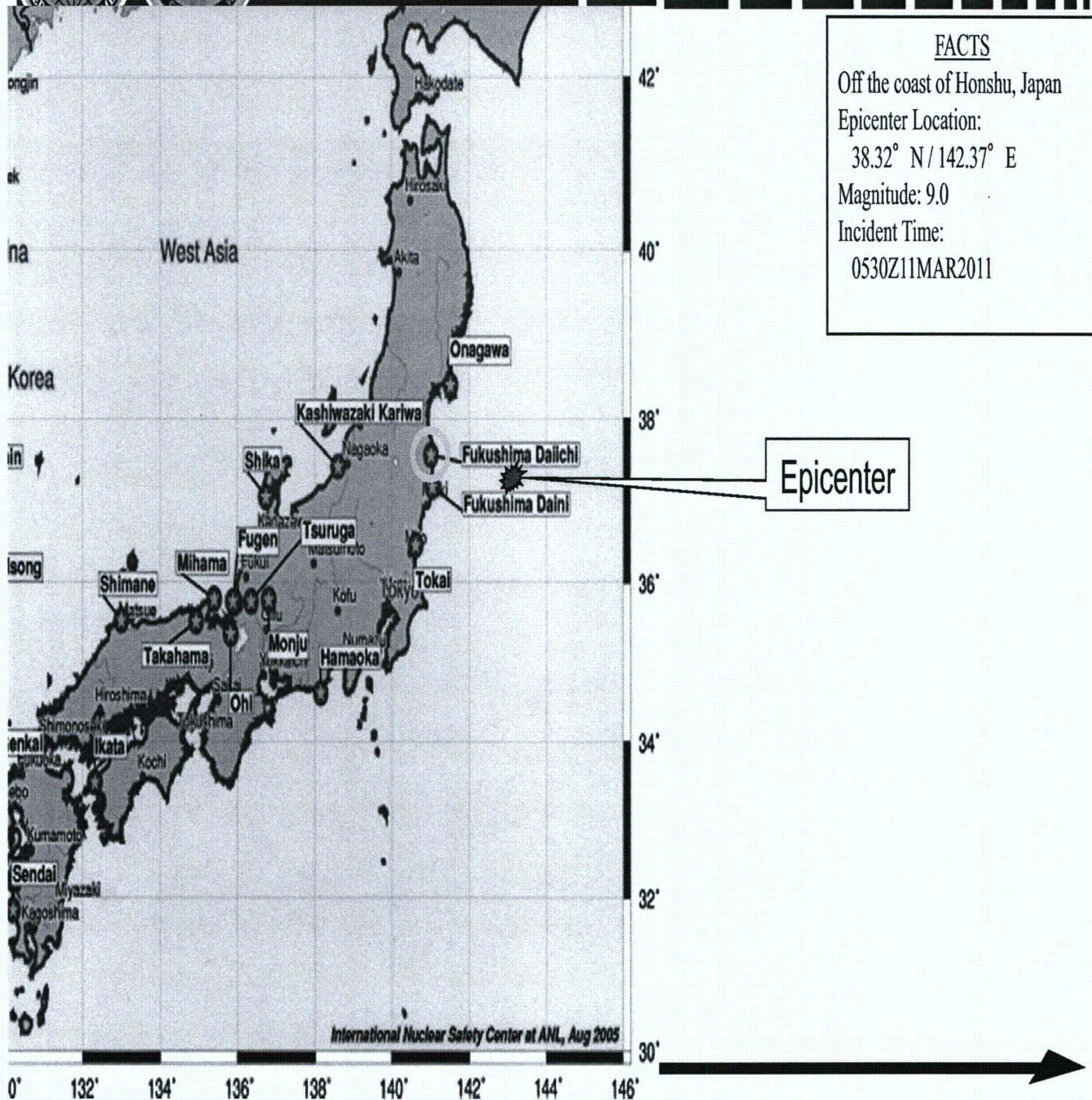
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Possible Release – Situational Details Unknown



Nuclear Power Plants

SCOPING PURPOSES ONLY

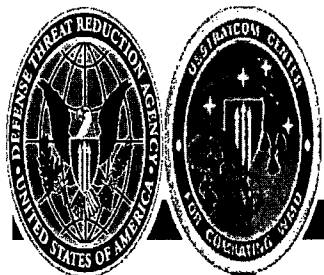


FACTS
Off the coast of Honshu, Japan
Epicenter Location:
38.32° N / 142.37° E
Magnitude: 9.0
Incident Time:
0530Z11MAR2011

As of 1500Z 17MAR11
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Possible Release – Situational Details Unknown



Fukushima Daiichi Nuclear Power Plant

- Highest reading at fence was 60 mrem/hr at 0600Z 15MAR2011
- Reduction of dose rates after the peak at 0122Z 15MAR2011 (400 mSv/hr in area surrounding unit 3)
- 30 mSv/hr between Units 2 and 3, and 100 mSv/hr surrounding Unit 4
- Offsite dose measured in Tokai on the coast 100 km NE of Tokyo on 2245Z 14MAR2011 was 5 μ Sv/hr

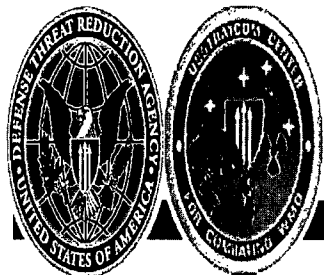
Source: IAEA Reporting at 1740Z 15MAR2011 (From NRC Update 2300Z 16MAR2011)

As of 1500Z 17MAR11

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4

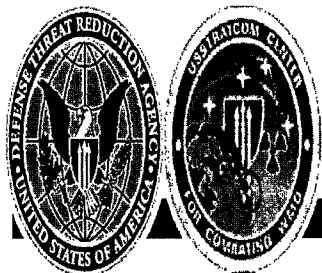
CV 2689 of 3058



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 with reported stable cooling
- Containment described as “functional”
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building (secondary containment)
- The spent fuel pool level is unknown
- High radiation levels reduced to 1.5-10 mSv/hr (0.15-1 rem/hr) at 1400Z 16MAR2011 at site gate
- Core cooling is via the core spray header.

Source: USNRC Emergency Operations Center Status Update, 1100Z 17MAR2011



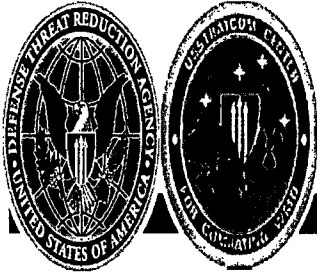
Fukushima Daiichi-2 Status

- 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
- Secondary containment: Cut hole to reduce hydrogen gas buildup
- The spent fuel pool level is unknown. Some water is available as evidenced by steam emanating from hole
- Sea water injection restarted with core cooling reported as not stable
- Primary containment is intact
- High radiation levels reduced to 1.5-10 mSv/hr (0.15-1 rem/hr) at 1400Z 16MAR2011 at site gate (same gate for all units)
- Spent fuel pool level is unknown. Some water is evidenced by steam.

Source: USNRC Emergency Operations Center Status Update, 1100Z 17MAR2011

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Possible Release – Situational Details Unknown



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
- Primary containment described as “functional”
- The spent fuel level is possibly drained – some evidence of steam
- High radiation levels reduced to 1.5-10 mSv/hr (0.15-1 rem/hr) at 1400Z 16MAR2011 at site gate (same gate for all units)
- Water cannon should be onsite as of 0800Z.

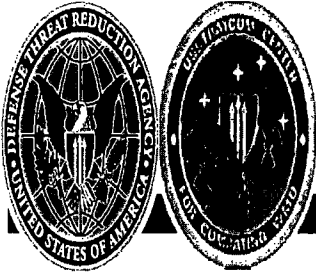
Source: USNRC Emergency Operations Center Status Update, 1100Z 17MAR2011

As of 1500Z 17MAR11

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7

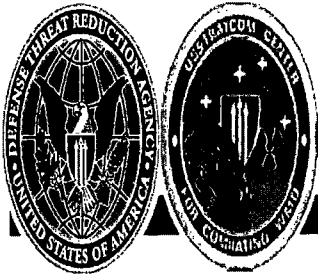
CV 2692 of 3058



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 0200Z 15MAR2011
- High radiation levels reduced to 1.5-10 mSv/hr (0.15-1 rem/hr) at 1400Z 16MAR2011 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. Fuel reported to be uncovered
- Radiation levels outside Unit 4 reported to be 30 R/hr following second fire
- High radiation dose rates measured between Units 3 and 4, source is suspected to be the partially uncovered Unit 4 spent fuel pool
- The spent fuel pool's ability to retain water is in doubt. No steam – likely dry

Source: USNRC Emergency Operations Center Status Update, 1100Z 17MAR2011



Status of additional reactors

- Fukushima Daiichi-5, and -6
 - The reactors are defueled
 - Spent fuel pools are reported to be heating up
 - A/C power available from Unit 6 diesel generator
- 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

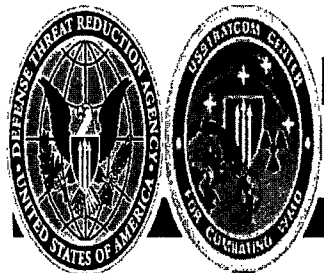
Source: USNRC Emergency Operations Center Status Update, 2300Z 16MAR2011

For Official Use Only

Possible Release - Situational Details Unknown

Fukushima Daiichi DTRA Modeling Assumptions

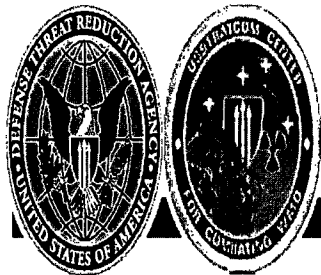
Most Likely



- **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 1200Z
 - ✓ NFAC Reactor Accident
 - ✓ Containment monitor reading: **100 R/hr (unconfirmed)**
 - ✓ Sprayers: Off (unconfirmed)
 - ✓ Filters: On (unconfirmed)
 - ✓ Weather 40 km GFS from NCEP run at 06Z 17March
 - ✓ Also run with the 15 km WRF from AFWA run at 00z17March, with similar results

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Possible Release – Situational Details Unknown

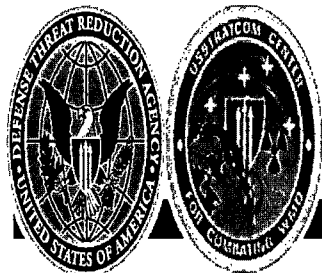


Fukushima Daiichi DTRA Modeling

- **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)

Fukushima Daiichi (Impacts) – Most Likely

Assumed Core Damage & Venting



- Weather
 - Surface winds in the vicinity of the power plant are currently from the NW. Northwestern (offshore) winds between 10-15 kts are forecasted for Friday (18Mar). **This means that any possible release through Thursday is forecasted to 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.
- Releases from spent fuel pools being evaluated

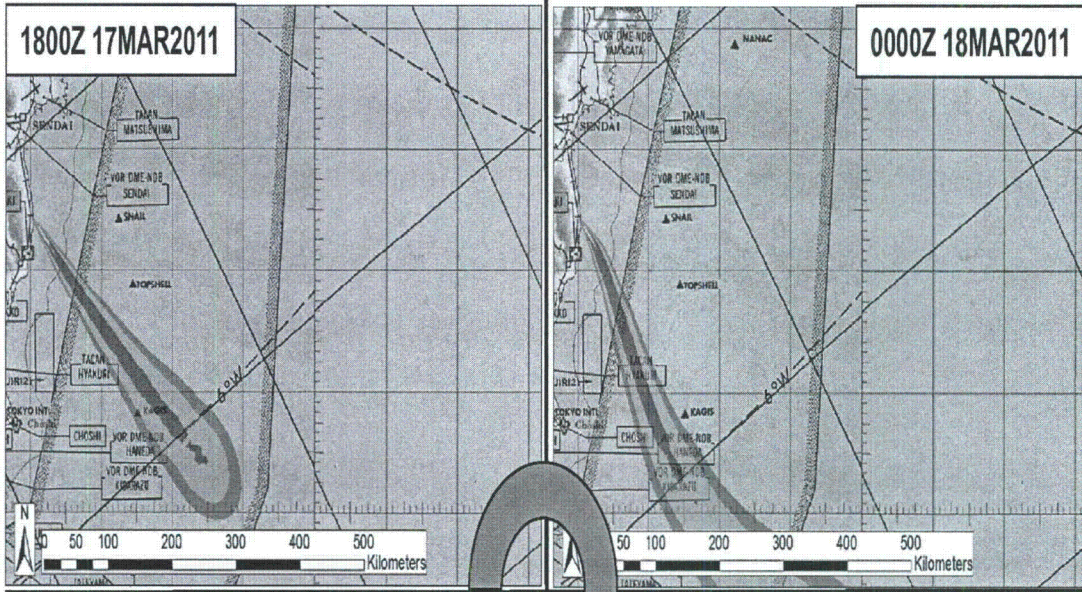
For Official Use Only

Possible Release – Situational Details Unknown

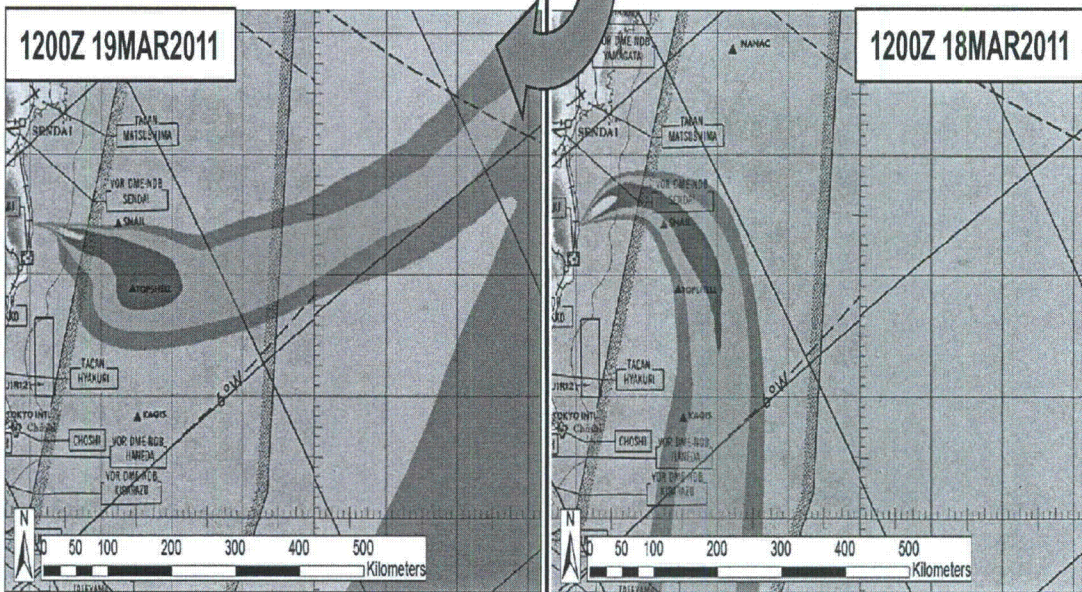


Isotope Air Concentration - Fukushima

GFS Forecast valid @ 06Z 17MAR2011



Total Activity Isotope Air Concentration	
	uCi/ml
10 nCi/m ³	1.0E-08
1 nCi/m ³	1.0E-09
100 pCi/m ³	1.0E-10
10 pCi/m ³	1.0E-11
1 pCi/m ³	1.0E-12
100 fCi/m ³	1.0E-13
10 fCi/m ³	1.0E-14



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

As of 1500Z 17MAR11

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13

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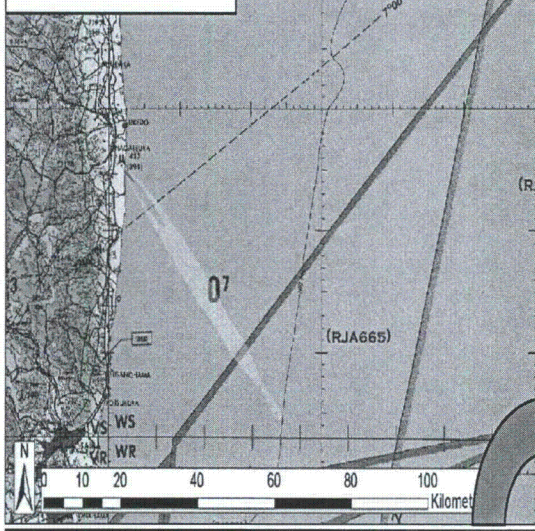
Possible Release – Situational Details Unknown

All External Surface Dose Rate - Fukushima

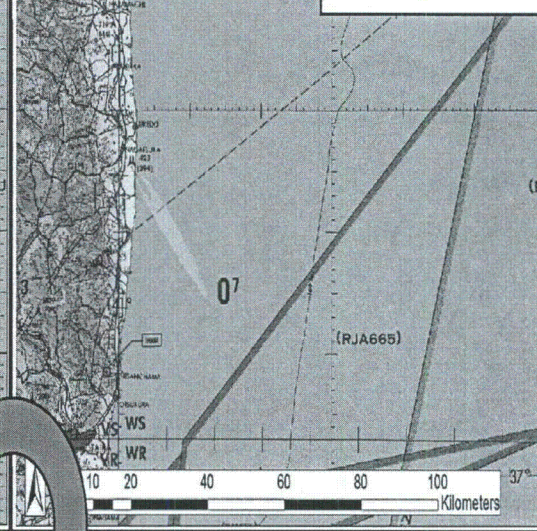
GFS Forecast valid @ 06Z 17MAR2011



1800Z 17MAR2011

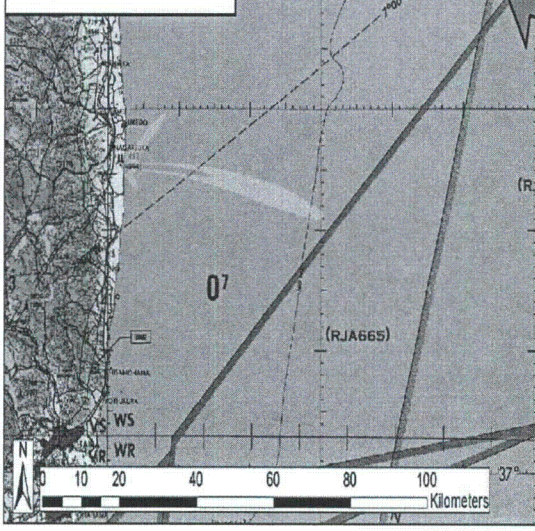


0000Z 18MAR2011

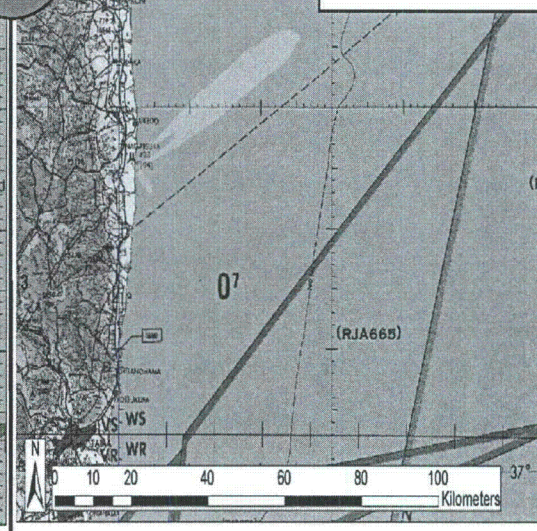


ALLEXTEFF(Rate) RTH Radiation Field	
1 urem/hr	1.0E-06
100 nrem/hr	1.0E-07
10 nrem/hr	1.0E-08
1 nrem/hr	1.0E-09

1200Z 19MAR2011



1200Z 18MAR2011



As of 1500Z 17MAR11

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14

CV 2699 of 3058

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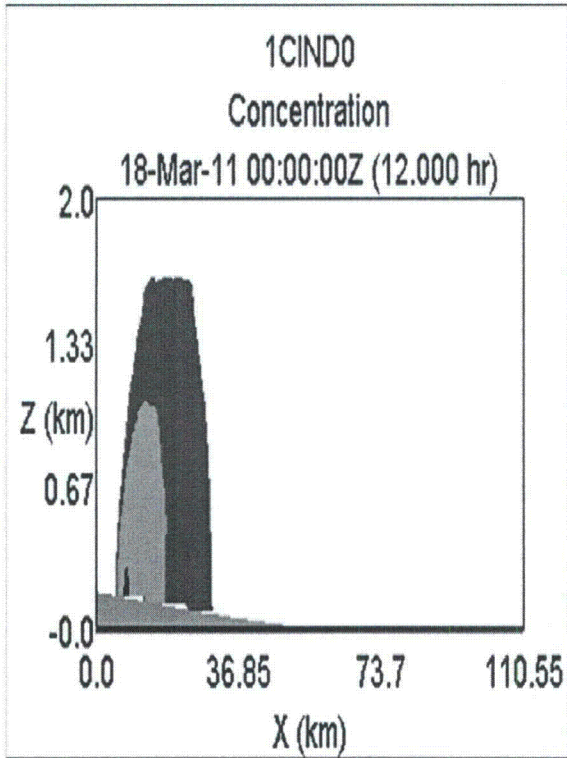
Possible Release – Situational Details Unknown

Fukushima Daiichi

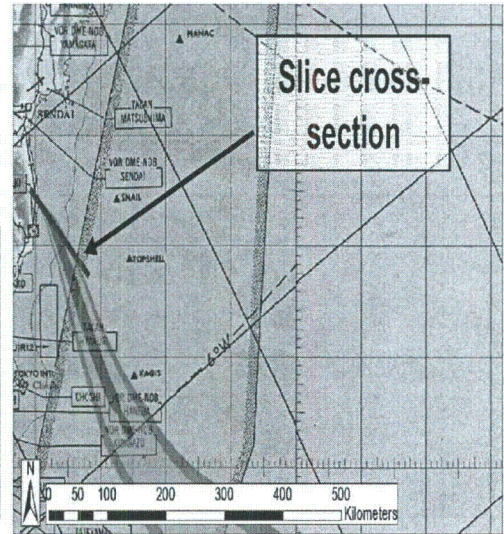
Most Likely Release Scenario



Vertical Slice Through Highest Part of Plume @ 0000Z 18 March



1CINDO Concentration	
18-Mar-11 00:00:00Z	
1 pCi/m ³	1.0E-12
100 fCi/m ³	1.0E-13
10 fCi/m ³	1.0E-14



Assumes continuous venting

FACTS
 Fukushima Daiichi
 37.42139° N / 141.0325° E
 1200Z 17MAR2011
 Type: Nuclear Facility Accident
 Weather: 40 km GFS
 Model: HPAC 5.0 SP1
 Static Population Estimates:
 LandScan 2009

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 2.0 km.



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.

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

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

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Possible Release – Situational Details Unknown

Backup: Radiation Exposure Reference



Exposure Received (mRem)		
Average Background Radiation for 1 hour	0.071	NCRP Report No.160, 2009
A single cross country flight	4	
A single chest x-ray	10	Mettler, FA, et al, <i>Effective Doses in Radiological and Diagnostic Medicine, 2008</i>
Average background radiation annually	620	NCRP Report No.160, 2009
A single mammogram study	400	Mettler, FA, et al, <i>Effective Doses in Radiological and Diagnostic Medicine, 2008</i>
A single CT scan	1,800	Mettler, FA, et al, <i>Effective Doses in Radiological and Diagnostic Medicine, 2008</i>
Chernobyl evacuation zone	10,000	
Hiroshima survivor inside structure	78,000	
Nagasaki survivor inside structure	156,000	

Exposure Limit (mRem)		
Maximum public exposure annually ¹	100	10CFR20.1201
Maximum radiation worker dose annually	5,000	10CFR20.1201
General emergency	1,000	NUREG-0654/FEMA REP1
Protective actions (shelter or evacuate)	1,000 – 5,000	EPA 400-R-92-001, 1992
Evacuation required	1,000	EPA 400-R-92-001, 1992
1 st Responder dose protecting valuable property ²	10,000	EPA 400-R-92-001, 1992
1 st Responder dose lifesaving or protection of large populations ²	25,000	EPA 400-R-92-001, 1992
Maximum 1 st Responder dose	25,000	EPA 400-R-92-001, 1992

¹ This number represents the exposure allowed in excess of the expected annual background radiation exposure of 620 mRem

² FEMA: Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) incidents.

From: RMTPACTSU_ELNRC <RMTPACTSU_ELNRC@ofda.gov>
Sent: Thursday, March 17, 2011 10:44 AM
To: PMT01 Hoc; Hoc, PMT12; PMT09 Hoc; Harrington, Holly; LIA01 Hoc; LIA11 Hoc; McIntyre, David; Burnell, Scott
Subject: FYI: Miami Herald Article on Radiation Suits Provided by South FloridaCompany
Attachments: image001.gif

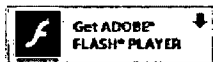
Subject: Miami Herald Article on Radiation Suits Provided by South FloridaCompany

Posted on Wednesday, 03.16.11

MEDICAL TECHNOLOGY

Radiation suits from South Florida sent to help Japan

Rescue workers will receive protective suits made of Demron, a unique material manufactured in a Medley factory.



Related Content

By **Bridget Carey**

bcarey@miamiherald.com

As Japan's nuclear crisis escalates, emergency workers are finding protection in a unique safety suit created in South Florida.

More than 200 full-body nuclear radiation protection suits manufactured in Medley have been donated to aid power plant workers and rescue teams in Japan, and the company, Radiation Shield Technologies, is working full-time to keep up with orders from companies in Japan.

The suits are in high demand because of their unique material, called Demron, invented by Coral Gables anesthesiologist and pain-management specialist Dr. Ronald DeMeo. The radiation-blocking material offers protection against multiple threats, including infrared radiation, extreme heat, nuclear fallout, biological and chemical agents.

DeMeo has been selling Demron products to military and rescue staff around the globe for several years, but he first invented the fabric for medical personal. After using a continuous X-ray machine with his patients, he saw sunburn-like skin damage on his arms and hands. And he also saw many colleagues in his field afflicted with different types of skin cancers.

“I didn’t think we were taking this X-ray machine seriously enough. I started to look into better shielding,” said DeMeo, who runs the medical practice Meridian Pain & Diagnostics in Coral Gables. “I didn’t realize I was venturing into something that hasn’t been invented before.”

After nuclear reactors following the earthquake and tsunami in Japan were damaged, DeMeo directed his Hong Kong distributors to send suits in stock to Japan. They are expected to arrive this weekend.

DeMeo made calls to donate the gear as soon as he saw footage of first responders who lacked protective clothing.

Rescue workers from Miami-Dade County, New York City and others worldwide have been customers of the Demron products. But with the Japan crisis, orders for the suits spiked. He said he plans to expand his current staff of 30 in Medley to keep up with growing demand from Asia and the Middle East, as well as an increase of interest from the U.S. West Coast. Currently, the company is able to make about 500 suits a month.

The all-black suits, valued at \$1,700 each, weigh nearly 10 pounds and can be put on by the wearer without outside assistance – which can’t be done with other radiological suits, according Dan Edward, head of business development at Radiation Shield Technologies.

DeMeo said he sees the wrong message being sent about how the radiation leak isn’t too dangerous.

“I really think it’s the wrong message. We really have to take this seriously,” DeMeo said. “Even low dose radiation exposure can increase your risk of cancer. Some people act like it’s a food group and it’s harmless. It’s not.”

Read more: <http://www.miamiherald.com/2011/03/16/2118690/radiation-suits-from-south-florida.html#ixzz1Griw95o6>

From: RMTPACTSU_ELNRC <RMTPACTSU_ELNRC@ofda.gov>
Sent: Thursday, March 17, 2011 10:05 AM
To: Hoc, PMT12; PMT01 Hoc; PMT09 Hoc; LIA01 Hoc; Marshall, Jane; Grant, Jeffery; Gott, William
Subject: TELECONFERENCE on Dosimetry & Nuclear technology activities 202-395-6392 PIN: 913 3687

FYI – Michael Dudek

From: Bentz, Julie A. [mailto:(b)(6)]
Sent: Thursday, March 17, 2011 7:39 AM
Subject: TELECONFERENCE on Nuclear technology activities (b)(6) PIN: (b)(6)

(b)(5)

I would like to host a teleconference today at **12:30pm** with dial in info and agenda provided below. Lines are limited, so if folks can share a speaker phone, I would appreciate it. Again, if I've missed anyone, please forward on.

BRIDGE NUMBER: (b)(6)
PASSCODE: (b)(6) #

Agenda

(b)(5)

(b)(5)

Thanks!
Julie

COL(P) Julie A Bentz
Director for Nuclear Defense Policy
National Security Staff
EEOB 379
1650 Pennsylvania Ave NW
Washington DC 20502

(b)(6)

From: NITOPS <NITOPS@nnsa.doe.gov>
Sent: Thursday, March 17, 2011 1:54 PM
To: HOO Hoc; PMT02 Hoc; PMT01 Hoc; CMHT; 'narak@ltnl.gov'
Cc: NITOPS
Subject: FW: ECHO Civ Protection Japan Update
Attachments: MIC_message_8_Earthquake_Japan.pdf; EU Offers 17032011_13.00 PM.XLS; Recovery Map_20110317.pptx

For your situational awareness.
NITOPS

From: RMTFACTSU_DOE [mailto:rmtfactsu_doe@ofda.gov]
Sent: Thursday, March 17, 2011 11:31 AM
To: NITOPS; McClelland, Vince; Heinrich, Ann; Buntman, Steven
Subject: FW: ECHO Civ Protection Japan Update

Good Map of activities

From: Brown, Patterson W [mailto:BrownPW@state.gov]
Sent: Thursday, March 17, 2011 9:49 AM
To: Bartolini, Mark (DCHA/OFDA) [USAID]; Chan, Carol(DCHA/OFDA) [USAID]; OD_Expanded [USAID]; RMT_PACTSU; RMTFACTSU_DMP; RMTFACTSU_INC; RMTFACTSU_PC; RMTFACTSU_RM; Siasoco, George(DCHA/OFDA) [USAID]
Subject: ECHO Civ Protection Japan Update

All,

Please find attached ECHO's latest civ protection Japan update.

Note the GoJ requests in the MIC message doc, including bottled water!

This follows-on a first letter from the Japanese Ambassador to the EU, which didn't include assistance requests.

Best,
Patterson

Patterson W. Brown
USAID Humanitarian Assistance and Food Security Advisor
U.S. Mission to the European Union
+32 (0)2 811-5512

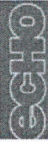
This email is UNCLASSIFIED.

Item	Description of the items	Participating State	Quantity	Total weight (kg)	Size & dimensions (m)	Total volume (m3)	Floor space (m2)	Packaging with due reference to air, land, packaging standards	Does the packaging allow for stacking (Yes / No)	Place of embarkment	Readiness to transport it somewhere else in Europe (indicate where)	When is assistance ready for transport (indicate date and time)	Available transport capacity for transport to Japan (give info on the type of plane, military or commercial)	Do you have spare transport capacity to JP for taking on board other assistance (indicate available floor space)
Water				64000										
	Water	Slovakia	15,120.00	24,000.00				30 pallets; one pallette with mineral waters has 800 kg weight; seize /pallette/ lenght x width x height 120x80x14,4 cm	Yes	airport within EU	-	21.03. / 12,00	-	No
	Water	Bulgaria		40,000.00										
Blankets			56,100.00											
		Austria	20,000.00											
	Blankets	Slovakia	1,000.00	2,500.00	1,2x0,8x1,4	1,344	0,96	-	Yes	airport within EU	-	21.03. / 12,00	-	No
	Blankets	Bulgaria	2,000.00											
	Blankets	France	8,100.00		45 pallettes de (120cm * 80cm * 140cm)	60.30		Yes	Yes	Paris	Available (road transport)	16.03 ; 8.00am	France did not make search because the MIC proposed an European brooker	No
	Blankets 50% wool 50% sy	Ireland	15,000.00	#VALUE!		#VALUE!		100 pallets		Dubai	NA		WFP will arrange transport via commercial means	NA
		Lithuania	2,000.00											

		Sweden	8,000.00												
Sleeping bags			412.00												
	Sleeping bags	Slovakia	112.00												
	Sleeping bags	Lithuania	300.00												
Mattresses			250.00												
	Mattress single, 90x190x8cm	Ireland	250.00	1,245.00		49.95		15 pallets		Dubai	NA		WFP will arrange transport via commercial means	NA	
Beds			1,112.00												
	Beds	Bulgaria	1,000.00												
	Camp beds	Slovakia	112.00												
Jerrycans			11,450.00												
	Jerrycans	France	450.00	78.00		1.00		Yes	Yes	Paris	Available (road transport)	16.03 ; 8.00am	France did not make search because the MIC proposed an European broker	No	
	Jerrycans	Austria	5,000.00												
	Jerrycans collapsible, 10lt w/tap outlet	Ireland	6,000.00	#VALUE!		13.72		8 pallets							
Watertanks			18.00												
	Pillowtank, 10000L, 4120-10000	Ireland	2.00	142.00		0.54		1 pallet		Dubai	NA		WFP will arrange transport via commercial means	NA	
	Pillowtank, 2x5000L, 4120-5000	Ireland	12.00	452.00		1.31		1 pallet		Dubai	NA		WFP will arrange transport via commercial means	NA	
	Pillowtank, 20000L, 4120-20000	Ireland	4.00	384.00		0.93		1 pallet		Dubai	NA		WFP will arrange transport via commercial means	NA	
Others															
	Tents	Slovakia	14.00	728.00	1,4x1,3x1,3	2.37	1.82	-	Yes	airport within EU	-	21.03. / 12,00	-	No	

Power stations HONDA 22	Slovakia	5.00	180.00	0,58x0,43x0,44	0,11	0,25	-	Yes	airport within EU	-	21.03. / 12,00	-	No
Power stations HONDA 45	Slovakia	4.00	248.00	0,65x0,51x0,52	0,172	0,33	-	Yes	airport within EU	-	21.03. / 12,00	-	No
Power stations 4401	Slovakia	6.00	252.00	0,65x0,51x0,52	0,172	0,33	-	Yes	airport within EU	-	21.03. / 12,00	-	No
Water pumps IB 30	Slovakia	3.00	84.00	0,5x0,4x0,45	0,09	0,20	-	Yes	airport within EU	-	21.03. / 12,00	-	No
Pressure hose (IB 30)	Slovakia	3.00	30.00	1,4x1,4x1,2	2,352	1,96	-	Yes	airport within EU	-	21.03. / 12,00	-	No
Water pumps WT40XK2D	Slovakia	4.00		0,8x0,6x0,6	0,288	0,48	-	Yes	airport within EU	-	21.03. / 12,00	-	No
Water pumps WB30XDXE	Slovakia	3.00	81.00	0,51x0,39x0,46	0,092	0,199	-	Yes	airport within EU	-	21.03. / 12,00	-	No
T-shirt	Slovakia	1,000.00	150.00	1,2x0,8x1,2	1,15	0,96	-	Yes	airport within EU	-	21.03. / 12,00	-	No
Pants	Slovakia	1,000.00	90.00				-	Yes	airport within EU	-	21.03. / 12,00	-	No
Shirt	Slovakia	1,000.00	300.00	1,2x0,8x1,5	1,44	0,96	-	Yes	airport within EU	-	21.03. / 12,00	-	No
Pullover	Slovakia	1,000.00	500.00	1,25x0,85x1,25	1,329	1,063	-	Yes	airport within EU	-	21.03. / 12,00	-	No
Shoes	Slovakia	1,000.00	2,200.00	1,25x0,85x1,25	1,329	1,063	-	Yes	airport within EU	-	21.03. / 12,00	-	No
Equipment													
ASMG90 (enhanced det	Austria	2.00											
Scintillation probe	Austria	1.00											
Identifinder	Austria	1.00											
DS 10 (decon sprayer)	Austria	3.00											
EPD (electronic personal)	Austria	6.00											
TLD (thermoluminescent)	Austria	4.00											
electronic dosimetre (Ulti	Denmark	15.00											
Intensity measures (Rad	Denmark	4.00											
spectral measures (RS-2	Denmark	2.00											

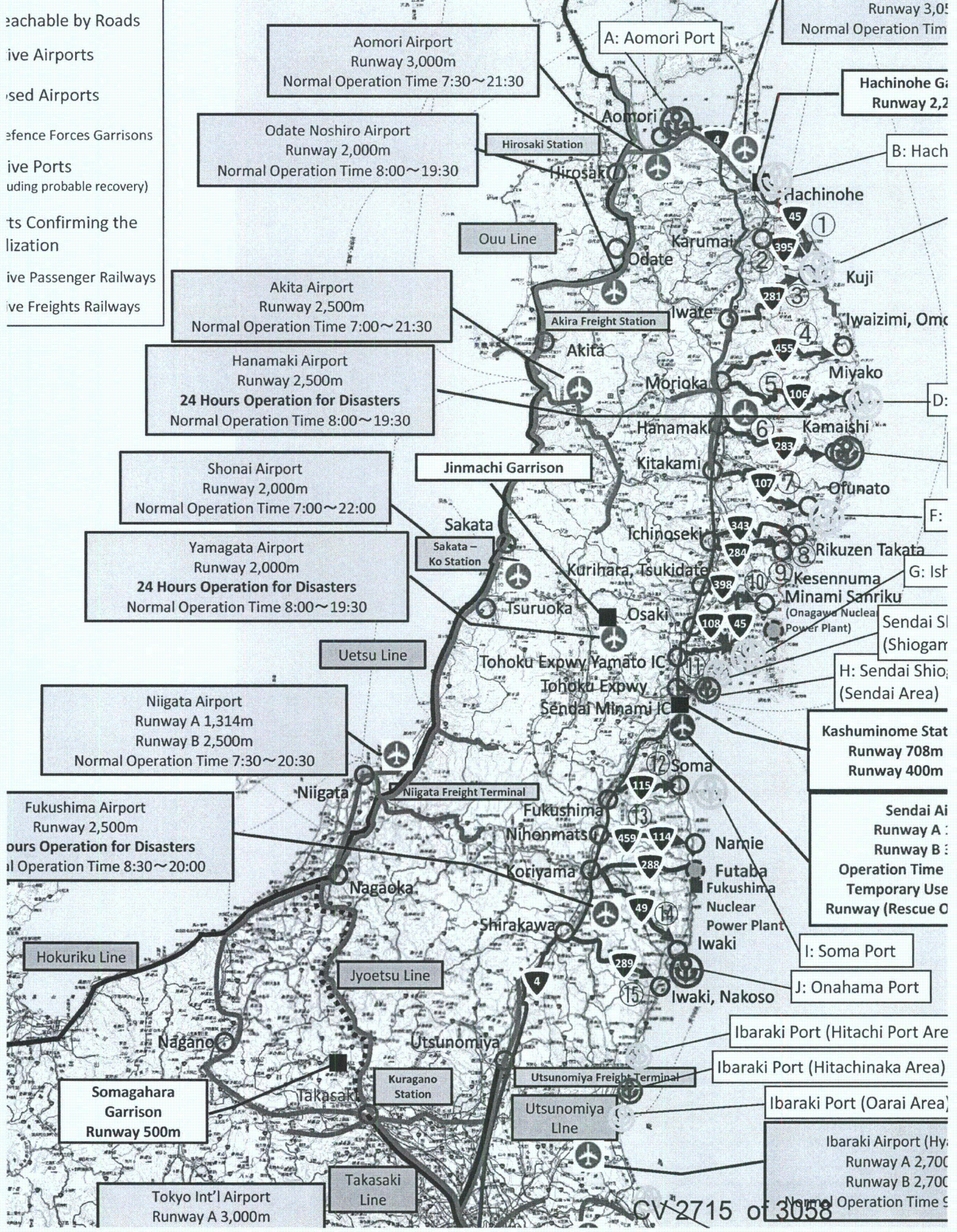
Any other relevant info
*comment
3litres bottles



Date: 2011/03/17 Time: 10:00 UTC

Status	Request for Assistance		From MIC to Civil Protection contact points
MIC contact	Olimpia Imperiali / Cristina Brailescu MIC Duty Officers		Telephone: +32 2 29 22222 Fax: +32 2 29 90525 E-mail: echo-mic@ec.europa.eu
Event	Cause: Natural disaster	Type: Earthquake	
Occurrence	Date: 03/11 Time: 07:40 UTC		
Situation	<p>The MIC is planning to deploy a EUCP Team, on Friday 18 March, to coordinate the incoming assistance. The Team Members will meet in Brussels where they will be briefed.</p> <p>The EUCPT Team is composed as follows:</p> <ol style="list-style-type: none"> 1. Vladimir VLCEK, CZ, team leader 2. Peter JACKOVICS, HU, deputy team leader 3. Johan GYLLEFJORD, SE, team member 4. Tomasz TRACILOWSKI, PL, team member 5. Orjan Nordhus KARLSSON, NO, team member 6. Agostino GORETTI, IT, team member 7. Peter GOUDSMITS, NL, team member 8. Vincent BOICHARD, FR, team member 9. Per R. GRIM, DK, CBRN expert 10. Stephane DRENNE, FR, CBRN expert 11. Antonin PETR, EU, MIC liaison Officer <p>The 2 CBRN experts have been asked to join the EUCPT to support the Team on its safety.</p> <p>There will be also a Danish TAST (Technical Assistance Support Team) to support the EUCP Team. It is composed of 6 members including 1 interpreter and 1 speaking Japanese.</p> <p>The Japanese Government has expanded its initial request and is now also asking the following:</p> <ul style="list-style-type: none"> - food that can be conserved (please be specific what kind of food they are) - bottles of mineral water (please let us know the volume of each bottle and number of bottles) - provisional toilets and disposable toilets - Tents: should not be transparent; preferred size: 100 m2. - plastic gloves and boots - blankets <p>The MIC is also exploring options to procure items locally/regionally.</p> <p>The final destination of in-kind assistance will likely be Iwate Prefecture or Miyagi Prefecture. It may change according to the quantity, to the type of the assistance and to the needs at that moment.</p> <p>The acceptance of military aircraft as well as of civilian aircraft will depend on the features of the aircraft (for example, minimum distance necessary for runway), vacancies for the landings and takeoffs in the relevant airports. For the time being the planned entry point for in kind assistance is Narita Airport with runway of 4 km.</p> <p>The operation has to be totally "autonomous" and self-sufficient, in terms of fuel, language, food, water, transport, drivers and insurance.</p> <p>So far the MIC has received the following offers: 56.100 blankets; 412 Sleeping bags; 1.112 beds; 250 mattresses; 11..450 Jerrycans; 18 water tanks; 728 tents; 15 generators; 10 water pumps and others (please see attached table of offers.)</p>		
Remarks			
Attachments	Summary of offers Maps		

Accessible by Roads
 Accessible by Roads
 Active Airports
 Closed Airports
 Defense Forces Garrisons
 Active Ports
 (Including probable recovery)
 Routes Confirming the
 Utilization
 Active Passenger Railways
 Active Freight Railways



From: Brandon, Lou
Sent: Thursday, March 17, 2011 8:26 AM
To: PMT02 Hoc; PMT11 Hoc; PMT09 Hoc
Subject: FW: CMweb book access granted (Home Team Products)

From: CMweb [cm-web-spt@aquinas.llnl.gov]
Sent: Thursday, March 17, 2011 4:59 AM
Subject: CMweb book access granted (Home Team Products)

CMweb Web User,

You have been granted access to the book titled,

Home Team Products

To access this information, you will need to log in to the CMweb system by clicking on the link below:

https://cmweb.llnl.gov/web/share/shareHome.html?pk=bok_201100000108

Additional Information:

AMS Flights 3/17/11

From: Pilgrim, Gary T. CONTRACTOR <(b)(6)> on behalf of
DTRA Operations Center <(b)(6)>
Sent: Thursday, March 17, 2011 5:34 AM
Subject: FW: RFI 216U Update
Attachments: RFI_216U_0900Z_17MAR2011_rev0.PPT

Attached is the 17March 2011 0900Z Update for RFI 216.

V/R

Mr. Gary Pilgrim
Operations Center Support
phone: 703.767.2116

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

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

From: DTRA Reachback (b)(6)
Sent: Thursday, March 17, 2011 5:07 AM
To: DTRA Operations Center
Cc: Reachback
Subject: RFI 216U Update

Ops-

Attached is the update for RFI 216U.

Very Respectfully,

M. Everett

Defense Threat Reduction Agency

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

Unclas: (b)(6)

SIPR: (b)(6)

JWICS: (b)(6)

R&D Enterprise

Innovation & Systems Engineering Office

Reachback Division

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Possible Release – Situational Details Unknown

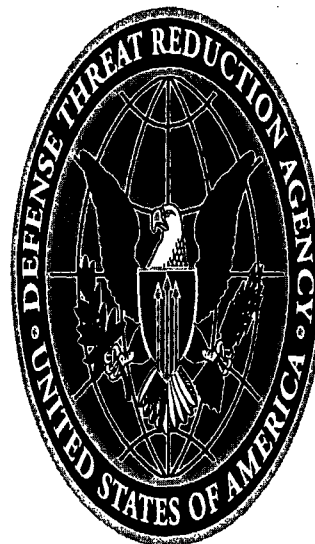
Planning:
**Model of a Nuclear Reactor Incident in
Japan as a Result of an Earthquake –
Update 0900Z 17MAR2011**

RFI – 216U

17MAR2011

Requestor: USFJ

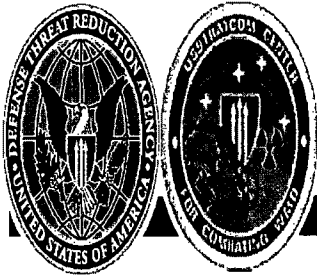
As of 0915Z 17MAR11



Distribution: Limited to DoD and authorized contractors. Further distribution contact DFRA
Derived From: USFJ
Reason: E.O. 12958 sections 1.4 (e), (g) and (h).

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



Request Summary

• (FOUO) Request data

• Requestor: [Redacted] (b)(6)

• Contact: [Redacted] (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: 0900Z Date: 17MAR2011
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.

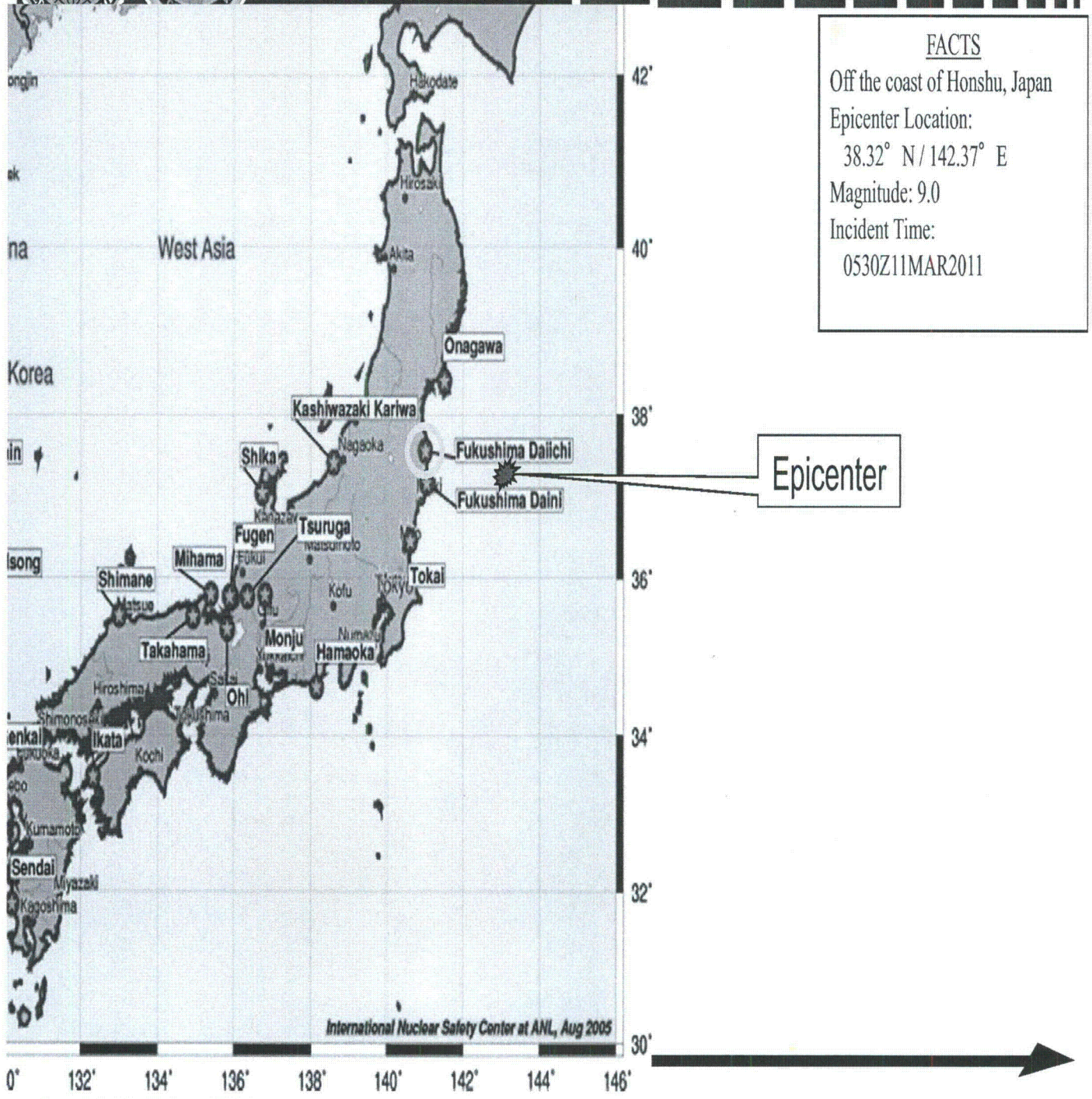
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Possible Release – Situational Details Unknown



Nuclear Power Plants

SCOPING PURPOSES ONLY



International Nuclear Safety Center at ANL, Aug 2005

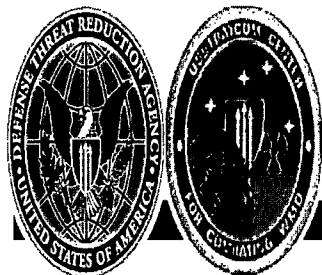
0° 132° 134° 136° 138° 140° 142° 144° 146°

As of 0915Z 17MAR11

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For Official Use Only

Possible Release – Situational Details Unknown



Fukushima Daiichi Nuclear Power Plant

- Highest reading at fence was 60 mrem/hr at 0600Z 15MAR2011
- Reduction of dose rates after the peak at 0122Z 15MAR2011 (400 mSv/hr in area surrounding unit 3)
- 30 mSv/hr between Units 2 and 3, and 100 mSv/hr surrounding Unit 4
- Offsite dose measured in Tokai on the coast 100 km NE of Tokyo on 2245Z 14MAR2011 was 5 μ Sv/hr

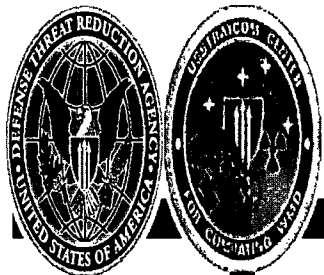
Source: IAEA Reporting at 1740Z 15MAR2011 (From NRC Update 2300Z 16MAR2011)

As of 0915Z 17MAR11

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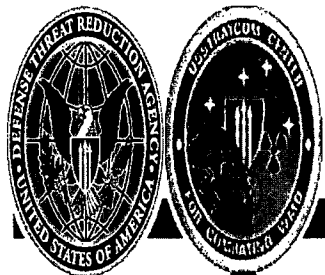
Fukushima Daiichi-1 Status

- 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 with reported stable cooling
- Containment described as “functional”
- Hydrogen explosion from overheated fuel-water reaction damaged the reactor building (secondary containment)
- 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, 2300Z 16MAR2011

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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
- Secondary containment: Cut hole to reduce hydrogen gas buildup
- The spent fuel pool level is unknown. Some water is available as evidenced by steam emanating from hole
- Sea water injection restarted with core cooling reported as not stable
- Primary containment is intact
- High radiation levels reduced to 600 mSv/hr (60 mrem/hour) at 0600Z 15MAR2011 at site gate (same gate for all units)

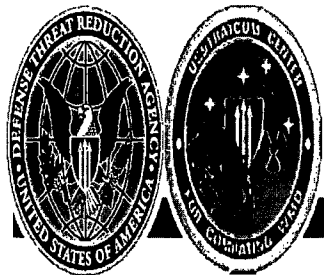
Source: USNRC Emergency Operations Center Status Update, 2300Z 16MAR2011

As of 0915Z 17MAR11

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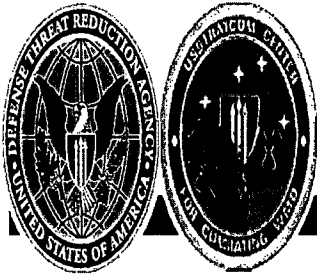
Fukushima Daiichi-3 Status

- 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
- Primary containment described as “functional”
- The spent fuel level is possibly drained – some evidence of steam
- 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, 2300Z 16MAR2011

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Possible Release – Situational Details Unknown



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. Fuel reported to be uncovered
- Radiation levels outside Unit 4 reported to be 30 R/hr following second fire
- High radiation dose rates measured between Units 3 and 4, source is suspected to be the partially uncovered Unit 4 spent fuel pool
- The spent fuel pool's ability to retain water is in doubt. No steam – likely dry

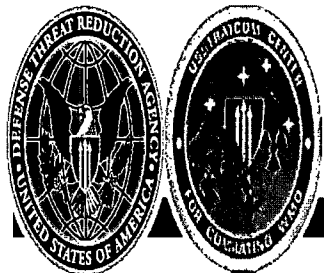
Source: USNRC Emergency Operations Center Status Update, 2300Z 16MAR2011

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Status of additional reactors

- Fukushima Daiichi-5, and -6
 - The reactors are defueled
 - Spent fuel pools are reported to be heating up
 - A/C power available from Unit 6 diesel generator
- 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

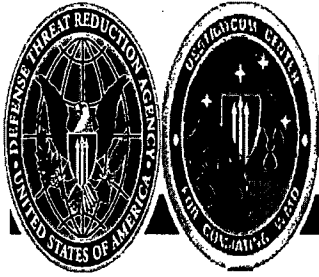
Source: USNRC Emergency Operations Center Status Update, 2300Z 16MAR2011

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Possible Release – Situational Details Unknown

Fukushima Daiichi DTRA Modeling Assumptions

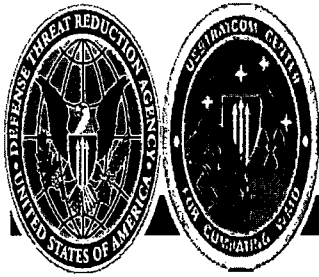
Most Likely



- **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 0900Z
 - ✓ NFAC Reactor Accident
 - ✓ Containment monitor reading: 10 R/hr (unconfirmed)
 - ✓ Sprayers: Off (unconfirmed)
 - ✓ Filters: On (unconfirmed)
 - ✓ Weather 40 km GFS

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Possible Release – Situational Details Unknown



Fukushima Daiichi DTRA Modeling

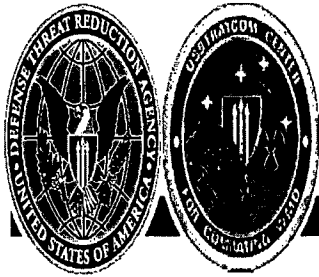
- **Summary of Models Provided in this Briefing**
- Assumption – Fukushima Daiichi #1, 2, and #3 suffered damage resulting in a continuous release/leak of a small portion of its inventory. Release occurs consistently throughout times shown in this product. (Precise details of this release are highly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

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Possible Release – Situational Details Unknown

Fukushima Daiichi (Impacts) – Most Likely

Assumed Core Damage & Venting



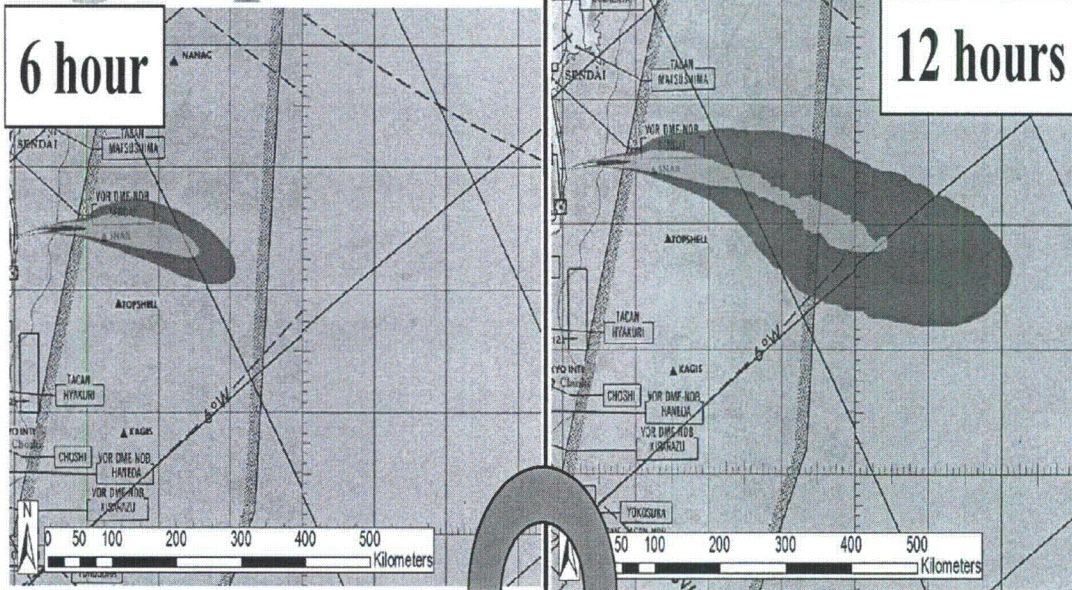
- Weather
 - Surface winds in the vicinity of the power plant are currently from the W-NW with some winds gusting to 25kts. Northwesternly (offshore) winds between 10-15 kts are forecasted for Thursday (17MAR). **This means that any possible release through Thursday is forecasted to move to the SE and 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.
- Releases from spent fuel pools being evaluated

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Possible Release – Situational Details Unknown

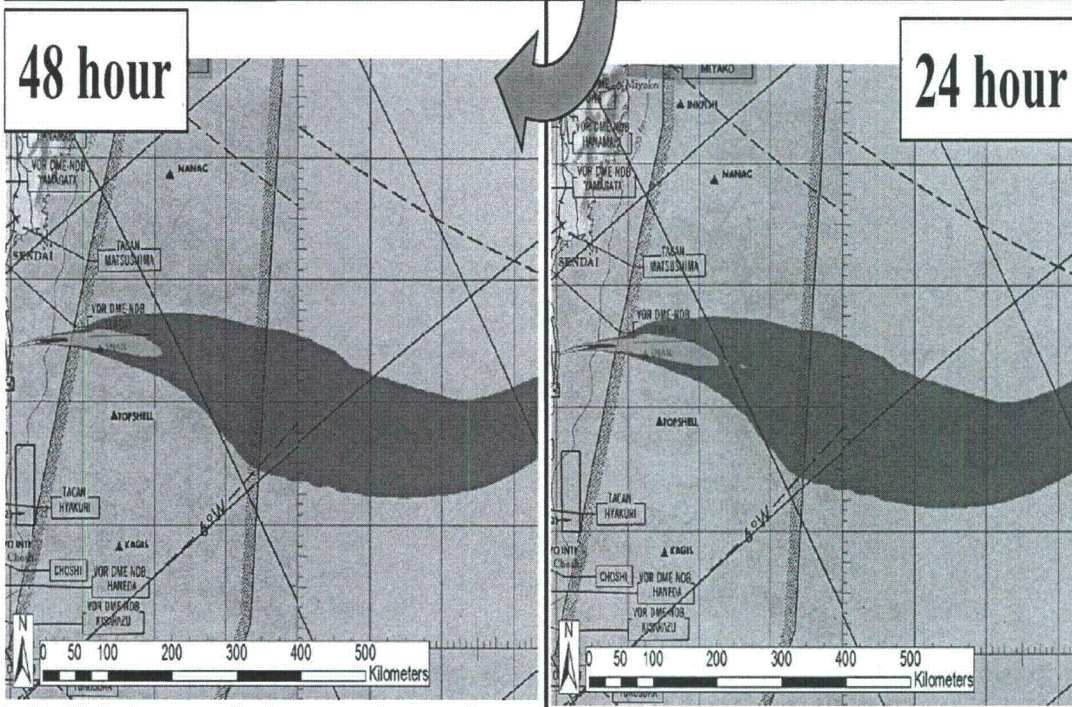


Isotope Air Concentration



Total Activity Isotope Air Concentration

	uCi/ml
10 nCi/m ³	1.0E-08
1 nCi/m ³	1.0E-09
100 pCi/m ³	1.0E-10
10 pCi/m ³	1.0E-11
1 pCi/m ³	1.0E-12
100 fCi/m ³	1.0E-13
10 fCi/m ³	1.0E-14



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

As of 0915Z 17MAR11

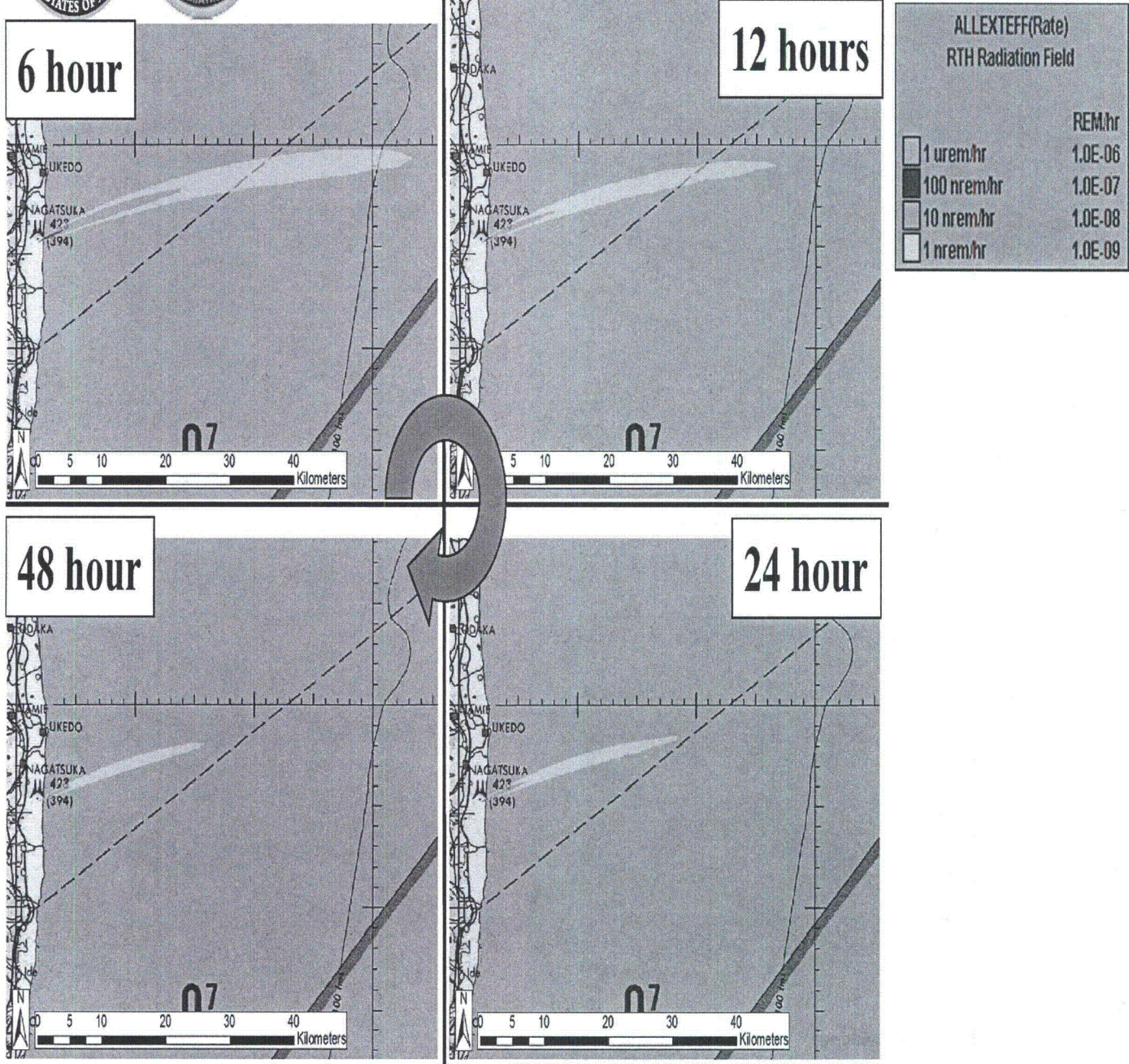
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Possible Release – Situational Details Unknown



All External Effects



As of 0915Z 17MAR11

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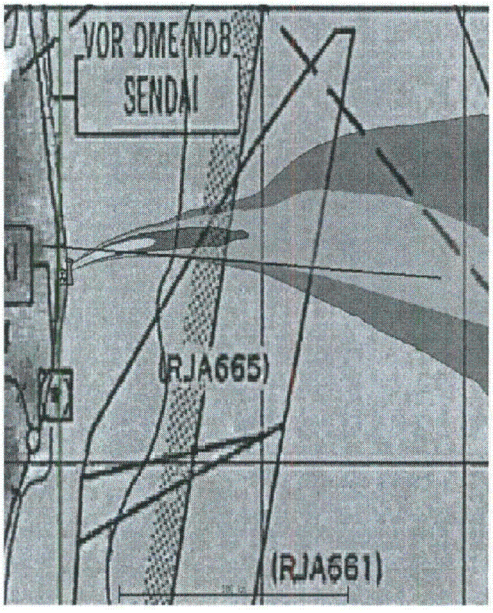
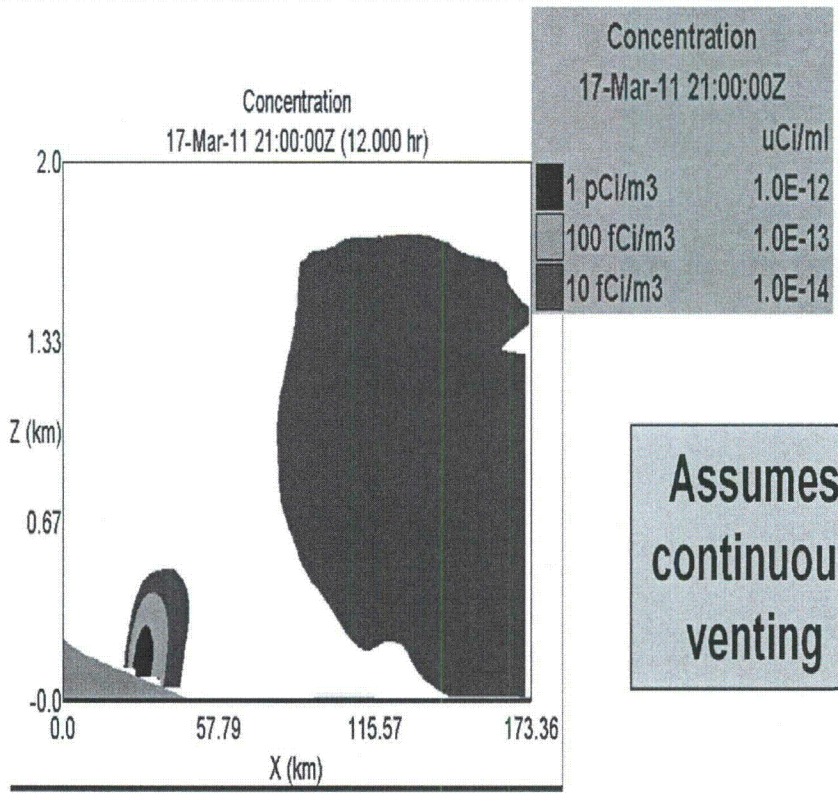
Possible Release – Situational Details Unknown

Fukushima Daiichi

Most Likely Release Scenario



Vertical Slice Through Highest Part of Plume @ 2100Z 17 March



Assumes continuous venting

FACTS
 Fukushima Daiichi
 37.42139° N/ 141.0325° E
 0900Z 17MAR2011
 Type: Nuclear Facility Accident
 Weather: 40 km GFS
 Model: HPAC 5.0 SP1
 Static Population Estimates:
 LandScan 2009

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 2.0 km.

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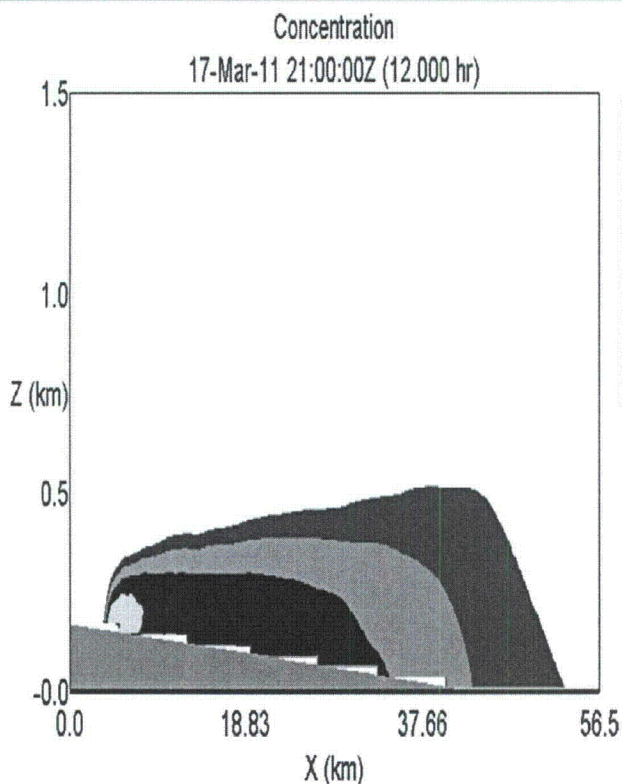
Possible Release – Situational Details Unknown

Fukushima Daiichi

Most Likely Release Scenario



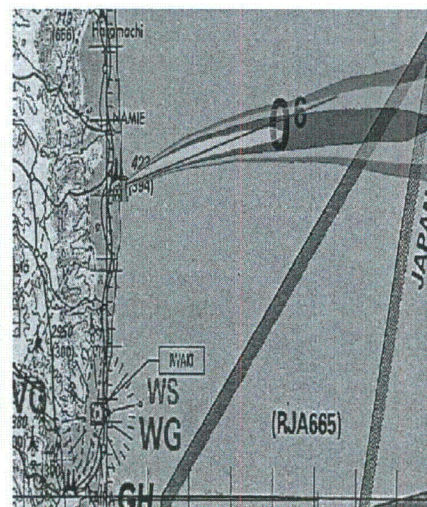
Vertical Slice Through Plant @ 2100Z 17 March



Concentration
17-Mar-11 21:00:00Z

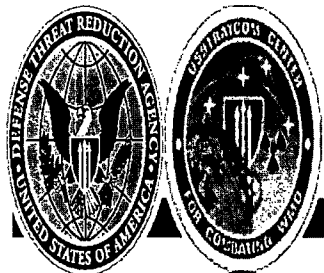
Concentration	uCi/ml
1 pCi/m ³	1.0E-12
100 fCi/m ³	1.0E-13
10 fCi/m ³	1.0E-14

Assumes
continuous
venting



FACTS
 Fukushima Daiichi
 37.42139° N/ 141.0325° E
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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 0.5 km elevation, lower concentrations up to approx 1 km.



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.

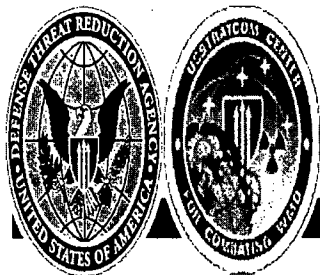
Note: Sieverts=Grays and Rad=REM for beta and gamma radiation as the Quality Factor is one.

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

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Backup: Radiation Exposure Reference



Exposure Received (mRem)		
Average Background Radiation for 1 hour	0.071	
A single cross country flight	4	
A single chest x-ray	10	Mettler, FA, et al, <i>Effective Doses in Radiological and Diagnostic Medicine, 2008</i>
Average background radiation annually	620	
A single mammogram study	400	Mettler, FA, et al, <i>Effective Doses in Radiological and Diagnostic Medicine, 2008</i>
A single CT scan	1,800	Mettler, FA, et al, <i>Effective Doses in Radiological and Diagnostic Medicine, 2008</i>
Chernobyl evacuation zone	10,000	
Hiroshima survivor inside structure	78,000	
Nagasaki survivor inside structure	156,000	

Exposure Limit (mRem)		
Maximum public exposure annually ¹	100	10CFR20.1201
Maximum radiation worker dose annually	5,000	10CFR20.1201
General emergency	1,000	NUREG-0654/FEMA REP1
Protective actions (shelter or evacuate)	1,000 – 5,000	EPA 400-R-92-001, 1992
Evacuation required	1,000	EPA 400-R-92-001, 1992
1 st Responder dose protecting valuable property ²	10,000	EPA 400-R-92-001, 1992
1 st Responder dose lifesaving or protection of large populations ²	25,000	EPA 400-R-92-001, 1992
Maximum 1 st Responder dose	25,000	EPA 400-R-92-001, 1992

¹ This number represents the exposure allowed in excess of the expected annual background radiation exposure of 620 mRem

² FEMA: Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) incidents.