Lessons Learned in Responding to the Accident at the Fukushima Daiichi Nuclear Power Stations:

The Way Forward

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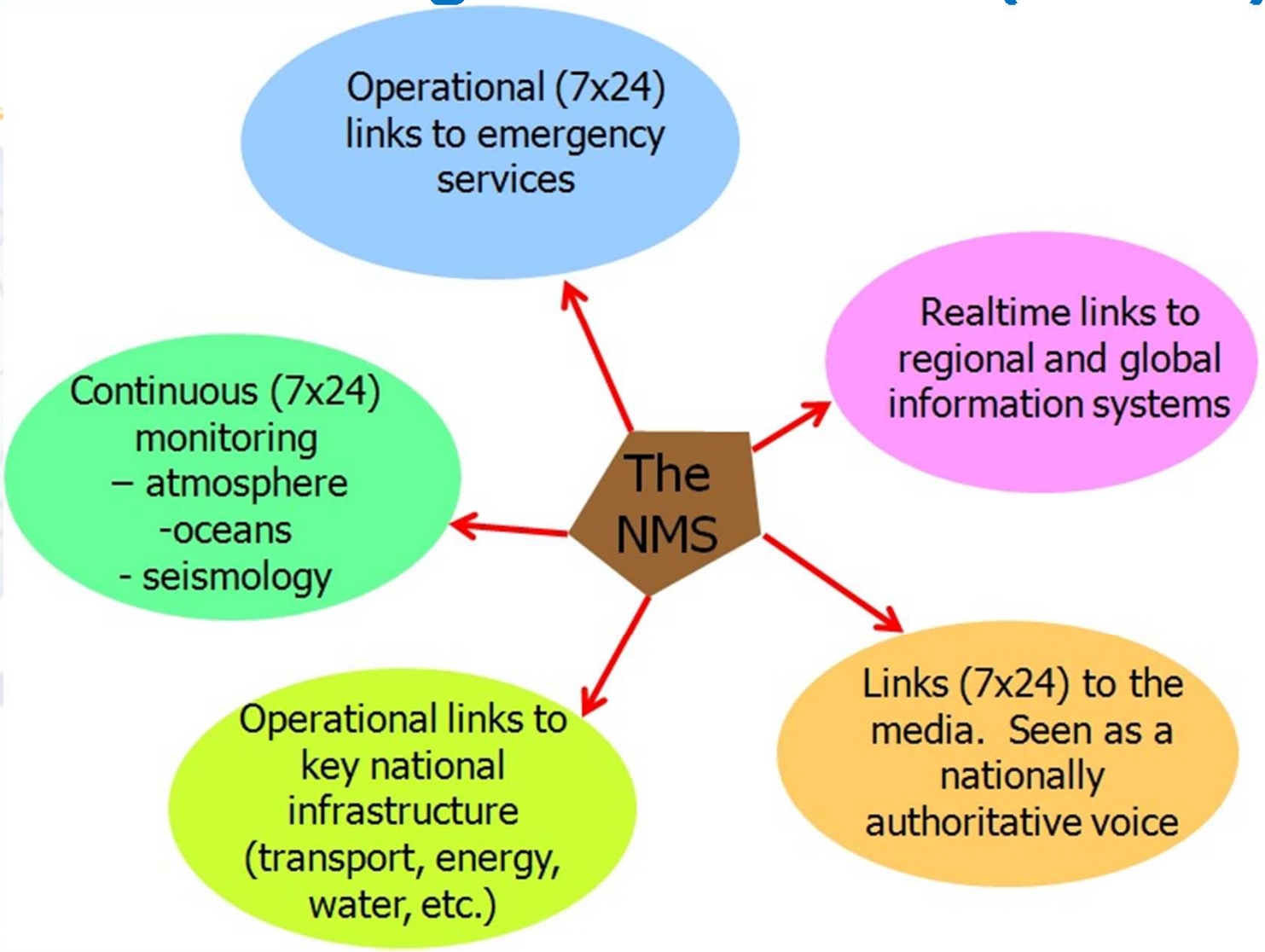
Relevant roles of National Meteorological Services (NMSs)



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WMO Environmental Emergency Response (EER) Activities:

Nuclear accidents and radiological emergency response

- Numerical simulation of atmospheric transport and dispersion - modelling technology to support environmental emergency response;
- Dependent on, integrated with operational Numerical Weather Prediction system infrastructure at global and regional centres;
- 24/7/365 operational commitment of designated regional specialized meteorological centres;
- Operational standards, procedures;
- Regular exercise and testing;

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EER Operations

The WMO's 8 Regional Specialised Meteorological Centres (RSMCs) for Environmental Emergency Response (EER)

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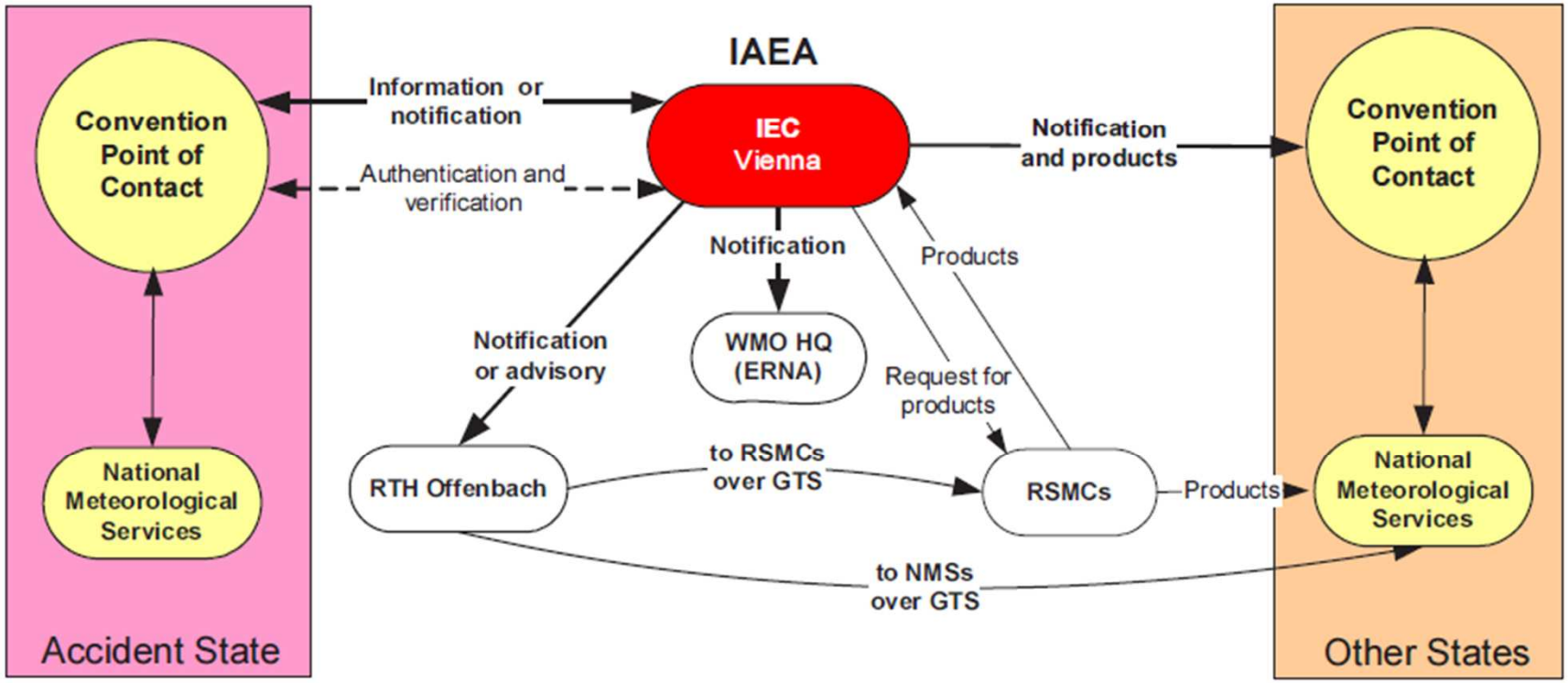
Concept of Operations: IAEA - WMO Notification and WMO provision of services (IAEA EPR-JPLAN 2010)



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EER System Performance

The Earthquake occurred at 05.46 UTC on the 11th of March, 2011 and at 09.30 UTC the WMO EER System was first requested to provide advice to designated authorities on the likely evolution of the radioactive cloud that was being accidentally released from the Fukushima Daiichi power plant.

Within hours the first dispersion charts were available, and were produced routinely until no longer required.

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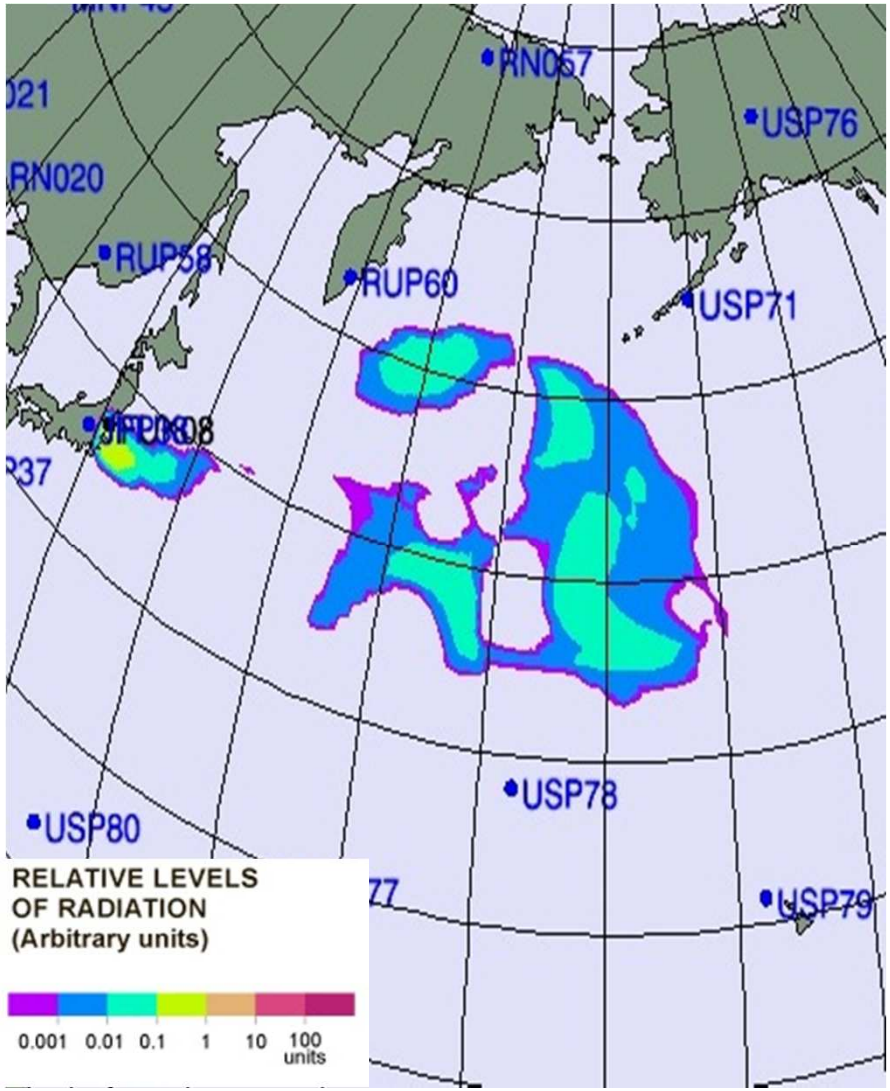
Lessons Learnt #1

The EER system worked well.

The EER dispersion charts are based on having:

- A well validated model
- Accurate winds to start with and high quality wind forecasts to calculate likely future cloud dispersion
- Good forecasts of rainfall through the forecast period and realistic “washout” processes in the model
- Realistic settling rates for the radioactive material
- Realistic radioactive decay rates.



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Lessons Learnt #2

The Source Term (from instructions to EER Centres):

Default values to be used in response to a request for products for the unspecified source parameters [1]

- Uniform vertical distribution up to 500 m above the ground;
- Uniform emission rate during six hours;
- Starting date/time: date/time specified at «START OF RELEASE» on request form or, if not available, then the «Date/Time of Request» specified at the top of the request form;
- Total pollutant release 1 Bq (Becquerel) over 6 hours;
- Type of radionuclide Cs 137.

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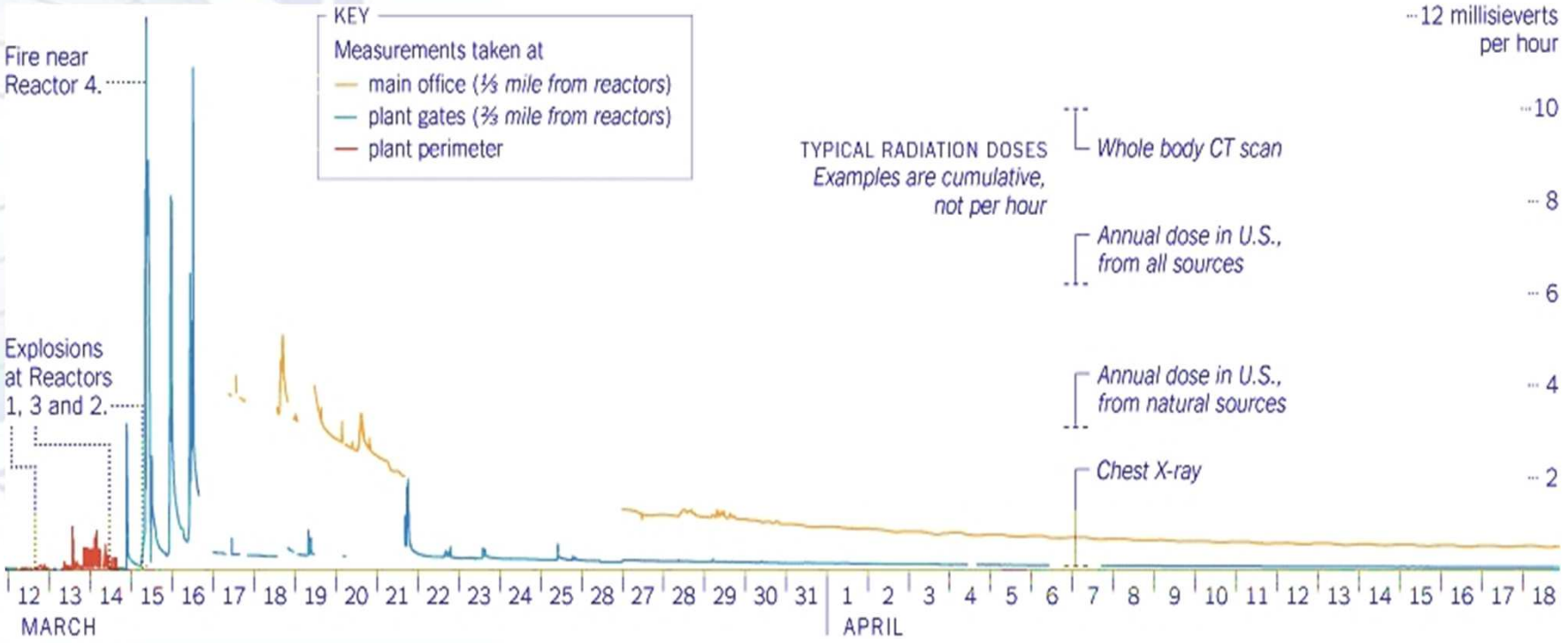
Lessons Learnt #3

From the New York Times (18 April, 2011) – a publicly available view of the time history of the source term



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Lessons Learnt #4

Adequate monitoring systems should be located around each nuclear power plant such that the source term is known accurately and quickly – why?

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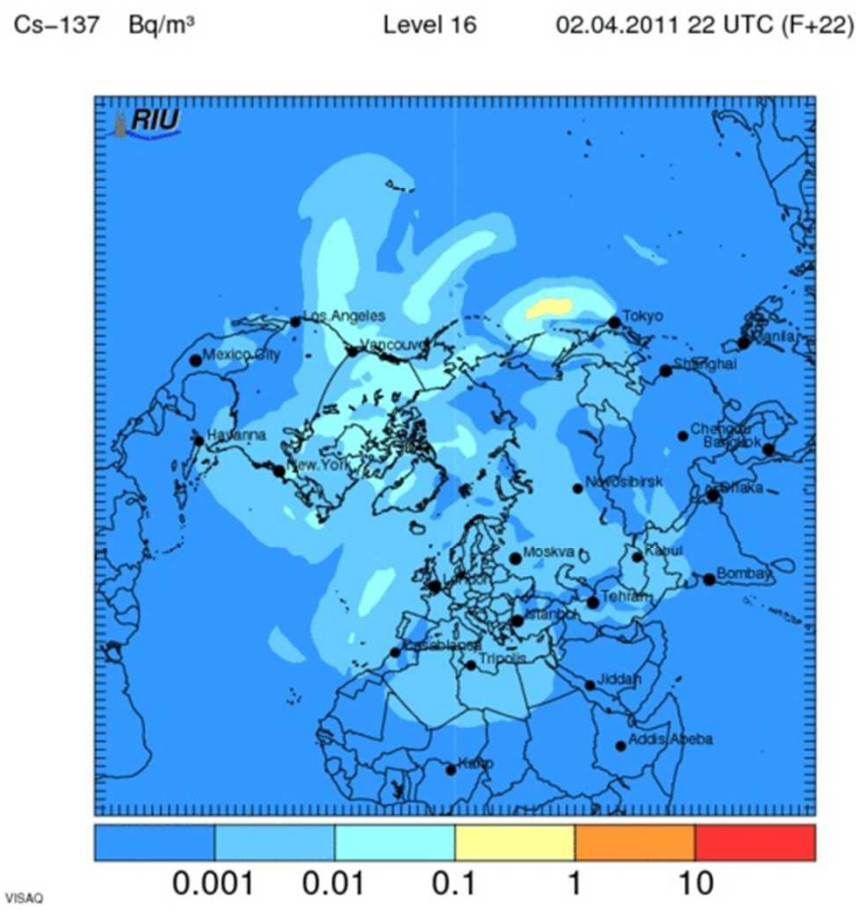
Basic set of products

Five maps consisting of:

- Three-dimensional trajectories starting at 500, 1500 and 3000 m above the ground, with particle locations at 6h intervals (main synoptic hours up to the end of the dispersion model forecast);
- Time-integrated air borne concentrations in Bq.s m^{-3} within the layer 500 m above the ground, for each of the three forecast periods;
- Total deposition (wet + dry) in Bq m^{-2} from the release time to the end of the dispersion model forecast.

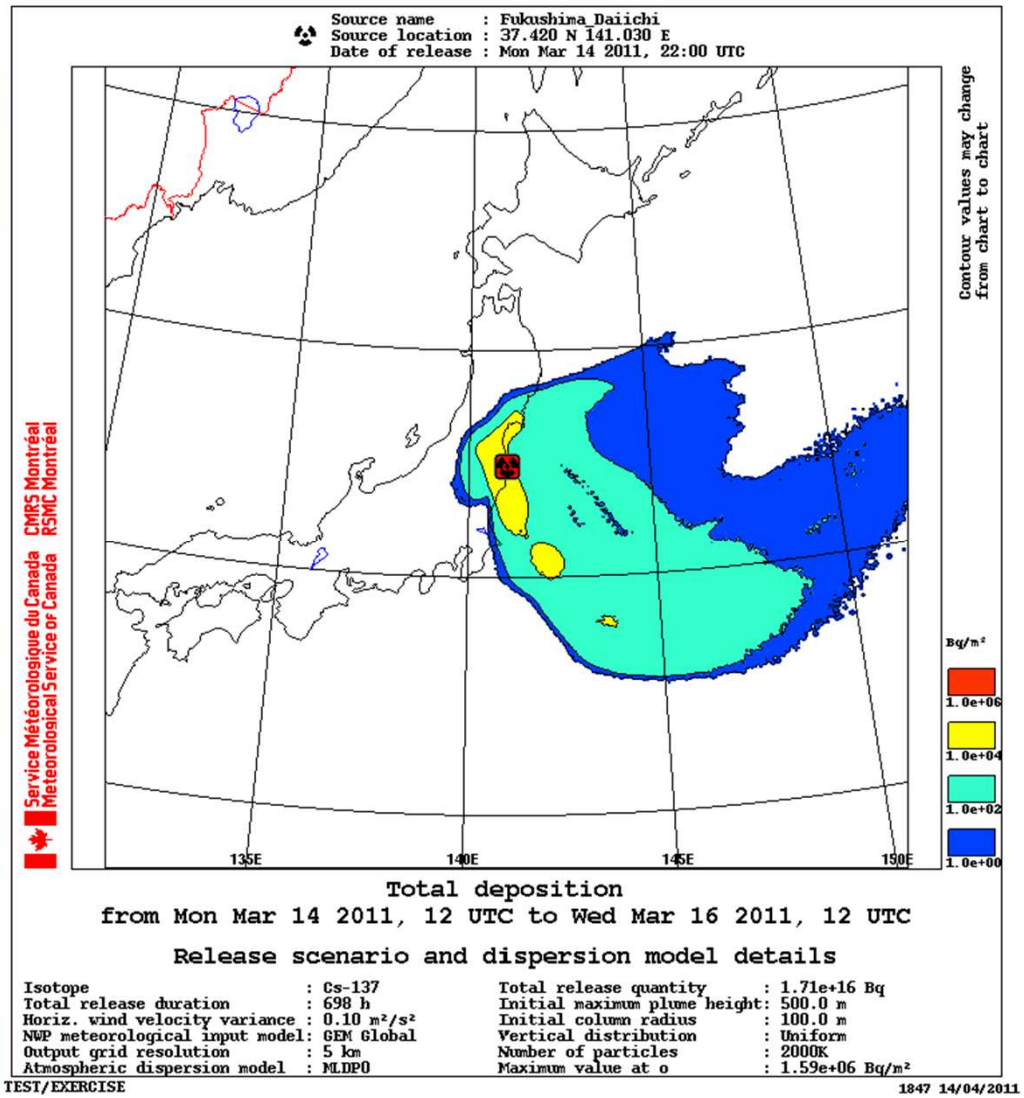
A joint statement that will be issued as soon as available.

Lessons Learnt #5



Lessons Learnt #6

Hindcasts are important.



- Use analysed wind fields not forecast wind fields;
- Use observed rainfall not forecast rainfall;
- Use a realistic, time dependent source term;
- Validate using available observations of fallout and atmospheric concentrations at available measuring sites

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Lessons Learnt #7

The tools exist, in the public domain to reproduce the EER products, albeit without the products that result having sufficient "metadata" attached to truly assess their utility.

The public demand for information is intense - and even if the metadata were there, could the public make informed assessments?

The coordination of advice to governments is difficult enough, under the pressure of an ongoing emergency coordinating information to the publics in a number of countries, across language barriers is truly very difficult – but critical if governments wish to maintain the confidence of their publics.

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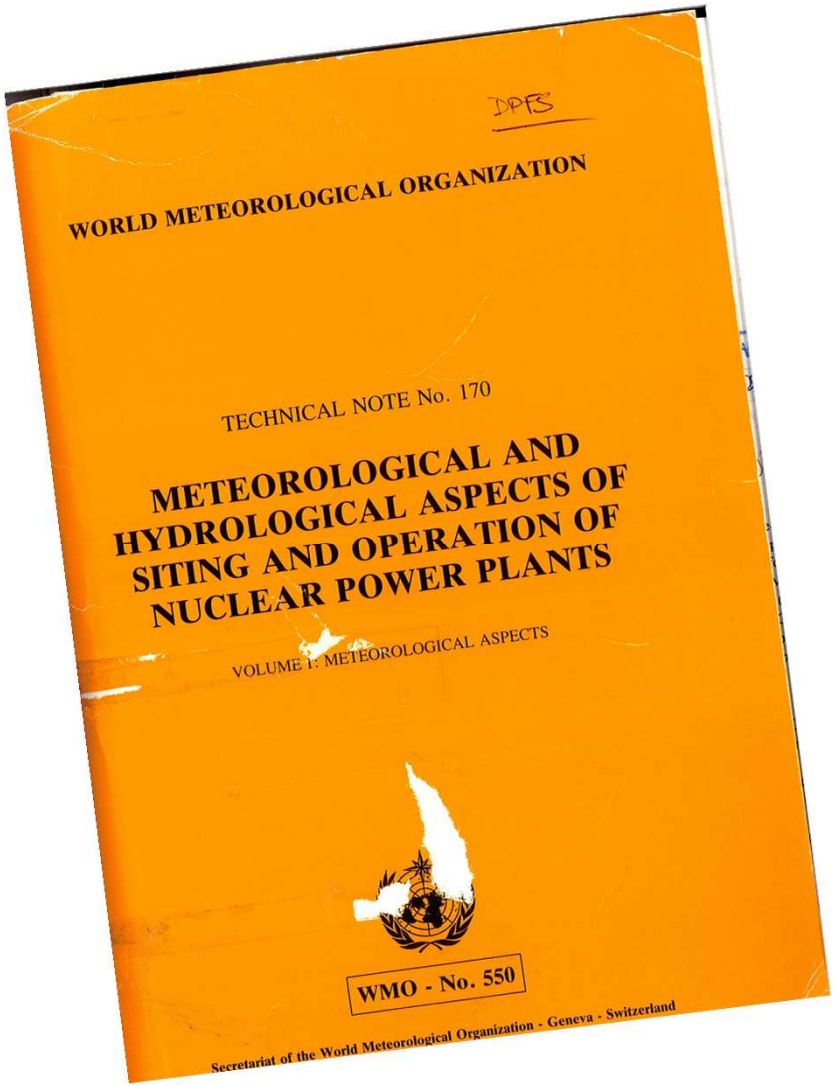
Lessons Learnt #8

Siting of Nuclear Power Stations

- Standard procedures urgently need to be updated for assessing all geophysical hazards, along with other hazards, for existing and proposed nuclear power stations;
- They should include climate change among the many considerations;
- They must be multi-disciplinary in the broadest sense.



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The Way Forward

- Review all aspects of the WMO EER system;
- Update the products to reflect current scientific capabilities;
- Work with the power station industry and CTBTO to make source term data available as soon as possible;
- Work within the UN-System to find more efficient ways of developing joint statements that inform all those potentially affected by the disaster – embed these “ways” into operational procedures and test them routinely; and,
- Use the routine tests to bring together organisations (including the media) and governments into cooperative alliances.

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Thank you