Role and activities of RTH/RSMC Offenbach

(Revised 1 March 2016)

Summary

The RTH Offenbach is one of the 18 Regional Telecommunication Hubs within the Main Telecommunication Network (MTN) of the Global Telecommunication System (GTS). RTH Offenbach is the operational counterpart of the Incident and Emergency Centre (IEC) of the IAEA with respect to the distribution of the notification of an accident and additional information. In the framework of the IAEA Convention on Early Notification and Assistance RTH Offenbach has to make sure that the NHMSs are informed as fast as possible of a nuclear accident. Additionally, in the context of the CTBTO/WMO backtracking arrangements Offenbach is one of the WMO-RSMCs for atmospheric dispersion modelling/backtracking.

Rationale

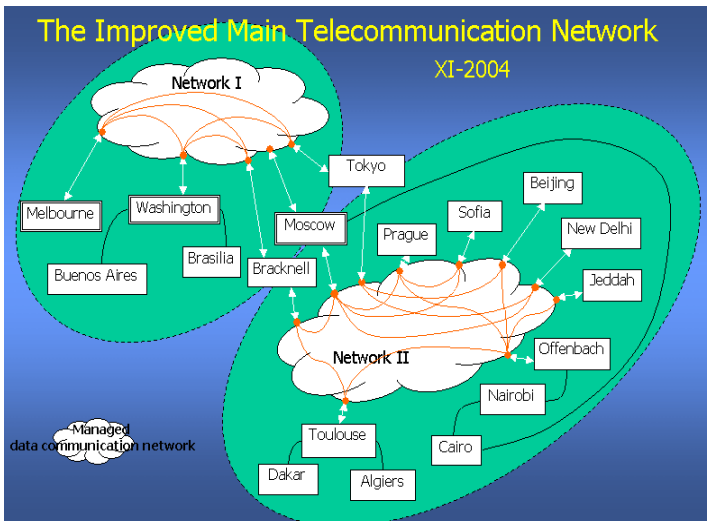
One of the main tasks of WMO within the framework of the IAEA Convention on Early Notification of Nuclear Accidents is to make sure that the NMHSs are informed as fast as possible of a nuclear accident in order

- to enable them to prepare a timely and competent expertise on the meteorological consequences of a nuclear emergency and
- to further the cooperation between the relevant national institutions responsible for meteorology and radiation protection

Consequently, the "REGIONAL AND GLOBAL ARRANGEMENTS FOR THE PROVISION OF TRANSPORT MODEL PRODUCTS FOR ENVIRONMENTAL EMERGENCY RESPONSE, SUPPORT FOR NUCLEAR ENVIRONMENTAL EMERGENCY RESPONSE" state with respect to Notification of WMO:

> *"In the framework of the Convention on Early Notification of nuclear accidents, the IAEA informs the WMO Secretariat and the RTH Offenbach (Germany) of the status of the emergency. If needed, the IAEA will request support from the WMO RSMCs. Beginning with a site area emergency, RTH Offenbach will disseminate the EMERCON message on the GTS in the form of an alphanumeric bulletin in plain-text English language under the abbreviated heading WNXX01 IAEA for global distribution to the NMCs and RSMCs. (See also the WMO Manual on the Global Telecommunications System, WMO Publication-No. 386).*
>
> *When the IAEA no longer requires WMO RSMC support, the IAEA will send an EMERCON termination message to the RSMCs, WMO Secretariat and RTH Offenbach. RTH Offenbach will disseminate the ERMERCON termination message on the GTS in the form of an alphanumeric bulletin in plain-text English language under the abbreviated heading WNXX01 IAEA for global distribution to the NMCs and RSMCs."*

Thus the RTH Offenbach which is one of the 18 Regional Telecommunication Hubs within the Main Telecommunication Network (MTN) of the Global Telecommunications System (GTS) (see figure) is the operational counterpart of the Incident and Emergency Centre (IEC) of the IAEA with respect to the distribution of the notification of an accident and additional information. Offenbach is also one of the currently 15 Global



Information Centres (GISC) of the WMO Information System (WIS).

Tasks of the RTH Offenbach

In case of an accident occurrence and/or whether emergency meteorological support is required. RTH Offenbach will

(a) receive a message from IAEA (email/fax/USIE website),

(b) verify its content by a phone call to the IEC of the IAEA,

(c) put the EMERCON message on the GTS in the form of an alphanumeric bulletin in plain-text English language under the abbreviated heading WNXX01 IAEA for global distribution to the NMCs and RSMCs (example listed in the appendix),

(d) check that the Lead-RSMCs has received the same information (email/fax) and

(e) forward the email/fax with the notification or additional information to the Lead-RSMCs if they did not get it directly from the IAEA.

Regular tests

The communication between IAEA and RTH Offenbach is tested every month. According to the actual valid procedures the tests are performed each third Tuesday a month except from one unannounced test per year. Once every quarter RSMCs and the delivery (but not the distribution) of products are included. These quarterly communication tests normally include the distribution of the information via the GTS.

The GTS link will be tested at least once per year and IAEA will decide when. Additionally, GTS messages are distributed in the framework of full scale tests like ConvEx-3 exercises.

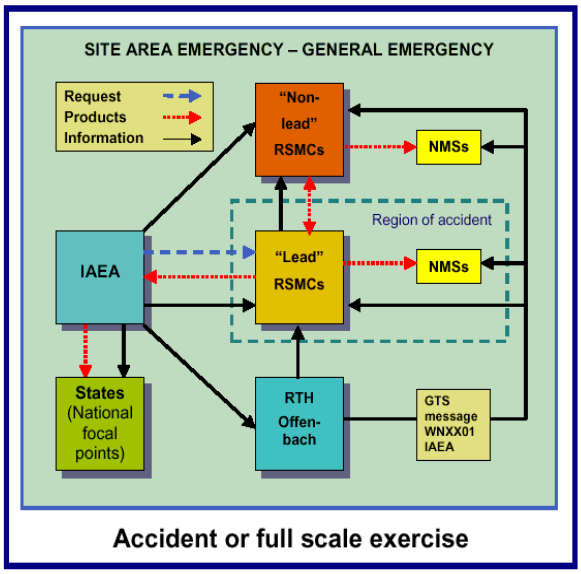
The figures show the flow of information

(a) in case of an accident or a full scale exercise (like ConvEx-3) and at least one quarterly test per year (right),

(b) the quarterly communication test including RSMCs (bottom left),

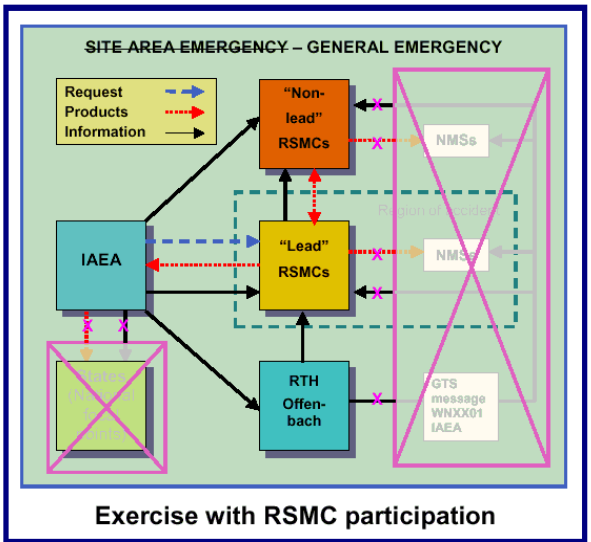
(c) the monthly communication tests between the IAEA and RTH Offenbach (bottom right).

are visualised in the three figures.

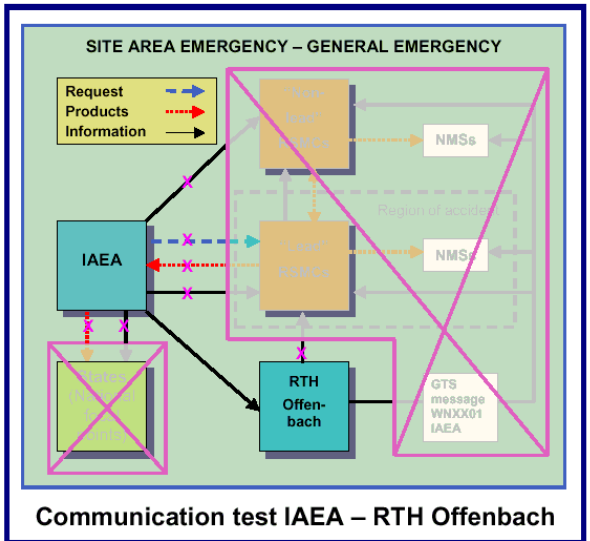


Accident or full scale exercise

(a)



Exercise with RSMC participation



Communication test IAEA – RTH Offenbach

Status of the DWD's operational atmospheric transport and dispersion model (employed for WMO/CTBTO)

The NWP modelling suite of DWD consists of three models, namely the global **ico**sahedral-hexagonal **n**onhydrostatic grid point model **ICON (** 13 km, 90 layers), which replaced the GME (grid spacing 20 km, 60 layers) in January 2015, the non-hydrostatic regional **COSMO-EU** (COSMO model Europe, grid spacing 7 km, 665 x 657 grid points/layer, 40 layers), and finally the convection permitting **COSMO-DE**, covering Germany and its surroundings with a grid spacing of 2.8 km, 421 x 461 grid points/layer and 50 layers.

Independent 4-dimensional data assimilation suites are performed for all three NWP models, ICON, COSMO-EU and COSMO-DE. For ICON, analyses are derived for the eight analysis times 00, 03, 06, 09, 12, 15, 18 and 21 UTC based on an ensemble data assimilation combined with a three-dimensional variational data assimilation scheme. For COSMO-EU and COSMO-DE, a continuous data assimilation system based on the nudging approach provides analyses at hourly intervals. Analyses and forecasts are currently run on a CRAY-XC 40.

As a part of the German radioactive emergency systems IMIS/RODOS a Lagrangian Particle Dispersion Model (LPDM) is applied at the DWD. The LPDM calculates trajectories of a multitude of particles emitted from a point source using the grid-scale winds and turbulence parameters of the NWP-models and a time scale based Markov-chain formulation for the dispersion process. Concentrations are determined by counting the number and mass of particles in a freely eligible grid. Dry deposition parameterisation follows a deposition velocity concept and wet deposition is evaluated using isotope-specific scavenging coefficients. Also included is radioactive decay, a vertical mixing scheme for deep convection processes and optionally particle-size depending sedimentation coefficients. The LPDM was successfully validated using data of the ANATEX and ETEX tracer experiments.

The dispersion model is driven by the DWD's weather forecast models (ICON, GME, COSMO-EU/COSMO-DE). In case of emergency the model output will be transmitted to the national 'Integrated Measurement and Information System' (IMIS) for the surveillance of radioactivity in the environment and the real-time decision system RODOS in Germany. Additionally, the LPDM was utilized for the EU-activity "ENSEMBLE" (participants: weather services in Europe and North America), which combines the forecast of different emergency dispersion models to a multi-model ensemble.

The model is also a member of the multi-model backtracking ensemble of the CTBTO (Comprehensive Nuclear-Test-Ban Treaty Organization). The code is optimised for MPP computers (e.g. CRAY-XC 40, NEC-SX8/SX9, IBM P5 575) utilizing MPI-based parallelisation features. The model is also implemented at MeteoSwiss based on the Swiss COSMO-version.

During the release phase of the Fukushima accident (March/April 2011) the DWD provided dispersion forecasts for the public mainly based on GME data. Additionally, the COSMO model (7 km grid spacing) was set up and run in an operational mode for the relevant region covering Japan and its surroundings.

In the last two years incremental updates and improvements were made to the DWD's dispersion model software, and to the response procedures (e.g. for GRIB2, preparations for the new DWD global model "ICON"). It is planned to replace the limited area model COSMO-EU by an ICON-EU nest model in 2016.

Status of the DWD's research atmospheric transport and dispersion models (COSMO-ART and ICON-ART)

The **COSMO-ART** system, where ART stands for 'Aerosols and Reactive Trace gases', is an extension of the operational COSMO model. The complete set of ART modules developed at the Institute for Meteorology and Climate Research at the Karlsruhe Institute of Technology (KIT) is online coupled in a tightly integrated way to the COSMO model. I.e. the same routines for transport and diffusion of the gas phase and aerosol tracers are used as for the prognostic moisture quantities in NWP. The possible applications of COSMO-ART range from simple tracer dispersion problems to complete aerosol-radiation and aerosol-cloud interaction studies including the formation of secondary aerosol particles from the gas phase.

At DWD the model system is mainly employed for the dispersion modelling of volcanic ash and mineral dust.
In case of a volcanic eruption with relevance for the German air space COSMO-ART is run on an enlarged domain, the model results are made available on the NinJo workstations of and used by the aviation forecasters as a secondary source of information. To parameterise the emission of volcanic ash an empirical relation between observed plume height and mass eruption rate is used. To get to quantitative results for the mass concentration of volcanic ash in the atmosphere, aircraft measurements of the particle size distribution and number concentration are used. At the University of Hohenheim a LIDAR forward operator is developed. This operator will ease the comparison of model results and observations of the ceilometer network of DWD and is a prerequisite for the data assimilation of such measurements.
Different institutions use COSMO-ART to run forecasts of mineral dust. For example the United Arabian Emirates have set up daily model runs in their operational cycle.
The strong Saharan dust event beginning of April 2014 is currently investigated in a joint effort of DWD and KIT. Runs including the aerosol-radiation interaction of the simulated dust showed a significant reduction of the short-wave radiation at the surface. This for example had a big impact on the power produced by solar energy. Further studies will also include the aerosol-cloud interaction parts.

Following the explanation of COSMO-ART in the previous section the **ICON-ART** system is the likewise extension of ICON (developed at the Deutscher Wetterdienst DWD and the Max-Planck-Institute of Meteorology Hamburg). ICON-ART is currently under development at the IMK of KIT and the DWD, aiming at the complete functionality mentioned above. New developments for the ART modules will actually first be implemented with ICON before to be taken over also for COSMO. At DWD the model will be employed for dispersion modelling of volcanic ash, mineral dust and radionuclides.
Nearly completely implemented are the modules for volcanic ash, radionuclides, sea salt and mineral dust. These modules will be ready when ICON becomes operational at DWD. The ART modules have been restructured at KIT to streamline further expansions and developments using the object oriented capabilities of FORTRAN 2003. For example it is planned to introduce the treatment of volcanic ash also in the 2-moment cloud-microphysics framework, i.e. to use prognostic equations for the 0th and 3rd moment and different modes to represent the particle size distribution.
The (internally mixed) aerosol modes for the interaction with the gas phase chemistry will be implemented. For a flexible configuration of the gas phase chemistry the Kinetic Pre-processor KPP will be used. Aerosol-radiation and aerosol-cloud feedback processes will be implemented, where the later is realized in combination with the 2-moment cloud-microphysics scheme which is now also available in ICON.

References:

Glaab H. et al. (1998), Evaluation of the emergency dispersion model at the Deutscher Wetterdienst using ETEX data. Atmospheric Environment 32, 4359-4366

Glaab H., Fay B., Jacobsen I. and Klein A. (2006), Emergency Dispersion Models at the Deutscher Wetterdienst - Model Evaluation using Ensemble Techniques - Proc. of the 9th ANS Emergency Preparedness and Response Meeting, pp. 181-187, Salt Lake City, 2006

Majewski D., 1998: The new icosahedral-hexagonal global grid point model GME of the Deutscher Wetterdienst. ECMWF Seminar “Numerical Methods in Atmospheric Models”, Sept. 1998.

Majewski D., D. Liermann, P. Prohl, B. Ritter, M. Buchhold, T. Hanisch, G. Paul, W. Wergen and J. Baumgardner, 2002: The operational global icosahedral-hexagonal grid point model GME: Description and high resolution tests. Mon. Wea. Rev., 130, 319338

Appendix: Example for GTS IAEA Emergency Message (WNXX01 IAEA)

Please note that the WNXX01 IAEA emergency messages are meant to inform the WMO, NHMSs and RSMCs. They are not destined to the general public and should not be accessible on the public internet.

!!! NOT FOR UNAUTHORIZED PUBLICATION!!!

WNXX01 IAEA 160942

EXERCISE - EXERCISE - EXERCISE

NOT FOR UNAUTHORIZED PUBLICATION

DATE: TUE, 16 FEB 2016 09:39:16 +0100
FROM: "IAEA USIE MAIL SERVICE" <USIE.NO-REPLY@IAEA.ORG>
REPLY-TO: USIE.NO-REPLY@IAEA.ORG
TO: MSS.OPERATOR@DWD.DE
SUBJECT: EXERCISE EMERCON GENF

EXERCISE EMERCON GENERAL EMERGENCY

MESSAGE #1

REPORTING STATE: SOUTH AFRICA

REPORTING COMPETENT AUTHORITY: SOUTH AFRICAN NUCLEAR ENERGY CORPORATION LTD (NECSA)

NAME OF CONTACT PERSON:

EMERGENCY CLASS: GENERAL EMERGENCY

EMERGENCY CLASS DECLARED AT: 2016-02-16 02:40 UTC

INSTALLATION NAME: KOEBERG-1

INSTALLATION TYPE: NUCLEAR POWER PLANT

NORMAL POWER: 2775 MWTHERMAL

CO-ORDINATES(LATITUDE = DEG . DECIMAL)
LAT: 33.676779 S
(LONGITUDE = DEG . DECIMAL) LONG:18.431606 E

INFORMATION VALID AT: 2016-02-16 04:30 UTC

ACTUAL OR PROJECTED RELEASE TO ENVIRONMENT:
HAS NOT OCCURRED, BUT LIKELY TO OCCUR

FUTURE/PROJECTED RELEASE
TO ATMOSPHERE:
    START TIME: 2016-02-16 10:00 UTC
    RELEASE BASE HEIGHT: 10 M
TO WATER:
    START TIME:
    WATER BODY AFFECTED:

DESCRIPTION OF RELEASE CONDITIONS AND
CHARACTERISTICS OF FUTURE/ PROJECTED RELEASE:

METEOROLOGY AT: 2016-02-16 08:00 UTC
WIND FROM: 195 DEG.
WIND SPEED: 9 M/S
PASQUILL STABILITY CLASS: C

EXERCISE EXERCISE EXERCISE

END OF MESSAGE #1