WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

MEETING OF THE CBS EXPERT TEAM ON EMERGENCY RESPONSE ACTIVITIES (ET-ERA)

Buenos Aires, Argentina, 30 November to 4 December 2015

FINAL REPORT

Front row, left to right: Anton Muscat, Jean Nicolau, Martina Suaya, René Servranckx, Abdoulaye Harou, Monika Krysta and Guenther Winkler.

Back row, left to right: Gerhard Wotawa, Ariel Stein, Masami Sakamoto, Nils Ek, Jim Fraser, Zhenxin Song, Jochen Förstner and Valery Kosykh.

EXECUTIVE SUMMARY

The CBS Meeting of the Expert Team on Emergency Response Activities (ET-ERA) took place at the Servicio Meteorológico Nacional of Argentina in Buenos Aires, from 30 November to 4 December 2015, under the chairmanship of Mr René Servranckx (Canada, for the nuclear ERA) and Mr James Fraser (Australia, for the non-nuclear ERA).

The meeting was presented with information related to the relevant decisions of the Commission for Basic System (CBS-Ext. (2014), Ascension, Paraguay, September 2014) and of 17th Congress of WMO (Geneva, June 2015).

The representatives of Regional Specialized Meteorological Centres (RSMCs) with activity specialization in Atmospheric Transport Modelling (RSMC-ATM) and RTH Offenbach presented their activities in relation to the Regional and Global Arrangements, which have been maintained in collaboration with IAEA.

The representatives of relevant international organizations (IAEA, ICAO and CTBTO) also presented an overview of their activities and highlighted issues requiring assistance of WMO, in particular of the ET-ERA, in relation to their respective decision making processes. IAEA expressed its strong support for Time of Arrival products. For ICAO, the development of modelling guidance for the issuance of radioactive cloud SIGMET remains a key issue to be addressed by the ET-ERA. CTBTO expressed its interest for RSMCs' backtracking for noble gases and sought assistance for the maintenance of the meteorological equipment at monitoring sites as well as the provision of weather forecasts and services to support its onsite inspection activities.

The meeting discussed various aspects related to global and regional arrangements for the nuclear ERA. It agreed on further developments and testing of the Time of Arrival products, the Transfer Coefficient Matrix method and on Ensemble modelling; maintaining and monitoring the RSMCs common web pages as well as continuing the regular tests between RSMCs, RTH Offenbach and the IAEA.

The meeting was presented with the outcomes of the non-nuclear ERA exercise (September 2014) and agreed to test additional scenarios in early 2016. The meeting reviewed and updated the texts to be included in the new Manual on the GDPFS.

The Expert Team’s lists of Actions for nuclear and non-nuclear ERA were updated.

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. OPENING

1.1 The CBS Meeting of the Expert Team on Emergency Response Activities (ET-NERA) was opened, at 09.30 on Monday, 30 November 2015, at the Library of the Argentina National Meteorological Service, by Dr Andrea Celeste Saulo, Director of the Servicio Meteorológico Nacional of Argentina and Permanent Representative of Argentina with WMO, followed by welcoming remarks by Mr Abdoulaye Harou Chief Data-Processing and Forecasting System at WMO and Mr René Servranckx (Canada), Chair of ET-ERA.

1.2 Dr Andrea Celeste Saulo welcomed the participants to Argentina and thanked WMO for choosing to hold the meeting in her country. She highlighted the importance of the work of the team and the strong desire for Argentina to be involved in its activities and wished to the group a very successful meeting. Mr Abdoulaye Harou, on behalf of Mr Michel Jarraud, the Secretary-General of the WMO, welcomed the participants to the meeting and expressed appreciation to the Government of Argentina and his representatives, for hosting this meeting. Mr Harou noted that the WMO Emergency Response Activities (ERA) programme is part of the WMO Global Data-Processing and Forecasting System and has been in place for 22 years to ensure a state of readiness for real time operational response to nuclear accidents. He highlighted that the system was put to good use during the Fukushima Daiichi Nuclear Power Plant (NPP) accident and that it responded very well because of the constant high quality work performed by the team. Mr Harou also pointed to some new areas of interest that have surfaced and that the team needs to address, such as the support for radioactive cloud SIGMET for aviation and the need for Ensemble Atmospheric Transport and Dispersion Model (ATDM) to address inherent uncertainties of ATDM calculation. He reminded the team of the necessity to be ready for CBS-16 planned for November 2016. Mr René Servranckx also thanked the PR of Argentina for hosting the meeting and initiated the introduction of participants as some were new to the Team.

2. ORGANIZATION OF THE MEETING

2.1 Adoption of the agenda

2.1.1 The meeting adopted the agenda with a few modifications and is found in Annex I.

2.2 Working arrangements

2.2.1 The meeting agreed on the organization of its work, including the working hours. All pre-session documents can be found via the Documentation Plan (INF. 1) which is posted on the WMO website linked to the banner for the meeting at:

https://www.wmo.int/pages/prog/www/DPFSERA/Meetings/ET-ERA_BuenosAires2015/DocPlan_000.html

2.2.2 The list of participants is available in Annex II.

3. INTRODUCTION

3.1 Outcomes of CBS-Ext. (2014) and Cg-17 (2015) related to ET-ERA

3.1.1 The WMO Secretariat provided background related to outcomes of WMO Constituent Bodies, particularly focused on the Extraordinary session of the Commission for Basic Systems (CBS-Ext. (2014) and the seventeenth session of the WMO Congress (Cg-17) relevant to ERA. There were a number of issues related to ERA discussed at and/or requested by CBS-Ext. (2014) and Cg-17 that need attention by ET-ERA. These include:

a) The major revision of the *Manual on the Global Data-processing and Forecasting System (GDPFS)*. The new Manual introduces a number of changes to the current procedures, and therefore some GDPFS centres may report temporary non-compliance with regard to some of the requirements. The CBS-Ext. (2014) recommended roadmap for the implementation of the New Manual was endorsed by Cg-17 including the approval of the final version for publication by the Executive Council at its 69th session (2017). In this context the Secretariat will arrange for the revision of the Manual to be continued so as to achieve its earliest possible completion, subsequent adoption by WMO constituent body and publication in all WMO languages;

b) The provision of appropriate training courses in the use and interpretation of RSMCs guidance and products through e-learning modules and web-based courses and/or through the training sessions conducted by the Severe Weather Forecasting Demonstration Project (SWFDP). This requirement is in recognition of the increasing sophistication of the atmospheric transport models used in the RSMCs, and the importance of full and correct interpretation of this information by forecasters in NMHSs.

c) The need to compile lessons learned and to develop guidelines for best practices on air quality forecasts and other related environmental predictions for the benefit of WMO Members;

d) The need to seek ways to improve the availability of source term information for use of NMHSs for emergency response. This has resulted from the work of the WMO Task Team on Meteorological Analyses for Fukushima Daiichi NPP accident which examined, in collaboration with research, the possibilities of the integration of methods to deal with unspecified source term, and the equivalent approach for forward calculations, and the additional high resolution ATDM products in the local scale;

e) The need to continue to assess and, if appropriate, consider and plan how the Transfer Coefficient Matrix (TCM) methodology could be implemented into operation. The TCM methodology was explored and successfully tested in the framework of the work of the Task Team on Meteorological Analyses for the Fukushima Daiichi NPP;

f) The need to identify steps necessary for the assessment and operational implementation of ensemble ATDM.

3.1.2 The meeting agreed to discuss these issues under the relevant agenda items.

3.2 Report of the chair and co-chair on nuclear and non-nuclear ERA, respectively

3.2.1 The chairperson, Mr René Servranckx, provided a short summary of the activities of the Expert Team on ERA. He noted that this is the second meeting of the Expert Team since the decision by CBS-15 (in September 2012) to restructure the CBS OPAG on DPFS. The ET-ERA consists of two Task Teams that deal respectively with operational procedures for nuclear and for non-nuclear ERA. They replace the groups previously known as the *Coordination Group for Nuclear Emergency*

Response Activities (CG-NERA) and the *Expert Team for non-Nuclear Emergency Response Activities* (ET-nNERA).

3.2.2 The meeting noted that the nuclear ERA programme is mature and has been in place for over 22 years. An important component of the work is to maintain real time operational response readiness and capacities, in accordance with the roles and responsibilities defined in the *Manual of the GDPFS*. New activities / products are also examined as well as ways to improve existing products and use better delivery mechanisms. Some of the ongoing activities include: (1) monthly and quarterly testing between the IAEA, RTH Offenbach and the RSMCs; (2) testing and maintaining RSMC common Web pages; (3) modelling for CTBTO requests; (4) maintaining and updating the WMO ERA web page, and 5) testing potential new products, such as the Time of Arrival (ToA).

3.2.3 The meeting noted that the first discussions on non-nuclear ERA began in the late 1990s. The growing need and interest by WMO Members for support led to the establishment of the *Expert Team on Modelling of Atmospheric Transport for Non-Nuclear Emergency Response Activities* in 2005. The meeting also noted that in the years that followed, this Expert Team gradually developed the scope and concepts for non-nuclear ERA operational support which has led to a Meeting of the *CBS Task Team on the Development of Operational Procedures for non-Nuclear Emergency Response Activities* (Melbourne, Australia in November 2012) which produced a draft set of operational procedures, guidelines and request for RSMC support form for non-nuclear ERA. Further development took place at the last meeting of the ET-ERA (College Park, USA, October 2013) with proposals for the possible inclusion of non-nuclear ERA in the Manual on GDPFS. Since that meeting, the proposals were further developed and the members of ET were consulted. The meeting was briefed that a second full exercise comprising a request from NMS Argentina to RSMC Montreal for ATDM modelling of a fictitious large industrial fire took place in September 2014. This is discussed in Agenda item 5 of this meeting.

3.2.4 The chair called for the full participation of members of the ET-ERA in the discussions at the meeting and, as importantly, for an active contribution to the follow up actions that the group will agree to. He also stressed that how much can be accomplished, and how quickly, are highly dependent on the involvement of each member of the ET-ERA.

4. NUCLEAR ERA

4.1 Review of actions from previous meeting (College Park, 2013)

4.1.1 The chairperson reviewed the progress made relative to actions from its previous meeting (College Park, 2013). The meeting agreed to continue to maintain a record of progress and to carry forward this list of actions, including adding new actions that have been identified from this meeting. The updated list of actions on nuclear ERA (October 2013) for the ET-ERA is found in Annex III.

4.2 Status of operational implementation / activities of RSMCs / RTH Offenbach

4.2.1 Representatives of the RSMCs and RTH Offenbach provided their respective reports on their 2013-2015 activities. The meeting was pleased to note that all parts of the operational nuclear ERA activities have been well maintained and upgraded (improved NWP systems) by the RSMCs and RTH Offenbach as well as working closely with IAEA and CTBTO for efficient response to requests and exercises.

4.2.2 The meeting noted that the success rate of RSMC fax transmissions to operational NMHS contact points continues to be generally low. It also noted that the number of WMO Members that have provided official contact points should be increased, even as plans for transition to e-mail

distribution of products move forward. The meeting stressed that the implementation of the plan to migrate from fax distribution of products to e-mail/internet distribution of products has been a challenge and discussed whether or not the facsimile transmission should be discontinued. The meeting noted that some Team Members are successfully using the facsimile to reach their user as demonstrated by RAII RSMCs who test and update their facsimile list every three months. The meeting arrived at the conclusion that the facsimile transmission system is still needed to reach some of the NMHSs with limited capabilities and it can also serve as backup to e-mail, in case of internet failure.

4.2.3 The meeting was pleased to note the good use of the RSMC mirrored websites. It also noted that not all links point directly to the mirror site and recommended some actions (see Annex III).

4.2.4 The meeting noted the report of DWD informing on the integrated approach to modelling whereby their global model ICON will be used for the dispersion modelling of volcanic ash, mineral dusts and radionuclides. It was also noted that the implementation for volcanic ash, radionuclides, sea salt and mineral dust modules is close to completion.

4.2.5 The meeting was pleased to note the nomination of RSMC Beijing as the National Nuclear Emergency Meteorological Monitoring and Forecasting Centre by the China National Nuclear Emergency Coordination Committee. The responsibility of the Centre includes the provision of meteorological data support, consequence assessment of nuclear accident, emergency decision-making and the forecast of trajectory, concentration and deposition of nuclear pollution. The meeting also noted the development of dose evaluation module in research mode to assess the impact of radioactive nuclear material on the human body in the post-processing system, which consists of three aspects: a) Early dose assessment model. External irradiation dose of radiation clouds, ground deposition and inhalation are calculated using the output of HYSPLIT 4.9, b) The calculation and evaluation of the radiation dose of radioactive nuclear materials for different populations and the production of different dose products, such as thyroid dose products and the effective dose products.

4.2.6 The meeting noted with satisfaction that RSMC Tokyo has established a monthly training of its forecasters and operators to ensure a degree of readiness for response to nuclear emergency and to the need for backtracking information. It recommended similar practice be implemented by other RSMCs.

4.2.7 RSMCs Toulouse and Exeter briefed on their participation in a Nuclear Accident exercise organized by Eurocontrol in Brussels in November 2014. The meeting noted that as a result of that exercise, the aviation community in Europe have begun the process of trying to ascertain what specific, bespoke, guidance products they would like to receive in the event of a NPP accident. It is clear that the aviation industry has a clear need for such information and that, currently, the RSMCs is not mandated to do so, nor is there a clearly defined requirement. The meeting agreed that it is highly likely that this will become a major requirement of RSMCs in the future. The issue is discussed in detail under agenda items 4.3 and 4.5.

4.3 Co-operation with other international organizations (ICAO, CTBTO, IAEA)

ICAO

4.3.1 The meeting noted that the ICAO Annex 3/WMO Technical Regulations (C.3.1), Chapter 3, 3.4 sets out the responsibilities of Meteorological Watch Offices (MWOs) within States that provide air traffic services. As part of these responsibilities, MWOs are tasked to provide information received concerning the release of radioactive material into the atmosphere, in their area(s) of responsibility or adjacent areas, to their associated area control centres (ACCs)/flight information centres (FICs) and aeronautical information services (AIS) units. The information, in the form of a SIGMET message, is to

comprise the location, date and time of the release, and trajectory of the radioactive material. Moreover, Annex 11 – Air Traffic Services and Annex 15 – Aeronautical Information Services to the Convention on International Civil Aviation contain provisions relating to the release of radioactive material into the atmosphere. Annex 11 requires a flight information service (through air traffic service units) to provide information on a release to all aircraft that are likely to be affected, while Annex 15 requires the promulgation of information on the release through the issuance of a NOTAM message (notice to airmen) by AIS units. The NOTAM message details relevant content derived from the SIGMET, supplemented by information on the associated aerodrome and/or airspace restrictions. Flight crew members and others concerned can then flight plan to avoid the hazard/restricted areas. To enhance flight safety, Amendment 75 to Annex 3, applicable since November 2010, has additionally required the RSMC Exeter, which is "co-located" with Volcanic Ash Advisory Centre (VAAC) London to be the focal point to directly notify the ACCs concerned about the release. This procedure was developed by ICAO with the assistance of the International Airways Volcano Watch Operations Group (IAVWOPSG), and consists of the VAAC London (RSMC Exeter) forwarding the early notification provided by the IAEA, without any modification or interpretation, to the ACCs concerned which in turn disseminate the information received to aircraft in flight or about to depart for the affected FIR. Through the regular meetings of the IAVWOPSG (every 18 months or so), the operation and the development of the referred arrangements have been overseen and further developed as required.

4.3.2 The meeting noted that the current Amendment 76 to Annex 3 is applicable since November 2013. However, it is expected that Amendment 77 to Annex 3 which will become applicable in November 2016 will introduce the requirement for the RSMC co-located with VAAC London to notify, in addition to the ACC, also the flight information centres (FICs) involved. The said amendment also includes minor changes in the details to the information provided in the SIGMET message for radioactive cloud.

4.3.3 Further to the above-mentioned activities, ICAO convened, in July 2014, a Meteorology (MET) Divisional Meeting in Montreal, Canada, in part conjointly with the Fifteenth Session of the WMO Commission for Aeronautical Meteorology (CAeM-XV). The MET Divisional Meeting addressed the expected evolution of meteorological service provision for international air navigation over the next 10 to 15 years or more, in keeping with ICAO's vision for a seamless, globally interoperable air traffic management system. The MET Divisional Meeting made recommendations on existing and foreseen future provisions, including the development of draft amendment 77 to Annex 3 (applicable in November 2016) referred above in 4.3.2. The meeting was informed that the recommendations by the MET Divisional Meeting also included the establishment by ICAO of an expert group, in coordination with WMO, to further develop provisions for information on the release of radioactive material into the atmosphere (MET/14, Recommendation 2/8 refers). Further information on the MET Divisional Meeting is available at: http://www.icao.int/meetings/METDIV14/ .

4.3.4 The meeting noted that in 2014 the Air Navigation Commission (ANC 197-5) established a Meteorology Panel (METP) to define and elaborate concepts and to develop ICAO provisions for aeronautical meteorological (MET) services consistent with operational improvements envisioned by the Global Air Navigation Plan (GANP), (Doc 9750) and in keeping with the working arrangements between ICAO and the World Meteorological Organization (WMO) (Doc 7475). Under the said panel a Working Group on Meteorological Information and Service Development (WG-MISD), tasked one of its work streams to work on issues related to the release of radioactive material in the atmosphere. As a follow-up of the (MET) Divisional Meeting (MET/14), Recommendation 2/8, one of the main tasks of this work stream will be to undertake further work as was referred above in 4.3.3.

4.3.5 Recognizing the importance of timely, reliable and accurate information on the location and movement of radioactive material in the atmosphere, the potentially hazardous effects of such material on safe and efficient civil aviation operations, and the need for efficient coordination and collaboration

during an emergency ICAO has formalized, through the referred IACRNE, an ad-hoc working group on air and maritime transportation (WG-AMT). A number of international organizations and transportation modal agencies participated in the WG-AMT with a view to facilitating coordinated and consistent preparedness and response in the event of a radiation incident or emergency. The WG-AMT provided a suitable outlet for the participants to share ideas and latest developments, and reported to the IACRNE committee on a regular basis on progress. The WG-AMT delivered most of its tasks and, as per the IACRNE decision, will be put on stand-by, until its work is needed again, once all tasks from its work plan are completed. In this regard, the meeting noted that up to now, only one important task is pending from its work plan which is to determine if quantitative modelling guidance criteria can be defined to assist in the preparation of a SIGMET message for a radioactive cloud and that this task is awaiting the results of a consultation made to the IACRNE/22 (8 to 9 December 2011, Paris, France) when ICAO in coordination with WMO and IAEA, invited the IACRNE to consider: a) the definition of which hazards need to be considered in the decision to issue a warning to aircraft in flight – for example, the health of the aircraft occupants or the contamination of the airframe (which may in itself become a vehicle with which to pass contamination to other people); and b) the determination of a total dose value that could serve as an international standard and to define what parameters should be used (cloud shine, inhalation, etc.) if no other information is provided. It is noted that until the reply to a) and b) above is provided, the ICAO Secretariat prepared a proposed initial guidance to support the issuance of SIGMET for the release of radioactive material into the atmosphere, based on a zone centred on the location of the release with a specific radius and vertical extent (See Memo 64 at http://www.icao.int/safety/meteorology/iavwopsg/Memos/Forms/AllItems.aspx). The said proposed guidance is going to be considered by the working group of the ICAO Meteorology Panel mentioned in 4.3.4 above.

4.3.6 The representative of RTH / RSMC Offenbach relayed the request from the Chair of ICAO's MISD Work Stream on RRM Dirk Engelbart and invited the ET-ERA to consider the provision of realistic emission scenarios to produce modelling guidance in the early stages of an accident. These scenarios would be used in the Concept of Operations for radioactive material information services in support of international air navigation. The group clarified that the procedures to produce modelling guidance rely on input from the IAEA and therefore answers to questions raised by the ET-ERA to the Expert Group IACRNE are needed before realistic emissions scenarios can be obtained.

4.3.7 The Chair, Mr Servranckx, and the WMO representative, Mr Harou, briefed the meeting on the result of the IAEA-IACRNE meeting that was held 24-26 Nov, in Vienna, focussing on the discussion related to the request of ET-ERA to IACRNE to address the questions related to radiological clouds SIGMET described in 4.3.5 above. The meeting was informed that IACRNE has decided to establish a Working Group composed of representatives from IAEA, ICAO and WMO to address these questions within a year time frame. IAEA committed to establishing this WG quickly to begin the work. The ET-ERA is awaiting the recommendations of that WG to pursue its work on possible ways to produce modelling guidance (see agenda item 4.6).

IAEA

4.3.8 The meeting recalled that the IAEA has an important role when a nuclear or radiological incident or accident has international consequences or when a state experiencing such an event asks for international assistance. The accident in Fukushima revealed the need of the international community for the IAEA's assessment of the situation and the possible prognosis of the accident.

4.3.9 After a high level international conference on the follow up of the Fukushima accident in Vienna, the IAEA Board of Governors approved the IAEA Action Plan on Nuclear Safety, which defines the expanded role of the IAEA on assessment and prognosis. This Action Plan has a general objective to improve nuclear safety, emergency preparedness and radiation protection of people and the environment worldwide. To that end IAEA organized an International conference on Global

Emergency Preparedness and Response in Vienna from 19-23 October 2015 with the aim for all parties involved in the field of Emergency Preparedness and Response to come together and discuss a range of issues and to share information and Best Practice where possible. The meeting was briefed on the participation of WMO represented by Dr. Xu Tang (Director Weather and Disaster Risk Reduction), Mr. Ata Hussain (Project Coordinator), Mr. Anton Muscat (representing RSMC Exeter) and Mr. Gerhard Wotawa (representing RSMC Vienna) and on key findings.

4.3.10 The meeting was briefed that Dr Tang addressed the Conference, talking about the WMO ERA programme and how WMO and IAEA had worked closely and successfully for more than 25 years. He also described how WMO also worked with other international organizations in order to provide these organizations with relevant information, enabling them to make sensible decisions in the event of disasters, e.g. in the event of a release of a contaminant into the atmosphere. In addition he made a presentation to the conference, entitled: Long Standing Co-operation between WMO and IAEA. This presentation described the relationship between WMO and IAEA, specifically related to the services that are provided by the RSMCs for ATM in case of a release of radiation into the atmosphere. In this presentation some of the products provided by RSMCs to IAEA were described, including the proposed Time of Arrival (ToA) plots. In addition, references were made to the RSMC Mirrored web pages. It was also made clear that the RSMCs with responsibility for ATM were planning to establish a non-nuclear capability.

4.3.11 The meeting noted that there were a number of presentations relevant to the work and outputs of the RSMCs including one from the National Atmospheric Release Advisory Centre (NARAC), Lawrence Livermore National Laboratory in the US.

4.3.12 The meeting noted that other presentations, around the theme of atmospheric dispersion modelling for radiological events, were made. The meeting understood that aesthetically, the products presented were good, but may often be generated without using the best available meteorological data, e.g. they may well be generated using meteorological data that is not current, or is of a very coarse resolution and the interpretation of the meteorological and dispersion was not being done by a trained meteorologist It noted that the attractive products may result in the Emergency Response and Preparedness (EPR) community finding them of greater use than the RSMC products. WMO and the RSMCs would like the EPR community to liaise closely with their NMHSs and/or the RSMCs in order to ensure that they do utilize the best meteorological data and expert advice. It is important to remember that the EPR community are not obliged to collaborate with, or use the products of, the RSMCs or the NMHSs.

4.3.13 The meeting noted that one way to encourage greater collaboration between the EPR community and the RSMCs/NMHSs is to ask that the IAEA encourage their members, and the wider EPR community, to regard the RSMCs and NMHSs as the “authoritative voice” on meteorology and suggest that their members should collaborate with the RSMCs/NMHSs whenever possible. This suggestion has been passed to Dr. Tang and is expected to be promoted at higher levels within the WMO.

CTBTO

4.3.14 The meeting recalled that CTBTO uses atmospheric transport modelling simulations to support samples collected at its radionuclide network. These simulations are generally performed in a backtracking mode. They are mimicked with the WMO RSMCs simulations for some samples of interest. Occasionally, mostly in the cases where a source term is known or can be hypothesized, CTBTO also performs forward mode simulations. The meeting also recalled that at the previous meeting, CTBTO invited the RSMCs to gradually move to a new upload mechanism and it noted with satisfaction that all the RSMCs successfully accomplished the transition. The new mechanism uses two communication points (wmogateways) and an sftp protocol. CTBTO interacted with each of the

RSMC individually to assist, if necessary, with this transition at their convenience. The meeting noted that a new notification message taking into account these changes was prepared and that the whole process was intended not to change the structure of the message and only to alter the configurable lines. In this way the requirement for software upgrades was minimal for the RSMCs and amendments to the Manual on the GDPFS were avoided. The new notification message was successfully tested on 3 March 2015 with all the RSMCs. All the request messages issued afterwards use the updated message content that reflects the new upload mechanism. The meeting noted the appreciation of CTBTO for RSMCs' collaboration and flexibility, enabling it to move to a modern and robust solution.

4.3.15 CTBO informed the meeting that, in addition to requesting the WMO RSMCs' backtracking support for samples collected at its particulate network, it also operates a noble gas network, co-located with some stations of the particulate network, with a purpose of detecting radioactive xenon isotopes. The meeting learned that there is a rapid development in the noble gas technology over the past years and currently 23 noble gas systems are part of the CTBTO operational pipeline. Given the growing importance of the noble gas systems as well as a steadily decreasing number of requests for support for particulate samples, CTBTO would like to investigate if, in addition to the currently supported particulate samples, the RSMCs would be willing to support CTBTO's requests for noble gases samples. Secondly, CTBTO would like to explore the possibility of the RSMCs using different modelling configurations for the particulate and noble gas samples, namely depositing and non-depositing tracers, respectively. The meeting recognized that RSMCs can address the noble gas requirement but need more technical details.

4.3.16 CTBTO further explained that it monitors compliance to the Treaty banning nuclear explosions while verification activities are exercised at a national level through National Data Centres (NDCs). The National Data Centre Preparedness Exercise (NPE) is a periodically held exercise. Its purpose is to enable the NDCs testing of their own capabilities as well as of CTBTO's products on fictitious but realistic scenarios of an increasing complexity. After a break of a couple of years, this year again, thanks to a tight collaboration between CTBTO and the RSMC Vienna in its role of the National Data Centre Austria, the operational component of the exercise as ensured by the WMO RSMCs became possible. The meeting noted that having consulted the chair of the ET-ERA and all the RSMCs beforehand, CTBTO issued requests for support in the framework of the NPE2015, in October and November 2015. A novelty was the presence of noble gas samples in these requests. All the RSMCs participated in the exercise but not all of them were able to answer the noble gas requests. CTBTO issued 12 full requests for support mixing particulate and noble gas samples and 11 containing only the particulate samples. Two among 12 full requests, 10th and 11th, referred in fact to the same exercise day. However, the original one was becoming prohibitive in size and was split into two. CTBTO intends to use this opportunity to encourage the NDCs participating in the NPE2015 to use the tools provided by the International Data Centre (IDC) of the CTBTO as well as their own tools in order to investigate diversity of these instances and robustness of the NPE2015 conclusions.

4.3.17 CTBTO recalled that, since 2005, exchange of correspondence between the ICAO and the CTBTO took place regarding the usefulness of seismic and infrasonic data from the CTBTO networks in support to the International Airways Volcano Watch. CTBTO together with its partners presented the concept of a Volcanic Notification System based on infrasound technology at the WMO Seventh International Volcanic Ash Workshop (IVAW) held in Anchorage, Alaska from 19 to 23 October 2015. These capabilities were also presented at the International Volcanic Ash Workshop. The meeting noted that one of the recommendations of the workshop was to foster collaboration between CTBTO, WMO and ICAO in support for the Volcanic Ash Advisory Centres (VAACs) activities. CTBTO is currently investigating the mechanism for establishing agreements with ICAO and the VAACs, while the volcano-infrasound community continues to advance the detection capabilities of volcanic eruptions. CTBTO requested an identification of contact within WMO to discuss further the use of this information.

4.3.18 CTBTO has been planning for a couple of years now an increase in resolution of its operational simulations (from 1.0x1.0/3 hours to 0.5x0.5/1 hour). The meeting noted that profiling simulations showed that the pre-processing of the meteorological data consisting in recasting variables defined on hybrid pressure levels on the altitudes was consuming a considerable amount of time. CTBTO contracted external resources in order to extract this pre-processing routine from FLEXPART and gain time. Still, CTBTO has more work to do on this issue, namely to ensure backward compatibility with the past meteorological fields. However, once these activities are achieved, CTBO will enhance its operational system to ingest and output higher resolution information. It will inform the RSMCs three months in advance of the change and ask those RSMCs which would be ready to proceed to increase the resolution of their CTBTO products. Possible amendments to the Manual on the GDPFS would have to be considered at a later time.

4.3.19 The meeting noted that, in the CTBTO context, the atmospheric transport modelling community has been recently put under an increasing pressure to provide uncertainty estimates for the simulation results. These refer in the first place to the spatial extension of a plume (and more often of a retro plume in the case of CTBTO). But, putting an error bar on the values of the activity concentration (or dilution factors) is also very important. The meeting discussed the RSMCs's approach and experience with assessing, quantifying and communicating uncertainty in the context of atmospheric transport modelling noting that direct experience may not be applicable to CTBTO as its mode of operation differs from the nuclear emergency and its focus is mostly on past events for which most often meteorological analyses are already available. However, simulation (backtracking) results are subject to uncertainties and CTBTO users are interested in the uncertainty/accuracy of the information related to retro plumes.

4.3.20 The meeting was informed that in some circumstances CTBTO may want to investigate regional atmospheric transport and use for this purpose high resolution meteorological information. To assist with this, CTBTO recently installed the mesoscale meteorological model WRF together with the dispersion model capable of ingesting WRF meteorological fields, namely FLEXPART-WRF and is currently implementing an automatic suite performing high resolution meteorological and atmospheric transport simulations for an event of interest fed into the automatic suite via a configuration file. The meeting noted the demand of CTBTO to learn from RSMC experience in high resolution modelling and particularly in the in configurations of the WRF model.

4.3.21 CTBTO reported that it collects meteorological measurements at its radionuclide and infrasound stations and, using the intermediary of the RSMC Montreal and RSMC Vienna, it feeds the meteorological observations from its operating radionuclide stations to the Global Telecommunication System (GTS) of the WMO. CTBTO would like to ensure the best possible quality of the meteorological observations transferred to the WMO. In collaboration with the University of Vienna, IDC hosted as an intern, a student of meteorology, to work on the assessment of the quality of the meteorological measurements. This 6-week internship brought already some initial results and more will come as the student will carry on the internship work towards her degree. The findings will be gradually transferred to the station operators with the intention of investigating performance of the meteorological equipment whenever indications of flaws with performance are found. The meeting noted the CBTO appreciation for RSMC Montreal and RSMC Vienna for their assistance and the quest for WMO advice on the appropriate practices in maintaining the meteorological equipment at the CTBTO stations bearing in mind limited resources, which could be devoted to it. The meeting discussed the request for advice on the maintenance of meteorological equipment and noted that this equipment is not, in most cases, maintained by the National Meteorological Service (NMS) and that the maintenance may not be done regularly. The meeting suggested to WMO to consider inserting, in the agreement between CTBTO and the national Agency responsible for this equipment, a requirement for the Agency to establish a maintenance agreement with the NMSs which most likely have expertise in maintaining meteorological equipment.

4.3.22 CTBTO expressed the desire to share meteorological observations from the 60 operational infrasound stations out of which 48 are certified. These infrasound stations collect high frequency measurements of meteorological variables. These comprise wind speed, wind direction, temperature and absolute pressure. These data are continuously sent to CTBTO. Several of the infrasound stations can be found in remote locations, in some cases different from those of the radionuclide stations. The meeting noted that these in situ measurements from remote locations could be useful for data assimilation and that CTBTO would be willing to share these measurements in a mode to be determined, taking into account the experience acquired with the transfer of meteorological observations from the radionuclide stations. The meeting expressed its view that access to these data would be useful. The meeting expressed its appreciation to CTBTO for the offer. Mr Abdoulaye Harou (C/DPFS) will consult with his colleague at WMO Observation department to identify a contact name for discussion access to CTBTO infrasound meteorological data.

4.3.23 The meeting noted that one of the pillars of the Treaty verification regime is the on-site inspection. This activity involves inspection of a limited geographical area (up to 1 000 km2) in a limited time window (up to 130 days) for indications of the Treaty violation. One of the important factors influencing activities of the inspection team is weather and, therefore, a reliable weather forecast source, external to the inspected country, is crucial to making best use of the time available for inspection. The needs of an inspection team include a) weather forecast in advance of the inspection for mission planning purposes; b) high resolution dispersion simulations for the days preceding inspection and; c) high resolution weather forecasts during the inspection. The meeting took note of the CTBTO enquiry on WMO's willingness to support an inspection team during an on-site inspection or in the framework of a realistic exercise with weather forecasts. In addition, CTBTO highlighted the fact that in addition to the specialized equipment deployed for the purpose of detection of indications of a possible Treaty violation, an inspection team will also deploy meteorological equipment. The purpose of the meteorological observations is two-fold. Firstly, these observations would be used to drive near-field atmospheric transport simulations in support of radionuclide detections. Secondly, they could be used to refine atmospheric flow in the inspection area. The meeting also noted the request for advice on the meteorological equipment to be used and best practices to be followed in the deployment of the team. The meeting explained that support at the local level by RSMCs will be difficult as this is seen as the responsibility of NMSs and suggested that perhaps CTBTO should consider an insertion, in the team, of a forecaster/Meteorological Technician with appropriate equipment to provide dedicated services to the inspection team. In terms of advice on the Meteorological equipment and training, the meeting requested that the CTBTO representative (Ms Krysta) to consult with her colleagues to identify clearly their requirements then connect with WMO Secretariat (Mr Harou) for the identification of a resource person to assist CTBTO in meeting its needs. CTBTO informed the meeting about an upcoming workshop to define meteorological and ATDM products to support on-site inspection. CTBTO invited a WMO participant to take part in this meeting. The WMO expressed an interest to participate in the workshop. CTBTO will inform the WMO once the details of the workshop are decided.

4.4 Improved product distribution / access methods

4.4.1 The meeting noted that the monitoring of the web pages and reporting on issues have been done on a volunteer basis by a few RSMCs over the years. There is a need for a more formal monitoring of all common / mirror web pages and to address the issue, the meeting agreed, on specific actions (Annex III).

4.4.2 The meeting acknowledged that the RSMC products posted on the common / mirror Web pages quickly become obsolete. They should therefore be deleted in a timely matter. It was noted that it is the responsibility of each RSMC to delete its products on all Web pages and that some RSMCs already do this as part of their SOP. However, this is not the case for all and some products remain on the Web pages for a few weeks (monthly tests) and sometimes for much longer in the case of

quarterly tests or due to other technical issues. The discussion that followed raised a number of questions such as how long the products should remain on the web pages before being deleted and can an RSMC erase products from another RSMC it they are old? The meeting concluded that for quarterly tests all RSMCs should have their products posted as soon as possible but not later than 36 hours after the reception of the request and that products should be removed within 84 hours. Expert from RSMC Washington will provide a script to do the cleanup for those interested.

4.4.3 The meeting discussed the quarterly test and the requirement for RSMCs to send their product to IAEA. It was determined that it is only necessary for the lead centre to send in their products and other centres will just have to post their products on the common/mirror website. It was, therefore, determined that the IAEA will need to add a sentence to this effect on their request form: ''Other RSMCs, run your ATDM and post results on RSMC common web pages''.

4.4.4 The meeting acknowledged that the links to the RSMC common / mirror web pages, provided in Annex IV (official links posted on the WMO ERA Web page, should be used on all common web pages. The meeting noted that there are a few differences between some links available in COLUMN1 on all main web pages and the ones provided in Annex IV. The meeting proposed an action to correct this (Annex III).

4.5 New Products and services based on user's requirements

4.5.1 The chair noted that the issue related to WNXX01 IAEA Messages posted on the public internet (paper 7.2) should be discussed under this agenda item and highlighted the fact that the WNXX01 IAEA emergency messages are meant to inform the WMO, NMHSs and RSMCs. They are not destined to the general public and should not be accessible on the public internet. A recent search of 'WNXX01 IAEA' on the Web revealed that messages are posted on some NMS websites. The NMS in question have been contacted and are taking action to fix this. The meeting agreed that action should be taken to ensure that the messages are not posted on the public websites.

4.5.2 The meeting noted with satisfaction that a test on Time of Arrival (ToA) was conducted (2-4 June 2015) under the lead of RSMC Obninsk and the participation of all RSMCs using test conditions developed by Experts from RSMC Obninsk (Dr Valery Kosykh), Tokyo (Mr Masami Sakamoto) and IAEA (Mr Guenther Winkler). The test was to address one of the action items of the meeting of ET-ERA (USA, 2013) with the goal to assess the options and usefulness of ToA products. Noting that some of the centres have not followed the defined requirements properly for outputs it was decided to run a second exercise on 27-29 October 2015 with the same conditions as the previous test.

4.5.3 The meeting noted the encouraging results of the tests and discussed the issues around the determination of a reasonable source term value, the concentration threshold value to have the information on ToA on the map (cloud boundary) and the time of release. The Expert from IAEA (Mr Winkler) informed the meeting that IAEA will no longer use 1 Bq as the default source value given that the minimum value for the display threshold needs to correspond to something that a mobile monitoring station would measure. The meeting agreed that further investigation is required and defined follow-up actions in Annex III.

4.5.4 The RSMC Washington Expert (Mr Ariel Stein) presented the meeting with information on the development of an operational Transfer Coefficient Matrix (TCM) modelling approach to dispersion modelling. The TCM approach was successfully tested by the WMO Task Team on the Evaluation of Meteorological Analyses for Radionuclide dispersion and deposition from the Fukushima Daiichi Nuclear Power Plant Accident. The meeting noted that the TCM provides atmospheric transport model products as a means to allow the end user the flexibility to modify the source term and output products. In the TCM approach, the dispersion model is run independently for a time series of segments using a unit source. Since the transport, dispersion, and deposition of any given species is

completely independent of the actual source's emission of that species, the dispersion model needs only to be run once. The source term information is then applied in the post-processing step. For example, every time a new source term becomes available, the post-processing can be run on the given dispersion output without having to rerun the model. The meeting noted that RSMC Washington plans to complete the development of this approach and transfer this to operations at NCEP.

4.5.5 Expert Team members appreciated the presentation on the TCM and engaged in discussion for the RSMCs to test the new method considering its efficiency. The meeting, therefore agree on an action (Annex III).

4.5.6 The meeting recalled one of the action items of the ET-ERA meeting at College Park, MD, USA (October 2013) requesting IAEA, RSMC Vienna and RSMC Montreal to, based on a realistic source term for a major event (Chernobyl or Fukushima), to assist in the development of guidance on radioactive clouds for aviation interests through examination of the horizontal and vertical extent of the radioactive plume for a few cases. This is to help answer some of the questions on possible modelling guidance for radioactive cloud SIGMET. The meeting acknowledged that the current operational RSMC products for nuclear emergencies are solely focused on the near-surface level and therefore cannot provide assessment on the potential impact for aviation. An investigation of the potential plume extent with realistic scenarios is needed to define the guidance products. To that end, RSMC Montreal and RSMC Vienna investigated several atmospheric transport and dispersion model simulations of major nuclear accidents locations and with different emissions and meteorological conditions. Realistic emission scenarios were defined for a subset of radionuclides and applied to the Fukushima Daiichi and Chernobyl locations.

4.5.7 The meeting noted that gross assumptions in the dose calculations, including the expected lack of information in the early stage of a nuclear accident (isotopes, amount released, emission rates and heights) make quantitative forecast dose rate products problematic. Quantitative guidance could also be produced, but its interpretation can also be problematic for users. In addition, the meeting noted that a potential usable product might include, when appropriate, a statement that there is no plume above a certain level, e.g. NO PLUME ABOVE 6000 METRES. Before deciding on further actions on quantitative or qualitative guidance, the Meeting decided that it would be preferable to await the response of the IACRNE WG recently created. The ET-ERA will continue to coordination on possible ways to address this problem, in the meantime.

4.5.8 The meeting noted with appreciation the offer of the DWD Expert (Mr Förstner) to run its Eulerian model to look at the effect of convection on the concentration.

4.5.9 The IAEA Expert (Mr Guenther Winkler) briefed the Expert Team on a meeting of a small group of IAEA Contact Points (March 2015). The meeting was held with representatives from three countries from which one country was a nuclear power and had a very good arrangement with its national meteorological service (the transport, dispersion and deposition calculations are fully integrated in the system of the National Competent Authority). The second country had a well-functioning arrangement with the national meteorological service but in this case the National Competent Authority received products from its meteorological service (there was no processing at the competent authority). The third country had limited arrangements with its national meteorological service but received some products (limited in distance from the national borders) from developed neighbouring countries.

4.5.10 The meeting noted that the discussion evolved around the different phases of a large scale nuclear emergency and talked about the different arrangements the countries have and what their expectations towards the IAEA are. It also noted that some of the conclusions that were drawn from this meeting:

a) The current set of products were developed for the IAEA Secretariat's needs and does not necessarily address all of the member states' needs;
b) Member states with less arrangements with their national meteorological services rely on the IAEA products, and would prefer products which would have information about radiation doses;
c) the further away the accident state is from the Member State, the more likely it is to use the IAEA products;
d) Member states with good arrangements would use IAEA products if they were available in a format which they could use (GRIB, shape files, geoTIFF), they could also imagine that they (as a country) request these products from the RSMC;
e) Ensemble products could be beneficial for expressing uncertainties (no strong demand for ensemble products was gathered from the meeting);
f) There is a need for different products at different times of a nuclear emergency;
g) Trajectories are appreciated. However the corresponding release heights could be extended to cover lower level releases (30 and 100 m)
    - As long as there is no release the trajectories should be made available more often
    - The joint statement is appreciated, as a statement on meteorological assessment provides additional benefit. The joint statement should as well describe the uncertainty associated with the products and whether the product would change a lot if the release would happen earlier or later.
h) Release phase
    - Time of Arrival Products would be much appreciated
    - Later dispersion and deposition products
i) Later phase
    - Mainly dose assessment products are needed (task for IAEA only)

4.5.11 The meeting commented on some of the point above in particular on the requirement for trajectories below 100m in that, the level 500m currently used provides a better representation of the general lower level flow. A lower level trajectory would therefore not be as representative of the motion of the plume in the low atmosphere.

4.5.12 The IAEA Expert expressed strong interest in seeing the Time of Arrival (ToA) product become operational.

4.5.13 The IAEA Expert informed the meeting that, early in 2015, the Incident Emergency Centre (IEC) worked on some dose calculations to improve the products and that they have developed some criteria for two radionuclides, I-131 and Cs-137 (being the most significant ones during the early and later phase of a nuclear accident release scenario). Criteria were developed for integrated air concentrations which would correlate to response measurements such as 1) take urgent protective actions; 2) take protective actions and; 3) potentially being able to identify the plume via an ambient dose rate measurement. Since these values are linked to potential measures, they could be used as threshold values for the RSMC products. In case that threshold would not be reached, nothing would be displayed on the maps. The IAEA Expert suggested that a few tests with interested RSMCs would be useful and will follow up in due time.

4.5.14 The meeting noted examples of such results provided by RSMC Toulouse and agreed that this approach looks promising in addressing the negative perspective that the current products, most often, seem to project catastrophic consequences independent of the source term. It also agreed that further test would be necessary to a) refining the criteria used for the products and; b) develop criteria for additional radionuclides, and begin a testing procedure with all RSMCs (similar to test for the ToA products). To that end, the meeting requested IAEA (Mr Winkler) to begin planning process for the test.

4.5.15 The IAEA Expert expressed the need for high-resolution products at local scale and the meeting explained that it is important to leave to the National Meteorological Centre (NMC) the responsibility for higher resolution products at local scale. The local scale was defined as anything within 50 km.

4.5.16 The RSMC Vienna Expert (Mr Gerhard Wotawa) provided a background on the participation of RSMC Vienna at IEC during the Fukushima Daiichi NPP accident. The meeting noted that, at the initiative of WMO, it was agreed, due to the proximity of RSMC to IEC, that a forecaster from RSMC Vienna would work in the IEC during the event to assist directly with meteorological information. The meeting noted that although this experience was fruitful, there are some issues that need to be addressed if this is to be done again for another such emergency. These issues include: a) the access to the Vienna International Centre (VIC) and the IEC; b) the terms of references for the visiting forecaster need to be developed and; c) exercising the support function of the forecaster. The meeting agreed that this is an excellent arrangement and requested that these issues be addressed through the new bilateral Letter of Agreement (LoA) between WMO and IEC. To that end, WMO and IAEA representatives are requested to address these issues.

4.6 Capacity Development

4.6.1 The RSMC Tokyo Expert (Mr Masami Sakamoto) briefed the meeting on Emergency Response Activities within the Regional Association II. The meeting noted with appreciation the activities conducted in the region under the leadership of the Theme Leader for ERA-RAII (Mr Sakamoto). The meeting also took note of the regular verification (every four months) to keep contact information up to date and of the Memorandum of Understanding developed for the joint statement. The meeting agreed that this successful approach should be considered by RSMCs in other regions. He also emphasized that dialogue with NMHSs is necessary for successful ERA activities.

4.7 Ensemble Atmospheric Transport Modelling

4.7.1 The RSMC Vienna Expert (Mr Wotawa) described an RSMC ensemble exercise that was conducted by RSMC Vienna, showing the feasibility to use the Ensemble platform provided by the Joint Research Centre (JRC) of the European Union to collect ATDM results and to process and display related ensemble products. The meeting acknowledged that a different approach was performed as part of the WMO Task Team (TT) on Meteorological Analyses for Fukushima Daiichi Nuclear Power Plant Accident, where ATDM results from RSMCs/NMCs were collected by RSMC Washington in a predefined format, and processed on the website on the expert team. The Transfer Coefficient Matrix (TCM) method proposed there created the opportunity to take into account time-varying emissions in a flexible and efficient computational framework. The meeting was informed that JRC Ensemble platform is a technically advanced and expandable tool to collect ATDM results from various models and to display ensemble results to the research community. However, the JRC itself is not a 24x7 operational entity. The operations of such a system would require that one or more RSMCs volunteer to host this platform in an operational framework.

4.7.2 The meeting considered feasible for all RSMCs to adopt the TCM computation framework introduced during the WMO TT exercise and that this framework is the forward-modelling equivalent to the Source Receptor Sensitivity (SRS) fields computed by the RSMCs as part of the CTBTO-WMO response system. The meeting agreed that an adoption of such a system would nicely bring together ATDM forward modelling and ATDM backtracking approaches. To the end the meeting requested Experts from RMSCs Vienna (Mr Wotawa), Washington (Mr Stein) and CTBTO representative to develop a proposal on the way forward. In addition Mr Stein is requested to consider the participation of RSMCs with post-processing capabilities when designing the TCM exercise.

4.7.3 RSMC Toulouse Expert (Mr Jean Nicolau) presented the results of a Study on Dispersion Ensemble Prediction System noting that Ensemble techniques have been used in atmospheric modelling since the early 90's years. The idea was to explicitly forecast uncertainties. Both NCEP and ECMWF have developed first ensemble prediction systems in 1992. At the time being roughly 10 centres are running daily global ensembles and a lot of LAM EPS have been developed by different NMSs. He indicated that Ensemble Prediction Systems have proved that useful information on uncertainties can be predicted by this way under different forms: plumes, stamps, probability charts, EFI and EPSgrams.

4.7.4 The meeting noted that the study was to evaluate the feasibility of a pollutant dispersion by coupling the ATDM with the global ensemble prediction system (PEARP). The results of the study suggest that it may be useful to test the system based on the modelling of uncertainties resulting from the atmospheric forcing and the source term. The meeting noted the proposal of RSMC Toulouse to develop a Dispersion Ensemble Prediction System (DEPS) using a few members from an atmospheric EPS (PEARP system in case of Météo-France) to force the dispersion model (MOCAGE) and a basic description of the source term uncertainties based on tuning the top and bottom of the release.

4.8 Review of current procedures and standards, with a view of developing proposed amendments to the Manual on the GDPFS (WMO-No. 485)

4.8.1 The WMO representative (Mr Harou) briefed on the status of the development of the New Manual on the GDPFS (WMO-No. 485) include the procedure for approval for publication. The meeting noted that the Manual will go to CBS-16 (Nov 2016) and to EC-69 (2017) for approval and that if there is any input to the Manual it can be considered. The meeting indicated that there is no input under the Nuclear ERA component but consideration will be given for inputs for the non-nuclear.

4.9 Status of the revision of the WMO technical Note 170: "Meteorological and Hydrological Aspects of siting and Operations of Nuclear Power Plants"

4.9.1 The Chair (Mr Servranckx) briefed the meeting on the progress of the TN-170 noting that the review began in 2013 and is needed for the following reasons: a) The current version dates back to 1985 and is out-dated and; b) A desire to have a close correspondence between TN-170 and IAEA's Specific Safety Guide No. SSG-18 (Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations), a document jointly sponsored by the IAEA and WMO. Quoting from the preface in SSG-18: 'This document is intended to assist Members States in meeting the requirements for nuclear installations established in the IAEA Safety Requirements Publication on Site Evaluation for Nuclear Installations (No. NS-R-3) in respect of the assessment of meteorological and hydrological hazards'. The meeting was informed that the difference between SSG-18 and TN-170 is that SSG-18 identifies in general terms the meteorological and hydrological parameters that must be taken into account while the TN-170 is a counterpart document that addresses the technical aspects on how to do this. This explains why the chapters in the document plan for the revised TN-170 follow closely those of SSG-18.

4.9.2 The meeting noted that significant progress has been made updating the TN 170 and that it is planned to be approved by the next CBS-16 (2016) and the EC-69 (2017). The meeting also noted that the TN-170 was originally only a WMO document but with the updated version it was decided to make it co-sponsored with IAEA. It will be distributed by WMO to its Members.

5. NON-NUCLEAR ERA

5.1 Review of actions from previous meeting (College Park, USA, 2013)

5.1.1 The Co-Chair, Mr James Fraser, reviewed the progress made relative to non-nuclear ERA actions from the meeting of the CBS Expert Team on Emergency Response Activities (ET-ERA, College Park, USA, 2013). The meeting agreed to maintain a record of progress and to carry forward this list of actions, including adding new actions that have been identified from this meeting. The meeting noted that there are a number of actions that are valid for both nuclear and non-nuclear, such as those related to the WMO-TD 778, ERA web pages, the WMO Bulletin on ERA, and capacity building and outreach. The updated list of actions on non-nuclear ERA (December 2015) for the ET-ERA is found in Annex V.

5.2 Report on the Exercise (2014)

5.2.1 The meeting noted that the ET-ERA meeting (College Park, USA, 2013) requested that a second non-nuclear exercise, comprising a simulated request from NMHS to RSMC for assistance during a large chemical fire, was to be held to further test the revised draft non-nuclear ERA RSMC support procedures and also possibly involve other neighbouring NMHSs. The exercise took place on 3 September 2014 and involved the RSMC Montreal and the National Meteorological Service of Argentina (Servicio Meteorológico Nacional). The assumed scenario and the results of this exercise to test the revised operational procedures to request RSMC support for a non-nuclear ERA were presented in Doc 5.2 of this meeting.

5.2.2 Based on the results of this exercise, the meeting recommended:

- Running a further exercise (or series of exercises) covering each of the four scenarios that are covered by the draft non-nuclear procedures (viz. Smoke from forest, grass or peat fires; Smoke from industrial fire; Chemical releases not involving fire; and Backtracking trajectories). Each exercise could involve multiple RSMCs, each responding to requests from either NMHS Argentina or an NMHS in their Regional Association;
- After a review of the exercise results, finalization of the non-nuclear request form.

5.2.3 The meeting requested the chairperson, the co-chairperson and the member from Argentina to continue to work on the above aspects, including the planning and running of a further exercise(s), involving other members of the Expert Team and their respective RSMCs and other NMHSs, as appropriate.

5.3 Review of the operational procedures, with a view of proposing amendments to the Manual on the GDPFS (WMO-No.485)

5.3.1 The meeting reviewed the draft operational procedures for non-nuclear ERA, which were originally developed at the *CBS Task Team on the Development of Operational Procedures for non-nuclear Emergency Response Activities* (TT-DOP-nNERA) meeting (Melbourne, November 2012) and have undergone reviews and modifications since then. The current proposed amendments were reviewed by all ET-ERA members at this meeting and are presented in Annex VI. The meeting stressed the need for final testing and evaluation of the procedures prior to submitting them for inclusion in the new Manual on the GDPFS. In this context, the meeting requested the chairperson, the co-chairperson and the member from Argentina to report back to the Expert Team on the results of a further full exercise testing all non-nuclear request scenarios (see agenda item 5.2) and any further potential amendments required to the draft operational procedures, for reviews and comments. The meeting also stressed the need to develop the “users” interpretation guide for non-nuclear ATM products provided by RSMCs as part of the Manual on the GDPFS.

5.3.2 The meeting noted the proactive contribution by the RSMC Tokyo Expert (Mr Sakamoto) to discussions in the lead up to the meeting on the review of the draft procedures for non-nuclear ERA. Many issues were clarified during these discussions. The meeting noted the following remaining concerns expressed by the RSMC Tokyo Expert:

- That a joint response, from multiple RSMCs to a NMHS for a particular request may be more appropriate than the one-to-one service between a NMHS and a RSMC, when considering predictability and uncertainties of ATDM products. The ET-ERA's conclusion was that the need to prepare joint statements would significantly slow down the provision of non-nuclear products and was therefore not desirable.
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- That backtracking and forward ATDM cases in which the emission source is alleged to be outside of the requester's Member State could be used with wrongful intentions and/or political purposes. The meeting noted that backtracking and forward ATDM results can be obtained from many sources other than RSMCs. Also, it was pointed out that WMO is a non-political body. For this reason, political considerations should not prevent provision of requested non-nuclear ERA products to authorized persons from Member States.

5.3.3 The meeting noted that appropriate designation criteria for any organization seeking to nominate an RSMC for non-nuclear ERA still need to be prepared.

5.4 Co-operation with other international organizations

5.4.1 The meeting noted that developing linkages with some of the relevant international organizations has remained a challenge, with little progress since the previous ET-ERA meeting (College Park, USA, 2013). As such, action items from that meeting have been carried over and are still ongoing.

5.5 Capacity development and outreach

5.5.1 There has only been minimal progress on aspects of capacity development and outreach for non-nuclear ERA since the previous meeting. As such, action items from that meeting have been carried over and are still ongoing.

5.5.2 During the meeting, the expert from RSMC/RTH Offenbach (Mr Förstner) provided links to information on the COSMO/CLM/ART Training Course 2015 which can be found on the internet at http://www.clm-community.eu/index.php?menuid=206. The availability of additional ICON-ART training material will be investigated by RSMC/RTH Offenbach.

6. ERA Website Content and Structure

6.1 The meeting confirmed that the discussion at the previous meeting of the ET-ERA is still valid and agreed there is no need to discuss the issue again.

7. Any Other Business

7.1 The RSMC Tokyo Expert (Mr Sakamoto) presented the meeting with a short presentation on the need to do a comparison and verification of NWP and ATDM system to understand the impact of discrepancies between different NWP and dispersion models. The meeting agreed that the issue is worth exploring and requested Mr Sakomoto to develop a proposal for an exercise with defined objectives and intended outcomes to share with the ET-ERA in order to assess the feasibility and participation in the exercise.

8. Closure of the Meeting

The CBS meeting of the Expert Team on Emergency Response Activities closed at 16:05 on 4 December 2015.

ANNEX I

AGENDA

1. OPENING OF THE MEETING

2. ORGANIZATION OF THE MEETING
- 2.1 Adoption of the agenda
- 2.2 Working arrangements

3. INTRODUCTION
- 3.1 Outcomes of CBS-Ext.(2014) and Cg-17 (2015) related to ERA
- 3.2 Report of the chair and co-chair on nuclear and non-nuclear ERA, respectively

4. NUCLEAR ERA
- 4.1 Review of actions from previous meeting (Washington, USA, 2013)
- 4.2 Status of operational implementation / activities of RSMCs / RTH Offenbach
- 4.3 Co-operation with other international organizations (IAEA, ICAO, WHO, CTBTO)
- 4.4 Improved product distribution / access methods
- 4.5 New products and services based on user's requirements
- 4.6 Capacity development and outreach
- 4.7 Ensemble atmospheric transport modelling
- 4.8 Review of current procedures and standards, with a view of developing proposed amendments to the *Manual on the GDPFS* (WMO-No. 485)
- 4.9 Status of the revision of the WMO Technical Note 170: "meteorological and Hydrological Aspects of Siting and Operations of Nuclear Power Plants"

5. NON-NUCLEAR ERA
- 5.1 Review of actions from previous meeting (Washington, USA, 2013)
- 5.2 Report on the Exercises (2014 and 2015)
- 5.3 Review of the operational procedures for incorporation into the *Manual on the GDPFS* (WMO-No. 485)
- 5.4 Co-operation with other international organizations (ICAO, WHO)
- 5.5 Capacity development and outreach

6. ERA WEBSITE CONTENT AND STRUCTURE

7. ANY OTHER BUSINESS (AOB)

8. CLOSURE OF THE MEETING

ANNEX II

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ANNEX III

**UPDATED LIST OF ACTIONS ON NUCLEAR ERA (DECEMBER 2015)
FOR THE ET-ERA**

ACTION 1: RSMCS Beijing, Montreal, Tokyo and Toulouse
Update to Annex 4, WMO TD-No. 778
DUE DATE: 31 March 2016
All will maintain the information regarding their respective Centres up-to-date in their mandatory annexes in the WMO Technical Note 778 on Environmental Emergency Response. The documentation should provide summary information on NWP model domains and resolution, and schedule regarding update cycles of NWP outputs that are used to feed the ATM. The WMO Secretariat will update the information on
http://www.wmo.int/pages/prog/www/DPS/WMOTDNO778/Annex4.html

ACTION 2: WMO Secretariat
Plan to migrate from fax distribution of products to e-mail/internet distribution of products
DUE DATE: ASAP
Engage WMO Regional Offices and relevant groups within Regional Associations in follow up to circular letter from WMO Secretary-General that requested all Permanent Representatives to provide confirmation or nomination of contacts for its Delegated Authority, and for its Operational NMHS Contact Point, including name, title, telephone and fax number, and only one operational e-mail address.

ACTION 3: All RSMCs and RTH Offenbach / DWD
Common Web-pages

1. RSMCs that have not yet done will examine option to include an ''all products'' web link on mirrored-web page where an archive of all modelling results will be maintained.
DUE DATE: Report back to ET-ERA by end of March 2016

2. Generate GRIB2 format for existing set of standard products.

3. A meta-data Web page and directory will be used to post non-standard / initial response products and files, including GRIB2 files.

4. RTH Offenbach / DWD will provide an example program to convert GRIB1 to GRIB2 based on GRIB_API of ECMWF.

5. Explore producing basic products in geo-referenced format preferably shape files, KML or other file formats (with suitable viewer). Post on meta-data Web link.

6. Monitoring of common web pages for quarterly tests: a) beginning with February 2016 quarterly test, a systematic monitoring of all postings on all common / mirror Web pages will be performed on a rotating basis by one of the lead RSMCs and; b) the Chair will prepare a checklist for the monitoring of all common / mirror web page for consultation with ET-ERA (January 2016).

ACTION 4: RSMCs Beijing, Melbourne and Toulouse
TCM for Fukushima case

DUE DATE: in 2016
Apply the TCM approach used by WMO Task Team the Fukushima meteorological analyses. Results will be added to NOAA ARL's TT-Fukushima Website.

ACTION 5: All RSMCs; coordination by RSMC Washington , RSMC Vienna and CTBTO
Test TCM, ensemble approach and compare with measurements
DUE DATE: next meeting ET-ERA
RSMC Washington (Mr Stein) to take the lead in organizing an exercise with other RSMCs to test the TCM approach to dispersion modelling within the next two years. Consideration could be given to test varying source terms to modify the release and to combine with Ispra JRC ensemble approach in combination with measurements.

ACTION 6: Chairperson
Revision of WMO Technical Note 170
DUE DATE: By end of January 2016
Distribute draft document to ET-ERA and request comments and feedback.

ACTION 7: Chair, Co-Chair and WMO Secretariat
Update to WMO Bulletin article on ERA
Update WMO Bulletin article on ERA (January 2006) to further promote the programme.

ACTION 8: IAEA and WMO SECRETARIAT
Co-operation agreement between IAEA and WMO
DUE DATE: 2016
Pursue revision of the co-operation agreement between WMO and IAEA and consider how to provide support and technical assistance to IAEA/IEC in relation to atmospheric dispersion calculations and their interpretation, as well as the provision of weather forecasts.

ACTION 9: WMO Secretariat
GIS database
DUE DATE: when available
Provide a GIS database of WMO RA and States to IAEA and RSMCs.

ACTION 10: RTH Offenbach and RSMCs
WNXX01 IAEA messages (posting on public internet)
DUE DATE: ongoing

a) ET-ERA members to check regularly if WNXX01 IAEA messages are posted on public internet and contact NMHS to correct the situation as needed.
b) RTH Offenbach to update document on http://www.wmo.int/pages/prog/www/DPS/WMOTDNO778/Annex4.html to indicate that WNXX01 IAEA are for internal use by NMHS and are not to be posted on public web pages.
c) RTH Offenbach to contact RTH Tehran regarding transmission of WNXX01 IAEA messages.

ACTION 11: WMO Secretariat
Eliminate multiple copies of WNXX01 IAEA message on the GTS / WIS

Report on the results from the 19 November 2015 quarterly test. Action will be closed or pursued depending on the outcome.

ACTION 12: Chair, Co-Chair, WMO Secretariat and members ET-ERA
Manual on the GDPFS

a) That WMO's role as the technical authority for atmospheric dispersion modelling be strengthened in the revised *Manual on the GDPFS.*

b) Expand the text in the *Manual on the GDPFS* (in the global and regional arrangements) in relation to the RSMC support and advice to the WMO and the IAEA Secretariats in the preparation of public and media statements. The statements should address both weather and dispersion aspects. WMO Secretariat to coordinate with the Member State concerned and with the RSMCs, as appropriate, for preparing a consensus statement.

ACTION 13: IAEA (lead) and available RSMCs
Propose new test with more realistic values for source term and contouring of outputs for specific threshold values

ACTION 14: Members of ET-ERA and WMO Secretariat
Public information
DUE DATE: depends on availability of members

Further develop the WMO-TD. 778 on the use and interpretation of RSMC products, including examples, and guidance on how to communicate with the public (based on the IAEA publication).

ACTION 15: ICAO, WMO and IAEA
Response from IACRNE Working Group
DUE DATE: Expected in 2016

Answer to Expert Team on ERA regarding the questions raised by the CG-NERA (Vienna, November 2011) on possible modelling guidance on radioactive clouds for aviation interests.

ACTION 16: Chair and RSMCs
Modelling guidance for radioactive clouds
DUE DATE: dependent on action 15
Continue to explore possible ways to provide modelling guidance

ACTION 17: ALL RSMCs, RTH / RSMC OFFENBACH and WMO Secretariat
Annual Report
DUE DATE: REPORT FOR 2015 and 2016 BY FEBRUARY 2016 and 2017
All RSMCs and RTH Offenbach will produce and share an annual report to cover the calendar year. The report should be submitted to the Chairman of the Coordination Group by the end of February of the following year, for posting on the WMO Web-site for the ERA programme.
The contents of the Annual Report shall include, but not limited to:
- Introduction
- Operational contact information

- Responses and information on dissemination of products (fax, web-page access, which products were sent and time delay from point of notification)
- Exercises and routine tests
- Lessons learned from recent experiences
- Operational issues / challenges
- Summary / status of the operational atmospheric transport and dispersion model(s)
- Plans for the coming year

WMO Secretariat will post the 2015 and 2016 reports on the ERA web pages:
https://www.wmo.int/pages/prog/www/DPFSERA/resources.html

ACTION 18: RSMCs and IAEA – Coordination by experts from RSMC Obninsk (Mr Kosykh), RSMC Japan (Mr Sakamoto),IAEA (Mr Winkler) and RSMC Vienna (Mr Wotawa).
Time of arrival products
DUE DATE: 2016
''Time of Arrival'' Product Tests

1. Produce document to define and clarify details and specifications for next ToA test to ensure consistency between RSMCs products
2. Conduct new test
3. IAEA to propose threshold value for cloud boundaries.

ACTION 19: Chairperson in coordination / collaboration with WMO Secretariat and RSMCs
Updates to WMO TD-778 and WMO ERA web pages
DUE DATE: Depends on availability of members
Check, review and update the ERA web pages and WMO TD-778. Produce and update as needed pdf version of WMO TD-778.

ACTION 20: IAEA
Wish list of RSMC products and support

a) Produce a list of RSMC products and support needed by the IAEA (i.e. higher resolution, long diagnostic runs with more realistic source term, etc.) and not currently defined in the Manual on the GDPFS.
b) Examine possible data formats (GRIB2, netCDF, etc.) that would be suitable for GIS and report back to ET-ERA.

ACTION 21: IAEA, RSMCs and RTH Offenbach
Quarterly IAEA – RSMC tests

Note:
i) Quarterly tests will be held on third Tuesday of the month from now on.
ii) For RAII quarterly test, the exercise will be postponed if the host state has not confirmed their participation by two weeks prior to the exercise.

2016		2017	
16. Feb	Region VI and I	21. Feb	Region IV and III
17. May	Region II	16. May	Region VI and I
16. Aug	Region IV and III	15. Aug	Region V
15. Nov	Region V	21. Nov	Region II

Information on the planned tests for 2016 and 2017 will be published on the IAEA USIE website. GTS message will be sent with each quarterly test. Distribution of products will be done by Lead RSMCs to their region(s) of responsibility.

ACTION 22: IAEA and RTH Offenbach
Monthly communication test

IAEA representative to coordinate with RTH Offenbach with regards to changing monthly communication tests from Thursday to Tuesday.

ACTION 23: NMC VIENNA, CTBTO, WMO and Canadian Meteorological Centre (RSMC Montreal)
Transmission of CTBTO meteorological data on WMO GTS
DUE DATE: Ongoing

1. NMC Vienna to continue take-over of transmission of data from Canadian Meteorological Centre to the WMO GTS.
2. WMO to provide identifiers to NMC Vienna as they become available.
3. NMC Vienna to finalize and distribute communication protocol and contact information between NMC Vienna, CTBTO, WMO and Canadian Meteorological Centre.
4. NMC Vienna will evaluate option of producing a synoptic type message at specific hours that could be used by data assimilation systems

ACTION 24: CTBTO and RSMCs
SRS fields for CTBTO
DUE DATE: Ongoing

CTBTO to provide technical requirements document to RSMC with regards to higher spatial and temporal resolutions for SRS fields. CTBTO will inform RSMCs at least three months in advance to enquire about the possibility of moving to higher resolutions.

ACTION 25: IAEA, WMO, RSMC Vienna
NMC Vienna support to IAEA during an emergency

a) IAEA Expert (Mr Winkler) to investigate NMC Vienna access to IEC and develop consequently a paragraph in the Letter of Agreement between WMO and IAEA to address this topic.

b) Experts from WMO (Mr Harou), IAEA (Mr Winkler) and NMC Vienna (Mr Wotawa) to develop the Terms of Reference for the visiting NMC Vienna Forecaster and plan an exercise to test the arrangement.

ACTION 26: RSMC Tokyo Expert
DUE DATE: Next meeting

The meeting requested RSMC Tokyo Expert to develop and share a proposal for a test with intended objective to allow RSMCs to assess the feasibility for their participation.

ACTION 27: DWD and RSMCs Montreal and Vienna
DUE DATE: Next meeting

DWD to run its Eulerian dispersion model for the same cases as studied by RSMCs Montreal and Vienna for the investigation of radioactive plume. Refer Action 16.

ANNEX IV

LINKS TO RMSCS COMMON/MIRROR WEB PAGES (password protected)

Beijing	http://rsmc.cma.gov.cn/rsmc-bin/jntrsmc.pl
Exeter	http://rsmc.metoffice.gov.uk/cgi-bin/jntrsmc.pl
Melbourne	http://reg.bom.gov.au/cgi-bin/reg/EER/jntrsmc.pl
Montreal	http://eer.cmc.ec.gc.ca/eer-bin/jntrsmc.pl
Obninsk	http://www.feerc.ru/rsmc-bin/jntrsmc.pl
Tokyo	http://eer.kishou.go.jp/cgi-bin/jntrsmc.pl
Toulouse	http://www.meteo.fr/cmrs/rsmc2-bin/jntrsmc.pl
Washington	http://ready.arl.noaa.gov/rsmc2-bin/jntrsmc.pl

ANNEX V

UPDATED LIST OF ACTIONS ON NON-NUCLEAR ERA (DECEMBER 2015) FOR THE ET-ERA

Area of Requirement: Development and testing of operational procedures

ACTION 1: Co-Chairperson, NMHS Argentina, RSMC Montreal
Conduct further exercises comprising simulated requests from NMHS to RSMC for assistance covering full set of non-nuclear event scenarios
DUE DATE: 1st week January 2016
Co-chairperson, the member from Argentina and RSMC Montreal to conduct a series of additional exercises covering requests for remaining non-nuclear scenarios and to report back to the Expert Team on the results of the full exercise and any further potential amendments required to the draft operational procedures, for review and comments.

ACTION 2: Co-Chairperson, all interested RSMCs (Melbourne, Exeter, Offenbach) selected NMHSs
Conduct further exercises comprising simulated requests from NMHS to RSMC for assistance covering full set of non-nuclear event scenarios
DUE DATE: Mon 4 Jan – Thu 8 January 2016
1. Co-chairperson to establish timetable for testing of scenarios with interested RSMCs

2. Co-chairperson, all interested RSMCs and selected NMHSs to conduct a series of exercises covering requests for all four non-nuclear scenarios and to report back to the Expert Team on the results of the full exercise and any further potential amendments required to the draft operational procedures, for review and comments.

ACTION 3: Chairperson, Co-Chairperson, all RSMCs
5.3.3 Develop appropriate designation criteria for any organization seeking to nominate as an RSMC for non-nuclear ERA. Finalize all additions for non-nuclear ERA procedures for new Manual.
DUE DATE: March 2016

ACTION 4: WMO Secretariat
Submission of non-nuclear ET-ERA additions to the Manual on the GDPFS (WMO-No.485) to CBS-16r 2016 (November)

Area of Requirement: Capacity building and ERA web pages

ACTION 5: RSMCs
Share information on improving mapping products
DUE DATE: Ongoing
RSMCs to share information and techniques regarding generation of improved high-resolution mapping products for display of results

ACTION 6: WMO Secretariat
Assist NMHSs in the interpretation of ERA-related products and their application by publicizing aspects covered by the WMO-TD. 778
DUE DATE: As soon as the WMO-TD. 778 is updated

WMO Secretariat to send out a circular letter to WMO Members and an e-mail to the ERA contact points informing/publicizing the aspects covered by the WMO-TD. 778

ACTION 7: TT members, RSMCs and WMO Secretariat
Advise the Secretariat on available n-NERA dispersion modelling capabilities from institutions in their RA area that can be ported to NMHSs
DUE DATE: Ongoing
TT members, RSMCs to advise; Secretariat to post it on the WMO website for ERA

ACTION 8: RSMC Offenbach
Investigate and advise on possible availability of ICON-ART web-based training modules
DUE DATE: February 2016

ACTION 9: WMO Secretariat
Enable access to web-based training modules
DUE DATE: Ongoing
Publicize web-based training modules by inclusion of these links on the WMO-TD. 778.

ACTION 10: Chairperson and Co-Chairperson, ET Members
Review and update the WMO website for non-nuclear ERA, including updating the glossary
DUE DATE: Dec 2015
1. ET-ERA Chairperson and co-chairperson to coordinate and identify TT members that could contribute and establish timelines;

DUE DATE: End Dec 2015
2. TT members to check within their Services on the possibility of contributing to this task.

DUE DATE: 2017
3. TT members to review and update the WMO website for non-nuclear ERA, including updating the glossary

ACTION 11: WMO Secretariat and ET members
Promote the non-Nuclear programme via the WMO Bulletin
DUE DATE: Once the operational procedures for non-nuclear ERA are in place (2017?)
Update the WMO Bulletin article on ERA (January 2006) to further promote the programme

ACTION 13: Jeff McQueen and WMO Secretariat
Capacity building in NMHSs
DUE DATE: Ongoing
Demonstrate transfer of the dispersion modelling capability to candidate NMHSs

Area of Requirement: Work with International Organizations

ACTION 14: WMO Secretariat
Engage with relevant international organizations to determine requirements
DUE DATE: Ongoing
Engage with relevant international organizations to promote the usefulness of ERA products and determine requirements

ACTION 15: WMO Secretariat
Make international organizations aware of nNERA procedures
DUE DATE: Once the operational procedures have been established and services to Humanitarian Agencies have been developed.
Make relevant international organizations aware of the operational procedures for non-nuclear ERA

ACTION 16: WMO Secretariat and Co-chairperson
Publicize outcomes of nNERA exercise
DUE DATE: After the exercise
Share the information of the outcomes / report of the exercise, which should include an item on potential implications to other relevant international organizations.

ANNEX VI

PROPOSED OPERATIONAL PROCEDURES FOR NON-NUCLEAR ERA FOR THE NEW MANUAL ON THE GDPFS

2.2.9. Response to non-Nuclear Environmental Emergencies

This activity includes a network of Regional Centre(s) and associated National Meteorological Centres within a geographical region.

Centres participating in activity II.2.2.9, response to non-nuclear environmental emergencies, shall:

- Prepare on request, from an authorized person[1], atmospheric transport and dispersion forecast or hindcast products relating to events in which hazardous non-nuclear contaminants have been released into the atmosphere. The criteria for activation of the Regional support procedures and the Request Form are given in Appendices A.II.2.2.9-a and A.II.2.2.9-e.
- As soon as possible, but usually within 2 hours of a request from an authorized person authorized person[1], make available a range of products to the NMHS operational contact point [2] by e-mail or retrieval from the RSMC password protected designated website. The minimum list to be made available, including parameters, forecast range, time steps and frequency, is given in Appendix A.II.2.2.9-b.
- Use agreed default emission source parameters for essential parameters when actual source information is not available. Default source parameters for a range of release scenarios are given in Appendix A.II.2.2.9-c.
- Make available on a website up-to-date information on the characteristics of its atmospheric transport and dispersion modelling (ATDM) system (minimum information to be provided is given in Appendix A.II.2.2.8-d) and a users interpretation guide for ATDM products (Appendix A.II.2.2.9-f).

RESPONSIBILITY *(Changes to Activity Specification)*			
To be proposed by:	CBS/ET-ERA		
To be approved by:	CBS		
To be decided by:	EC / Congress		
DESIGNATION			
To be approved by:	CBS		
To be decided by:	EC / Congress		
COMPLIANCE			
To be monitored by:	CBS/ET-ERA		
To be reported to:	CBS/ICT-DPFS	CBS	

[1] The person authorized by the Permanent Representative of the WMO Member to request RSMC Support; normally the NMHS operational contact point.
[2] Designated by the Permanent Representative

Appendix A.II.2.2.9-a

ACTIVATION OF SUPPORT FOR NON-NUCLEAR EMERGENCY RESPONSE

Environmental emergencies can be caused by a broad range of events with various temporal and spatial scales involving the release of hazardous substances into the environment. The scope of non-nuclear ERA includes: smoke from large fires, emissions from volcanic eruptions, and large chemical releases. Volcanic ash activities are not covered here, but are instead covered under activity II.2.2.6. Atmospheric sand and dust storm forecasts are covered under activity II.2.2.10.

NMHSs may request RSMC support for releases that have the potential for large-scale (i.e. mesoscale) and/or long-duration (hours to days) impacts, according to the capability of the RSMC. RSMC products are typically not applicable for shorter range incidents. RSMCs will advise NMHSs if requests are not within their capabilities.

NMHSs requesting RSMC support shall:

- Request via the authorized person[1] that an RSMC provides, in accordance to its designation, products relating to events in which hazardous non-nuclear contaminants have been released into the atmosphere.
- Requests should be made by e-mailing (preferred) or faxing the completed form in Appendix A.II.2.2.9e to the appropriate RSMC. If the RSMC has not confirmed reception within 20 minutes, the requester should contact the RSMC by phone or e-mail.
- Provide the RSMCs with the essential information specified on the request form.
- NMHSs will distribute the products within their State based on their national arrangements.

[1] The person authorized by the Permanent Representative of the WMO Member to request RSMC Support; normally the NMHS operational contact point.

Appendix A.II.2.2.9-b

MINIMUM LIST OF PRODUCTS

Smoke from forest, grass or peat fires (default values in Appendix A.II.2.2.9-c will be used for source parameters not provided)

- Forecast duration 36 hours
- Relative concentrations[1] from the surface to 200 m [2]
- Images at intervals of 1, 3 or 6 hours [2]
- Contouring to be determined based on specifics of the event or the request

Smoke from industrial fire (default values for parameters not provided)

- Forecast duration 12 hours
- Relative concentrations[1] from the surface to 200 m [2]
- Images at intervals of 1 or 3 hours [2]
- Contouring to be determined based on specifics of the event or the request

Chemical releases not involving fire (default values for parameters not provided)

- Forecast duration 12 hours
- Relative concentrations[1] from the surface to 100 m [2]
- Images at intervals of 1 or 3 hours [2]
- Contouring to be determined based on specifics of the event or the request

Backtracking

- Produce backtrajectories from point of interest for low levels based on specifics of the event or the request
- Hindcast to 36 hours
- Image [2]

All products shall include a list of parameters that were used for the dispersion modelling as listed in Appendix A.II.2.2.9-f.

The RSMC will perform a quick assessment of the products before they are issued, and may provide a short explanatory message if any issues of concern are noted.

[1] Absolute concentrations may be provided if an estimate of the total mass released or actual mass rate are provided.
[2] Additional products (e.g. GIS-format files) may be provided to requesting NMHSs if possible.

Appendix A.II.2.2.9-c

DEFAULT EMISSION SOURCE PARAMETERS

Scenario*	Type of Event	Material released	Rate of Emission	Vertical Distribution
Forest, grass or peat fires	Smoke	Tracer	One unit per hour over 36 hours	Constant from the surface to 500 m
Major industrial fire	Smoke	Tracer	One unit per hour over 6 hours	Constant from the surface to 500 m
Chemical release not involving fire	Chemical	Tracer	One unit per hour over 6 hours	Constant from the surface to 20 m
Other events	RSMC defined	Tracer	RSMC defined	RSMC defined

* Default date and start time of release are those given in the request form (mandatory information). If not provided, date and time of the reception of the request will be used.

Appendix A.II.2.2.9-d

CHARACTERISTICS OF ATMOSPHERIC TRANSPORT AND DISPERSION MODELLING SYSTEM

The designated Centres will document and maintain in WMO TD No. 778 and on the WMO Emergency Response Activities website up-to-date information on the characteristics of their atmospheric transport and dispersion modelling (ATDM) system. The information will contain at a minimum:

For ATDM:

- Name of model(s) and type (Lagrangian, Eulerian)
- Horizontal grid(s) spacing and extent
- Vertical spacing and type of vertical coordinates used to calculate layer concentrations
- Model calculation time step(s) and model output time step(s)
- Information on horizontal and vertical diffusion schemes for the tracers
- Information on dry and wet scavenging schemes
- Information on how chemicals are treated (if available)
- How the emission (source term) is represented / modelled

For Numerical Weather Prediction data used for ATDM:

- Name of system
- Horizontal grid(s) spacing and extent
- Number of vertical levels and type of vertical coordinates
- Forecast length (hours)
- Update frequency

Appendix A.II.2.2.9-e

REQUEST FORM TO ACTIVATE RSMC SUPPORT

ENVIRONMENTAL EMERGENCY RESPONSE REQUEST FOR WMO RSMC SUPPORT BY AUTHORIZED PERSON[1]

1. This form should be sent by e-mail to one the RSMCs' operational contact in the Regional Association when support is needed for releases that have the potential for large-scale (i.e. mesoscale) and/or long-duration (hours to days) impacts. The RSMC operational contact information is available on http://www.wmo.int/pages/prog/www/DPFSERA/transport_model_products.htm.

2. If RSMC does not confirm the reception of the request within 20 minutes, requester will phone the RSMC.

3. The RSMC shall make available its products as soon as possible but usually within 2 hours. An e-mail will be sent by the RSMC with information on where to access the products. The requester will confirm reception by e-mail.

DATE AND TIME OF REQUEST:

1) MANDATORY INFORMATION:

- Status: (Exercise/Event)
- Name, title, Organization/Agency, Country, phone number and e-mail of the requester:
- Select type of event and provide brief description or details:
  - ☐ Forest, grass or peat fire:
  - ☐ Chemical incident:
  - ☐ Industrial Fire/Smoke:
  - ☐ Backtracking request:
  - ☐ Other:
- Date and Start time of release (DD/MM/YYYY and UTC):
- Location of release (as accurately as possible) in order of preference:
  1) Geographic coordinates (**decimal degrees** or degrees, minutes and seconds):

[1] The person authorized by the Permanent Representative of the WMO Member to request RSMC Support; normally the NMHS operational contact point.

Latitude	
Longitude	

2) (*if appropriate*) Address, City, Country:

2) OTHER INFORMATION: If known, the following would be useful for the modelling and should be provided as well *(if not provided, modeller will use default parameters or make a reasonable assumption)*:

- Name of location (name of chemical plant, factory, etc.):

- Meteorological conditions at location at the start of the release (wind speed and direction, weather, cloudiness, presence of inversion, etc.):

- Name or type of pollutant(s) to be modelled if known (smoke, natural gas, sulphur dioxide, etc). *If unknown, a tracer will be used.*

- Quantity (mass) or release rate (mass per unit time) of pollutant. *If unknown, one unit mass or one unit mass per hour will be used.*

- Expected or estimated release duration.

- Duration of simulation for the dispersion model run.

- Size of area of interest (for example, within 300 km of source).

- Base of release (surface or meters above surface), dimension of release area and estimated maximum height in meters reached by the release (top of smoke plume for example).

- If quantity (mass) and name of pollutant(s) are provided, what concentrations should be displayed on modelling outputs? Please specify.

- Any other information that may be useful:

Appendix A.II.2.2.9-f

USERS INTERPRETATION GUIDE FOR NON-NUCLEAR ATMOSPHERIC TRANSPORT AND DISPERSION MODELLING PRODUCTS PROVIDED BY RSMCs

The designated Centres will make available in WMO TD-778 on the WMO Emergency Response Activities website an interpretation guide for users.

General rules for displaying results

In order to make the interpretation of the maps easier, the producing centres should adopt the following guidelines:

General guidelines for all maps:

(a) Provide labelled latitude and longitude lines at regular intervals and sufficient geographic map background (shore lines, country borders, rivers, etc. and possibly roads and town names for localized events) to be able to locate precisely the trajectories and contours;
(b) Indicate the source location with a highly visible symbol (▲, ●, ■, etc.);
(c) Indicate the source location in decimal degrees (latitude – N or S specified, longitude – E or W specified, plotting symbol used), date/time of release (UTC), and the meteorological model initialization date/time (UTC);
(d) Each set of maps should be uniquely identified by at least product issue date and time (UTC) and issuing centre;
(e) Previously transmitted products from the dispersion model need not be retransmitted;
(f) Indicate with a legend if this is an exercise or requested services.

Specific guidelines for concentration maps:

(a) Adopt a maximum of five concentration contours ;
(b) A legend should indicate contours used on the chart;
(c) Contours may be colour-filled but should be clearly distinguishable from map background lines;
(d) Indicate the following input characteristics: (i) source assumption (height, duration, pollutant type, amount released); (ii) the units of concentration. In addition, charts should specify: (i) “surface to xxx-m layer concentrations”, where xxx depends on the pollutant type, and if the default source is used; (ii) “Results based on default initial values”;
(e) Indicate, if possible, the location of the maximum concentration with a symbol on the map and include a legend indicating the symbol used and the maximum numerical value;
(f) Indicate the starting and ending date/time (UTC).

Specific guidelines for backtrajectory maps:

(a) Distinguish each trajectory (levels chosen will depend on specifics of the event or the request) with a symbol (▲, ●, ■, etc.) at synoptic hours (UTC);
(b) Use solid lines (darker than map background lines) for each trajectory;

Provide a time-height (m or hPa) diagram, preferably directly below the trajectory map, to indicate vertical movement of trajectory parcels.

The RSMCs will distribute their standard products to the NMHS Operational Contact Points by e-mail or enabling retrieval by the NMHS from RSMCs password protected designated website. Standard products in the ITU-T T4 format suitable for group 3 facsimile machines will be maintained by exception and only if requested by the NMHS Operational Contact Point. The RSMC may also make use of other appropriate technologies.