# Manual on the Global Data-processing and Forecasting System

Annex IV to the WMO Technical Regulations

2017 edition

WORLD
METEOROLOGICAL
ORGANIZATION

WMO-No. 485

# CONTENTS

*Page*

2.2.2.6.3 **All six RSMCs for tropical cyclone forecasting together with Tropical Cyclone Warning Centre Darwin, which are designated as Tropical Cyclone Advisory Centres by regional air navigation agreement within the framework of the tropical cyclone watch of the International Civil Aviation Organization (ICAO), shall issue tropical cyclone advisories for aviation in accordance with the provisions made in *Meteorological Service for International Air Navigation*, Annex 3 to the Convention on International Civil Aviation, ICAO; and *Technical Regulations* (WMO-No. 49), Volume II, Parts I and II. SIGMET information concerning tropical cyclones shall be issued by meteorological watch offices for the flight information region concerned and shall be based on the tropical cyclone advisory information issued by the Tropical Cyclone Advisory Centres.**

2.2.2.6.4 **Members holding Metareas under their responsibility within the Global Maritime Distress and Safety System (GMDSS) protocols – established by the International Maritime Organization in Chapter IV of the International Convention of Safety Of Life At Sea – shall include information on tropical cyclones as needed in their GMDSS maritime weather information for shipping.**

Note: The bodies in charge of managing the information contained in the present Manual related to tropical cyclone forecasting are specified in Table 15.

**Table 15. WMO bodies responsible for managing information related to tropical cyclone forecasting**

| | | | |
|---|---|---|---|
| *Responsibility* | | | |
| *Changes to activity specification* | | | |
| To be proposed by: | Technical coordination meeting | | |
| To be recommended by: | CBS | Regional tropical cyclone committee | |
| To be decided by: | EC/Congress | | |
| *Centres designation* | | | |
| To be recommended by: | CBS | Regional tropical cyclone committee | |
| To be decided by: | EC/Congress | | |
| *Compliance* | | | |
| To be monitored by: | Technical coordination meeting | | |
| To be reported to: | CBS | | |

## 2.2.2.7 ***Nuclear environmental emergency response***

**Centres conducting nuclear environmental emergency response shall:**

**(a) Contribute to support for WMO Members and the International Atomic Energy Agency (IAEA):**

**(i) Prepare, on request from a delegated authority[1] and/or IAEA, basic information relating to events in which nuclear contaminants have been released into the atmosphere; the activation of the support for nuclear emergency response is described in Appendix 2.2.22;**

[1] The person authorized by the Permanent Representative of the WMO Member to request support.

**(ii) Within two to three hours of reception of a request, make a range of products available to the NMHS operational contact point[2] and/or IAEA on WIS.[3] The minimum list, including parameters, forecast range, time steps and frequency, is given in Appendix 2.2.23;**

**(iii) Use agreed standard emission source parameters for atmospheric transport and dispersion modelling (ATDM) when source information is not available; default source parameters are given in Appendix 2.2.24;**

**(iv) Make available up-to-date information on the characteristics of their ATDM systems (minimum information to be provided is given in Appendix 2.2.25) and a user interpretation guide for ATDM products.**

Note: The forms to request WMO support by a delegated authority and by IAEA are given in Appendix 2.2.26.

**(b) Contribute to support for the Comprehensive Nuclear-test-ban Treaty Organization (CTBTO):**

**(i) Prepare, on request from CTBTO, relevant atmospheric backtracking products;**

**(ii) Make the requested products available to CTBTO.**

Notes:

1. Arrangements for activation and product specifications are given in Appendix 2.2.27.
2. The bodies in charge of managing the information contained in the Manual related to nuclear environmental emergency response are specified in Table 16.

**Table 16. WMO bodies responsible for managing information related to nuclear environmental emergency response**

| *Responsibility* | | | |
|---|---|---|---|
| *Changes to activity specification* | | | |
| To be proposed by: | CBS/ET-ERA | | |
| To be recommended by: | CBS | | |
| To be decided by: | EC/Congress | | |
| *Centres designation* | | | |
| To be recommended by: | CBS | | |
| To be decided by: | EC/Congress | | |
| *Compliance* | | | |
| To be monitored by: | CBS/ET-ERA | | |
| To be reported to: | CBS/ICT-DPFS | CBS | |

Acronyms not previously defined: ET-ERA – Expert Team on Emergency Response Activities.

## 2.2.2.8 *Non-nuclear environmental emergency response*

Note: This activity includes a network of regional centres and NMCs within a geographical region.

**Centres conducting non-nuclear nuclear emergency response shall:**

[2] Designated by the Permanent Representative.
[3] Via a password-protected dedicated website.

**(a) Prepare, on request from an authorized person,[4] ATDM 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 2.2.28 and 2.2.32, respectively;**

**(b) As soon as possible, but usually within two hours of a request from an authorized person, make available a range of products to the NMHS operational contact point[5] by email or retrieval from the RSMC password-protected designated website; the list of mandatory and highly recommended products to be made available, including parameters, forecast range, time steps and frequency, is given in Appendix 2.2.29;**

**(c) 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 2.2.30;**

**(d) Make available on a website up-to-date information on the characteristics of their ATDM systems (minimum information to be provided is given in Appendix 2.2.31) and a user interpretation guide for ATDM products (Attachment 2.2.5).**

Note: The bodies in charge of managing the information contained in the present Manual related to non-nuclear emergency response are specified in Table 17.

**Table 17. WMO bodies responsible for managing information related to non-nuclear emergency response**

| *Responsibility* | | | |
|---|---|---|---|
| *Changes to activity specification* | | | |
| To be proposed by: | CBS/ET-ERA | | |
| To be recommended by: | CBS | | |
| To be decided by: | EC/Congress | | |
| *Centres designation* | | | |
| To be recommended by: | CBS | | |
| To be decided by: | EC/Congress | | |
| *Compliance* | | | |
| To be monitored by: | CBS/ET-ERA | | |
| To be reported to: | CBS/ICT-DPFS | CBS | |

### 2.2.2.9 *Atmospheric sandstorm and duststorm forecasts*

**Centres conducting atmospheric sandstorm and duststorm forecasts shall:**

**(a) Operate an NWP model incorporating parameterizations of all the major phases of the atmospheric dust cycle;**

**(b) Prepare limited-area analyses of variables relevant to atmospheric sandstorms and duststorms;**

**(c) Prepare limited-area forecast fields of variables relevant to atmospheric sandstorms and duststorms;**

**(d) Make available on WIS and on a web portal a range of these products; the list of mandatory products to be made available is given in Appendix 2.2.33.**

[4] The person authorized by the Permanent Representative of the WMO Member to request RSMC support; normally the NMHS operational contact point.
[5] Designated by the Permanent Representative.

Note: The bodies in charge of managing the information contained in the present Manual related to atmospheric sandstorm and duststorm forecasts are specified in Table 18.

**Table 18. WMO bodies responsible for managing information related to atmospheric sandstorm and duststorm forecasts**

| | | | |
|---|---|---|---|
| *Responsibility* | | | |
| *Changes to activity specification* | | | |
| To be proposed by: | CAS/SDS-WAS Steering Committee | CBS/ET-ERA | |
| To be recommended by: | CAS (WWRP/SSC) | CBS | |
| To be decided by: | EC/Congress | | |
| *Centres designation** | | | |
| To be recommended by: | CAS (WWRP/SSC, SDS-WAS Steering Group) | CBS | RA |
| To be decided by: | EC/Congress | | |
| *Compliance* | | | |
| To be monitored by: | CBS/ET-ERA | | |
| To be reported to: | CBS/ICT-DPFS | CBS | |

Acronyms not previously defined: CAS – Commission for Atmospheric Sciences; SDS-WAS – Sand and Dust Storm Warning Advisory and Assessment System; WWWRP/SSC – WMO World Weather Research Programme Scientific Steering Committee.

* The detailed designation procedure of RSMCs with activity specialization on atmospheric sandstorm and duststorm forecasts (RSMC-ASDF) is referred to in *Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) Science and Implementation Plan 2015–2020*, WWRP 2015-5, Geneva, WMO, 7 – Transition to operational activities: Proposed designation as regional specialized meteorological centre with specialization on atmospheric sand and dust forecasting (RSMC-ASDF).

### 2.2.2.10 ***Volcano watch services for international air navigation***

Note: Volcanic ash advisory centres which provide services in support of international air navigation are designated by ICAO. This designation is made in consultation with WMO. Service provision arrangements in this respect and those for volcano observatories are described in *Technical Regulations* (WMO-No. 49), Volume II, 3.5 and 3.6, respectively.

### 2.2.2.11 ***Marine meteorological services***

Note: Regulations specific to marine meteorological services are contained in the *Manual on Marine Meteorological Services* (WMO-No. 558), Volume I.

### 2.2.2.12 ***Marine environmental emergencies***

Note: Regulations specific to marine environmental emergencies are contained in the *Manual on Marine Meteorological Services* (WMO-No. 558), Volume I.

## 2.2.3 Non-real-time coordination activities

### 2.2.3.1 ***Coordination of deterministic numerical weather prediction verification***

#### 2.2.3.1.1 The centre(s) coordinating DNV (Lead Centre(s) for DNV) shall:

**(a) Provide the facility for GDPFS centres producing global NWP to automatically deposit their standardized verification statistics as defined in Appendix 2.2.34, and provide access to these verification statistics;**

# APPENDIX 2.2.22. ACTIVATION OF THE SUPPORT FOR NUCLEAR EMERGENCY RESPONSE AND STANDARDS IN THE PROVISION OF INTERNATIONAL SERVICES BY REGIONAL SPECIALIZED METEOROLOGICAL CENTRES

## Notification of WMO

Within the framework of the Convention on Early Notification of a Nuclear Accident, IAEA informs the WMO Secretariat and the Data Collection or Production Centre (DCPC) of Regional Telecommunication Hub (RTH) Offenbach (Germany) of the status of the emergency. If needed, IAEA will request support from the WMO RSMCs. Beginning with a site area emergency, the DCPC of RTH Offenbach will disseminate the EMERCON messages on the Global Telecommunication System (GTS) and WIS in the form of an alphanumeric bulletin in plain-text English language under the abbreviated heading WNXX01 IAEA for global distribution to the NMCs and RSMCs (see also the *Manual on the Global Telecommunication System* (WMO-No. 386) and the *Manual on the WMO Information System* (WMO-No. 1060)for details on the dissemination of the EMERCON messages).

When IAEA no longer requires WMO RSMC support, IAEA will send an EMERCON termination message to the RSMCs, the WMO Secretariat and the DCPC of RTH Offenbach. The DCPC of RTH Offenbach will disseminate the EMERCON termination message on the GTS and WIS in the form of an alphanumeric bulletin in plain-text English language under the abbreviated heading WNXX01 IAEA for global distribution to the NMCs and RSMCs.

## Regional arrangements

**The RSMCs designated by WMO for the provision of ATDM products for nuclear environmental emergency response shall:**

**(a) Provide products only when either the delegated authority[1] of any country in the RSMC region of responsibility or IAEA requests RSMC support. Upon receipt of a request from the delegated authority[2] or from IAEA, the RSMC shall provide basic information to the NHMS of that country or to IAEA, respectively. If multiple requests are received, highest priority shall be given to IAEA requests;**

**(b) Upon receipt of a first request for products related to a nuclear incident and in the absence of a prior notification by IAEA, inform the WMO Secretariat, all designated RSMCs and IAEA of the request;**

**(c) For an IAEA request "all RSMCs generate products and distribute with their region(s)", (lead RSMCs only) distribute the basic products to IAEA, and (all RSMCs) distribute to all NMHS operational contact points in their region(s) of responsibility[3] and WMO; for a request for support from a delegated authority and without a request by IAEA, basic information provided to the NMHS operational contact point of the requesting country shall not be disclosed to the public in that country nor distributed by RSMCs to other NMHS operational contact points;**

**(d) Provide, on request, support and advice to the IAEA and WMO Secretariats in the preparation of public and media statements; the WMO Secretariat informs relevant NMHSs of the public and media statements beforehand, when necessary;**

---

1 The person authorized by the Permanent Representative of the country to request RSMC support.

2 The RSMC products will be provided to the NMHS operational contact point designated by the Permanent Representative.

3 The basic information will normally be provided by the NMHS to the IAEA national contact point and to other agencies as needed based on the specific arrangements defined within the State as discussed in the paragraph on National Arrangements.

**(e) Determine the standard set of basic products and the method of delivery in consultation with users and IAEA;**

**(f) Provide product interpretation guidelines to users;**

**(g) Provide support and technology transfer to national and regional meteorological centres that want to become designated RSMCs;**

**(h) Make arrangements to provide backup services; these shall normally be between the designated centres in a region. Interim arrangements shall be made by centres in regions with a single designated RSMC;**

**(i) Provide a joint response, which means that the collaborating RSMCs shall immediately inform one another of any request received; initially all centres within the region shall produce and send the basic set of products (charts) independently and then move rapidly towards providing fully coordinated responses and services for the duration of the response;**

**(j) Following the initial response, develop, provide and update as required, a joint statement to describe a synopsis of the current and forecast meteorological conditions over the area of concern, and the results from the transport models, their differences and similarities and how they apply to the event.**

### Global arrangements

Until such time as new RSMCs have been designated, it is proposed that RA VI-designated RSMCs be responsible for providing services for radiological emergencies to RA I; RA IV-designated RSMCs be responsible for providing services to RA III; and the RA V-designated RSMC, in collaboration with RA IV-designated RSMCs, be responsible for providing services to RA V and the Antarctic.

### National arrangements

The regional and global arrangements are designed to respect the authority of a State with regards to information flow within its boundaries. The NMHSs receiving the RSMC products should determine to which agencies or authorities they should be distributed, based on the arrangements within their State. The ATDM products and relevant information provided by the RSMCs are to be made available to NMHSs to help them assist nuclear agencies and authorities within their State with the interpretation of meteorological and ATDM products.

### Standards in the provision of international services by Regional Specialized Meteorological Centres for nuclear emergency response activities

The delegated authority requests support from RSMCs for ATDM products by using the form entitled "Environmental Emergency Response Alert Request for WMO RSMC Support by Delegated Authority" (Appendix 2.2.26). The delegated authority then sends the completed form to the RSMCs as per the regional and global arrangements and ensures receipt of the form by phone. This will initiate a joint response from the RSMCs in their region of responsibility.

The IAEA requests support from WMO RSMCs for ATDM products by using the form agreed between WMO and IAEA entitled "Environmental Emergency Response Request for WMO RSMC Support by IAEA" (Appendix 2.2.26). The IAEA then sends the completed form by email (preferred) or by fax, to the RSMCs as per the regional and global arrangements and ensures receipt of the form by phone. **The lead RSMCs shall confirm receipt of IAEA request by email (preferred) or by fax to IAEA.** This will initiate a joint response from the RSMCs in their region of responsibility. An information copy of its request form is sent by IAEA by email (preferred) or by fax to the DCPC of RTH Offenbach. **When the lead RSMCs' products become available, the**

**lead RSMCs shall send an announcement to IAEA stating that their respective products are available and where they can be found (RSMC dedicated website), by email (preferred) or by fax.**

**The designated RSMCs shall implement agreed standard procedures and products by:**

**(a) The provision of the standard set of basic products (see Appendix 2.2.23) within two to three hours of reception of a request and according to the general rules for displaying results;**

**(b) The adoption of the forecast periods (see Appendix 2.2.23) for the numerical calculations;**

**(c) The adoption of a joint response approach (paragraphs (i) and (j) of the regional arrangements, above);**

**(d) The adoption of the general rules for displaying results.**

The RSMCs will distribute their standard products to the NMHS operational contact points by email and retrieval from RSMC password-protected designated web pages. Standard products in the International Telecommunication Union Telecommunication Standardization Sector (ITU-T) T.4 format suitable for both group 3 facsimile machines and transmission on parts of WIS 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.

# APPENDIX 2.2.23. MANDATORY PRODUCTS AND GENERAL RULES FOR DISPLAYING PRODUCTS (NUCLEAR)

## 1. Basic set of products

**Seven maps that shall consist of:**

**(a) Three-dimensional trajectories starting at 500, 1 500 and 3 000 m above the ground, with particle locations at six-hour intervals (main synoptic hours up to the end of the dispersion model forecast);**

**(b) Time-integrated airborne concentrations within the layer 500 m above the ground, in Bq s $m^{-3}$ for each of the three forecast periods;**

**(c) Total deposition (wet + dry) in Bq $m^{-2}$ from the release time to the end of each of the three forecast periods.**

**A joint statement that shall be issued as soon as available.**

## 2. Forecast periods for numerical calculations

**The initial set of products shall cover the period from T, the start time of the release, through a forecast of 72 hours from t, the start time of the current output from the operational NWP model.**

**The first 24-hour period for integrated exposures in the dispersion model shall start at the nearest synoptic time (0000 or 1200 UTC) prior to or equal to T. Subsequent 24-hour integrations of the dispersion model shall be made up to, but not exceeding, the synoptic time nearest to t+72.**

**If T is earlier than t, the first response shall use hindcasts to cover the period up to t.**

## 3. Joint response and joint statements

**A joint response means that the collaborating RSMCs shall immediately inform each other of any request received; initially they shall produce and send the basic set of products (charts) independently and then move rapidly towards providing fully coordinated response and services for the duration of the response. Following the initial response, the RSMCs shall develop and provide, and update as required, a joint statement to describe a synopsis of the current and forecast meteorological conditions over the area of concern, and the results from the ATDM, their differences and similarities and how they apply to the event.**

## 4. General rules for displaying results

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 10° intervals and sufficient geographic map background (shorelines, country borders, and the like) to be able to locate precisely the trajectories and contours;

(b) Indicate the source location with a highly visible symbol (●, ▲, x, ✻, ■, etc.);

(c) Indicate the source location in decimal degrees (latitude – N or S specified; longitude – E or W specified; plotting symbol used), date and time of release (UTC); and the meteorological model initialization date and 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, requested services, or an IAEA-notified emergency.

Specific guidelines for trajectory maps:

(a) Distinguish each trajectory (500, 1 500, 3 000 m) with a symbol (▲,●, ■, etc.) at synoptic hours (UTC);

(b) Use solid lines (darker than map background lines) for each trajectory;

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

Specific guidelines for concentration and deposition maps:

(a) Adopt a maximum of four concentration/deposition contours corresponding to powers of 10 with minimum values not less than $10^{-20}$ Bq s $m^{-3}$ for time-integrated airborne concentrations and not less than $10^{-20}$ Bq $m^{-2}$ for total deposition;

(b) A legend should indicate that contours are identified as powers of 10 (that is, $-12 = 10^{-12}$). If grey shading is used between contours, then the individual contours must be clearly distinguishable after facsimile transmission and a legend provided on the chart;

(c) Use solid dark lines (darker than map background lines) for each contour;

(d) Indicate the following input characteristics:

  (i) Source assumption (height, duration, isotope, amount released);

  (ii) The units of time integrated concentration (Bq s $m^{-3}$) or deposition (Bq $m^{-2}$);

(e) In addition, charts should specify:

  (i) "Time-integrated surface to 500-metre layer concentrations";

  (ii) "Contour values may change from chart to chart";

  (iii) If the default source is used, "Results based on default initial values";

(f) Indicate, if possible, the location of the maximum concentration/deposition with a symbol on the map and include a legend indicating the symbol used and the maximum numerical value;

(g) Indicate the time integration start and end date and time (UTC).

## APPENDIX 2.2.24. DEFAULT EMISSION SOURCE PARAMETERS (NUCLEAR)

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

(a) Uniform vertical distribution up to 500 m above the ground;

(b) Uniform emission rate during six hours;

(c) Starting date and time: Date and time specified at "START OF RELEASE" on request form or, if not available, then the "date/time of request" specified at the top of the request form;

(d) Total pollutant release 1 Bq over six hours;

(e) Type of radionuclide $^{137}Cs$.

---

[1] The adoption of default values is based on the understanding that some runs of the transport/dispersion models need to be carried out with default parameters because little or no information (except location) will be available to the RSMC at an early stage. RSMCs are, however, requested to conduct and propose subsequent model runs with more realistic parameters as they become available (products based upon updated parameters will be provided on request only or confirmed from IAEA or a delegated authority). This may, for example, refer to a more precise assumption of the vertical distribution or the need to conduct a model run for the release of noble gases.

## APPENDIX 2.2.25. CHARACTERISTICS OF ATMOSPHERIC TRANSPORT AND DISPERSION MODELLING SYSTEMS (NUCLEAR)

The designated centres will document and maintain in Documentation on RSMC Support for Environmental Emergency Response (WMO/TD-No. 778) on the WMO Emergency Response Activities website up-to-date information on the characteristics of their ATDM system. The information will contain at a minimum:

For ATDM:

- Name of model(s) and type (Lagrangian, Eulerian);
- Horizontal grid spacing and extent;
- Number of vertical levels and type of vertical coordinates;
- Model calculation time step(s) and model output time step(s);
- Information on dry and wet scavenging schemes;
- How the emission (source term) is represented/modelled;
- Isotopes that can be taken into account.

For NWP data used for ATDM:

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

# APPENDIX 2.2.26. REQUEST FORM TO ACTIVATE REGIONAL SPECIALIZED METEOROLOGICAL CENTRE SUPPORT (NUCLEAR)

**ENVIRONMENTAL EMERGENCY RESPONSE ALERT**
**REQUEST FOR WMO RSMC SUPPORT BY DELEGATED AUTHORITY**

*This form should be sent by fax to the RSMC. At the same time, the Delegated Authority must immediately call the RSMC to confirm the transmission of this request for RSMC support.*

*(This section must be completed in full)*

STATUS:..... (EVENT OR EXERCISE) Date/time of request:..... (UTC)

NAME OF DELEGATED AUTHORITY:.....

COUNTRY:.....

DELEGATED AUTHORITY TELEPHONE/FAX NUMBERS: (.....)..... (Tel.)

(.....)..... (Fax)

REPLY TELEPHONE/FAX NUMBERS FOR NMS OF

REQUESTING COUNTRY: (.....) ..... (Tel.)

(.....)..... (Fax)

NAME OF RELEASE SITE:..... (facility and place)

GEOGRAPHICAL LOCATION OF RELEASE:..... (lat./long. decimal degrees N or S; E or W)

*(essential accident information for model simulation — if not available, model will execute with standard default values)*

RELEASE CHARACTERISTICS:

START OF RELEASE:..... (date/time, UTC)

DURATION:..... (hours), or end of release..... (date/time, UTC)

RADIONUCLIDE SPECIES:.....

TOTAL RELEASE QUANTITY:..... (Becquerel)

OR POLLUTANT RELEASE RATE:..... (Becquerel/hour)

EFFECTIVE HEIGHT OF RELEASE: Surface:..... or

Stack height: ..... (m), or

Aloft: top ..... (m), base..... (m)

*(helpful information for improved simulation)*

SITE ELEVATION: ..... (m)

LOCAL METEOROLOGICAL CONDITIONS NEAR ACCIDENT:.....

.....

.....

..... (wind speed and direction/weather/cloudiness, etc.)

OTHER INFORMATION:.....

.....

.....

..... (nature of accident, cause, fire explosion, controlled release, foreseeable development, normal activity, projected conditions, etc.)

*(to be completed by RSMC)*

DATE/TIME OF RECEIPT OF REQUEST:..... (UTC)

DATE/TIME OF RETURN CONFIRMATION OF RECEIPT:..... (UTC)

NOTE: All times in UTC.

**ENVIRONMENTAL EMERGENCY RESPONSE**
**REQUEST FOR WMO RSMC SUPPORT BY IAEA**

*The IAEA sends the completed form by fax to all RSMCs and RTH Offenbach. At the same time the IAEA calls the 'Lead' RSMCs (selected on the form) to ensure receipt of this form.*

**STATUS:** ☐ **EMERGENCY** ☐ **EXERCISE** Date/time of request: yyyy-MM-dd/HH:mm (UTC)

REQUESTED RSMCs: (indicate the lead RSMCs by a checkmark below)

☐ EXETER ☐ TOULOUSE ☐ MELBOURNE ☐ MONTREAL ☐ WASHINGTON

☐ BEIJING ☐ TOKYO ☐ OBNINSK ☒ RTH Offenbach

SENDER'S NAME: **INTERNATIONAL ATOMIC ENERGY AGENCY**

COMMUNICATION DETAILS:
Tel.: +43 1 2600 22023 Use to confirm receipt of request
Fax: +43 1 26007 29309 Use to confirm receipt of request
E-mail: iec3@iaea.org Use to confirm receipt of request

NAME OF RELEASE SITE AND COUNTRY:..... (facility and place)

GEOGRAPHICAL LOCATION OF RELEASE:
(MUST BE COMPLETED) . Decimal degrees ☐ N ☐ S
. Decimal degrees ☐ E ☐ W

DECLARED EMERGENCY CLASS:
☐ NONE ☐ Other, specify:.....

ACTION REQUIRED:
- ☐ NONE
- ☐ GO ON STANDBY (request for products or for assistance on weather conditions is to be expected)
- ☐ LEAD RSMCs ONLY GENERATE PRODUCTS AND SEND TO IAEA ONLY
- ☐ ALL RSMCs GENERATE PRODUCTS AND DISTRIBUTE WITHIN THEIR REGIONS
- ☐ OTHER ACTION:.....

*(essential accident information for model simulation — if not available, model will execute with standard default values)*

RELEASE CHARACTERISTICS:
START OF RELEASE: Date/time: – – / : (UTC)
DURATION: (hours) or END OF RELEASE: Date/time: – – / : (UTC)
RADIONUCLIDE SPECIES:.....
TOTAL RELEASE QUANTITY:..... (Becquerel)
OR POLLUTANT RELEASE RATE:.....(Becquerel/hour)
EFFECTIVE HEIGHT OF RELEASE: ☐ Surface or
☐ Release height: base: (m), top:..... (m)

*(helpful information for improved simulation)*
SITE ELEVATION: .....(m)
LOCAL METEOROLOGICAL CONDITIONS NEAR ACCIDENT:.....
.....
.....
(wind speed and direction/weather/cloudiness, etc.)
OTHER INFORMATION:.....
.....
.....
(nature of accident, cause, fire explosion, controlled release, foreseeable development, normal activity, projected conditions, etc.)

*(to be completed by RSMC)*
DATE/TIME OF RECEIPT OF REQUEST:.....(UTC)
FOR LEAD RSMC(s) ONLY
DATE/TIME OF RETURN CONFIRMATION OF RECEIPT: .....(UTC)

NOTE: All times in UTC.

# APPENDIX 2.2.27. SPECIFICATIONS FOR SUPPORT TO THE COMPREHENSIVE NUCLEAR-TEST-BAN TREATY ORGANIZATION

**Global arrangements for all Regional Specialized Meteorological Centres to distribute products to the Comprehensive Nuclear-test-ban Treaty Organization**

Within the framework of the cooperation agreement between the Preparatory Commission for the CTBTO and WMO that entered into force on 23 May 2003, the Provisional Technical Secretariat (PTS) notifies both the RSMCs designated for the provision of atmospheric backtracking products and also the WMO Secretariat in the case that anomalous radionuclide measurements occur in the International Monitoring System. The notification will be in the form of an email message that will specify the coordinates of the requested stations as well as the start and termination of the measurements. The measurement scenario will not be revealed.

**(a) All notified RSMCs shall acknowledge the receipt of the request and deliver the requested atmospheric backtracking products in electronic form and in the predefined format to a server specified by CTBTO PTS as part of the notification.**

**(b) The products shall be delivered as fast as technically possible within defined timelines.**

(c) Every participating RSMC that is temporarily unable to honour the request should notify CTBTO PTS and the WMO Secretariat as soon as possible, but in any case within 24 hours. The contact officer of the PTS is specified in the email message.

(d) Requests for support from CTBTO PTS are considered confidential and must not be disclosed.

**Products provided by Regional Specialized Meteorological Centres with activity specialization in atmospheric transport and dispersion modelling (backtracking for Comprehensive Nuclear-test-ban Treaty verification support)**

The CTBTO PTS requests support from RSMCs for ATDM (backtracking) products by using an email message with the subject line "====== PTS REQUEST FOR SUPPORT =====" to all RSMCs. This will initiate a response from all RSMCs.

**The designated RSMCs shall:**

**(a) Email back the response form to the responsible officer at PTS within three hours;**

**(b) Conduct standardized backtracking computations according to the specifications listed below for all measurements included in the request email message;**

**(c) Upload the results on a secured FTP server, as defined in the request email message, within 24 hours of reception and according to the format as defined below.**

The specifications for the backtracking are as follows:

– Simulate a release of 1.3 $10^{15}$ Bq of a tracer integrated backward in time (no deposition, no decay) at a constant rate at the point of the station location from surface to 30 m from measurement stop to measurement start.

– Calculate the respective (backward) tracer concentrations in Bq $m^{-3}$ at a global 1° x 1° grid, with an output frequency of three hours, time average of output three hours, from surface to 30 m.

– Simulate backwards in time to the requested end date/time (up to 30 days from issuance of request).

**The PTS shall:**

**(a) Restrict requests to cases of anomalous radionuclide measurements or system tests;**

**(b) Contact the RSMCs in case no confirmation of a request was received within three hours;**

**(c) Conduct regular announced and/or unannounced system tests;**

**(d) Share the results of tests with the other RSMCs at a website;**

**(e) Send a cancellation message of the request for support to RSMCs when an issued request is cancelled.**

The PTS will not request any graphical products or products other than those specified above. Customized end-user products will be produced by the PTS for submission to the national authorities, along with RSMC model output. Measurements and end-user products will not be shared by PTS with RSMCs or WMO Secretariat for reasons of confidentiality.

**REQUEST MAIL MESSAGE FOR SUPPORT SENT OUT BY THE PTS TO WMO RSMCs**

====== PTS REQUEST FOR SUPPORT =====
Date issued: YYYYMMDD hhmm
Responsible officer: NAME

Point of contact:
NAME
Tel. ……
Fax. ……
name@****.***

Secure website (location/user/password)
---
Download of information:
****://**********
username
Password
---
Data upload:
****://**********
Username
Password
---

For authentication purposes, this mail message is also available
on the website:
****://**********.txt
==========
Source-receptor matrix results are requested for
005
stations
# LON LAT ID Measurement Start/stop time (YYYYMMDD hh)
001 -70.90 -53.10 CLP18 20050328 15 20050329 15
002 -70.90 -53.10 CLP18 20050329 15 20050330 15
003 -71.25 -41.10 ARP03 20050329 12 20050330 12
004 -58.47 -34.54 ARP01 20050329 18 20050330 18
005 -70.90 -53.10 CLP18 20050330 15 20050331 15
==========
Please calculate backward to
YYYYMMDD hh
==========
Please upload data within
24
hours

==RESPONSE FORM==========
=== WMO Centre response form ===
=== Please send back this form ===
=== to the sender of the request as ===
=== soon as possible ===
==========
(x) We will send our contributions within the time limit (default)
( ) We will send our contributions kkk hours later then the time limit
( ) We got your request but are not able to perform computations
==========
====== PTS REQUEST FOR SUPPORT =====

**CANCELLATION MAIL MESSAGE SENT OUT BY THE PTS TO WMO RSMCs**

====== PTS CANCELS REQUEST FOR SUPPORT =====
Date issued: YYYYMMDD hhmm

**FORMAT OF THE MODEL RESULTS AS DELIVERED BY THE RSMCs**

Line 1: Header line (station longitude, latitude, start of measurement interval (YYYYMMDD hh), end of measurement interval (YYYYMMDD hh), release strength (Bq), number of hours backward, output every "k" hours, time average of output, horizontal grid space in x direction, horizontal grid space in y direction, station name)

Line 2-k: data lines (latitude, longitude, time step number, value)

17.57 59.23 20030106 09 20030107 09 0.13E+16 144 3 3 1.0 1.0 "SEP63"
58.00 15.00 1 0.1209120E-01
59.00 15.00 1 0.6446140E-01
60.00 15.00 1 0.3212887E-02
58.00 16.00 1 0.2649441E+01
59.00 16.00 1 0.9029172E+01
60.00 16.00 1 0.7616042E-01
58.00 17.00 1 0.1073919E+02
59.00 17.00 1 0.3082339E+02
60.00 17.00 1 0.1408468E-01
58.00 18.00 1 0.2643455E+00
59.00 18.00 1 0.7357535E+00
58.00 14.00 2 0.7759376E-02
59.00 14.00 2 0.6508716E-01
60.00 14.00 2 0.2403110E-01
61.00 14.00 2 0.6662516E-03
62.00 14.00 2 0.2838572E-04
58.00 15.00 2 0.1015775E+01
59.00 15.00 2 0.5030275E+01
60.00 15.00 2 0.8239139E+00
61.00 15.00 2 0.6797127E-02
62.00 15.00 2 0.6521360E-04
58.00 16.00 2 0.8181147E+01
59.00 16.00 2 0.2503959E+02
60.00 16.00 2 0.5937406E+00
61.00 16.00 2 0.1784474E-02
58.00 17.00 2 0.1403705E+02
59.00 17.00 2 0.3715418E+02
60.00 17.00 2 0.1306086E-01
58.00 18.00 2 0.2718492E+00
59.00 18.00 2 0.7555131E+00
……

# APPENDIX 2.2.28. ACTIVATION OF SUPPORT FOR NON-NUCLEAR ENVIRONMENTAL 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 emergency response activities includes: smoke from large fires, emissions from volcanic eruptions (excluding those service arrangements covered by 2.2.2.10 – Volcano watch services for international air navigation) and large chemical releases. Atmospheric sandstorm and duststorm forecasts are covered under activity 2.2.2.9.

National Meteorological and Hydrological Services may request RSMC support for releases that have the potential for large-scale (that is, 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.

**National Meteorological and Hydrological Services 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;**

- **Send, by email (preferred) or fax, the completed form in Appendix 2.2.32 to the appropriate RSMC; if the RSMC has not confirmed reception within 20 minutes, the requester shall contact the RSMC by phone or email;**

- **Provide the RSMCs with the essential information specified on the request form;**

- **Distribute the products within their State or territory 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 2.2.29. MANDATORY LIST OF NON-NUCLEAR ENVIRONMENTAL EMERGENCY RESPONSE

The following list of mandatory non-nuclear responses shall be provided:

- Smoke from forest, grass or peat fires (default values in Appendix 2.2.30 shall be used for source parameters not provided):
  - Forecast duration 36 hours;
  - Relative concentrations from the surface to 200 m;[1]
  - Images at intervals of one, three or six 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 from the surface to 200 m;[1]
  - Images at intervals of one or three 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 from the surface to 100 m;[1]
  - Images at intervals of one or three hours;[2]
  - Contouring to be determined based on specifics of the event or the request.

All products shall be displayed following the general rules, as listed in Attachment 2.2.5.

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

---

[1] Absolute concentrations may be provided if an estimated or actual value of the total mass released or mass release rate is given.

[2] Additional products (for example, GIS-format files) may be provided to requesting NMHSs if possible.

## APPENDIX 2.2.30. DEFAULT EMISSION SOURCE PARAMETERS (NON-NUCLEAR)

| *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, the date and time of reception of the request will be used.

## APPENDIX 2.2.31. CHARACTERISTICS OF ATMOSPHERIC TRANSPORT AND DISPERSION MODELLING SYSTEMS (NON-NUCLEAR)

The designated centres will document and maintain in Documentation on RSMC Support for Environmental Emergency Response (WMO/TD-No. 778) on the WMO Emergency Response Activities website up-to-date information on the characteristics of their ATDM system. The information will contain at a minimum:

For ATDM:

- Name of model(s) and type (Lagrangian, Eulerian);
- Horizontal grid 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 NWP data used for ATDM:

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

# APPENDIX 2.2.32. REQUEST FORM TO ACTIVATE REGIONAL SPECIALIZED METEOROLOGICAL CENTRE SUPPORT (NON-NUCLEAR)

## Environmental emergency response request for WMO Regional Specialized Meteorological Centre support by authorized person[1]

(a) This form should be sent by email to an operational contact of the appropriate RSMC when support is needed for releases that have the potential for large-scale (that is, 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.

(b) If the RSMC does not confirm the reception of the request within 20 minutes, the requester will telephone the RSMC.

(c) The RSMC will make available its products as soon as possible but usually within two hours. An email will be sent by the RSMC with information on where to access the products. The requester will confirm reception by email.

**Date and time of request:** .....

**(a) Mandatory information:**

– Status (exercise/event):.....

– Name, title, organization/agency, country, phone number and email of the requester:

.....

.....

.....

– Select type of event and provide brief description or details:

- ..... Forest, grass or peat fire
- ..... Chemical incident
- ..... Industrial fire/smoke
- ..... Other

.....

.....

.....

.....

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

– Date and start time of release (DD/MM/YYYY and UTC): .....

– Location of release (as accurately as possible) in order of preference:

(i) Geographic coordinates (decimal degrees or degrees, minutes and seconds):

| | |
|---|---|
| Latitude (specify N or S) | ..... |
| Longitude (specify E or W) | ..... |

(ii) (If appropriate) address, city, country:

.....

.....

**(b)** **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 (for example, top of smoke plume):

.....

.....

– 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 2.2.33. MANDATORY ATMOSPHERIC SANDSTORM AND DUSTSTORM PRODUCTS TO BE MADE AVAILABLE ON THE WMO INFORMATION SYSTEM

**Forecasts, with an appropriate uncertainty information statement, shall include the following set of variables:**

- **Dust load (kg $m^{-2}$);**
- **Dust concentration at the surface (µg $m^{-3}$);**
- **Dust optical depth at 550 (nm);**
- **Three-hour accumulated dry and wet deposition (kg $m^{-2}$).**

**Forecasts shall cover the period from the starting forecast time (0000 and/or 1200 UTC) up to a forecast time of at least 72 hours, with an output frequency of at least three hours. They shall cover the whole designated area. The horizontal resolution shall be finer than 0.5° x 0.5°.**

**Forecasts shall be disseminated through WIS and provided on a web portal in pictorial form not later than 12 hours after the starting forecast time.**

An explanatory note should be published on the web portal when operations are stopped due to technical problems.

# ATTACHMENT 2.2.5. USER INTERPRETATION GUIDE FOR NON-NUCLEAR ATMOSPHERIC TRANSPORT AND DISPERSION MODELLING PRODUCTS PROVIDED BY REGIONAL SPECIALIZED METEOROLOGICAL CENTRES

The designated centres will make available in Documentation on RSMC Support for Environmental Emergency Response (WMO/TD-No. 778) on the WMO Emergency Response Activities website an interpretation guide for users.

**General rules for displaying results:**

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 (shorelines, country borders, rivers, and the like, 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 and time (UTC) of release, and the meteorological model initialization date and 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 a requested service.

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) Units of concentration;

(e) In addition, charts should specify:

  (i) “Surface to xxx-metre layer concentrations”, where xxx depends on the pollutant type, and whether the default source is used;

  (ii) “Results based on default initial values”;

(f) 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;

(g) Indicate the start and end date and time (UTC).

Specific guidelines for back-trajectory maps:

(a) Distinguish each trajectory (levels chosen will depend on the 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 email or enable retrieval by the NMHS from an RSMC password-protected designated website. Standard products in the ITU-T T.4 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.

# PART III. CURRENT DESIGNATED GLOBAL DATA-PROCESSING AND FORECASTING SYSTEM CENTRES

## LOCATION OF WORLD METEOROLOGICAL CENTRES, AND REGIONAL SPECIALIZED METEOROLOGICAL CENTRES WITH GEOGRAPHICAL SPECIALIZATION OR ACTIVITY SPECIALIZATION

1. **The World Meteorological Centres are located at:**

- Beijing
- ECMWF
- Exeter
- Melbourne (southern hemisphere only)
- Montreal
- Moscow
- Tokyo
- Washington

2. **The Regional Specialized Meteorological Centres with geographical specialization are located at:**

Algiers
Beijing
Brasilia
Buenos Aires
Cairo
Dakar
Darwin
Exeter
Jeddah
Khabarovsk
Melbourne
Miami
Montreal
Moscow
Nairobi
New Delhi
Novosibirsk
Offenbach
Pretoria
Rome
Tashkent
Tokyo
Tunis/Casablanca
Washington
Wellington

Broadened RSMC functions:

- Offenbach – Provision of ultraviolet-index forecasts for Region VI (Europe)

3. **General purpose activities**

Provision of global deterministic numerical weather prediction:

RSMC Beijing
RSMC Exeter
RSMC ECMWF
RSMC Montreal
RSMC Moscow
RSMC Tokyo
RSMC Washington

Provision of limited area deterministic weather prediction:

RSMC Khabarovsk
RSMC Moscow
RSMC Novosibirsk
RSMC Offenbach
RSMC Pretoria

RSMC Rome

Provision of global ensemble numerical weather prediction:

RSMC Beijing
RSMC Exeter
RSMC ECMWF
RSMC Montreal
RSMC Moscow
RSMC Tokyo

Provision of limited area ensemble numerical prediction:

RSMC Offenbach
RSMC Rome

Provision of nowcasting:

RSMC Offenbach
RSMC Tokyo

Global Producing Centres for long-range prediction:

GPC Beijing
GPC CPTEC (Brazil)
GPC ECMWF
GPC Exeter
GPC Melbourne
GPC Montreal
GPC Moscow
GPC Offenbach
GPC Pretoria
GPC Seoul
GPC Tokyo
GPC Toulouse
GPC Washington

Acronyms not previously defined : CPTEC – Centro de Previsão de Tempo e Estudos Climáticos; ECMWF – European Centre for Medium-range Weather Forecasts.

4. **The Regional Specialized Meteorological Centres for specialized activities are the following:**

Tropical cyclone forecasting, including marine-related hazards:

– RSMC Honolulu – Hurricane centre
– RSMC La Réunion – Tropical cyclone centre
– RSMC Nadi – Tropical cyclone centre
– RSMC New Delhi – Tropical cyclone centre
– RSMC Miami – Hurricane centre
– RSMC Tokyo – Typhoon centre

Provision of atmospheric sandstorm and duststorm forecasts:

– RSMC-ASDF Barcelona
– RSMC-ASDF Beijing (RA II)

Provision of atmospheric transport and dispersion modelling (for environmental emergency response and/or backtracking):

RSMC Beijing
RSMC Exeter
RSMC Melbourne
RSMC Montreal
RSMC Obninsk
RSMC Offenbach (backtracking only)
RSMC Tokyo
RSMC Toulouse
RSMC Vienna (backtracking only)
RSMC Washington

Provision of volcano watch services for international air navigation:

– RSMC Tokyo