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THE ROLE OF NMHSs IN EER

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Summary and purpose of document

NMHSs are a critical component of the total EER system as managed and coordinated by WMO. The NMHS role in an emergency includes: monitoring alert pathways, defining source characteristics, notifying various agencies and other meteorological centres at onset, collating and interpreting meteorological data, including ATM products, and disseminating meteorological guidance to the local and national agencies. In addition, there are a number of ongoing maintenance functions necessary for ensuring the NMHS remains in a state of readiness for an environmental emergency.

1. Introduction

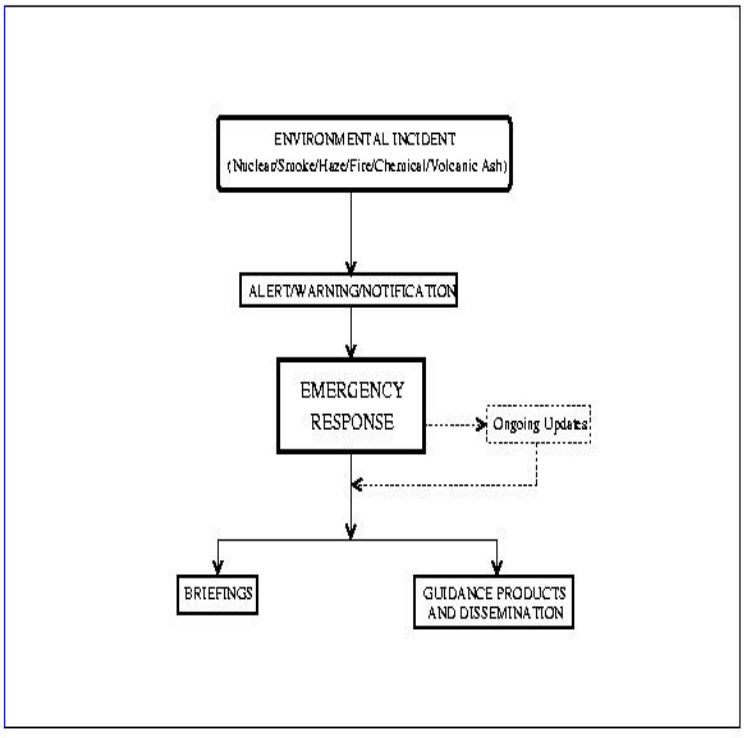
Environmental emergencies, whether they be the result of releases into the atmosphere from nuclear accidents, forest fires, chemical explosions or volcanic eruptions, tend to be relatively unexpected or ad-hoc in character. This feature has the potential to generate a certain degree of confusion at their onset resulting in unacceptable delays in the preparation of a meaningful response from the various authorities. Although the response time is critical when considering human health and safety matters, a delicate balance needs to be maintained between accuracy and speed of response (Bacon 2000). The timeliness of the response can be improved through ongoing development and formalization of procedures, managed by WMO, to integrate and coordinate the capabilities and facilities of National Meteorological and Hydrological Services (NMHSs), Specialized Centres with areas of interest (eg ASMC) and Regional Specialised Meteorological Centres (RSMCs) for Environmental Emergency Response (EER). The following attempts to focus on the critical role played by the NMHSs in helping to ensure an efficient and effective response.

2. The Integral Role of NMHSs in Environmental Emergency Response

When an environmental emergency incident occurs, it usually initiates an alert, or warning, of some description which, in turn, eventually prompts a response from relevant agencies, or authorities, within the country (or countries) affected (Figure 1). The NMHS's overall role includes both maintaining an alert watch for incidents (within and outside their area of responsibility) and making a suitable response in the form of providing guidance products and meteorological briefings, where appropriate. Depending on the longevity of the incident, the response may be ongoing for a considerable time with regular updating of products and briefings.

These general functions, along with the unexpectedness of emergency incidents, highlight the importance of a 24-hour a day operational real-time capacity in the NMHSs for a quick and meaningful response. There may also be a need to define extra duties and tasks for operational shift staff that are specific to an environmental emergency situation.

Figure 1. General schema for Environmental Emergency Response

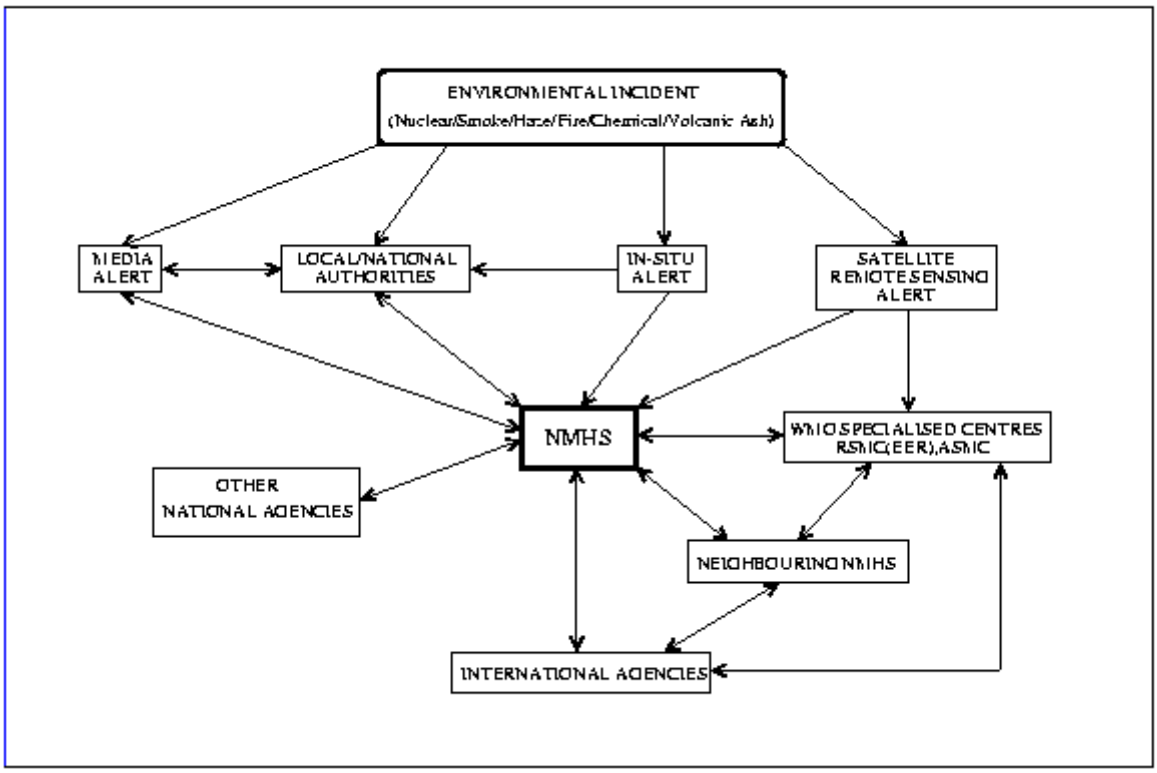


3. Monitoring of Alert Pathways by NMHSs

There are a number of pathways, or communication channels, by which an NMHS may be alerted to the onset of an environmental emergency incident (Figure 2). For the case of an incident within their area of responsibility, these may include “word-of-mouth” (eg by way of the media or the various local and national authorities) or those from more direct and objective origins (eg in-situ monitoring or satellite remote sensing - from, say, AVHRR, geostationary or TOMS data). The initial notification of an incident could also come from outside the NMHS’s area of responsibility - from, say, other NMHSs or the RSMCs.

In the case of a real emergency, there may be an inundation of alerts which can quickly confuse the situation and may also clog up, or saturate, the various communication lines. (The examination of the adequacy of the communication lines needs to be one of the ongoing functions of the NMHSs in non-emergency times.) It is noted that some alert messages may contain information that is more useful (eg source details) than others, leading to the need for continually prioritising the alert messages from the different pathways as they arrive.

Figure 2. General alerting pathways



4. NMHS Response

The response by the NMHS will vary according to whether environmental emergency incident and its effects occur within its area of responsibility or outside it.

4.1 Environmental Incident within area of responsibility

Initially on receiving an alert message, or a request for action, the NMHS should send (if appropriate) an acknowledgement of receipt to the originating body (Figure 3). For later evaluation, it may also be advisable to start and maintain a log of events as they happen, during the emergency. A notification of the onset of the emergency should then be sent out to RSMCs, neighbouring NMHSs and various agencies alerting them and seeking their support. This notification should contain specific details about the source or the nature of the release. The type of source information required can be obtained by answering the basic questions:"Where? When? What? How much?" (Bacon 2000). More specifically, an exact location in terms of latitude/longitude, the time of release (UTC) and its duration (which may be ongoing), the nature of the release - the emission particle type and a spatial description of the source (eg point, line areal, mobile) and an estimate of the quantity of release (if at all known) are all invaluable details. However, if this information is not available, then the NMHS should take steps to gather it and send out further notifications as it becomes available. The NMHS then needs to start accessing the most recently available meteorological observations, analyses and forecasts and, in addition, acquire as much information as possible about the terrain and local meteorological effects that may be of use for the environs of the release.

In many cases the NMHSs will have the capability of generating much, if not all, of the necessary guidance material. However, support is available (on request) from the RSMCs for EER. This support would usually provide basic meteorological products and transport model forecast guidance A plain language summary of the relevant synoptic situation and comments on the transport products is also part of the basic RSMC support, in the form of a 'Joint Statement'.

The NMHS then needs to prepare and disseminate the relevant meteorological guidance information and give meteorological briefings to their local agencies. Once the initial set of products has been distributed, it is then important that further development of the episode be continually monitored with the subsequent issue of updated products. Finally, when the episode has finished, it is also important that some notification be sent out stating the same to save an unnecessary waste of resources.

4.2 Environmental Incident and Effects outside area of responsibility

If the emergency incident and its effects are located outside the area of responsibility of the NMHS, then it may happen that the first alert or notification may come from one of the RSMCs with responsibility for EER. In this case it may be just a matter of acknowledging receipt of the various notifications and products from the RSMC(s) and being aware of the incident in case of any queries by national agencies.

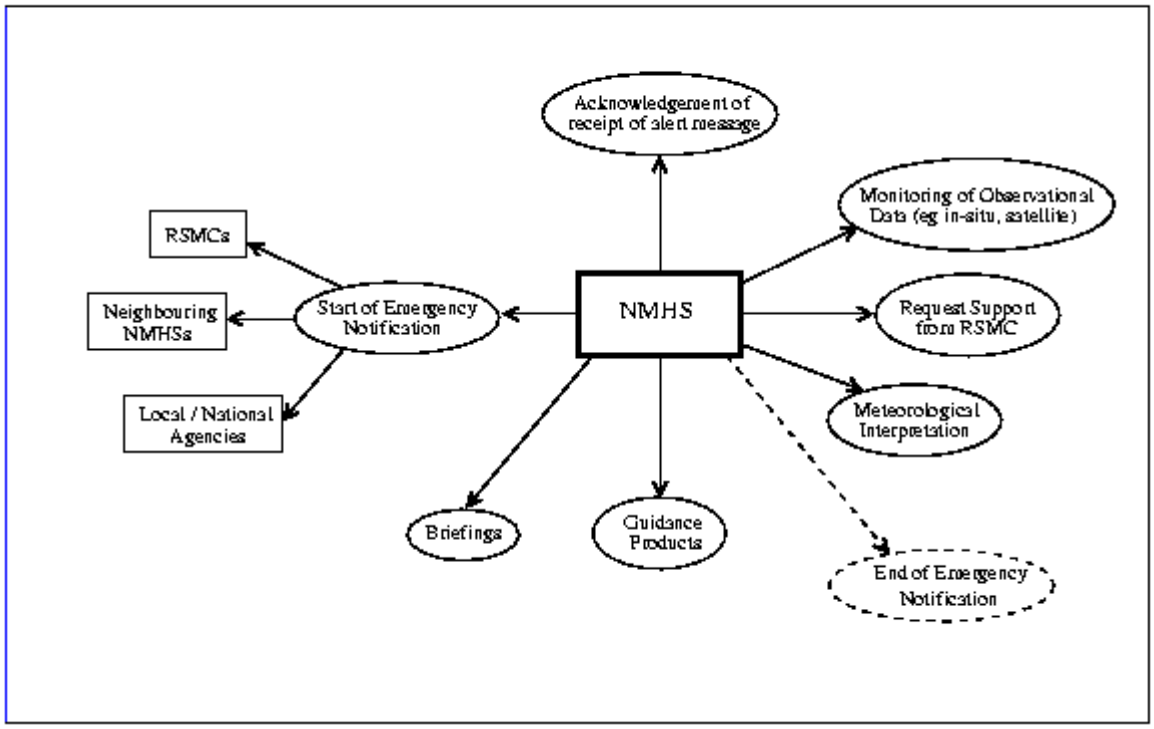
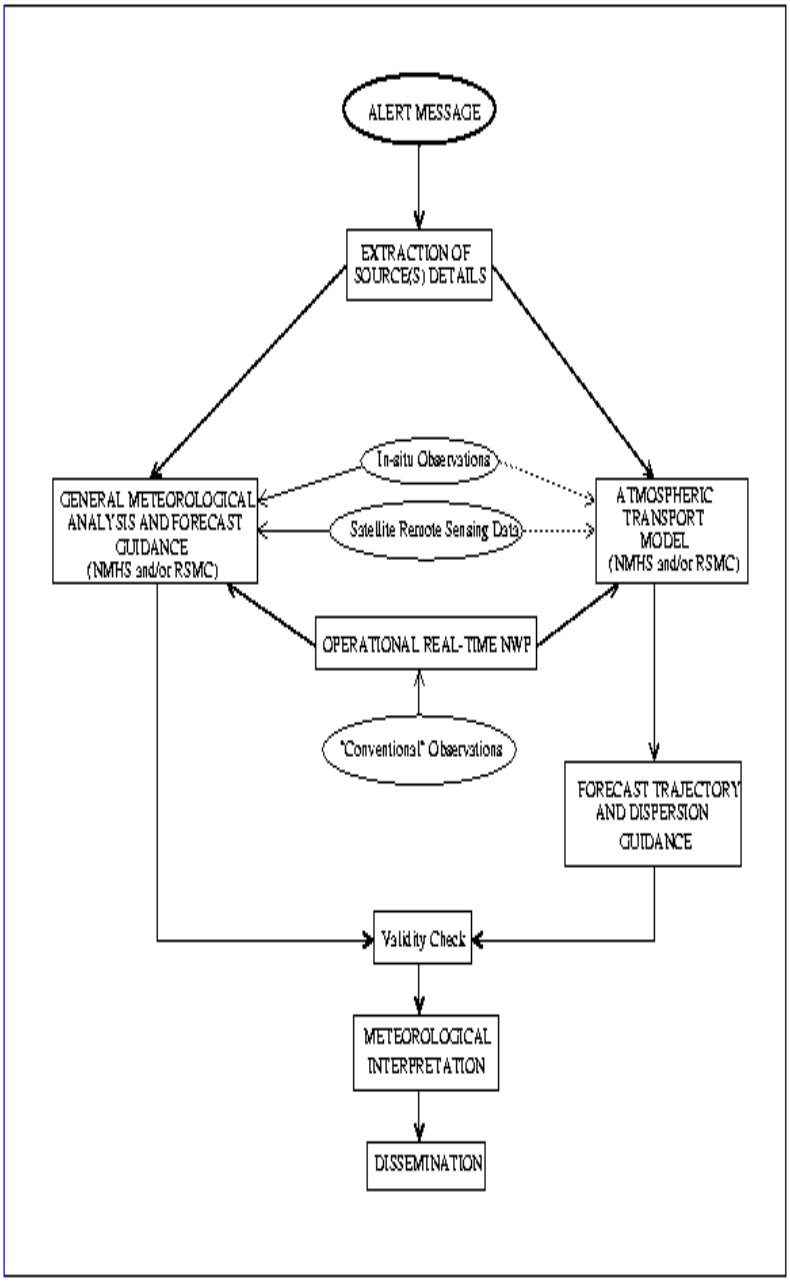


Figure 3. Basic response by NMHS on receipt of alert message

5. Product Generation

When an alert message is received by a NMHS, a number of procedures should spring into action to generate, request or collect the necessary products. As already mentioned, specific information about the location and type of incident is critical for the generation of meaningful products. The types of products can perhaps be categorised into those of a more general meteorological type and those associate with the output from an Atmospheric Transport Model (Figure 4). The former may include real-time processed satellite imagery and data (depicting, for eg, hot spots and plume extent), displays of in-situ measurements, various monitoring products (eg AQIs and PMs) and analysed and forecast wind and precipitation fields centred on the source location(s). The more specific forecast products, using known details about the source together with input from the latest real-time NWP model run, can be generated using the ATM. Products from the ATM include forecast trajectories and dispersion charts.

Figure 4. Steps involved in the production of guidance material by NMHS.



6. Meteorological Interpretation Role of NMHSs

The interpretation of the available meteorological data is another critical function of the NMHSs. Initially, there may be observational data from various origins that needs to be examined for consistency. Satellite imagery may be used to highlight hot spots and plumes which can help define the extent of the problem. Analysis and forecast products (from NWP systems) need to be checked using local knowledge and expertise about any known limitations in the vicinity of the source. The available ATM products need to be examined bearing in mind the observational data available for the area concerned. Much of this interpretation would be second nature to the operational staff. However, it may become more pertinent in a real emergency.

7. Product Dissemination by NMHSs

A number of different procedures may be used to disseminate the guidance products to the local and national agencies and other NMHSs. These include using fax, the GTS, telex, phone or email (Figure 5). The attachment of 'gif' files to email messages can provide a convenient and efficient dissemination mechanism. Each mechanism has advantages whether it be the reliability or robustness of the communication channels or the types of products that can be sent. In addition, the products can be made available through the web. This may imply that NMHSs maintain their own web page or perhaps have common shared web pages with other NMHSs, in much the same way as some RSMCs are doing at present. Since restricted access may be required for many of the products, there is a necessity for password protection (implying that users are registered) be put in place when setting up web systems. The web has the advantage that it provides on-demand facilities for the various agencies, which may be preferred in an emergency.

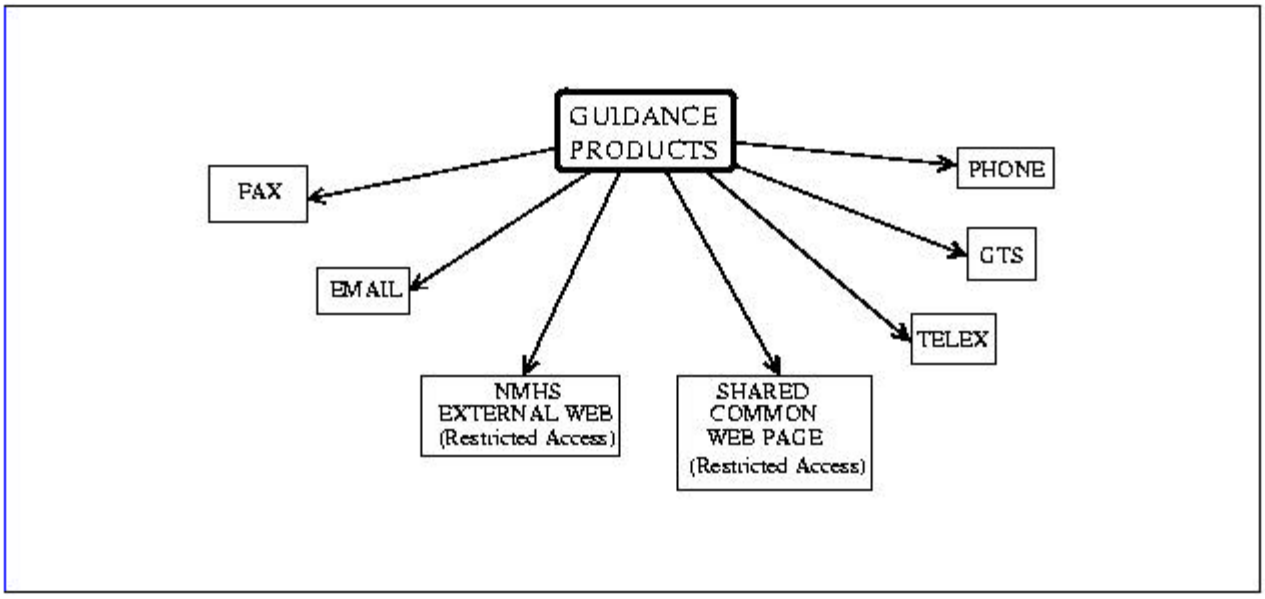


Figure 5. Product dissemination mechanisms.

Associated with each of the dissemination mechanisms, mentioned above, are the intended destinations for the various products which will usually be just the various local and national agencies. These destinations will be incorporated into the dissemination mechanisms in different ways. When using fax, telex or phone, the respective numbers of the various destinations will be required. Email will require an operationally valid address for each of the destinations. As already indicated above, the "destination" for the web products will only be those agencies who are properly registered users. The need for back-up procedures is also emphasised and in most cases can be fairly easily implemented once the basic mechanisms are in place - eg the same products could be faxed and placed on the web. The availability of automatic delivery audits with faxes (showing whether products arived at the destinations successfully) is a useful facility.

8. Briefings provided by NMHSs

During an environmental emergency, there will be a need for many briefings targetting different groups or agencies. Specific information on the (changing) characteristics of the source, already detailed in section 4.1, would provide a basis for any such briefings. Observational data and the various forecast guidance products would also be of great interest. The ATM output (both trajectories and dispersion), provide an ideal pictorial representation of what can be expected. However, all the information needs to be carefully vetted before issue, bearing in mind the particular interest of, and possible use by, the target group. Again, the Joint Statement prepared by the RSMCs, as part of their support, would provide a basis for many of the briefings involving a forecast.

9. System Maintenance by NMHSs - Importance of Ongoing Tests

In order to keep an emergency response system or procedure, within the NMHS, in a state of readiness, it is necessary to keep checking and testing the various components to make sure they are in a satisfactory working state. This is all the more important in the case of a system that has to cater for ad-hoc, and maybe infrequent, events. Internal changes within the NMHSs, such as upgrades and changes to computer operating and NWP systems, may impact on the generation or collation of products. From the dissemination point of view, fax and phone numbers and the various addresses can change. In view of these and other possibilities, it is important that regular tests be carried out.

These tests can vary from just sending out faxes to the various local or national agencies (to check the validity of numbers) to more comprehensive tests whereby various products are exchanged with other centres and are then compared. These tests should be relatively frequent (eg monthly) with different scenarios. Such tests also have the advantage of familiarizing the operational staff with the different procedures eventually leading to greater efficiencies in response. It is important that all test products contain a prominent label saying that they are part of a test - which will distinguish them from those for a real emergency. Again, it is important that messages should be sent out at the conclusion of a test to say that it has officially ended, to save any unnecessary confusion.

10. Standardisation of Output from NMHS

There is a need to standardise the various output from NMHSs during an environmental emergency. Standardisation can often result in a quicker response, since valuable time will not be lost when trying to glean the required information. Standards need to be developed carefully, and then basically adhered to, so that all the output will be generally understandable and useful. Initially, standards would be set up internally within each NMHS and then later there could be broader standardization among the different NMHSs.

Some basic examples of standards or conventions, that may be followed already, include: (a) cover sheets for faxes specifying issuing centre, issued date/time (UTC), event specification (eg source location) and the content of following sheets; (b) specifying the format of any attachments in emails; (c) email notifications of web updates (and password changes, if relevant); (d) the use of acknowledgements (often these will save confusion when trying to ascertain whether products have reached their destination). Other standards may define the basic set of meteorological analysis and forecast charts (both respect to fields and prognosis intervals) that should be produced in a given emergency. However, having said all this and depending on how an environmental emergency evolves, the use of additional non-standard output may also be a necessity.

11. Conclusion

The foregoing discussion highlights the important role played by the NMHSs in Environmental Emergency Response. The following is an attempt to summarise this role by enumerating the main functions and tasks.

11.1 General Functions:

11.1.1 Maintain an alert watch for environmental incidents both within and outside area of responsibility.
11.1.2 Make a suitable response by preparing and issuing products and briefings.
11.1.3 Make regular updates as new data becomes available.
11.1.4 Maintain a full operational capacity.

11.2 Specific Tasks during an emergency:

11.2.1 Send acknowledgement of alert message to originating body (if appropriate).
11.2.2 Start monitoring alert pathways (media, in-situ, satellite remote sensing).
11.2.3 Prioritise alert messages according to usefulness of content.
11.2.4 Send notification of onset of emergency to RSMCs, neighboring NMHSs and agencies, giving known details of source and seeking support (where appropriate).
11.2.5 Start and maintain a log of events.
11.2.6 Access and collate latest meteorological observations, analyses, forecasts and satellite imagery.
11.2.7 Carry out Quality Control on available meteorological data.
11.2.8 Acquire more information about terrain and local meteorological effects in vicinity of source(s).
11.2.9 Collate any RSMC ATM, and other output, received.
11.2.10 Extract and update source details.
11.2.11 Send out notifications with any new source details.
11.2.12 Interpret meteorological data (observations, satellite imagery, analyses, forecasts and ATM products).
11.2.13 Disseminate products via appropriate means (fax, GTS,telex, phone, mail or web).
11.2.14 Prepare and give briefings.
11.2.15 Repeat previous tasks as necessary until end of emergency.
11.2.16 Send “End of Emergency” notification.

11.3 Ongoing Tasks:

11.3.1 Maintain system, or procedures, allowing for changes to communication links, computer hardware or software.
11.3.2 Maintain addresses and numbers of product destinations.
11.3.3 Maintain password protection for web products.
11.3.4 Carry out regular testing of all components of system and procedures.
11.3.5 Provide feedback to RSMCs on supporting products.
11.3.6 Examine adequacy of communication lines.
11.3.7 Standardise output.

12. Reference

Bacon D.P.: “Real Time Modeling and Emergency Response Forecast.” pp.171-192, Mesoscale Atmospheric Dispersion. Ed: Z. Boybeyi. WIT Press, Southhampton, 2000.

13. Acronyms used

AQI - Air Quality Index.
ASMC - The ASEAN Specialised Meteorological Centre, Singapore. (A centre with WMO geographical specialisation).
ATM - Atmospheric Transport Model.
AVHRR - Advanced Very High Resolution Radiometer.
EER - Environmental Emergency Response
GTS - Global Telecommunications System (WMO).
NMHS - National Meteorological and Hydrological Service.
NWP - Numerical Weather Prediction.
PM - Particulate Matter (particle sizes in microns).
RSMC (EER) - Regional Specialised Meteorological Centre (with Environmental Emergency Response specialisation). Designated centres include: Beijing, Bracknell, Melbourne, Montreal, Obninsk, Tokyo, Toulouse and Washington.
TOMS - Total Ozone Mapping Spectrometer.