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Section 5 Annex 8

Adopted at CBS-Ext.06

DEFINITION OF REQUIREMENTS CONCERNING CHEMICAL INCIDENTS

1. In a broad discussion on meteorological requirements aspects related to chemical incidents it was noted that there was a need to have:
   (a) Representative meteorological data reflecting the characteristic atmospheric conditions at and in the vicinity of the incident site;
   (b) Data on evolution of atmospheric conditions within the incident area;
   (c) Chemical information data base;
   (d) Emergency planning and response information including meteorological support aspects;
   (e) Expertise at various organizational levels, (e.g. regional to the local level), to provide model output interpretation and/or run very simple models on site to support rapid response;
   (f) Dispersion model facilities;
   (g) Good communication facilities for rapid receipt of notification and dissemination of results.

2. The above requirements should be considered with a specific focus on:
   (a) Data (meteorological observations and incident related);
   (b) Tools including models and visualization facilities;
   (c) Expertise.

2.1 Data
As input to dispersion models and for understanding and evaluating the dispersion processes involved, data that characterize the atmospheric conditions, especially the local boundary layer and turbulence regime, of the site normally should include:
   (a) Wind speed at 10 m;
   (b) Wind direction and the directional fluctuations (σ_θ);
   (c) Atmospheric stability (e.g. Pasquil category);
   (d) Height of atmospheric boundary layer;
   (e) Humidity at surface;
   (f) Precipitation — occurrence and type;
   (g) Surface temperature;
   (h) Boundary layer profile (temperature, humidity, wind);
   (i) Prevailing climatological conditions and dispersion climatology.

2.2 There are a number of approaches to obtain the characteristic atmospheric conditions. These may include making arrangements to have deployable mobile weather stations, or to establish standard observing facilities installed and operated at the chemical plant sites and to provide such data routinely from the site. Another approach in countries with dense networks and running mesoscale atmospheric models, is that their outputs could be used as input to dispersion models. Mesoscale model output could also serve to indicate the evolution of atmospheric conditions within the incident area.

2.3 To efficiently run such a model and provide outputs for rapid guidance, there is a need to have an up-to-date integrated system of other related data and information prepared and selectable to include for example, chemical information data base, possible accident scenarios, local surface cover characteristics, and related response planning information. These may include:
   (a) Chemical inventories (e.g. types and quantities, geographically referenced to facilities, and transportation corridors);
   (b) Type of possible release (fixed facility, mobile tanks, explosive, flammable, etc);
   (c) Physical characteristics (mapped) of the incident site and nearby or local areas (e.g. out to 50 km);

(d) Action levels (e.g. Immediate Danger to Life and Health (IDLH) or Lethal Dose (LD50)) that are established in emergency response plans and linked to activating specific emergency response activities. These may be defined quite differently from jurisdiction to jurisdiction.

2.4 The available information on chemical information data base and national emergency planning include the US Environmental Protection Agency (EPA) Computer-Aided Management of Emergency Operations CAMEO: a computer-based planning and response system designed to help emergency planners and responders at regional and local level for, and safely handle, chemical hazards does address these issues. CAMEO operates in two computer environments, IBM compatibles and Apple Macintosh. It contains chemical specific response information, a planning module for assisting the risk posed by extremely hazardous chemicals, an atmospheric dispersion model to assist in evaluating release scenarios, and a series of related data bases for storing and retrieving information required for planning and response (the latter to serve as place holders for local information). CAMEO information may be displayed on maps to assess the relative risk presented by various chemical release scenarios and determine response actions to chemical emergencies.

2.5 Tools

Major tools include atmospheric boundary layer and dispersion models for domains less or equal to 50km. These should assimilate all available local data for diagnostic and prediction purposes. Various factors may come into play in the choice of a suitable model to be run:

(a) Nature and scale of incident (chemical species, emission conditions, surrounding terrain e.g. open field, urban setting, etc);
(b) Treatment of different dispersion regimes, e.g. heavy gas, passive tracer, or buoyant plume (explosion, fires);
(c) Nature of source (chemical release scenario), depending on whether it is a facility or transport incident, or different source term modelling (e.g. jets, pools, flashing liquid) to provide input for specific dispersion model;
(d) Input data requirements (some models will require extensive data sets); timeliness in receiving input data and turn-around time of running models will constrain the possible support to response, perhaps limiting response options to only major incidents;
(e) In details, new technologies continue to emerge.

2.6 Several NMSs operate EER procedures and models in support of chemical incidents. These models may be:

(a) Empirical ones informed by basic meteorological conditions such as wind velocity, vertical stability, existence of precipitation etc.;
(b) Gaussian models of passive dispersion are easy to run on PCs, require little input data (wind and vertical stability) but are of limited applications;
(c) Integral models of heavy gas dispersion may also be run quickly and efficiently on PCs, and are applicable to a range of chemical releases;
(d) Complex, time dependent, three-dimensional, non-homogeneous models are difficult and expensive to operate in real-time. However, they may be used for scenario simulation of the pollution around a potentially hazardous site, taking into account the small-scale features of the topography. The focus of this application is examining worst cast scenarios for prospective of inputs. It is necessary to run the models on a selected sample of worst case characteristic meteorological condition for each site with due consideration for worst case impacts. Such a catalogue of dangerous areas corresponding to the worse case meteorological situation could be useful in order to determine areas of vulnerability depending on worst case meteorological conditions;
(e) Model intercomparison and validation against observational data (e.g. from field trials) contributes to the understanding of the applicability of the various models.

2.7 Assimilation and application of the output information will require:

(a) Visualization facilities for estimating hazardous zones from model output (e.g. scalable map size, zoom, pan, sections, animation, overlays, etc.);
(b) Geographical information system facilities for detailed interpretation of local meteorological effects on the movement and dispersion of chemicals and aiding in communicating output results using geographical references;

(c) Coupling with established action levels for hazards related decision making.

2.8 Expertise

The meteorological expertise required include expert knowledge and information related to the dispersion models and dispersion processes with a view to advising facility operators on meteorological data measurement systems and on implementation and operation of local dispersion models. This also includes:

(a) Selecting and operating suitable models;

(b) Assessing quality and suitability of model results in the context of specific incidents.