

# Web GIS for Emergency Planning and Response

*Disasters have always posed a serious threat to human life, be it natural disasters like earthquakes, cyclones etc. or manmade disasters like chemical accidents, chemical/biological war, etc. With rapid industrialization, usage of chemicals for industrial, commercial and domestic purposes has inter-alia increased their storage, production, transportation and handling, leading to increased number of serious chemical accidents affecting surrounding communities in a short span of time and mostly without warning. Trauma of Bhopal tragedy is still fresh in our memories. Therefore, there is a pressing need to understand the potential of chemical emergencies and develop tools for emergency planning and response to minimize the damage in case of any eventuality.*



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Ministry of Environment and Forests (MoEF), government of India, which is the nodal ministry for management of hazardous chemicals, has made tremendous efforts to minimize chemical accidents and to improve emergency preparedness. The project “GIS based Emergency Planning and Response System (GEPR)”, sponsored by Ministry of Environment & Forests, is an important step in this direction.

## The Product

GEPR has been developed to assist the district administration, Major Accident hazard (MAH) units in emergency planning and response. It is a unique, first of its kind approach and envisages developing a comprehensive web based GIS application with database of MAH units, hazardous chemicals stored, and resources available to combat emergency.

GEPR is focused on chemical accidents arising out of MAH units. Chemical accidents can be broadly categorized as resulting in fire, explosion and toxic release. Other factors such as ignition source, over-pressurization, meteorological conditions, etc also play an important role. With the help of computer simulation models, it is possible to predict the area that may be affected under different emergency scenarios. Further, to assess the damage and

carry out emergency planning and response exercise, it is essential to overlay the outcome on area map having features such as other industries, residential areas, schools, markets, road, rail, etc. The resources required such as fire and spill control, medical aid, etc. to combat the emergency situation arising out of chemical accident, their location and access to site of accident also needs to be plotted. All of the above requirements have been incorporated in the GEPR package to make it a versatile tool for chemical emergency management.



*Sh. Sanjay S Gahlout, DDG NIC is receiving memento from Sh. S. K. Saxena, DG FASLI at CIDM-2010 conference.*

Latest information was collected from Directorate of Factories to identify MAH industries. Data on each MAH industry was collected through a well-designed questionnaire. Data collected pertain to chemical data type of chemicals, quantities, storage containers, storage conditions, etc. and response data PPEs, medical facilities, fire fighting facilities, vehicles, etc. for each MAH unit separately. Data was collected for “First Responders” and “Sensitive Area” district wise. First Responders

include Police, Fire Service and Medical Service. Relevant data was collected with respect to contact information, facilities available to combat chemical emergencies, etc. such as fire tenders, BA sets, etc. with fire department, burn and chemical poisoning facilities with hospitals, etc.

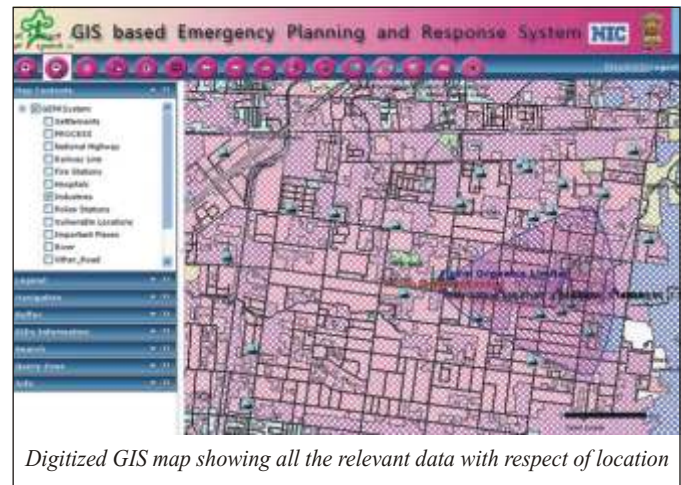
In addition, Field data collected with GPS pertaining to location of MAH industries and first responders and other sensitive areas have been superimposed on base maps. Customization of districts maps has been done to get seamless maps of industrial cluster with MAH industries along with MCL scenarios, police stations, fire stations, hospitals and venerable locations. Based on the MCL scenarios computer modeling has been done using ALOHA and ARCHIE. Outcome is made compatible to complete software package.

Customized software is developed, that displays relevant data with respect of location of MAH units, first responders, chemical and response data, possible accident scenarios, hazard zone under each scenario, etc. User can customize the view, Hazard zone in case of toxic scenarios can be viewed with respect to user input wind direction, fire/explosion scenarios shall be depicted as circular buffer zone.

The fourteen states covered in the project are Gujarat, Maharashtra, Tamil Nadu, Andhra Pradesh, Delhi, Punjab, Haryana, Uttar Pradesh, Rajasthan, Madhya Pradesh, West Bengal, Assam, Karnataka and Kerala.

#### Following are some of the main features of GEPR:

- State of the art solution with integrated spatial, non spatial data & chemicals models
- Planning for worst-case scenarios.
- User friendly structure allows rapid zoom on different layers
- Can call up Response Information Data Sheets (RIDS) of hazardous chemicals
- Can calculate contaminant arrival time, affected area and overlay the plume on the base map
- Strong query builder capable for handling dynamic queries



Digitized GIS map showing all the relevant data with respect of location

GEPR comprises digitized maps of the districts and that of the industrial clusters / surroundings comprising the following layers-

- Administrative boundaries
- National Highway
- Rail/ road network
- Settlements
- River/water bodies
- MAH Industries
- First responders
- Accident Scenarios (templates)

The product has been developed in three phases. Phase I and II was developed district wise on stand alone system with Map objects. Based on the feedback received from various end users during workshops and to further improve the product GEPR (phase III) was developed. Phase-III of GEPR is developed using ArcIMS. It has Web based GIS Technology for easy implementation and updating of required non-spatial data. High Resolution Mapping i.e. Quickbird data is used and enhanced modeling features like Process hazards have also been added on pilot basis.

The workshop for GEPR (Phase III) was conducted in April 2010 at Pune and it was highly appreciated by the authorities. The project needs to be expanded to cover

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