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Shandong Environmental Protection Agency - Intergraph: Shandong Environmental Emergency Response System - Feasibility Study (SEERS-FS)
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FINAL REPORT

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1 Kickoff Report

1.1 Executive Summary

Intergraph Inc. of Huntsville, Alabama, USA is working with the Shandong Environmental Protection Bureau (SEPB) located in Shandong Province headquartered in Jinan, China to develop a Feasibility Study for the Shandong Environmental Emergency Response System Project. The Feasibility Study is sponsored by U.S. Trade and Development Agency (USTDA). SEPB is seeking to build a real-time environmental emergency response and management system to better protect the Shandong environment and populace by reducing the threat from environmental pollutants, accidents, and disasters. Using a state-of-the-art communication network and an early warning component, the system is expected to rapidly identify environment threats in real-time alerting the proper authorities and stakeholders. In addition, the plan is for the system to incorporate a comprehensive decision support toolbox capability assisting emergency environmental response decision makers to make effective decisions and mitigate risks during, before and after an environmental crisis.

The feasibility study and subsequent project aligns to China's 12th Five Year Plan as China moves to combat environmental degradation due to years of rapid economic and industrial growth. This rapid growth has led to rising pollution threatening the economy, ecology, and people's health along with a tremendous price tag. In order to protect the environment, China has increased its environmental clean-up and pollution control spending to over $95 billion over the next five years. These environmental hazards have led to a rising number of environmental incidents that require a complete system and method or a "total solution" to quickly recognize the threat and to rapidly respond to them. SEPB has undertaken this feasibility study to achieve SEBP's objectives and goals, determine the best approach to this for the problem, and to provide a blueprint for the full scale project.

1.2 Economic Growth and the Environment - China

As China is grown at a rapid economic pace the last two decades, it has presented its share of environmental challenges. China's economy is on a historic run, posting a succession of double-digit growth rates, but pollution has become a major concern. The expansion of heavy industry and urbanization in continuing as China moves into its most robust stage of its industrial revolution. This has led to overall environmental degradation as pollution continues to be a major problem all over China in the air, water, and land. The Chinese government recognizes the problems and have made environmental sustainability and pollution reduction major goals of its next five year plan. In his equivalent of a State of the Union address this year, Prime Minister Wen Jiabao made 48 references to "environment," "pollution" or "environmental protection." The government has numerical targets for reducing emissions and conserving

energy. Different campaigns have been started to close illegal coal mines and shutter some heavily polluting factories. Major initiatives are under way to develop clean energy sources like solar and wind power.

1.3 Shandong Environmental Protection Agency

The Shandong Environmental Protection Agency headquartered in Jinan, China is responsible for the environmental protection of the province of Shandong China located in the north eastern portion of the country. The province accounts for 1.6% of the total land area of China and is a provincial economic powerhouse with a large population. The province has experienced rapid and sustained development of its economy. During the same time, the province has experienced environmental challenges. The Shandong Environmental Protection Agency (SDEPA) is the governmental agency to take the lead in addressing these environmental concerns.

The agency participates in the drafting of local laws and regulations related environmental protection, the drafting of regulations, the development of environmental protection planning, drafting Shandong's environmental zoning plans, the development of local environmental protection standards, creating benchmarks and technical specifications, producing watershed pollution prevention plans, securing drinking water sources, and other environmental protection activities. SDEPA is the lead coordinating the investigation and handling of major environmental pollution accidents and ecological damage events including early warning, the resolution of cross-regional environmental pollution disputes, pollution prevention and control activities, monitoring of environmental protection, and organizing the province's environmental protection law enforcement inspection activities. SDEPA is also engaged in or is responsible for the following:

- Emission reduction targets
- Pollution Permitting
- Environmental impact assessments
- Environmental pollution control - water, air, soil, noise, light, odor, solid waste, chemicals, motor vehicles
- Ecological protection planning
- Nuclear safety and radiation safety supervision and management
- Environmental protection scientific research
- International environmental cooperation
- Environmental protection education and community outreach

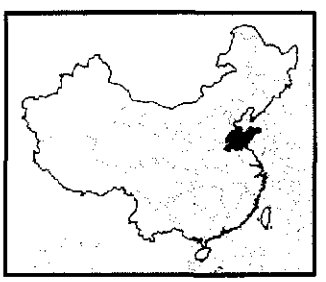


Figure 1Figure 1 Shandong China (macaubulletin.blogspot.com, 2011)

1.4 Project Synopsis

As the China's economy and industry grows, so do the risk of environmental emergencies or disasters. Environmental emergencies or disasters are events that have an adverse impact on the environment. These events can be made-man or natural. Sometimes natural events can create an environmental disaster such as a flood or forest fire. Other times, these events are made-man such as a river chemical spill from a factory. Often the impact of these events can be mitigated or even prevented if event indicators are known ahead of time. Increasingly, Chinese officials are looking to develop a system to manage the environmental emergencies and prevention strategies. In order to address these concerns in Shandong Province, SDEPA has is in the initial phase to develop an "environmental emergency management and response" system.

The system includes providing a real-time environmental emergency early warning and a rapid environmental disaster response capability improving overall public safety and environmental enforcement and compliance. The scale of the system will be massive, connecting over 17 different governmental divisions and over 1,000 known pollution sources. The system consists of monitoring equipment and sensors, the data collection and management of the environmental data, a capable GIS component, an incident response and management system, a dispatching system, a robust decision support component, a communication network and integration strategy, and an emergency response and management element.

1.5 Project Objectives

The objective of the Study is to determine the feasibility of implementing an environmental emergency response system for the Environmental Protection Department of Shandong Province. The Environmental Protection Department of Shandong Province ensures environmental safety and protects public health. In Shandong, heavy industry is an important aspect of economic activity and there is sharp contradiction between rapid industrial growth and the carrying capacity of the environment. Environmental incidents pose significant economic risks and a serious threat to the health and safety of the people and social stability. To systematically address these issues, Shandong Province will establish an environmental early warning and emergency response command system. The system will improve real time data monitoring and analysis of environmental conditions, establish an emergency operations and incident response command center, and deploy an effective early warning capability for environmental hazards. The system will address technical response and information management requirements at the provincial, municipal, and county levels.

Project: Objectives and Goals

- **Goal:** to better protect the Shandong environment and populace by reducing the threat from environmental pollutants, accidents, and disasters
- **Objective:** to create a real-time environmental emergency response and management system

Feasibility Study: Goals and Objectives

- **Goal:** to provide recommendations for the best approach forward for the project
- **Objective:** to assess and evaluate the feasibility of creating the following:
  - Real-time environmental safety and emergency management monitoring and detection network and system
  - Emergency early warning network and system for environmental safety
  - Emergency command and control center

The Shandong EPA seeks to develop:

- A real-time environmental emergency response and management system —
  - State-of-the-art communication network
  - Rapidly identify environment threats
  - Comprehensive decision support capabilities
  - Emergency environmental response and management

The feasibility study will be conducted to adhere to SDEPA's other objectives of the study listed below:

- Speed up the establishment of an environmental safety control system
- Reinforce basic work on industrial environmental safety
- Strengthen environmental safety early warning and monitoring
- Improve responses to "sudden environmental events"
- Put into effect dedicated environmental emergency response human resources and equipment
- Develop and establish command and control platform for provincial environmental safety emergency response management

1.6 Current Project Status - Environmental Emergency Response System (SEERS)

Current technology and applications

- The current personnel uses GIS (ArcGIS), Oracle databases, Windows Server, Unix, and other custom software
- The largest application is a custom build application (co-built by a third party) that is used in the Emergency Center Operations displaying a map of Shandong and its pollution monitoring points
- There are 6 other smaller custom applications ran by different departments
- The current staff of 42 in SDEPA - Information Technology Department

Project Status

- The project is in the early initiate phase.
- They are currently gathering information from companies - - problem polluters

International Cooperation

- SDEPA works with companies and governments from Europe, North America, Taiwan, and Japan

Environmental Issues - Shandong

- Heavy metals pollution is one of Shandong's biggest environmental concerns.
- Four years of improved air quality in Shandong
- Issues at SDEPA - need to look at total operation picture not silo - article to focus on this, need to look at big picture
- Standard procedures across departments
- Stakeholders - education about the environment - with policy

Environmental Safety and Emergency Management Division - (Emergency Department)

- The project is under the SDEPA - Environmental Safety and Emergency Management Division headed by Yuan Cheng Jin - Director
- SDEPA - Emergency Department has four groups
- Inspection
- Response
- Remediation
- The Emergency Department receives information from other departments - the monitoring, air, water, and hazardous waste departments
- The Emergency Department is currently collecting company/industry information and data to support the future project
- The Emergency Department will forward reports to various other departments within SDEPA such as air, water, and hazardous waste departments
- 11 big environmental accidents 2011
- Last several years the emergency department team has worked on some environmental emergencies in other provinces
- Emergency Dept. worked on the Hunan water accident

Project Focus

- Indicated that the major focus would be on environmental incident prevention
- Project needs include a predictive analysis element and decision support capability
- Project needs a standard platform - centralize system to gather data from different sources
- Risk assessment is a major focus
- Currently working on a rick assessment in progress - identify highest risk projects/companies
- Highest risk will be monitored by the province
- 2nd highest risk - city
- 3rd highest risk - county
- Random process
- Inspection process

Project Issues

- National monitoring standards are used to monitor air and water
- Little data is shared between provincial agencies
- Project is environment management not just response.
- Emphasis is on the pre-alarm prevention aspect.
- Need to understand the process flow and possible scenarios.
- Stakeholders - internal departments within SDEAP, EOC China, city and county authorities, MEP
- No formalized requirements - not there yet - early stage
- There is no central database or repository for all of the data; the monitoring center only uses the real-time data, no data from other sources.
- Need the following:
    1. Data management
    2. Command and control
    3. Problem / resolution matrix
    4. Decision support system needed
    5. Best practices identified
    6. SOP
    7. Narrow down high risk of consequence

8. Need to develop risk of consequence in their risk management strategy

- Different levels of government all monitor the environment- cities, province, counties, villages

Monitoring Center - Issues (Needs)

- Increase automated systems; add stations
- Facilities - add
- Personnel - add resources
- Laboratory for heavy metals
- System to be able to remotely adjust the data frequency measurements and other procedures remotely; current system does not work well
- Increase pts in county and villages - rural areas
- Add more video
- More data in real-time
- Need to boost their water quality capabilities

Monitoring Center

- The monitoring center does not have enough quality data to support the emergency department to date
- Currently working on a rick assessment in progress - identify highest risk projects/companies
- Monitoring center
- Air - every minute
- Water - every 2 hours; need to increase
- Real-Time points
- Air - 144
- Water - 59
- Company 1000
- Drink water 24
- Mobile - yes capability; 2 vans; small labs; 1 boat
- Random risk assessments for companies in rural areas
- History of the Monitoring and Emergency departments - founded 2008 after 2003 environmental incident

Emergency Management

- Four phases of emergency management - prevent, pre-alarm, response, recovery/assessment
- SDEPA Department
- Pollution prevention office
- Pollution recycle office
- Water office
- Air office
- Chemical hazmat office
- Emergency Department
- Prevention, pre-alarm, emergency response, recovery
- Focus on prevention

1.7 Project Approach and Methodology

The Feasibility Study will follow an innovative technical approach and an efficient work plan. The feasibility study calls for a unique mix of technical components that must be integrated to work as a single system as a total solution. The project approach and methodology will align to the project's goals and objectives and be flexible and adaptable enough to adapt quickly to situational changes. The situation analysis will be completed first to gain a solid understanding of the objectives, the state of the SDEPA's current systems and capabilities, the stakeholders, and other project background information in order to create the project requirements and high level specification for the technical plan and sequent tasks an deliverables.

The overall approach is to use a team effort to analyze the current situation and build requirements and offer the best recommendations based on the requirements.

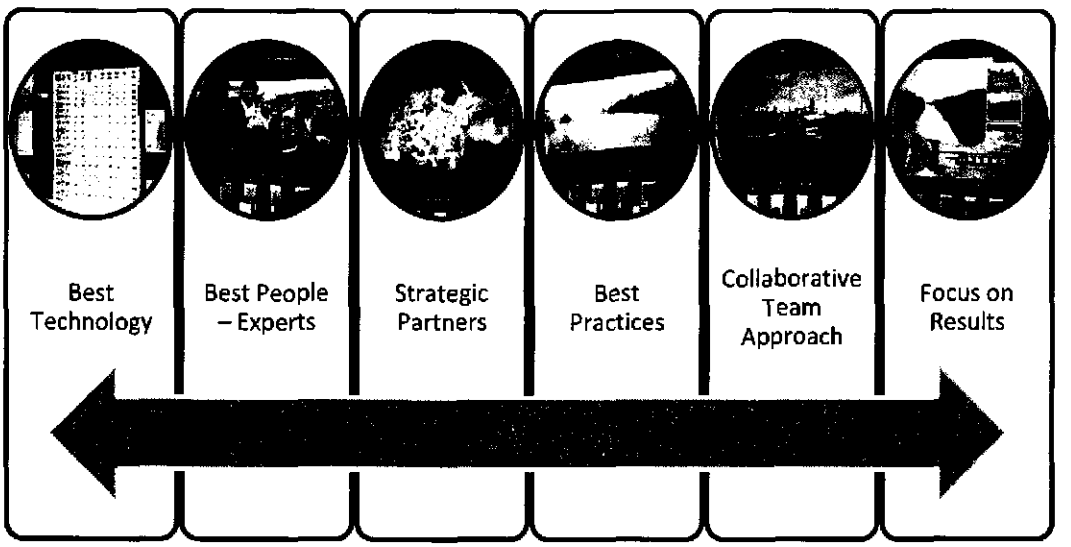


Figure 2 Overall Approach

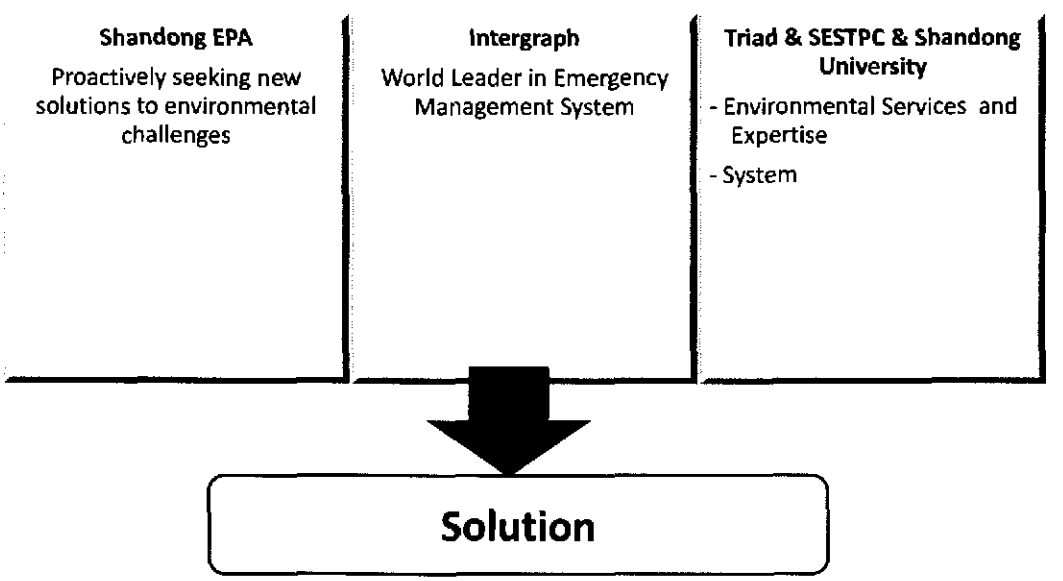


Figure 3 Total Solution

The approach is open to any recommendation that can best meet the project requirements including both open source and commercially supported solutions. This would include looking for best of breed products that could potentially bundle several core features into a single solution or a single all-inclusive solution. The overall technical recommendations will be evaluated based on the following:

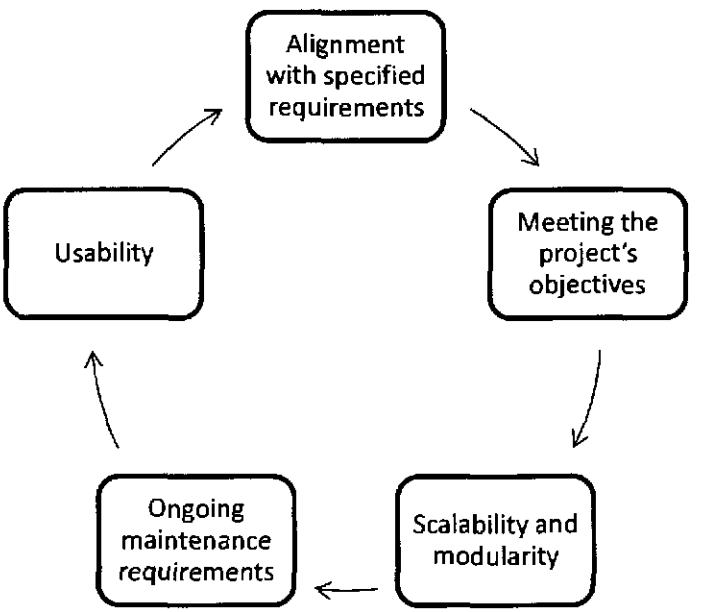


Figure 4 Recommendations Evaluations

For the technical approach, Intergraph will examine the following technical considerations:

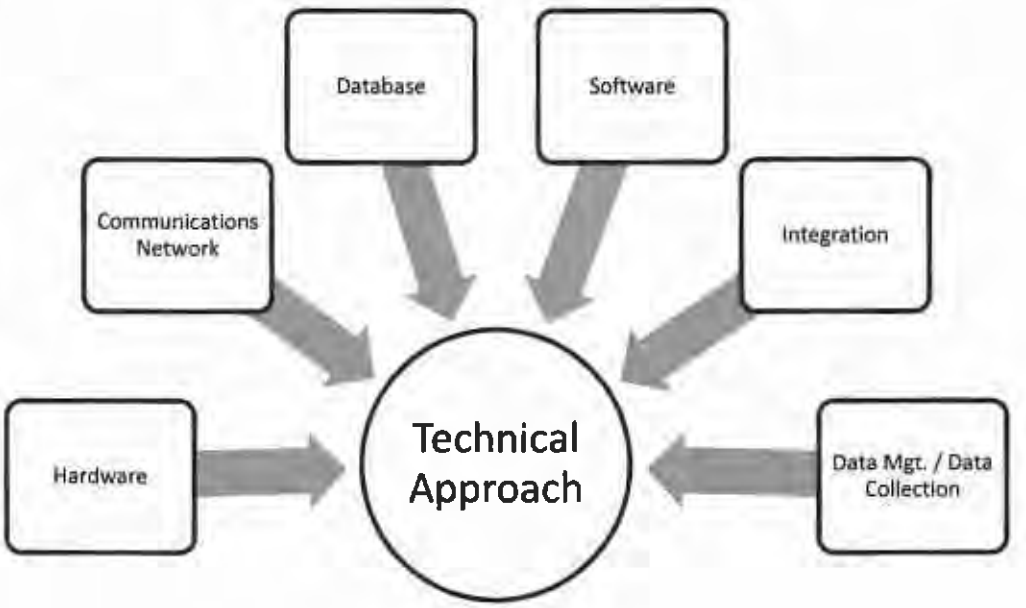


Figure 5 Technical Approach

By utilizing a well-defined approach and analyzing the current and future operations and overall direction of the program, a complete list of functional requirements can detailed. After a requirement analysis, the best alternatives and recommendations of the system can be evaluated. These alternatives will be identified and analyzed to determine the technical and business benefits, limitations, and risks associated with implementing. The alternatives will be chosen based on an established rating/ranking system process.

The Study will follow the project management procedures and are core functions throughout all lifecycle activities to ensure issues, risks, and resources are managed appropriately. Successful project planning and management will also ensure the identification and communication of work activities and schedules relating to the tasks, internal and external approvals, and coordination with the feasibility team.

Table 1 - Project Management Cycle

Based on the initial findings, the following operational/ functional blocks are proposed (see table below):

Risk Assessment & Mangement	Reporting	Data Collection and Management
Environmental Parameters	Monitoring	Prevention Mitigation
Emergency Response and Dispatch	Predictive Analysis	Operating Management & SOP
Emergency Command and Control	Environmental Policy	Interagency / Industry Cooperation

The functional blocks listed above along with the technical approach and the list of technical components listed in the Technical Plan will be used to build the requirements and high level. The operational perspective would be combined with the technical aspect to provide an overall system picture. The process would be to develop requirements that are aligned to the project goals and objectives to develop a list of viable alternatives and then to provide the best recommendations based on the combined perspective (see process below):

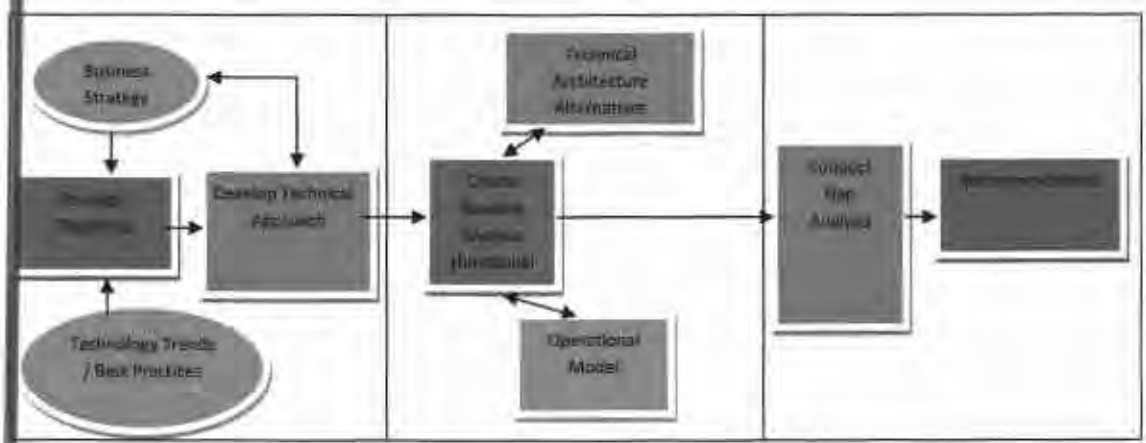


Table 2A - Selection Process

This overall system functional framework is designed based on the process of Emergency Management workflow which is presented as a cycle (see figure below) in which the various phases would follow each other until the next disaster event. It involves several phases: Prevention, Preparedness, Relief / Response, Recovery and Reconstruction. However, all of the processes and activities aim for two objectives:

1. Reducing the vulnerability for the elements at or exposure at hazard risk
2. Limiting extent of damage when the hazard event happens

Figure 6 The emergency management workflow overview

Therefore, we divide the system functionality into 12 functional blocks based on the objectives of the feasibility study and emergency management workflow. The 12 functional blocks cover the flowing subsystem aspects:

Figure 7 Environmental Emergency Management

1.8 Project Tasks

Task 1: Project Kick Off	Task 2: Situational Analysis	Task 3: Best Practices
Task 4: Technical Plan	Task 5: Financial Analysis	Task 6: Implementation Roadmap
Task 7: Impact Analysis and US Export Potential	Task 8: Final Workshop	Task 9: Final Report

Table 3A - Tasks

Table 4- THE FOUR PHASES OF EMERGENCY MANAGEMENT

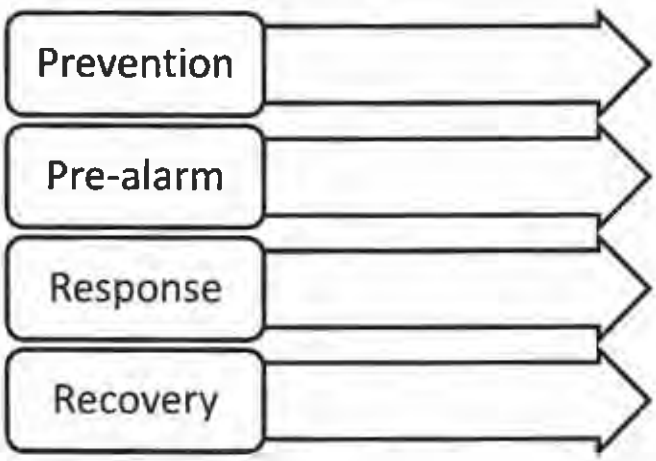
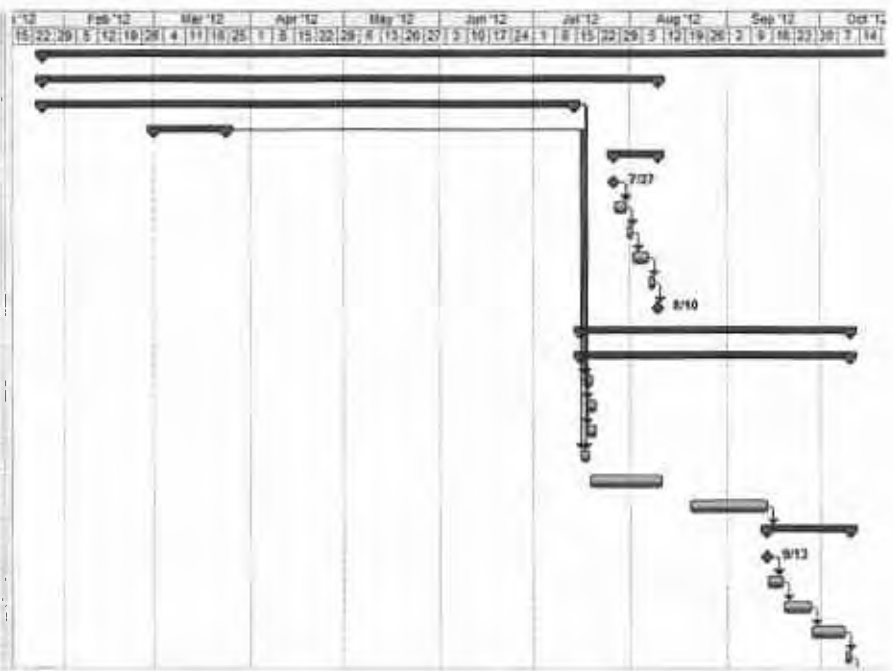


Table 5-A THE FOUR PHASES OF EMERGENCY MANAGEMENT - SDEPA

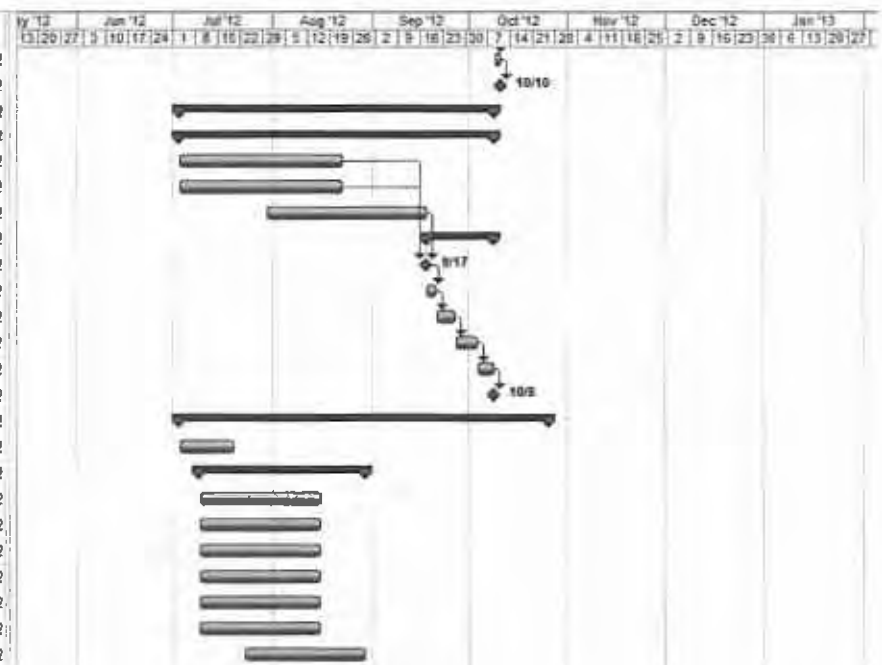
1.9 Benchmarks and Timelines

1.9.1 Schedule

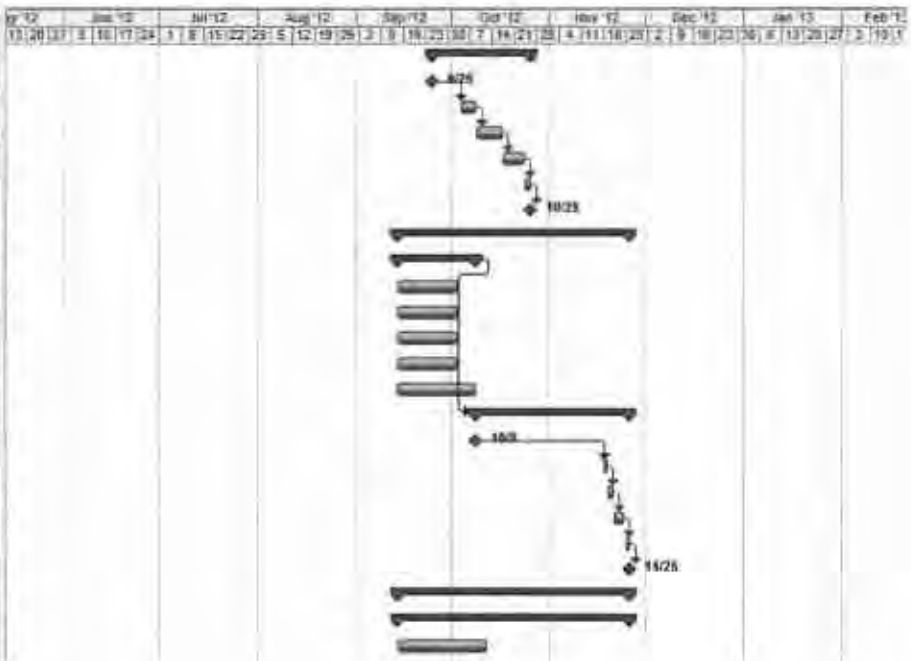
	Task Name	Start	Finish
1	SDEPA - Intergraph: SEERS-FS	Wed 1/25/12	Mon 4/8/13
2	Task 1: Project Kick Off	Wed 1/25/12	Fri 8/10/12
3	Project Review and Planning Review	Wed 1/25/12	Fri 7/13/12
11	Kickoff Meeting	Thu 3/1/12	Fri 3/23/12
14	Deliverable: Feasibility Kick-Off Report	Fri 7/27/12	Fri 8/10/12
15	Kick-off Report - Draft	Fri 7/27/12	Fri 7/27/12
16	Kick-off Report - Internal Review	Fri 7/27/12	Mon 7/30/12
17	Kick-off Repon - Report Translation	Tue 7/31/12	Wed 8/1/12
18	Kick-off Report - SDEPA - delivery,review	Thu 8/2/12	Mon 8/6/12
19	Kick-off Report - revison,translation,signoff	Tue 8/7/12	Wed 8/8/12
20	Deliverable: Kick-off Report	Fri 8/10/12	Fri 8/10/12
21	Task 2: Situational Analysis	Mon 7/16/12	Wed 10/10/12
22	Create Situation Analysis Report	Mon 7/16/12	Wed 10/10/12
23	Conduct Interviews	Tue 7/17/12	Thu 7/19/12
24	Identify national policies and provincal priorities and other organizations	Wed 7/18/12	Fri 7/20/12
25	Identify environmental risks, research, mgt., and response	Wed 7/18/12	Fri 7/20/12
26	Identify environmental monitoring, assessment, analysis, and E-respons	Mon 7/16/12	Wed 7/18/12
27	Ongoing Information Gathering	Thu 7/19/12	Fri 8/10/12
28	Compile Situation Analysis Report	Mon 9/20/12	Thu 9/13/12
29	Deliverable: Situation Analysis Report	Thu 9/13/12	Wed 10/10/12
30	Situation Analysis Report - Draft	Thu 9/13/12	Thu 9/13/12
31	Situation Analysis Report - Internal Review	Fri 9/14/12	Tue 9/18/12
32	Situation Analysis Report Translation	Wed 9/19/12	Thu 9/27/12
33	Sit Analysis Report- SDEPA - delivery,review	Fri 9/28/12	Mon 10/8/12
34	Sit Analysis Report- SDEPA - revison,translation,signoff	Tue 10/9/12	Wed 10/10/12



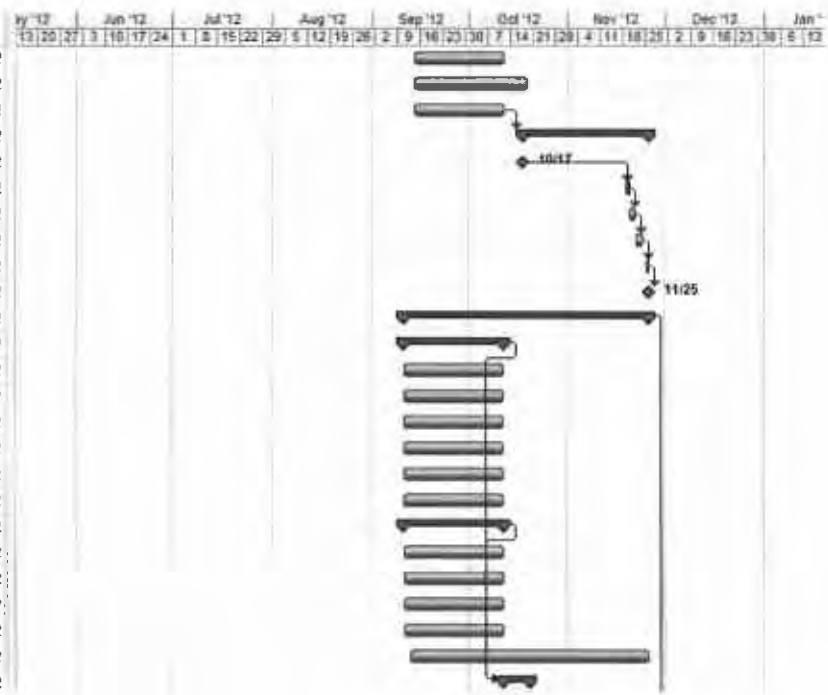
	Task Name	Start	Finish
34	St Analysis Report- SDEPA - revison,translation,signoff	Tue 10/9/12	Wed 10/10/12
35	Deliverable: Situation Analysis Report	Wed 10/10/12	Wed 10/10/12
36	**- Task 3: Best Practices**	**Tue 7/3/12**	**Mon 10/8/12**
37	**- Create Best Practices Report**	**Tue 7/3/12**	**Mon 10/8/12**
38	Summarize US policy, frameworks, and standards	Tue 7/3/12	Wed 8/22/12
39	Perform high level gap analysis	Tue 7/3/12	Wed 8/22/12
40	Identify areas for improvement	Mon 7/30/12	Mon 9/17/12
41	**- Deliverable: US Best Practices**	**Mon 9/17/12**	**Mon 10/8/12**
42	US Best Practices -Draft	Mon 9/17/12	Mon 9/17/12
43	US Best Practices - Internal Review	Tue 9/18/12	Thu 9/20/12
44	Report Translation	Fri 9/21/12	Wed 9/26/12
45	US Best Practices- SDEPA - delivery,review	Thu 9/27/12	Wed 10/3/12
46	US Best Practices- SDEPA - revison,translation,signoff	Thu 10/4/12	Mon 10/8/12
47	Deliverable: US Best Practices Summary - Environmental Emergenc	Mon 10/8/12	Mon 10/8/12
48	**- Task 4: Technical Plan**	**Tue 7/3/12**	**Thu 10/25/12**
49	Review plans, proposals, technical specs, and other relevent materials	Tue 7/3/12	Thu 7/19/12
50	**- Develop technical concept and high level specs (incl)**	**Mon 7/9/12**	**Wed 8/29/12**
51	Emergency operating center	Mon 7/9/12	Wed 8/15/12
52	Incident Management and Decision Support System	Mon 7/9/12	Wed 8/15/12
53	Monitoring and Early Warning	Mon 7/9/12	Wed 8/15/12
54	Emergency Communication Network	Mon 7/9/12	Wed 8/15/12
55	Data Center	Mon 7/9/12	Wed 8/15/12
56	Geographic Information System	Mon 7/9/12	Wed 8/15/12
57	Emergency Response Database	Mon 7/23/12	Wed 8/29/12

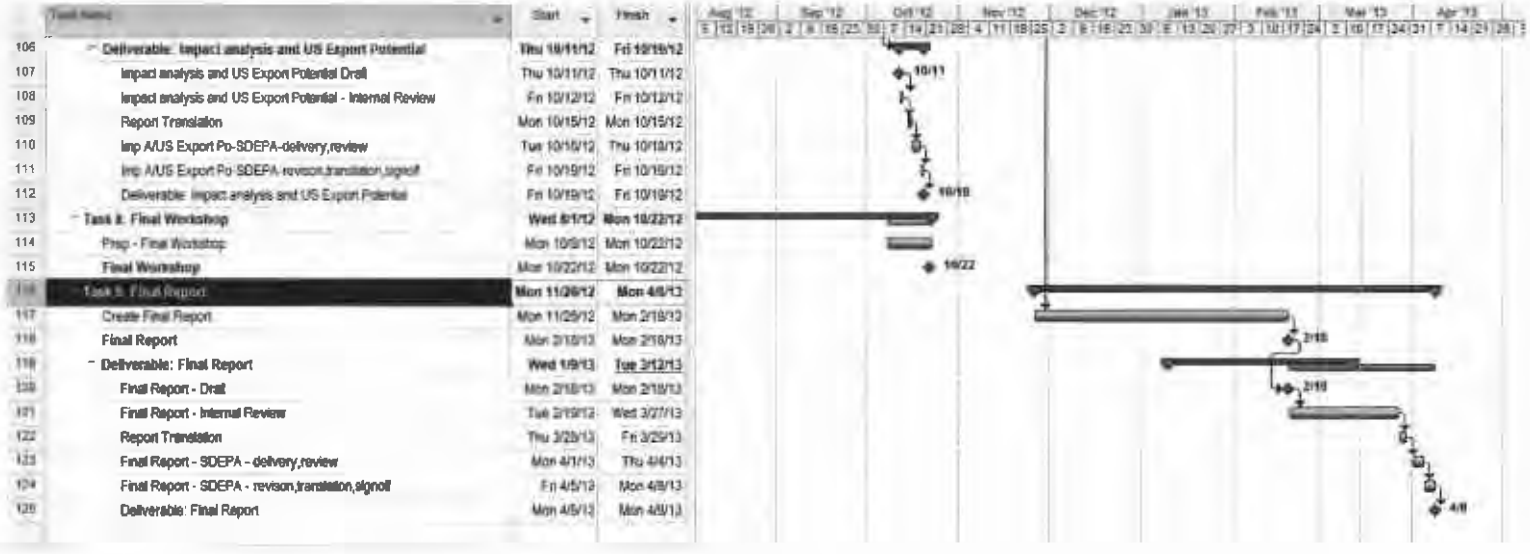


	Task Name	Start	Finish
58	Deliverable: Technical Plan	Tue 9/25/12	Thu 10/25/12
59	Technical Plan - Draft	Tue 9/25/12	Tue 9/25/12
60	Technical Plan - Internal Review	Thu 10/4/12	Mon 10/8/12
61	Report Translation	Tue 10/9/12	Tue 10/16/12
62	Technical Plan - SDEPA - delivery,review	Wed 10/17/12	Tue 10/23/12
63	Technical Plan - SDEPA - revison,translation,signoff	Wed 10/24/12	Thu 10/25/12
64	Deliverable: Technical Plan	Thu 10/25/12	Thu 10/25/12
65	Task 5: Financial Analysis	Fri 9/14/12	Sun 11/25/12
66	Create Financials Analysis - Project; (incl)	Fri 9/14/12	Mon 10/8/12
67	Cost model - capital expenses	Fri 9/14/12	Tue 10/2/12
68	Cost of ownership - 5 year	Fri 9/14/12	Tue 10/2/12
69	Budget	Fri 9/14/12	Tue 10/2/12
70	Funding	Fri 9/14/12	Tue 10/2/12
71	Public - Private Cooperation and Investment	Fri 9/14/12	Mon 10/8/12
72	Deliverable: Financial Analysis and Forecast Model	Mon 10/8/12	Sun 11/25/12
73	Financial Analysis - Draft	Mon 10/8/12	Mon 10/8/12
74	Financial Analysis - Internal Review	Sun 11/18/12	Sun 11/18/12
75	Report Translation	Mon 11/19/12	Tue 11/20/12
76	Financial Analysis - SDEPA - delivery,review	Wed 11/21/12	Fri 11/23/12
77	Financial Analysis - SDEPA - revison,translation,signoff	Sun 11/25/12	Sun 11/25/12
78	Deliverable: Financial Analysis and Forecast Model	Sun 11/25/12	Sun 11/25/12
79	Task 6: Implementation Roadmap	Fri 9/14/12	Sun 11/25/12
80	Create Implementation Roadmap	Fri 9/14/12	Sun 11/25/12
81	Business planning, contingencies, risks, mitigation strategies, order of tasks	Fri 9/14/12	Thu 10/11/12



	Task Name	Start	Finish
82	Project Mgt Plan, schedule, metrics, procurement, oper/maintenance	Fri 9/14/12	Thu 10/11/12
83	Considerations for improvement, hardware, and software	Fri 9/14/12	Thu 10/18/12
84	Success metrics	Fri 9/14/12	Thu 10/11/12
85	**- Deliverable: Implementation Roadmap**	**Wed 10/17/12**	**Sun 11/25/12**
86	Implementation Roadmap Draft	Wed 10/17/12	Wed 10/17/12
87	Implementation Roadmap - Internal Review	Mon 11/19/12	Mon 11/19/12
88	Report Translation	Tue 11/20/12	Wed 11/21/12
89	Imp Roadmap - SDEPA - delivery,review	Thu 11/22/12	Fri 11/23/12
90	Imp Roadmap - SDEPA - revison,translation,signoff	Sun 11/25/12	Sun 11/25/12
91	Deliverable: Implementation Roadmap	Sun 11/25/12	Sun 11/25/12
92	**- Task 7: Impact Analysis and US Export Potential**	**Tue 9/11/12**	**Sun 11/25/12**
93	**- Create Development Impact Analysis**	**Tue 9/11/12**	**Thu 10/11/12**
94	Infrastructure	Tue 9/11/12	Thu 10/11/12
95	Market-Oriented Reform	Tue 9/11/12	Thu 10/11/12
96	Human Capacity Building	Tue 9/11/12	Thu 10/11/12
97	Technology	Tue 9/11/12	Thu 10/11/12
98	Other	Tue 9/11/12	Thu 10/11/12
99	Economic Impacts	Tue 9/11/12	Thu 10/11/12
100	**- Environmental and Other Impacts**	**Tue 9/11/12**	**Thu 10/11/12**
101	Review of project's environmental impact	Tue 9/11/12	Thu 10/11/12
102	Identify negative impacts and mitigation - environment	Tue 9/11/12	Thu 10/11/12
103	Identify steps subsequent -study's completion and prior to implementation	Tue 9/11/12	Thu 10/11/12
104	Identify the impact of equipment, energy, and technologies - environmer	Tue 9/11/12	Thu 10/11/12
105	US Export Potential	Thu 9/13/12	Sun 11/25/12
106	**- Deliverable: Impact analysis and US Export Potential**	**Thu 10/11/12**	**Fri 10/19/12**





	Task Name	Start	Finish
106	Deliverable: Impact analysis and US Export Potential	Thu 10/11/12	Fri 10/19/12
107	Impact analysis and US Export Potential Draft	Thu 10/11/12	Thu 10/11/12
108	Impact analysis and US Export Potential - Internal Review	Fri 10/12/12	Fri 10/12/12
109	Report Translation	Mon 10/15/12	Mon 10/15/12
110	Imp A/US Export Po-SDEPA-delivery,review	Tue 10/16/12	Thu 10/18/12
111	Imp A/US Export Po-SDEPA-revison,translation,signoff	Fri 10/19/12	Fri 10/19/12
112	Deliverable: Impact analysis and US Export Potential	Fri 10/19/12	Fri 10/19/12
113	Task 8: Final Workshop	Wed 8/1/12	Mon 10/22/12
114	Prep - Final Workshop	Mon 10/9/12	Mon 10/22/12
115	Final Workshop	Mon 10/22/12	Mon 10/22/12
116	Task 9: Final Report	Mon 11/26/12	Mon 4/8/13
117	Create Final Report	Mon 11/26/12	Mon 2/18/13
118	Final Report	Mon 2/18/13	Mon 2/18/13
119	Deliverable: Final Report	Wed 1/9/13	Tue 3/12/13
120	Final Report - Draft	Mon 2/18/13	Mon 2/18/13
121	Final Report - Internal Review	Tue 2/19/13	Wed 3/27/13
122	Report Translation	Thu 3/28/13	Fri 3/29/13
123	Final Report - SDEPA - delivery,review	Mon 4/1/13	Thu 4/4/13
124	Final Report - SDEPA - revison,translation,signoff	Fri 4/5/13	Mon 4/8/13
125	Deliverable: Final Report	Mon 4/8/13	Mon 4/8/13

Table 6A - Feasibility Schedule

1.9.2 Milestones

Task	Completion Date
Deliverable: Kick-off Report	August 10, 2012
Deliverable: Situation Analysis Report	October 10,, 2012
Deliverable: US Best Practices Summary - Environmental Emergency Mgt.	October 8,, 2012
Deliverable: Technical Plan	October 25 , 2012
Deliverable: Financial Analysis and Forecast Model	November 25, 2012
Deliverable: Implementation Roadmap	November 25, 2012
Deliverable: Impact analysis and US Export Potential	November 25, 2012
Final Workshops / August 2012 and June 2013 (Final Report Meeting)	May 2013
Deliverable: Final Report	June, 3 2013

Table 7 - Feasibility Study Milestones

1.10 Kickoff Conclusion

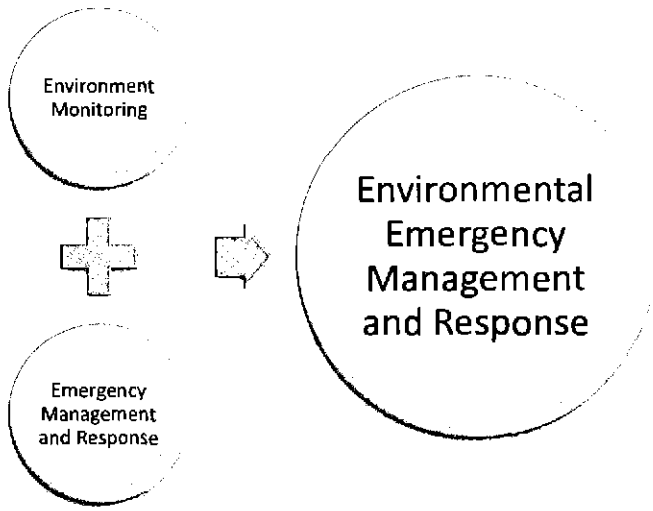
The Shandong Environmental Emergency Response System project is in the early initiation phase. The purpose of this feasibility study will be to assist SDEPA in the development of a full scale system.

2 Situation Analysis

2.1 Situation Analysis - Introduction

China has been growing at a rapid pace over the last thirty years, especially in the last decade. This growth has lifted the economy and the standard of living throughout China. Along with this economic growth, environmental challenges have also risen. Environmental challenges have increased with air and water pollution, degradation to water, and soil contamination. China's overall environmental situation is still "serious" with frequent pollution accidents affecting the quality of life for many people. Another environmental challenge facing China is how to prevent, manage, mitigate, and recover from an environmental emergency caused by these environmental challenges. The key is to bring together emergency management and environmental expertise when environmental emergencies or disasters occur. The Chinese government has been working to address these environmental emergency management challenges. The Chinese environmental efforts are carried out at the national level, then down to the provincial and local levels. In order to address environmental emergencies at the provincial level, the Shandong Environmental Protection Agency (SDEPA) is seeking to build a real-time environmental emergency response and management system to better protect the Shandong environment and populace by reducing the threat from environmental pollutants, accidents, and disasters. By using a state-of-the-art communication network and an early warning component, the system is expected to rapidly identify environment threats in real-time alerting the proper authorities and stakeholders. In additional, the plan is for the system to incorporate a comprehensive decision support toolbox capability to assist emergency environmental response decision makers to make effective decisions and mitigate risks during, before and after an environmental crisis. Increased economic activity and environmental risks have led to a rising number of environmental incidents that require a system and method to quickly recognize the threat and to rapidly respond to them. This system should contain the following:

- Real-time environmental safety and emergency management monitoring and detection network and system
- Emergency early warning network and system for environmental safety
- Emergency command and control center



2.2 China - Environmental Situation

China faces a multitude of environmental challenges and opportunities. In a past speech that is the equivalent of a State of the Union address, Prime Minister Wen Jiabao made 48 references to "environment," "pollution" or "environmental protection." In China and around the world, observers are concerned about the effects of that country's rapid economic development on the air, water, land, and energy resources. At the same time, China is recognized as a world leader in green technologies. This is the paradigm that exists in China today.

As China as grown at a rapid economic pace the last two decades, it has presented its share of environmental challenges. China's economy is on a historic run, posting a succession of double-digit growth rates, but pollution has become a major concern. The expansion of heavy industry and urbanization in continuing as China moves into its most robust stage of its industrial revolution. This has led to overall environmental degradation as pollution continues to be a major problem all over China in the air, water, and land. The Chinese government recognizes the problems and have made environmental sustainability and pollution reduction major goals of its next fifth year plan. The government has numerical targets for reducing emissions and conserving energy. Different campaigns have been started to close illegal coal mines and

shutter some heavily polluting factories. Major initiatives are under way to develop clean energy sources like solar and wind power.

The government has numerical targets for reducing emissions and conserving energy. Export subsidies for polluting industries have been phased out. Different campaigns have been started to close illegal coal mines and shutter some heavily polluting factories. Major initiatives are under way to develop clean energy sources like solar and wind power. For air quality, a major culprit is coal, on which China relies for about two-thirds of its energy needs. It has abundant supplies of coal and already burns more of it than the United States, Europe and Japan combined. Expanding car ownership, heavy traffic and low-grade gasoline have made autos the leading source of air pollution in major Chinese cities. One major pollutant contributing to China's bad air is particulate matter, which includes concentrations of fine dust, soot and aerosol particles less than 10 microns in diameter (known as PM 10). Emissions of sulfur dioxide from coal and fuel oil, which can cause respiratory and cardiovascular diseases as well as acid rain, are increasing even faster than China's economic growth. In 2005, China became the leading source of sulfur dioxide pollution globally, the State Environmental Protection Administration, or SEPA, reported last year.

Perhaps an even more acute challenge is water. China has only one-fifth as much water per capita as the United States. But while southern China is relatively wet, the north, home to about half of China's population, is an immense, parched region that now threatens to become the world's biggest desert. Farmers in the north once used shovels to dig their wells. Now, many aquifers have been so depleted that some wells in Beijing and Hebei must extend more than half a mile before they reach fresh water. Industry and agriculture use nearly all of the flow of the Yellow River, before it reaches the Bohai Sea.

In response, Chinese leaders have undertaken one of the most ambitious engineering projects in world history, a $60 billion network of canals, rivers and lakes to transport water from the flood-prone Yangtze River to the silt-choked Yellow River. But that effort, if successful, will still leave the north chronically thirsty.

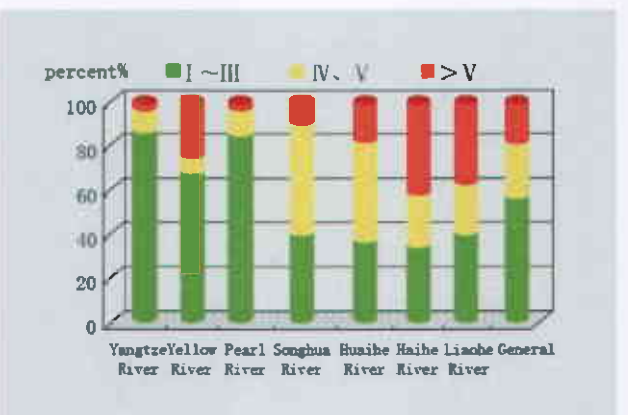
In 1996, China and the United States each accounted for 13 percent of global steel production. By 2005, the United States share had dropped to 8 percent, while China's share had risen to 35 percent. Similarly, China now makes half of the world's cement and flat glass, and about a third

of its aluminium. In 2006, China overtook Japan as the second-largest producer of cars and trucks after the United States. Each year for the past few years, China has built about 7.5 billion square feet of commercial and residential space, more than the combined floor space of all the malls and strip malls in the United States, according to data collected by the United States Energy Information Administration. In 2005 alone, China added 66 gigawatts of electricity to its power grid, about as much power as Britain generates in a year. Last year, it added an additional 102 gigawatts, as much as France. That increase has come almost entirely from small- and medium-size coal-fired power plants that were built quickly and inexpensively.

The Ministry of Environmental Protection - China provided the following information (environmental report for China).

2.2.1 Water Quality

Pollution of surface water in China remains serious. In general, the seven major water systems and rivers in Zhejiang Province and Fujian Province reported pollution problems. Rivers in northwest China recorded pollution whereas those in the Southwest with more annual rainfall fared better and had better good water quality that the rivers in northern China. Eutrophication in lakes (reservoirs) was prominent.



The seven big rivers (the Yangtze River, Yellow River,Pearl River, Songhua River, Huaihe River, Haihe River and Liaohe River) all experienced some degree of pollution. Among the 408

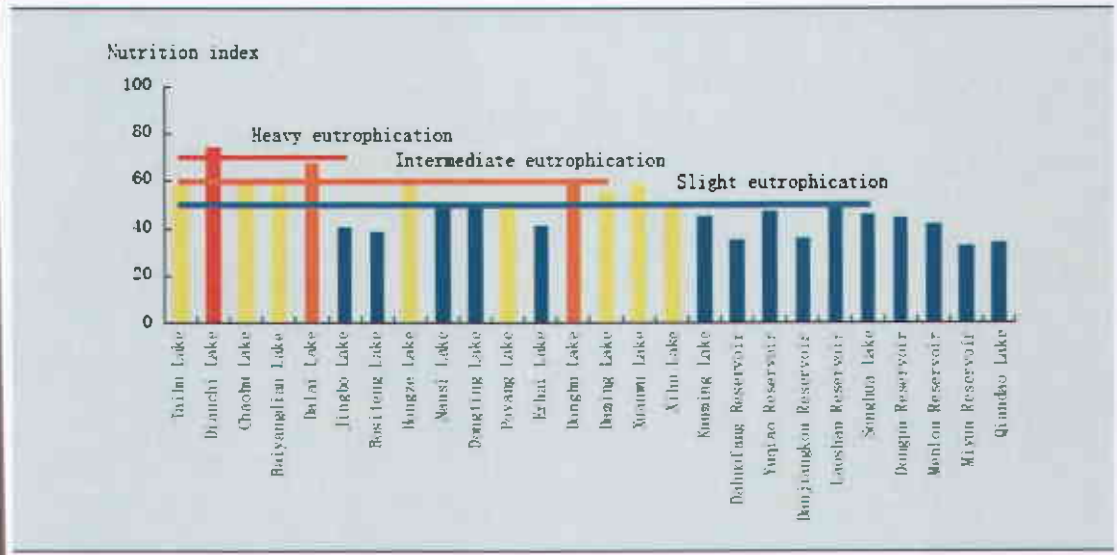
sections of 203 rivers under national monitoring, sections with water quality ranged from Grade I to III, Grade IV to V, and inferior to Grade V accounted for 57.3%, 24.3% and 18.4% respectively. Major pollutants included permanganate value, BOD5 and NH3-N. Of the big rivers, the Pearl River and the Yangtze River enjoyed better water quality relative to the other river systems. The Songhua River and Huaihe River were measured with some degree of pollution, while the Yellow River and Liaohe River had intermediate pollution and Haihe River heavy pollution levels.

Among the 26 key lakes (reservoir) under national monitoring program, one met the Grade II quality standard, accounting for 3.9%; five met the Grade III standard, or 19.2%; six met the Grade IV standard, accounting for 23.1%; five met Grade V standard, or 19.2%; nine failed to meet Grade V standard, or 34.6%. The main pollutants were TN and TP. Among the 26 lakes (reservoir) under eutrophication monitoring, one was under heavy eutrophication, or 3.8% of the total; two were under intermediate eutrophication, or 7.7%; eight were under slight eutrophication, accounting for 30.8% and the rest 57.7% posted mesotrophic levels.

Water quality of major lakes (Reservoirs) |

Grade / Waters	Amount	I	II	III	IV	V	>V	Major pollutants
Three lakes*	3	0	0	0	0	1	2	TN, TP
Big fresh-water lake	9	0	0	3	2	1	3	
Urban lake	5	0	0	0	2	1	2	
Big reservoir	9	0	1	2	2	2	2	
Total	26	0	1	5	6	5	9	
Percent (%)		0	3.9	19.2	23.1	19.2	34.6	

* Three lakes refer to Taihu Lake, Dianchi Lake and Chaohu Lake.



Water quality monitoring of 641 wells in 8 provinces, autonomous regions and municipalities (Beijing, Liaoning, Jilin, Shanghai, Jiangsu, Hainan, Ningxia and Guangdong) revealed that 2.3% of the wells met Grade water quality standard, which could be used for various purposes; 23.9% of wells met Grade III standard, fit for centralized drinking water sources, agricultural and industrial purposes and 73.8% fell between Grade IV and Grade V suitable for other purposes except drinking. The major pollutants were total hardness, ammonia nitrogen, nitrite nitrogen, nitrate nitrogen, iron and manganese.

In 2009, the quality of groundwater in 202 cities across the country ranged between good and poor. Deep groundwater recorded better quality than shallow groundwater in general and groundwater quality in areas subject to mild exploration was better than those with extensive exploration. On the whole, the groundwater quality changed little compared with that of the last year and places showing a trend of degradation or amelioration scattered across the country.

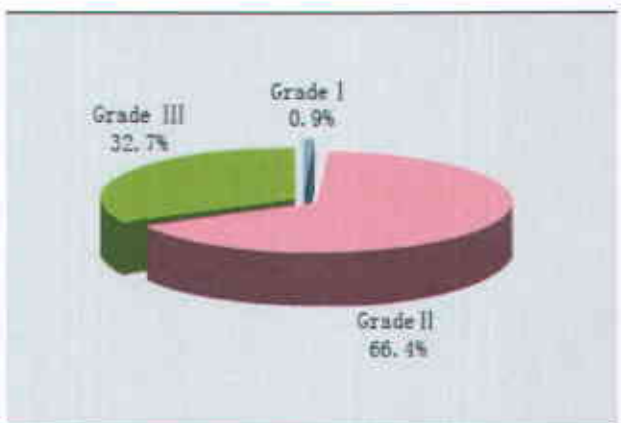
In general, coastal sea waters across China had some pollution concerns. Compared with that of the last year, water quality had no obvious change. In 2009, a total of 279,940 km2 coastal areas were under monitoring. Among them, 213,208 km2 met Grade I or II national marine water quality standard; 18,834 km2 met Grade III standard; and 47,898 km2 failed to meet Grade III standard. Monitoring results showed that 72.9% of coastal sea waters met Grade I or

Grade II national marine water quality standard, up 2.5 percentage points compared with that of the last year; 6.0% met Grade III standard, down 5.3 percentage points and 21.1% failed to meet Grade III standards.

2.2.2 Air Quality

The air quality in urban areas across the country was better than that of previous years, but some cities still suffer from relatively serious pollution. The acid rain distribution areas remained unchanged and acid rain pollution was still serious. In 2009, the ambient air quality monitoring results of 612 cities in China indicated that 26 cities enjoyed Grade I air quality standards (accounting for 4.2%), 479 ones enjoyed Grade II air quality standards (accounting for 78.3%), 99 ones reached national Grade III air quality standards (accounting for 16.2%), 8 of them failed to meet Grade III standards (accounting for 1.3%). 79.6% of the cities at or above prefectural level met with air quality standards, and so did 85.6% of the county-level cities. In cities at or above prefectural level (including capitals of prefectures, autonomous prefectures and leagues), 3.7% of the cities had national Grade I air quality standards, 75.9% had national Grade II air quality standards.

Acid rain frequency 258 out of 488 cities (counties) under the monitoring program saw acid rain, accounting for 52.9%. Over 25% of the precipitation in 164 cities proved to be acid rain, accounting for 33.6%, and over 75% of the precipitation in 53 cities proved to be acid rain, taking up 10.9%.



Percent of key cities with varied air qualities in 2009

2.3 Emergency Response and Management

2.3.1 Introduction

Emergency management is the generic name of an interdisciplinary field dealing with the strategic organizational management processes used to protect critical assets of an organization from hazard risks that can cause disasters or catastrophes, and to ensure their continuance within their planned lifetime (Haddow & Bullock, 2003). Assets are categorized as either living things, non-living things, cultural or economic. Hazards are categorized by their cause, either natural or human-made. The entire strategic management process is divided into four fields to aid in identification of the processes. The four fields normally deal with risk reduction, preparing resources to respond to the hazard, responding to the actual damage caused by the hazard and limiting further damage, e.g. emergency evacuation, quarantine, mass decontamination, etc. and returning as close as possible to the state before the hazard incident. The field occurs in both the public and private sector, sharing the same processes, but with different focuses. Emergency Management is a strategic process, and not a tactical process, thus it usually resides at the Executive level in an organization. It normally has no direct power, but serves as an advisory or coordinating function to ensure that all parts of an organization are focused on the common goal. Effective Emergency Management relies on a thorough integration of emergency plans at all levels of the organization, and an understanding that the lowest levels of the organization are responsible for managing the emergency and getting additional resources and assistance from the upper levels. (

2.3.2 Chinese Emergency Management Law

The Emergency Response Law passed by the national legislature on 30 August 2007 is aimed at improving handling of industrial accidents, natural disasters, and health and public security hazards. The Law has seven chapters and 70 clauses and became effective from 1 November 2007. It main thrust is to legally oblige officials to provide accurate and timely information on public emergencies, while media organizations that knowingly publish false reports could lose their business licenses.

Four colors of emergency declaration (blue, yellow, orange and red) are used to indicate the hazard level, with red signaling the most serious situation. Another cited objective of the

legislation is to help minimize losses and prevent minor mishaps from turning into major public crises.

The law requires that "coal mines, construction sites, and work units that produce, deal with, transport, stockpile and use explosives, combustible and hazardous chemicals and radioactive material production must establish detailed emergency plans and launch inspections at sites where hazardous materials are produced and stored so as to eliminate possible risks and avoid emergencies." There are serious penalties for "for looting of properties during emergencies and for disrupting emergency response work."

When extremely serious emergencies occur, which severely threaten life and property, state security, public security, environmental security or public order, which are not covered by the provisions in the law, the NPC Standing Committee or the State Council can declare a 'state of emergency' in accordance with the Constitution and the law.

2.3.3 Emergencies and Disasters in China

Over the 5,000 years of Chinese history, natural and man-made disasters have been a recurring theme. From 1971 to 1980, for example, it is estimated that 55.5 billion RMB were lost because of natural disasters. In the 1990s, the losses amounted to 112 billion RMB. In the first decade of the 21st century, the estimated losses caused by disasters reached 200-300 billion RMB. In spite of this, a formal system of emergency management did not emerge in China until after the SARS pandemic in 2002-2003. The government in China has therefore established an emergency management system including a new coordination structure, and the establishment of a new department. In July, 2005, China established the Emergency Management Office to be the headquarters of the emergency management system. Up to this point, roughly one per cent of GDP, (about 240 billion RMB), has been spent in the disaster prevention and reduction field.

2.3.4 Environmental Emergencies and Disasters in China

2.3.4.1 Past Chinese Environmental Disasters

China has been experiencing a high frequency of environmental accidents, due to its fast economic growth and lack of emergency reaction mechanism, a senior Chinese environmental official said in a past statement. "A series of grave environmental accidents have occurred since the beginning of this year," said Wang Yuqing, deputy director of the State Environmental

Protection Administration (SEPA), at a national video conference on handling environmental pollution. The major cause, he said, is that some regions are not significantly prepared to prevent and handle environmental emergencies. "As a result, they are obviously weak in handling major environmental emergencies, including filing reports and monitoring accidents," said Wang.

He singled out the environmental administration of Jilin Province, criticizing its poor performance in collecting information and delaying reporting to the SEPA the chemical spill in the Songhua River. One hundred tons of benzene were spilled into the Songhua River in northeast China after a petrochemical plant blast on the river on Nov. 13. The accident forced cities and towns along the river to suspend water supply to residents for several days. "We missed the best opportunity to contain the pollution because of their poor work," said Wang. Wang said there are still many unreported hazards to the environment around the country as some plants are built on river banks and in residential areas. Accidents in those places might cause new ecological disasters, he warned. Some regional governments gave tacit consent to the discharging of pollutants into rivers in the random pursuit of economic growth, he said, adding some regions also approve the construction of polluting businesses that are forbidden by the central government.

He asked local authorities to learn from the Songhua River pollution accident and immediately check hidden environmental hazards in their areas. He urged the regions to make environmental emergency response plans, establish command and control systems to handle environmental emergencies and publicize methods of preventing such accidents. According to the SEPA, in the past only 14 provinces in China have emergency reaction plans in the event of environmental accidents, but the number is growing. "After the Songhua River pollution occurred, the State Environmental Protection Administration activated its preparedness plan for the first time. The plan proved useful in dispelling panic and controlling the pollution," said Wang.

Figure **8** Songhua River - Disaster

2.3.4.2 **Environmental Emergencies and Disasters in China**

In 2009, Ministry of Environmental Protection received the report and properly handled 171 sudden environmental accidents, up by 26.7% compared with that of the last year. Among them, two were rated very severe sudden environmental accidents, two were rated severe sudden environmental accidents, 41 were relatively severe sudden environmental accidents and 126 general environmental accidents.

Classification by cause: 63 were due to production accidents, or 36.84% of the total, up by 6 compared with that of the last year; 52 were due to traffic accidents, accounting for 30.41% of the total, up by 27 compared with that of the last year; 23 were due to pollution discharge by

enterprises, accounting for 13.45%, same as that of the last year; 33 were due to other factors, accounting for 19.30%, up by 3 compared with that of the last year.

Classification by pollution types: 80 were water pollution accidents, 61 were air pollution accidents, 3 solid waste pollution accidents, 16 soil pollution accidents, 2 marine pollution accidents and 9 other types of environmental pollution accidents.

2.3.4.3 Emergencies and Disaster Policy

The Chinese government has gone to great lengths to establish a modern emergency management system. These measures include new laws and local regulations. The policy changes to support these efforts came quickly. They include short term reactive measures as well as longer term strategies.

Short term efforts can generate quick responses to hazardous situations. One good example here is the earthquake in 2008. The massive 12 May 2008 Wenchuan earthquake caused horrific loss of life and heavy property damage in Sichuan, Shanxi, and Gansu. In order to support the earthquake relief and reconstruction effort, the Ministry of Finance and State Administration of Taxation implemented post-disaster tax deductions and exemptions. These relief measures impacted affected individuals or enterprises, and also donations toward the relief effort. The most significant tax relief measures were announced in the "Notice on Implementing the Earthquake Relief and Reconstruction Tax Policies" (Notice 62). The taxes covered in the Notice included: enterprise income tax, individual income tax, house property tax, resource tax, stamp tax, urban land use tax, vehicle and vessel use tax, import tax.

The SARS epidemic in China in the spring of 2003 was ultimately checked after concerted efforts by public health officials and direct intervention by the Chinese government. Nevertheless, it was a trial for Chinese public health policy. The aftermath of this disaster precipitated much soul searching and highlighted defects in Chinese emergency public health management. It probably also demonstrated that many countries tend to take a somewhat blinkered view of emergency management, seeing it in terms of more physical disasters. SARS showed that emergencies can come in many forms. Nevertheless, the Chinese government realized its mistake and public health policy has now been brought into the emergency management arena.

Developing this point, before 1 November 2007 there were 35 laws and 37 regulations in existence in China covering various areas including environmental, safety, health and security issues. However, these laws were limited in scope and were not part of one systematic program. As such, some people now ascribe to the view that real emergency management in China started after the SARS epidemic. Beyond the lessons learned from the SARS response, the Chinese government modified public hygiene and many related tactical regulations. On 12 May 2003, the "Regulation on the Urgent Handling of Public Health Emergencies" was published. This regulation brought together many scattered regulations regarding public health crises and has become the document which now underpins emergency public health management. It proved to be a milestone from which other initiatives flowed, as below.

In November 2003, the "Emergency Law" was initiated but it has not been published yet. In March 2004, however, the Amendment to the Constitution finally repealed "martial law" in favor of "emergency law" and this legislation now enables the declaration of a 'state of emergency' much as in the United States and authorizes the deployment of resources to handle disasters with a speed and concentration which would not have been possible (without a great deal of bureaucracy) hitherto. A short time later, in December 2005, China established an Emergency Management Office (EMO) and started to build a new emergency management system for China. Following on from that, The State Council issued "Master State Plan for Rapid Response to Public Emergencies" in January 2006. Started on 31 May 2006 as a draft, the legislation was finally passed as "The Law of the People's Republic of China on Emergency Responses" on 30 August 2007. On 1 November 2007, it came into effect. This law is a major step forward for emergency management in China. Under this law, emergency management in China has the necessary legal support from all levels of authority from central government to local jurisdictions. The new law gave rise to the production of a master state emergency management plan, with a supporting framework through the country. By March 2009, 51

national level emergency plans devoted to specific emergencies had been developed for the country. In addition, 138 nationally owned corporations and all mine and chemical related corporations had developed emergency plans as well.

2.3.4.4 Chinese Environmental Emergency Efforts and Policy

Emergencies, which set forth clear requirements on how to receive report, handle, compute and analyze information concerning environmental emergencies, as well as how to monitor and release early-warning information. The State has formulated and improved nine plans for water environment emergencies. Among them are plans for handling water environment emergencies in sensitive water areas in key river valleys, plans for handling atmospheric environment emergencies, plans for handling dangerous chemicals (discarded chemicals) emergencies, and plans for handling nuclear and radioactive matter emergencies. In addition, it has worked out the Plan for Handling Water Environment Emergencies in Sensitive Sections of the Yellow River Valley, Plan for Handling Terrorist Attacks Involving Chemical Weapons, Plan for Handling Terrorist Attacks Involving Nuclear and Radioactive Materials, Plan for Handling Agriculture-related Environmental Pollution Emergencies, and Plan for Handling Emergencies Involving Major Harmful Agricultural Organisms or Intrusion of Foreign Organisms. In recent years, China has evaluated the potential risks of 127 key chemical and petrochemical projects located near such environmentally-sensitive areas as the shores of rivers, lakes, oceans, densely-populated regions and nature reserves, conducting comprehensive and careful examinations on nearly 50,000 leading enterprises. (Natural Resource Use and Environmental Impacts from Economic Growth, 2011)

In 2003, the State put into practice the Plan for the Construction of Facilities for the Treatment of Dangerous Wastes and Medical Wastes. Systems such as those requiring the use of duplicate receipts and operation licenses in transferring dangerous industrial wastes have been reinforced. The amount of treated dangerous industrial wastes in 2005 was 3.39 million tons, as compared with 1.31 million tons in 1998. Thirty-one provinces, autonomous regions and municipalities directly under the Central Government have established management centers for solid wastes.

China has sought to improve its nuclear facilities operations and their threat to the environment. It has achieved the goal of "protecting the staff, the public and the environment from being exposed to larger amounts of radiation and pollution than permitted by the State." China strictly follows the Code of Conduct on the Safety and Security of Radioactive Sources

issued by the International Atomic Energy Agency. It has adopted the licensing system, requiring that the import and export of all radioactive sources go through the formalities of examination and approval according to law.

In 2011, MEP issued the "The 12th Five-Year Plan for the Environmental Health Work of National Environmental Protection" plan for "Monitoring, Early Warning and Emergency Response Techniques and Methods on Environmental Health" and stated the following:

"We will study comprehensive monitoring, data acquisition and data standardization techniques on environmental health; biological monitoring technique of environmental pollutant related group in typical areas; treatment and disposal methods of chronic cumulative and sudden environmental health events, rapid identifying technique of health hazard caused by environmental pollution, and different techniques and methods for blocking, controlling, preventing and pre-warning environmental health risks of various types and in different areas."

2.3.5 Organization of Emergency Management

China does not have national level emergency management departments as exist in some other countries, preferring that a number of departments share responsibility for emergency management depending on the nature of the emergency concerned.

The Ministry of Civil Affairs (MCA) generally leads natural disaster relief, with support from other related departments. It was founded in May 1978. It is responsible for social and administrative affairs. MCA is in charge of registration and administration of associations, NGOs and foundations. Its routine functions include registration of births, marriages, divorces, deaths, etc. MCA also has responsibility for the aged, children, orphans, disabled people and retired army personnel.

The National Disaster Reduction Center (NDRC) of MCA is a specialized agency under the Chinese Government engaged in information services in order to support decisions on various natural disasters. It provides reference material for disaster management departments in their decision-making in addition to technical support for China's disaster-reduction undertakings by way of collecting and analyzing disaster information, assessing disasters and emergency relief, and analyzing and studying disasters using such advanced technology as satellite remote sensing.

The State Administration of Work Safety (SAWS), reporting to the State Council, is the non-ministerial agency of the Government of China responsible for the regulation of risks to occupational safety and health in China. The National Workplace Emergency Management Centre (NWEMC) of the State Administration of Work Safety and Sate Administration of Coal Mine Safety is mostly in charge of technology disasters. It is responsible for several areas of emergencies ranging from hazardous materials (HazMat), traffic incidents, mine safety and others.

The Ministry of Public Security (MPS), headed by the Minister of Public Security, is the principal police authority in China. It is the agency that is responsible for most of the day-to-day law enforcement in China. Furthermore, the MPS is the main domestic security agency in China, thus making it the equivalent to the national police in other countries. It controls and administers the People's Armed Police. In general, the MPS does not undertake paramilitary functions, which are within the province of the People's Armed Police, nor does it generally conduct domestic intelligence which is the responsibility of the Ministry of State Security.

Local municipal police under the MPS have historically been unarmed in contrast to members of the PAP. Since 2006, however, frontline officers have carried sidearms. The MPS is the leading body in China pertaining to antiterrorist, criminal prevention and other security related crisis responses.

The Ministry of Health (MOH) of China (PRC) is an executive agency of the state which plays the role of providing information, raising health awareness and education, and ensuring the accessibility of health services. It continually monitors the quality of health services provided to citizens and visitors in the mainland of the People's Republic of China. The MOH is also involved in the control of illnesses, diseases, pandemics, food safety issues, and coordinates the utilization of resources and expertise where necessary. It also cooperates and keeps in touch with other health ministries and departments, including those of the special administrative regions and the World Health Organization (WHO).

Beside the above organizations, there are two agencies which provide integrated emergency management. They are the National Civil Defense (CD) and the Emergency Management Office (EMO). Civil Defense is responsible for aerial defense, CBRN (chemical, biological, radiological and nuclear), HazMat and kindred issues in cities. The Emergency Management Office covers emergency planning, natural disasters, technological accidents, public sanitation issues, social

security concerns, and recovery and reconstruction activities. The CD has its own resource and tactical teams to respond to emergencies, whilst the EMO has more of a coordination role between MCA, SAWS, MPS, MOH and other related agencies. The Chinese central government established the EMO in December 2005 and this was another milestone in the development of an effective emergency management system.

Under the central government, all local governments follow the same structure to establish a province or city level EMO. This local level EMO has authority to coordinate the same level MCA, SAWS, MPS, MOH and other related agencies in emergency responding, disaster relief and recovery. Under national law, different levels of emergencies precipitate escalation to the appropriate level of EMO and the government. For example, SAWS has published a regulation pertaining to coal mine production safety incident reporting and investigation. It classifies emergencies at four levels and is the typical classification in China. These levels are:

- Level 1, extremely serious, over 30 fatalities, escalate to the State Council
- Level 2, serious, between 10-30 fatalities, escalate to province level
- Level 3, major incident, 3-10 fatalities, escalate to city level, and
- Level 4, small case, less than 3 fatalities, escalate to local level

2.3.6 Challenges and Opportunities

China, like the United States, is a large country with diverse geographical regions that will be affected in different ways by global warming. The north is expected to get drier, much like the southwest in the United States. Meanwhile, southern China will become wetter, like the American northeast. And, just like America, China must develop advanced coal-burning technologies due to the possibility of global warming pollution.

China does not have one centralized powerful agency like FEMA or DHS to handle emergencies yet. The establishment of EMO showing the trend of centralization is positive. Moving forward, China will need more professional emergency management staff. Thus, they will need more education program from local universities. By 2008, there is only one university that has an emergency management master degree education in Beijing, several emergency management research centers in other 5 or 6 universities in Beijing, Shanghai and Chengdu.

In terms of security, Chinese tactical teams and EOCs are equipped with new technology such as GIS and internet based information distribution and collection systems. These will lead to

more demands on budgets and knowledge, thus generating more purchase and training. However, with this emergency management enhancement or modernization, China will develop stronger capability to handle disasters.

2.3.7 Emergency Management – Operations

The emergency management field occurs in both the public and private sectors, sharing the same processes, but with different focuses. Emergency management is a strategic rather than tactical process and as such it usually resides at the executive level in an organization. It normally has no direct power but serves as an advisory or coordinating function to ensure that all parts of an organization are focused on the common goal. Effective emergency management relies on a thorough integration of emergency plans at all levels of the organization and an understanding that the lowest levels of the organization are responsible for managing the emergency and getting additional resources and assistance from the upper levels. The levels of emergency management range from preparedness, response, and recovery.

THE FOUR PHASES OF EMERGENCY MANAGEMENT

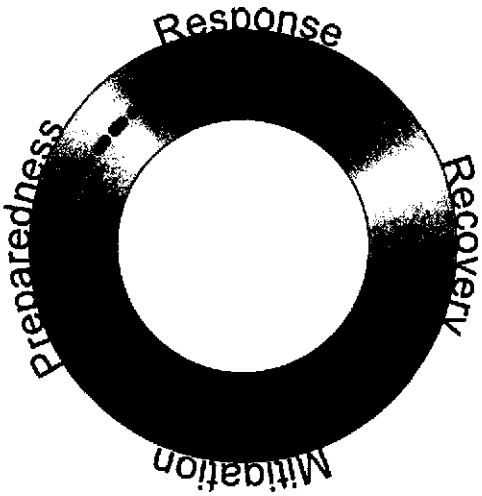


Figure 9 Phases of Emergency Management (Em_cycle)

2.4 Chinese Environmental Agencies and Policies

2.4.1 Chinese Environmental Efforts and Organizations

In concert with increasing national infrastructure, China has issued laws, regulations and standards on environmental monitoring. Chinese lawmakers are suggesting more severe punishment for enterprises that excessively discharge water pollutants. Such fines are to be assessed according to the amount of monitored pollutant discharge. The operation of the online monitoring equipment is also subject to regular supervision. Furthermore, the Chinese government has set the goal to establish an advanced environmental monitoring forecast system during the 11th Five-Year Plan period. In 2008, the Chinese government issued the "The 11th National Plan on Environmental Monitoring and Supervision" in order to establish an overall automatic air quality monitoring system for all the cities, an overall automatic monitoring system for the major rivers and basin, and an automatic system on desert storm and acid settlement and offshore sea areas. (United Nations)

China has begun to establish a basic automatic monitoring environmental system. The three-tiered system is composed of the national, provincial and municipal levels which include over 2,300 monitoring stations and 47,000 professional experts. There are ten national environmental monitoring networks covering the major rivers and basins. These rivers and basins include the Yangtze River, Yellow River, Huai River, Hai River, Pearl River, Liao River, Song Hua River, Tai Lake, Chao Lake and Dian Lake. Those systems generate reports on weekly, monthly and quarterly bases. The other environmental efforts are carried out by each respective provincial environmental protection agency.

During the 11th Five Year Plan period, it is projected that all key sources of pollution will be equipped with automatic monitoring instruments. Currently, China is moving towards monitoring the pollutant sources of key manufacturers in heavy polluting industries. The major monitored parameters include:

- CODC
- NH3-N
- TP
- pH
- temperature
- water flow

The continuing online emissions monitoring equipment (CEM) is an essential component of China's plan of an integrated environmental monitoring network. China will need to introduce high-level automatic online monitoring instruments and relevant computer network technology and equipment in order to achieve its goals.

2.4.2 Chinese Government Environmental Objectives

According to the latest Chinese government planning, the government will place an emphasis on environmental objectives. First, environmental protection efforts will become more proactive with more effective macroeconomic regulation and control while maintaining economic growth with adjustments to the basic economic structure. The environmental challenges presented opportunities to develop environmental industries and promote environmental well being during the last 5 to 6 years during the global financial crisis. It offered an opportunity to transform economic development and restructure the economy aligning them to more balance approach which includes environmental sustainability. During this time, China has made some strides to clean up the environment by exercising stricter control over energy and resource-intensive high pollution producing industries and projects and reducing overcapacity and redundancy. Second, pollution reduction efforts have resulted in better environmental awareness and environmental quality improvement. COD discharge and SO2 emission went down by 3.27% and 4.60% respectively compared with that of the last year and down by 9.66% and 13.14% against 2005 level. The target of SO2 reduction set in the eleventh Five-Year Plan was accomplished a year ahead of schedule, laying a solid foundation for the overall success of emission reduction for the eleventh Five-Year Plan. Third, plans were put into place for the rehabilitation of rivers and lakes, and new breakthrough was made in pollution control in key river basins and regions. Provisional measures for assessing implementation of special plans for water pollution prevention and control in key river basins has been supported by the General Office of the State Council, indicating the full establishment of water quality assessment system for provincial sections at key river basins. This will be a crucial instrument for promoting water pollution prevention and control in key river basins. Fourth, more efforts will be made to promote environmental law enforcement and emergency management and priority was given to prominent environmental issues like heavy metal pollution that concern public health and well being. A plan to control heavy metal pollution was launched with special environmental campaigns. Fifth, reward-based pollution control measures were enacted and spurred widespread environmental protection improvements in rural areas and improved overall ecology in those areas. Sixth, the three basic strategic projects for pollution reduction

produced positive results, and the early work for the 12th Five-Year Plan is progressing as plan. Overall advances have been made in environmental policy and legislation, science and technology, environmental monitoring, publicity and education and international cooperation. Environmental policies and legislations continued to improve and the catalogue on products with high pollution and high environmental risks was developed. Steady progress has been made in the transformation of environmental monitoring, publicity and education and international cooperation.

2.4.3 National and Provincial Policy and Priorities

A major focus of the Chinese government's Ninth Five-Year Plan was to address pollution and protect the environment. See below:

The Plan for Total Amount Control of Major Pollutants Discharge in China During the Ninth Five-Year Plan Period

The Outline of the Ninth Five-Year Plan of the People's Republic of China for National Economic and Social Development and the Long-Term Targets for the Year 2010 sets forth the country's objectives of environmental protection during the Ninth Five-Year Plan period: "By 2000, we shall have, through our efforts, brought the worsening trend of environmental pollution and ecological destruction basically under control and improved the environmental quality of some cities and regions to some extent." "Conditions shall be created to enforce total amount control of pollutant discharge."

Enforcing Total Amount Control of Pollutant Discharge Is An Important Measure of Environmental Protection in China

The enforcement of total amount control of pollutant discharge is necessary to ensure the attainment of the objectives of environmental protection during the Ninth Five-Year Plan period. Environmental pollution in China is already very serious. The total amount of pollutant discharge in many regions has obviously exceeded the environmental load capacity. The total

amount of pollutant discharge will further increase with the economic development and population growth. The total amount of pollutant discharge must be brought under strict control so as to attain the objectives of environmental protection during the Ninth Five-Year Plan period.

The enforcement of total amount control of pollutant discharge is necessary to bring about the fundamental shifts in the economic system and the mode of economic growth. The crux of serious environmental pollution in China lies in the extensive operation of economic growth. The enforcement of total amount control of pollutant discharge will accelerate the economization of resources, optimization of the industrial structure, technological progress and pollution treatment and promote the shift in the mode of economic growth.

The enforcement of total amount control of pollutant discharge is necessary to pursue the strategy of sustainable development. Sustainable development has been designated as an important guiding principle for national economic and social development in China in the 15 years to come. The enforcement of total amount control of pollutant discharge by applying environmental protection laws and administrative means is easily workable and assessable, and conducive to promoting the implementation of sustainable development in China.

The enforcement of total amount control of pollutant discharge is necessary to deepen the reform and open China wider to the outside world. We shall work hard to reduce the amount of discharge in the light of the level of economic and technological development. It is an concrete measure of China's participation in the global actions of environmental protection.

The Basic Principles Regarding the Total Amount Control of Pollutant Discharge

A. The Principle of Index Screening

1. Major pollutants that greatly harm the environment and shall be brought under control by the state;
2. It can be supported by environmental monitoring and statistical means;
3. Total amount control can be enforced.

In accordance with the above-mentioned principles, total amount control of the discharge of 12 pollutants shall be enforced during the Ninth Five-Year Plan period.

1. The indices of air pollutants (3): soot, industrial dust and sulphur dioxide.
2. The indices of water pollutants (8): chemical oxygen demand, oil pollutants, cyanide, arsenic, mercury, lead, cadmium and chromium.
3. The index of solid wastes (1): The discharge amount of industrial solid wastes.

B. The Principle of Total Amount Distribution

1. Abiding by the general objectives. In 2000, the total discharge amount of major pollutants in China shall be restricted to the level registered at the end of the Eighth Five-Year Plan period and shall not be exceeded on the whole.
2. Laying stress on the key areas. The total discharge amount of pollutants that should be brought under appropriate control shall be reduced to some extent in the regions and basins where major pollutants are controlled by the state during the Ninth Five-Year Plan period. The main areas are:

The acid rain control regions and sulphur dioxide control regions;

The Huaihe, Haihe and Liaohe river basins; and

The Talhu, Dianchi and Chaohu lake basins.

3. Dealing with different situations in different ways. We shall give due consideration to the regional disparity in view of the current economic and environmental conditions in different regions. In the eastern part of the country, the total discharge amount of major pollutants shall be reduced to some extent on the basis of what was achieved at the end of the Eighth Five-Year Plan period; in the central part of the country, it shall be restricted to the level registered at the end of the Eighth Five-Year Plan period; in the western part of the country, restrictions on some of the indices may be appropriately relaxed in view of the specific conditions.

   Highly hazardous and toxic pollutants such as cyanide, arsenic and heavy metal must be brought under strict control and their discharge amount shall be reduced to some extent as compared with the end of the Eighth Five-Year Plan period; the discharge amount of soot, industrial dust, chemical oxygen demand, oil pollutants and industrial solid wastes shall be restricted to the level registered at the end of the Eighth Five-Year Plan period; in the acid rain and sulphur dioxide control regions, great efforts shall be made to restrict the discharge amount of sulphur dioxide, which is difficult of control, to the level registered at the end of the Eighth Five-Year Plan period.

4. Supporting the strong. The enforcement of total amount control of pollutant discharge should be beneficial to a rational distribution of environmental resources, to implementing the industrial policies of the state, to the technological progress of enterprises, and to enhancing their enthusiasm for pollution treatment. When the discharge amount of pollutants.. is distributed among enterprises, they shall be urged first of all to reach the discharge standard.

he Basic Methods of Total Amount Control

. The provincial-level basic figures of discharge amount in 1995 shall be verified on the basis of pplications submitted by the provinces, autonomous regions and municipalities directly under he Central Government; a national plan for total amount control of pollutant discharge shall be

worked out after national overall balance; the discharge amount of major pollutants during the Ninth Five-Year Plan period shall be distributed among the provinces, autonomous regions and municipalities directly under the Central Government as planned indices of control by the state.

B. The provinces, autonomous regions and municipalities directly under the Central Government shall distribute the planned indices of control by the provincial level authorities and assign them to various local departments and enterprises, and planned management of total amount control shall be enforced from level to level.

C. Those industrial sectors that discharge a fairly large amount of pollutants shall do everything possible to increase production without increasing pollution.

D. Annual plans shall be worked out.

E. Annual inspection and examination shall be conducted, and the fulfillment of the indices regarding total amount control in various localities shall be made public regularly.

F. In accordance with the provisions of the Law on the Prevention and Control of Water Pollution, a system of total amount control of the discharge of major pollutants shall be enforced on the seriously polluted water bodies. Total amount indices of pollutant discharge that strictly abide by this Plan shall be defined in conformity with the water environmental quality standards set for water bodies, and a system of pollutant discharge amount check and ratification shall be enforced on those enterprises that have the task of reducing their pollutant discharge amount.

According to the latest Chinese government plan - Twelve Fifth-Year Plan, the government

looks to further its efforts to reign in pollution and promote more sustainable environmental policies (see below):

China has set goals to make significant reductions in the total emissions of major pollutants: chemical oxygen demand (COD) and SO2 by 8%, ammonia nitrogen and nitrogen oxide by 10%. Forest coverage rate will increase to 21.66% and national forest stocks will increase by 600 million cubic meters.

Target		2010	2015	Change over 5 years (%)	Forecast or Binding
Farmland reserves (billion mu)		1.818	1.818	0	binding
Decrease in water consumption per unit of value-added industrial output (%)				30	binding
Increase of water efficiency coefficient in agricultural irrigation		0.5	0.53	0.03	forecast
Increase of non-fossil fuel usage in primary energy consumption (%)		8.3	11.4	3.1	binding
Decrease in energy consumption per unit of GDP (%)				16	binding
Decrease in CO2 emissions per unit of GDP (%)				17	binding
Total decrease in emissions of major pollutants (%)	Chemical Oxygen Demand (COD)			8	binding
	Sulphur Dioxide (SO2)			8	
	Ammonia Nitrogen			10	
	Nitrous Oxides			10	
Forest Increase	Forest coverage rate (%)	20.36	21.66	1.3	binding
	Forest stock (m^3)	137	143	6	

2.4.4 Ministry of Environmental Protection

Ministry of Environmental Protection - China (MEP) is responsible for the formulation and enforcement of national policy as well as the coordination and supervision of major environmental projects. Since 1998, MEP's role has expanded from pollution control to broader environmental issues such as desertification, biodiversity, wetlands preservation, the exploitation of natural resources and nature reserves, protection of the ozone layer, and the reduction of greenhouse gas emissions. MEP is responsible for directing the organization and development of the country's emission control system and pollutant discharge license system and carries out environmental protection measures. With the reorganization of the Ministry of Environmental Protection (MEP) that was upgraded to ministry level in March of 2008 from State Environmental Protection Administration, the ministry has decided to establish a new department specializing in environmental monitoring, demonstrating the government's resolution to strengthen China environmental monitoring capacities. Through the reform of Chinese government administrative structure, the MEP has focused on macro administration, law, and regulation enforcement. Monitoring has become the main factor in the MEP's administration both in urban and industrial sectors.

The national monitoring network under the MEP consists of over 4,700 monitoring stations. There are an additional 2,000 environmental monitoring stations not associated with the MEP in other industrial sectors. However, all industrial stations are required to share information with the national environmental monitoring system, which is macro-managed by MEP. Environmental Monitoring Stations (EMSs) are independent subsidiaries of the local Environmental Protection Bureaus (EPB) that are responsible for environmental monitoring. The EPB uses the monitoring data to verify the discharge status of facilities.

Examples of the efforts of the MEP are listed below:

In order to reduce major pollutant COD by 10% by 2010 according to the 11th Five Year Plan, MEP required the below measures taken to enhance national water monitoring management:

- By 2010, all urban wastewater treatment plants are required to install automatic online monitoring systems to achieve real-time monitoring of the operation and discharge of plants.

- In order to perfect the early warning system of drinking water sources, monitoring and management of drinking water sources need to be improved. Analysis of monitored results should be conducted at least once a year for centralized drinking water sources.

- Monitoring of key water basins and major projects including the South-to-North Water Transfer Project and Yellow River Xiaolangdi Project should be perfected, and quality monitoring of border rivers including Heilong River, Yalu River and Yili River should be enhanced.

- Full supervision and monitoring of hazardous and toxic sewage sources along rivers and lakes are required. Regular water quality monitoring report system will be established by 2010.

- China will set up a national environment emergency response monitoring network. All provinces, cities and river basins should be equipped with water and air environment emergency monitoring vehicles and equipment, and key sea and river ports should be equipped with emergency response monitoring ships.

- China will step up efforts to build up national automatic surface water monitoring stations with an enhanced focus on monitoring of provincial border rivers and river outlets.

- County monitoring stations should be equipped with regular lab apparatuses. By 2010, 90% of eastern region, 80% of central region and 60% of western region stations should meet national standards.

- On-line automatic monitoring equipment, pollution accident emergency response monitoring technology and equipment as well as remote monitoring systems will see development in preferential areas within the 2006-2010 Five-year plan.

EP's mission:

1 Develop and organize the implementation of national policies and plans for environmental protection, draft laws and regulations, and formulate administrative rules and regulations for

environmental protection. Organize the development of environmental function zoning, organize the development of various kinds of environmental protection standards, criteria and technical norms; organize the development of the plan for pollution prevention and control in key regions and river basins as well as environmental protection plan for drinking water source areas; cooperate with relevant department to develop the plan for pollution prevention and control in key marine areas and participate in the development of national zoning of main function areas according to national requirement.

2. Take charge overall coordination, supervision and management of key environmental issues. As the leading organization coordinate the investigation and handling of very serious environmental protection accidents and ecological damages; guide and coordinate the activities of local governments in terms of early warning and emergency response to very serious environmental protection accidents; coordinate and address trans-province pollution disputes; make overall arrangement for pollution prevention and control of key watershed, regions and marine areas; guide, coordinate and supervise marine environment protection work.

3. Shoulder and materialize the responsibility for achieving national target on emission reduction. Organize the development of total emission control system and pollutant discharge license system for major pollutants and supervise their implementation; identify the name and control indicators of the pollutants under total discharge control; check and supervise if local governments finish their emission reduction task; carry out environmental protection target responsibility system, examine the outcome of total discharge control and make public the examination results.

4. Take charge putting forward recommendations on the scale and direction for fixed assets investment in the field of environmental protection and arrangement of national financial budget; review and check the fixed-asset investment projects under national plan and annual plan in accordance with its terms of reference identified by the State Council; cooperate with relevant departments to do well the implementation and supervision work. Take part in, guide and facilitate the development of circular economy and environmental protection industry; take part in climate change activities.

5. Shoulder the responsibility for preventing and controlling environmental pollution and damage at source. Conduct environmental impact assessment as entrusted by the State Council on major economic and technical policies, development programs and major economic

development plans; put forward suggestions on environmental impacts to draft laws and regulations relevant to environmental protection; review and approve environment impact statements of key development regions and projects.

6. Take charge supervision and management on the prevention and control of environmental pollution. Develop and carry out the management system for pollution prevention and control of water, air, soil, noise, light, odor, solid wastes, chemicals and vehicle emissions; it and relevant departments supervise and administrate environmental protection of drinking water source areas; organize and guide comprehensive environmental control activities in urban and rural areas.

7. Guide, coordinate and supervise ecological conservation. Develop ecological conservation plan, organize the assessment of eco environment quality, monitor natural resource development & utilization, important eco environment development and ecological restoration activities that influence eco environment. Guide, coordinate and supervise the environmental protection of various kinds of nature reserves, scenic spots and forest parks; coordinate and supervise such activities as conservation of wildlife, wetland environmental protection and prevention and control of desertification. Coordinate and guide eco environment protection in rural areas, supervise environmental safety of biotechnology; take charge biological species (including genetic resources) activities; organize and coordinate the conservation of biodiversity.

8. Take charge the supervision and administration of nuclear and radiation safety. Draw up relevant policies, laws, regulations and standards; take part in emergency response to nuclear accidents, take charge emergency response to radiation environmental accidents. Monitoring and administrate the safety & security of nuclear facilities and radioactive sources; supervise and administrate pollution prevention and control of nuclear facilities, application of nuclear technology, electromagnetic radiation, and the development and utilization of mineral resources with radioactive pollution. Supervise and administrate the regulation of nuclear materials and the safety of design, manufacture, installation and damage-free test of civil nuclear safety equipment.

9. Take charge the work on environmental monitoring and information release. Develop environmental monitoring systems and norms; organize the implementation of the monitoring of environment quality and pollution sources. Organize investigation, assessment, prediction

and early warning of environmental quality; organize the development of and administrate national environmental monitoring network and national environmental information network; establish and practice environment quality publication system, make public comprehensive national environment report and key environmental information.

10. Carry out environmental science and technology work, organize key scientific research projects and technological demonstration in the field of environmental protection and facilitate the development of environment science & technology administration system.

11. Carry out international cooperation and exchanges on environmental protection; study and put forward recommendations on relevant issues in international environment cooperation; organize and coordinate the implementation of international environmental conventions, take part in handling of foreign environmental protection affairs.

12. Organize, guide and coordinate environmental publicity and communications work; develop and organize the implementation of the outlines for publicity and communications of environmental protection; carry out the publicity and education on the development of conservation culture and environment-friendly society; promote the participation of the public and social organizations in environmental protection.

13. Undertake other affairs delivered by the State Council.

2.4.5 Environmental Protection Bureau (EPB) and State Environmental Protection Agencies (SEPA)

Although national environmental policy is guided by China's MEP, there is still a large degree of autonomy of provincial, municipal, and local level environmental protection agencies. The institutional system of Chinese environmental management puts a remarkable degree of enforcement authority in the hands of municipal environmental protection bureaus (EPB's). These local EPB's are technically accountable to higher-level government agencies and the State Environmental Protection Agencies (SEPAs), but work primarily at the local level where they receive funding and support. EPB management is also appointed by the local government. Consequently, China's national environmental goals depend in large part upon the willingness of municipal governments and their respective EPB's to implement and enforce environmental reform.

2.5 Shandong Province - Environmental Situation

2.5.1 Shandong Province - Background

Situated in the lower reaches of the Yellow River, on China's eastern coast line, Shandong province's territory consists of the Shandong Peninsular and adjacent inland. Protruding into the conjunction area of the Bohai Sea and the Yellow Sea, the peninsula faces the Liaodong Peninsular of Liaoning Province over the sea. Its inland adjoins the provinces of Hebei, Henan, Anhui and Jiangsu. The province stretches 420 km from south to north and 700 km from east to west, covering an area of 156,700 sq kilometers and a total population of 86 million people; it boasts the largest agricultural output amongst China's provinces. In terms of GNP and gross industrial output it holds second rank; in terms of total exports, Shandong ranks fourth. The province has been one of the engines driving China's impressive economic growth over the last decade. This was primarily the result of substantial increases in agricultural productivity and industrial output. The latter took place to a large extent in Shandong's urban areas, particularly in Jinan, the capital city and in the coastal cities of Qingdao, Yantai and Weihai.

Figure 10 Shandong. China (Yantai-Life Maps)

Shandong ranks first among the provinces in the production of a variety of products, including cotton and wheat as well as precious metals such as gold and diamonds. It also has one of the biggest sapphire deposits in the world. Other important crops

include sorghum and maize. Shandong has extensive petroleum deposits as well, especially in the Dongying area in the Yellow River delta, where the Shengli Oilfield (lit. Victory Oilfield) is one of the major oilfields of China. Shandong also produces bromine from underground wells and salt from sea water.

Shandong is one of the richer provinces of China, and its economic development focuses on large enterprises with well-known brand names. Shandong is the biggest industrial producer and one of the top manufacturing provinces in China. Shandong has also benefited from South Korean and Japanese investment and tourism, due to its geographical proximity to those countries. The richest part of the province is the Shandong Peninsula, where the city of Qingdao is home to three of the most well-known brand names of China: Tsingtao Beer, Haier and Hisense. In addition, Dongying's oil fields and petroleum industries form an important component of Shandong's economy. Despite the primacy of Shandong's energy sector, the province ranks as the largest consumer of fossil fuels in all of China. In 2011, the nominal GDP for Shandong was 4.50 trillion yuan (US$711 billion), ranking third in the country (behind Guangdong and Jiangsu). Its GDP per capita was 42,014 yuan (US$6,365), ranking eighth. (United Nations)

Figure 11 Map of Shandong (Asia Times Online: China Business News : Shandong)

2.5.2 Shandong Environment

Along with its population and economic prowess, Shandong has ever increasing environmental challenges. As a consequence, Jinan City, for example, suffers from coal emission pollution and acid rain from its abundance of industrial and residential boilers which is exacerbated by the city's adverse topographic location with over 200 inversion days per year. Thus, in terms of air quality Jinan ranks fourth among the 37 most "environmentally stressed cities in China, constricting economic development, according to the National Environmental Protection Agency. Most other cities in the province are also failing to meet the national standards on air pollution. The situation is especially alarming during the heating season (four months of the year).

Figure 12 Shandong waterway

Shandong Province has a rain-sparse climate with a large amount of the water supply derived from underground sources. Some of these aquifers are being increasingly polluted and reduced below replenishment amounts and domestic and industrial water has to be extracted from often polluted rivers, rain-fed reservoirs or piped from distant water sources. Some cities, e.g., Jinan, Qingdao and Zibo, have to rely on costly water transmission from the Yellow River. At the same time, most rivers and lakes, especially the Xiaoqing River and the Nansihu Lake are heavily polluted, aggravating water shortages and restricting long-term economic development.

Ambitious efforts to improve waters, wetlands and forests

Shandong will see a fundamental change in its environment as the province puts great efforts into construction of environmental facilities, said Jiang Yikang, Party secretary of the province. It plans to have a "circular economic system" and green development model in place by 2015 to reduce the main pollutants. Water quality will also be improved, with over 90 percent of urban effluent treated. Both urban and rural household refuse will be disposed of or treated by using advanced techniques, according to the provincial development plan. The green coverage rate in the urban areas will reach 40 percent while forest coverage across Shandong will grow to 25 percent. "Shandong will protect the environment and is expected to be a pioneer in ecological civilization," Jiang said. Shandong's efforts in environmental preservation started in 2003 when the province launched an outline for improvements. Over the past six years, 59 polluted rivers in Shandong have been treated to reach a water quality able to sustain fish. The achievement won the province three successive championships in national assessment of pollution control on the Huaihe River Basin as well as five successive national awards for pollution control in its sea and rivers. Shandong issued requirements on strengthening aquatic ecosystems last

November that calls for 60 billion Yuan ($9.4 billion) in investment in six major projects over the following 10 years. The province's aquatic program focuses on the eight major water systems that flow through Shandong, including the Yellow, Haihe, Dawen, Xiaoqing, Yishu and Weihe rivers, as well as Nansi Lak.

Efforts on four major zones along important rivers in Shandong will be accelerated, according to the latest plan. Engineering measures used to improve eco-fragile areas around the Yellow River Delta will include introducing clean water, diverting water from other regions, planting trees and watershed management. Existing water quality in four lakes in the south of Shandong and Dongping Lake will be protected. The plan also calls for an environmental protection system along Shandong's coast and provincial boundary. Shandong will speed up forestation projects in the watershed by developing green corridors. Farmland will also be returned to a forest state. The province will also carry out wetland conservation and restoration work focusing on the wetland nature reserves in Nansi Lake and Dongping Lake. Other wetland parks will be created in canals, at Xiashan Mountain, on Yangma Island, on Bohai Bay and along some important rivers. By 2015, 1.3 million hectares of new wetland park will be created and 130,000 hectares of wetland will be restored. Shandong will implement comprehensive treatment of industrial and urban sewage along with mitigation of minor watershed pollution. It aims to complete 650 industrial source treatment projects and 350 minor watershed treatment projects by 2015.

The province has put great effort into improving the environment while developing its economy. Combined energy consumption per unit of GDP during the five years from 2006 to 2010 fell by 22.1percent, while sulfur dioxide emissions were reduced by 20 percent and chemical oxygen demand decreased by 18 percent. "The province's aim is to make the sky blue and the rivers healthy enough to raise edible fish," said Shandong Governor Jiang Daming. To meet those goals, the province jointly issued a protocol on environmental protection with China's Environmental Protection Ministry last year that calls for Shandong to be a demonstration base for rehabilitating lakes and rivers. Shandong has shut down out-of-date shaft kilns capable for producing 75.96 million tons of cement, furnaces that before made 8.2 million tons iron annually and equipment that generated 7.17 million kW of electricity. According to Zhang Bo, head of the Shandong Environment Protection Bureau, the province built 211 treatment facilities by the end of 2011 that can handle 90.4 percent of the sewage produced in urban

areas. Partly due to the efforts, all 59 rivers under the province's control were able to sustain fish by the end of 2010. (United Nations)

Figure 13 Shandong waterway

Environmental Policy in Shandong

The provincial government readily acknowledges that the environmental situation in Shandong is "serious" due to its extremely fast industrial growth as result of its transition to the market economy. These efforts should on one hand permit economic growth, but on the other hand markedly reduce industrial pollution and improve municipal environmental treatment measures and provide ecological protection. Particular mention is made in these plans to regional water-shed protection as well as environmental management.

2.6 Organization - Shandong Environmental Protection Agency (SDEPA)

The Shandong Environmental Protection Agency headquartered in Jinan, China is responsible for the environmental protection of the province of Shandong China located in the north eastern portion of the country. The province accounts for 1.6% of the total land area of China and is a provincial economic powerhouse with a large population. The province has experienced rapid and sustained development of its economy. During the same time, the province has experience environmental challenges. The Shandong Environmental Protection Agency (SDEPA) is the governmental agency to take the lead in addressing these environmental concerns. SDEPA's main task and goal is to improve the quality of the environment in the province and to ensure a safe environment. SDEPA is responsible for Jinan City and Qingdao City 17 Municipal Environmental Protection Bureau (EBP) and other agencies under the Department of Environmental Protection.

The agency participates in the drafting of local laws and regulations related environmental protection, the drafting of regulations, the development of environmental protection planning, drafting Shandong's environmental zoning plans, the development of local environmental protection standards, creating benchmarks and technical specifications, producing watershed pollution prevention plans, securing drinking water sources, and other environmental protection activities. SDEPA is the lead coordinating the investigation and handling of major environmental pollution accidents and ecological damage events including early warning, the resolution of cross-regional environmental pollution disputes, pollution prevention and control activities, monitoring of environmental protection, and organizing the province's environmental protection law enforcement inspection activities. SDEPA is also engaged in or is responsible for the following:

- Emission reduction targets
- Pollution Permitting
- Environmental impact assessments
- Environmental pollution control - water, air, soil, noise, light, odor, solid waste, chemicals, motor vehicles
- Ecological protection planning
- Nuclear safety and radiation safety supervision and

management

- Environmental protection scientific research
- International environmental cooperation
- Environmental protection education and community outreach

Figure 14 SEPA Headquarters - Jinan, Shandong - China

SDEPA's headquarters are located in Jinan City, East Jingshi Road East. There is a new building for environmental monitoring with 17 floors, an environmental emergency command center, a large conference room, with other meeting room and office space.

2.6.1 SDEPA's Responsibilities

SDEPA is responsible for the following:

1) Is responsible for establishing the basic system of sound environmental protection. Drafting local laws and regulations of environmental protection, the draft regulations; the development of environmental protection planning, and organize the implementation; organize the preparation of the province's environmental function zoning; organizations to develop various types of local environmental protection standards, benchmarks and technical specifications; organizations to develop and supervise the implementation of the province's focus regional, watershed pollution

prevention planning and drinking water sources, environmental protection planning; required in conjunction with relevant departments to develop key sea pollution prevention plan.

2) Is responsible for major environmental problems of co-ordination and supervision and management. The lead in coordinating the investigation and handling of major environmental pollution accidents and ecological damage event; guidance and coordination around the emergency of major environmental emergencies, early warning; coordinate the resolution of cross-regional environmental pollution disputes; co-ordination in key river valleys in the province, region, marine pollution prevention and control work; guidance, coordination and monitoring of marine environmental protection; organize the province's environmental protection law enforcement inspection activities.

3) Assume responsibility for the implementation of emission reduction targets. Organization and implementation of the emissions of major pollutants control and permit system; implementation of the total control of the name of the pollutants and control indicators in conjunction with relevant departments; responsible for the pollutant discharge permit required; supervision, supervision and verification of around the emissions of pollutants the task is completed; implement the responsibility system for environmental protection objectives, the total amount of emissions reduction and publish the results of the exam.

4) To put forward the views of the field of environmental protection investment in fixed assets, direction and provincial funding arrangements; according to the provincial government regulations permission, approval, approval of the province's planning and the scale of the annual plan fixed assets investment projects, and cooperate with relevant departments to do implementation and monitoring of good organization; management work of the province for collecting the fees; involved in guiding and promoting the development of circular economy and environmental protection industry; involved in responding to climate change.

5) Bear the prevention, control, responsibility for environmental pollution and environmental damage from the source. By the provincial government to commission

an environmental impact assessment of the significant economic and technical policies, development planning, and major economic development plan; local laws and regulations related to environmental protection, the draft regulations on the environmental impact; required to approve development and construction area, the project environmental impact assessment documents.

6) Is responsible for the supervision and management of environmental pollution control. The development of pollution prevention and control of water, air, soil, noise, light, odor, solid waste, chemicals, motor vehicles and other administrative rules and organize their implementation; in conjunction with the relevant departments of supervision and management of drinking water resources to environmental protection work; organize and guide the urban and rural integrated environmental management.

7) The development of ecological protection planning, organizational assessment of the ecological environment quality conditions, monitoring an impact on the ecological environment, natural resources development and utilization of important ecological environment and ecological damage to return to work; supervision of the various types of nature reserves, scenic spots, Forest Park's environmental protection work, coordination, supervision and protection of wild flora and fauna, wetlands, environmental protection, desertification control; building various kinds of national, provincial nature reserve declaration, examination and approval to the provincial government recommendations, supervision and management of Provincial Nature Reserve ; coordination to guide the rural ecological environment protection, supervision and safety of biotechnology environment, the lead biological species (including genetic resources) work, organization and coordination of biodiversity conservation.

8) Responsible for nuclear safety and radiation safety supervision and management. The development of local nuclear safety and radiation safety policy, planning; to participate in the nuclear accident emergency response; responsible for the radiation environment and emergency work; to oversee the management of nuclear facility safety, security of radioactive sources; supervision and management of nuclear facilities, nuclear technology application, electromagnetic radiation, associated with radioactive mineral resources development and utilization of pollution prevention; responsible for the management of radioactive waste.

9) Is responsible for environmental monitoring, statistics and information dissemination. Develop and organize the implementation of environmental monitoring systems and norms; organization and implementation of environmental quality monitoring and pollution monitoring; organizations to investigate the state of the environmental quality assessment, prediction and warning; organization of the province's construction and management of environmental monitoring networks and environmental information network, the establishment of environmental quality announcement system, unified release a comprehensive report of the province's environment and major environmental information.

10) Demonstration of the major environmental protection scientific research and technology projects, to promote environmental management system; organization and implementation of the licensing system of environmental protection qualification; responsible for the supervision of the implementation of cleaner production.

11) The recommendations of issues related to international environmental cooperation; organizing and coordinating the implementation activities of the province's environmental protection of international treaties, the common external contact; manage the province's environmental protection system of foreign economic cooperation, coordination and compliance-related foreign-funded projects; by the provincial government and the Department of Environmental Protection commissioned to deal with the affairs of foreign environmental protection.

12) To organize, coordinate environmental protection publicity and education work; to develop and organize the implementation of environmental protection publicity and education framework to carry out the construction of ecological civilization and environment-friendly social construction of publicity and education work to promote public and social organizations to participate in environmental protection.

13) In accordance with the relevant provisions of the central and provincial and municipal environmental protection department head is responsible for co-management districts.

14) The contractor Provincial Party Committee and other matters assigned by the provincial government.

2.6.2 SDEPA's Organization

SDEPA consists of the following departments:

Environmental Protection Scientific Research and Design Institute of Shandong Province

The main responsibilities:

To provide a basis for environmental protection and environmental management research, applied research and technical services. Responsible for environmental and economic, environmental and social, environmental management and development planning studies, the ecological environment restoration, protection, rational development and research, environmental protection policies, norms, chemical analysis of legislation, environmental standards, environmental pollution control and comprehensive utilization of resources , water, environmental protection and pollution control technology, the protection of the atmospheric

environment and air pollution control technology, solid waste disposal and comprehensive utilization, noise pollution control technologies, ecological function regionalization and regional environmental planning, environment and facilities, the introduction of complete sets of technology , development and promotion of large and medium-sized construction project environmental impact assessment, environmental engineering and technical services, environmental management system (ISO14000) certification services, cleaner production audit, environmental protection, technical training, environmental science and technology information exchange.

Environmental Monitoring Central Station of Shandong Province

Main responsibilities:

To provide for environmental protection monitoring protection. Responsible for water environment quality monitoring, atmospheric environmental quality monitoring, ecological and environmental monitoring, marine environmental monitoring, geological environmental monitoring, radiation and vibration environmental monitoring, noise monitoring, groundwater quality monitoring; acid rain monitoring, ozone depletion, monitoring, GHG monitoring, biodiversity monitoring, solid waste monitoring, industrial monitoring of pollution sources, agricultural sources of pollution monitoring, urban life monitoring of pollution sources, radioactive sources of pollution monitoring, pollution emission monitoring of motor vehicles and vessels; environmental monitoring methods and standards research, environmental monitoring technical specifications, environmental monitoring and management, environmental monitoring information complete sets of technology research for processing and delivery of technical studies, monitoring of pollution sources, environmental monitoring equipment research and development, material research and development of environmental monitoring standards, environmental quality prediction study; emergency treatment of environmental pollution, environmental monitoring, technical advice, environmental monitoring, technical arbitration by the commissioned by social environmental monitoring; environmental monitoring network operation and management; environmental monitoring staff training; environmental monitoring technology exchanges.

Green Schools and Training Centers in Shandong Province

Main responsibilities:

In order to meet the needs of China's economic development and environmental protection cause in Shandong Province, is responsible for training much-needed environmental protection secondary professional and technical personnel, as well as to strengthen environmental management and actively carry out the training of environmental officials and employees to improve the quality of the environmental protection team. Schools under the Environmental Protection Department of Shandong Province, three environmental secondary school the only one located in the north of the Yangtze River. Was established in 1984, Shandong Province on the basis of environmental cadre school leadership and the offices of the Provincial Environmental Protection Department, the unit care for and support, new under the leadership of the party branch secretary, Chancellor Wang Zhen, all the faculty after 12 years of hard work in Shandong Provincial People's Government approved the establishment of 1996.

Shandong Provincial Environmental Protection Information Center

The main duties:

To carry out environmental publicity and education to improve people's environmental awareness. Responsible for environmental protection publicity and education; environmental protection scientific knowledge publicity and education; publicity and education of environmental protection policies and regulations. Responsible for environmental protection and technical training; pollution prevention and technical training; ecological and environmental protection and technical training; ecological restoration and technical training; Environmental management knowledge training; Environmental Protection of legal knowledge, training and environmental protection technology exchange.

Environmental Information and Monitoring Center in Shandong Province

Responsibilities:

1. Responsible for the operation and management of the province's environment automatic monitoring system construction, and real-time monitoring of environmental quality and the key sources of pollution emissions.
2. Responsible for the audit of the province's environment automatic monitoring data to confirm and artificial than the docking of data and automatic data promptly submit to send monitoring information.
3. Responsible for the Office of organ construction and operation and management of environmental information network.
4. Responsible for environmental protection, satellite communications Shandong sub-station management, maintenance and information received transfer.
5. Responsible for the Office of the video conferencing system construction and management.
6. In charge of environmental information and data backup, confidentiality, ensure that the information and data security.
7. Responsible for the Shandong Environment website, computer and network security technology to protect. Responsible for the Office of e-government platform for building and technical support.
8. Responsible for the province's environmental information and automated monitoring technology, guidance and training.
9. Arranged by the Office of the leadership tasks.

Shandong Province Environmental Monitoring Corps

Responsibilities:

1. Inspection and guidance of all cities of sewage charges levied;
2. Direct collection of the Central subordinates, provincial power industry focus sewage unit sulfur dioxide emission fees;
3. The development of the sewage charging policy;
4. To inspect and guide the province inspection and guidance of the cities to sources on-site environmental supervision;

5. The supervision and inspection of key pollution sources;
6. With the provincial Department of Environmental Protection offices on the supervision and inspection of the implementation of the deadlines governance projects;
7. Standardized remediation work for the province's sewage outfall;
8. Is responsible for job training of members of the provincial environmental supervision;
9. To inspect and guide the province's environmental supervision institutions standardization of construction work;
10. With the provincial Department of Environmental Protection offices do pollution incidents investigation and handling of disputes and petition.

Hazardous Waste Management Center in Shandong Province

Main responsibilities:

1. Responsible for the province's hazardous waste (including solid waste, hazardous chemicals, the same below) the preparation of the pollution prevention plan and organize the implementation;
2. Responsible for day-to-day supervision and management of the province's hazardous waste pollution prevention;
3. Responsible for the province's transfer of hazardous waste a single unified supervision and administration
4. Responsible for the technical review of the inter-provincial transfer of hazardous waste; responsible for the province's hazardous waste generation, transfer, storage, handling and disposal of the supervision and management; responsible for hazardous waste reporting registration and dynamic database, the transfer of hazardous waste manifest database and the province's hazardous waste exchange the set-up and maintenance
5. The application for the hazardous waste operating permit units of research, technology assessment and permit changes and the annual review in the first instance; responsible for drafting the hazardous waste management approach, technical specifications, etc.;
6. Organizational hazardous waste use, storage, disposal and other technical thematic studies

7. Hazardous waste management and disposal of employees in training, hazardous waste management technology communication and technology to promote and carry out the processing of solid waste disposal technologies with technical advice.

Shandong Province Radiation Environment Management Station

Main responsibilities:

1. Carry out the implementation of national and provincial environmental protection laws, rules, regulations, standards;
2. Participate in the preparation of the province's nuclear and radiation safety management planning and development of local laws and regulations of radiation safety management standard;
3. Responsible for the running of the urban radioactive waste repository in Shandong Province, the day-to-day management of the reservoir area and its surrounding radiation environment monitoring; bear the day-to-day supervision and management of the province of waste radioactive sources
4. Is responsible for site supervision and inspection, in accordance with the provisions of the province accompanied by radiation and electromagnetic radiation units for processing;
5. Involved in the radiation projects "three simultaneous" acceptance;
6. Bear the daily management of radiation accidents emergency response and on-site emergency ring. Should work; involved in the radiation incident handling and mediation of radioactive contamination caused by civil disputes, supervision and clear the pollution caused by radiation accidents;
7. Commitment to nuclear and radiation safety, scientific research, publicity, technical services, technical advice, international exchanges and cooperation, and related business training;

Service Center of Shandong Province Department of Environmental Protection authorities

Authority service center is responsible for the Office of the organs of administrative and logistical services to protect their specific duties are:

1. Prepare the Office of the organs of administrative and logistics support planning, management system, standardize procedures for the authorities to provide quality and efficient logistics support.
2. Responsible for the Office of authority fixed assets, office supplies and labor supplies to the acquisition, registration, distribution, storage and dispensing.
3. To draw up the Office of authority of office space allocation program, responsible for adjusting the arrangement and maintenance. According to the Bureau of housing distribution leading the group's views, for the Office of authority staff housing allocation procedures, responsible for sporadic adjustment and maintenance of the housing. The guidance the real estate management.
4. Is responsible for the Office of authority of office phone, institutions, staff of residential service telephone installation, maintenance and management.
5. Responsible for the Office of organs and quarters water, electricity, warm maintenance services, security, environmental remediation, health management and greening work.
6. The arrangements of the authority responsible for vehicle scheduling, maintenance, management and security inspection and supervision
7. Is responsible for the Office of authority documentation, print, copy work. Responsible for the conduct of business of the province's Environment Conference; contractor ticketing and authority data, send and receive work for newspapers and magazine subscriptions, manage, distribute and letters.
8. Responsible for contact with the resident authorities, coordination with the community's relations, improve outreach efforts.
9. The family planning work of the responsible authorities of the Office to strengthen contact with the resident planning department, to accept the guidance of its operations.
10. Prepare, apply for the Office of authority of office, logistical, administrative expenses, and extra-budgetary funds of the annual budget and final accounts, the audit work of reimbursement and a variety of accounting statements.
11. Mission statement, budget estimates and budget preparation and reporting of the Office of organs of the annual plan of capital construction projects, construction supervision and construction projects, to inspect the quality, organization completion and acceptance.
12. The establishment of the tertiary industry, and actively organize operations to generate income, and efforts to improve workers' welfare.
13. To complete the other tasks of leadership.

2.7 The Project: Emergency Environmental Management System

2.7.1 Project Synopsis

The risk of environmental emergencies or disasters in China is increasing. Environmental emergencies or disasters are events that have an adverse impact on the environment. These events can be made-man or natural. Sometimes natural events can create an environmental disaster such as a flood or forest fire. Other times, these events are made-man such as a river chemical spill from a factory. Often the impact of these events can be mitigated or even prevented if event indicators are known ahead of time. Increasingly, Chinese officials are looking to develop a system to manage the environmental emergencies and prevention strategies. In order to address these concerns in Shandong Province, SDEPA is in the initial phase to develop the "environmental emergency management and response" system.

The system includes providing a real-time environmental emergency early warning and a rapid environmental disaster response capability improving overall public safety and environmental enforcement and compliance. The scale of the system will be massive, connecting over 17 different governmental divisions and over 1,000 known pollution sources. The system consists of monitoring equipment and sensors, the data collection and management of the environmental data, a capable GIS component, an incident response and management system, a dispatching system, a robust decision support component, a communication network and integration strategy, a risk assessment and management component, and an emergency response and management element.

2.7.2 Project Goals and Objectives

The goal of the project is to better protect the Shandong environment and populace by reducing the threat from environmental pollutants, accidents, and disasters. The objective of the Study is to determine the feasibility of implementing an environmental emergency response system for the Environmental Protection Department of Shandong Province (SDEPA). SDEPA ensures environmental safety and protects public health. In Shandong, heavy industry is an important aspect of economic activity and there is sharp contradiction between rapid industrial growth and the demands on the environment. Environmental incidents pose significant economic risks and a serious threat to the health and safety of the people and social

stability. To systematically address these issues, Shandong Province will establish an environmental early warning and emergency management and response command system. The system will improve real-time data monitoring and analysis of environmental conditions, establish an emergency operations and incident response command center, and deploy an effective early warning capability for environmental hazards. The system will address technical response and information management requirements at the provincial, municipal, and county levels. To summarize, the project objectives are to create a system with the following attributes:

- A real-time environmental emergency response and management system
- State-of-the-art communication network
- Rapidly identify environment threats
- Comprehensive decision support capabilities
- Emergency environmental response and management

2.7.3 Current Project Status and Background - Environmental Emergency Response System (SEERS)

The Chinese National Emergency Response Department was founded after SARS incident in 2008, and SDEPA Emergency Department was founded in 2010. In past four years, Chinese environmental protection efforts have made progress, but there are still many challenges. The speed of economic development over the last 30 years, have created many environmental challenges, especially heavy metals, water pollution and air pollution. These problems are also the main challenges and risks facing Shandong province. SDEAP encounter over 11 major environmental accidents in 2011.

A major focus of SDEPA is monitoring chemical enterprises, e.g. mining companies; smelting enterprises, heavy metal enterprises, oil industry, etc. Currently, SDEPA Emergency Department has six people, but the department is cross functional and has access to resources and personnel across all or most of the of the other SDEPA departments. Environmental information gathering and data collection is carried out by various other departments. A portion of this data and information is uploaded to a centralized database. This information

and more is needed for the new system. The following is a list of some the departments that will work with the Emergency Department:

- Meteorological Department
- Conservancy Department
- EIA Agency
- Monitoring Agency
- Supervision Agency
- Hazardous Waste Management Agency
- Information Monitoring Agency
- Pollution Prevention Agency and Basin Agency

The system standard is based on the four steps:

1. Prevention
    a. Setting up the environmental database
    b. Provide an interface to collect risk points of the existing chemical companies and heavy metals companies
    c. Create an operating information plan with the local government, each section in each enterprise.

2. Pre-Alarm
    a. Collect environmental sensor data through manual monitoring and real-time system
    b. Setting the threshold of risk point sensor values
    c. Sending pre-alarm information to the SDEPA when the sensor value exceed the threshold

3. Emergency Response
    a. Provide a scientific basis and reasonable solution proposal to the government while processing environmental pollution or secondary environmental pollution events.

4. Environmental Assessment and Recovery

a. Hazard assessment of environmental events
b. Provide the sentencing basis for civil / criminal for environment violations
c. Provide EAP and SOP for environmental disasters, and recovery plans, and public information dissemination and policy management

SDEPA places emphasis on steps one and two. SDEPA aims to build the emergency system as an international model by using international standards and the latest technology. SDEPA cooperates with many international companies and agencies in the environmental, information technology, and emergency management fields. SDEPA has cooperated with SGS, which is involved in environmental projects in Taiwan, North America, and Europe.

SDEPA is looking to build their system by using the four steps: prevention, pre-alarm, emergency response, recovery. According to SDEPA, prevention is the most important step. By building up this system in this manner, SDEPA will have the ability to control the risk points for new industrial enterprises. Currently, SDEPA does not have a system for collecting, storing, and manage all of the data that is required for the system. SDEPA plans to build the system that includes processes/standard operating procedures that will help them easily identify the responsibilities for different department and offices.

There are different business units within SDEPA which will contribute to the system. The Emergency Department will take charge of future projects incorporating risk management practices and risk mitigation into the system and the overall environmental management work at SDEPA. Currently, there are different departments within SDEPA that are responsible for their own data and information with no coordinated procedures for sharing the data from those different departments. The new system will have to have a centralized database and management center and coordinate a data sharing solution into a single repository storing data from all departments. By cooperating and working with different departments from the different government levels, the system of SDEPA is vertical and cross functional . The four different tiers are as following:

- No.1 Tier: The Ministry of Environmental Protection
- No.2 Tier: The Provincial Environmental Protection Bureau
- No.3 Tier: The Municipal Environmental Protection Bureau

- No.4 Tier: The County Environmental Protection Agency

With the ministry level involved mostly with carrying out special operations, the Shandong EPA delegates the day to day monitoring work to lower levels of environmental protection departments. First, companies will carry out a self-examination. Second, the local environmental protection agencies will check these self examinations. Third, SDEPA will do selective and random examinations of the company sites. Currently, SDEPA is gathering information by itself, but in the future they hope to coordinate the data management information among the different departments in a combined strategic effort. The current procedure of transferring data and information is as following:

- point terminals at monitoring stations collect data and sends the data, most likely by GPRS, to the various departments; other data and information is sent manually
- the departments collect the data and publishes the information in reports
- the new system would collect and manage the data in a centralized database before it is sent to the various departments

In the future, the data would be in a centralized database. This centralized data would greatly increase the effectiveness of the Emergency Department's risk management efforts including pre-alarm prevention and risk mitigation efforts. The centralized data being systematically updated in or close to real-time would allow the emergency department to identify potential environmental risks and issues in a timely manner allowing mitigation and prevention efforts to be carried out. This would give the department greater lead time to identify the risks and start risk minimization efforts. With this, the department expects to prevent 99% of potential environmental threats from man-made risks.

The 1% would be the ones that they failed to prevent and would be managed as part of a emergency response. These would be from two sources: natural disaster and secondary pollution. In addition, SDEPA is looking to add an economic cost model into its system for environmental accidents/emergencies and the cost to the environment after recovery. This would assist SDEPA in calculating environmental fines/penalties for polluters or responsible parties involved in environmental accidents or discharges.

To help with these, SDEPA has increased its monitoring capabilities especially in air pollution monitoring. The recovery process will be defined. As of yet there, the recovery process has not been defined. SDEPA's platform has five different types for environment protection. SDEPA follows national environmental standards coupled with some of their own provisions.

SDEPA has 59 river segments for protecting water and 24 stations to monitor and protect the drinking water. SDEPA has 144 stations to check the air quality every minute and for companies they have more than 1,000 stations to check environmental conditions automatically in every 2 hours.

The project is in the early phase of development in the initiate phase. The group is still gathering information and requirements and working on a project plan for the project. There are academic and research programs underway related to SDEPA's ICT and with local Shandong University, but due to confidentially agreements, the full extent and the details of the research is not known at this time.

Below is the project summary and current status:

Project Status

- The project is in the early initiate phase.
- SDEPA Emergency Department (the project sponsor) is currently gathering information from companies - problem polluters and gathering requirements.

International Cooperation

- SDEPA works with companies and governments from Europe, North America, Taiwan, and Japan

Project Focus

- Indicated that the major focus would be on environmental incident prevention
- Project needs include a predictive analysis element and decision support capability
- Project needs a standard platform - centralize system (procedure and database) to gather data from different sources
- Risk assessment and managment is a major focus
- Currently working on a risk assessment/managment effort to identify highest risk projects/companies
  - Highest risk will be monitored by the province
  - 2nd highest risk - city
  - 3rd highest risk - county
  - Random process
  - Inspection process

Environmental Issues - Shandong

- Heavy metals is one of Shandong's biggest environmental concerns.
- Four years of improved air quality in Shandong

Issues at SDEPA

- Need to look at total operational picture not silo departmental; need to look at big picture
- Need standard procedures across departments
- Stakeholders - education about the environment - with policy

Projects Issues

- National monitoring standards are used to monitor air and water
- Little data is shared between provincial agencies
- Project is environment management not just environmental emergency response.
- Emphasis is on the pre-alarm prevention aspect and risk management.
- Need to understand the process flow and possible scenarios.
- Stakeholders - internal departments within SDEAP, EOC China, city and county authorities, MEP
- No formalized requirements - not there yet - early stage
- There is no central database or repository for all of the data; the monitoring center only uses the real-time data, no data from other sources.
- Need the following:
  - Data mgt
  - Command and control
  - Problem / resolution matrix
  - Decision support system needed
  - Best practices identified
  - SOP
- Narrow down high risk of consequence
- Need to develop risk of consequence in their risk management strategy
- Different levels of government all monitor the environment- cities, province, counties, villages

Environmental Safety and Emergency Management Division - (Emergency Department)

- The project is under the SDEPA - Environmental Safety and Emergency Management Division headed by Yuan Cheng Jin - Director
- SDEPA - Emergency Department has four groups
  - Inspection
  - Monitor
  - Response
  - Remediation
- The Emergency Department receives information from other departments - the monitoring, air, water, and hazardous waste departments
- The Emergency Department is currently collecting company/industry information and data to support the future project
- The Emergency Department will forward reports to various other departments within SDEPA such as air, water, and hazardous waste departments
- 11 big environmental accidents 2011
- Last several years the emergency department team worked on major environmental emergencies in other provinces
- Emergency Dept. worked on the Hunan water accident

Current Technology and Applications

- **Software:** GIS (ArcGIS), Oracle databases, Windows Server, Unix, and other custom software
- The largest application is a custom build application (co-built by a third party) that is used in the Emergency Center Operations displaying a map of Shandong and its pollution monitoring points
- There are 6 other smaller custom applications ran by different departments
- The current staff of 42 in SDEPA - Information Technology Department

Emergency Management

- Four phases of emergency mgt - prevent, pre-alarm, response, recovery/assessment
- SDEPA Department
  - Pollution prevention office
  - Pollution recycle office
  - Water office
  - Air office
  - Chemical hazmat office
  - Emergency dept
- Prevention, pre-alarm, emergency response, recovery
  - Focus on prevention

Monitoring Center

- The monitoring center does not have enough quality data to support the emergency department to date
- Currently working on a risk assessment in progress - identify highest risk projects/companies
- Monitoring center
  - Air - every minute
  - Water - every 2 hours; need to increase

- Real-Time points
  - Air - 144
  - Water - 59
  - Company 1000
  - Drink water 24

  - Mobile - yes capability; 2 vans; small labs; 1 boat
  - Random risk assessments for companies in rural areas
  - History of the Monitoring and Emergency departments - founded 2008 after 2003 environmental incident

Monitoring Center - Issues (Needs) Efforts, Current Systems

- Increase automated systems; add stations
- Facilities - add
- Personnel - add resources
- Laboratory for heavy metals
- System to be able to remotely adjust the data freq measurements and other procedures remotely; current system does not work well
- Increase points in county and villages - rural areas
- Add more video
- More data in real-time
- Need to boost their water quality capabilities

2.7.4 SWOT

2.7.5 Existing Emergency Environmental Management Systems

Currently, SDEPA has a number of systems to monitor and manage the environment. SDEPA has a number of real-time monitoring stations that provide environmental data. Other environmental data and information is collected through manual methods although not all of this information is shared across all SDEPA departments. SDEPA main environmental system is the Environmental Management System (EMS) which was created by a Chinese third party. The system is supported and maintained by SDEPA 's Information Technology Department. The system takes information from other 1,000 monitoring stations and displays the information in real or near real-time providing environmental managers and emergency managers with an tool

to manage environmental events. The Emergency Department is looking at options to incorporate some aspects of the current system with the new proposed system.

Existing Environmental Management System (EMS)

Figure 15 - EMS: Map Display and Environmental Data

Figure 16 EMS: Environmental Data Graph

Figure 17 EMS: Environmental Data Table

Figure 18 EMS: Map Display and Environmental Data

Figure 19 EMS: Environmental Data Table

Figure 20 EMS Command Center: Environmental Video

Figure 21 EMS Command Center: Environmental Video

Figure 22 EMS Command Center: Environmental Video

Figure 23 EMS Command Center: Environmental Video

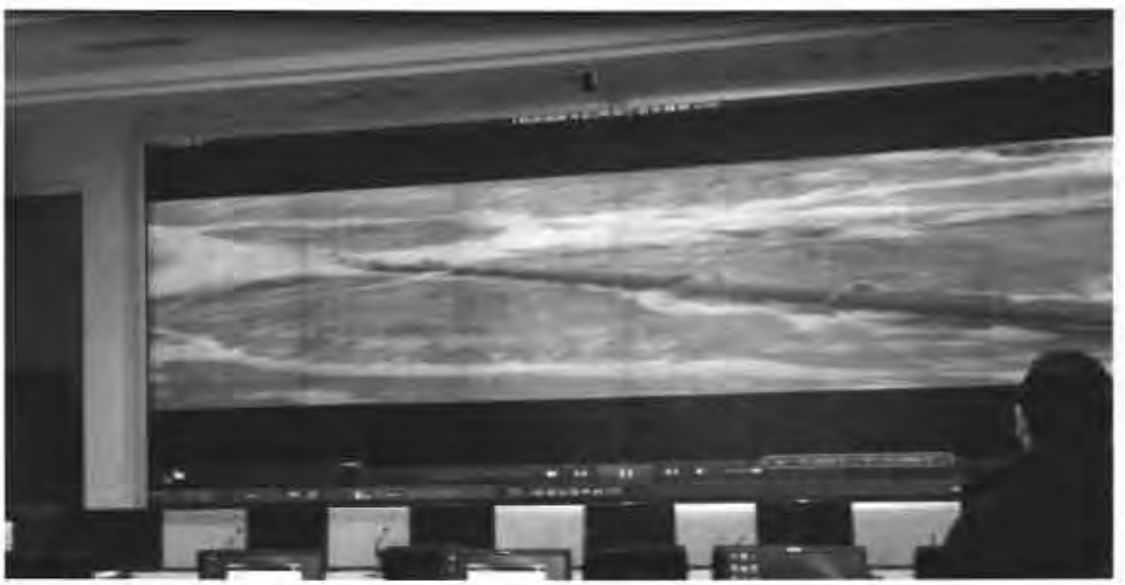


Figure 24 EMS Command Center: Environmental Video

Figure 25 EMS Command Center: Environmental Video Conference

Figure 26 11 EMS Command Center: Environmental Maps and Data Display

EMS, the existing system:

- Located at the Shandong Department of Environmental Protection, environmental monitoring and emergency command center - SDEPA Headquarters, Jinan, Shandong - China
- Ability to take sharp high-definition recording and broadcasting system video used in video conferencing
- Offers a screen to monitor of the environment online
- Ability to host video conference calls between various branches

EMS - Needs Analysis

- Environmental monitoring center monitoring and control of the province's "three top five automatic monitoring network" hub to meet the environmental monitoring, diversified information display, academic exchanges, remote point-to-point or multi-point video conferencing and training needs .
- The system requirements for monitoring hall, large screen display area throughout the monitoring center, monitoring duty area, observe visit the area, control center, multifunction speech area the venue real-time situation recorded in real time, at least a 4-way HD 1080P effects synchronized recording while recorded side-on-demand;

Figure 27 Conference Room

- Environmental emergency command center requirements should reflect the most state-of-the-art atmosphere, ability to house emergency command, have an academic

exchange, audio and video equipment, remote point-to-point or multi-point video conferencing and training needs.

- The system requirements for the emergency command includes dispatching reponse teams for accidents and allowing the relevant accident information to be displayed quickly
- Query on-site monitoring, emergency vehicle location and tracking, information transmission, the pollution impact of simulation analysis, display decisions and data in real-time to save and record to respond to the incident
- Ability to place a variety of audio and video signals in real-time recording requires at least 4 Road 1080P HD signal synchronized recording.
- West podium large conference room will serve as a video conference venue
- The main video conference room - contains the conference room and meeting function, serves as a video conferencing venue, media room, and academic exchange meeting room.
- The system requirements to support the recording of a single point, the point-to-point conference recording and MCU held multipoint conferencing recording. Recording video format support HD 720P, 1080I, 1080P signal and have the ability to record two component video and two-way RGB signals at the same time and ability to support both the recording H.239 Dual image; all recording and broadcasting system through third-party control systems.
- The system also requires each conference room to have the ability to record 2-way HD 1080P signal while recording simultaneous recording capacity of at least three meeting rooms.

Figure 28 Conference Room

The EMS system structure is as follows:

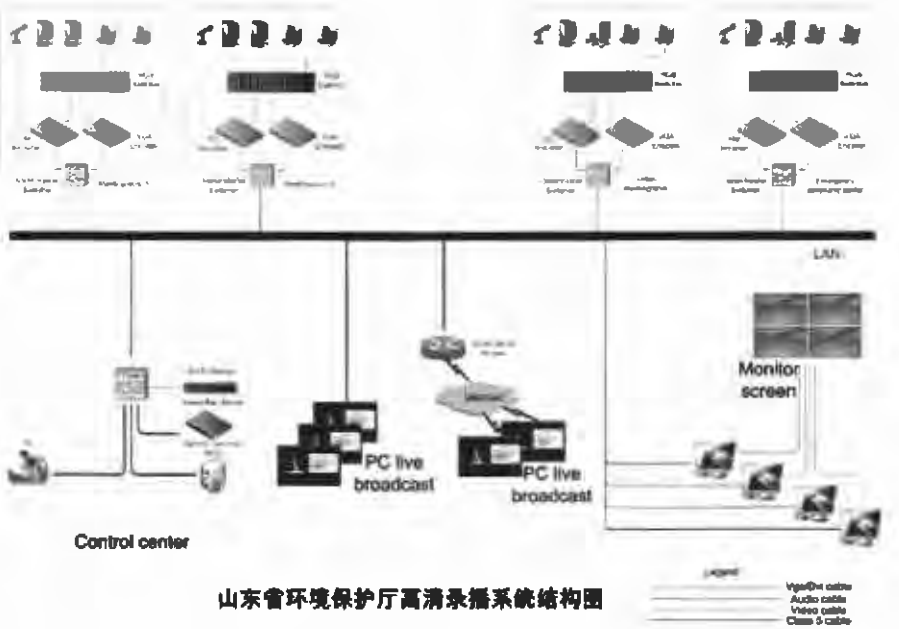


Figure 29 EMS Network Architecture

The EMS system was developed by Rui. The Rui multimedia recording and broadcasting system uses a distributed product architecture, from the front desk equipment and back-office equipment. The reception apparatus includes various types of the signal encoder and is responsible for signal acquisition. The background device for the multimedia video server, which is responsible for signal processing and communication between the front and rear station apparatus, is connected through an IP network. Encoded video and audio signal or VGA signal reception encoder can be collected through the IP network. Simultaneous combination of recording, live and on-demand multimedia recording and broadcasting server, multimedia recording and broadcasting server will receive the signal sent to the background. Rui takes advantage of the distributed product architecture and offers flexible combination and expansion options. It is well positioned to meet the recording and broadcasting system

requirements. It offers the application of different sizes in a variety of different environments. It has 2 to 4-way HD 1080P signal for live and recording. Rui is a single taped server that can access any four meeting rooms equipped with a four-channel simultaneous recording and live video feed.

Other systems aspects:

- Taped server single maximum 64-channel HD / SD / VGA signal mix recording and live In addition
- Multiple recording server with Rui multimedia recording and broadcasting integrated management platform DSS-R-TMP to meet the larger, higher user requirements taped demand.
- Seamless integration of high-definition video conferencing systems with hardware and software
- Compatible with all video conferencing equipment manufacturers (hardware or software), such as Huawei, H3C, ZTE, Polycom, Tandberg and other domestic and foreign manufacturers.
- Low coupling design does not take up the MCU resources, the operating status of the video conferencing without interference
- Supports a variety of formats such as H.323 and H.320 video conferencing recording and broadcasting.
- Interoperability with traditional conference system interconnect.
- Breakthrough standardized video compression technology
- High Profile video compression technology can save 50% for high-definition teleconferencing and SD video conferencing bandwidth

Rui

Shenzhen Rui Software Technology Co., Ltd., a national high-tech enterprise, industry-leading visual information recording and dissemination of products and solutions provider, great market sense of smell, the spirit of innovation and growth potential of small and medium-sized high-tech technology companies. Rui was founded in 2003, headquartered in Shenzhen Nanshan National High-tech Park, with offices in Beijing, Shanghai, Guangzhou, Nanjing, Chengdu, Xi'an, Wuhan and other places, business and customers throughout the domestic provinces and autonomous regions and overseas. The company has a number of core

intellectual property and proprietary technology, has passed the ISO9001: 2000 certification, the software companies that visual information recording and dissemination

Rui has an R & D team has extensive experience of years of research and development, design, visual information recording and communications field, relying on a strong R & D capabilities, take sharp in recent years, the successful launch of a multimedia recording and broadcasting system, the VGA encoder, HD encoder, and a number of innovative products and patented technologies.

Contact Rui

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Tel :0755 -86,073,600 Fax 755 -86073689

2.7.6 *SDEPA: Environmental Emergency System* - High Level Objectives and Requirements

1. Environmental safety significance
   a.
      - Ensuring environmental security is an important aspect of protecting public health and maintaining of social stability
      - In the Shandong, chemical industry has experienced a high rate of growth
      - This has led to a degradation of the environment and makes environmental regulation more difficult; SDEPA needs to address this.
      - In the past, Shandong province has experienced environmental incidents leading to economic losses and threats to public health and society; SDEPA needs to address this.

   b.
      - The current environmental agencies' departmental structures at all levels in the province need to improve cooperation
      - Environmental protection departments at all levels must attach great importance to continued improvements to increase the level of

environmental safety management taking effective measures to curb the high incidence of environmental emergencies, and speed up the development of environmental security prevention and control systems in order to ensure that environmental protection departments have the tools and wherewithal to manage environmental security throughout the province

2. Implementation of the new project environmental risk assessment system
    a. All new construction projects, including extensions structural changes, shall have environment assessment documents which include environmental risk assessments
    b. The environmental risk assessment according to "the construction project technical guideline for environmental risk assessment "(HJ/T169-2004), the environment impact assessment on strengthening the management of environmental risk prevention " (HuanFa [2005] 152 date) regulation
    c. All new construction projects, including extensions structural changes shall include a environment risk source recognition, environmental risk prediction, site and sensitive goal statements, prevention measures commenting on the facts, and put in place scientific and feasible early warning detection measures and emergency treatment measures into an emergency plan.
    d. If these environmental risk assessment provisions and environmental impact assessments do not conform to the specified requirements, the environmental protection department shall not approval the construction project
    e. Environmental monitoring agencies at all levels will put the warning monitoring measures and emergency measures into an emergency plan with regards to new construction including items of basic construction environmental risks
    f. The environment department will have the right to approval the acceptance of these projects; for those do not confirm to the national industry policy, the environmental protection department shall recommend actions to be taken by local government organization
3. Carry out environmental testing and establishing environmental risk and source dynamic management files
    a. For all already built projects, the local environmental protection department should urge companies to have annual environmental risk potential self-

examinations and organize a comprehensive testing of local environmental risk every year.

b. If environmental risk is found, the local environmental protection department shall instruct the entity to review the qualification of environmental impact assessment and the environmental risk assessment including the reports to the environmental engineering appraisal institution and environmental impact assessment document review institutions for the review.
c. Environmental risk source unit should improve environmental risk early warning monitoring including the emergency response measures and emergency plan, accordingly to evaluate the examination suggestions and apply for the allowance from the inspection and acceptance from the institution. Only if the measure has the corrected the problem and formal acceptance of that correction or an exception was granted will normal production be permitted. Until then, limited production or stop production order should remain in effect.
d. According to the environmental risk assessment, the environmental protection department shall propose relocation or structural adjustments for existing facilities that have major environmental hidden security danger / risk or improper locations
e. The environmental protection departments at various levels should establish dynamic files of environmental risk source, keeping these files up-to-date
f. Various environmental protection department in cities should have updated files and report these to the provincial environmental protection bureau on the 15th of January 15 each month

4. Environment warning system - improve emergency environmental accidents rapid response capability
    a. Set warning monitoring sites
    In the following key nodes, departments must set environmental risks
    Warning monitoring sites:
    1. At the shop or the total exhaust port of the risk source;
    2. Inlet of urban sewage treatment plants;
    3. Risk source areas near the lower reaches of rivers units section,
    4. County (city, area) exit river section;
    5. Province exit river section.
    b. Grading regular monitoring

- Provincial environmental monitoring institutions should carry out the "four measures" every ten days
- Provincial environmental monitoring institutions should offer a complete inspection of highly toxic substances at the river segment, especially with areas that cross different provinces.
- The substance are total mercury, cadmium, total chromium, hexavalent chromium, the total arsenic, total lead, the total nickel, benzene and pyrene, total beryllium, total silver, cyanide, yellow phosphorus, etc.), each for a ten-day all detection
- Urban sewage treatment plants to the inlet poisonous substances; every ten days random monitoring should be carried out on at least 10% of the polluted rivers.
- The city level monitoring should also offer a complete inspection of the highly toxic substance at river segments that intersect with cities.
- The municipal county (city, area) environment monitoring institutions must focus on pollutant risk source characteristics and provide daily testing to risk source units including urban sewage treatment plants and risk source units and inlet downstream river areas.
- Risk source units should test the risk source characteristics of the facilities
- The municipal sewage treatment plant should test the source characteristic of the water inlet every day.
- The provincial and the municipal units should transmit the analysis of monitoring results timely to the lower levels (different counties and districts, environmental monitoring units, risk resource units, and the municipal sewage treatment plants). If necessary, the monitoring scope should be transmitted to the lower level units whenever it is adjusted
- Implementation of automatic monitoring to report highly toxic substances in order to improve the early warning and rapid response capacity.

c. Implement reporting system
    a. Poisonous substances reporting system - whenever Risk source units and urban sewage treatment plant find out the poisonous substances exceed

standards, they should report to environmental department during the first two hours. The environmental department should also report to the 1st level office in two hours upon the receipt of such reports given.

b. Emergency environmental issues reporting system - When emergency environmental accidents are found, risk source units should report to local environmental protection department within 1 hour, the environmental protection department should report to the people's government at the corresponding level within 1 hour upon the receipt of such report. In great (III), major (level II), special major (grade I) emergency environmental accidents, can report over the immediate leadership. Falsely reporting or hiding and omitting data, according to the relevant provisions of the relevant units and personnel, shall be investigated and dealt with accordingly.

5. Improve the environmental safety - daily supervision level
   a. The environmental protection department of various cities, counties, and areas, shall refer to state and provincial environmental protection management system, to strengthen the development of environmental safety emergency management agency operations and environmental safety emergency response management
   b. To strengthen the environmental operations at the provincial and municipal level environmental protection department to handle poisonous substances monitoring
      - The environmental protection departments at the county level and risk source units shall have the ability to monitor the characteristics of risk source pollutions.
   c. To strengthen environmental safety emergency technology and materials support, and constantly improve the technology and material support capabilities to manage emergency environmental issues and to gradually improve environmental emergency knowledge base in order to improve the environmental emergency management work decision-making level.
   d. The environmental protection departments at various levels should prepare emergency environmental accidents emergency plans, and after approval by the government at the next higher level for the record to the environmental

protection department, all the departments should carry out regular environmental emergency drills exercise

- According to the principle of dependency administration, all departments should urge risk source unit emergency drills and planning each year to effectively improve ability to manage the emergency environmental incidents

e. Carry out environmental awareness and education

- To make full use of the news media with regards to environmental pollution accidents to improve environmental awareness
- Utilize publicity for environmental protection laws and regulations to increase the public's consciousness and awareness of emergency environmental accidents
- Focus on news releases to offer accurate and timely release of information from authorities regarding environmental emergency events to guide public opinion

3 Best Practices

3.1 Best Practices - Introduction

This Best Practices section will summarize U.S. policies, frameworks, technical standards and principle operating practices for the management of environmental hazards in the U.S. at the federal, state and community levels including a high level gap analysis of U.S. best practices and the current situation.

3.1.1 Environment and Environmental Management - China and the United States

The United States is a developed country and has been for the past 80 years. The United States is one of the leaders in the world in environmental protection standards, regulatory authority, management and technical know-how. The U.S. through government and private efforts has established environmental standards for the world in environmental sustainability.

China is a developing country with rapid development coming in the last 20-30 years. China has developed rapidly in the last 30 years. This rapid economic expansion has outpaced environmental concerns similar to the United States development which almost a century ago. Environmental efforts civilian and government, regulations, standards, and awareness in the United States are been firmly established for over 30 - 40 years. This environmental focus has resulted in significant environmental improvements over the last 30 to 40 years. Restorations of ecology, lakes, rivers, and land as well as clean-up of past polluted industrialized sites have resulted in a successful environmental advancement in the United States. In China, these are still evolving. In China over the past five years, environmental efforts and awareness have greatly increased.

The U.S. is on a mature environmental management level. China on the other hand is a fast developing nation with economic activity rapidly increasing over the last 20 to 20 years. Environmental management and awareness had not been a major focus and had been secondary concern in the past; however, over the past 5 to 7 years, there has been a shift. Over the past several years, China has shifted the focus to environmental management. In China's recent five-year plan, Chinese government officials allocated huge resources and a major focus to the environment. The environmental comparison between China and the United States is shown in the table below:

Category	China	United States
Areas under protection	809	3,481
	Ranked 15th.	Ranked 8th. 3 times more than China
Carbon efficiency	2.03 CO2 emissions/$ GDP	1.77 CO2 emissions/$ GDP
	Ranked 35th. 15% more than United States	Ranked 42nd.
CO2 Emissions	3,473,600	5,762,050
	Ranked 2nd.	Ranked 1st. 66% more than China
CO2 emmissions >kt (per capital)	3.2 kt per 1,000 people	19.9 kt per 1,000 people
	Ranked 89th in 2003.	Ranked 11th in 2003. 5 times more than China
Coral reefs > Area	1,510 sq km	3,770 sq km
	Ranked 11th.	Ranked 5th. 150% more than China
Ecological footprint	1.84	12.22
	Ranked 77th.	Ranked 2nd. 6 times more than China
Endangered species protection	100%	87.5%
	Ranked 6th. 14% more than United States	Ranked 39th.
Forest area > % of land area	21.15 % of land area	33.08 % of land area
	Ranked 122nd in 2005.	Ranked 84th in 2005. 56% more than China
Forest area > sq. km	1,972,900 km^2	3,030,890 km^2
	Ranked 5th in 2005.	Ranked 4th in 2005. 54% more than China
Known mammal species	394	428
	Ranked 6th.	Ranked 4th. 9% more than China
Pollution > Carbon Dioxide from fossil fuels 2000	775	1,571
	Ranked 2nd.	Ranked 1st. 103% more than China
Protected area	6.4	13.4
	Ranked 67th.	Ranked 26th. 109% more than China

Category	China	United States
SO2 emissions per populated area	2,680 thousand metric tons/squared	1,680 thousand metric tons/squared
	Ranked 22nd. 60% more than United States	Ranked 38th.
Threatened species	213	854
	Ranked 6th.	Ranked 1st. 3 times more than China
Threatened species > Mammal	75	35
	Ranked 2nd. 114% more than United States	Ranked 16th.
Water > Availability	1.72 thousand cubic meters	7.09 thousand cubic meters
	Ranked 89th.	Ranked 47th. 3 times more than China
Water > Freshwater pollution	3.78 tons/cubic km	1.14 tons/cubic km
	Ranked 14th. 2 times more than United States	Ranked 30th.
Water pollution, wood industry > % of total BOD emissions	0.91 %	4.12 %
	Ranked 56th in 2001.	Ranked 14th in 2001. 4 times more than China
Wildness	31.49%	35.89%

3.1.2 Emergency Management - Challenges and Opportunities

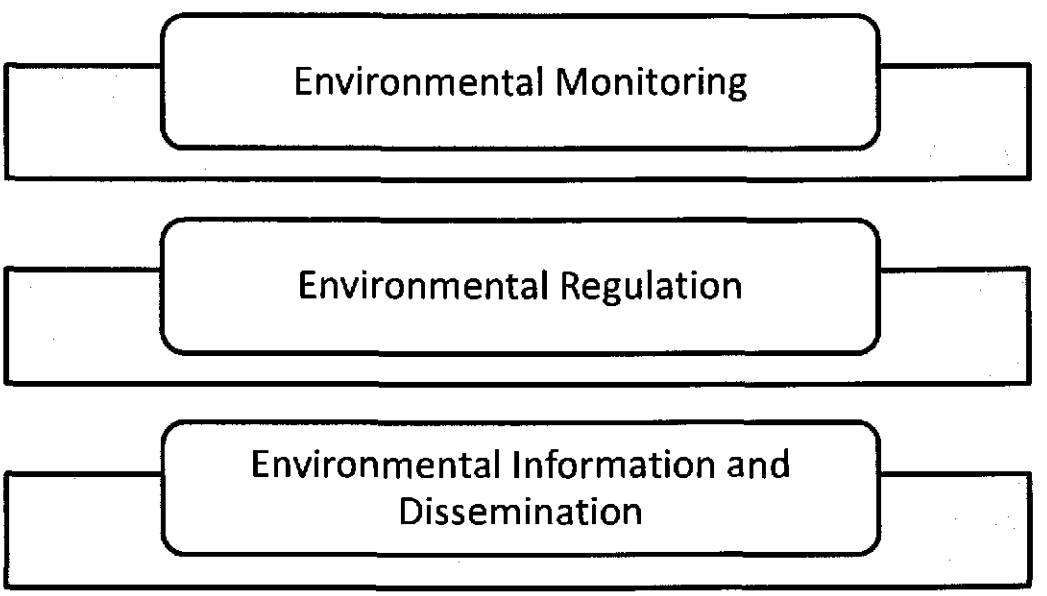
China, like the United States, is a large country with diverse geographical regions that will be affected in different ways by global warming. The north is expected to get drier, much like the southwest in the United States. Meanwhile, southern China will become wetter, like the American northeast. And, just like America, China must develop advanced coal-burning technologies due to the possibility of global warming pollution.

China does not have one centralized powerful agency like FEMA or DHS to handle emergencies yet. The establishment of EMO showing the trend of centralization is positive. Moving forward, China will need more professional emergency management staff. Thus, they will need more education program from local universities. By 2008, there is only one university that has an emergency management master degree education in Beijing, several emergency management research centers in other 5 or 6 universities in Beijing, Shanghai and Chengdu.

In terms of security, Chinese tactical teams and EOCs are equipped with new technology such as GIS and internet based information distribution and collection systems. These will lead to more demands on budgets and knowledge, thus generating more purchase and training. However, with this emergency management enhancement or modernization, China will get stronger capability to handle disasters.

3.2 High Level Gap Analysis of U.S. Best Practices and the Current Situation in Shandong Province - China

The purpose of this section is to document the gaps between the U.S. practices and the Chinese practices in environmental management and environmental emergency response and management. There are major gaps between the Chinese and United States in environmental management and response practices. The major gaps between the United States and China are listed below:



3.2.1 Environmental Monitoring

The U.S. has a mature system to monitor the environment in the U.S. There are systems in place at the national, state, and local levels. The systems include proven processes and methods using state-of-the-art technologies. Along with these mature systems, there are environmental laws in place to protect the

environment. After its rapid growth over the last decade, China is now looking to improve its environmental monitoring capabilities. It is looking to add the latest environmental technologies and processes to "catch up" to the rest of the developed world in environmental monitoring and close this gap.

3.2.2 Environmental Regulation

Environmental regulations and enforcement differ greatly in the United States and China. Environmental regulations are generally considered more lax in China. One of the major factors is the difference is effluent standards and discharge permits. China uses a national standard. The U.S. system is based on the flow rate and concentrations on a case-by-case situation. Another contrast is that the Chinese national environmental agency - MEP has a smaller role in day-to-day environmental regulation than their counterparts in the U.S. EPA. Most of these day-to-day regulations are carried out by local EPBs. The EPBs regulate in the same area in which they reside and are supported by they are supported by the local government making it much more difficult to enforce the regulations versus the federal level. In the U.S., the U.S. EPA is responsible for implementation environmental regulation with some state support.

EPBs have much greater flexibility to change the permitted limits. This leads to a less consistent application of the rules leading to more polluted waterways. In addition, Chinese EPBs regulate containments than in the United States. Another contrast in China and United States is that Chinese EPB's regulate enterprises only and not federal or provincialities entities. These fundamental regulation differences are a major gap between China and the United States.

3.2.3 Information Collection, Sharing, Communication, and Dissemination

For Environmental Emergency Management and Response, users need to make accurate and timely decisions and must have an accurate perception of the situation (situation awareness). The ability to have access to the right information about the situation is essential to this cognitive state. Effective information collection and sharing has been a historic challenge in many arenas, and the problem was highlighted during the interviews. The fast pace and critical nature of emergency management require the ability to access and share information efficiently and effectively; however, a number of competing factors often make this a challenge.

Environmental emergency management personnel often have difficulties obtaining the information they need. This is due to several fundamental problems: lack of awareness that the information exists; not knowing who controls the information; and the inability to access the information or having access but in a format that is not understandable. Also, personnel frequently find that information is not shared across organizations. To address sharing concerns, an appropriate level of trust in the information recipient is required by the information owner.

Emergency communications are essential within and across Environmental Emergency Management (EEM) agencies and jurisdictions throughout the lifecycle of an incident. EEM communications systems during a catastrophic disaster must operate sufficiently to meet internal and external emergency communication requirements. Research suggests that gaps associated with communications may have organizational, technological, and sociological components. Organizational challenges prevalent in EEM deal with a transition from day-to-day centralized decision making to a more dynamic ad hoc organization that emerges with post-disaster relief efforts. The main technological post-disaster challenge is rapid deployment of communication systems for the EEM community. Sociological-based communications challenges can arise from public fear, stress, and other emotions aggravated by the lack of information.

Currently in the U.S., environmental data is collected at the local, state, and national levels and is shared across many of these agencies and the public at large. This access to data and transparency helps increase environmental awareness and greater overall effective environmental management. In China, environmental data is not readily shared within agencies, between agencies, or the public resulting in less transparency, lower environmental awareness be the agencies and the public, and less environmental operational and environmental emergency efficiency and management. Improvement in communication and data sharing will increase environmental management and efficiency.

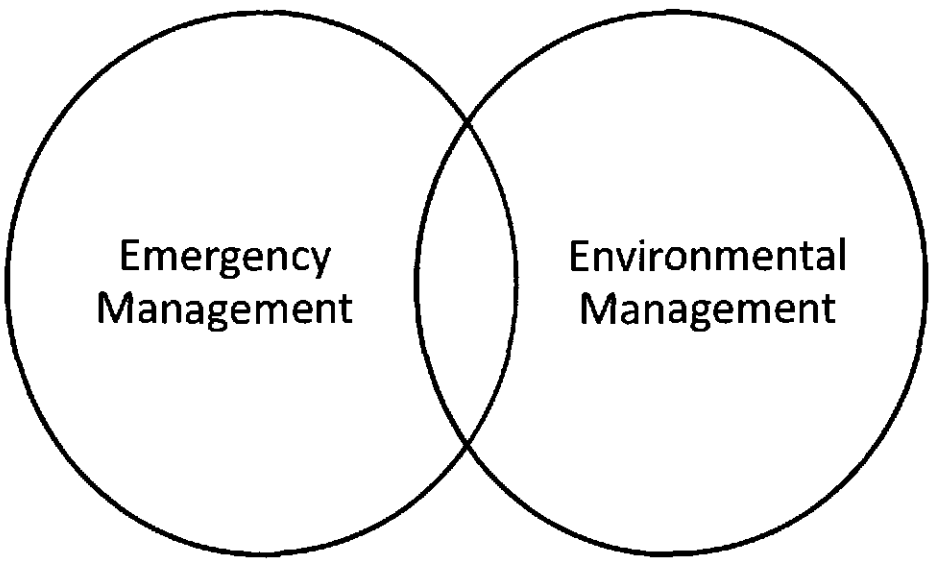
3.2.4 Environmental Emergency Management and Response System

Currently, there are few known fully integrated decision support systems for environmental emergency management and response. China is moving ahead to develop these systems. Even in the United States, Japan, and Europe, which have a mature environmental monitoring, and practices, these systems have yet to be fully realized.

3.3 The Convergence: Environmental Management and Emergency Management and Response

Environmental management and emergency management are a merger of two management disciplines. Recently these two have been brought together as a need has grown to understand how the baseline environment was before an environmental disaster/crisis and how it was affected during and after an environmental disaster/crisis. There is a growing need to understand the environmental before, during, and after an environmental crisis and the direct effects on the human populace and the ecology. In the past, little attention was given to environmental concerns in a disaster scenario. Government around the world are becoming more aware of environmental disasters and crisis and are developing tools and systems to mitigate the risk before, during, and after an environmental disaster/crisis. Both of these management disciplines share many of the same processes such as risk assessment and management, response planning, and emergency action planning.

In the past, these disciplines usually are not formally combined and were usually only integrated at the local level during accidental chemical spills or hazardous materials incidents. More and more governmental institutions around the world are looking at emergency management cross functionally including different disciplines and fields in emergency management and response operations and emergency action planning. The environmental field has grown increasingly more important over the last 20 years as more governmental institutions realize the importance of sustainability and the environment and the environment's role in the quality of life and a part of a balanced approach. Emergency management and response stakeholders are seeking more and more to include the environmental concerns, and environmental experts and expertise into the emergency management and response operations and planning. Likewise, governmental environmental management stakeholders are looking to incorporate emergency management and response into their operations and planning. Efforts are increasing to merge the two disciplines from both sides as the need, the awareness, and the realization continues to grow.



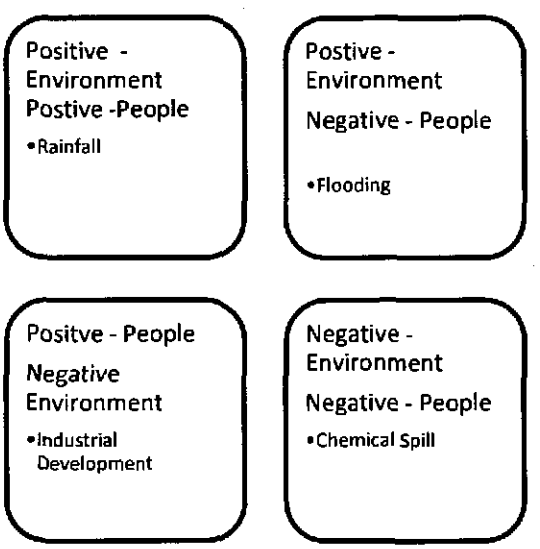
Emergency Management and Environmental Management Convergence

In an emergency, situation, there may be an element of the environment that comes into play. It may be man-made or natural event that could cause or trigger and environmental emergency. A man-made event is one that is caused by human being such as an chemical spill or industrial fire. A natural event occurs in nature such as a flood or earthquake. Both events can trigger an environmental emergency. These events cause harm the environment with potential damage to people, property, and the ecology. Any of these events that adversely affects the environment to a certain degree or has potential to affect the environment to a certain degree is an environmental emergency. Man-made choices such as chemical plant safety play a direct role in the environmental risk and the ability of emergency responders to mitigate and recovery from these incidents.

The environment and people are intertwined in a complex relationship. People's activities affect the environment and the environment affects people's activities. Some events are both negative for people and the environment, however; sometimes some events that negatively affect the people may be a positive for the environment and vice versa. There can also be positive and negative aspects for both people and the environment in the same event. These

relationships are complex. For example, annual floods in a river delta can bring fertile soil and bring in sediment that may protect the area from larger future floods in the future protecting the area from salt water infiltration. This is a positive for the environment and a negative. These same floods can destroy the river ecology and damage sensitive ecosystems, sweep debris and other pollutants from the land into the river and wetlands causing wide spread damage to the environment. In the same event at the same time, the flooding can be a negative and a positive for people. The floods can cause loss of life, damage to infrastructure and property, but also provide farmers with fertile sediment deposits for farmland and build up areas to protect them from larger floods in the future.

Also, these can be to different degrees of positive and negative aspects. Some emergencies may not trigger an environmental emergency or may have only a small effect on the environment. Other events may trigger an emergency response greatly affecting people and the environment. Sometimes an event can negatively affect people, but be positive for the environment and vice versa.



As environmental awareness grows, so too has the understanding that man-made decisions, actions and inactions can cause or exacerbate environmental damage, increases environmental risk, or can lead to even greater damage to the environment and risk to people, damage to property, higher recovery costs. For example, a river that has been subjected to repeated polluting from a local industrial factory can attribute to more environmental damage during a flood as the containments and pollutants are spread over a larger area increasing the risk to people that live near the river and making recovery clean-up more costly. If these pollutants were not released into the environment in the first place, then the effect of the flood would had be less and the recovery less costly. The man-made actions of polluting increased the damage to the environment and risk to people when a secondary natural event occurred, the flood. Poor planning can also lead to greater environmental damages and risk to people when a natural event/disaster occurs. Building industrial facilities to close to waterways and flood prone areas, building on slide prone slopes, or in areas that have a high chance of natural disasters such as hurricane prone barrier islands are all examples of how these decisions effect the potential environmental damage and recovery efforts and costs.

In the past, more emphasis was placed on direct effect on people during an emergency. Now, the attention has included the environment. The environment will have a direct impact on people and human activities. Also in the past, emergency management had been more reactionary. After an event or disaster occurred, then the environment was considered. The BP oil disaster the Gulf of Mexico in 2011 was a massive environmental disaster. Also, events that occurred slowly over time were not properly responded to such as pollution of groundwater. These events occur slowly over time and end up as a crisis growing over time.

Environmental emergencies should be managed in a more complete approach taking into account the various systems and elements as a whole and how these systems and elements interact together with each other. These elements include water, soil, and air and how these interact with human development and ecological systems (plants and animals). Emergency management and response should take into account these elements and systems as whole planning and preparing, responding to and recovering from an emergency.

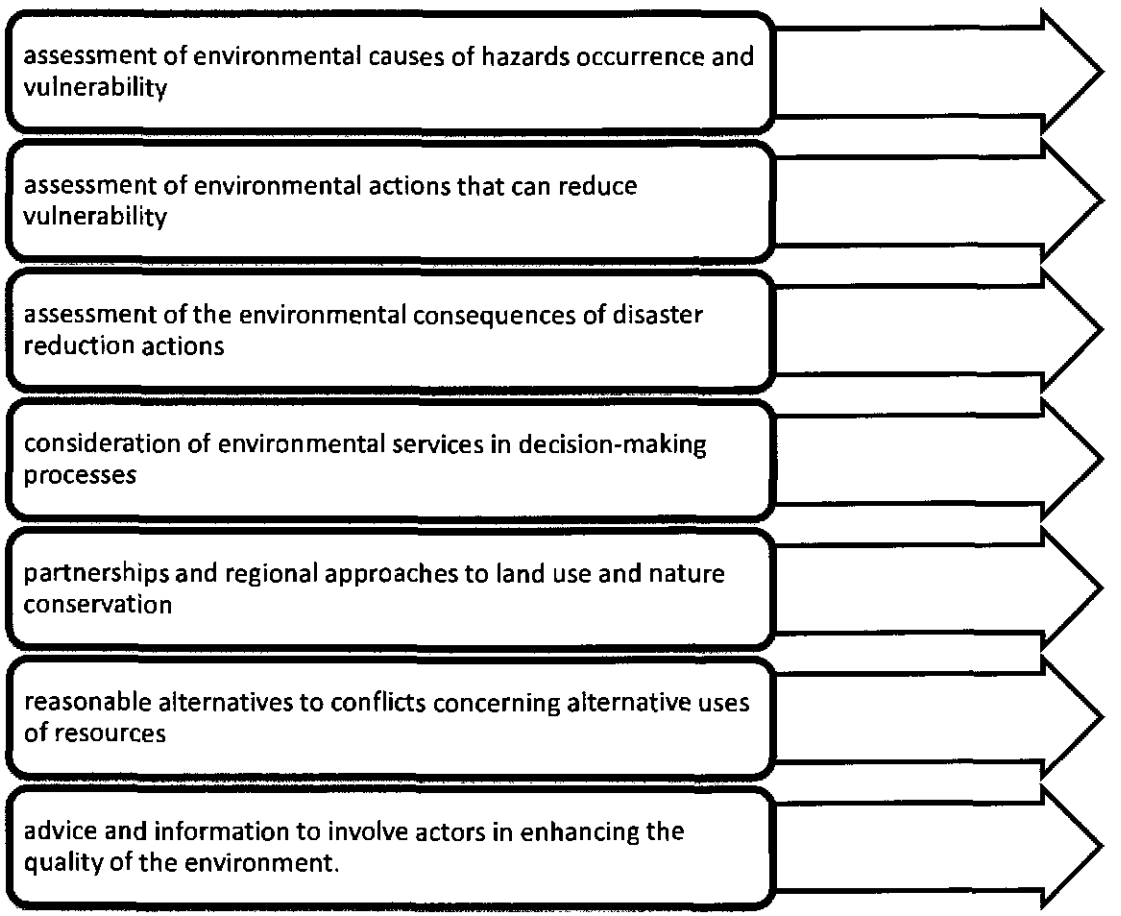
Consider the scope of environmental hazards/disasters:

Acute	Chronic
• Floods • Oil spills on water bodies • Hazardous materials spills (to soil) • Hazardous materials spills (to water bodies) • Landslides • Containment failure (mine spoils, industrial wastes) • Fish kills	• Sedimentation and siltation • Air pollution • Genetic mutation in indicator species • Drought[1] • Global warming • Deforestation and flooding • Loss of wetlands

(John R. Labadie, p. 14)

Environmental emergency management will examine the occurring or potential emergency or disaster from an environmental point of view and use environmental technical skills and environmental management practices to prevent or mitigate environmental damage before an environmental emergency/disaster, to respond during an environmental emergency/disaster, and launch recovery efforts to mitigate environmental damage after an environmental emergency. Although some governmental agencies are starting to adapt certain aspects of environmental emergency management in some countries, this movement is still in its early stages, and is still not a widely accepted practice around the world. In the past, there has been some research in this area in the United Nations, the European Union, and the United States. In recent years, Asia (in particular China) and Europe has begun to step up their efforts to merge emergency management and environmental management practices and to adapt these concepts.

Ways to integrate environmental and disaster reduction strategies (John R. Labadie, p. 19):



Emergency management and environmental management should find ways to work together and take actions before environmental emergencies happen. Planning ahead and reducing risk from potential environmental hazards through risk assessment and management efforts can reduce environmental damage and speed recovery efforts. Efforts should be made for emergency and environmental management to coordinate together in the recovery efforts to ensure that resources and expertise are properly used. Each of the management fields are starting to develop individual departments with a specific focus to ensure that the environmental concerns are being addressed in emergency management and that emergency management concerns are being addressed in the environmental management. For example, emergency management may create a department of environmental emergency management

and vice versa. In the larger picture, both environmental and emergency management should still coordinate with each other to ensure that emergency and environmental concerns are consider in the larger context when determining the best course of action before, during and after and emergency or disaster.

"Environmental management professionals can make considerable contributions during the mitigation and recovery phases of emergency management. They can identify possible improvements and enhancements as well as things to avoid. More importantly, after enhancements or improvements are in place, they *can monitor and* assess environmental performance indicators to ensure that goals are met. Environmental assessments should be integrated into emergency planning processes ... Environmental Impact Statements should (but currently do not) specifically include disaster-hazard considerations. Rapid environmental assessments should be conducted as part of disaster damage assessment and should be an integral part of response/recovery considerations (Kelly 2001). " (John R. Labadie, p. 21)

Mitigation	Preparedness	Response	Recovery
•Inventory environmental assets •Identify environmental projects and environmental enhancement opportunities as part of hazard mitigation planning •Integrate local land use and growth management ordinances into hazard mitigation planning •Assist in developing Hazard Mitigation Plans •Establish and monitor Environmental Performance Indicators for assessing progress & operation of environmental projects conducted as part of mitigation •Identify and monitor environmental regulatory requirements •Identify and monitor government funding programs to support environmental mitigation actions	•Identify/assess environmental vulnerabilities and threats (analysis of Environmental Impact Statements) •Review emergency management policies, plans, and procedures for potential environmental impacts •Assist in emergency preparedness planning (especially for hazardous materials incidents) •Assist in the activities of the Local Emergency Planning Committee (under EPCRA) •Assist in developing response procedures to ensure that environmental factors/hazards are addressed	•Conduct Environmental Impact Assessments •Identify environmental threats/damage related to disaster effects •Assist in response to environmental hazards or emergencies (e.g., orphan drums; releases; etc.)	•Identify environmental damage •Identify possible recovery options for environmentally sensitive areas •Identify enhancements to environmental assets/resource for recovery •Monitor Environmental Performance Indicators (short & long-term) •Assist in and monitor debris removal and clean-up (e.g., for hazardous materials/wastes problems) •Identify and monitor environmental regulatory requirements. •Identify and monitor government funding programs to support environmental mitigation actions

Figure: Environmental Management and the Four Phases of Emergency Management

(John R. Labadie, p. 22)

3.4 U.S. - Policies, Framework, Technical Standards, and Operating Practices for Environmental Emergency Management

The following section describes the U.S. framework, technical standards, and operating practices by the United State's governmental agencies in charge of environmental emergency management. The United States emergency management and response is carried out by FEMA and coordinated with other federal, state, local, and private organizations depending on the emergency and the EPA, state environmental protection agencies, and other local or regional environmental protection agencies carry out the environmental management. The response is dependent on the size and type of the emergency. Larger emergencies that may affect large numbers of people may be coordinated and managed by at the state or federal level. Smaller emergencies often are coordinated and managed at the local level.

3.4.1 U.S. Federal Government - Emergency and Environmental Emergency Responsibilities

The U.S. federal government's responsibilities for emergency response are established by statute and by executive orders issued by the President.

Statutes

The **Stafford Act (PL-93-288)** provides the authority for the federal government to respond to disasters and emergencies in order to provide assistance to save lives and protect public health, safety, and property. Under the Stafford Act, the President is authorized to:

- Establish a program of disaster preparedness that uses services of all appropriate agencies
- Make grants to states, upon their request, for the development of plans and programs for disaster preparedness and prevention
- Ensure that all appropriate federal agencies are prepared to issue warnings of disasters to state and local officials

The **Federal Water Pollution Control Act Amendments of 1972/ Oil Pollution Act of 1990** expands the National Contingency Plan (NCP) to include response to releases of hazardous substances, as well as oil, to any navigable waters of the US. The Oil Pollution Act broadens the response and enforcement authorities of the federal government.

The **Resource Conservation and Recovery Act (RCRA)** gives EPA the authority to control hazardous waste from "cradle to grave", including its generation, transportation, treatment, storage, and disposal.

Executive Orders

EO 12088-Federal Compliance with Pollution Control Standards delegates pollution prevention, control, and abatement responsibilities to federal agencies, including EPA.

3.4.2 U.S. Emergency Management

- Four phases of emergency management
- Organization of emergency management at the local, State and Federal levels
- Emergency management at the local, State and Federal levels

Historical Background on Emergency Management

Emergency management was institutionalized in 1979 with the creation of the Federal Emergency Management Agency (FEMA). Five Federal agencies that dealt with many types of emergencies consolidated to form FEMA. Since that time, many State and local organizations have changed the names of their organizations to include the words: emergency management. The name change indicates a change in orientation from specialized preparedness for single or narrowly defined categories of hazards toward an all-hazards approach that includes potential threats to life and property through environmental and technological hazards, and domestic and foreign attacks. This change reflects not a reduction in security, but an increased emphasis on making the nation's emergency management capability responsive to any major emergency.

The concept of emergency management consists of three interrelated components, as shown in this table.

All types of hazards	There are many common features of technological and natural disasters and attack, suggesting that many of the same management strategies can apply to all emergencies.
An emergency management partnership	Finding resources for disaster management requires a partnership among all levels of government (local, State, and Federal) and the private sector (business and industry,

voluntary organizations, and the public). This approach also allows the disaster victims to contribute to emergency management solutions.

An emergency life cycle

Disasters do not just appear one day — they exist throughout time and have a life cycle of occurrence. This cycle is matched by a series of management phases: establish strategies to mitigate hazards; prepare for and respond to emergencies; and recover from effects.

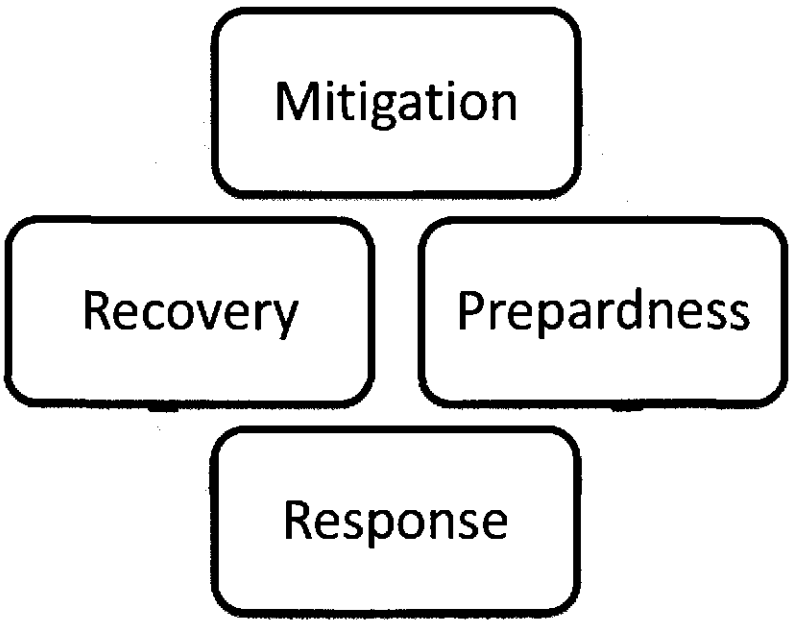
Legal Responsibilities

Many States require that local jurisdictions provide for the position of emergency program manager. At each level of government, laws define the responsibility and authority of emergency managers and management programs. Coordination of knowledge, resources and expertise between government officials and the private sector is a basic principle of emergency management.

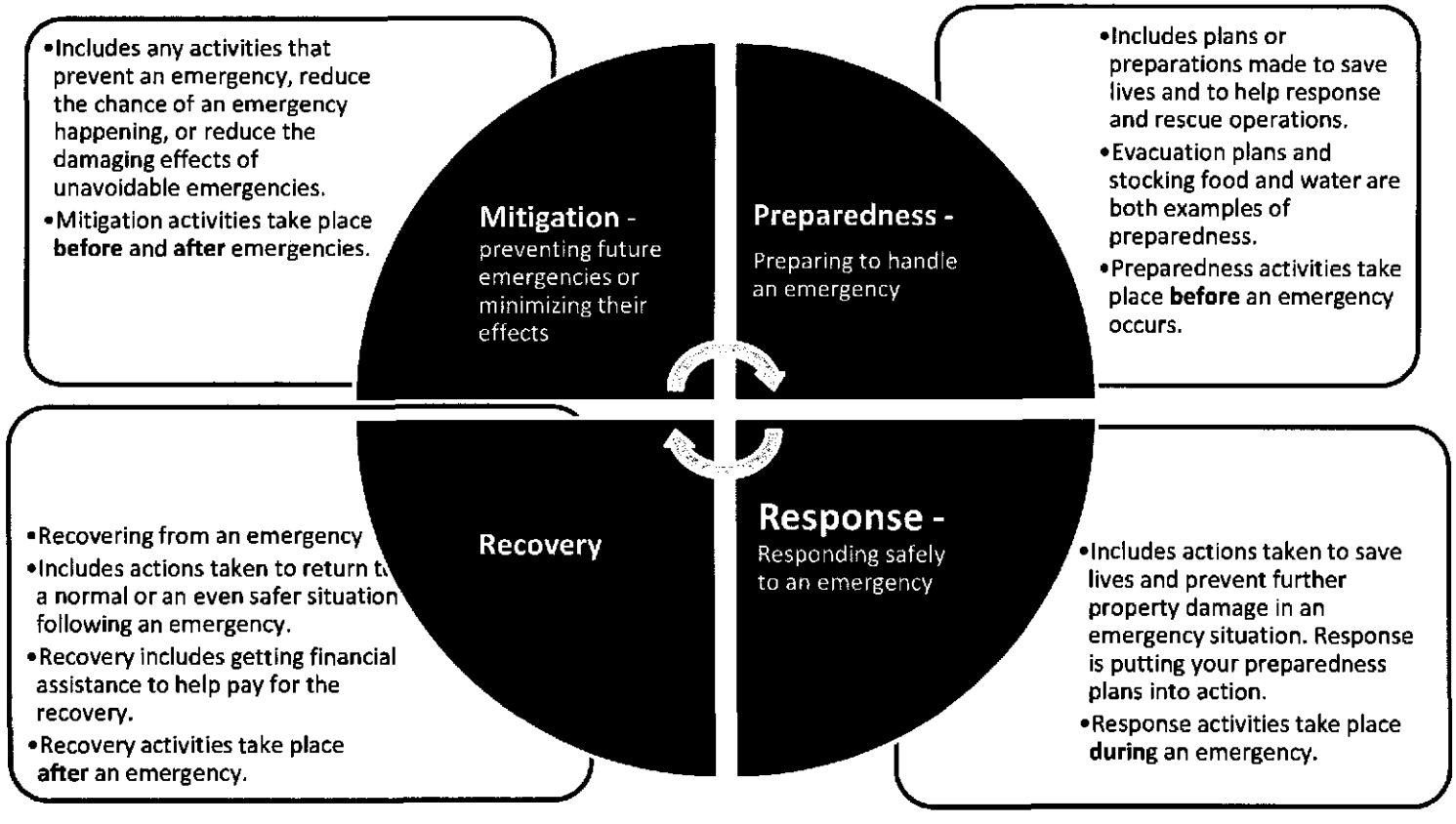
The Four Phases of Emergency Management

Since World War II emergency management has focused primarily on preparedness. Often this involved preparing for enemy attack. Community preparedness for all disasters requires identifying resources and expertise in advance, and planning how these can be used in a disaster. However, preparedness is only one phase of emergency management. Current thinking defines four phases of emergency management: mitigation, preparedness, response, and recovery. There are entire courses on each of these phases.

The following diagram illustrates the four phases of emergency management.


Mitigation
Recovery
Prepardness
Response

The Four Phases of Emergency Management



Local government responsibilities

Local governments make plans and provide resources to protect their citizens from the hazards that threaten their communities. This is done through mitigation activities, preparedness plans, response to emergencies, and recovery operations. The local government level is the most important at which to develop emergency management plans because local governments serve as the link between you and the State and Federal agencies in the emergency management network. Local law will specify a chain of command in emergencies.

The following table lists responsibilities of local governments in terms of emergency management.

Local Government Responsibilities

- Identifying hazards and assessing their potential risk to the community.
- Determining the community's capability to mitigate against, prepare for, respond to, and recover from major emergencies.
- Identifying and employing methods to improve the community's emergency management capability through efficient use of resources, improved coordination, and cooperation with other communities and with the State and Federal governments.
- Establishing mitigation measures such as building codes, zoning ordinances, or land-use management programs.
- Developing and coordinating preparedness plans.
- Establishing warning systems.
- Stocking emergency supplies and equipment.
- Educating the public and training emergency personnel.
- Assessing damage caused by the emergency.
- Activating response plans and rescue operations.
- Ensuring that shelter and medical assistance are provided.
- Recovering from the emergency and helping citizens return to normal life as soon as possible.

State government responsibilities

The State emergency management office is responsible for protecting communities and citizens within the State. The State office carries out statewide emergency management activities, helps coordinate emergency management activities involving more than one community, or assists individual communities when they need help. If any community lacks the resources needed to protect itself or to recover from a disaster, the State may help with money, personnel, or other resources. State emergency management offices often have various names and procedures for operating. Titles commonly used include Emergency Management, Civil Defense, Civil Preparedness, and Disaster Services. In this text, the term emergency management is used to refer to these State offices. The State is the pivotal point between policy guidance and resources available at the Federal level and the implementation of comprehensive emergency management programs at the local level.

Federal government responsibilities

At the Federal level of government, the Federal Emergency Management Agency (FEMA) is involved in mitigation, preparedness, response, and recovery activities. FEMA helps the States in several ways. FEMA provides the following programs:

- Training programs and research information on the latest mitigation measures;
- Review and coordination of State emergency plans;
- Financial assistance;
- Flood insurance to individuals and businesses in communities that join the National Flood Insurance Program (NFIP);
- Subsidies to State and local offices of emergency management for maintaining emergency management programs;
- Guidance and coordination for plans to warn and protect the nation in national security emergencies; and
- Coordination of services for disaster response and recovery activities

emergency communications applies to those technical means and modes required to provide and maintain operable and interoperable communication before, during, and after presidentially declared emergencies, disasters, or planned National Special Security Events. The Disaster Emergency Communications Division has six geographically dispersed Mobile Emergency Response Support (MERS) detachments and a number of Mobile Communications Office Vehicles (MCOV).

The Disaster Emergency Communications Division establishes, maintains, and coordinates effective disaster emergency communications services and information systems critical to FEMA's role in coordinating the Federal government's response, continuity efforts, and restoration of essential services before, during, and after an incident or planned event. The DEC Division promotes and provides operable and interoperable communications and information systems capabilities across all levels of government to ensure mission–critical information and situational awareness for emergency management decision makers and support elements. This is accomplished through:

- Supporting effective tactical operable and interoperable voice, video, and information systems for federal emergency response teams
- Identifying and documenting mission-critical disaster emergency communication and information systems capabilities, requirements, solutions, and mitigation strategies.
- Developing effective command and control communications frameworks
- Supporting the coordination and delivery of secure communications solutions
- Promoting communications interoperability with Federal, State, tribal, and local emergency response providers

Disaster Emergency Communications Division (Headquarters Element) The DEC Division at FEMA headquarters provides the executive leadership, program support, guidance, planning, and national intra-and interagency coordination required for the effective delivery of FEMA disaster emergency services. The DEC Division also advocates for the resolution of strategic policy issues impacting the communications needs of emergency responders, engages across the Federal government to support response to State and local governments and help establish consistent DEC operability and interoperability standards and capabilities, and facilitates a coordinated emergency communications response framework. Specifically, the DEC Division headquarter element performs the following roles:

- Programmatic oversight and support, to include:
- Doctrine, policy, and standards development and maintenance
- Planning
- Logistics and Budget
- Interagency Coordination
- Regional Emergency Communications Coordination Working Groups
- Research, Testing, Development, and Evaluation
- Lifecycle Management
- Integration Management
- Training and Exercises
- Readiness Reporting
- Security
- Administrative Support
- Engineering Review Board
- Change Control Board

Operations:

- Deployment and support of MERS Detachments
- Spectrum management
- Interagency all-hazards response coordination

3.4.5 Environmental Violation Versus Emergencies

An **environmental violation** occurs when an activity or an existing condition does not comply with an environmental law or regulation. Environmental violations can include (but are not limited to):

- Smoke or other emissions from local industrial facilities;
- Tampering with emission control or air conditioning systems in automobiles;
- Improper treatment, storage, or disposal of hazardous wastes;
- Exceeding pollutant limits at publicly-owned wastewater treatment plants;
- Unpermitted dredging or filling of waters and wetlands;
- Any unpermitted industrial activity; or
- Late-night dumping or any criminal activity including falsifying reports or other documents.

An **environmental emergency** is a *sudden threat* to the public health or the well-being of the environment, arising from the release or potential release of oil, radioactive materials, or hazardous chemicals into the air, land, or water.

Examples of environmental emergencies include:

- Oil and chemical spills,
- Radiological and biological discharges, and
- Accidents causing releases of pollutants

These emergencies may occur from transportation accidents, events at chemical or other facilities using or manufacturing chemicals, or as a result of natural or man-made disaster events.

3.4.6 Environmental Hazards - EPA

Hazard Identification

Hazard Identification: To identify the types of adverse health effects that can be caused by exposure to some agent in question, and to characterize the quality and weight of evidence supporting this identification.

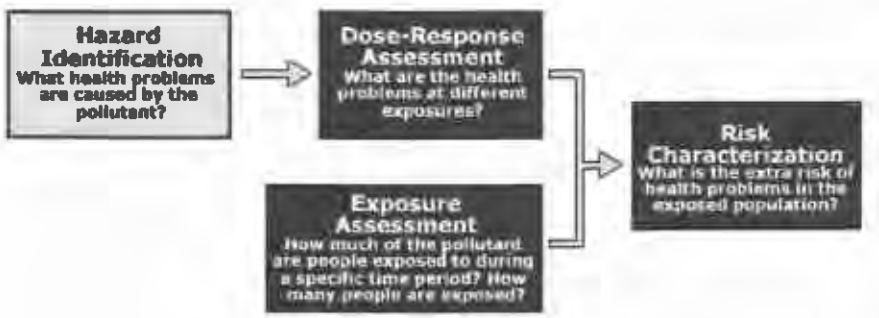


Figure 30 4 Step Risk Assessment Process

Hazard Identification is the process of determining whether exposure to a stressor can cause an increase in the incidence of specific adverse health effects (e.g., cancer, birth defects) and whether the adverse health effect is likely to occur in humans. In the case of chemical stressors, the process examines the available scientific data for a given chemical (or group of chemicals) and develops a weight of evidence to characterize the link between the negative effects and the chemical agent.

Exposure to a stressor may generate many different adverse effects in a human: diseases, formation of tumors, reproductive defects, death, or other effects.

Key Components of Hazard Identification

A wide variety of studies and analysis are used to support a hazard identification analysis.

- Toxicokinetics considers how the body absorbs, distributes, metabolizes, and eliminates specific chemicals.
- Toxicodynamics focus on the effects that chemicals have on the human body. Models based on these studies can describe mechanisms by which a chemical may impact human health, thus providing insights into the possible effects of a chemical.

When assessing a chemical for potential carcinogenic behavior, current EPA practice is to focus on analysis of a mode of action. Mode of action is a sequence of key events and processes, starting with interaction of an agent and a cell, proceeding through operational and anatomical changes, and resulting in cancer formation. A given agent may work by more than one mode of action, both at different tumor sites as well as at the same site. Analysis of mode of action is based on physical, chemical, and biological information that helps to explain key events in an agent's influence on tumor development.

A key component of hazard characterization involves evaluating the weight of evidence regarding a chemical's potential to cause adverse human health effects. The weight of evidence narrative may include some standard 'descriptors' that signify certain qualitative threshold levels of evidence or confidence have been met, such as 'Carcinogenic to humans' or 'Suggestive evidence of carcinogenic potential'.

3.4.7 Risk Assessments: Planning - EPA

Planning - There is a need to make judgments early when planning major risk assessments regarding the purpose, scope, and technical approaches that will be used. To simplify our discussion of planning the following structure focuses on human health risk assessment.

Risk assessors will typically ask the following questions when planning a human health risk assessment:

Who/What/Where is at Risk?

- Individual
- General population
- Life stages such as children, teenagers, pregnant/nursing women
- Population subgroups - highly susceptible (for example, due to asthma, genetics, etc.) and/or highly exposed (for example, based on geographic area, gender, racial or ethnic group, or economic status)

What is the environmental hazard of concern?

- Chemicals (single or multiple/cumulative risk)
- Radiation
- Physical (dust, heat)
- Microbiological or biological
- Nutritional (for example, diet, fitness, or metabolic state)
- Socio-Economic (for example, access to health care)
- Where do these environmental hazards come from?
- Point sources (for example, smoke or water discharge from a factory; contamination from a Superfund site)
- Non-point sources (for example, automobile exhaust; agricultural runoff)
- Natural sources

How does exposure occur?

- Pathways (recognizing that one or more may be involved)
    - Air

- Surface Water
- Groundwater
- Soil
- Solid Waste
- Food
- Non-food consumer products, pharmaceuticals

- Routes (and related human activities that lead to exposure)
  - Ingestion (both food and water)
  - Contact with skin
  - Inhalation
  - Non-dietary ingestion (for example, "hand-to-mouth" behavior)

What does the body do with the environmental hazard and how is this impacted by factors such as age, race, sex, genetics, etc.?)

- Absorption - does the body take up the environmental hazard
- Distribution - does the environmental hazard travel throughout the body or does it stay in one place?
- Metabolism - does the body breakdown the environmental hazard?
- Excretion - how does the body get rid of it?

What are the health effects?

- Example of some health effects include cancer, heart disease, liver disease and nerve disease.
- How long does it take for an environmental hazard to cause a toxic effect? Does it matter when in a lifetime exposure occurs?

How long?

- Acute - right away or within a few hours to a day
- Subchronic - weeks or months (for humans generally less than 10% of their lifespan)
- Chronic - a significant part of a lifetime or a lifetime (for humans at least seven years)
- Intermittent
- Timing

EPA's risk management research identifies, develops and tests innovative tools, methods and technologies used to solve and prevent complex environmental problems to safeguard human health and the environment. EPA scientists and engineers seek to determine what environmental risks exist and then determine how to manage, reduce or eliminate those risks in a sustainable manner.

Models, Methods, and Databases

- Models
- Methods
- Databases

Models
Air Integrated Air Pollution Control System (IAPCS) Cost Model: The IAPCS model estimates costs for implementing various air pollution control technologies for coal-fired power plants. The IAPCS model is intended for use by pollution control regulators, architecture and engineering companies, utility companies, public utility commissions, and legislators. Economics and Performance Modeling: These economic and performance evaluation models estimate costs for air pollution prevention and control strategies. The models are intended for use by decision makers looking for objective, authoritative information on the cost-effectiveness of environmental technologies and risk management methods. Mobile Source Ozone Precursor Emissions Characterization and Modeling Mobile Emissions Assessment System for Urban and Regional Evaluation (MEASURE): This model characterizes mobile source emissions. This model estimates emissions for specific vehicle and engine operating modes (e.g., engine starts, acceleration, deceleration, and idling) so that more accurate information about actual on-road emissions can be obtained. Highway Vehicle Particulate Emission Modeling Software – PART5: This model estimates particulate emissions from highway vehicles. The model analyzes the pollution effect of in-use various fueled vehicles. The model is appropriate for comparative analyses, such as determining the potential impact of one traffic control measure versus another. Indoor Air Quality Modeling: This is an indoor air quality model for analyzing the effect of emissions sources, sinks, ventilation, and air cleaners on indoor air quality. RISK Model: This model is designed to calculate individual exposure to indoor air pollutants from emissions sources. The model can calculate exposure due to individual (as opposed to population) activity patterns and source use. It can also determine risk from the calculated exposure to indoor air pollution.

IAQX (Indoor Air Quality and Inhalation Exposure Model): This model performs conventional indoor air quality simulations, computes inhalation exposure, and estimates the adequate ventilation rate for improving indoor air quality.

Cost Analysis of Indoor Air Control Techniques

Energy Costs of Increased Ventilation in Humid Climates (DOE-2 Modeling): Energy Costs of Increased Ventilation in Humid Climates: This building energy methodology is used to improve indoor air quality. It assesses the energy costs of indoor air quality control through increased ventilation in a warm, humid climate (a climate that makes improving indoor air quality particularly challenging).

Cost Analysis of Indoor Air Control Techniques

Cost Analysis of Air Cleaners for Removing VOCs From Indoor Air: This model compares the cost of using granular activated carbon with the cost of using photocatalytic oxidation for treating volatile organic compounds in indoor air.

Water

EPANET: EPANET is software that models water distribution piping systems. It performs extended period simulations of the hydraulic and water quality behavior within pressurized pipe networks. EPANET was developed to help water utilities maintain and improve the quality of water delivered to consumers through distribution systems. It can be used to design sampling programs, study disinfectant loss and by-product formation, conduct system vulnerability and consumer exposure assessments, and to improve a system's hydraulic performance.

Storm Water Management Model (SWMM): SWMM is a general purpose urban study of the movement, distribution, and quality of water and conveyance system hydraulics software. EPA has extended SWMM to model the performance of specific types of low impact development (LID) controls, such as porous pavement, rain gardens, rain barrels, and vegetative swales. The model allows engineers and planners to accurately represent any combination of LID controls within a study area to determine their effectiveness in managing stormwater and combined sewer overflows.

Sanitary Sewer Overflow Analysis and Planning (SSOAP) Toolbox: The SSOAP toolbox is used for measuring rainfall infiltration and inflow and capacity analysis of sanitary sewer systems. The toolbox is currently interfaced with EPA's Storm Water Management Model Version 5.

System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN) Model: SUSTAIN is a decision support system to develop, evaluate, and select optimal best management practices combinations at various watershed levels based on cost and effectiveness. It was developed to assist stormwater management professionals in developing plans to protect source waters and meet water quality goals.

Ecosystems

Center for Subsurface Modeling Support (CSMoS): CSMoS provides modeling software used to perform site characterization and ground water flow and transport simulations. The models are also used for selecting groundwater remediation options at Resource Conservation and Recovery Act (RCRA) and Superfund sites, and for determining wellhead protection areas.

Sustainability

PARIS II: This software addresses industrial solvents whose continued use raises concern about worker health and toxics in the environment. This tool identifies pure chemicals or designs chemical mixtures that can serve as alternatives to more hazardous substances currently in use.

CAPE-OPEN (Computer-Aided Process Engineering): Chemical process simulation is a design tool that has long been used to determine the best chemical process options for the metal finishing industry. This program can be easily applied to other chemical process industries.

TEST (Toxicity Estimation Software Tool): TEST allows users to estimate toxicological and physical properties of a chemical from its molecular structure.

TRACI: Tool for the Reduction and Assessment of Chemical and other environmentalImpacts: TRACI is a tool for comprehensive life cycle impact assessment, sustainability metrics, industrial ecology, process design, and pollution prevention.

Methods

Air

Cost Analysis of Indoor Air Control Techniques

Methodology for Cost-Effective Selection of Indoor Air Quality (IAQ) Control Options:This

methodology can be used for preliminary comparison of the cost effectiveness of alternative indoor air quality control measures for commercial or institutional building. It addresses improved ventilation, air cleaners, and source management options. This was designed for indoor air quality diagnosticians, architects, engineers, building owners and operators, and the scientific community.

Sustainability

Computer-Aided Chemical Process Design Methodologies for Pollution Reduction:This method is used to develop computer optimization and simulations for the design of economical chemical manufacturing processes. These computer tools help to minimize the potential adverse effects of pollution while keeping capital and operating costs from increasing.

Chemical Process Simulation for Waste Reduction (WAR Algorithm): These methodologies help reduce the adverse effects of chemical waste on the environment while minimizing the cost of chemical processing. The goal is to minimize the potential environmental impact for a process instead of minimizing the amount of waste generated by a process. Users can emphasize or de-emphasize different hazards as needed for particular applications. For example, an operation in an area suffering from smog may emphasize air pollution effects, while an operation where workers are routinely exposed to chemicals may emphasize human health effects.

LCAccess: This was designed for practitioners, policy developers, environmental managers, product designers, or other decision makers to better understand the human health and environmental impacts associated with products, processes or activities, and to identify possible improvements across all of the life cycle stages of a product, process, or activity. LCA methods have been standardized as part of the International Standards Organization (ISO).

Databases

Water

Drinking Water Treatability Database (TDB): Drinking Water Treatability Database (TDB): TDB presents referenced information on the control of contaminants in drinking water. It allows drinking water utilities, first responders to spills or emergencies, treatment process designers, research organizations, academicians, regulators, and others to access referenced information gathered from thousands of literature sources and assembled on one site.

Ecosystems

Inventory of Ecological Restoration Projects Within the Mid-Atlantic Integrated Assessment Region: This inventory is a central repository of restoration project information specific to the mid-Atlantic region. The inventory includes individual restoration projects conducted in both water and land environments by federal, state, and local government entities, and nongovernment organizations. Each project listing consists of a description of the restoration site, the problem being addressed, the goals of the project, critical ecosystem and environmental factors, technical approaches, costs, monitoring activities, and a contact for more detailed information. The database is intended for researchers, restoration practitioners, environmental resource managers, policy makers, consultants, and communities in the mid-Atlantic area.

Risk Management Research

Everyday activities that create wastes, emissions, or resource depletion, are risks. Risk management seeks to proactively improve or prevent environmental and health risks. EPA's Risk Management Research protects human health and the environment.

- Control and prevent air pollution emissions
- Support Homeland Security programs by investigating ways to contaminate buildings
- Reduce greenhouse gas (GHG) emissions thru new technologies
- Identify and reduce water quality and availability issues
- Protect groundwater
- Provide technical support on below ground pollution and ecosystem restoration
- Determine which oil spill dispersants work best
- Help communities achieve growth goals, improve resident quality of life, and enhance financial and environmental sustainability
- Work on soil and sediment contamination issues
- Cleanup waterways to make them usable for drinking, swimming and fishing
- Provide choices for managing wastes
- Help communities with the land use decisions
- Identify consequences of technology changes and present sustainable alternatives
- Analyze product processes or services and their adverse impacts and recommend greener choices
- Demonstrate practices that meet the needs of the present without compromising the ability of future generations to meet theirs
- Develop approaches and tools to monitor, treat, protect, and restore impaired waterways
- Improve drinking water and wastewater systems

What does Risk Management Research involve?

Analyzing environmental risks and providing solutions by:

- Working with outside organizations to design, develop, and evaluate technologies and methods
- Providing assistance to develop and apply environmental technologies
- Incorporating cost-effective techniques that lead to successful pollution prevention and control strategies

How does EPA conduct Risk Management Research?

Our research is accomplished through:

- In-house research
- Cooperative agreements with academia and non-profit organizations
- Memorandums of understanding with industry
- Federal interagency agreements
- Use of environmental consultants

EPA also works closely with research staff around the world. The Risk Management Research Program offers technical support for contaminated sites and waterways. It shares research information through a variety of products, including reports, web pages, blogs, and databases

3.4.8 Risk Assessment - FEMA

FEMA's Comprehensive Preparedness Guide (CPG) 201 focuses on the conduct of risk assessments. This Threat and Hazard Identification and Risk Assessment (THIRA) Guide provides a comprehensive approach for identifying and assessing risks and associated impacts. Understanding the risks faced by communities and the nation as a whole and how this information can be used to build and sustain preparedness is an essential component of the National Preparedness System. It expands on existing local, tribal, territorial and state Hazard Identification and Risk Assessments (HIRAs) and other risk methodologies by broadening the factors considered in the process, incorporating the whole community throughout the entire process and by accounting for important community-specific factors. This THIRA Guide provides a common and consistent approach for identifying and assessing risks and their associated impacts. The THIRA is complemented by a Strategic National Risk Assessment (SNRA) that analyzes the greatest risks to the nation and contributes to a shared understanding of the full range of risks, including long-term trends that face our nation. THIRAs and the SNRA, along with specialized risk assessments, provide an integrated national risk picture. Producing that integrated risk picture and achieving the National Preparedness Goal requires participation by the whole community. Consistent conduct and application of THIRAs provides an important tool for integrating whole community contributions toward achieving the Goal and to educate individuals, families, businesses, organizations,

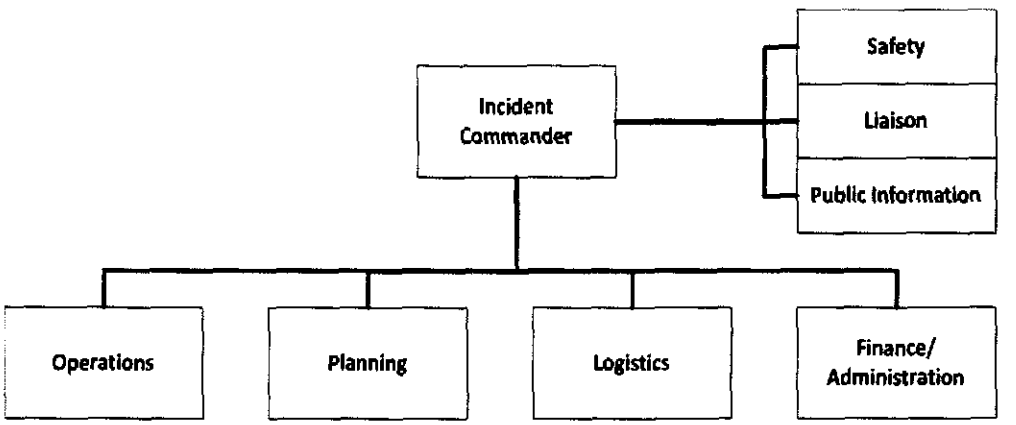
community leaders and senior officials on the risks they face and on their roles in and contributions to prevention, protection, mitigation, response and recovery.

3.4.9 Incident Management - Best Practices

When an emergency occurs or there is a disruption to the business, organized teams will respond in accordance with established plans. Public emergency services may be called to assist. Contractors may be engaged and other resources may be needed. Inquiries from the news media, the community, employees and their families and local officials may overwhelm telephone lines. How should a business manage all of these activities and resources? Businesses should have an incident management system (IMS). An IMS is "the combination of facilities, equipment, personnel, procedures and communications operating within a common organizational structure, designed to aid in the management of resources during incidents" [NFPA 1600].

The National Incident Management System (NIMS) was established by FEMA and includes the Incident Command System (ICS). NIMS is used as the standard for emergency management by all public agencies in the United States for both planned and emergency events. Businesses with organized emergency response teams that interface with public emergency services can benefit from using the ICS. ICS is also well suited for managing disruptions of business operations. Public information and crisis communications are an integral part of the ICS structure.

When an incident occurs, incident stabilization activities (e.g. firefighting, damage assessment, property conservation) may be underway at the scene of the incident. Others assigned to support incident stabilization, business continuity or crisis communications activities will report to an emergency operations center (EOC). The emergency operations center is a physical or virtual location from which coordination and support of incident management activities is directed. The Incident Command System and the use of an Emergency Operations Center will support incident management.



The Incident Command System (ICS) is used by public agencies to manage emergencies. ICS can be used by businesses to work together with public agencies during emergencies. Private sector businesses should be familiar with the fundamental concepts of incident command and should coordinate planning with local public emergencies services. The use of ICS within a business depends upon the size and complexity of the business. Functions and roles may be assigned to multiple individuals or a few persons may be assigned multiple responsibilities.

Not all of the ICS positions need to be active in each incident. The ICS structure is meant to expand and contract as the scope of the incident requires. For small-scale incidents, only the incident commander may be assigned. Command of an incident would likely transfer to the senior on-scene officer of the responding public agency when emergency services arrive on the scene. Command transfers back to the business when the public agency departs.

An abbreviated summary of the roles and responsibilities of each ICS position are presented below.

INCIDENT COMMANDER

- In charge of the organization's on-scene response
- Maintain command until public agencies arrive and assume command or when relieved at start of next operational period
- Assess the situation
- Order warning of persons at risk or potentially at risk to take appropriate protective actions

- Notify or verify internal teams, departments, public agencies, regulators, contractors and suppliers have been notified
- Appoint others to incident command positions as needed
- Brief staff on current organization and activities; assign tasks; schedule planning meeting
- Determine the incident objectives and strategy; identify information needed or required by others; ensure planning/strategy meetings are held and attend as needed
- Coordinate activities with the EOC; identify priorities and activities; provide impact assessment for business continuity, crisis communications and management
- Review requests for resources; confirm who has authority to approve procurement; approve all requests for resources as required
- Provide information to and coordinate with crisis communications or media relations team
- Terminate the response and demobilize resources when the situation has been stabilized

SAFETY

- Identify and assess hazardous situations; prevent accidents
- Prepare safety plan; ensure messages are communicated
- Stop unsafe acts; correct unsafe conditions

LIAISON

- Point of contact with outside agencies and companies
- Monitors operations to identify inter-organizational problems

PUBLIC INFORMATION

- Notify spokespersons and Crisis Communications Team
- Develop information for use in media briefings
- Obtain IC's and management approval for all news releases
- Conduct periodic media briefings
- Arrange for tours, interviews and or briefings
- Monitor and forward useful information to the media

OPERATIONS

- Manage all tactical operations during the incident
- Assist in the development of the operations portion of the Incident Action Plan
- Ensure safe tactical operations for all responders (in conjunction with any assigned Safety Officer)
- Request additional resources to support tactical operations
- Expedite appropriate changes in the operations portion of the Incident Action Plan
- Maintain close communication with the Incident Commander

PLANNING

- Conduct and facilitate planning meetings
- Supervise preparation of the Incident Action Plan
- Determine need for technical experts from within the company or outside as well as specialized resources to support the incident
- Coordinate with business continuity and senior management teams
- Assemble information on alternative strategies and plans
- Assess current and potential impacts on people, property, environment
- Compile and display incident status information

OGISTICS

- Provides resources to stabilize the incident and support personnel, systems and equipment:
- Workspace or facilities for incident management staff
- Media briefing center
- Transportation

- Communications equipment
- Food, water, shelter and medical care
- Ensures Incident Command Post and other facilities have been established as needed
- Assesses communications needs and facilitates communications between teams/personnel/agencies
- Attends planning meetings; provides input to Incident Action Plan
- Provides updates on resources (availability, response time, deployment)
- Estimates and procures resources for the next operational period

FINANCE/ADMINISTRATION:

- Manages all financial aspects of the incident
- Provides financial and cost analysis information as requested
- Create accounts for claims and costs; coordinates with Logistics
- Tracks worker time and costs for materials and supplies
- Documents claims for damage, liability and injuries
- Notifies risk management/insurance to initiate claims reporting
- Provides incurred and forecasted costs at planning meetings
- Provides oversight of financial expenditures, new leases, contracts and assistance agreements to comply with corporate governance

EMERGENCY OPERATIONS CENTER

An emergency operations center (EOC) is a physical (e.g., a conference room) or virtual (e.g., telephone conference call) location designed to support emergency response, business continuity and crisis communications activities. Staff meets at the EOC to manage preparations for an impending event or manage the response to an ongoing incident. By gathering the decision makers together and supplying them with the most current information, better decisions can be made. A primary EOC should be established at the main business facility and a secondary EOC should be available at another company facility, a temporary facility (such as a hotel) or through a teleconference bridge established to bring staff together virtually. The EOC supports the following incident management functions.

A large conference room can be used as an emergency operations center and primary team meeting location. It must be outfitted with furniture, telephone and internet access and be in close proximity to photocopiers, network printers, fax machines and other office equipment. The conference room or other space to be used as the EOC should be equipped with the following equipment and supplies:

- Communications equipment including sufficient telephones (cell and landline with at least one speakerphone) to handle incoming and outgoing calls; incoming and outgoing fax machines; and access to any radio systems used by the business
- Computers and printers with access to network resources (including electronic copies of emergency response, business continuity and crisis communications plans that can be printed on demand), electronic mail and the internet
- Information gathering and display tools including access to broadcast radio and television (preferably with recording capability) or internet news sources; white boards, TV monitors, projection units or flipcharts with easel and markers to compile and display information
- Hard copies of emergency response, business continuity and crisis communications plans, contact/telephone lists, resource inventory and diagrams of facilities and systems
- Stationery, business and incident management forms, pens, pencils, markers and supplies
- Food, water and dining supplies for EOC staff

The emergency operations center should be activated whenever there is a major incident that causes significant property damage, potential or actual business disruption or has the potential to cause a significant impact on the business.

An EOC is not an on-scene incident command post (ICP) - where the focus is on tactics to deal with the immediate situation. An EOC is used to support on-scene activities through the prioritization of activities and the allocation of available resources. A major function within the EOC is communications between the emergency response team, business, crisis communications team and company management.

Activation -Bring knowledge and expertise together to deal with events that threaten the business

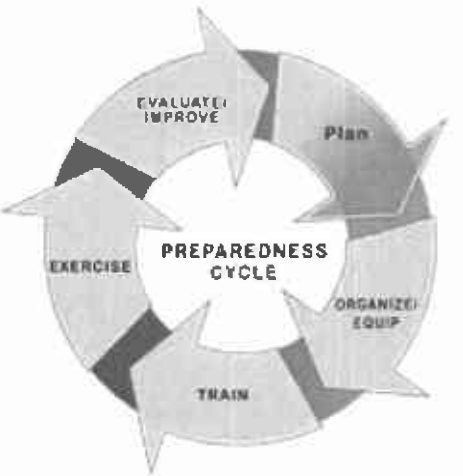
Situation Analysis -Gather information to determine what is happening and to identify potential impacts

Incident Briefing - Efficiently share information among team members

Incident Action Plan - Provide a single point for decision-making and decide on a course of action for the current situation

Resource Management - Provide a single point of contact to identify, procure and allocate resources

Incident Management -Monitor actions, capture event data and adjust strategies as needed



Planning makes it possible to manage the entire life cycle of a potential crisis. Strategic and operational planning establishes priorities, identifies expected levels of performance and capability requirements, provides the standard for assessing capabilities and helps stakeholders learn their roles. The planning elements identify what an organization's Standard Operating Procedures (SOPs) or Emergency Operations Plans (EOPs) should include for ensuring that contingencies are in place for delivering the capability during a large-scale disaster.

3.4.10 Emergencies, Accidents and Spills

An environmental emergency is a sudden threat to the public health, or the well-being of the environment, arising from the release or potential release of oil, radioactive materials, or hazardous chemicals into the air, land, or water. These emergencies may occur from transportation accidents, events at chemical or other facilities using or manufacturing chemicals, or as a result of natural or man-made disaster events. While there are many other serious environmental problems with which EPA is concerned, these activities are focused generally on sudden, immediate threats.

Stakeholders for Emergency Plans and Responses

There is a complex system of responsibilities for these types of emergencies because there are many parts to them. In general, responsibilities are spread across the federal, state and local sectors, depending upon the size and type of the emergency and involve the environmental, emergency management, public safety, and public health agencies of the three levels of government. In addition, industry has a very important role to play in preparing for and responding to such emergencies.

- **Prevention and Preparedness** - In response to the public concern about chemical spills and accidents, EPA created its Chemical Emergency Preparedness Program (CEPP) as a voluntary program to encourage State Emergency Response Commissions (SERCs) and Local Emergency Planning Committees (LEPCs) to identify hazards in their areas and to plan for potential chemical emergencies. This local planning complements emergency response planning carried out at the national and regional levels by the National Response Team and Regional Response Teams.

- **Chemical Spills** - provides information on how EPA works with other partners to respond to Superfund emergencies.

- **Oil spills** - provides information about the U.S. EPA's program for preventing, preparing for, and responding to oil spills that occur in and around inland waters of the United States.

- **Homeland Security** - provides links to information on an infrastructure that has been established to prepare and respond to acts and potential acts of terrorism.

- **The National Response Team** is made up of fifteen federal agencies with responsibilities for preparing for, or responding to, major oil or hazardous chemical emergencies. EPA is the chair with the U.S Coast Guard as vice-chair, and corresponding regional teams are in each of the ten federal regions.

- **Area Contingency Committees** are made up of regional representatives which specifically plan for oil spills.

- **The Federal Response Disaster Group** is made up of over 30 federal agencies with responsibilities for preparing for or responding to major national disasters.

- **The Federal Radiological Preparedness Group** is made up of 17 federal Departments and Agencies. They respond to radiological emergencies under the Federal Radiological Emergency Response Plan (FRERP).

- The American Red Cross is America's largest humanitarian organization, helping people each year prevent, prepare for and cope with emergencies.

3.4.11 Environmental Emergency

An **environmental emergency** is a *sudden threat* to the public health or the well-being of the environment, arising from the release or potential release of oil, radioactive materials, or hazardous chemicals into the air, land, or water.

Examples of environmental emergencies include:

- Oil and chemical spills,
- Radiological and biological discharges, and
- Accidents causing releases of pollutants

These emergencies may occur from transportation accidents, events at chemical or other facilities using or manufacturing chemicals, or as a result of natural or man-made disaster events. If you are involved in or witness an environmental emergency that presents a sudden threat to public health.

Facility Response Plan (FRP) Rule

As part of the Oil Pollution Prevention regulation, some facilities that store and use oil must prepare and submit plans to respond to a worst-case discharge of oil and to a substantial threat of such a discharge.

Local Governments Reimbursement (LGR) Program

EPA's program helps local governments pay for emergency response measures.

National Contingency Plan (NCP) Subpart J Product Schedule

Subpart J provides for a schedule of dispersants, other chemicals, and other spill mitigating devices and substances that may be authorized for use on oil discharges.

Reporting Oil Discharges and Hazardous Substance Releases

Regulated facilities must report discharges of oil or releases of hazardous substances to EPA, other federal agencies, and/or state and local government agencies.

Risk Management Plan (RMP)

Facilities that produce, handle, process, distribute, or store certain chemicals must develop and report to EPA an accident prevention plan including a hazard assessment, a prevention history, and an emergency response program.

Spill Prevention, Control, and Countermeasure (SPCC) Rule

As part of the Oil Pollution Prevention regulation, specific facilities must prepare, amend, and implement SPCC Plans.

3.4.12 EPA and FEMA Partnership

EPA and FEMA Partner to Help Communities Prepare for and Recover from Natural Disasters

Communities across the country are using smart growth approaches to ensure that growth and development meets a variety of community goals—stronger economies, safer and more convenient neighborhoods, vibrant downtowns, and clean water and air. These approaches include revising land use policies and codes so they are more responsive to market demands, ensuring that public and private investments are made in ways that support job creation and increased economic activity, and getting significant and meaningful involvement from all stakeholders when making decisions about development.

How and where growth occurs, both in the short term and the long term, can have a major impact on how well communities can prepare for and recover from natural disasters. But communities have not always used development planning as a strategy to become more resilient to hazards. Integrating smart growth approaches into preparedness and recovery can change this dynamic. Smart growth strategies like creating flexible land use policies, targeting public investment to catalyze private investment, and engaging the entire community in making decisions about the future can help communities to recover from a disaster in a more resilient way, rebuild according to a shared community vision, and be prepared for the next natural disaster.

3.4.12.1 Memorandum of Agreement (MOA) - FEMA and EPA

In 2010, EPA and the Federal Emergency Management Agency (FEMA) signed a Memorandum of Agreement (MOA) that will make it easier for the two agencies to work together to help communities become safer, healthier, and more resilient. The two agencies will collaborate to help communities that have been hit by disasters to rebuild in ways that protect the environment, create long-term economic prosperity, and enhance neighborhoods. FEMA and EPA will also help communities incorporate into hazard mitigation plans strategies that will improve quality of life and direct development away from vulnerable areas.

The agencies intend to use the lessons they learn from working together under this MOA, as well as from working with other federal agencies, to better coordinate federal assistance to communities on hazard mitigation planning and post-disaster recovery. The MOA could also help the agencies to work together on climate change adaptation.

PURPOSE

The purpose of this Memorandum of Agreement (MOA) is to finalize efforts to explore opportunities to incorporate sustainability and smart growth practices into communities' hazard mitigation planning and long term disaster recovery efforts, and to incorporate hazards resilience into smart growth assistance for communities.

This MOA reflects the mutual desire of both parties to coordinate Federal Emergency Management Agency (FEMA) and Environmental Protection Agency (EPA) networks of nationwide, regional and community-based expertise, practices, initiatives, and programs to help communities reduce vulnerability to natural hazard events, recover from disasters that do occur, and achieve economic, environmental, and public health outcomes as part of redevelopment and recovery efforts. In particular, this MOA contemplates coordination of activities between EPA's Smart Growth Program and FEMA's long term disaster recovery and hazard mitigation planning programs. Second, this MOA also seeks to provide lessons learned for EPA, FEMA and other federal agencies that can be used to build a stronger federal framework for both post-disaster planning and post-disaster recovery. Third, it seeks to provide a collaborative framework for policy work related to both hazard mitigation planning and climate change adaptation to create more resilient communities.

BACKGROUND

FEMA

Federal Emergency Management Agency FEMA, which is within the Department of Homeland Security (DHS), is an Executive Agency that serves as a single point ofcontact within the federal government for emergency management activities. It is dedicated to establishing and maintaining a comprehensive and coordinated emergency management capability designed to support state and local governments to prepare for, protect against, respond to, recover from, and mitigate hazards of all types.

EPA

Environmental Protection Agency EPA is an Executive Agency dedicated to protecting human health and safeguarding the natural environment -air, water and land -upon which life depends. EPA endeavors to ensure that: al1 Americans are protected from significant risks to human health and the environment where they live, learn and play; national efforts to reduce environmental risks are based on accurate information and the best scientific information; and that federal laws protecting human health and the environment are enforced fairly and effectively.

EPA's Development, Community and Environment Division works with states and communities to help them grow in ways that protect the environment, support economic vitality, and create healthy communities. DCED promotes development approaches that have clear environmental benefits, including improved air and water quality, increased wetlands preservation, more clean up and re-use of brown field sites, and increased preservation of natural areas. DCED achieves these goals by providing tools and technical assistance that help states and communities make good decisions about how and where they want to grow. Smart growth approaches cover a range of development and conservation strategies that help protect our natural environment and make our communities more attractive, economically stronger, and more socially diverse.

The current EPA-FEMA collaboration has three broad goals:

1. Help the five communities use smart growth, green infrastructure, and green building practices to rebuild and accommodate growth in appropriate places;
2. Create a positive, replicable model for using smart growth technical assistance as part of long term community disaster recovery and hazard mitigation;
3. Use the lessons learned from this work to show how smart growth approaches can be used to help communities rebuild in a more resilient way and how these approaches can be part of a broader effort to mitigate or adapt to future hazard events that will occur as a result of climate change.

GOALS

FEMA and EPA intend, to the extent set forth below, to coordinate their activities and programs as they relate to incorporating sustainability and smart growth practices into communities' hazard mitigation planning and long term disaster recovery efforts, and likewise to incorporate hazards resilience into smart growth assistance for communities. Cooperative efforts may focus on disciplines such as natural hazard risk analysis and reduction, preparedness, adaptation and hazard mitigation planning, urban design and planning, local codes and ordinances, watershed and water infrastructure planning,

economic development, housing and equitable development and fostering of community-based disaster risk reduction and environmental protection partnerships.

1. Enhanced Agency Coordination FEMA and EPA intend to take appropriate steps to encourage, coordinate, and enhance ongoing relationships between the headquarters and regional offices of both entities. FEMA and EPA also intend to consider ways to encourage, coordinate and enhance linkage of efforts under this MOA with ongoing efforts of other related federal agency programs such as the U.S. Department of Housing and Urban Development (HUD) Office of Sustainable Housing and Communities and the U.S. Department of Transportation (DOT) Office for Livable Communities. (See Addendum 1 for *HUD-DOT-EPA Partnership for Sustainable Communities)*

   (I) Increased awareness and capability at EPA will enable a stronger engagement of EPA regional offices in a post disaster environment to assist in facilitating State and Federal decision making to include sustainability and smart growth principles as part of ESF #14's interagency coordination efforts.

2. When non-disaster smart growth technical assistance efforts have potential hazard mitigation opportunities, EPA intends to coordinate with FEMA, and, as necessary, FEMA will strive to provide hazard mitigation expertise. FEMA also intends to share information with EPA on the status of hazard mitigation plans and current hazard mitigation planning activities being conducted by States, local communities and Tribal governments in an effort to assist EPA in scoping work and coordinating with local officials to ensure that smart growth assistance efforts consider hazard mitigation.

3. FEMA and EPA intend to examine and consider revisions, as appropriate, to policies and programs to promote development that is sustainable, that does not cause significant direct or indirect harm to the environment, and/or that does not significantly increase risks from natural disasters.

3.4.13 U.S. Environmental Protection Agency - EPA

3.4.13.1 Agency Mission Statement

The mission of the U.S. Environmental Protection Agency is to protect human health and to safeguard the natural environment--air, water, and land--upon which life depends.

EPA's purpose is to ensure that:

- All Americans are protected from significant risks to human health and the environment where they live, learn and work.
- National efforts to reduce environmental risk are based on the best available scientific information.
- Federal laws protecting human health and the environment are enforced fairly and effectively.
- Environmental protection is an integral consideration in U.S. policies concerning natural resources, human health, economic growth, energy, transportation, agriculture, industry, and international trade, and these factors are similarly considered in establishing environmental policy.
- All parts of society--communities, individuals, business, state and local governments, tribal governments--have access to accurate information sufficient to effectively participate in managing human health and environmental risks.
- Environmental protection contributes to making our communities and ecosystems diverse, sustainable and economically productive.
- The United States plays a leadership role in working with other nations to protect the global environment.

3.4.13.2 EPA's National Goals for Protecting Public Health and The Environment

CLEAN AIR: The air in every American community will be safe and healthy to breathe. In particular, children, the elderly, and people with respiratory ailments will be protected from health risks of breathing polluted air. Reducing air pollution will also protect the environment, resulting in many benefits, such as restoring life in damaged ecosystems and reducing health risks to those whose subsistence depends directly on those ecosystems.

CLEAN AND SAFE WATER: All Americans will have drinking water that is clean and safe to drink. Effective protection of America's rivers, lakes, wetlands, aquifers, and coastal and ocean waters will sustain fish, plants, and wildlife, as well as recreational, subsistence, and economic activities. Watersheds and their aquatic ecosystems will be restored and protected to improve public health, enhance water quality, reduce flooding, and provide habitat for wildlife.

SAFE FOOD: The foods Americans eat will be free from unsafe pesticide residues. Children especially will be protected from the health threats posed by pesticide residues, because they are among the most vulnerable groups in our society.

PREVENTING POLLUTION AND REDUCING RISK IN COMMUNITIES, HOMES, WORKPLACES AND ECOSYSTEMS: Pollution prevention and risk management strategies aimed at cost-effectively eliminating, reducing, or minimizing emissions and contamination will result in cleaner and safer environments in which all Americans can reside, work, and enjoy life. EPA will safeguard ecosystems and promote the health of natural communities that are integral to the quality of life in this nation.

REDUCTION OF GLOBAL AND CROSS-BORDER ENVIRONMENTAL RISKS: The United States will lead other nations in successful, multilateral efforts to reduce significant risks to human health and ecosystems from climate change, stratospheric ozone depletion, and other hazards of international concern.

EXPANSION OF AMERICANS' RIGHT TO KNOW ABOUT THEIR ENVIRONMENT: Easy access to a wealth of information about the state of their local environment will expand citizen involvement and give people tools to protect their families and their communities as they see fit. Increased information exchange between scientists, public health officials, businesses, citizens, and all levels of government will foster greater knowledge about the environment and what can be done to protect it.

SOUND SCIENCE, IMPROVED UNDERSTANDING OF ENVIRONMENTAL RISK, AND GREATER INNOVATION TO ADDRESS ENVIRONMENTAL PROBLEMS: EPA will develop and apply the best available science for addressing current and future environmental hazards, as well as new approaches toward improving environmental protection.

A CREDIBLE DETERRENT TO POLLUTION AND GREATER COMPLIANCE WITH THE LAW: EPA will ensure full compliance with laws intended to protect human health and the environment.

EFFECTIVE MANAGEMENT: EPA will establish a management infrastructure that will set and implement the highest quality standards for effective internal management and fiscal responsibility.

3.4.13.3 Federal Role of the EPA

The United States Environmental Protection Agency (EPA) implements the Federal laws designed to promote public health by protecting our Nation's air, water, and soil from harmful pollution. EPA endeavours to accomplish its mission systematically by proper integration of a variety of research, monitoring, standard-setting, and enforcement activities. As a complement to its other activities, EPA coordinates and supports research and anti-pollution activities of

State and local governments, private and public groups, individuals, and educational institutions. EPA also monitors the operations of other Federal agencies with respect to their impact on the environment.

EPA was created through Reorganization Plan #3 of 1970, which was devised to consolidate the Federal Government's environmental regulatory activities into a single agency. The plan was sent by the President to Congress on July 9, 1970, and the Agency began operation on December 2, 1970.

EPA was formed by bringing together 15 components from 5 executive departments and independent agencies. Air pollution control, solid waste management, radiation control, and the drinking water program were transferred from the Department of Health, Education, and Welfare (now the Department of Health and Human Services). The Federal water pollution control program was taken from the Department of the Interior, as was part of a pesticide research program. From the Department of Agriculture, EPA acquired authority to register pesticides and to regulate their use, and from the Food and Drug Administration inherited the responsibility to set tolerance levels for pesticides in food. EPA was assigned some responsibility for setting environmental radiation protection standards from the Atomic Energy Commission, and absorbed the duties of the Federal Radiation Council.

The enactment of major new environmental laws and important amendments to older laws in the 1970s and 80s greatly expanded EPA's responsibilities. The Agency now administers ten comprehensive environmental protection laws: The Clean Air Act (CAA); the Clean Water Act (CWA); the Safe Drinking Water Act (SDWA); the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or "Superfund"); the Resource Conservation and Recovery Act (RCRA); the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); the Toxic Substances Control Act (TSCA); the Marine Protection, Research, and Sanctuaries Act (MPRSA); Uranium Mill Tailings Radiation Control Act (UMTRCA); and the Pollution Prevention Act (PPA).

3.4.13.4 **National Response Center - EPA**

There is a complex system of responsibilities for these types of emergencies because there are many parts to them. In general, responsibilities are spread across the federal, state and local sectors, depending upon the size and type of the emergency and involve the environmental, emergency management, public safety, and public health agencies of the three levels of government. In addition, industry has a very important role to play in preparing for and responding to such emergencies.

- **Prevention and Preparedness** - In response to the public concern about chemical spills and accidents, EPA created its Chemical Emergency Preparedness Program (CEPP) as a voluntary program to encourage State Emergency Response Commissions (SERCs) and Local Emergency Planning Committees (LEPCs) to identify hazards in their areas and to plan for potential chemical emergencies. This local planning complements emergency response planning carried out at the national and regional levels by the National Response Team and Regional Response Teams.
- **Chemical Spills** - provides information on how EPA works with other partners to respond to Superfund emergencies.
- **Oil spills** - provides information about the U.S. EPA's program for preventing, preparing for, and responding to oil spills that occur in and around inland waters of the United States.
- **Homeland Security** - provides links to information on an infrastructure that has been established to prepare and respond to acts and potential acts of terrorism.
- **The National Response Team** is made up of fifteen federal agencies with responsibilities for preparing for, or responding to, major oil or hazardous chemical emergencies. EPA is the chair with the U.S Coast Guard as vice-chair, and corresponding regional teams are in each of the ten federal regions.
- **Area Contingency Committees** are made up of regional representatives which specifically plan for oil spills.
- **The Federal Response Disaster Group** is made up of over 30 federal agencies with responsibilities for preparing for or responding to major national disasters.
- **The Federal Radiological Preparedness Group** is made up of 17 federal Departments and Agencies. They respond to radiological emergencies under the Federal Radiological Emergency Response Plan (FRERP).

3.4.13.5 National Response Team (NRT)

The National Response Team (NRT) is an inter-agency group that provides guidance prior to an incident and, when requested, technical and financial assistance during an incident. The NRT is co-chaired by EPA and the U.S. Coast Guard. When activated for a response action, the NRT may take several actions:

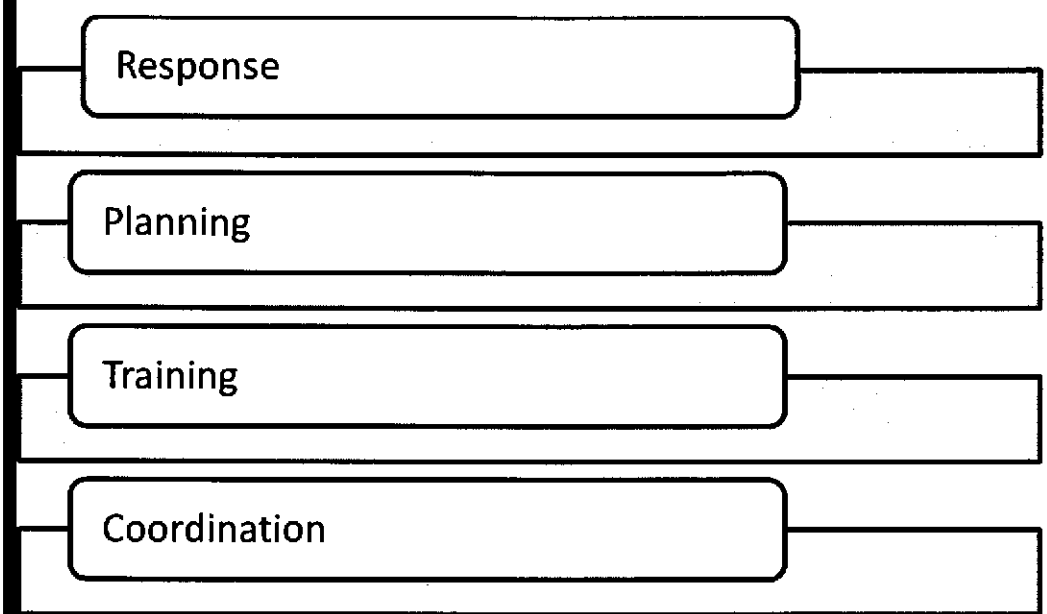
- Monitor and evaluate reports from the OSC and recommend, through the Regional Response Teams specific response actions;
- Request resources from other federal, state, or local governments or private agencies to combat a release, or to monitor response operations; and/or

- Coordinate the supply of equipment, personnel, or technical advice to the affected region from other regions.

Regional Response Teams (RRTs) also are interagency groups that consist of representatives from federal, state, and local governments that conduct pre-response planning and preparedness activities, as well as coordinate and provide advice during response actions. The two principal components of the RRT are below:

- Thirteen standing teams that provide region-wide support on communications, planning, coordination, training, evaluation, and preparedness. The jurisdiction of each standing team corresponds to the ten Federal Regions, with the addition of: (1) Alaska; (2) Puerto Rico and the Virgin Islands; and (3) Hawaii and U.S. trusts or territories in the Pacific.
- Incident-specific teams for which participation depends on the technical nature and location of the incident

There are thirteen Regional Response Teams (RRTs) in the U.S., each representing a particular geographic region (including the Caribbean and the Pacific Basin). RRTs are composed of representatives from field offices of the federal agencies that make up the National Response Team, as well as state representatives. The four major responsibilities of RRTs are:



Response

RRTs provide a forum for federal agency field offices and state agencies to exchange information about their abilities to respond to On-Scene Coordinator's (OSC's) requests for assistance. As with the National Response Team (NRT), RRT members do not respond directly to releases or spills, but may be called upon to provide technical advice, equipment, or manpower to assist with a response.

Planning

Each RRT develops a Regional Contingency Plan to ensure that the roles of federal and state agencies during an actual incident are clear. Following an incident, the RRT reviews the OSC's reports to identify problems with the Region's response to the incident and improves the plan as necessary.

Training

Federal agencies that are members of the RRTs provide simulation exercises of Regional plans to test the abilities of federal, state, and local agencies to coordinate their emergency response activities. Any major problems identified as a result of these exercises may be addressed and changed in the Regional Contingency Plan so the same problems do not arise during an actual incident.

Coordination

The RRTs identify available resources from each federal agency and state within their regions. Such resources include equipment, guidance, training, and technical expertise for dealing with chemical releases or oil spills. When there are too few resources in a region, the RRT can request assistance from federal or state authorities to ensure that sufficient resources will be available during an incident. This coordination by the RRTs assures that resources are used as wisely as possible, and that no Region is lacking what it needs to protect human health and the environment from the effects of a hazardous substance release or oil spill.

3.4.13.6 The National Response System

The National Response System (NRS) routinely and effectively responds to a wide range of oil and hazardous substance releases. It is a multi-layered system of individuals and teams from local, state, and federal agencies, industry, and other organizations that share expertise and resources to ensure that oil spill control and cleanup activities are timely and efficient, and that they minimize threats to human health and the environment.

At the heart of the system is the National Contingency Plan (NCP), which ensures that the resources and expertise of the federal government are available immediately for oil or hazardous substance releases that are beyond the capabilities of local and state responders. The NCP provides the framework for the NRS and establishes how it works.

When releases are serious enough to be considered "Nationally Significant Incidents," the National Response Framework (NRF) is activated, and works in conjunction with the NRS and NCP. The NRF is the federal government's comprehensive, all-hazard approach to crisis management, and provides a mechanism for coordinating federal assistance to state governments and localities.

3.4.13.7 National Oil and Hazardous Substances Pollution Contingency Plan Overview

The National Oil and Hazardous Substances Pollution Contingency Plan, more commonly called the National Contingency Plan or NCP, is the federal government's blueprint for responding to both oil spills and hazardous substance releases. The National Contingency Plan is the result of our country's efforts to develop a national response capability and promote overall coordination among the hierarchy of responders and contingency plans.

The first National Contingency Plan was developed and published in 1968 in response to a massive oil spill from the oil tanker *Torrey Canyon*off the coast of England the year before. More than 37 million gallons of crude oil spilled into the water, causing massive environmental damage. To avoid the problems faced by response officials involved in this incident, U.S. officials developed a coordinated approach to cope with potential spills in U.S. waters. The 1968 plan provided the first comprehensive system of accident reporting, spill containment, and cleanup, and established a response headquarters, a national reaction team, and regional

reaction teams (precursors to the current_National Response Team and Regional Response Teams).

Key Provisions of National Contingency Plan

300.110 Establishes the National Response Team and its roles and responsibilities in the National Response system, including planning and coordinating responses to major discharges of oil or hazardous waste, providing guidance to Regional Response Teams, coordinating a national program of preparedness planning and response, and facilitating research to improve response activities. EPA serves as the lead agency within the National Response Team (NRT).

300.115 Establishes the Regional Response Teams and their roles and responsibilities in the National Response System, including, coordinating preparedness, planning, and response at the regional level. The RRT consists of a standing team made up of representatives of each federal agency that is a member of the NRT, as well as state and local government representatives, and also an incident-specific team made up of members of the standing team that is activated for a response. The RRT also provides oversight and consistency review for area plans within a given region.

300.120 Establishes general responsibilities of federal On-Scene Coordinators.

300.125(a) Requires notification of any discharge or release to the National Response Center through a toll-free telephone number. The National Response Center (NRC) acts as the central clearinghouse for all pollution incident reporting.

300.135(a) Authorizes the predesignated On-Scene Coordinator to direct all federal, state, and private response activities at the site of a discharge.

300.135(d) Establishes the unified command structure for managing responses to discharges through coordinated personnel and resources of the federal government, the state government, and the responsible party.

300.165 Requires the On-Scene Coordinator to submit to the RRT or NRT a report on all removal actions taken at a site.

300.170 Identifies the responsibilities for federal agencies that may be called upon during response planning and implementation to provide assistance in their respective areas of expertise consistent with the agencies' capabilities and authorities.

300.175 Lists the federal agencies that have duties associated with responding to releases.

300.210 Defines the objectives, authority, and scope of Federal Contingency Plans, including the National Contingency Plan (NCP), Regional Contingency Plans (RCPs), and Area Contingency Plans (ACPs).

Oil Removals

300.317 Establishes national priorities for responding to a release.

300.320 Establishes the general pattern of response to be executed by the On-Scene Coordinator (OSC), including determination of threat, classification of the size and type of the release, notification of the RRT and the NRC, and supervision of thorough removal actions.

300.322 Authorizes the OSC to determine whether a release poses a substantial threat to the public health or welfare of the United States based on several factors, including the size and character of the discharge and its proximity to human populations and sensitive environments. In such cases, the OSC is authorized to direct all federal, state, or private response and recovery actions. The OSC may enlist the support of other federal agencies or special teams.

300.323 Provides special consideration to discharges which have been classified as a spill of national significance. In such cases, senior federal officials direct nationally-coordinated response efforts.

300.324 Requires the OSC to notify the National Strike Force Coordination Center (NSFCC) in the event of a worst case discharges, defined as the largest foreseeable discharge in adverse weather conditions. The NSFCC coordinates the acquisition of needed response personnel and equipment. The OSC also must require implementation of the worst case portion of the tank vessel and Facility Response Plans and the Area Contingency Plan.

3.4.13.8 Modeling for EPA's Risk Management Program

Introduction

Releases of toxic substances to the atmosphere are an unfortunate reality of an industrial society. The discharge of toxic material may occur either as a routine release or an accidental release. The consequences of toxic chemical releases can range from a simple nuisance to a virtual destruction of land, bodies of water or human injury and death.

In the United States, toxic releases from industrial sources and accidents have been addressed through various regulations, i.e., Superfund Title III: State Community Right-To-Know and Emergency Planning Laws, and the U.S. Department of Transportation's Hazardous Material Transportation Act. Before 1990 many state agencies developed their own regulations for toxic releases because the federal regulations were not clear on air toxins. However, the Clean Air Act Amendments of 1990 clearly specify the need for the determination of the impact of air toxins.

As a result of new regulations, more than 66,000 chemical process industries across the United States are required to prepare Risk Management Plans (RMP) under 1990 Clean Air Act's Title III, Section 112(r) if they store or use certain hazardous chemicals. Aforementioned rule covers 77 toxic chemicals and 63 flammable chemicals if they are used or stored in amounts in excess of regulated limits. Toxic chemicals include gases,

liquefied gases, liquids and solutions. Flammable chemicals include both gases and liquids.

Many companies have already prepared their plans while others are at different stages of preparation. This section provides helpful hints for the preparation of an RMP (including modeling) for those who have not completed their plans. The industry is required to submit their RMP by June 21, 1999. Noncompliance with the program is expensive and fines can be $10,000 to $25,000 per day, with up to a year in jail for each day of noncompliance or falsification.

Risk Management Program

The final RMP promulgation (U.S. EPA, 1996) is in accordance with the rule, which requires the development of a risk management program for industries that store or use chemicals on the list that includes the following elements:

- Hazard assessment
- Prevention program

- Environmental emergency-response program
- Overall management system

Any facility that is required to submit an annual Toxics Release Inventory (TRI) Form R to the U.S. Environmental Protection Agency (EPA), or is subject to the U.S. Occupational Safety and Health Administration's (OSHA) Process Safety Management regulations, is likely to be regulated under the RMP rule. However, the amount of specific chemicals that could be involved in a possible catastrophe at the facility will determine the applicability of RMP rule. A threshold quantity (TQ) is specified for each regulated substance. The TQ varies between 500 lbs to 20,000 lbs for toxic chemicals; the TQ is 10000 lbs for all flammables.

Facilities subject to their regulations must assess all potential hazards and failure modes, analyze worst-case scenarios of potential chemical release, determine one other most probable release, perform off-site consequence analysis, prepare emergency-response plans, and coordinate them with the Local Emergency Response Planning Committees.

The facilities subject to these regulations are divided into three program areas under the RMP rule:

- Program 1 applies to "extremely safe facilities".
- Program 2 covers the facilities that are subject to threshold quantities that trigger OSHA or EPA planning requirements, but do not meet the specific requirements of Program 1 or Program 3.
- Program 3 applies to facilities in specific industries that do not meet the requirements of Program 1, but are subject to OSHA's PSM requirements (see 29CFR 1910.119)

Program 1 requires all facilities to evaluate the worst-case scenario, and one other most-probable incident for each regulated chemical stored or used onsite. The risk management plan must include the facility's five-year accident history and must demonstrate formalized coordination with any projected emergency response with the Local Emergency Planning Committee. In addition to Program 1 requirements, Program 2 calls for a hazard assessment. The requirements for this assessment are not as comprehensive as Program 3 requirements. Program 3 additionally requires a management structure to oversee the development, implementation and integration of the risk management program elements and a hazard assessment.

An organized approach is required for the development of the RMP. Typical steps are:

- Determination of applicability
- Setting goals and priorities
- Examination of ways to opt out of the program

- Determination of applicability of Program 1, 2, or 3
- Preparation of the plan elements
- Implementation of the plan

Consequence Analyses

The key element of a plan is to determine the impact of a release. Atmospheric dispersion modeling of chemical releases, vapor cloud fires and explosions are important components in evaluating risks from released hazardous chemicals during the preparation of an RMP. Hanna and Drivas (1996) prepared guidelines for use of vapor cloud dispersion models in 1987 and revised it in 1996. The American Institute of Chemical Engineers prepared a workbook of test cases for vapor cloud source dispersion models (Hanna and Strimaitis, 1989).

The Environmental Protection Agency prepared a workbook of screening techniques for assessing impacts of 18 different types of air toxic release scenarios (U.S. EPA, 1988). The EPA released a computer program TSCREEN, based on the above workbook, in 1990. EPA revised the workbook in 1992 (U.S. EPA, 1992a). Kumar and Rao (1990) give a list of the programs available for managing chemical hazards. Latest guidance on the application of refined models for air toxic releases was published in 1993 (U.S. EPA, 1993). A summary of the guidance on dispersion models for toxic releases is given in Table 1. A comprehensive discussion on vapor cloud fires and explosion is given in "Guidelines for Evaluating the Characteristics of Vapor Cloud Explosions, Flash Fires, and BLEVEs" (AIChE, 1994).

Table 1

- Guidance Models for Air Toxic Releases
- Type of Modeling
- Models
- Screening Technique
- Refined Technique - Non-dense Gas
- Refined Technique - Dense Gas
- TSCREEN
- EPA Air Quality (U.S. EPA, 1986)
- Guideline Models
- ADAM, ALOHA, DEGADIS, HEGADAS and SLAB

During the last 15 years, consulting companies, research organizations and other government agencies have developed a number of computer programs. Preparation of an RMP requires information on

emission rates for worst-case scenarios and one other most probable release. The computer program ERate 1.1.1 described in the book by Kumar and Vashisth (1999) will help you determine release rates for different accident scenarios. Once the information on release rates is available, you will need an air quality model or "look-up tables" provided by EPA to perform offsite consequence analysis. Look-up tables are useful for companies without air modeling capabilities. The results for air contaminant concentrations obtained using these tables are conservative and should be used with caution.

Computer Models

In order to assist the reader in selecting a model for atmospheric dispersion, a brief description on five screening models: TSCREEN, ARCHIE, ALOHA/CAMEO, DEGADIS, and RMP*Comp which are widely used in the United States, is included. The choice of these models in this discussion is not an indication that other models cannot be used. The selection and application of a model really depends on the release scenario. The sources and the cost of obtaining each model are given in Table 2.

Table 2

- Source and Cost of the Screening Models
- Model
- Source
- Telephone No./ e-mail
- Cost
- ARCHIE
- CAMEO suite
- ALOHA
- TSCREEN
- DEGADIS
- RMP*Comp

TSCREEN Model

The model is an easy to use computer program. It was developed by Pacific Environmental Services, Inc. to model emissions of toxic chemicals and their subsequent dispersion (concentration as a function of distance) from one of many different types of possible releases. The EPA models SCREEN, RVD and PUFF are grouped in the TSCREEN model and they are used to model the various scenarios according to the situation.

TSCREEN is programmed to automatically:

- Select a particular release scenario from the entered input values,

- Select and execute the appropriate atmospheric dispersion model, and
- Select the worst case meteorological conditions based on criteria given in the workbook (U.S. EPA, 1988).

TSCREEN is an IBM PC-based software application written and compiled in Microsoft Basic Version 7.0 and Microsoft C version 5.1. The program requires 500 kilobytes of free random access memory (RAM). The TSCREEN program files occupy about 1 MB of disk space. The hard disk space needed will increase as scenario files are created. To install TSCREEN on hard disk systems make sure there is at least 1 MB of free disk space available to load and execute the program. A well-written user's guide is available from the EPA (U.S. EPA, 1994).

ARCHIE Model

The Automated Resource for Chemical Hazard Incident Evaluation (ARCHIE) model is designed for evaluating potential consequences of hazardous materials accidents by local emergency planning committees and industry. The program was developed by U.S. Department of Transportation in association with Federal Emergency Management Association (FEMA) and U.S. EPA. The program requires detailed input such as quantities of chemical released and physical conditions of releases. The ARCHIE program should be used in conjunction with the brown book (Anonymous, 1989). ARCHIE can be used to develop a variety of scenarios for incidents involving toxic, flammable and explosive hazards. The model uses a Gaussian equation for air dispersion calculation.

The program uses 717 Kb of disk space. It takes about 10-15 minutes to run the program including time required to respond to all the questions for a typical problem on an IBM compatible personal computer. The model is very user friendly.

ALOHA/CAMEO Model

The National Oceanic and Atmospheric Administration (NOAA) and the EPA developed the current version of the program with distribution and technical support provided by the National Safety Council. The Aerial Locations of Hazardous Atmospheres (ALOHA) model is the light-gas dispersion model and DEGADIS is the heavy gas model used in conjunction with CAMEO. ALOHA and DEGADIS estimate airborne pollutant concentrations downwind from a spill. The complete CAMEO system is designed for emergency planning and life-saving responses to chemical accidents.

ALOHA package is available in Apple Macintosh and IBM PC versions. ALOHA consists of multiple, integrated databases and programs and is completely menu driven. The chemical database, the mapping module and other emergency planning tools are accessible from the main menu screen. The latest version of ALOHA permits sophisticated modeling by estimating the area of the cloud and concentration overtime, given various environmental conditions. ALOHA's new modeling capabilities include: complex

source routines for tanks, puddles, pipes, gas dispersion and indoor air filtration calculations. Therefore, the model could be used for refined modeling. A user's guide is available and is quite explanatory.

ALOHA runs on Apple Macintosh with five megabyte of random access memory (RAM) and 20 MB free hard disk space. It will run much faster on a Macintosh with a math co-processor chip. It requires at least two megabytes of hard disk space available to load ALOHA. ALOHA will also work on computers that do not have the math co-processor chip.

ALOHA will run on PC compatibles with Windows 3.1 or Windows 95. A minimum of 8 MB RAM and 30 MB free hard disk space is required.

DEGADIS Model

The DEGADIS (Dense Gas Dispersion) was developed for the U.S. Coast Guard and the Gas Research Institute. It simulates the three phases of low initial momentum release of heavy gases: (1) the negative buoyancy-dominated dispersion phase, (2) the stratified shear flow phase and (3) the passive dispersion phase. The model is publicly available from EPA's web site. More user-friendly versions of the model can be purchased from consulting companies.

RMP*Comp

The RMP*Comp program performs offsite consequence analysis recommended by EPA under the RMP rule. This program was developed by NOAA and EPA. The 1999 version of the program handles vapor cloud fires for flammable gases liquefied under pressure. The generic distance-tables from Offsite Consequence Analysis Guidance are used for most chemicals to determine toxic endpoints. Separate tables are given for ammonia, chlorine and sulfur dioxide. No interpolation is performed from the distance-tables. Instructions for downloading, installing, and running the program are available from NOAA web site.

ENDPOINTS

Atmospheric dispersion modeling discussed above is used to determine the distance to the endpoint for each toxic chemical released from a source. Endpoint concentrations are given in Appendix A to 40 CFR 68. These concentrations are less than the corresponding health indicators given by OSHA, NIOSH or ACGIH.

The endpoint for flammable compounds is defined as the point where the pressure will be equal to 1 psi as a result of explosion. Minor building damages are a result of this level of pressure.

3.4.13.9 Environmental Monitoring and Assessment Program (EMAP) and Environmental Risk Assessment

The Environmental Monitoring and Assessment Program (EMAP) was a research program run by EPA's Office of Research and Development to develop the tools necessary to monitor and assess the status and trends of national ecological resources. EMAP collected field data from 1990 to 2006. EMAP's goal was to develop the scientific understanding for translating environmental monitoring data from multiple spatial and temporal scales into assessments of current ecological condition and forecasts of future risks to our natural resources.

EMAP aimed to advance the science of ecological monitoring and ecological risk assessment, guide national monitoring with improved scientific understanding of ecosystem integrity and dynamics, and demonstrate multi-agency monitoring through large regional projects. EMAP developed indicators to monitor the condition of ecological resources. EMAP also investigated designs that addressed the acquisition, aggregation, and analysis of multiscale and multitier data.

Data & Metadata Files

- Surface Waters
- Estuaries
- Landscape Ecology
- Great Lakes
- Wetlands
- Agroecosystems

Background Information

- Surface Waters
- Estuaries
- Landscape Characterization
- Great Lakes
- Wetlands
- Agroecosystems
- Forests
- Rangelands

3.4.13.10 National Risk Management Research Laboratory (NRMRL)

As EPA's premiere laboratory for risk management research, NRMRL focuses on environmental problem-solving. Recognized as a national leader in scientific and engineering expertise and capability, NRMRL's research portfolio spans the five goals outlined in EPA's Strategic Plan, and directly supports efforts to reduce greenhouse gas emissions, improve air quality, manage chemical risks, clean up hazardous waste sites, and protect America's water. Environmental risk management seeks to determine what environmental risks exist and how to manage those risk in a way best suited to protect human health and the environment. Their mission is to advance scientific and engineering solutions to manage current and future environmental risk.

Research Projects Managed by NRMRL

EPA Strategic Goal 1: Taking Action on Climate Change and Improving Air Quality

- Air Quality Management
- Green Buildings and Indoor Contaminants/Asthma
- Mercury and other Persistent Pollutants
- Source Based Strategies, including Near Roadway Research
- Climate Change Adaptation and Mitigation
- Risk Management Air Research

EPA Strategic Goal 2: Protecting America's Waters

- Aging Drinking Water Infrastructure
- Aging Wastewater Infrastructure
- Distribution Systems Water Quality
- Drinking Water Treatment Technologies
- Nonpoint Source Characterization and Control
- Source Water Protection
- Watershed Management
- Risk Management Water Research

EPA Strategic Goal 3: Cleaning Up Communities and Advancing Sustainable Development

- Material Management, Waste to Energy, and Resource Conservation of Land Wastes
- Mitigation, Management and Long-Term Stewardship of Superfund Contaminated Sites and Wastes
- Ecosystems: Place-based Valuation and Decision Support Studies
- Development and Evaluation of P2 Tools
- Environmental Systems Management / Sustainable Metrics Development
- Environmental Technology Assessment and Verification
- Environmental Technology Verification
- Risk Management Ecosystem Research
- Risk Management Land Research
- Risk Management Sustainable Technologies Research

EPA Strategic Goal 4: Ensuring the Safety of Chemicals and Preventing Pollution

- Homeland Security
- Nanotechnology
- Safe Pesticides/Safe Products and Endocrine Disrupting Chemicals

Organizations

National Risk Management Research Laboratory

NRMRL includes:

- Air Pollution Prevention and Control Division (APPCD)
- Ground Water and Ecosystems Restoration Division (GWERD)
- Land Remediation and Pollution Control Division
- Sustainable Technology Division
- Water Supply and Water Resources Division (WSWRD)
- Environmental Technology Assessment, Verification, and Outcomes Office (ETAV)

Air Pollution Prevention and Control Division (APPCD)

- APPCD is responsible for research, development, and evaluation of air pollution control technologies. APPCD conducts research, and develops and demonstrates air pollution prevention and control technologies for key industries, electric power plants, incinerators, indoor environments, and sources of greenhouse gases.

Ground Water and Ecosystems Restoration Division (GWERD)

- GWERD conducts research and engages in technical assistance and technology transfer on the chemical, physical, and biological structure and processes of the subsurface environment, the biogeochemical interactions in that environment, and alterations to other environmental media.

Land Remediation and Pollution Control Division (LRPCD)

- LRPCD conducts research at the basic level, as well as bench- and pilot-scale levels, to explore innovative solutions to current and future land pollution problems.

Sustainable Technology Division (STD)

- STD advances the scientific understanding, development, and application of technologies and methods for prevention, removal, and control of environmental risks to human health and ecology.

Water Supply and Water Resources Division (WSWRD)

- WSWRD research supports EPA's systematic evaluations of the primary and secondary regulations for drinking water and pollution control programs for water quality by developing innovative approaches to manage water contaminants that pose a threat to human health and the environment.

Environmental Technology Assessment, Verification, and Outcomes Office (ETAV)

- ETAV serves as a focal point for EPA state-of-the science technology assessment and verification. ETAV coordinates EPA and others in the private sector to develop, test, and implement technologies to protect the environment and human health.

3.4.13.11 EPA - Spills

EPA seeks to prevent, prepare for, and respond to oil spills that occur in and around inland waters of the United States. EPA is the lead federal response agency for oil spills occurring in inland waters, and the U.S. Coast Guard is the lead response agency for spills in coastal waters and deepwater ports. To learn more about our oil pollution activities, please visit the following links:

- Facility Response Plan (FRP) Rule - Certain facilities that store and use oil must submit plans to respond to a worst-case discharge of oil and to a substantial threat of such a discharge. Information about preparing and submitting an FRP can be found on this page.
- National Contingency Plan (NCP) Subpart J - Product Schedule - Provides for a schedule of spill mitigating devices and substances that may be authorized for use on oil discharges. Information on this page includes the Product Schedule, information on how to list a product, and the complete NCP Subpart J rule.
- Reporting Requirements – Oil Spills and Hazardous Substance Releases - Regulated facilities must report discharges of oil or releases of hazardous substances to EPA and/or other federal, state, and local government agencies. Information about reporting requirements.
- Spill Prevention, Control, and Countermeasure (SPCC) Rule - Certain facilities must prepare, amend, and implement SPCC Plans to address the potential for a discharge of oil. Information on this page includes links to select portions of the SPCC rule, recent amendments to the rule, and SPCC Guidance for Regional Inspectors.

3.4.13.12 EPA - Emergency Management Programs

EPA programs help ensure that facilities and organizations take steps to prevent oil spills, chemical accidents, and other emergencies, implement planning and preparedness requirements, and respond to environmental emergencies.

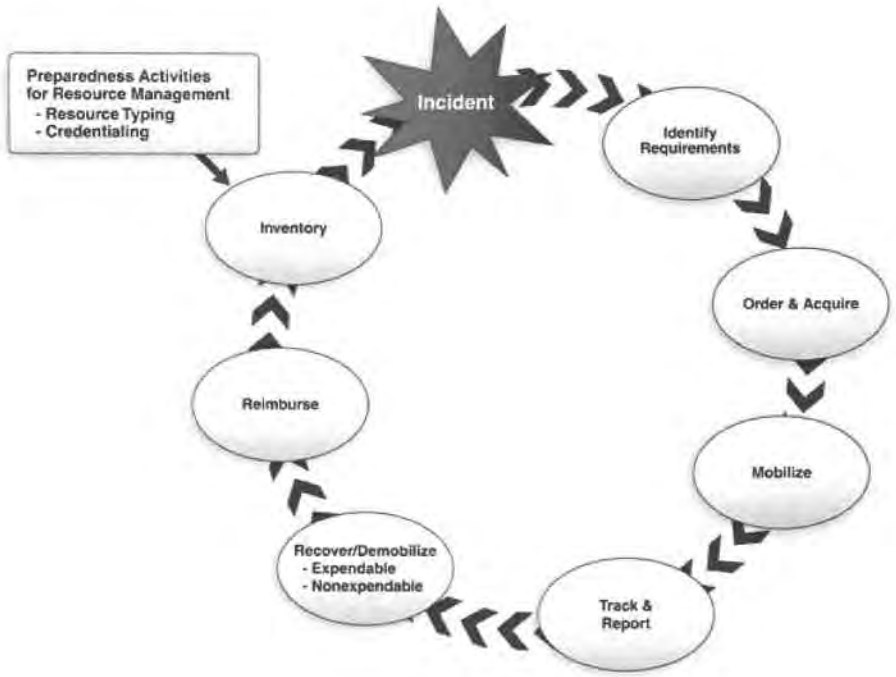
- Environmental Response Laboratory Network (ERLN) - EPA's National Network of laboratories that can be accessed as needed to support large scale environmental responses.
- Emergency Planning and Community Right-to-Know Act (EPCRA) Requirements - These requirements help communities prepare for and respond to chemical accidents by requiring facilities to report chemical storage and release information and communities to develop emergency response plans.
- Emergency Response and Cleanup Actions - EPA coordinates and implements a wide range of activities to ensure that adequate and timely response measures are taken in communities affected by hazardous substances and oil releases.

3.4.14 Federal Emergency Management Agency (FEMA)

The Federal Emergency Management Agency coordinates the federal government's role in preparing for, preventing, mitigating the effects of, responding to, and recovering from all domestic disasters, whether natural or man-made, including acts of terror.

Resource Management Overview

Emergency management and incident response activities require carefully managed resources (personnel, teams, facilities, equipment and/or supplies) to meet incident needs. Utilization of the standardized resource management concepts such as typing, inventorying, organizing and tracking will facilitate the dispatch, deployment and recovery of resources before, during and after an incident. Resource management should be flexible and scalable in order to support any incident and be adaptable to changes. Efficient and effective deployment of resources requires that resource management concepts and principles be used in all phases of emergency management and incident response. The resource management process can be separated into two parts: resource management as an element of preparedness and resource management during an incident. The preparedness activities (resource typing, credentialing and inventorying) are conducted on a continual basis to help ensure that resources are ready to be mobilized when called to an incident. Resource management during an incident is a finite process, as shown in the below figure, with a distinct beginning and ending specific to the needs of the particular incident.



Credentialing

The credentialing process entails the objective evaluation and documentation of an individual's current certification, license or degree; training and experience and competence or proficiency to meet nationally accepted standards, provide particular services and/or functions or perform specific tasks under specific conditions during an incident.

Stakeholders

Job Titles:

- Animal Health Emergency
- Emergency Medical Services
- Fire and Hazardous Materials
- Incident Management (IM)

- Law Enforcement
- Mass Care
- Medical and Public Health
- Public Works (PW)
- Search and Rescue (SAR)

Resource Typing

Resource typing is categorizing, by capability, the resources requested, deployed and used in incidents. Measurable standards identifying resource capabilities and performance levels serve as the basis for categories. Resource users at all levels use these standards to identify and inventory resources. Resource kinds may be divided into subcategories to define more precisely the capabilities needed to meet specific requirements.

Tier 1 Resource Typing Definitions:

- Animal Health Emergency
- Emergency Medical Services
- Fire and Hazardous Materials
- Incident Management (IM)
- Law Enforcement
- Mass Care
- Medical and Public Health
- Public Works (PW)
- Search and Rescue (SAR)

Summary of Requirements

NEPA directs federal agencies to thoroughly assess the environmental consequences of "major federal actions significantly affecting the environment." Before FEMA can fund or implement an action that may affect the environment, agency decision-makers must study the potential impacts that the proposed action and alternatives will have on the human and natural environment, and make that information available to the public. Because different actions may not have similar, significant effects on the environment, there are differing levels of review under NEPA:

- Statutory Exclusions
- Categorical Exclusions
- Environmental Assessment

- Environmental Impact Statement

Environmental Assessments

Environmental Assessments (EAs) and associated documents are generated to fulfill the requirements of the NEPA. EAs are used to determine if significant environmental impacts would occur as a result of a FEMA action or a FEMA funded action.

An EA is a concise public document that serves to provide:

- Sufficient evidence and analysis regarding the significance of environmental impacts of the proposed action
- Alternatives to that proposal to aid in decision-making when there is an unresolved conflict in the use of resources.

3.5 Environmental Emergency Management and Response: State Level Best Practice - Missouri - U.S.

Missouri was chosen for the best practice example for environmental emergency management at the state level in the United States. The following section is information from Missouri's State's Environmental Emergency Response Department. Missouri's Environmental Emergency Response Section is the state's front line of defence against significant and imminent hazardous substance releases, natural or man-made disasters, or homeland security threats that impact public safety and the environment. Responsibilities include responding to address any chemical, petroleum, or other material spilled on to the land, water, or atmosphere that may impact the public health and safety and the environment. Duty officers monitor the statutorily-mandated Spill Reporting Hotline 24 hours a day, seven days a week, 365 days a year, on a rotating basis. During normal business hours, duty officers staff the Incident Command Center located at the Environmental Services Program in Jefferson City. In addition to the duty officers, staff are stationed at six different locations throughout Missouri. State On-Scene Coordinators conduct operations out of these locations and are dispatched via the 24-hour Spill Reporting Hotline by a duty officer in Jefferson City. Environmental Emergency Response staff includes hazardous material technicians in Jefferson City, St. Louis, Poplar Bluff, Kansas City, Macon and Springfield who respond when an environmental emergency occurs. On average, the Environmental Emergency Response section receives more than 1,500 incident calls and responds to nearly 450 hazardous substance emergencies each year.

- 2,570 incidents (including methamphetamine incidents) were reported through the 24- hour Spill Reporting Hotline.
- Responded to 366 incidents, not including methamphetamine lab incidents.
- Provided disaster response to the St. Louis tornado, Joplin tornado, Sedalia tornado, Southeast Missouri flooding, including the Bird's Point levee detonation, and Northwest Missouri flooding.
- Purchased homeland security equipment to more effectively respond to mercury releases and improve disaster communications.
- Received and responded to 815 requests for technical assistance.
- Participated in 271 outreach events reaching more than 17,300 citizens and responders.
- Continued the no-cost Mercury Collection Removal and Recycling Program for private Missouri citizens, non-profit organizations and limited educational facilities.

Environmental Emergency Response Tracking System

Emergency Response uses a database, the Missouri Environmental Emergency Response Tracking System as a repository for information related to all hazardous substance emergencies and releases. Details of each spill or incident are entered into the system by the officer on duty at the time of the spill. The database information can be queried as far back as December 1993 and is available on the internet in a searchable format.

3.5.1 Missouri Air Quality Assurance and Air Quality Monitoring

The unit is responsible for planning, managing and performing all quality assurance activities in Missouri's ambient air monitoring network. In addition, the unit oversees state required networks operated by private industries.

The data from air instruments may be used:

- To determine whether an area meets the National Ambient Air Quality Standards.
- If the public is being exposed to unhealthy conditions.
- To identify air pollution trends
- To investigate citizen complaints.
- To determine the source of pollution problems.
- To inform people of the current air quality in real time for major metropolitan areas within Missouri.

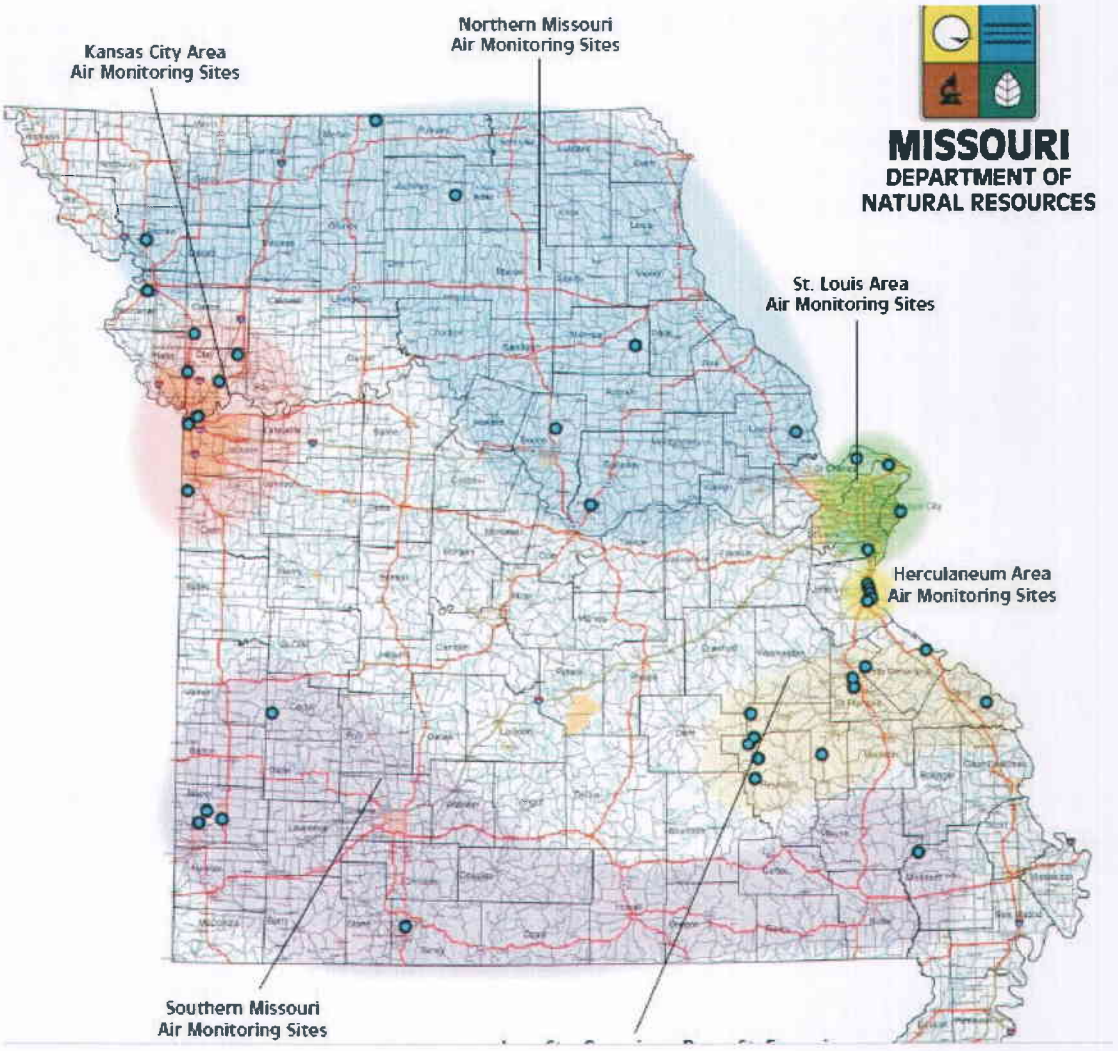


Figure 31 Missouri Air Monitoring Sites

3.5.2 Water Quality

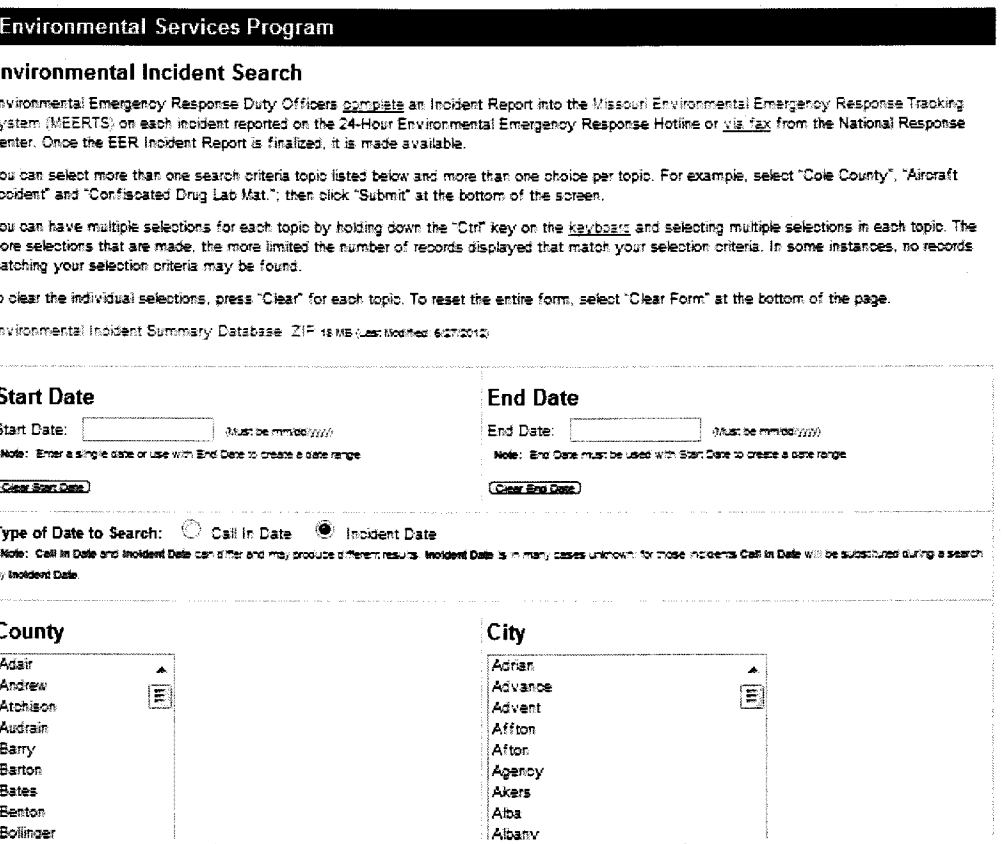
The Water Quality Monitoring Section is responsible for assessing the biological health of Missouri's rivers and streams, and monitoring water and sediment quality throughout the state.

3.5.3 Missouri Environmental Emergency Response Tracking System

Figure 32 Missouri Environmental Emergency Response System

Under the Missouri Spill Bill (260.500 - 260.550 RSMo) responsible parties/spillers are required to report releases of hazardous substances to the department's 24-hour Environmental Emergency Response Hotline, 573-634-2436, or to the National Response Center, 800-424-8802. Environmental Emergency Response duty officers, maintaining the 24-hour hotline, provide technical assistance regarding the chemical and necessary cleanup actions, work with the responsible party/spiller to ensure that proper cleanup is completed and impact to the public health and environment is minimized, conduct notifications to various agencies, and determine if an on-site response is needed by program staff. Duty officers complete an Environmental Emergency Response Incident Report using the Missouri Environmental Emergency Response Tracking System database as a repository for information related to all hazardous substance emergencies and releases reported on the 24-hour hotline or to the National Response Center. Once the Incident Report is finalized, it is made available. Information in the database can be queried as far back as December 1993 and is available on the Web in a searchable format at Missouri Environmental Emergency Response Search.

The Environmental Emergency Response Section provides a weekly report that summarizes the reported incidents for a given week. These reports are distributed via email upon finalization.



Environmental Services Program

Environmental Incident Search

Environmental Emergency Response Duty Officers complete an Incident Report into the Missouri Environmental Emergency Response Tracking System (MEERTS) on each incident reported on the 24-Hour Environmental Emergency Response Hotline or via fax from the National Response Center. Once the EER Incident Report is finalized, it is made available.

You can select more than one search criteria topic listed below and more than one choice per topic. For example, select "Cole County", "Aircraft Accident" and "Confiscated Drug Lab Mat."; then click "Submit" at the bottom of the screen.

You can have multiple selections for each topic by holding down the "Ctrl" key on the keyboard and selecting multiple selections in each topic. The more selections that are made, the more limited the number of records displayed that match your selection criteria. In some instances, no records matching your selection criteria may be found.

To clear the individual selections, press "Clear" for each topic. To reset the entire form, select "Clear Form" at the bottom of the page.

Environmental Incident Summary Database .ZIP 18 MB (Last Modified: 6/27/2012)

Start Date

Start Date: (Must be mm/dd/yyyy)

Note: Enter a single date or use with End Date to create a date range

Clear Start Date

End Date

End Date: (Must be mm/dd/yyyy)

Note: End Date must be used with Start Date to create a date range

Clear End Date

Type of Date to Search: Call In Date Incident Date

Note: Call In Date and Incident Date can differ and may produce different results. Incident Date is in many cases unknown; for those incidents Call In Date will be substituted during a search by Incident Date.

County

Adair
Andrew
Atchison
Audrain
Barry
Barton
Bates
Benton
Bollinger

City

Adrian
Advance
Advent
Affton
Afton
Agency
Akers
Alba
Albany

Figure 33 Missouri - Environmental Incident Form - Online

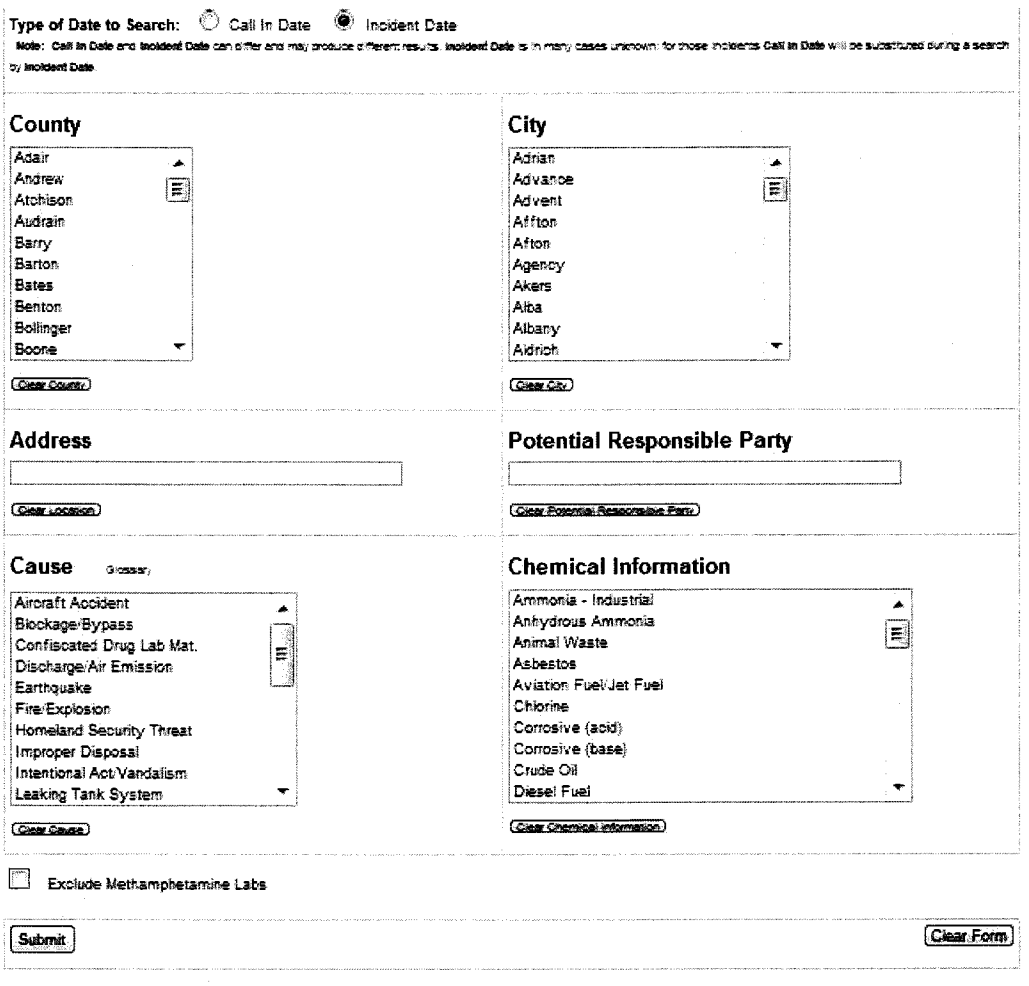


Figure 34 Missouri - Environmental Incident Form - Online

Environmental Services Program
Environmental Emergency Response Unit
Incident Report Summary from 07/01/04 to 06/30/05

Regional Office	SLRO	KCRO	SWRO	JCRO	SERO	NERO	Out of State	Totals
Total Incidents	435	436	325	0	289	285	0	1685
Materials Involved:								
Ag Chem	6	15	7		11	12	0	56
Other	196	143	156		85	133	1	712
PCB	2	1	1		0	2	0	6
Petroleum	210	224	149		107	132	2	824
Radiation	1	2	2		1	1	0	7
Sewage	28	50	19		14	14	0	126
Locations:								
Fixed Facility	261	253	212	0	127	185	0	1042
Transportation								
Motor Vehicle	83	71	72	0	53	45	0	324
Railroad	19	28	8	0	5	8	0	78
Pipeline	4	34	1	0	5	14	0	58
Water/Waterway	44	14	19	0	7	13	0	97
Aircraft	1	4	1	0	4	1	0	11
							Total Transportation:	568
Incident Cause:								
Abandoned Containers	39	7	14		4	11	0	75
Accident	94	97	92		58	74	0	415
Act Of God	5	27	3		1	1	0	38
Equipment Failure	57	73	26		18	34	2	210
Intentional Discharge	93	78	97		57	69	0	404
Leaking Tank	17	44	53		25	25	0	164
Operator Error	24	32	17		14	15	1	103
Other/Unknown	70	68	46		33	56	0	273
							Total Incidents:	1685
Fish Kill:	7	1	6	0	1	2	0	15
DNR On Scene Response:								
Immediate On-Scene								
EER - ESP Staff	3	4	11		7	30	*****	55
EER - Regional Staff	32	39	34		23	13	*****	141
Other Regional Staff	8	1	10		2	2	*****	23
Non-Immediate On-Scene								
EER - ESP Staff	4	7	3		2	12	*****	46
EER - Regional Staff	67	19	25		16	11	*****	136
Other Regional Staff	23	31	37		19	38	*****	153

Figure 35 Missouri - Environmental Incident Form - Online

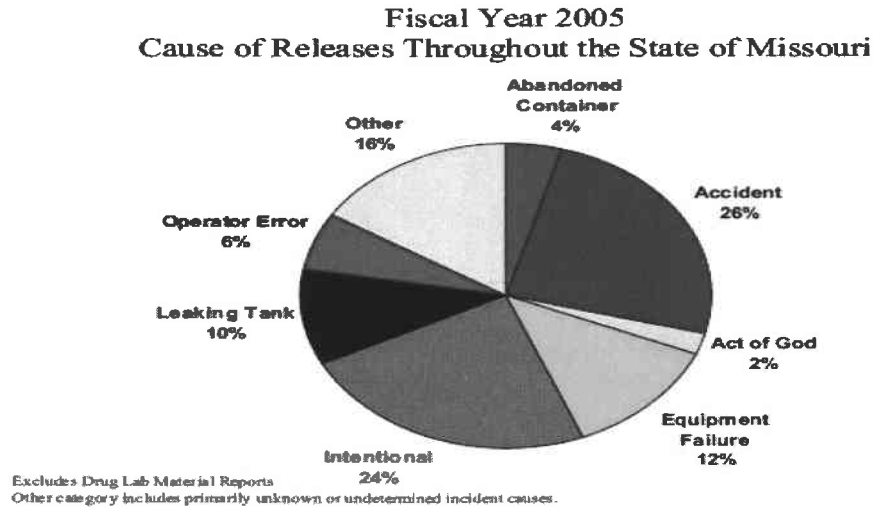


Figure 36 Missouri - Environmental Incidents

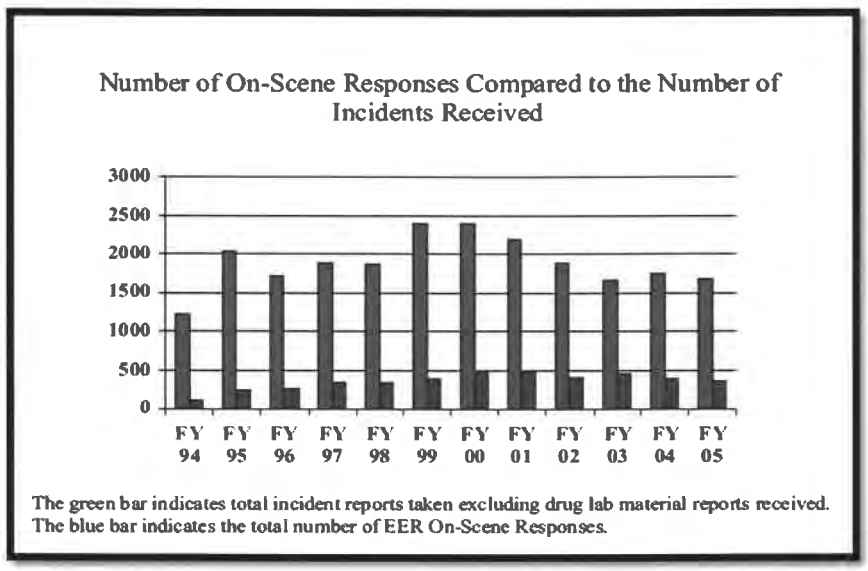


Figure 37 Missouri - Environmental Incidents

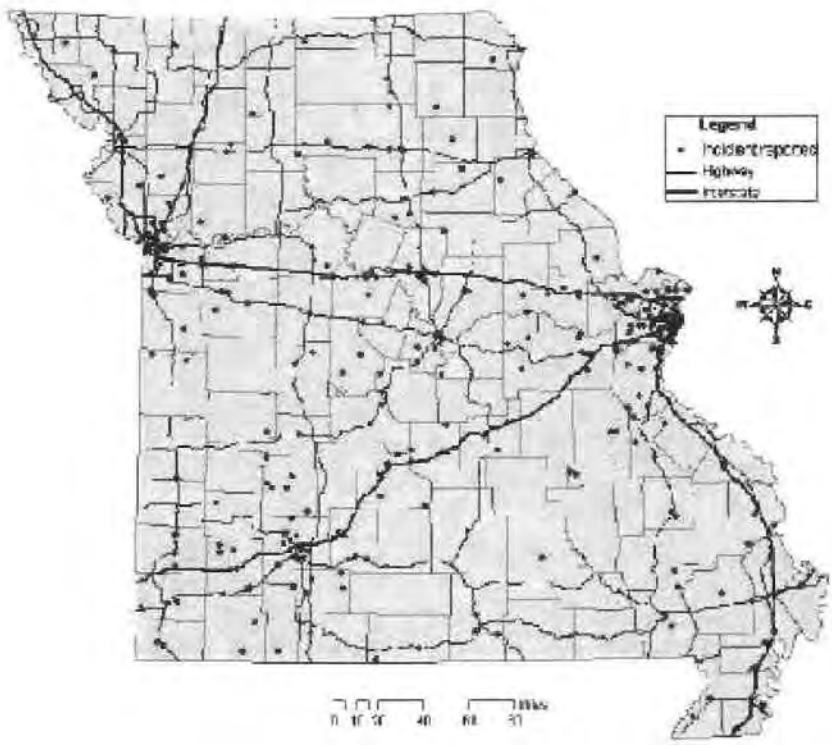


Figure 38 Missouri - Environmental Incidents

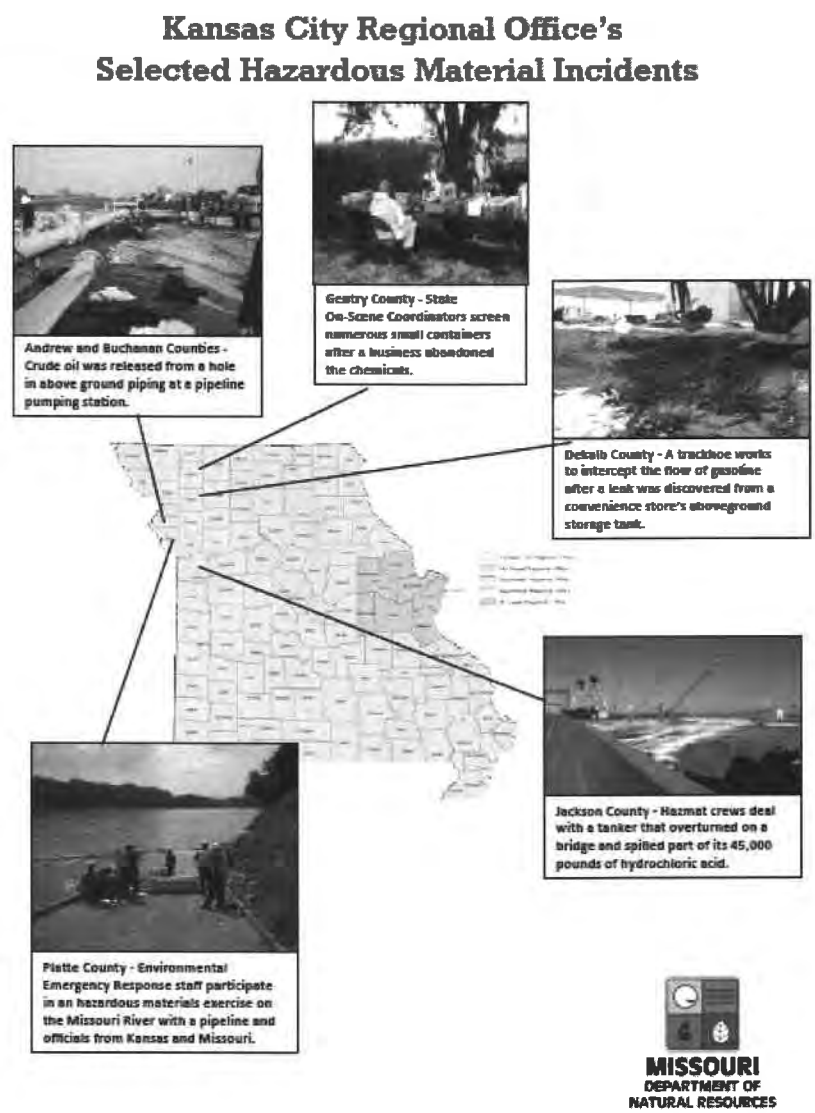


Figure 39 Missouri - Environmental Incidents

3.5.4 Environmental Emergency Response Field Services Unit

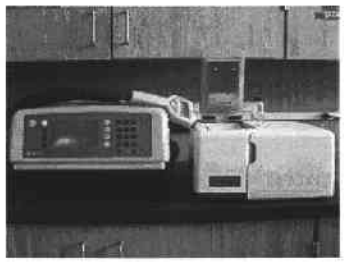
The Environmental Emergency Response/Field Services Section includes the Field Services Unit, which, in addition to performing emergency response duties, provides field support services for

client programs within the department and other state agencies. Staff are part of the Environmental Emergency Response section and help provide field sampling support as needed on emergency response incidents that occur throughout the state. Consequently, staff are not only sampling experts, but are cross-trained as Environmental Emergency Response Duty Officers and On-scene Coordinators for the department.

Field Service Unit staff provide field support to the department's Hazardous Waste Program. Unit personnel have the training, experience and equipment to conduct field investigations that involve collection and analysis of various environmental media and potential hazardous wastes at Superfund sites, Resource Conservation and Recovery Act-regulated facilities, leaking underground storage tank sites, and emergency response incidents. The unit provides clients with technical document reviews, environmental assessment services, equipment, and extensive field sampling support services at a variety of abandoned hazardous waste sites, regulated facilities, and petroleum tank sites. Personnel are proficient with several pieces of specialized in-house equipment used to collect high quality soil, water, and air samples for analysis. The department's in-house laboratory analyzes a majority of samples collected to provide managers the information necessary to make decisions and assess risks posed by individual sites.

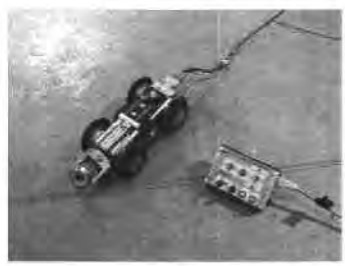
Examples of in-house equipment available for use at investigations include:

Ground Penetrating Radar



Field gas chromatography/ mass spectroscopy (Hapsite®)

Hydraulic soil probe



Robotic camera system

Infrared spectrophotometer
Sensir HazMat ID

Flashpoint tester

Thermal Imaging Camera

Various qualitative air monitoring instruments

Water quality instruments

Various pumps for water sampling

4 Technical Plan

1.1 General Structure

1.1.1 Overview

The Feasibility Study for the Shandong Environmental Emergency Response System Project focus is to recommend a solution and technical plan to monitor the environmental quality and the environmental pollution situation, track environmental trends, and provide a response and management solution based on SDEPA's organization structure and environmental safety and emergency response requirements in Shandong province at the following three levels.

- The Shandong Environmental Safety and Emergency Management Department of the provincial Shandong Environmental Protection Bureau (SDEPA) is the leading authority in Shandong of environmental real-time emergency safety monitoring and the provincial environmental emergency commanding center.
- There are 17 districts which have an environmental safety and environmental emergency responding center at the municipal level. These directly report to the provincial bureau SDEPA.
- The county-level (lower than city level) environmental safety and emergency responding centers will directly report to the municipal level offices.

  Note: The Industrial Enterprise Environmental Safety Prevention and Monitoring System support the system structure of the three tiers. This system is the key element of Environmental Safety Prevention and Monitoring which supports the systematic management of the three tiers.

Figure 40 Shandong Application Tiers

1.2 Technical Structure

1.2.1 Conceptual Model Schema

The three tiers systematic structure is a generic structured solution as a framework that can sense the internal and external situation organically. Each small component can solve the internal/local problems. When it comes to the big issue or external threat, the system will manage all of its child components, as a highly trained organism, integrated to avoid any external threats and protect the entire organism. The figure below depicts a structure which composes many inter-connected blocks. A block here represents a sub-system at any tier. The grey blocks indicate the sub-systems installed at Tier 4, while the green ones are the Tier3 sub-systems configured at the city/region level. The purple colored blocks denote sub-systems at the Tier 2 level. Sub-systems located at higher tiers have management as well as decision-making features, having access to more information and therefore a wider operational picture. On the contrary, sub-systems at lower tiers focus on task execution. The relationship between sub-systems at different tiers is as 'parent-and-child.'

The operational principles are straightforward:

- Sub-systems at lower-tiers escalate issues that they cannot or should not handle to their associated parent sub-systems
- Instructions coming from the associated parent-sub-system will have higher priority or overriding power over issues at lower tier sub-systems
- Events or instructions associated with a given event shall be traced throughout the interconnected Solution

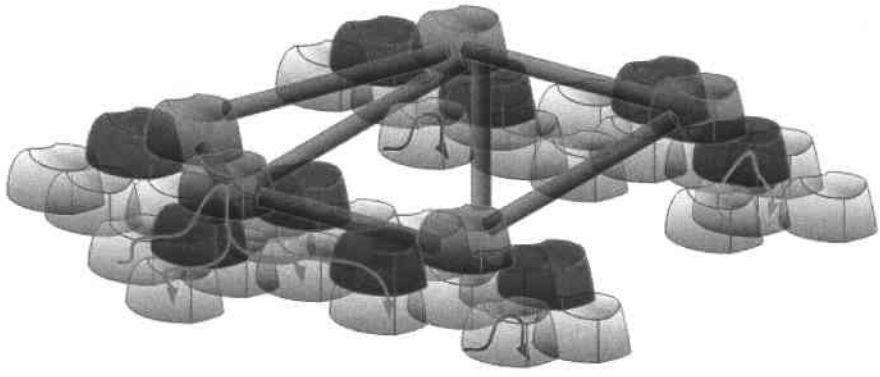


Figure 41 Self-Protected Organism

The Feasibility Study for Shandong Environmental Emergency Response and Management System will be divided into three layers, each is an independent system with a many to one relationship with other layers which can be both a child node to be connected to the higher node and also as a parent node to be connected to the lower node.

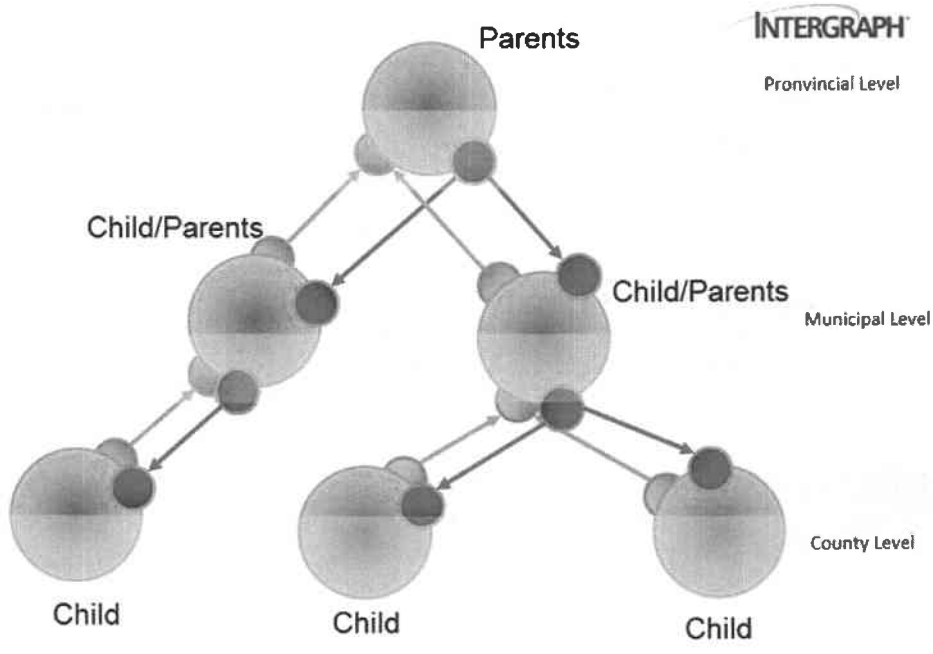


Figure 42 Parent and Child Relationship

1.2.2 Logical Architecture

This program is an integrated platform based on advanced Information technology, network technology, GIS technology, communication technology, and various software and hardware. It is committed to achieve timely detection, prediction and pre-warning, assessment, decision and graded response and disposal of environmental emergencies in Shandong province in order to improve the efficiency of the SDEPA and enhance the management of relevant staff for timely detection, delay, prevent, and deal with the environmental emergencies in the whole province. The core of this platform is "COP - Common Operating Picture". As an information-supported platform, it will integrate the infrastructure and GIS information with communication, alarm, video monitoring, and other application systems and the real-time information, into real-time dynamic information offering to emergency staff, relevant entities, experts and managers by various communication methods such as telephone, email, video conference etc. Thereby, this system can help to perceive and prevent environmental risks, reduce and mitigate risks and improve the overall efficiency as following diagram:

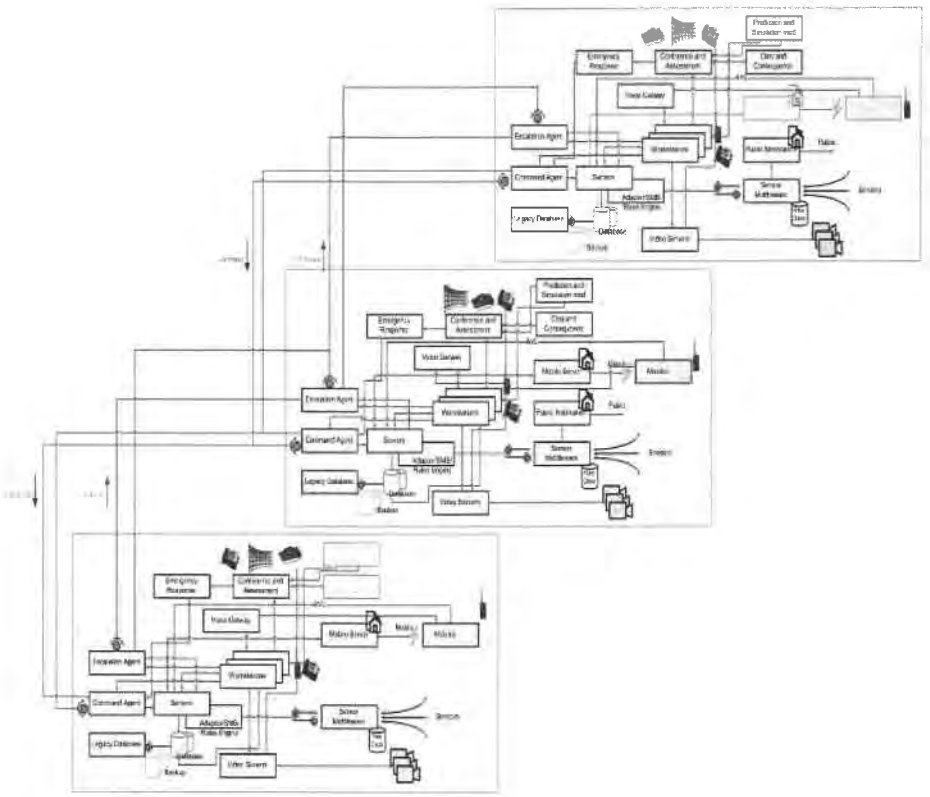


Figure 43 System Structure

1.2.3 System Structure

Here are the characteristics of Shandong Environmental Emergency Response and Management System:

(1) Integrated subsystem - Data is shared between different subsystems; seamless communication between different departments; data collection, updating, retrieval, and analysis are automated.
(2) Combination of existing standards and customized development
(3) Openness and compatibility of the system - This system will account for the importance of communication between daily application and data, to offer an open data interface and database structure.

1.2.4 Network Structure

Following is the physical structure of Shandong Environmental Emergency Response and Management System network:

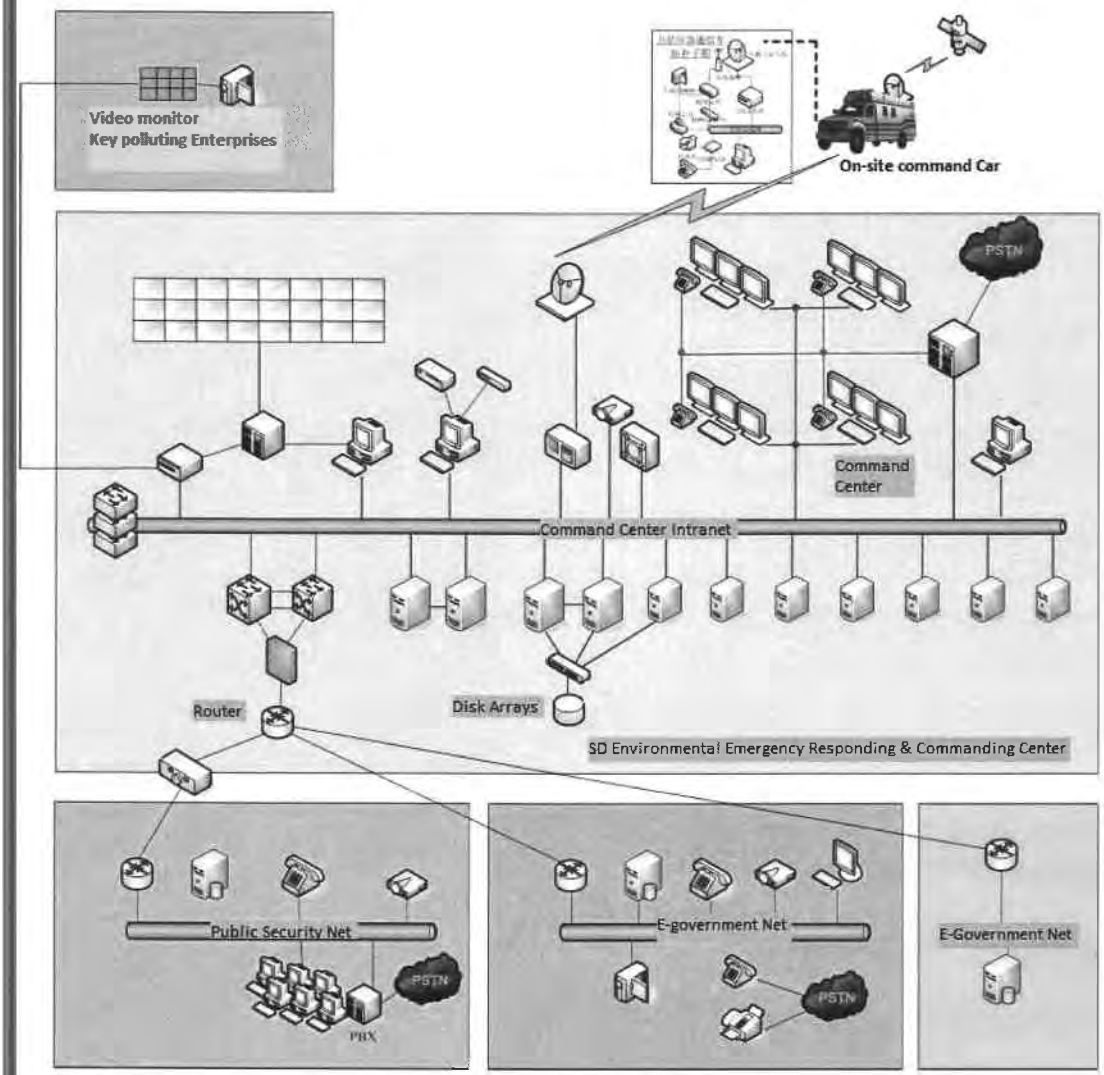


Figure 44 Network Structure

Different levels of command centers are connected together by Shandong government intranet, which will meet the needs of accessing to the system anytime anywhere by different government offices and relevant staff, for the mobile pollution resource monitoring, tracing and forensics, emergency dispatching and mobile video conference. According to the real-time monitoring information from different monitoring stations of the provincial monitoring network, once the system is monitored to an alert or call center received a call, the department should make a decision based on the information from the video monitor and sensors. After the initial decision, the information will be report to relevant department for disposal. Meanwhile, the emergency dispatching units arrive at the scene, should trace the emergency issue based on field monitoring and algorithm analysis and record discovery information and manage the forensics through photography, interview, investigations and testing data. At the same time, the department is responsible for conferring with emergency responding department, making a decision according to the emergency plan, and dispatching relevant departments for cooperating disposal if needed.

1.2.5 Application System Structure

Based on Shandong Environmental Safety and Emergency Response and Management System, the following nine applications would assist the operations of environmental departments at the application level.

Figure 45 Application System Architecture

The whole structure is a design of close-loose processes for emergency management. In the emergency management level, it includes key pollution sources, prevention and control, environmental emergency support and logistics, data management and operating management. At the environmental safety prevention level, it includes environmental risk assessment, pre-alarm and information dissemination. In the emergency monitoring and sudden disaster level, it includes environmental safety monitoring and emergency response and C&C. In addition, after the disaster, the system will provide environmental safety cost-benefit analysis and recovery analysis. All in all, there are two goals of the whole process:

(1) Reduce the risk of spreading harmful environmental substances and pollution that may damage the environment, ecology, or pose a threat to human health or life.
(2) Reduce the damage of harmful environmental substances and pollution that may damage the environment, ecology, or pose a threat to human health or life if the risk occurs.

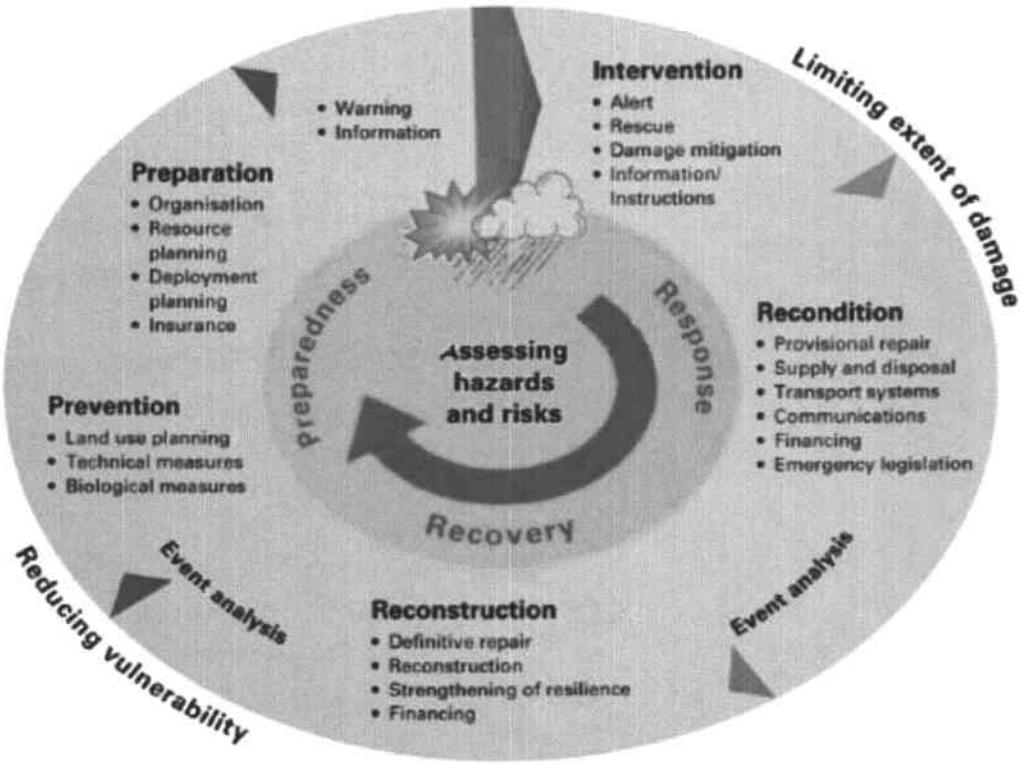


Figure 46 Environmental Emergency Responding Process

Therefore, according to the feasibility study objectives and the emergency management workflow, the system can be divided into 9 functional modules as follows:

(1) Key pollution resources prevention and Industrial Enterprise Environmental Safety;
(2) Environmental safety monitoring;
(3) Environmental emergency information early-warning and dissemination;
(4) Environmental safety cost-benefit and recovery analysis;
(5) Environmental emergency control and management;
(6) Emergency responding and commanding;
(7) Environmental safety, emergency support and logistics management including management of human resources and equipment, emergency communication network;
(8) Environmental risk assessment;
(9) Data center

1.3 Emergency Command Center

1.3.1 Components of Emergency Command Center System

According to the study, the Shandong Emergency Command Center would have a system network design as follows:

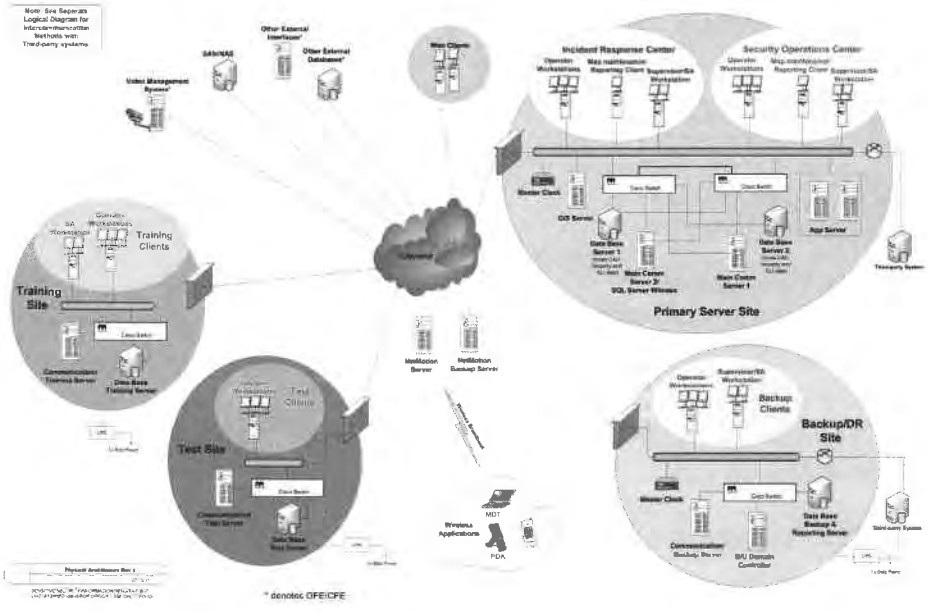


Figure 47 Emergency Command Center Network

The Shandong environmental safety and emergency command center system includes call center systems, emergency decision-support systems, command dispatching systems, video conference systems, computer network and service system, and integrated security systems etc. in including decision-support system includes contingency subsystems, accident simulation systems, and experts knowledge base subsystems. The command hall is for the senior management staff and authorities to provide command and control at the top level providing strategic and tactical command ability during an environmental emergency event. In addition, the command hall would be at a place to provide comprehensive environmental pollution monitoring. The command hall would support video conferencing linking integrated environmental emergency management centers, terminal nodes of integrated command system and the national emergency responding platform so that it can provide a platform for senior management and authorities to monitor the situation/event on-site and off-site. By

having the video monitoring function, stake holders and command personnel can be informed of the situation/event in real-time either at the command center or remotely using the integrated application system that includes pre-alarm, simulation, solution workshop, and decision support.

1.3.2 Emergency Call Center System

1.3.2.1 Fundamental Functions of Emergency Call Center

1.3.2.1.1 One- Call-One-Check Processing

The emergency call center system offers an integrated interface with CTI system and other locating services. When the interface and the CTI system interfaces, the emergency call center system will get the position data and number data automatically, which will be loaded into the interface immediately in the appropriate area. In necessary cases, the position and number data will be transferred in real-time into the dialog boxes of the operators.

1.3.2.1.2 Incident Site

There will be various ways for operators to input position information such as a specify address, intersection or public places, or obtain geographic information of a certain point by click on the map by using the mouse. When place information once been verified, the emergency call center will automatically zoom the location on the digital map, identify the point, and at the same time provide event/incident information in real-time. If the incident location is not verified, the system will provide users with a list of similar sites for further confirmation. Meanwhile, the location verifying command used at the emergency call center can help verify incident location at the regional level including the location of emergency units and engagement permissions.

1.3.2.1.3 Incident Type

The emergency call center system can be customized according to different incident levels and types by digital code or short title code. The system will provide operators with incident levels and classes, which will provide value for subsequent handling of emergency responding incidents.

1.3.2.1.4 Repeat-Alarm Events Handling

Emergency call center systems can automatically notify emergency personnel events that have taken place within a certain range, such as within a radius of 0.5 miles. If other events occur within the prescribed range, there will appear an accident dialog box with a list of the event number, location,

event type, priority level and the current situation. Personnel will determine whether the current call is a duplicate/repeated call by looking at the details of any event which had occurred in the vicinity. If there is a duplicate/repeated call, the emergency call center system will attach the information of current call to the original event in order to avoid repeat calls.

1.3.2.1.5 Event Establishment

After the completion of corresponding information entered (at least with the location and event type), then click "accept", the emergency personnel can display the event from the event list.

1.3.2.1.6 Other Emergency Information

- Event details - Emergency personnel can input specific details for event; this function is of great value for defining the scene providing emergency responding units information of the situation
- Additional information - Emergency personnel can input additional information into customized additional information interfaces in order to make the right response.

1.3.2.2 Other Functions of the Emergency Call Center System

1.3.2.2.1 Q&A Prompt

Emergency call center system provides emergency personnel with a series of question-and-answer modes for them to gather information. By providing a question and answer script, preset questions can be adjusted according to the needs (such as adding, modifying, or deleting) depending on the answer such as "set the type of event", or "raise the priority level for the selected event".

It provides a utility designed to assist users in developing a scripted series of questions and answers that support calltakers and dispatchers in the process of collecting information. By scripting question and answer trees, the I/QA product allows calltakers or dispatchers to enhance their ability to quickly assist a caller or to make decisions regarding the disposition of a call. Predefined lines of questions can be manipulated (inserted, changed, or deleted) and answers have an associated action, such as setting the event type or raising the priority of the selected incident. I/QA provides a robust GUI using built-in icons, buttons, and comment boxes to assist the operator.

Using I/QA, operators follow a hierarchical set of questions that, when responded to, rapidly records pertinent information concerning an incident. Each response entered determines the

next question to be asked. For example, a "Yes" response to Question 4 cues the system to ask Question 5, but a "No" response cues the system to skip to Question 9. This treed or conditional branching logic is useful for calls where, for example, an oil spill event occurs and the operator is immediately is prompted to pursue a line of questions specifically designed to determine from the caller the size and scope of the spill and the exact location. This vital information can then be relayed to a dispatched to environmental response units to rapidly respond to the event to mitigate environmental and ecological damage.

As the questions are asked and answered, I/QA automatically date-and time-stamps each entry to the I/CAD database. Later, the user can query a report that lists each question in the order asked, with the corresponding "Yes" or "No" answer and any comments recorded.

I/QA interfaces with the database in real-time and updates the records as information is entered. In addition, I/QA's flexibility ensures that it can be tailored to any specific requirement. I/QA can be configured to automatically run with each call or can be started at the operator's discretion. Questions that are responded to with a "Yes" may require that a comment be added—if configured differently, a comment may be entered as an option.

I/QA consists of a server component called I/QA Builder, and a client component that integrates the question and answer session into the dispatch environment. I/QA Builder uses the Microsoft Access database management system through an ODBC driver. A license for both Microsoft Access and ODBC are required for each workstation that builds I/QA question and answer scripts.

Emergency call center system is connected with the real-time database so it will automatically update the database records as long as information is input. In addition, the system provides a great deal of flexibility which can be used with any specific requirement.

1.3.2.2.2 Pending Events and Active Events Dialogs

The Pending Events portion of the dispatcher's main screen is shown in the figure below. In I/Calltaker, the dialog is called the Active Events dialog and is similar to the Pending Events dialog, except that it shows all events that have been accepted by and forwarded from any workstation until the event is either cleared or closed. By default, the display is arranged in the following order:

- Alarm
- Event Status
- Event Priority
- Alert
- Time in Current Status
- Event Number
- Event Type
- Location

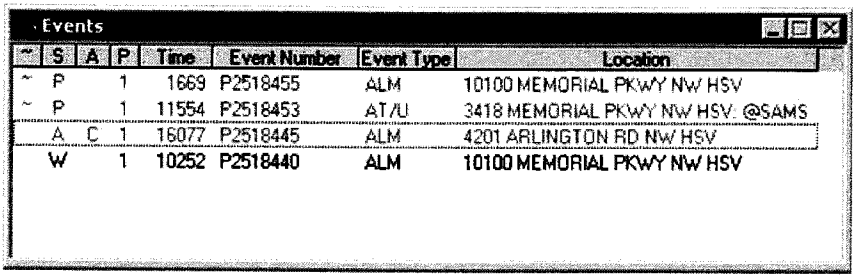


Figure 48 Pending Events Dialog

Information is displayed on the dialogs in the sorting order the operator specifies. By default, the event with the highest status and numerical priority that has been in the pending list the longest time appears first on the list. Other events of equal status and priority that were received more recently follow in the list. If there are no other events of that status or priority, the oldest event of the next highest status appears next on the list, and so on.

The operator can click on the individual columns to establish a custom sort. For example, if the operator wants to view the pending events by time rather than by priority, they click on the Time column and the events will be sorted in ascending order (oldest event first). Clicking the Time column again will cause the events to be displayed in descending order (newest event first).

The operator can set a timer to notify them that an event has been awaiting dispatch for a certain amount of time. If there are contractual obligations to dispatch events within a certain time period, these notifications remind the operator to assign the event or to transfer it to another dispatch group. Each agency can configure the number of events displayed on their arrangement.

As new calls for service arrive, dispatchers receive meaningful summaries, plus an easy-to-view graphic representation of event area activity. This is a dynamic display of the pending incident (those for which resources have not been dispatched). The status of the incident is shown in the "S" column. Please refer to the figure below.

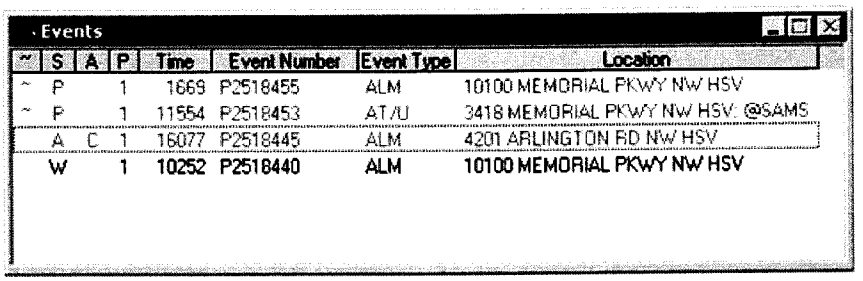


Figure 49 Pending Events Dialog

In the default setup of the system, color is per priority. In the setup when color shows, the following statuses and colors are used in the Pending Events dialog:

- **New event/not reviewed**—when a new event is received and has not been reviewed, it appears bright green in the pending event list by default. The color is user-definable. The status code is "N".
- **Reviewed/still pending**—events that have been reviewed, but are still pending, appear yellow in the pending event list by default. The color is user-definable. The status code is "P".
- **Held for unit and/or specific time**—events that are held for a specific unit or time are shown in the user-defined color and have an alphanumeric code ("H") showing that it is a held event. The default color is dark gray.

- **Agreed response events**—agreed response events are color-coded and have an "R" next to them in the status column. The default color is dark green.
- **Station Alert**—the "Station Alert" command is used to create a system timestamp and notify a station of a new event. Typically, "Station Alert" is used in jurisdictions served by volunteer fire departments. When the center receives a fire event, and while the event is still active, the operator selects "Station Alert" to record the notification. The default color is black. The status code is "S"/

Scroll bars, located on the side of the Pending Events window, indicate the relative number of events hidden from view, and dragging the scroll bar enables the user to page to specific information. The window size can also be temporarily maximized to view more events at one time. In the figure below, the dialog can display all the existing Pending Events and the scroll bars along the side are not necessary. Note the scroll bar along the bottom of the dialog that allows the operator to view information out of view.

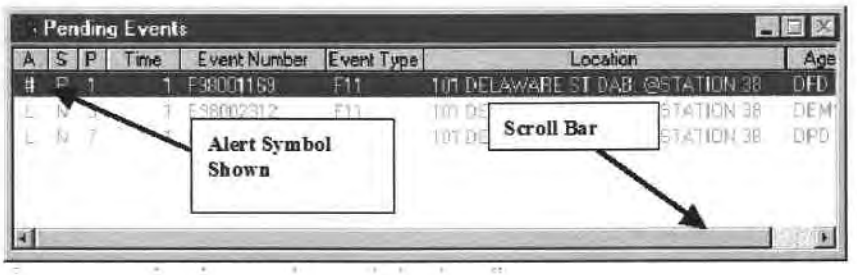


Figure 50 Pending Events Dialog Showing Alert Symbol and Scroll Bar

The operator may select an event from the Pending Events dialog for review. The "Display Event" is used to retrieve for review an event record. The dialog is shown in the figure below.

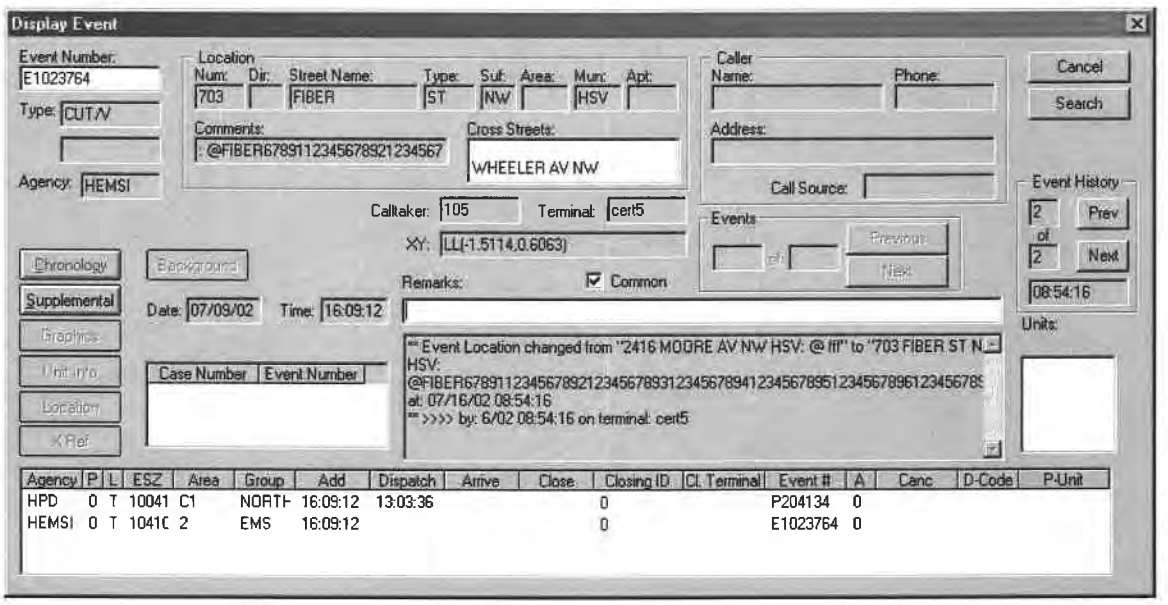


Figure 51 Display Event Dialog

Once the event has been reviewed and units recommended/assigned and dispatched, the event is moved to the Unit/Event Status dialog and is removed from the Pending Events dialog. In I/Calltaker, the Active Events dialog shows all events that have been accepted by and forwarded from any workstation until the event is either cleared or closed.

Emergency call center can shelve the calls with less priority and pick up useful information from it. When the less priority calls are at pending state, the emergency personal will deal with the emergency calls with high priority. There is a time limitation if the calls in pending state, as long as the time runs off, relative staff will get the call and deal with the calls. The personal can also deal with the calls with a certain consequence. All the call information will be restored with a time and date, except the calls with interruption.

1.3.2.2.3 Incident Copy

In comprehensive circumstance, it is allowed to let any personnel to establish a new event based on the events which are solved.

1.3.2.2.4 Radio Information Receiving and Controlling

This system provides automatic management of talk groups, such as units, incidents, dispatch groups, and all active units and dispatchers. A unit talk group encompasses all radios for that unit, including hand-held radios. An incident talk group includes all units currently assigned to an incident, as well as the dispatchers responsible for the incident. A dispatch talk group represents all units and dispatchers of a given agency responsible for incidents of a particular type in a given geographic area. An active units and dispatchers talk group includes all personnel currently signed on. These talk groups are managed dynamically as personnel sign on and off the system and as units are dispatched. Dispatchers can also manually create new talk groups by combining individual radios and the automatic talk groups defined above. For speaking, a dispatcher can identify a Unit, Incident, Dispatch group, or manually created talk group and with a single keystroke, select that group. Dispatchers can also monitor multiple talk groups. When simultaneous communication by multiple talk groups occurs, a priority scheme is maintained. By default, automatically created dispatch groups are arranged by incidents in priority order; however, dispatchers can manually rearrange the priority. In addition, the system also has the function for information publish.

1.3.3 Emergency Decision Support System

After any environmental pollution, with analysis of different prediction from different department and the current situation, it is easy to get a comprehensive estimate of the implications, ways of effect, continued time and hazard level. As the following diagram shows, after a toxic gas leak, the emergency command personnel or managers can create a gas proliferation model based on the parameter, then the managers can create an alert region, control traffic, and command evacuation procedures. During the emergency response, the Emergency Decision Support System (EDSS) can automatically collect the appropriate response data, geographic information, history of disposal programs, display analysis and assessment in order to develop appropriate tactical response plan for the event /incident and respond accordingly. According to emergency responding plans, the Emergency Decision Support System can use the geographic information platform, combined with the emergency response planning, and workflow processes to respond timely and effectively to environmental emergency incidents. The EDSS can provide accurate location information to ensure better response times.

Figure 52 Emergency Decision Support System

1.3.3.1 Basic Function of the Emergency Decision Support System

The difference between different emergency decisions is based on the difference between different event levels, dispatching regions, and application system functions. In this way, each level can achieve the systematic decision support function.

Plan selection

- Condition list

The system can implement conditions by adding, modifying and deleting. The conditions set are based on following elements: plan name, publishing time, publisher units, applicable event type, and applicable region scope, plan level, etc.

The system can set the relation between conditions which includes 'and', 'or', and 'not'.

- Plan selection

The system can confirm the selected conditions based on the conditions as event type, event level, event region and responsible units, and also it can research a plan to match the event.

1.3.3.2 Resource Dispatching Decision Support

This part is divided into two categories:

- Center Performance - assists decision makers in the management of resources
- Resource Utilization - assists management in the utilization and deployment of field resources.

The default reports within the area of Center Performance are as follows.

- **Time to Enter Events** - this report measures the performances of calltakers by calculating the time required by an operator to enter data associated with an event. Time to Enter Events is defined as the amount of time elapsing between the time the event is accepted and the time the event is created
- **Calltaker Accuracy** - the Calltaker Accuracy report computes the number of modifications to event data entered by the calltaker. Counts of the number of event type code changes and the number of address re-entries are provided
- **Calltaker Workload** - this report calculates the number of events handled by calltakers from a designated logged-on time
- **Time to Dispatch** - the Time to Dispatch reports measure the performances of dispatchers by calculating the amount of time required to send the first unit to an event after receiving a notification of the call from the calltaker
- **Total Time to Dispatch** - this report measures the overall performance of center personnel by calculating the time required to dispatch the first unit to an event after the initial call is received
- **Dispatcher Workload** - Dispatcher Workload reports the number of events handled by a dispatcher from a designated logged on time
- **Event Statistics List** - this report groups a designated number of events by any combination of the defined selection criteria
- **Event List** - this report provides a textual display of detailed information related to an event
- **Event Chronology** - this report displays key occurrences in the progression of an event from creation to closure

Resource Utilization

The default reports within the Resource Utilization area are as follows.

- **Unit Workload** - the following Unit Workload reports may be generated:
  - Available by Agency
  - Available Time by Dispatch Group
  - Available Time by Unit
  - Events Dispatched by Day of the Week
  - Events Dispatched by the Hour of the Day
  - Transports by Day of the Week
  - Unit Response by Day of the Week
- **Demand Analysis** - the Demand Analysis report measures unit demand during each hour of the day. This report also displays the average event completion time during each hour of the day
- **Planned Coverage** - the Planned Coverage report correlates planned unit load to actual unit load for each hour of a specified day
- **Event Handling Time** - this report provides an indication of the efficiency of unit personnel by computing the time elapsed between unit arrival at an event site and the time the event is cleared
- **Response to Emergency Events** - this report calculates the time elapsed between a dispatcher's assignment of a unit to an event and the time the unit actually leaves enroute to the event
- **First Responding Unit Time** - the First Responding Unit Time report calculates the time elapsed between the dispatch of units to the event site and the time the first unit arrives on site
- **Arrival to Transport Time** - this report calculates the amount of time elapsed between the arrival time of a unit and the time transport begins
- **Transport to Clear Time** - the Transport to Clear report computes the amount of time elapsed between the beginning of a unit's transport of a patient to a hospital and the unit's arrival at the hospital
- **Create to Transport Arrive** - this report computes that amount of time elapsed between initial receipt of a call and delivery of a patient to the hospital

- **Hospital Diversion** - the Hospital Diversion report displays the times in which units were diverted from primary hospitals to secondary hospitals
- **Event Statistics List** - this report displays the number of events that meet defined selection criteria
- **Event List** - the Event List report details event information
- **Event Chronology** - the Event Chronology report provides a historical synopsis of event progression

1.3.3.3 Environmental Emergency Decision Support

The environmental emergency decision support system supports third party analysis models which can integrate the emergency response system, emergency duty system and plan management system. It displays the pollution resource information which can realize event locating, resource information research, emergency planning research, emergency organization dispatching, MSDS researching, information matching & analyzing and decision making.

1.3.4 Test System

This system adopts the third party mathematical models (explosion event model, hazmat diffusion event model, poison leaks model) and sets model parameters to automatically simulate and calculate the damage radius, damage situation, damage influence region, etc. It can also display all the information on the e-map and generate assessment reports.

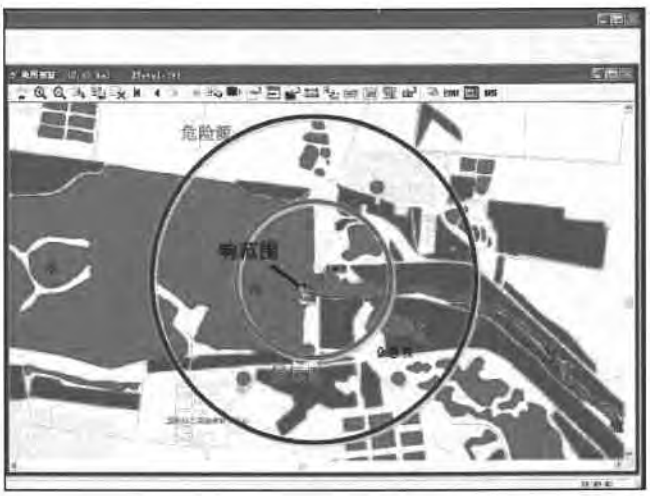


Figure 53 Accident Simulation

This system supports integrated third-party e-map service which can publish map through the GIS system for displaying the event. It can also offer interface for user management and authentication. The administrators can set permissions of relative function and roles, managers' information and log-in system.

The test system has functions as following:

- Accident simulation;
- Accident features learning;
- Environmental regulation learning;
- Meet the management competency requirements;

Command and dispatching system

Within the communication centers where operators are responsible for both calltaking and dispatching operations, the I/Dispatcher product is needed; when the separation of calltaking and dispatching duties are required, the I/Calltaker software module will be proposed immediately. I/Calltaker is essentially a subset of the I/Dispatcher software but retains the commands to support call entry and event creation and call routes. It provides a low-cost product for customers desiring to separate the calltaking and dispatching functions and it can be supported for either a single- or dual-monitor workstation configuration. In either configuration, windows are used to display both data entry forms and the integrated graphical maps.

The default software interface uses two screens—the Command screen/window and the Map screen/window. The Command window is where the operator begins all processing. A single mouse and keyboard are used to communicate with both monitors. Windows and icons can be moved for operators to dictate. Windows, including the map window, may also be dismissed, resized, and minimized. To activate a window, the operator simply clicks anywhere on the window and the title bar changes color to visually indicate that the window is active. The operator can also easily switch to another window by using the ALT/TAB keys. The operator can access the commands from the menu bar or tool bar. The figure below is representative.

Please note that the customer can connect up to 10 monitors to a Windows XP-based computer.

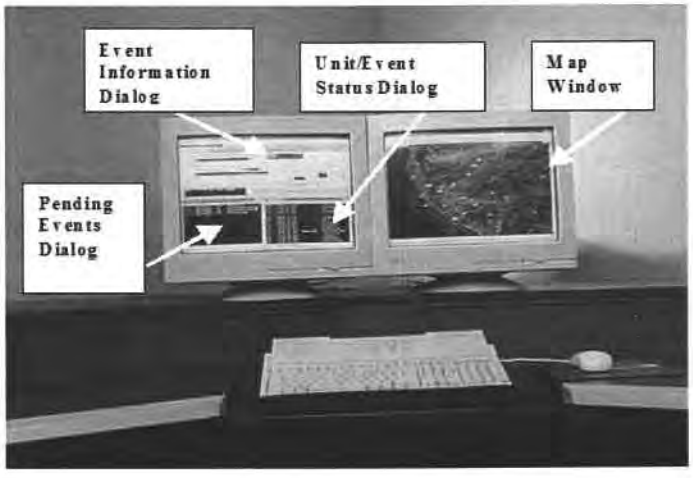


Figure 54 Default Software Interface

When calltaking is performed separately from the dispatching process (no unit control), the proposed I/Calltaker also has two windows—the Command window and the Map window. I/Calltaker is typically configured on a single monitor workstation. The figure below illustrates:

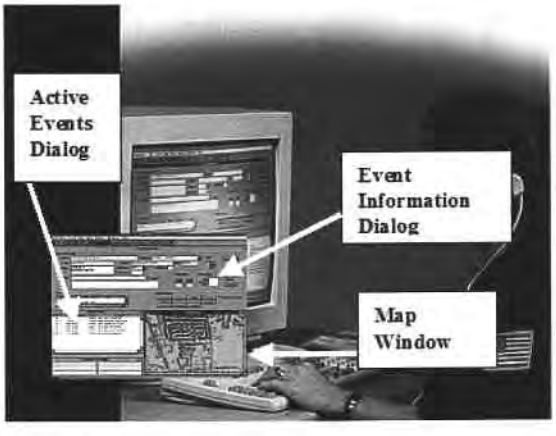


Figure 55 ICalltaker Configuration

The Command window (I/Dispatcher) contains three dialogs and a window:

- Event Information dialog

- Pending Events dialog (Active Events dialog in I/Calltaker)
- Unit/Event Status dialog (I/Dispatcher only)
- Map View window

The actual customer application may appear differently from the examples shown here. The interface is configured using Microsoft Visual C++, configuration IDs, and parameter definitions. The configuration IDs and parameter definitions are established using the CAD Database Maintenance utility (CADDBM) described in more detail later in this overview.

Processing Commands

Multiple methods of data and/or command entry are used in the I/CAD System. The operator can perform commands using one of the following methods:

Pull-down menus—to select commands

Dialogs—with pick lists and command buttons to select from a number of data options, including selecting event types or street names (if the typed street name is misspelled); to issuing commands; or accessing additional information, such as information pertinent to a particular location

Command icons—to issue the most commonly used commands. Several command icons are available from either the status monitor or the Map window

Site-specific function and shortcut keys—to issue commonly used commands. Function and shortcut keys are mapped to commands, as requested, to service the customer environment

Command-line entry—command line entries include a number of command abbreviations and shortcuts to make executing these commands as efficient as possible

Pop-up menus—given particular circumstances, the right mouse button can be used to access pop-up menus relevant to the current process from dialog fields or the I/CAD Map

- **Point and click**—to designate resources for dispatch, events to be dispatched, or to select map icons, such as hydrants, for which the operator requires specific information
- The operator may use drag and drop to dispatch units

Most commands cause a dialog to appear on one of the windows, either as part of the configuration of the command or requested a dialog. Dialogs usually appear on top of the command window.

Menu Bar

The Menu Bar contains the commands and menu options. The figure below shows the menu bar portion of the command window.

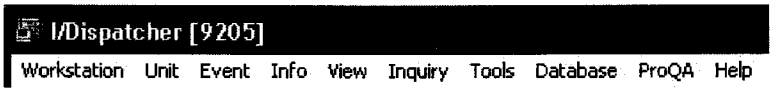


Figure 56 Menu Bar of the Command Window

The table below lists the menus and provides a brief description of the commands available in that menu.

Menu bar commands

Menu	Description
Workstation	This menu is used to change passwords, change operators, define modes, schedule commands, sign off, and exit the software. This menu also provides the operator with the capability to refresh the windows, map, parameter definition, and schema.
Unit	This menu is used to deploy or clear units, change the status of units, transfer units to and from dispatch groups, and perform other actions on units. This menu is not available in the I/Calltaker application.
Event	This menu provides the capability to create an event, verify a location, search for nearby events, define special situations, retrieve a location of interest, accept an event, and modify an event.
Info	The operator uses this menu to send a message, receive a message, retrieve a message, schedule a callback, add information to the scratch pad, retrieve information from the scratch pad, broadcast information, hold information, display information, and add unit history.
View	This menu allows the operator to manipulate the map view, window in to a specific event or location, and define a sort sequence for pending events.

Inquiry	The operator uses this menu to inquire on events, display a location of interest, or recall ANI/ALI. The operator can also inquire on operators, geographic locations, and routing.
Tools	The Tools menu provides the capability to define and run macros in I/Dispatcher and I/Calltaker to streamline daily routine tasks. The operator can combine commands and eliminate some steps in a daily workflow.
ProQA	This menu provides access to ProQA functionality when interfaced with the system.
Database	This menu provides the capability to check the database status.
Help	The Help menu provides access to the table of contents and the capability to search for a specific topic in the on-line Help. The operator may also display the version number of the software through this menu.

Tool Bar

The tool bar appears below the menu bar along the top of the dialog. The tool bar is system definable. The figure below is provided as an illustrated example of the command buttons that may appear on the tool bar.

Figure: Example of a Tool Bar

The tool bar offers convenience for the operator. The System Administrator can customize the tool bar to include the commands used most. All of the commands accessed using the buttons are also accessible using the Menu Bar discussed above. To aid the operator in identifying the commands on the tool bar, tool tips are provided. The figure below illustrates:

Figure: Tool Tips for Menu Bar

Event Information Dialog

When an event occurs, the operator uses the Event Information dialog to record the basic information associated with the event. The figure below illustrates:

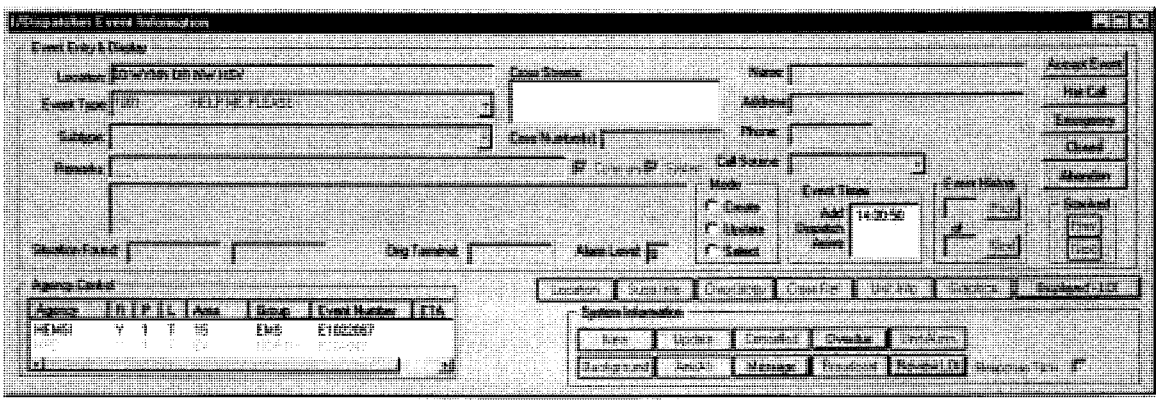


Figure 57 Event Information Dialog

The Event Information dialog contains indicator buttons. Each indicator button provides another way to access the command. The figure below provides a close up view of the indicator button area. The table that follows is a list of each indicator button and its purpose.

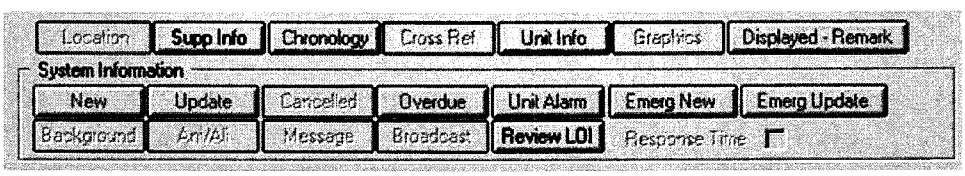


Figure: Indicator Button Area of the Event Information Dialog

Indicator buttons definition

Button	Becomes active and turns red when...
SOP	...standard operating procedures exist for the event. If configured, this button displays the Scratch Pad dialog with a site-defined standard operating procedure for the event.
Location	...Location of Interest information is available.

Supp Info	...there is supplemental information for the active event. Please note that the Supplemental Event information button is always active so that the operator can add supplemental information at any time and it turns red when available for the active event.
Chronology	...event chronology information is available.
Cross Ref	...cross reference event information is available.
Unit Info	...unit information is available.
Graphics	...a graphics set is associated with an event. Clicking the button will display and undisplay the graphics set.
Displayed	...there has been updated information received on the currently displayed event.
New	...there is a new event to select.
Update	...the operator can update the event.
Cancelled	...the operator has received a request to cancel one of their events.
Overdue	...the operator has an overdue event.
Unit Alarm	...a unit emergency exists or a unit has entered alarm status.
Background	...background information is available.
Ani/Ali	...ANI/ALI information is available.
Message	...the operator has a message(s) to read.
Broadcast	...broadcast information is present and has not been read.
Emerg New	...a new emergency event has been received.
Emerg Update	...an update to an existing emergency event has been received.
Review LOI	...Location of Interest information is present and has not been read.
Response Time	This is actually a checkbox rather than a button. An "X" will appear in the checkbox when the response time for a unit to reach an event may not be able to be met.

Figure 58 Indicators Buttons Definitions

The information that the operator enters into the text boxes on the Event Information dialog typically falls into certain categories.

- **Location**—this text box refers to the location of the event. Locations can be entered as:
  - Street address, number, and street name
  - Intersection
  - Commonplace name (for example, hospitals and schools)

- Alias street names/common misspellings
- Cataloged alarm (pre-stored information on incoming alarms)

- **Event Type**—this text box refers to the type of event. Each agency has event type abbreviations, 10-codes, or both event type abbreviations and 10-codes to describe the activity to which a unit must respond to. Those event types are loaded into the associated list on the Event Type text box. The operator can type the event type, or they can choose an event type from the associated list.
- **Subtype**—this text box refers to additional qualifiers of the basic event type. The subtypes are loaded into the associated list on the Subtype text box. The operator can type the subtype or they can choose a subtype from the associated list
- **Name**—the name of the caller is entered into the Name text box (this text box is horizontally scrollable)
- **Address**—the caller's address is entered into the Address text box (the address may or may not be the same as the location of the event)
- **Phone**—the caller's telephone number is entered into the Phone text box
- **Cross Streets**—if there are cross streets, the nearest intersection will appear in this text box after the location has been verified
- **Case Numbers**—on the Event Information dialog, a scrollable list of case numbers associated with the displayed event appear
- **Call Source**—this text box defines how the operator received the call. The default associated list (list is configurable) contains the following choices:
  - Telephone (seven digit, E9-1-1, or in some countries 000)
  - Walk in
  - ANI/ALI
  - Officer
- **Remarks**—any information about the event that cannot be entered into the other text boxes is typed into the Remarks text box. When the operator presses the Enter key, the remarks are loaded into the non-editable text box below the editable text box in which the operator entered the information. If the operator has a multi-agency event and

wants the remarks entered to be available to all agencies, they click Common (the figure below illustrates)

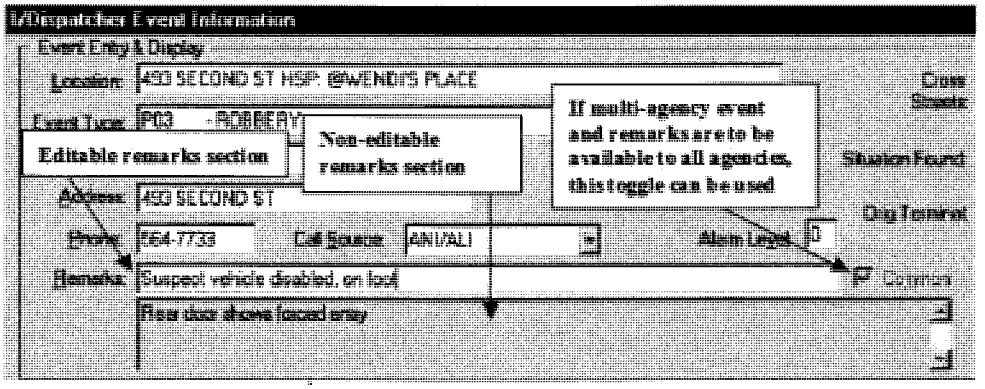


Figure 59 Remarks Section of the Event Information Dialog

System generated remarks appear in the read only list box below the Remarks field with double asterisks (**) beside them. This provides the capability to distinguish system-generated comments from user-specified or selected comments. The system provides the capability to turn off the display of system-generated remarks.

- **Agency Control**—this area is located beneath the caller and event information area. Scroll bars provide the capability to see all the information displayed in this area. When the operator successfully verifies an event location, the remaining text boxes in the Agency Control area are completed as follows:
  - The Area and Group information is automatically entered. The Area is the assigned jurisdiction for the event location and the group is the dispatch group
  - The automatically assigned Area and Group determine which workstations (dispatch group) will receive the new event for processing
  - When the operator selects a Type that describes the event, the R[esponse] and P[riority] text boxes are completed. R[esponse] determines which agency will respond to the event, and P[riority] is the priority of the new event. The operator may override any of the information in the editable columns (ones not "grayed out")

The operator may override any of the information in the editable columns (R[esponse], P[riority], L[ocation], Area, and Group).

For associated events, the operator may review the agency information by double-clicking on the row containing the associated event information. The operator can also access the agency information by right-mouse clicking over the Agency Control list and selecting the "Select Event" command. The operator cannot edit the agency information for an associated event.

Event History

Events can be recorded multiple times, due to changes of location, multiple calls for an incident, or other occurrences. Event History indicates the number of multiple events and allows the operator to scroll through them. When Event History shows more than one occurrence of an event, the operator uses the "Next" and "Prev" (previous) buttons to scroll through the events. The figure below illustrates.

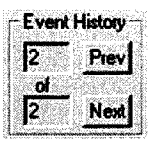


Figure: Event History Area

The appearance of the system may be customized to meet specific needs. For example, the System Administrator may perform the following functions:

- Redesign the default dialogs
- Define the screen colors
- Configure the appearance of the command icons
- Determine the location of the indicator buttons and possibly the Active (I/Calltaker) or Pending Events (I/Dispatcher) dialogs
- Program the function keys

The map that displays at the workstation contains information that the operator may not see, but can access for more details. For example, all fire hydrants in the city can be on a level of the map, but as a Police dispatcher, the operator will not display them on the map.

The width and color of lines that show streets, boundaries, rivers, routes, and other information is predefined. Location information will have been detailed to include commonplace names for locations such as schools, hospitals, and businesses. Some common misspellings will have been entered, as will have the other aliases that some streets use (for instance, highways that run through cities typically take on a street name while they are within the city limits).

The System Administrator will also have defined the operators in the database so that they have a means of logging on and a password. The operator may or may not be required to change their password when they first use the system (site-specific policy).

Command Line Text Box

To access the command line text box, the operator simply clicks on the text box. To enter a command, the operator uses the text box. The operator can use the drop-down button to select a command previously entered. Any messages appear in the message status field at the bottom or the command window. The figure below provides an example of the command line text box.

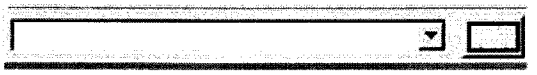


Figure: Command Line Text Box

To display additional command line text boxes (multiple command line functionality), the operator selects the button to the right of the default command line text box. When this button is pressed, a separate window containing another command entry field will appear and will float on top of the Event Information dialog. This window can be used to enter command lines and will stay up until explicitly dismissed using the "X" in the upper right corner. If the keyboard button is pressed multiple times, multiple windows will be created. This allows the user to decide how many different command entry fields they need. The figure below illustrates.

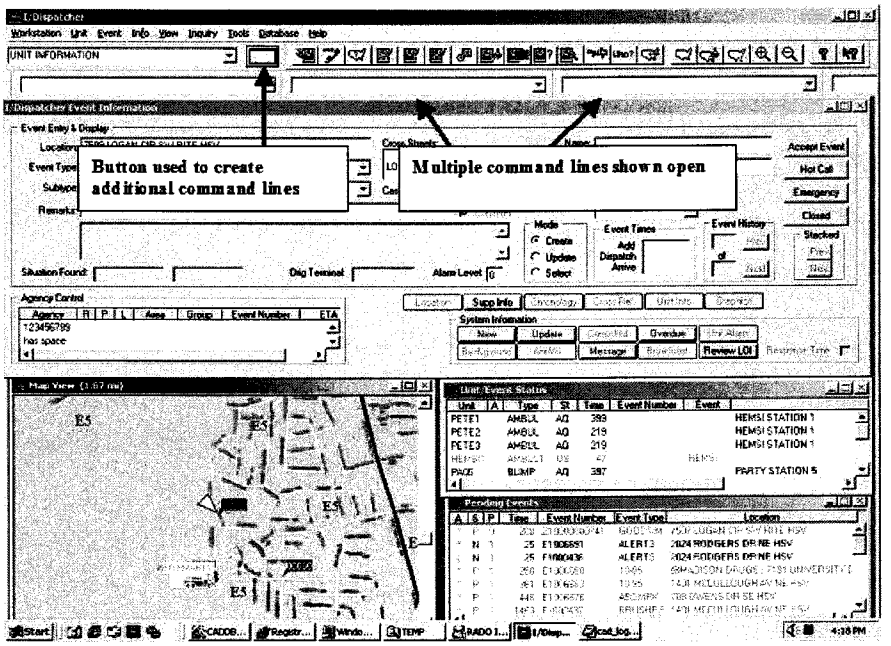


Figure: Multiple Command Lines

Unit/Event Status Dialog

The Unit/Event Status dialog summarizes information on each unit the operator controls. This dialog appears on workstations configured with I/Dispatcher. The operator can assign units to events using drag and drop. The information is unit-related and I/Calltaker does not provide unit control capabilities.

The Unit/Event Status dialog (status monitor) contains the following:

- Unit Number
- Alarm
- Alert
- Unit Type
- Unit Time in Current Status

- Status of the Event
- Event Number
- Event Type
- Unit or Event Location

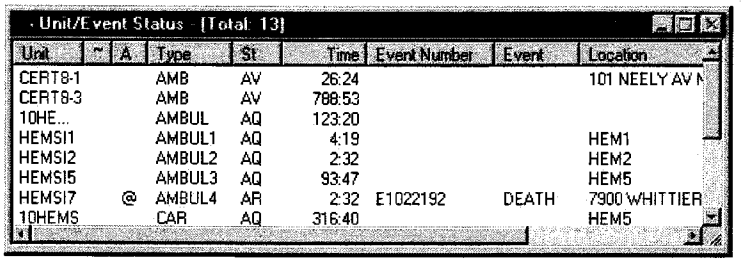


Figure 60 Unit/Event Status Dialog

Once an event is assigned, the information line for the unit in the dialog also contains the location of the event. The information in the dialog is dynamically updated as changes occur. The operator can use the scroll bar to view any number of units. The System Administrator configures the maximum number of events that display without scrolling.

The operator can sort the Unit/Event Status dialog by clicking on the column headers of the dialog. For example, if the operator wants to sort the information by Unit ID, they click the Unit column and the events will be sorted in ascending order. Clicking the Unit column again will display the events in descending order.

The Unit/Event Status dialog supports dynamic lists of monitors and allows custom monitors to be installed. It provides a monitor capable of displaying more than one unit per line to allow many more units to be displayed. A sample of this monitor is shown in the figure below.

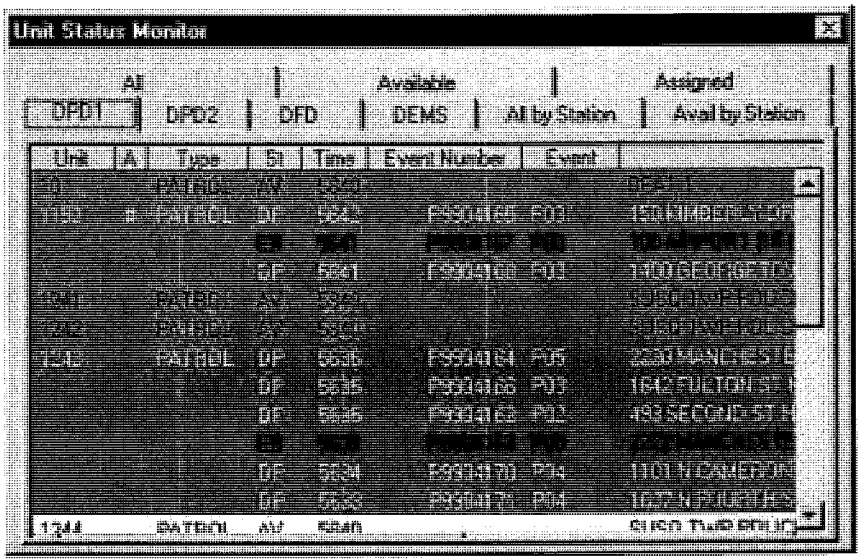


Figure 61 Unit Status Monitor

Map View Window

The Map View window is an integrated component with the command window. An example is shown in the figure below. When a new event location is verified, a flag is placed on the map and when the event is accepted, a symbol is placed on the map at the location of the event. When a unit flag is queried (the operator clicks on it to select) on the map, textual information appears in the dialogs window. Depending on the configuration of the system, the unit flag on the map changes color when it changes status. For example, the flag of a unit that is in service but not dispatched can be white, but when the operator dispatches it, the flag may change to blue. The System Administrator determines the colors for the different statuses.

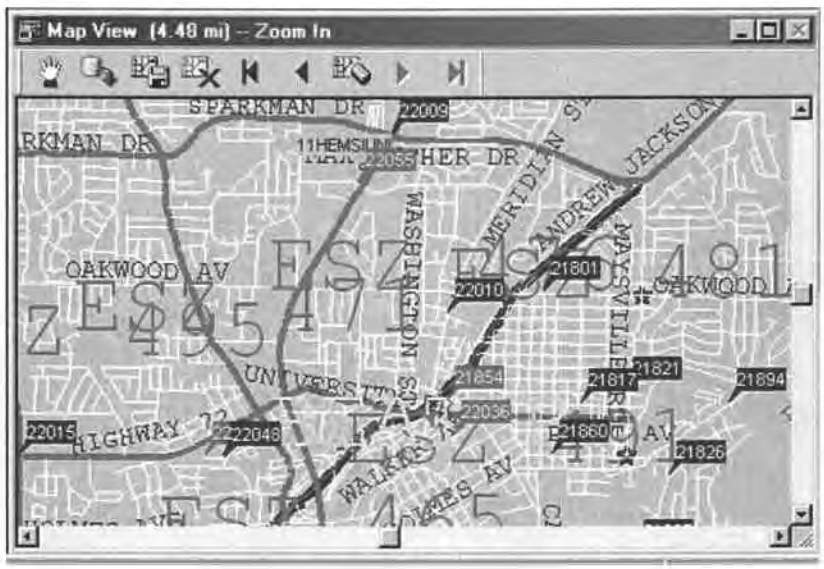
The operator can assign units to events and events to units using drag and drop. When manipulating the map using the "Zoom In", "Zoom Out", "Area", and "Center" commands, the command title appears in the title bar of the map view.

Each of the map views supports the capability to display a toolbar with a set of map view related commands.

Figure: Map View Toolbar

Button	Command	Click to
	Pan Window	Scroll or move around the map view.
	Load View	Load a saved view.
	Save View	Save the current view.
	Delete View	Delete a saved view.
	Back All	Move back through all of the previous map view changes. When you perform commands such as zoom in, zoom out, area, center, scroll or fit, these changes are recorded.
	Back	Move back one to the previous view change.
	Erase History	Remove the stored map view change history.
	Forward	Move you forward one view change.
	Forward All	Move you forward through all of the view changes.

If configured, the operator can also view a tool tip window containing information on events and units.



Example Map Window

Figure 62 Example Map Window

The spatial relationship of emergency vehicles to incident locations is displayed on the map, complete with roadways and jurisdictional boundaries. Dispatchers can quickly identify the most appropriate response personnel and judge the fastest and safest route to the event. The I/CAD System uses both graphic and non-graphic information to determine real-time vehicle position, provide automatic dispatch recommendations, and assist in optimal path planning.

The I/CAD map is robust. There is no practical limit to the amount of information that can be displayed on the fully interactive, intelligent map. In addition to streets and highways, the map can display building footprints, HazMat (hazardous information) flags, fire hydrants, power lines, rivers, lakes, and railroad lines. These intelligent maps are not just pictures on a screen—they are "smart" maps. All information regarding map features that has been stored in database records is available for immediate data recall. The operator can query the system by simply pointing and clicking on symbols on the map. Using the street network, the system can route units to locations by the shortest time, shortest distance, fewest turns or

intersections, and minimum risk involved. When a dispatcher has closed a street, the system can route units around the closure.

Dispatchers can easily understand the real-time, color display of streets, units, status, event markers, and stations on the map screen. Building floor plans can be retrieved and displayed; road closures are mapped and units routed around them; and locations of fire hydrants and utility poles, as well as gas, water, and sewer lines can be displayed.

Dispatchers can zoom in on views, window certain areas, attach related graphic files to expand their informational base, turn on and off different map layers to control the amount of data shown, display multiple views, and query the database about map symbols.

To an observer, the power of the map resembles a geographical information system (GIS). The mapping component of the system is not linked to a GIS, although the information required to produce the map may be taken from an existing GIS of the area. Instead, the capability, speed, intelligence, and integration of the map are purposefully designed to function as an integral part of I/CAD.

I/NetViewer Application

I/NetViewer is a browser-based product that allows personnel throughout the agency to access dispatch information needed without having special I/CAD software installed on their computers. With the proper security privileges, database access licenses (on the server), and Internet Explorer, these positions can access current and historical information from the I/CAD System.

Positions with I/NetViewer access are provided with the capability to display information on units and their status, as well as pending and active events. Unit and event information may also be displayed on an interactive map for a visual summary of current activity throughout the agency. If the operator wants more detailed information about a specific unit or an event, a simple mouse click retrieves the additional data.

In addition to providing a view of the agency's resources and workload, I/NetViewer provides the capability to accomplish a number of other tasks. For example, the browser interface can be used to display historical information, such as a listing of a particular unit's activity for the past week or the number of traffic accidents reported during a particular month.

I/NetViewer also permits the operator to search operational information such as the personnel who are on duty, what special equipment they may have in their vehicles, and any specific skills they have (for example, foreign languages).

I/NetViewer also enables the user to initiate limited activities in the I/CAD System. Using the browser software, the user may create a call for service; place a unit in or out of service; update personnel lineups; and send a message to any user on the system, including mobile users.

Once the user has logged onto I/NetViewer successfully, the main screen is displayed. The figure below shows an example of the main dialog.

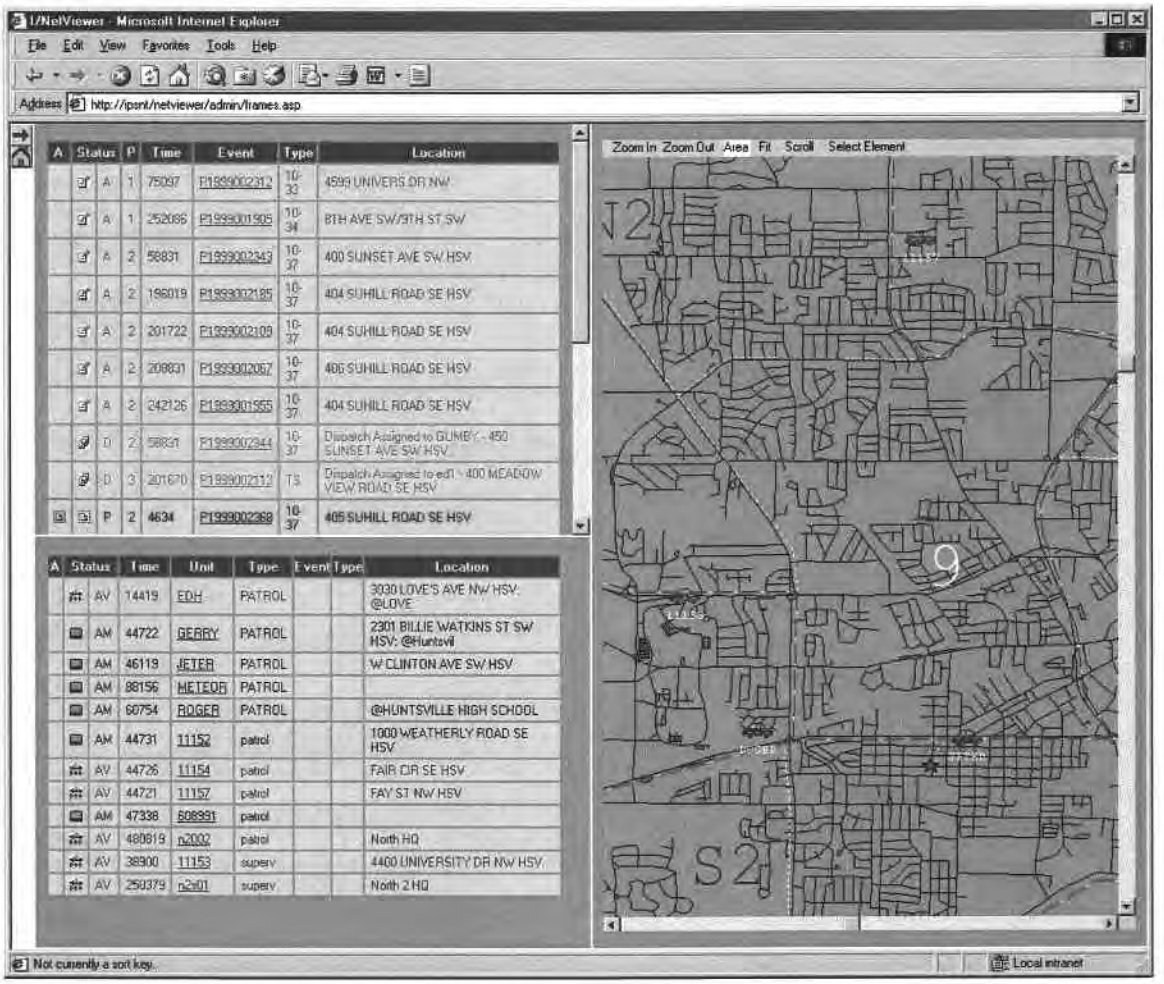


Figure 63 I/NetViewer Main Screen

Capabilities provided by I/NetViewer include the following:

- Monitor pending events and unit status
- Display the map with windowing operations to view location of events and units
- Configurable monitor display and the map within a single browser page

- Query unit and event details, including supplemental event information
- Create a simple event and add comments
- Place individual units in and out of service
- Display and edit unit personnel, equipment, location, and mileage
- Display, edit, and receive I/CAD messages among calltakers, dispatchers, MDTs, pagers, and other I/NetViewer and I/NetDispatcher clients
- Create, update, and view I/CAD lineups
- Query unit history, summary, equipment, roster, and lineups
- Search for events and/or supplemental information
- Query signed-on users and database status

I/NetDispatcher Application

I/NetDispatcher uses I/NetViewer as its underlying foundation. I/NetDispatcher provides access to live operational I/CAD data via the Microsoft Internet Explorer in the same manner as the I/NetViewer product. I/NetDispatcher provides secure access to I/CAD data by validating users using I/CAD security to determine which agency/dispatch groups a user is allowed to see, as well as which operations the user is allowed to execute.

I/NetDispatcher contains the same functionality as is available within I/NetViewer and includes the following additional functionality:

- Dispatch Unit
- Unit Status (Acknowledge, Enroute, Arrive)
- Clear Unit
- Dispatch Assign
- Hold Event
- Cancel Event
- Update Event
- Preempt Unit

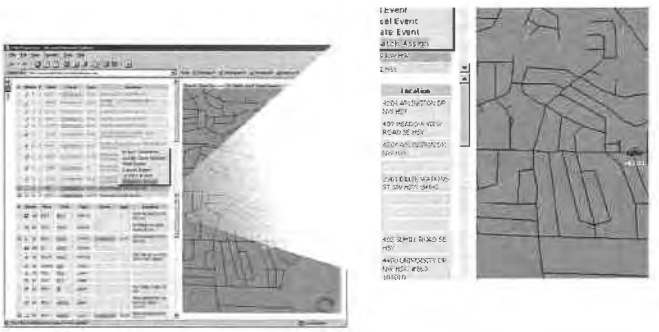


Figure 64 I/Net Dispatcher

1.3.4.1 Processing Calls

Call processing is a crucial element of any public safety system. Whether a call is taken from a calltaker or dispatcher, I/CAD automates the process reducing human error. In multi-agency communications centers, each agency can configure the dialogs (forms) to accommodate unique methods of collecting and recording data.

Within communication centers whose operators are assigned responsibility for handling both calltaking and dispatching operations, the I/Dispatcher product is used; when the separation of calltaking and dispatching duties is required, the I/Calltaker software module is proposed. I/Calltaker is essentially a subset of the I/Dispatcher software but retains the commands needed to support call entry and event creation and the routing of calls to a dispatcher. It provides a low-cost product for customers desiring to separate the calltaking and dispatching functions.

An interface with automatic number identification/automatic location identification (ANI/ALI) loads data immediately into the Event Information dialog. Once the location is validated and event type determined based on the information taken from the caller, one button directs the information to the correct dispatcher and initiates a database record.

Other call processing capabilities include the following:

- Flexible event location processing

- Manual address input
- Integrated map display with the automatic display of incident locations to assist in the detection of duplicate or related incidents
- Expanded remarks/comment fields
- Multiple call processing
- Automatic location verification
- Messaging, broadcasting, and condition warning

1.3.4.1.1 Time Stamping

Performing any of the following calltaking activities causes all information to be date- and time-stamped, as well as appending the terminal ID to the event history log:

- Receiving E9-1-1 calls
- Creating events
- Adding remarks
- Accepting events
- Stacking calls
- Updating events
- Reading LOI information
- Canceling events

1.3.4.1.2 Duplicate Call Search

I/CAD notifies the calltaker (or dispatcher) of events within a defined range, such as 0.5-mile radius, which is specified in the system's parameter file. If other events occur within the defined range, the Nearby Events dialog appears and lists the event number, location, event type, priority, and current status.

In this way, the operator can review the details of any nearby event to determine whether the current call is a duplicate. If it is a duplicate, I/CAD appends all of the information from the current call onto the original event, preventing the calltaker from having to re-enter the call information.

1.3.4.1.3 Hazard/Flag Alerts

The LOI function in I/CAD provides specific location information, such as hazardous materials or patient histories and recent events for that location.

By default, I/CAD automatically initiates an LOI search once a location has been verified. This process runs in the background, searching both premises and recent incidents information, and returns results if a historical record is found for the event location *or surrounding area*. I/CAD-based LOI searches entail more than looking up and down the same block or the adjacent block, as with most CAD systems. Using powerful graphics-based location processing, I/CAD actually searches the neighborhood.

After LOI is completed, any operator looking at an event can access this information by selecting the red LOI button on the Event Information dialog. HazMat records, known health problems, active warrants, and major call records become available at the touch of a button. The I/CAD storage and retrieval information system functions whether data was entered manually or captured automatically by the system.

In addition, I/CAD presents a form listing summary information for all searches pertinent to a location, including whether the notation is for a recent event or for a special situation. Selecting an entry from this list displays the full details of the entry. Special situations can be defined in I/CAD and can include dangerous or hazardous situations for any agency. These circumstances are generally temporary, but can be designated as permanent in the database maintenance program.

The database maintenance program can also be used to enter and associate remarks to special addresses or locations. Using this feature, when an incident occurs at that location, the verification process appends these remarks, such as field unit warnings, to the Event Information dialog Remarks field.

When an LOI search has been completed, a line of comments is added to the Remarks field. After the operator reads the returned LOI information, another line is added to the Remarks field with the date, time, and terminal ID.

LOI searches may also be configured to require manual initiation. LOI searches may be initiated without creating an event.

1.3.4.1.4 Suspect/Vehicle Description Information

Suspect and vehicle information are recorded in the Supplemental Information dialog. By entering specific person and vehicle information into this form, this data becomes available during searches of past events involving that person or vehicle.

1.3.4.1.5 Placing/Resuming Calls on Hold

I/CAD provides the flexibility to take partial information on a low-priority call, set the call aside, and answer a higher priority call. Once a call is "stacked" or put on hold, the calltaker can complete the higher priority call. Stacked calls have a predefined time limit and are monitored by I/CAD. If a call is on hold beyond this time limit, the operator is alerted. Calltakers can stack more than one call and recall any calls in any order. All information previously taken on the call is saved, unless the call is abandoned, in which case no information is to be recorded. Each stacked call is date- and time-stamped for future reference and analysis.

1.3.4.2 Dispatching Functionality

The following sections cover operations for tracking pending and assigned events and for monitoring unit status. These procedures are the same for Police, Fire, and EMS events.

1.3.4.2.1 Unit Assignment

I/CAD allows different ways for dispatchers to select units for assignment. For example, the dispatcher can manually assign a unit to an event by issuing the "Dispatch Unit" command, then use the graphical interface, the command line, or hot keys to designate the unit. Each of these methods speeds the process of dispatching units, once the event is selected. In addition, a unit can be dispatched by selecting the unit ID from the Unit/Event Status window or by entering the unit ID. Multiple units can be assigned to a single event by dispatching each unit separately or by invoking a separate "Assist" command. I/Dispatcher also provides the capability to drag and drop to dispatch or dispatch assign units and events.

Multiple events can also be assigned to the same unit, and the system can be configured to show all of the assignments for that unit in the Unit/Event Status window, or it can be configured to return all but the first incident to the Pending Events window. If returned to the Pending Events window, the events are coded as assigned to a unit, and the unit ID number is listed with the event.

1.3.4.2.2 Unit Reassignment

Units can also be exchanged, switching unit status, as well as assignments; or units can be pre-empted from one assignment and given another. A change of original assignment can be performed in several ways, such as returning the event to the Pending Events window and holding it for the original unit, returning the event to the window and reassigning it to the next available unit, or immediately reassigning the event to another unit.

1.3.4.2.3 Unit Recommendation

A unit can be assigned to an event by unit recommendation that considers several factors, such as the geographical area, as well as information contained in various database tables, to determine which unit(s) a dispatcher should use.

The Event Type table determines which agency or agencies should respond to a given event type code, and each event type code is tied to an associated response list record in the Response List table. I/CAD uses the response lists to determine unit response based on the event type code.

In addition to the information retrieved from the Event Type and the Response List tables, I/CAD retrieves information from the Deployment Plan table concerning the proper station order or specific unit order associated with a given geographical area. The Deployment Plan table maintains records that indicate when a given event type for a specific geographical area should use a response list recommendation different from the normal response list. This feature accommodates the requirements of special recommendations, such as nursing homes, hospitals, schools, and churches.

All system-configured conditions are taken into account when units are automatically recommended for response. The proper recommendation, based on conditions, is displayed in the Recommend Units form that further lists the units in the recommended order of response. The list highlights one, or a number of units, as system recommendations, and selecting a single button automatically dispatches all highlighted units. If a unit is currently assigned to an event with a lower priority, yet fits the recommendation parameters, it appears as un-highlighted on the list. To dispatch an unavailable unit, the dispatcher must highlight the unit prior to accepting the Recommend Units form. Of course, regardless of the recommendation, dispatchers can always send a specifically chosen unit.

In addition to a list of units, the Recommend Unit dialog provides Task Force assignment, special instructions, information about the area or the location, and procedures to follow for the particular event type.

I/Dispatcher provides several methods for dispatchers to recommend units, but beat and station order are the standards for most responses. When required, however, I/Dispatcher can also make recommendations by the closest unit (real travel distance, not "as the crow flies") or by special equipment needs.

1.3.4.2.4 Time Stamping in Dispatching

Any unit assigned through manual dispatch, unit recommendation, or a unit status change is date- and time-stamped, with the terminal ID appended. All unit status changes are recorded in the unit history record, and a full audit trail can be given on the activities of a unit while on duty.

1.3.4.2.5 Queue Timers

By default, calls for service are sorted in the Pending Events window by priority and each event is monitored by the queue timer. In this way, if three priority-one calls exist simultaneously, they will be listed together in the Pending Events window, with the "oldest" call listed first.

Based on the event type, call priority, and a predefined time limit, notification timers may be established and loaded into the system. When an event remains in pending status longer than the time allowed for that event type and priority, a notation appears in the alarm column, an alarm sounds, and an indicator button lights. In this manner, operators are reminded to assign a call or to transfer a call to another dispatch group, preventing any call from being neglected without the operator being aware of it. Timer notifications are also displayed to supervisors monitoring the dispatch group.

When an event times out, the time-out information is recorded and can be derived in a management report.

1.3.4.2.6 Complaint Disposition

When the first unit clears an event, a disposition can be assigned. Based on the event type, the disposition may be required or optional. If a disposition is required, I/CAD prompts the operator to enter a code. Valid disposition codes are predefined in the database and are displayed to dispatchers.

1.3.4.2.7 Complaints/Events Generated from the Street

The "Field Event" command creates events initiated by field units; the operator is then prompted to enter the event type, unit, location, and remarks. After accepting this information, the unit is automatically assigned to the event with the status of arrived. The unit history record shows a 1-second, time-stamp delay between the dispatch, enroute, and arrived status codes to preserve the proper order of unit history records if they are subsequently retrieved from the database.

Four other options can be used with the "Field Event" command—Traffic Stop, Traffic Pursuit, Subject Stop, and Subject Pursuit. When an operator selects any of these options, the event type field is populated based on the predefined code for each option. Selecting any of these options automatically assigns the relevant unit to the event and places the unit in the arrived status.

1.3.4.2.8 Vehicle Stops

Vehicle stops are handled using the Traffic Stop option of the "Field Event" command, allowing the operator to specify the unit that stopped the vehicle and enter the vehicle's location, license number, state, license year, and license type. Additional remarks can also be added. The vehicle information is automatically entered into the vehicle supplemental information table. By accepting this information, the unit is immediately assigned to the traffic stop and marked as arrived at the location. Once the traffic stop event is created, I/CAD can perform a Vehicle of Interest search based on the license number. If previous events are found based on that same license number, the dispatcher will be notified and allowed to review the historical information.

1.3.4.3 Dispatcher Supervisory and Reporting Capabilities

By assigning supervisory privileges to special log on names and passwords, supervisors can monitor on-going event activity from any workstation that runs the I/Dispatcher software module, and the fact that an event is being monitored is transparent to dispatchers and calltakers.

In addition, supervisory privileges can be granted that allow managers to analyze center activity over time by accessing records stored in the system's Oracle or Microsoft SQL database. The report module in the I/CAD System includes a set of standard reports that can be used for tracking, maintenance, research analysis, and planning activities. These reports provide

information on events, calls for service, unit assignments, and operator workload. The selection criteria for the reports and report initiation are simplified for the user through the use of preformatted forms. Even though the reports are designed to be executed interactively, they may be set up for batch execution at predefined times. Others may be written on site with tools provided with the system. Standard reports are requested using dialogs that resemble other dialogs used in the database, map maintenance, and in I/CAD. The following is a brief description of the 19 standard delivered I/CAD reports:

Event Snapshot—provides a snapshot of pending events, unit status, and a chronology of events, comments, and unit activity over a specified timeframe

Events by Type—calculate the number and type of events, per agency, that have been processed within a user-specified timeframe. The data is ordered by event type code within the agency

Events by Source and Priority—provides the number of incidents by agency, priority, and call source that have occurred within a user-specified timeframe

Events by Source, Day of Week, and Hour of Day—compile a listing of events by the day of the week and hour of the day in which the events occurred, according to the agency and call source. The reporting timeframe can be user-defined

- **Event Handling Time**—lists the number and type of events, per agency, computing the average and maximum times used to address the events. The reporting timeframe can be user-defined
- **Event Register**—catalogs detailed information, by agency, regarding events and provides the event type, location, event receipt time, beat, emergency service zone, and the dispatch group that addressed the event. Unit information is also delineated, including the units assigned to each event, unit dispatch time, unit arrival time, time the unit became available, and the personnel staffing the units
- **Event Chronology**—A chronological listing of all activities associated with an event
- **Calls for Service**—lists, by agency, the number of calls for service by day of week for a user-specified timeframe
- **Calls per Hour of Day**—provides, by agency, an hourly breakout of the number of calls for service received over a user-specified timeframe

- **Address Validation**—provides information on addresses that are unverified as part of dispatching operations. This report can then be used as a tool to update the geofile and map data
- **Average Response Time per Hour of Day**—computes, by agency and hour of day, a summary of the number of calls received and the average length of time that was required to respond. The reporting timeframe can be user-defined
- **Logged on Duty Time**—calculates the amount of time operators have been logged onto the I/CAD System. The information is reported by agency, operator name, and day of the week within a user-specified timeframe
- **Logged on Duty Position**—provides information on operator position assignments over a user-specified period of time. The information is reported by operator, terminal identification, and day of the week assignments
- **Unit Workload**—lists, by agency, each unit and the number of events that unit has responded to over a user-specified timeframe
- **Units' Time in Service**—chronicles, by agency, the logged on time, time spent on assignment, and the time spent out of service for each unit. The reporting timeframe can be user-defined
- **Unit History**—a chronological listing of a unit or units activity over a user-specified timeframe
- **Operator/Officer History**—provides a historical listing of the events that specific operators/officers have handled within a user-specified timeframe. The information is listed by operator/officer ID and contains event data, such as the event number, date and time of event, and any remarks associated with the event
- **Wrecker Rotation**—provides an index of wrecker companies that are available for service calls. The report lists the companies in the order in which they should be called by placing the wrecker company with the oldest service call date at the top of the list
- **Wrecker Information**—itemizes wrecker company services. Information provided includes company name, equipment, telephone number, date last used, and availability

The main menu used for the reporting applet is illustrated below:

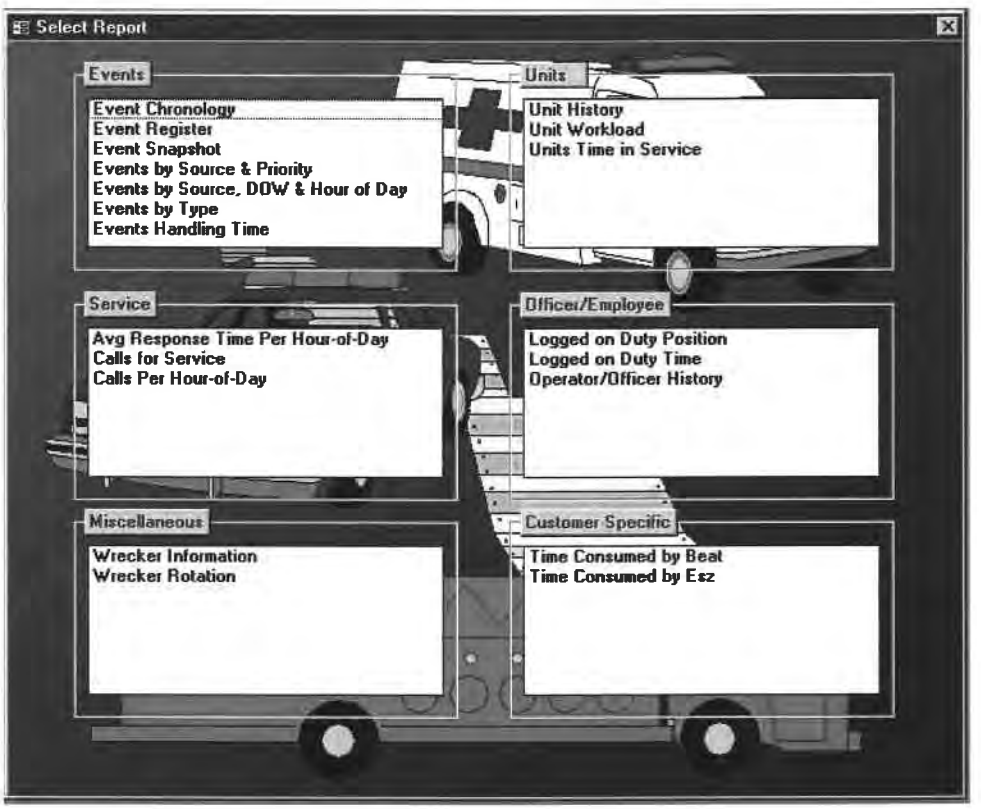


Figure 65 Select Report Menu

After selecting the desired report, an associated form appears for the operator to use in supplying additional information that specifically defines the report. The following dialog illustrates the information requested for the "Calls Per Hour" report.

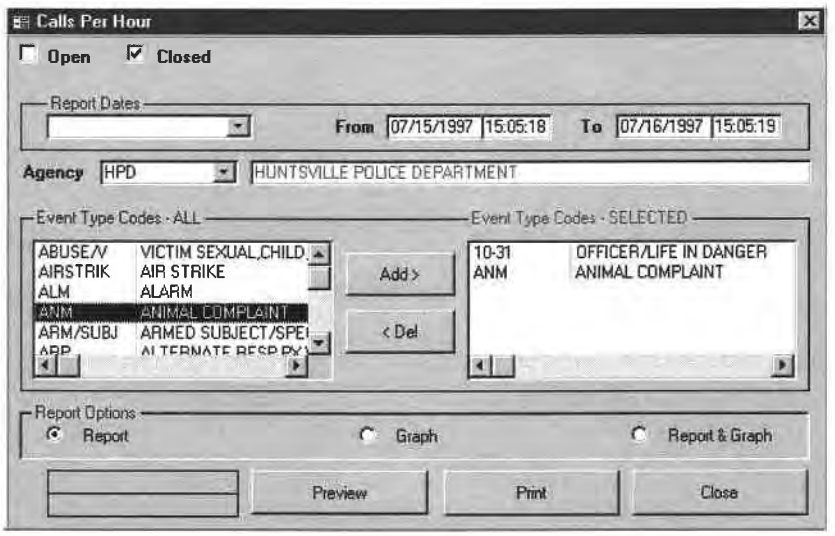


Figure 66 Calls Per Hour

In addition to the standard reporting utility provided with I/Dispatcher, IPS recommends the IPS/Management Analysis and Reporting System to enhance reporting and provide trend and statistical analyses capabilities which provides tools for creating deployment plans that consider the number of available resources by time of day or by the day of the week.

Query results can be returned as printed lists; in spreadsheet format; displayed on the same map seen by calltakers or dispatchers; or can be output as graphs, bar charts, or histograms. Selected datasets can be manipulated by many functions, including filter, sort, trend analyses, univariate or multivariate analyses, and dynamic analyses. Following diagram is an example:

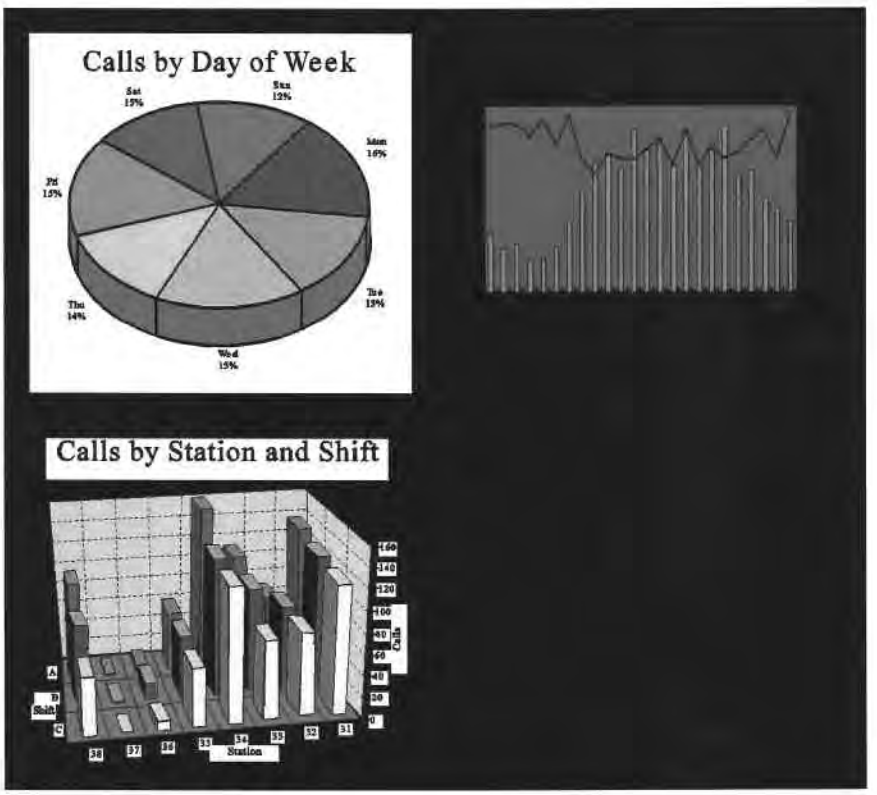


Figure 67 Query Results Examples

1.3.5 Video Conference System

The video conference system of Shandong environmental safety and emergency platform relies on the national governmental information network to meet the needs of emergency command for the various departmental levels - provincial, municipal and district levels. According to different needs of the different departments, there may be more video conference terminals set up for emergency command as the following figure:

Here is the figure for video conference system:

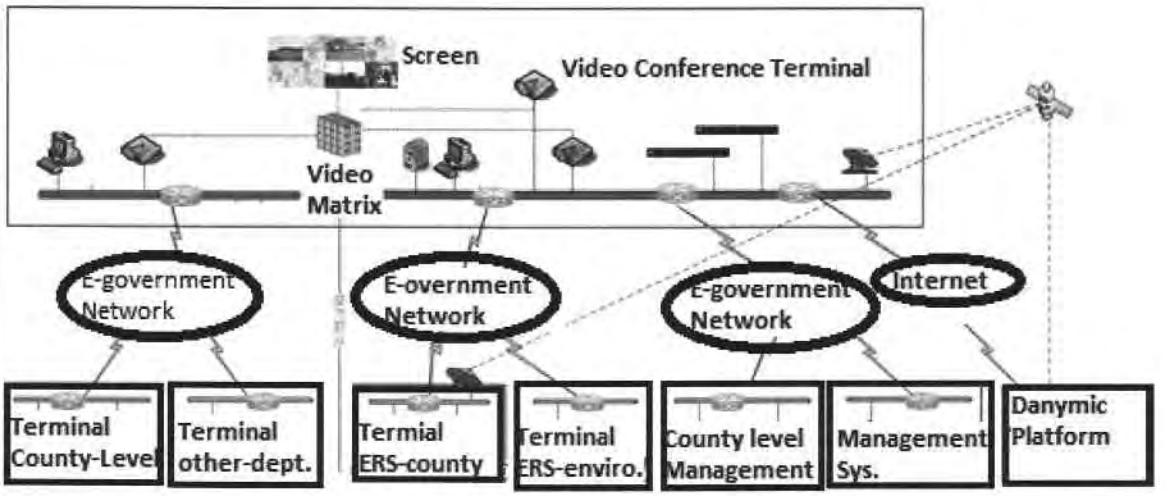


Figure 68 Video Conference Terminal

The main component of the video conference is set up in the emergency command hall equipped with MCU, video conference server, and conference terminals. The MCU is designed at telecom-level, and the key components of each MCU are designed with the capability of switching to fully guarantee the safety and reliability of video conferencing systems. The MCU can access 64 channels and each of them supporting 2M. The video conferencing terminal and MCU are independently used in real-time operations, which guarantees the safety of floor terminal by using a sophisticated firewall and NAT crossing capability. The terminal control is in the router with a built-in codec, which also simplifies the network.

The municipal level video conference system uses a unified IP address for connecting with the provincial environmental security emergency response platform. The network architecture of video conference system is as follows:

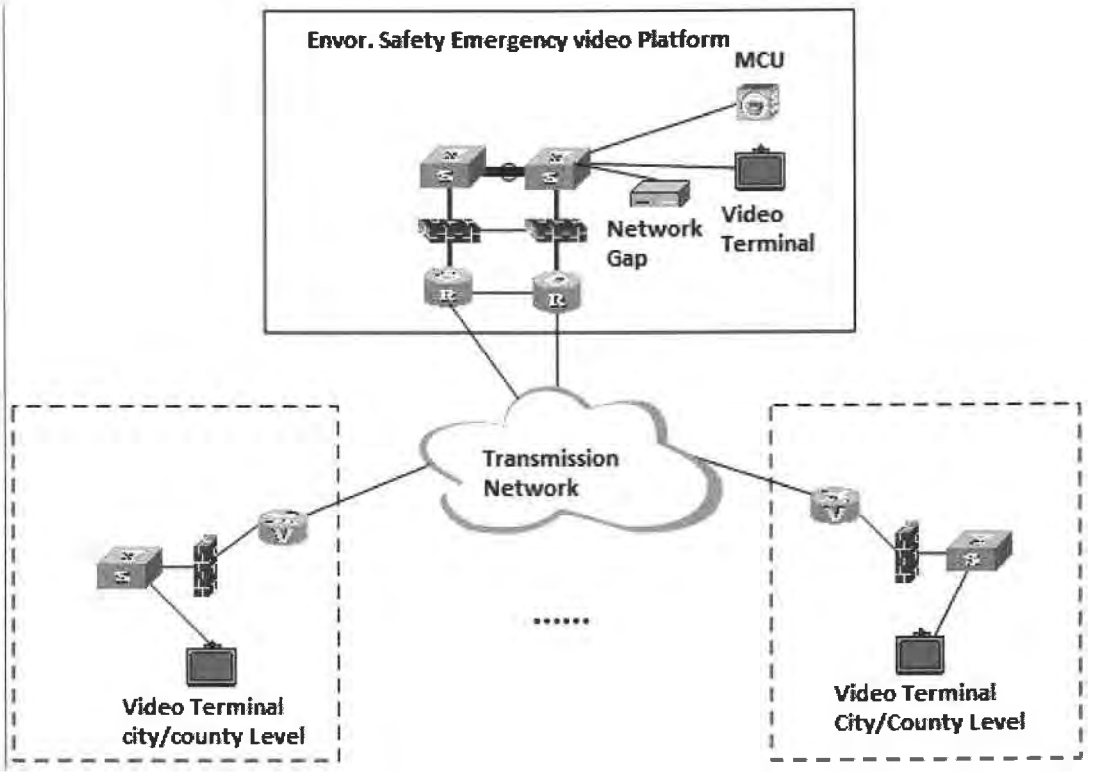


Figure 69 Safety Emergency Video Platform

The system can also organize several group conferences without interference from the other conferences. For example, when two emergency incidents happen at the same time, the platform will

allow the command center to organize the video conferences separately in the command hall and duty room at the same time if need be. The municipal emergency response platform is configured with video conferencing terminals, while conditional cities are responsible for configuring their own MCU or video conference servers. The video conference system of municipal emergency platform is built based on H.323 standard, which can be compatible with H.320 (V4) to support IP video conference in different segments through trans-national Internet, e-government network, or satellite broadband. The video conference system can be connected with the on-site mobile emergency platforms. Different mobile emergency response platforms can be connected with the video conference system by desktop video conference software or video conference terminals which are able to support H.323 (V4) and also be compatible with H.264 via the Internet or satellite broadband Internet access.

1.3.5.1 Functional Description

1.3.5.1.1 Multi-point Conferencing Capabilities

1) **The caller convenes meetings**: Calling round up technology can directly define/convene a meeting between different terminals and different sessions. Through this function, there can be multiple terminal sessions at the same time with no need for MCU managers to manually operate them, which greatly simplifies the use of video conferencing system.
2) **Web order to convene meetings**: Configuring web servers to make appointments and convene meetings via IE browser.
3) **Meetings convened by the administrator of the system**: To meet the needs of the administrators who might be accustomed to traditional video conference, the system allows users to convene meetings by administrator in the business management center.
4) **Special service number to join the Conference**: Setting up special service numbers for anyone to access to the conference; the one is supposed to enter the meeting by dialing the service number.
5) **Group meetings:** Hold group video conferences at the same time without multiple conferences affecting each other.

1.3.5.1.2 Conference System Management

Conference system management is completed by GK, RMCC and MCU.

1) **GK** - GK's primary function is node management which refers to the terminal, MCU and gateway. Node management includes address resolution, regional management, access control, registration management, call management, bandwidth management and regional calls

management. In addition, GK can also forward calling round up information, offer address resolution, service resolution and support point to point calls.

GK's main features are as follows:

- **H.323 Signal Processing** -
  H.323 signal processing management includes node registration, address resolution, call management, call routing, network segments register restriction, network bandwidth restriction, group services, call transfers, etc.
- **Node Registration Management** -
  Upon receipt of a registration request, GK will authenticate the node's registration status by the different methods including: fixed IP address authentication, H323ID name authentication, password authentication and radius authentication. After authentication, GK will return the registration confirmation message to the node.
- **Address Resolution** -
  When there's a call between nodes, GK will automatically parse the IP address and return it to the calling node without needing to enter the IP address as long as the input is called the node number or alias.
- **Call Management** -
  Call management can determine whether the node is allowed to call or if any nodes call should be hung up according to the node's bandwidth and property.
- **Segment Register Restriction** -
  GK provides similar segment register restrictions featuring of blacklists and white lists which allow users to selectively allow or disallow certain network segment users to use video communications
- **Group Services** -
  GK provides a value-added service. When a node calls a number, the GK network control center will find an available node in the service community and send the address to the application cluster service node and establish the call.

2) **RMCC** - RMCC can accomplish resources scheduling, conference control and venue management of video conference via relative network communication. RMCC's main features are as following:

- **Equipment & Resources Management and Dispatching** -
  RMCC can perform unified management for the devices of the video conference exchange platform, including E1, V.35, IP, ISDN, multi-screen and rate adaptor. RMCC can synchronize video communication and data conferences by scheduling the data services platform business. In general, a video conferencing network typically contains

multiple MCUs. RMCC can provide integrated management to the MCU. Based on resource usage, RMCC can automatically select the corresponding MCU and hold a cascade conference, so that the scheduling can be automatic.

- **Conference Management -**

  RMCC's Conference Management, includes predefined conference management and subscribed conference management. Pre-defined conference management contains adding, modifying, deleting and query for meetings. Adding, modifying and deleting can be provided through RMCC's own interface. It can also be operated on predefined servers. Predefined content includes the venue, start time and ending time, bandwidth, screen, data support etc. RMCC's subscribed conference management including conference scheduling and cancelling scheduled conference. Conference scheduling needs to authenticated the account while cancelling scheduled conference requires authentication through the original scheduling account. Through resource management, RMCC ensures that a single meeting on the MCU does not exceed the ceiling.

- **Service Area Management -**
  According to the users' distribution, existing network layout, and the video conference network; it can be broken down to several areas for service area management.

- **Conference Control -**
  Conference control RMCC for the entire video conferencing online meeting is for unified monitoring and management. Controls include adding at the meeting venue of the conference venue, adding/deleting the meeting, sound adjustment, picture setting adjustment, volume control, mute control, time delay adjustment, etc. All conference controls are operated during the conference, without having to disconnect the session.

- **Calling Setting Support -**
  RMCC supports conference calling setting, by which you can call out the set function terminal by different methods to convene a meeting having the information passing to the RMCC. The RMCC, according to the actual situation, will dispatch the convening of the conference. By using the business video conference, a conference call can be set up to convene video conferences as easy as a call to the user.

3) **MCU Control** - The main function of MCU control parameter configuration and diagnosis is the operation backstage for MCU. The MCU can be managed locally with the MCU parameter configuration including diagnosis and logging of queries, complete venue and conference

management, and activity (activity refers to the meeting being held in the conference) such as the controlling such as video communication etc. Double Feature Video communications often needs to send video signals of different types to the video terminal to remote venues. By having the double feature, it can easily transfer 2-3 images to remote venues which will be displayed through a terminal interface as video output.

4) **Multiple-screen Conferencing Features** - For a true representation of the conference experience, the system provides a powerful multi-screen function. When selecting the multi-screen display mode after the conference, it will greatly enhance the performance effects. During the multiple- screen meeting, you can also enable the voice-activated mode. The system supports multi-screen screens, which means a large screen multi-screen display mode will be displayed in real-time.

5) **Double-vision Transmission** - The video conference system is able to transmit double channel camera images at real-time which greatly enhances the tele-presence effect of the video communication.

6) **Subtitle Function** - The video conference system has built-in subtitle functions in the terminal, which can be used in the meetings such as important tips in situations with notices of meetings, welcoming, etc. By using this method, if the venue can be onsite or edited well in advance, the conference can be accessed by scrolling or sent to other venues in real-time.

7) **Protocol, and Rate Adaptation Function** - The video conferencing exchange platform provides different protocols and rate adaptation. It also allows different rates in the same conference with the rate range from 128Kbps to 1920Kbps. The video conferencing exchange platform can achieve the image codec protocol adaptation of the H.261, H.263, H.263+, H.264 and can support audio codec protocol adaptation of G.711, G.722, G.722.1, G.728.

8) **Monitoring Features** - The video conference system supports an intermediate device with a processor to transfer images from the MCU to flat-panel displays for breakout image monitoring.

1.4 Emergency Management and Decision Support System

1.4.1 Design for Emergency Monitoring and Controlling

By using Shandong e-Government network and a VPN network connection, the development of the information management system for environmental emergency management and response for the provincial, municipal, county and industrial levels can be established as a dynamic information management system providing a monitoring, pre-alarm, alarm, management and response system for provincial environmental incidents or events for river, air, surface water, urban sewage treatment plants, and diffused hazardous chemical materials and heavy metals. The system will offer information support for all of the pollution monitoring departments. The objectives of system are as follows:

- To achieve full dynamic management of significant pollution incidents and events.
- To realize dynamic management of sewage treatment plants, weather station, surface water monitoring and river monitoring stations
- To provide an information management system for environmental emergency responders
- To realize comprehensive management of geographic information
- To realize the technology control of remote monitoring
- To implement information sharing and operational collaboration of internal and external systems.

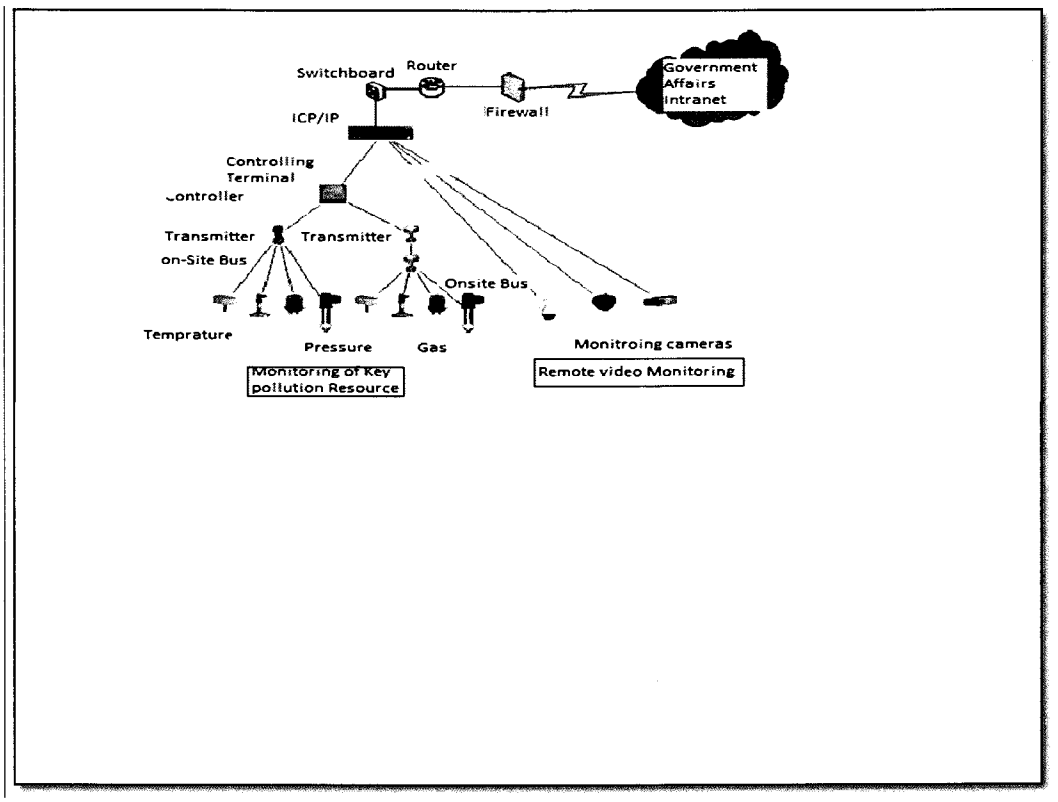


Figure 70 Emergency Monitoring Network

1.4.2 Access Design of Significant Pollution and Monitoring Station

The access design includes two parts which are sensor data access system and video access system. Both of these systems are used in the major pollution resource monitoring, surface water monitoring, air and hazardous substance monitoring, cross domain river monitoring and sewage treatment plant monitoring. The specific data access modes are divided into different modes depending on the different monitoring situations as follows:

- **Equipment Access to Data Center** - The equipment access to data center includes network switches, routers, transmission equipment, network management equipment, servers and data processing middleware which will be built in their own dedicated computer rooms or telecom IDC engine rooms.

- **Monitoring Station Access to Sewage Treatment Plant, Weather Station and Surface Water** - For the single project of urban sewage treatment plant, weather monitoring station and surface water monitoring station, the sensor data or video data of a certain area will be accessed to the data center through transmission network of a deployed internet gateway.
- **Major Pollution Resource - 20 Significant Polluted Enterprise Access** - For major pollution resource and significant polluted enterprise, the system adopts converging access to directly access to enterprise management platform to capture data from each enterprise then send to data center through transmission network.

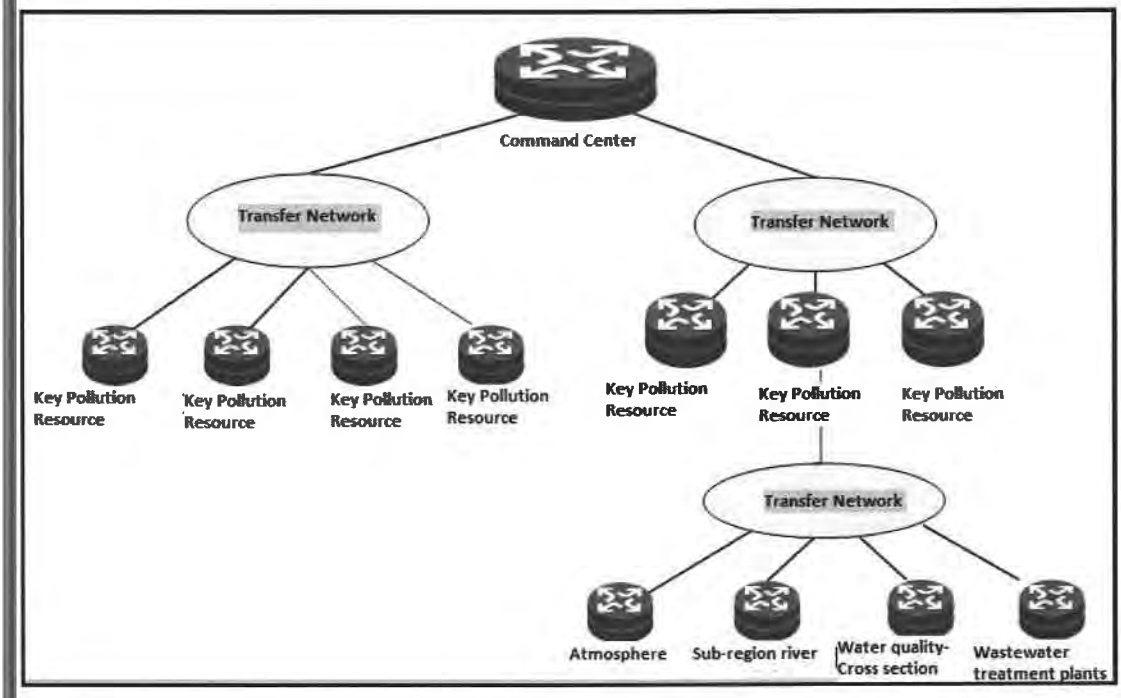


Figure 71 Access System Network Topology

1.4.3 Transmission Network Design

1.4.3.1 Transmission Network Design

The transmission network will use the e-government special network and public communication network. The special network includes fiber-optic network, microwave network and cluster network while the public network includes public wired network (such as PSTN, XDSL, SDH), public mobile network (such as GSM, CDMA and 3G).

1.4.3.2 Transmission Bandwidth Design

Different monitoring scenarios create different video effects. For meeting the requirement of remote monitoring, the image resolution should be at least up to CIF format (352×288) and the video transmission bandwidth should be at least 384Kbps. To obtain a satisfied image quality, the video transmission bandwidth is recommended to be 512Kbps. For obtaining HD images, the image resolution should be at least up to D1 format (704×576), and the video transmission bandwidth should be at least 1.5 Mbps.

In actual running case, here are different video transmission bandwidth modes as following:

- 3-4Mbps---- image resolution of 1080P HD video transmission in real-time with the speed of 25 frames per second.
- 1-1.5Mbps---- image resolution of D1 video transmission in real-time with the speed of 25 frames per second.
- 512Kbps---- image resolution of CIF video image transmission

1.4.4 Network Gateway Design

The network gateway supports the connection of voltage signal, current signal, switches quantity signal, data acquisition and transmission of RS-485 and TCP/IP protocols. The network gateway devices are designed for the intelligent management of key domains such as sewage treatment plants, cross domain river - multiple live image acquisition access, data acquisition of simulation data, real-time data access and remote video dispatching, which also supports monitoring application of the e-map and stream media delivery. The devices support the communication protocol of Modbus/TCP, ASCII, RTUs, DNP3, SNMP, PPP and HART with the function of main station query and store-and-forward and peer-to-peer communication. It also supports a variety of wired and wireless communication modes which can be expanded to data access, audio and video access, network access and translation modes. The devices implement the guide module for data backup and data restore with a large capacity of data recording space. With time stamps in the system, it can support recording by periodic time intervals and by triggered event. By achieving important data backup, it can prevent data loss caused by communication network failures.

1.4.4.1 Design of Sensor Data Access System

The data center is equipped with data collection and server security which deploys the functional modules of the database security and data collection to achieve data security management. For monitoring stations, the real-time digital signal can be accessed by the data server and data center directly from the system. For the significant pollution industrial and sewage treatment plants, sensor data will be connected to DCS database via data access server with the cooperation between security-isolated network gateway and internet gateway equipment. For air, surface water and river monitoring,

sensor data can be captured through direct docking to the monitoring platform and access to data center by data access servers.

1.4.4.2 Direct Access from Internet Gateway

The sensors deployed in monitoring stations can directly connect to the internet gateway through data cables, network cables or Wi-Fi while the sensor data will access the data center after the data collection and data coding via the internet gateway.

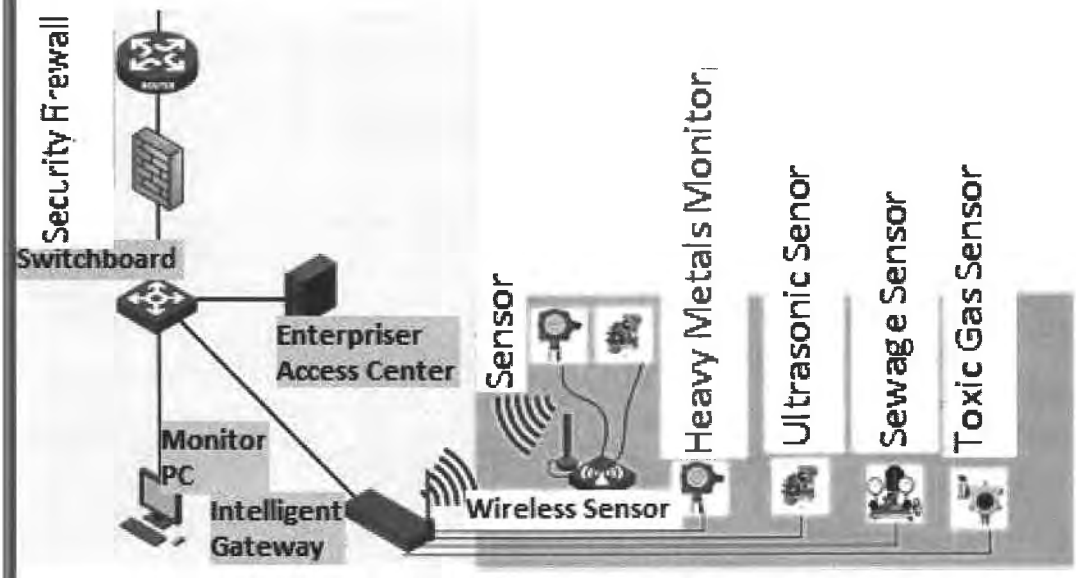


Figure 72 Internet Gateway Access Mode

1.4.4.3 Front-End Control Panel Access

The front-end control panel access applies to the monitoring of major facilities that produce significant pollution. These major polluters will be monitored and controlled by simulation or digital instrumentation. The front-end control panel can separate a channel of data to access to the internet gateway through a security fence and a protocol converter to upload the data to the data center.

1.4.4.4 DCS System Docking

This mode is suitable for weather monitoring and surface water monitoring. The sensor data converges to the central control room, and the whole process can be controlled through DCS system docking. By using security-isolated gateway to achieve security isolation, monitoring units can use data access

middleware software to capture sensor data by DCS system and send the data to the data center through data collection platform.

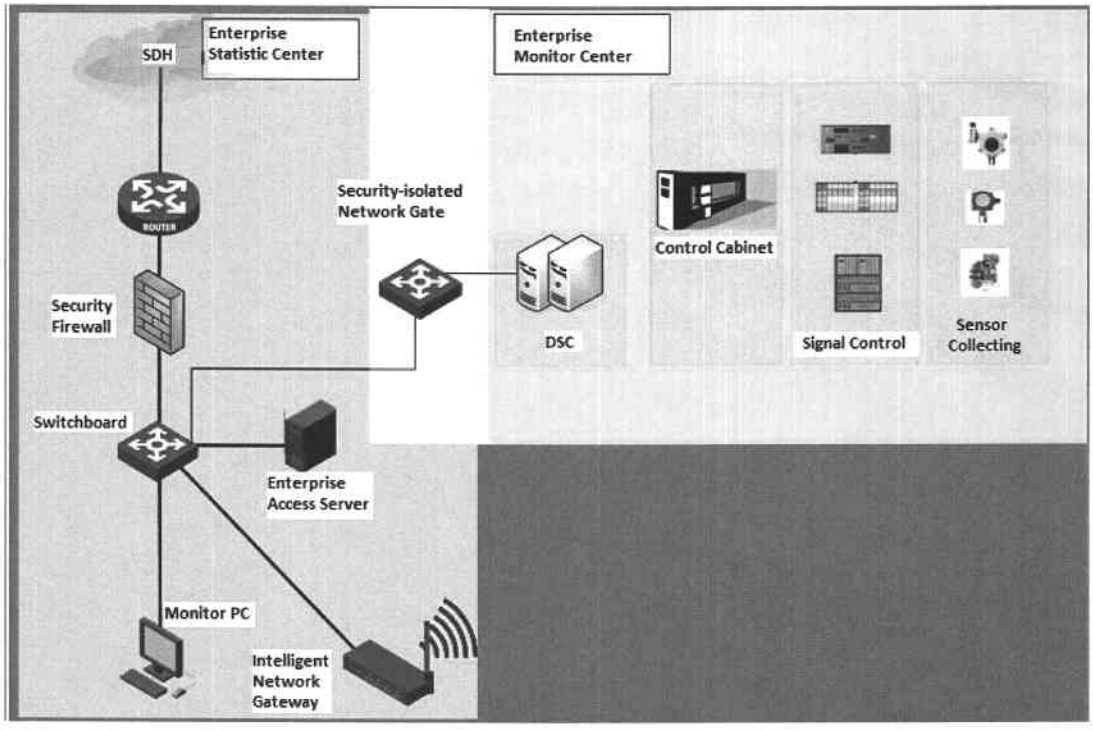


Figure 73 DCS System Docking Mode

1.4.4.5 Application Platform Access

Application platform access is suitable for major polluters and sewage treatment plants. Information of each subordinate polluter should be brought together to the head office platform with a data fusion system deployed in the server and data for each subordinate polluters will be sent to data center through a transmission network.

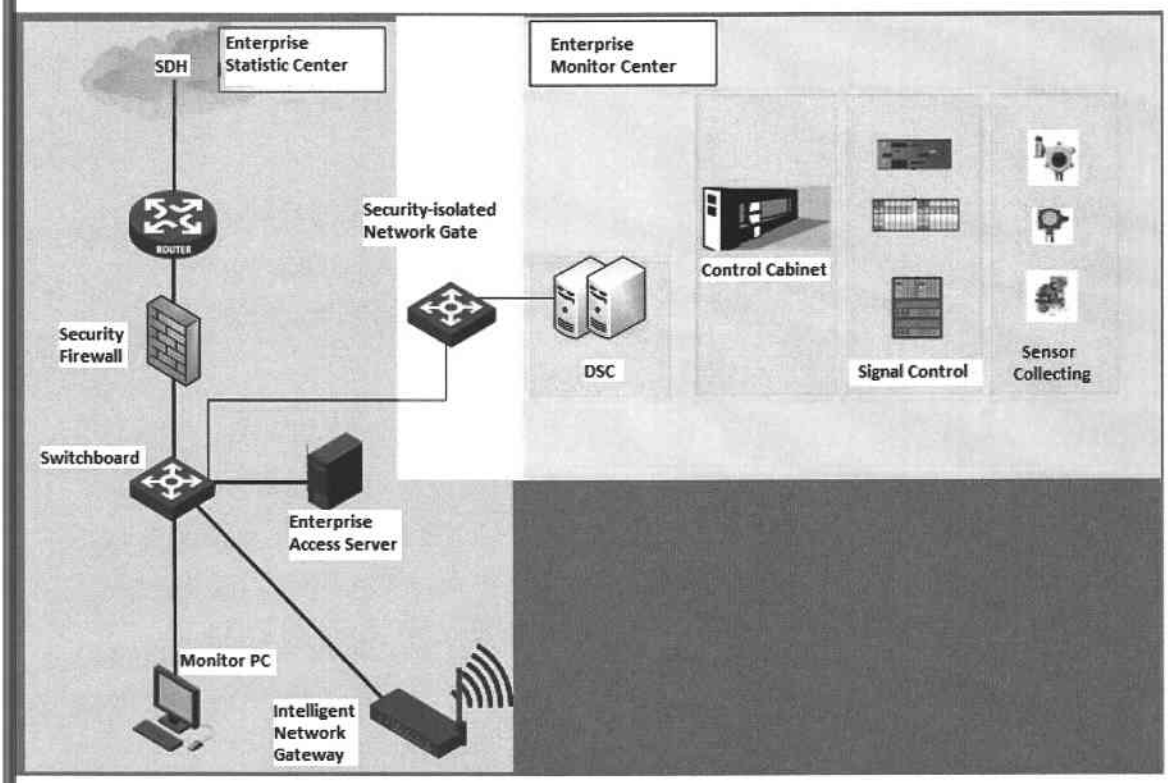


Figure 74 Application Platform Access Mode

1.4.4.6 Video and Image Data Access System

The video and image data access system is equipped with an image access server, image forward server, and an image storage-and-demand server to provide image receiving and sending. For group companies, all the monitoring images of each subordinate polluter will be collected into the management platform at the headquarters. An image consolidation and access server and an image forward server will be deployed in the headquarters to implement image access to the image system of command center through transmission network. For single industrial polluters and hazardous chemical polluters, the system will deploy 4-channel, 8-channel VGA driver and network video decoder to achieve the video access to the image center of the command center through the transmission network.

1.4.4.7 Video Dividing Access

The video dividing access uses the divider to divide a simulated signal channel and decode it into an image for accessing in the image system. This mode applies to middle and small size monitoring stations which may use a few channels of video data without an independent video management platform.

1.4.4.8 Image Storage Device Access

This mode can directly get real-time and historical video streams from the enterprise image storage devices through manufactures' SDK package which can transmit the real-time video data to up-level image system through enterprises' image management software. It applies to middle and small size monitor stations which have more channels of video data and adopts complicated simulation modules without using the independent image management platform.

1.4.4.9 Image Platform Access

This mode can directly get real-time and historical video streams from the enterprise image storage devices through manufactures' SDK package which can transmit the real-time video data at a priority level to an image system using enterprise image management software. This mode applies to major companies that will use more channels of video data and will adopt higher cost complicated simulation modules. It can capture real-time images and access SDK through the enterprise image platform.

1.4.4.10 Encode to Management Objects and Sensing Devices

To meet the demand of environmental monitoring, it is necessary to encode management objects and sensing devices. This scenario references uniformed standards and requirements to encode management objects and sensing devices. When monitoring data is packaged for transmission, it is necessary to encode the information such as sensor data, time stamp, and data source options according to certain encoding standards which will recognize the data based on the standards and requirements. The encoding standards and requirements refer to monitoring data, data units, data source and alarm classification.

1.5 Monitoring and Early Warning

1.5.1 Sensor Monitoring and Pre-warning

1.5.1.1 Sensor Monitoring

Efficient monitoring is the basic measure of the emergency information platform. There are two main categories of monitoring systems:

- Major pollution sources and major polluting sites - real-time monitoring system
- GPRS-based automotive locating and data collection system

➢ **Real- Time Monitoring System of Major Pollution Sources** - This system is available to monitor real-time video, cross-region video, and image auto storage systems which will allow departments to view the major pollution incidents and situations in the regions in real-time via the emergency decision support system.

➢ **Automatic GPRS-based Locating and Data Collection System –The** automatic GPS locating system can realize dynamic monitoring of dangerous chemical transportation vehicles and can also implement GIS mapping online and dynamic tracking to monitor vehicles in real-time through wireless video terminals.

1.5.1.2 Rule-based Early Warning – Rule Engine

The rule engine is mainly composed of 3 parts: rules base, inference engine and working memory, as below.

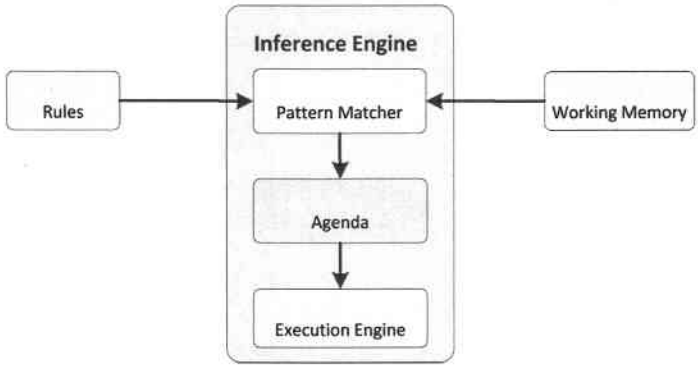


Figure 75 Components of Rules Engine

The rules engine of the subsystem has two attributes defined as follows:

1) The rules engine will be based on the configuration of rules and policies, which is meaningful and pertinent the individual end users.

2) The rules engine will provide filtering to exclude unintentional configuration.

The Rule engine has important characters as following:

- Priority
- Buffer
- Importance

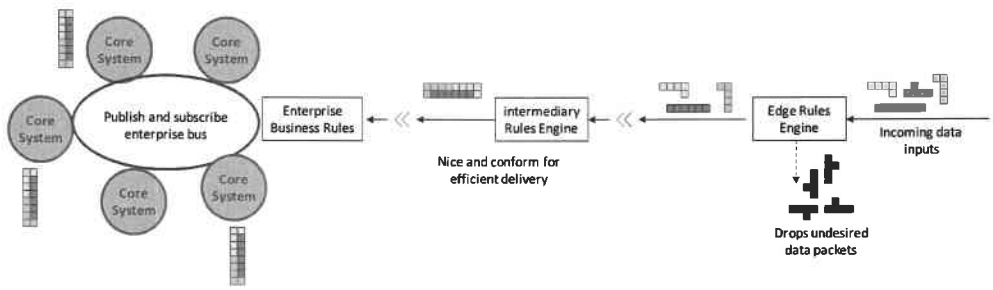


Figure 76 Conceptual Model of Simple Data Types

1.5.2 Communication between Current Monitoring Centers

The main duty of the provincial environmental monitoring center is to assure the environmental protection of the province and to be responsible for water quality monitoring, air quality monitoring, ecological monitoring, marine monitoring, geological related monitoring, radiation, vibration monitoring, noise monitoring, groundwater monitoring, acid rain monitoring, ozone depletion monitoring, greenhouse gas monitoring, biodiversity monitoring, and solid waste monitoring, etc. In addition, the provincial environmental monitoring center will include effective monitoring of major pollution sources and will provide emergency information.

it is recommended that we use EdgeFrontier as middleware for data transferring which has characters as following:

- Connection with various devices, systems and networks
- Connection with various types including TCP/IP, UDP, FTP, serial, HTTP, SNMP, WMI, message queue, email, web services

- Supports reading and writing files to the database
- Supports the connection systems to the interfaces (APIs) for the third-party and custom application programming

As the intermediary between multiple systems, devices, and networks, it supports protocol/ format encoding/decoding and data transferring.

- Provides immediate event handling which contains data filtering, correlation and anomaly detection, and event generation
- Provides a rules engine for event configuration and policy-based actions
- Provides an extensible application processing server and a computing system
- Provides a sophisticated network and management system
- Distributes data as network data, data files/database files which can be interfaced to enterprise system platforms
- Expands IP network and IT infrastructure to remote devices, systems, and network

By having the new emergency responding platform, the system will deployed using two sets of EdgeFrontier as middleware between the emergency responding platform and the environmental monitoring network center which will allow the connection for sending monitoring data, alarm data and video data, etc.

1.5.3 Emergency Message

1.5.3.1 The Message Bus

- **The Message Route** - the system can devise the route based on the message contents combining with rules engine and technical characteristics of ESB, shown as below.

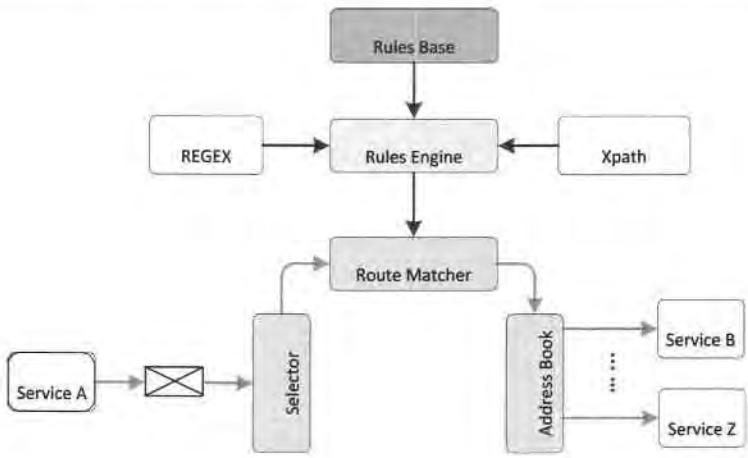


Figure 77 The Message Route

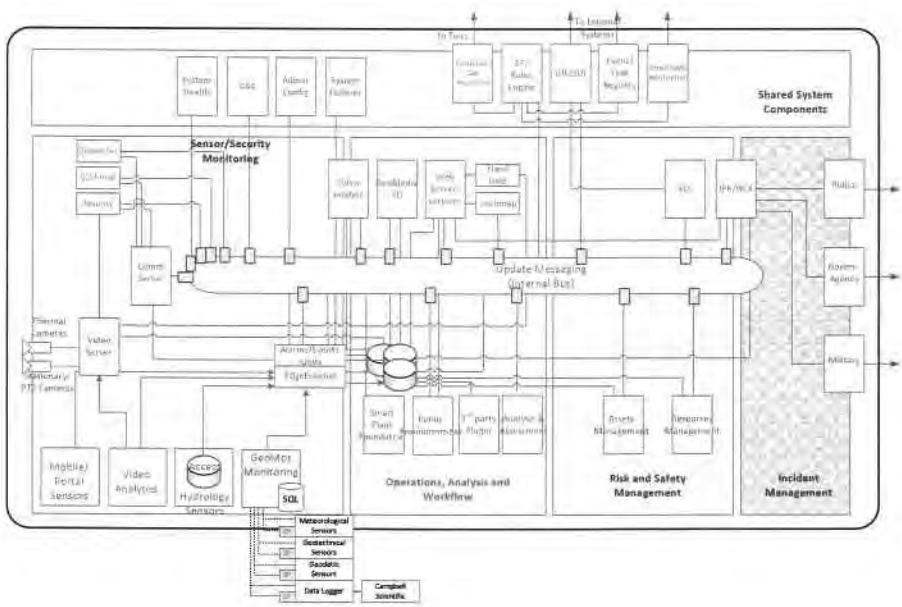


Figure 78 Architecture Design of Message Bus

- **The Architecture Design of Message Bus -** This system provides the internal bus to synchronize various types of messages and broadcasts. The messages types contain task, event, alarm and unit location, etc. All the software components of the solution can achieve message interconnection through the message bus. Also the message functions can be configured, and the components' properties can be changed by configuration of files. We call this configuration mode 'adapter'.

1.5.3.2 The Message Adapter

The blue rectangle in the message bus architecture design is message adapter. It is between the system components and internal message bus. It provides a message input and output of the filter condition which is configurable. This means by configuring the filter condition of the adapter that it can decide the message type and whether to monitor the components or not.

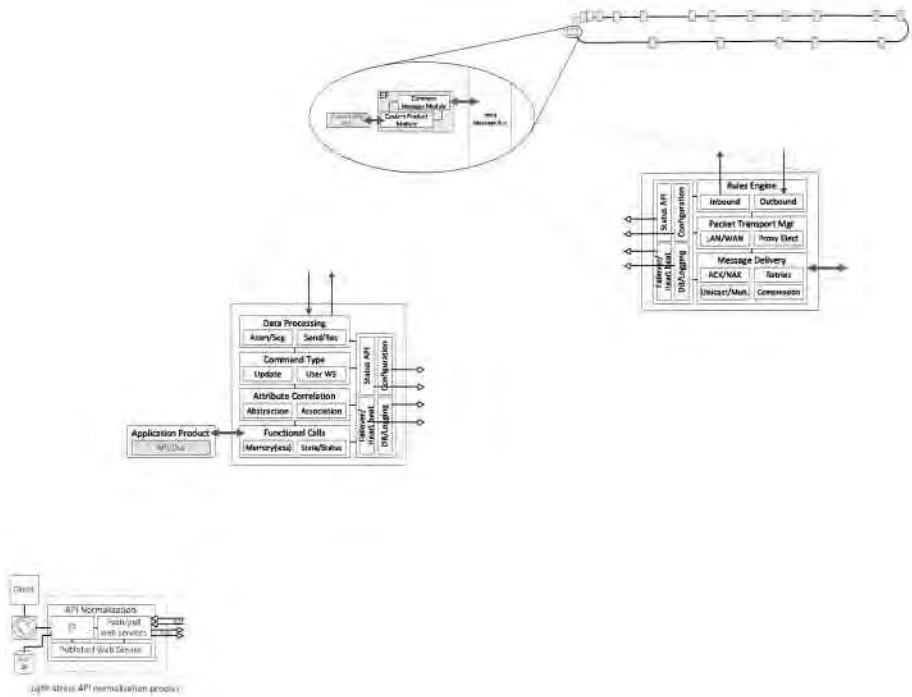


Figure 79 The Message Adapter

This figure describes the functional structure of the message adapter. Each adapter is made up of two basic modules which are connected internally to deliver and broadcast message. One of the modules is

responsible for the distribution of messages, and another is mainly used to provide a software interface. For the software which is not offered the program application interface, the adapter will provide a configurable interface which is made up of a message middleware and internet service. For example, software security has no application interface provided with the internal message format Sensor XML. For external software that sends messages in XML format responding to the software protocols, the adapter will inform security by storing and transferring the message in XML format when security is able to be recognized.

1.5.3.3 Message Data Formats

In SensorML, sensor and sensor components (probes, transmitters, actuators and filters) can be modeled as processors which can be connected in the process and can use the same model framework as other processors.

- Purposes of SensorML:
  1) Provides sensors and description of sensors for inventory management
  2) Provides support resources and processing information and sensor for observation
  3) Provides observation process and analysis
  4) Provides geographic location of measured data
  5) Provides characteristics (e.g. accuracy, threshold values, etc.)
  6) Provides clear description of available observations.

- Key SensorML data type:
  1) Boolean: true or false
  2) Category: enumeration value
  3) Text: string value
  4) Any Numerical: the constraint property is numeric value constraint
  5) Quantity and Quantity Range: Quantity is decimal value; Quantity Range is range for maximum value and the minimum value
  6) Count and Count Range: counted shaping values, Count Range is for the minimum and maximum range
  7) Time and Time Range
  8) Union: types, can be any combination of values, scalars and scope

1.5.4 Video Monitoring System

The video monitoring system will allow connection to different levels of environmental departments together with the following concerns:

- Transmission quality—on the premise of ensuring low delay of video transmission to guarantee the transmission quality
- Reasonable cost
- High reliability
- Expansibility

1.5.4.1 Video Monitoring System of County Level

In order to ensure the network security, each company is responsible for accessing the major source video information to the environmental departments' server which supports firewall, packet filtering and VLAN.

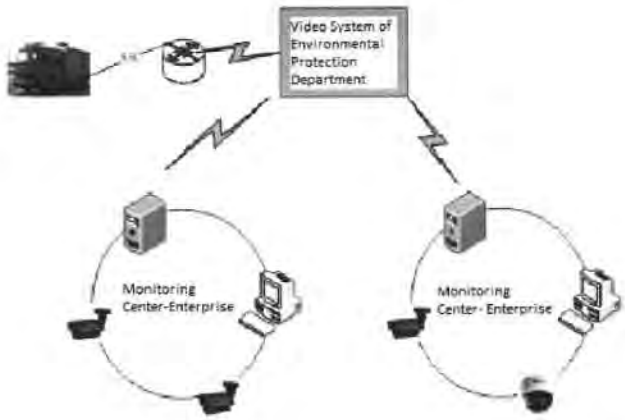


Figure 80 Sub-video Monitoring System of County Level

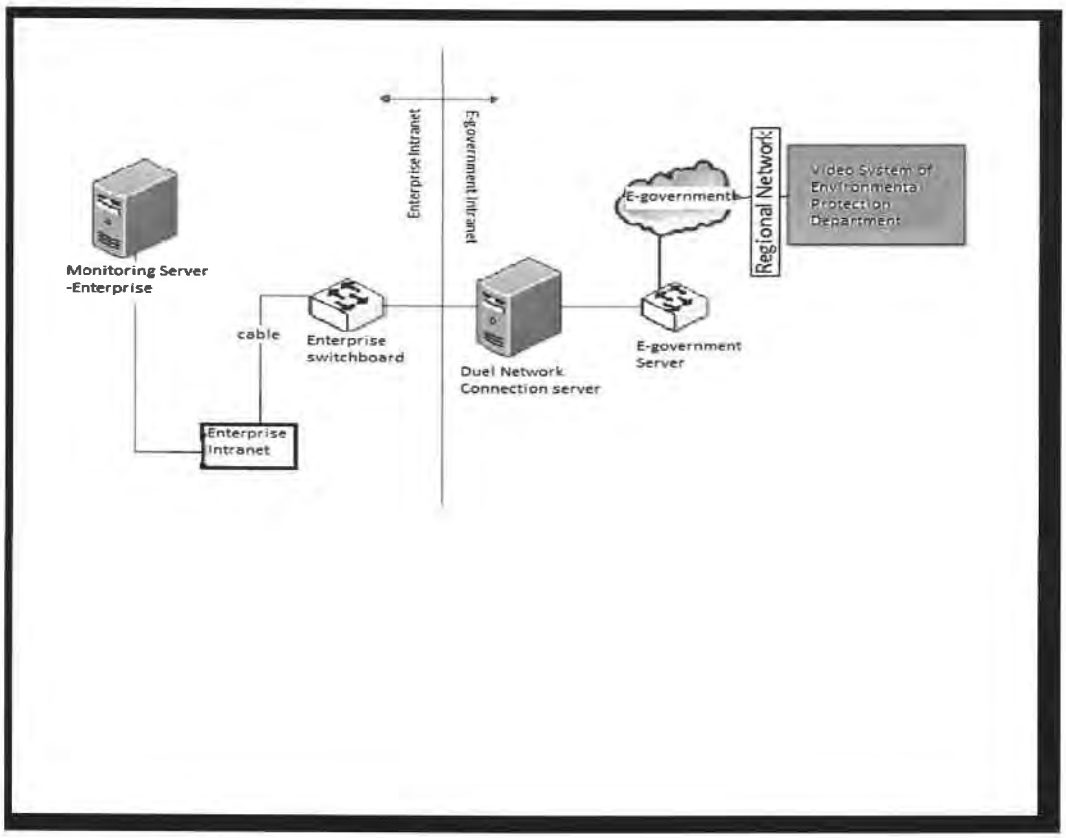


Figure 81 Network Design of the County Level Environmental Monitoring System

In order to ensure the isolation of the enterprise intranet and main network, this system uses two network interface servers and internal NICs which will allow one card to connect the switches between different enterprise system while the external NIC allows the connection between the enterprise systems and the main network.

For sending the video to the clients, either the single or multi-transfer technology works but it should take into account the local network bandwidth. For the highest priority cameras located at key infrastructure locations, there is a configuration to achieve the two video streams: one is of low resolution and the other one is of higher resolution. The lower resolution videos can be used for daily operation monitoring which can help to reduce the network load while the higher resolution video stream can be used to assess or recognize objects that need more attention.

1.5.4.2 Video Monitoring System of Municipal Level

Compared with the sub-monitoring systems at the county level, the municipal system is set up with a video sever with a local camera connected to it. The clients can access to the videos via the video servers. In addition, the municipal level monitoring system will allow the clients to access to the videos of lower levels. This method depends on the usage of the bandwidth network and can be achieved in two ways:

- The first way is to let the county level monitoring system to send multi-wave video stream to the clients of municipal levels, which needs a network design of the county level system or adopts NAT technology. Also, for supporting the multi-wave video streams, the system needs the configuration for connection between clients and camera.
- Alternatively, municipal levels monitoring centers can configure subagents for clients to access. The subagents are like a subsystem in which clients can access the county level clients on the municipal level camera system.

1.5.4.3 Provincial Environmental Protection Monitoring Center

This system is integrated with the subsystem of county level and municipal level which can transmit the video information to provincial environmental emergency responding center and command hall through the external network. Meanwhile, in accordance with standards, the enterprise system should provide the first information of the major pollution source for comprehensive analysis and decision support.

This system perfectly integrates the monitoring system and the video monitoring system which uses the monitoring network and the infrastructure to achieve collaboration, search, and display of the information and analysis which can show the dynamic monitoring results to the decision makers.

The functions of this system are: video monitoring integration, vehicle location and navigation, path analysis, integrated sensors, integrated alarm monitoring, vector image map display, GIS information research, etc.

Figure 82 Emergency Detection and Control System Interface

1.5.5 Decision Support System

See chapters on decision support system of the risk management module.

1.5.6 Emergency Duty

As normalized emergency duty includes address book management, number index, phone management, message management, fax management, conference management, event management, document management, duty dairy and task reminding, etc.

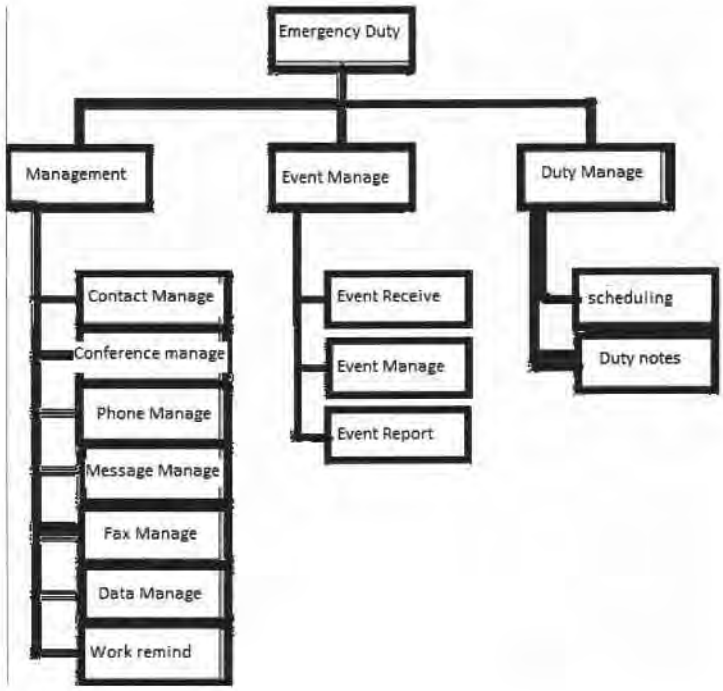


Figure 83 Emergency Duty Block Diagram

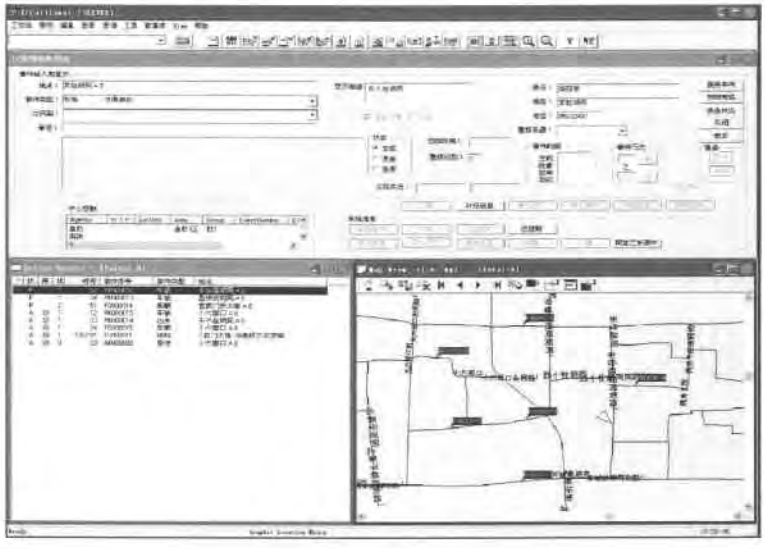


Figure 84 - Intergraph Display

- **Address Book Management-** Phonebook management program with functions of data insert, modify, delete, display, and query. The insert data includes: name, work telephone, EMAI, and address. It will modify the names and phone numbers in the records. You can add and delete records to display all the saved records, names and phone numbers.

- **Conference Management** - It provides whole process management of the conference which is made up by the two parts: conference planning and conference minutes. Conference planning includes plan development, plan approvals, notifications and queries. Conference minutes include notes releases, draft approval, draft summary file management and query.
- **Telephone Management-** It mainly refers to the management of the telephone directory which includes basic functions such as adding, deleting, modifying, etc.
- **Message Management-** It can provide functions as real-time communication and texting message.
- **Fax Management-** Fax document backup which includes basic operations as adding, deleting, modifying and checking.

- **Document management-** It refers to files storage, reading, researching organization and controlling.
- **Work reminds-** It reminds the main inspection by day, month, and quarter.

1.5.7 Early Warning Indicators Management

Establishment of an environmental risk warning indicator system is the basis of emergency early warning and responding. For different environmental elements, the risk indicator system should be designed with different sub- systems for water environment, air environment and soil environment etc.

Early warning management includes environmental indicator management and rules engine management.

1) **Set up a Sound Indicator Library-**The content of indicator library refers to different elements as following diagram:

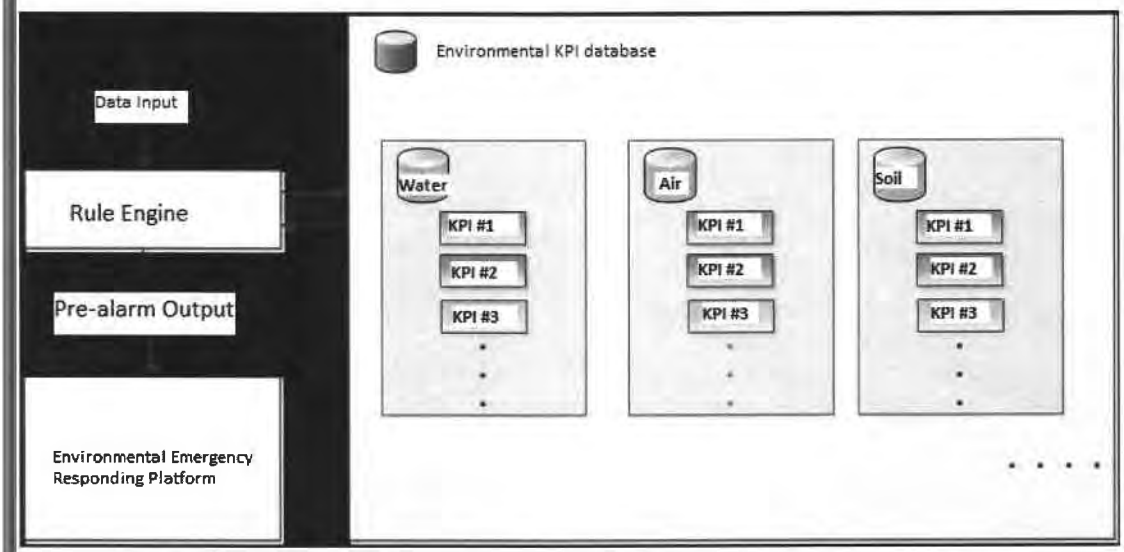


Figure 85 Index Gallery Design

2) **The Rules Engine to Manage-** The rules engine was evolved by the engine development which separates business decisions from the application code and write a predefined semantic module

into the business decision. It accepts data input and make business decision based on business rules. Its data contains sensor data and video data etc. Rule engines can transmit early warning information to the environmental platform according to the indicators and data analysis. The early warning messages can be sent through the message bus and also through a third party such as current provincial environmental monitoring center.

3) **Transition from Normal Status to Early Warning Status** - The following figure shows the mode transition, t represents time:

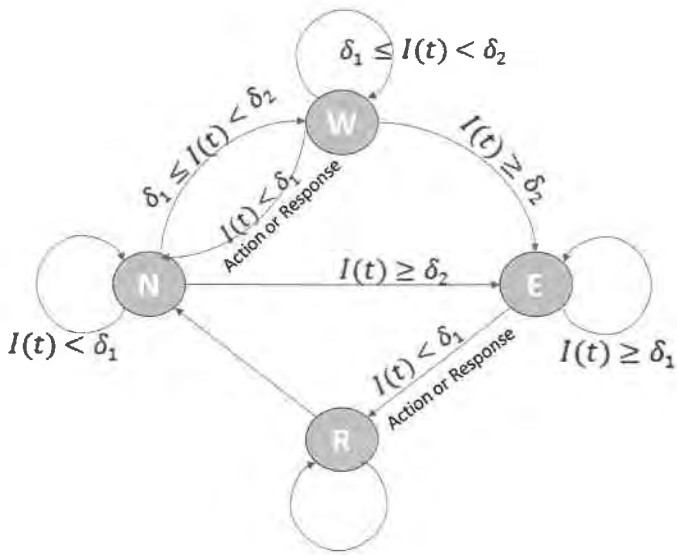


Figure 86 Four Possible Sub-systems State

Regarding of the frequency of the subsystem, the following diagram shows the mode transition from emergency mode to non-emergency mode.

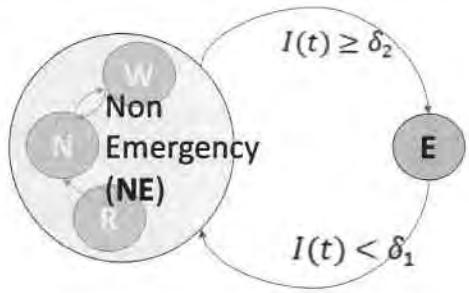


Figure 87 Emergency and Non-Emergency State

1.5.8 Warning-level Management

Warning level	Warning-police	Warning color
I-level	Special major	Red
II level	Major	orang
III level	Large	yelloe
IV level	General	blue

The early warning management mainly includes following parts:

- For different emergency events, pre-warning according to their levels and matches the four colors: red, orange, yellow and blue;
- Create indicator database based on different types of emergency events which includes key elements such as fatalities and causalities number, economic loss and influence domain etc.
- Associate the metadata and warning level to digitalize the indicator of different types of events.
- By having the three contents, the warning indicator can be in a digitalized mode to recognize the emergency level.

- This system can also provide the functions of adding, deleting, changing and researching.

1.5.9 Early-Warning Updates and Releases

The publication of early warning information is for automatically notifying relevant personnel of emergency platform to receive the warning information via message or email or website. The content of the information includes the alarm name, warning status, warning level, release target, release time and so on. The process is as following diagram:

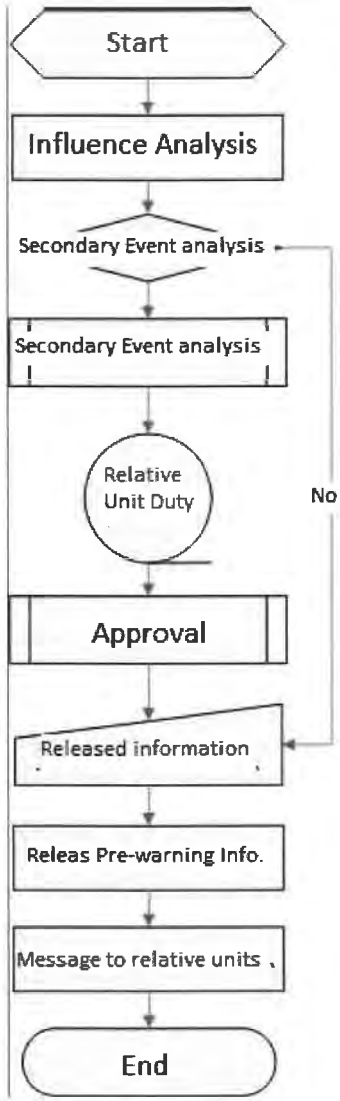


Figure 88 Early-Warning Information Release Process-Orchestration

- Early warning information publication IPO:

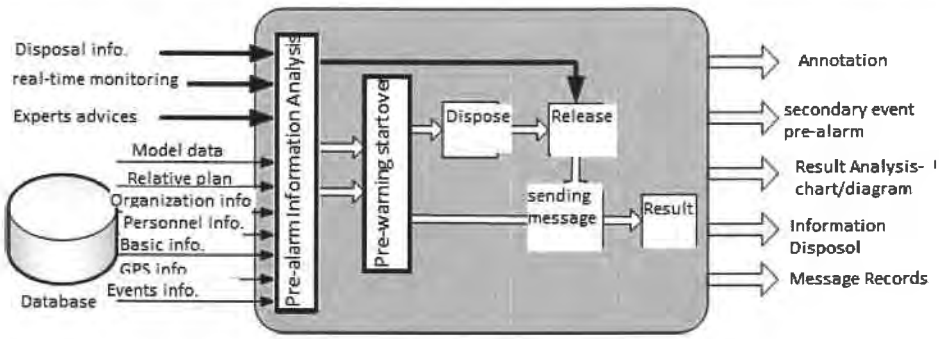


Figure 89 Early Warning Information Release IPO Plans

The warning information is allowed to release to relevant departments after approval. The system can choose to send information to unit/personnel, message type, message content, relevant record and publish list.

1.5.10 Early Warning Distribution

The following is the process-orchestration of this module which contains four part of early warning distribution:

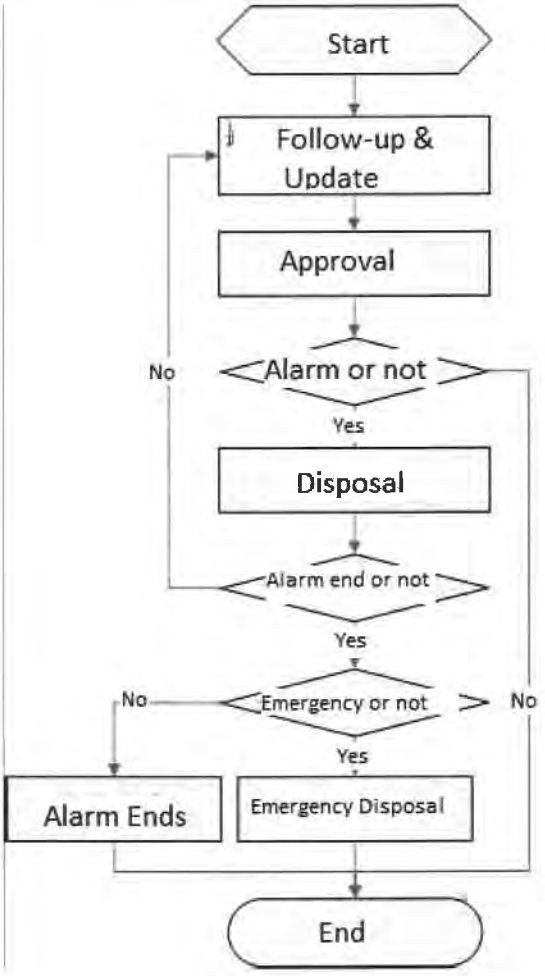


Figure 90 Process-Orchestration of Early Warning Distribution

The following diagram is the IPO plans of early warning distribution:

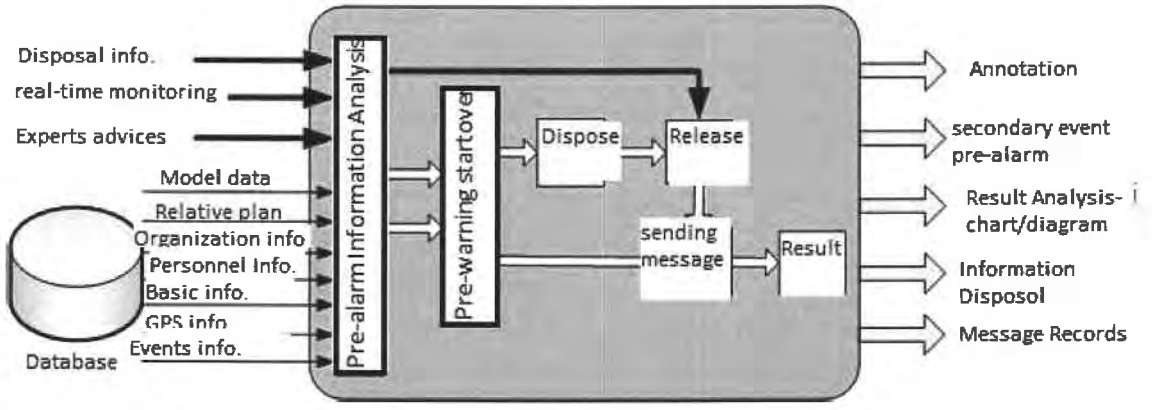


Figure 91 IPO Plan of the Early Warning Distribution

1.5.10.1 Early Warning Starts

After the warning starts, the event information will be sent to relevant officials for review. When the officials approve the dissemination of the event, the warning information will be sent by telephone, message or system platform to other relevant official units or departments to keep them into warning status.

Early Warning Steps:

- Save relevant data to early warning records table:
  - disposal process/recorder
  - disposal time
  - disposal contents: early warning start
  - disposal type: early warning start
- Change the status of event record to "start"
- Start selected early warning event, send default content to public as "information release" to start sending commands

- Select sending units/personnel, sending method, information type and content of the distributing information, then keep relevant records to the warning distribution publication table
- Early warning disaster analysis—after received the warning information from higher level departments, the command center will need to analyze the secondary disaster or derivative disaster for comprehensive early warning
- Combine with the real-time operational data or sensors or videos for environmental disaster analysis
- Further look up the information of the key units, organization, personnel and facilities of the area for a comprehensive analysis

1.5.10.2 Comprehensive Prediction

Comprehensive prediction is the analysis of potential range of outcomes (includes information of environmental facilities and important users) based on the professional weather prediction, which uses the secondary and derivate disaster models and GIS information systems and combines the environmental and emergency resource operating information. While the facilities are running online, the system can estimate the outage probability of the device based on the running status of the system for a comprehensive analysis. The analysis results include reliable operation device information and system running status information. Comprehensive prediction can comprehensively analyze the single or group early warning information to achieve multidimensional visualization by simulation technology.

1.5.10.3 Warning Procedure

The warning procedure includes:

- warning event reception
- event level approval
- warning publishing
- warning start
- warning ending

The warning procedure also contains other procedures such as personnel arrangement, device mobilization and resource mobilization.

1.5.10.4 End of Early Warning

For ending an early warning, the system has to confirm the warning are already published or started, or else it is not permitted to publish information as ending the warning but change the status of the warning to ended.

There are two possibilities of warning ending:

- First- crisis abates which means the system returns to ordinary status
- Second- warning turns to be an emergency which means the warning ending and the system will transfer to emergency procedure status.

1.6 Emergency Communication Network

1.6.1 What is ECN

An emergency Communication Network (ECN)) /Emergency Operation Center (EOC) enhances an area's ability to coordinate multi-agency responses to disasters and emergencies. Alternatively known in different industries as installation operations centers (IOC), transportation operations centers (TOC), war rooms, command centers, and other similar terms, an ECN is a place where emergency personnel conduct a coordinated response to severe, major events (see Figure 1). It typically consists of large building or room reinforced for maximum disaster protection. The building is self-sufficient and can operate for extended periods of time independent of outside power supplies or communications facilities.

An EOC is equipped to perform a number of crisis management functions but is also able to function as a day-to-day operations resource and support efforts to test and exercise contingency and response plans. It is activated during an emergency that has overwhelmed the normal day-to- day functions of first responders. It typically performs the following functions: information collection, information processing, information display, information dissemination, management and coordination of interagency activities, implementation of relevant plans, and command and control of assigned resources. Generally, an EOC includes communications links (i.e. telephones, two-way radios, patching equipment); computer equipment; map displays to show geographic attributes; dynamic data of the unfolding situation; static reference data; and response plans. This paper presents typical EOC requirements, and the technology available to address them.

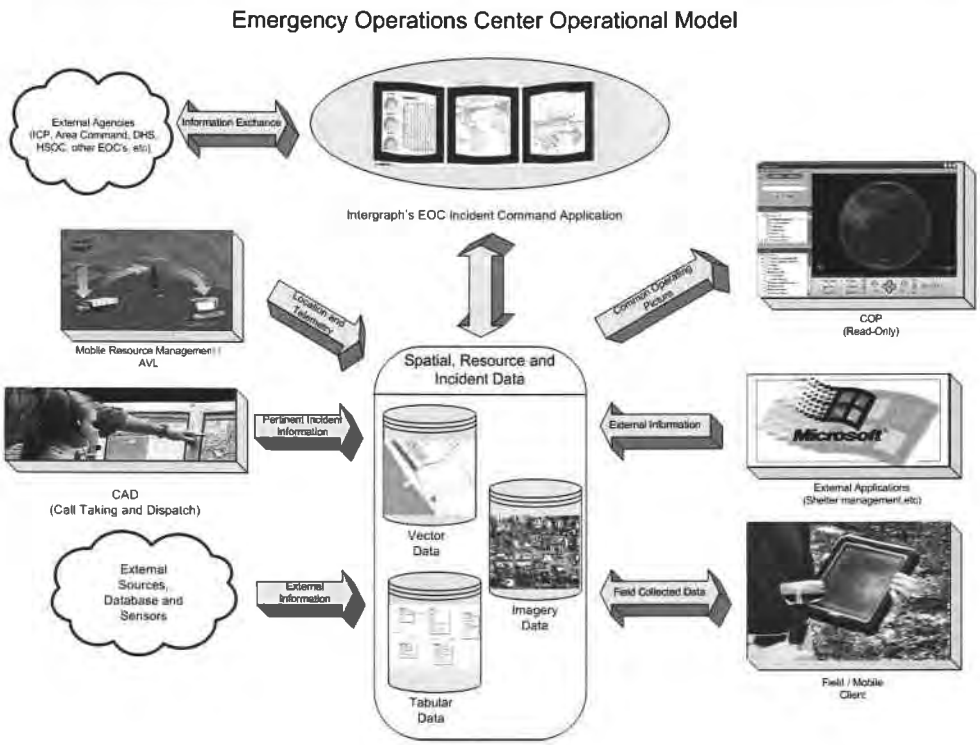


Figure 92 An EOC Architectural Blueprint

1.6.2 Requirements for EOCs

Recent disasters have raised critical requirements for EOCs that technology can solve. EOCs face many challenges that prevent them from obtaining and sharing the information required to respond effectively to incidents. Perhaps the biggest challenge is interoperability between the multiple agencies involved, such as police, fire, public works, health services, emergency medical services, and more. Each has their own systems and procedures, with data arriving from many sources in all types of formats. EOCs need technology and tools that provide them with real-time collaboration, external data fusion, situational awareness, financial tracking, status reporting, and resource and consequence management.

Through our cooperation with the state of Louisiana, Louisiana State University (LSU), the U.S. Army Warfighter Protection Lab, and Oak Ridge National Laboratory, Department of Homeland Security, and NORTHCOM, Intergraph has worked to develop and package solutions for EOCs that meet these unique needs.

1.6.2.1 Standards-based

Intergraph understands that any EOC solution must meet specific standards. EOCs must report using a standard format and meet basic government policy and requirements for regulations. Our solutions align with U.S. standards such as the National Incident Management System (NIMS) and international standards such as the Association of Public Safety Communications (APCO). Our EOC solution supports the NIMS organizational structure for emergency response (i.e. Command, Operations, Planning, Logistics, Finance, and Admin) by addressing the entire incident management life-cycle process – preparation, response, mitigation, and recovery. From developing contingency plans and building SOPs and checklists to tracking the progress of the response effort and maintaining status reports, Intergraph supports EOCs in their efforts every step of the way.

We are also directly involved in the development and implementation of technical standards in close association with the Open Geospatial Consortium (OGC®) while cooperating with Microsoft, Adobe, Oracle, and others. We partner with them to create open and extensible software application programming interfaces for geographic information systems (GIS) and other mainstream technologies. Intergraph's GeoMedia® technology, which provides flexibility, interoperability, open architecture, and adherence to industry standards, is just one example of this collaboration.

Additionally, we adhere to critical information security standards such as DoD Information Assurance Certification and Accreditation Program (DIACAP), National Information Assurance Certification and Accreditation Process (NIACAP), and others. We are presently working with the Oak Ridge National Laboratory (ORNL), the Department of Energy's largest science and energy laboratory, to implement and promote industry-wide information sharing standards for ubiquitous, cost-effective, and secure networks for chemical, biological, radiological, nuclear, and explosive (CBRNE) sensors and intrusion detection systems. This project will also address the issues of interfacing sensor networks to local and regional emergency centers and personnel.

1.6.2.2 Interoperability

As the U.S. Department of Homeland Security (DHS) has stressed, interoperability is a key requirement for EOCs. Interoperability takes on two distinct forms. One is organizational and communicative, the other is technological. However, these are tied together. Technology enables improved communications, which allows interagency cooperation. By aligning with organizational and technological standards, our solutions can improve interagency communication and cooperation.

As a result of our work within the public safety and national security sectors, we have developed a number of solutions that are leading the way in open, interoperable enterprise solutions. Our solutions help EOCs collect intelligence and manage and control event information and response activities. All of

Intergraph's products are built on industry-standard, non-proprietary formats and platforms, such as the Common Alerting Protocol (CAP) and Web Features Servers (WFS). This enables the products to be easily ported from one system to another and adapted and developed to meet specific industry requirements.

For example, Intergraph's GeoSpatial Monitor (see Figure 3) uses advanced spatial information management technology to provide multiple live connections to more than a hundred GIS, computer-aided dispatch (CAD), and image data formats. It then integrates these multiple spatial data formats into a single view, requiring no translation or re-projection of data.

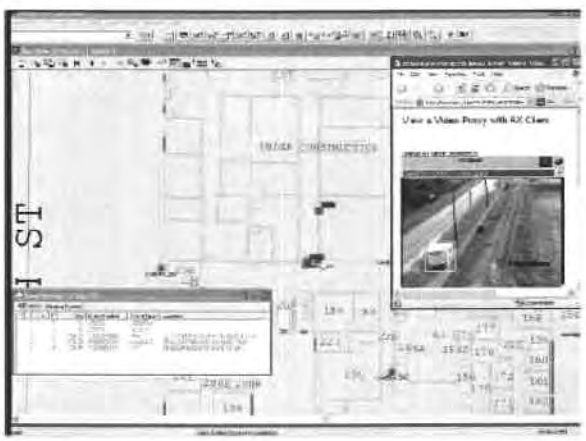


Figure 93 Intergraph's Geospatial Monitor allows integration with a variety of open data sources, including video and map data such as camera locations

1.6.2.3 Scalability

An EOC solution must be flexible to meet all requirements. It must be applicable to small-scale daily operational activities as well as major mobilizations. Our solutions are scalable, and can range from portable operation center platforms to imbedded operation centers focused on large, established areas. We also provide mobile operation centers working with leading vehicle and communications providers. We can adjust our solution to your requirements and budget.

1.6.2.4 Daily Operations

True domain awareness means that EOC systems can support daily operations, as well as emergencies. An EOC may serve a number of uses, including operations, training, meetings, and more. EOCs designed to meet these requirements, such as TOCs or IOCs, help reduce costs and
training time because the same facilities and tools are used every day as opposed to just during emergencies

1.5.3 Data and Image Management

The situational awareness of an EOC is only as good as the data it uses. A careful plan must be put in place to access and manage that data. Because data from multiple departments is not likely to be in a single format, an EOC solution must be able to access a variety of data – from utility to transportation to public safety data.

1.5.3.1 Data Management

Intergraph works closely with Oracle, Microsoft, and other database providers to ensure our solutions can integrate and use multiple data types. We help you determine what critical data is required, catalog all the available data, and then obtain the data. In our approach, wherever possible, all data – video, audio, telephonic and radio switches, intrusion sensors, infrastructure sensors, perimeter monitoring systems, etc. – are accessible throughout the system for authorized users. By fully supporting OGC standards, our solution can read multiple geospatial data types you are already using, including ESRI, AutoCAD, MicroStation, SmallWorld, and others, as well as sensor data.

1.5.3.2 Image Management

In some cases, publicly available data can be useful, and our technology fully integrates with Google and others. However, in many cases, publicly data is not functional because it is dated or inaccurate. Intergraph's TerraShare® product helps manage and access multiple image and map sources to ensure you are using the latest and most accurate data. It provides transparent access to common imagery, so personnel throughout an EOC or jurisdictional area can use their time more efficiently and make better decisions. This in turn makes your response more accurate. Used by LSU for FEMA and the state of Louisiana during Katrina, TerraShare increased situational awareness and helped with the recovery effort (see Figure 4).

LSU | Florida DOT | Ordnance Survey (Great Britain)

Figure A sampling of Intergraph TerraShare customers

1.6.3.3 Publishing Data

Once data is gathered by an EOC, it must be put in the correct context and presented in an organized way to be useful to all involved personnel (see figure below). The need to publish data for public viewing is critical, whether its evacuation routes, road closures, impact areas, damage assessments, or analysis results. However, the design of publishing data must consider that the context may change at each level of decision-making. First responders and dispatchers are more concerned about individual units and capabilities and support of the local mission. Decision makers require a different context that includes other potentially related events, overall regional capability, potential public impact, and more.

Our solution takes each level of the incident response team into account when distributing data to those who need it. The same real-time data is used to populate all displays, which provides a consistent look and feel at each level to reduce the reorientation required for each one. As a result, we can integrate data at all levels from the incident site to national levels. Our solution also includes the capability for quickly publishing map, imagery, or analytical data on the Web for internal (intranet) or external (Internet) uses on both desktop and field-computing platforms.

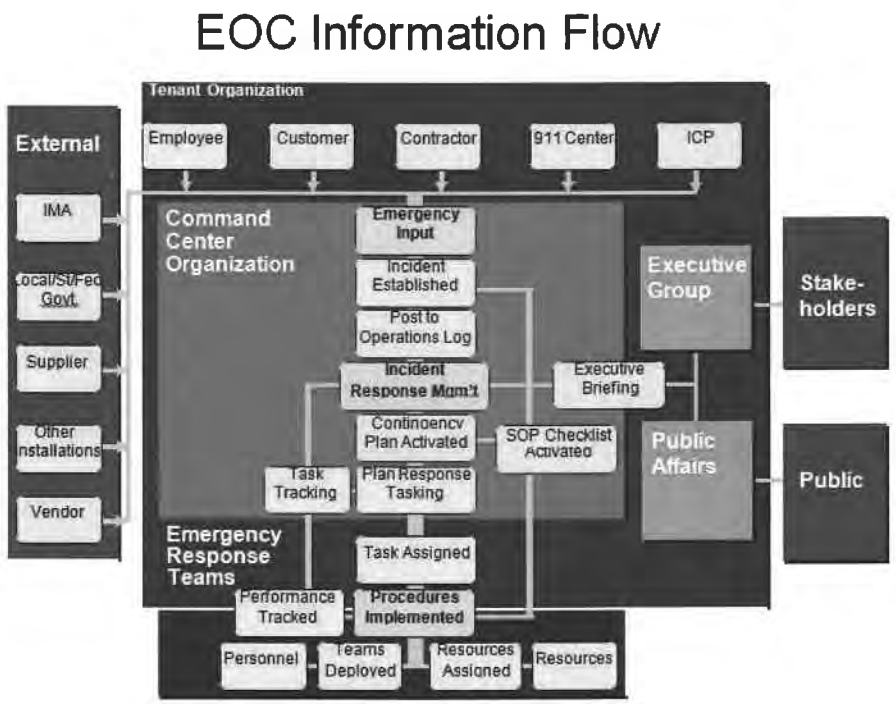


Figure 5: *An example of the information flow process within an EOC.*

1.6.4 Public Safety Dispatch

Intergraph provides the world's leading public safety dispatch system, which is accessed by more than half a billion people worldwide when they dial for emergency response. Because coordination with public safety agencies during a large-scale event is so critical, our public safety dispatch tools often form the basis for interagency coordination and management of operations.

1.6.4.1 Basic CAD Features

Fast and effective incident response depends on a reliable and up-to-date decision support system, namely CAD. Intergraph's Computer-Aided Dispatch (I/CAD) solution fully integrates interactive, intelligent mapping with dispatching, records management, and state-of-the-art communication capabilities (see Figure 6A). It provides call-center and EOC operators with the tools they need to field calls, create and update incidents, and manage critical resources by providing real-time interaction of crucial data. Dispatchers are able to see response vehicle locations and the events they are responding to on an interactive digital map, allowing them to locate, filter, and route calls more effectively. Mission-critical functionality is wrapped in a simple, easy-to-use interface based on the Microsoft® Windows® operating system and industry-standard databases and hardware platforms.

I/CAD supports various platforms to increase scalability and performance for high-activity EOCs, including Oracle, SQL Server, and Citrix. It also integrates data from various communication devices, as well as sensors. Automatic data feeds from alarm systems, ANI/ALI controllers, and the display of mobile phone caller's geographical location and estimated address on the integrated GIS map all allow dispatchers to rapidly identify an incident's location. Additionally, all information associated with an incident is automatically made available to all other authorized users. Road closures, temporary search results, and real-time and scheduled messaging are just a sampling of the information available.

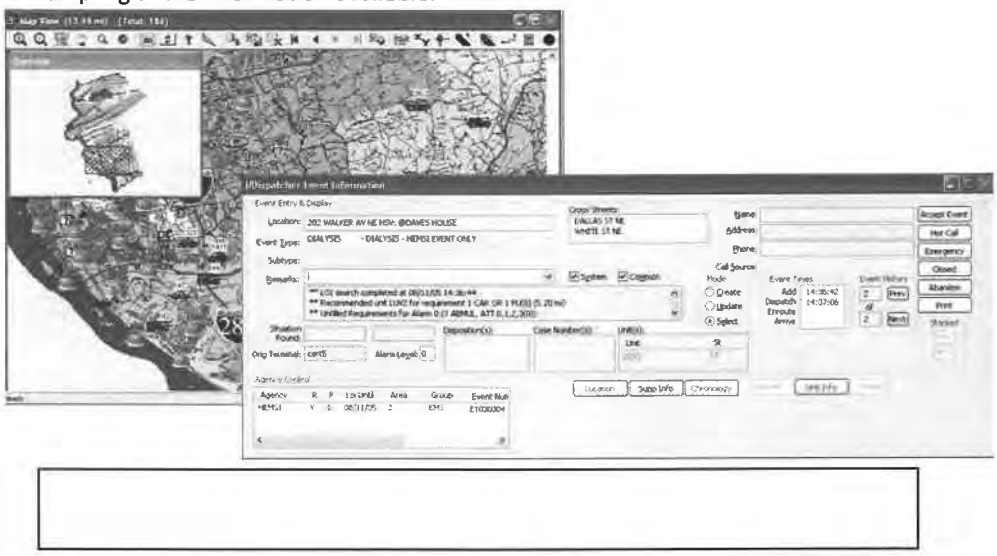


Figure 94 -I/CAD Many Features Include Map and Event Windows

1.6.4.2 Consequence Management

Consequence management is the process of responding to an event after it has occurred. Intergraph's public

safety dispatch system is designed to help EOC personnel respond to non- standard, potentially catastrophic events by executing predefined standard operating procedures (SOPs). With I/CAD, you can define response plans in terms of objectives, strategies, and tasks and define a set of objectives for every response plan. This helps to coordinate the response across all levels of an EOC, ensuring that no task is unallocated or forgotten.

I/CAD also enables you to access major incident response plans and follow the associated National Incident Management System/Incident Command System (NIMS/ICS)-compliant checklists. It limits information overload, however, through the use of pre-defined rules and operational concepts. Our dispatch solution also logically queues information for operators and recommends a course of action that accounts for factors such as temporal conditions, special events, and traffic conditions.

Our public safety dispatch system also addresses the need to have a real-time asset catalog available during a major incident. This asset catalog dynamically updates recorded assets deriving from manual entry, sensors, external databases, or a combination of all three. You can import, input, and maintain site-specific asset data; search for assets; manage the quantity, status, and location of each; and obtain a real-time, accurate picture of all assets available despite your location.

1.6.4.3 Interoperability

Interoperability between dispatch systems across multiple regions is key to effective incident response. The Inter CAD system, based on APCO standards, allows us to establish communication between CAD systems to provide a common operating picture of resources. We can establish rules as to what can be seen or not seen, what information is shared, and how agencies can interact and communicate using these systems. No matter what your SOP, we can ensure your system supports it.

1.6.5 Incident Command

The incident command structure is a critical component within NIMS to manage an incident and its consequences. Because some EOCs are highly mobile or may require specific management tools, Intergraph has developed an incident command tool. This tool serves as the core of an EOC and provides a lightweight system to view and manage resources and activities associated with an event.

Our incident command tool (see Figure 7) provides integrated situational awareness during planning, response, recovery, and mitigation. Its open architecture and standards-based design provides the interoperability and information sharing vital for success during each phase of consequence management. It also helps prevent uncoordinated planning, shared information lapses, lack of unity of purpose, and improper execution of response SOPs.

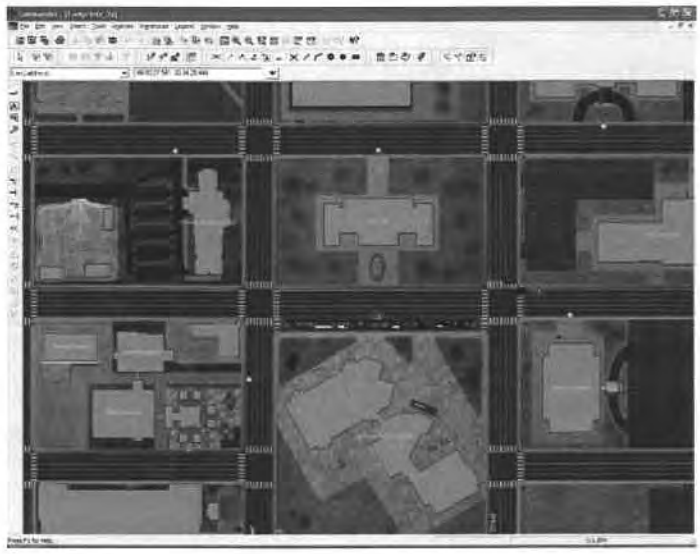


Figure 95 Intergraph's I/Incident Commander gives you complete access to all your Area of Interest geographic information system (GIS) data and spatial information management toolsets. (The map shown here is from the Center for Disaster Preparedness model city.)

1.6.5.1 Weather Integration

Tracking weather in relation to resources or activities is imperative when responding to weather- related events such as hurricanes or tornadoes. You can view live, streaming local weather radar in the same screen as other assets through our WeatherBug® interface, and also overlay and geo- reference it to a map display. In addition, our highly configurable system can support any types of weather data, such as the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS), as

required. Our open approach to integration allows you to combine approximately 1,200 NWS readings with 8,000 WeatherBug readings, as well as readings from other sources, providing you with the accurate, local weather updates you need to effectively respond to an incident.

1.6.5.2 Resource Management

A major issue when responding to an event is knowing exactly where resources or assets are located before and after placement. If you don't know how much food, how many shelters, or how many barriers you have, you cannot effectively manage an event. We can help manage location and costs of assets used, such as blankets, water, etc. We also provide integrated tools to help you track finances as you use resources, so you can maintain a realistic estimate of costs and recoup costs, as necessary.

1.6.5.3 Collaboration

Collaboration among agencies, jurisdictions, charities such as the Red Cross, and private companies such as Wal-Mart or other entities is absolutely necessary during an event, both locally and with organizations at regional headquarters. Data must be shared without security risks. We provide the tools needed to improve collaboration across multiple agencies, including Web-based interfaces, dispatch systems, and more.

1.6.5.4 Reporting

Agencies are required by law to report events to higher headquarters, regional EOCs, or the federal government. NIMS establishes the format for many of these reports. Our incident command system provides all basic reports and helps to automate the creation and submission of them to speed your response and support management.

1.6.6 Mobile Solutions

The value of knowing the location of assets in real time during a major event has never been greater. Intergraph offers a range of mobile solutions to help you track planned and unplanned assets remotely, as well as maintain highly portable operations.

1.6.6.1 Mobile Resource Management

Mobile resource management (MRM) can help you access real-time location information on assets – such as vehicles, equipment, emergency supplies, and more – and monitor them remotely instead of expending the time and money it would require to track them on site. Intergraph helps alleviate the concerns surrounding mobile resources management by taking an integrated approach. Our MRM solutions (see Figure 8) go beyond simple resource monitoring to what we call presence management. We integrate several key components – wireless communications, geospatial software, location tracking tools, and the Internet – to help you track and manage mobile assets and personnel. We can track and manage multiple resources using the latest in radio frequency identification (RFID) technology, global

positioning systems (GPS), automatic vehicle location (AVL) systems, cell and sensor technologies, and geospatial mapping applications. Additionally,
we offer both thick- and thin-client systems to view and manage these resources and can establish rules such as zones of operation or set off-limits areas that will create an alarm upon entry.

Figure 8A: Intergraph's mobile resources management software enables you to track the location of field personnel and mobile assets.

1.6.6.2 Mobile Command Centers

While some critical mass of decision makers need to reside in a central location, others are most effective if not moved from their own source of resources and talent. Mobile command centers are an important component when responding to an incident. They serve as a central location from which first responders and strategic decision makers can direct strategic and potentially complex operations. They also provide a secure place to meet and prepare for the tasks at hand. We work with many vendors to design and outfit mobile command or operation centers. We can incorporate flexible, multi-function areas such as communications, tactical workstations, surveillance systems, weather stations, briefing/operations area, command offices, and many other configurations.

1.6.7 Integrating the Package

As a systems integrator, we can help you design and build all components of your EOC. We have partnerships with more than 70 vendors – including small, disadvantaged businesses – to ensure
you get the right solution to meet your needs. Additionally, we use staging facilities and integration labs to research and develop best practices and eliminate all potential malfunctions before final implementation, ensuring an optimal solution.

1.6.7.1 EOC Design

We have worked with customers across multiple environments to help design EOC structures to meet needs from the highly portable to permanent multi-agency facilities. We understand basic EOC design concepts and standards, as well as communication requirements, and can help you with the location, budget, detailed design, and engineering of the facility. Drawing from former experience at Naval District Washington, Midwest Regional Operations Center, the Army Warfighter Protection Lab, and other EOCs, we can help define the optimum arrangement of dispatcher and calltaker workstations, cable management strategies, lighting and windows placements, equipment, and more.

Designs must take into account facility codes and requirements, such as those outlined by the National Fire Protection Association, MIL-HDBK-1012/3, and the American National Standards Institute (ANSI), as well as local, national, and international codes or standards for electrical, mechanical, plumbing, or other property or facility requirements. Incorporation of these standards at the design level reduces the cost of the solution and ensures that standards are met from the beginning.

1.6.7.2 Tool and Technology Selection

With partners ranging from the U.S. Army Corps of Engineers and Department of Energy to vendors such as Cisco, Object Video, and Skyline, Intergraph can help you select the appropriate toolsets, sensors, and devices to meet all your needs, including unmanned aerial and ground vehicles. We can advise you in the best-of-breed plume, blast, and terrain modeling and analysis tools, help you select appropriate monitoring and sensor devices, and integrate these technologies
in a single common operating environment. Working with U.S. government labs, we have access to the same monitoring and sensor optimization tools the government uses for many of its weapons systems, helping ensure your solution is open and optimized.

1.6.7.3 System Integration and Implementation

To cost-effectively pull together multiple technologies from various agencies and organizations into a well-integrated information infrastructure requires specialized knowledge and skills. As a Microsoft Gold and Cisco Certified Partner, Intergraph can help you implement and maintain your operating environment. We can help plan, design, test, stage, install, and support many products and technologies, including security, wireless, and video devices. We use staging facilities and integration labs to develop, test, configure, and burn-in software and hardware before implanting them into your mission-critical EOC environment.

For example, Intergraph is currently partnering with ORNL, ObjectVideo, Federal Signal, and Stanley Security Solutions to provide advanced perimeter security as part of an Integrated Incident Management Center (I^2MC) at Fort Bragg, North Carolina. The I^2MC, based on Intergraph's I/CAD, integrates information from GIS, E9-1-1, radio, and sensors (including cameras, mass notification, alarms, and vehicles) for a comprehensive command-and-control system that facilitates situational awareness and preparedness via a common operating picture. It is built on a net-centric, standards-based framework

that links sensors and alarms, detectors, multiple data sources, and many applications to emergency 9-1-1 centers. This effective solution meets Fort Bragg's situational awareness and preparedness requirements and supports interoperability across multiple agencies and technology platforms, resulting in better decision making and faster responses to security incidents.

1.6.8 Training and Simulation

Working with our public and private partners, Intergraph provides 3D modeling and simulated real- world training on your EOC tools to ensure your team is familiar with all the technology and processes involved. This familiarity helps to improve your response to real situations.

1.6.8.1 Training

We provide exercise support to give you the practice you need. We can help develop training schedules, coordinate with key players in your area or jurisdiction, and create a program that best fits your needs. Our experience with federal exercises such as Ardent Sentry, Vigilant Shield, and TOPOFF 3, as well as local exercises across the nation, enables us to bring a wealth of training experience to guide you in incident preparedness and response (see Figure 9). Our training is compliant with Homeland Security Exercise Evaluation Program (HSEEP) standards and is based on National Planning Scenarios. As a result, our procedures help support the Department of Homeland Security grant-writing process.

Figure 96 Severe Weather Week Tornado Training in Alabama (courtesy of the U.S. Army WarfighterProtection Lab).

1.6.8.2 Modeling

Intergraph uses tools ranging from the Corps of Engineers (blast modeling) to the DOT (traffic modeling) as well as popular plume modeling tools, such as ALOHA, to help you conduct incident scenario analysis and mission rehearsal prior to an event. First responders such as police, fire, and EMS can greatly benefit from these tools – allowing them to plan their operations and tactics ahead of time. We also offer our own industry-leading 3D design and modeling software geared specifically for plants and other industrial environments. With these tools, we can help you obtain that bird's-eye view of locations of assets and

infrastructure on a map and apply incident management technology to emergency response initiatives. And, through modeling, simulation, and testing of existing command-and-control systems and EOC facilities, we can design optimal EOC layouts and help develop tactics, techniques, and procedures for force protection and incident response.

1.6.8.3 Simulation

Simulation supports training by providing a real-life environment that saves time and cost of real exercises. By practicing in a virtual environment, you can test solutions and processes before committing resources, enabling you to gain in-depth knowledge that only experience can provide and make adjustments to your operations as you go. We work with military research, development, and engineering centers, the University of Alabama in Huntsville, the DHS Center for Domestic Preparedness, and other experts in simulation and modeling to build realistic simulations that meet your needs.

1.6.9 Interoperability, Standards are Key

Intergraph offers a broad range of solutions for EOCs. The key to our approach is standards and interoperability. Because we adhere to national and technology standards, you can be sure that our solution will meet your needs. Our partnerships with vendors, government and military agencies, and commercial organizations enable us to continuously create and hone our open and extensible software applications to meet the needs of EOCs. Whether you need to establish and EOC from the ground up or enhance your current EOC, Intergraph can provides the expertise and technology you need to develop a mission-critical environment.

1.7 Data Center

The following is a data center recommendations based on Cisco's data center requirements and best practice. These requirements are essential for full enterprise level centers managing data centers with rigorous performance and service demands (Cisco).

1.7.1 Data Center Design Objectives

There are four objectives in the design of any high performance data center: Security, availability, scalability, and manageability.

Today's business and competitive environment requires that each of these objectives be considered from a complete end-to-end perspective. Clients or users connecting to the data center measure performance by timely access to the desired application data, whether the connection is point to point or via an Internet connection. The user must perceive reasonable response and connection time. Access is no longer measured solely on an arbitrary measure of "network availability" or ping times. This fact does not lesson the goal of developing networks that provide 99.999 percent availability. However, the implication is that the designers of the traditional networking elements must also become "content-aware."

1.7.1.1 Security

Security can no longer be treated as an afterthought when it comes to optimum network design. Trial-and-error networking is not an option, as a single vulnerability could compromise the corporate lifeblood, the network. In such a high-stakes environment, only specialized expertise is acceptable. There are challenges in offering encryption, certification, directory, network, and other security components that enable what one would consider a 100 percent secure network. While industry struggles with developing the technology to provide these protective components, the IT manager must still cope on a daily basis to reduce the network's imminent risk.

A complete network security solution includes authentication, authorization, data privacy, and perimeter security. Perimeter security is traditionally provided by a firewall, which inspects packets and sessions to determine if they should be transmitted or dropped. In effect, firewalls have become a single point of network access where traffic can be analyzed and controlled according to parameters such as application, address, and user for both incoming traffic from remote users, and outgoing traffic to the Internet.

In general, firewalls are intended to protect resources from several kinds of attacks such as passive eavesdropping/packet sniffing, IP address spoofing, port scans, denial-of-service (DoS) attacks such as SYN chronize-AC Knowledge attack (SYN flooding), packet injection, and application-layer attack.

See the data center best practices checklist. The checklist begins with the physical security of the data center and its environment (electric power, temperature, and humidity controls). The checklist also contains recommendations concerning network security in general terms, recognizing that threats may occur actively or passively (sometimes called opportunistically), and from people and events either outside or inside the data center itself. Connectivity paths to external networks, and each function inside the data center (such as gateway or WAN edge, core, distribution, and access), must be designed with no single point of entry for unauthorized users.

1.7.1.2 Availability

Availability is generally ensured by the overall network design and implemented in several ways. First, networks are designed with steps to minimize the occurrence of service problems and the time to recover from problems (such as backup recovery policies). Second, high availability must be considered at each layer of the Open Systems interconnection (OSI) reference model, with redundancy and failover provisions made at the physical, data link (for example, Ethernet), network (for example, IP), and application layers. The most effective solutions are those with consistent engineering considerations tightly integrated throughout the data center, rather than those approached with a series of "point-solution" products and techniques.

1.7.1.3 Scalability

Scalability must be provided in every data center. Server load balancing is the norm, and techniques such as reverse proxy caching are often used to offload servers. Server load balancing, like other aspects of data center design, must also be content-aware, preferably using delayed binding, full URL and cookie inspection, and "stick y (server) connections" as part of the logic of choosing a server for each user request.

Specific content may be in high demand and considered "hot." Because this content may not be known in advance (such as breaking news stories), advanced data centers should also have the ability to automatically and immediately identify and replicate hot content to overflow or backup servers or cache to ensure the ability to support the increased demand without compromising performance.

Both the complications and available solutions increase greatly if the data center is part of a geographically dispersed set. The ability to provide content at multiple sites allows the served data to be "closer" to the requesting client, thus providing faster response but also higher availability (due to partial or complete redundancy of the data). But multi-data center design must then include considerations of management of the data content, distribution of updates, synchronization of different sources, proper routing of requests, handling of downed servers, additional security and so on.

1.7.1.4 Manageability

Manageability means much more than simply knowing if a server or other network element is "up or down." Especially in service provider data centers supporting multiple customers, the ability to assess service levels on a per-customer basis is essential to the offering and administration of service-level agreements (SLAs). Managing IP address assignments, keeping track of network configurations, and not losing site of trouble tickets and alarms often requires use of a mechanized network operations center (NOC) support system. Good manageability tools and qualified personnel supporting the infrastructure translate into lower operations costs, since time is not wasted trying to resolve indications from conflicting management systems and higher customer satisfaction.

1.7.2 Cisco Powered Network Program Data Center Best Practices Checklist

1.7.2.1 Facility and Physical Requirements

- Multiple physically separate connections to public power grid substations
- Continuous power supply with backup uninterruptible power supply (UPS) systems: – Adequate UPS capacity including air conditioning and lights
    - UPS systems tested at full load on monthly schedule
    - Fuel for UPS generators (48 hours worth) kept on premises and monitored for local environmental compliance
- Conform to or exceed applicable local structural building codes utilizing standards such as bullet proof glass, fire doors and reinforced walls and complying with disaster proof design:
    - Comply with all local zoning ordinances
    - Certify not located in a 100-year flood plain
    - Earthquake and hurricane bracing on all racks and cable trays (where appropriate)
- Adequate multi-zone air conditioning, including a backup system for the multi-zone air conditioning: – Climate control including humidity sensors and control
- Heat and smoke detectors that meet or exceed all local fire code regulations. – Very Early Smoke Detection Alarm (VESDA)
    - FM200 [ETG5] fire suppression system in data center and NOC – Separate detection/FM200 zone under raised floors
- Dry pipe system zoned to release water only where needed
- Easily removable access panels in raised flooring
- Flood sensors and monitoring under raised floors and in other critical areas
- Separate grounding systems to prevent grounding loops; true ground versus green wire ground
- Sealed cable vault entrances to facility, remotely monitored
- Formalized physical facility preventive maintenance program
- Sub-breakers per relay rack or lineup

- 48 VDC power converters, 220 VAC, 20A, 30A, 40A
- Power filtering in UPS system

1.7.2.2 Physical Security

- Written security policies readily accessible: – Badge sharing and piggy back entry rules
  - All visitors must be admitted through reception – Written statement of work upon sign-in
- Building access procedures:
  - Limited number of building entrances in compliance with local fire ordinance
  - Provide access to limited and managed security policies for all facility entrances – 24x7 onsite security guards
  - Visitor-logging procedure
  - Card-key, biometric, or similar entry locks
  - ID-badge system for all employees and visitors
  - Staff and visitors must wear badges at all times on premises
  - Individual cabinet locks; master in NOC; key list from customer
- Equipment locations
  - Video surveillance and motion sensors for entrances, interior doors, equipment cages, and critical equipment locations within the building
  - Locked cages with ceilings; locking cabinets with climate control for those wanting more privacy – Secure rooms available
  - Managed firewall services with 24x7 monitoring available – Backup lighting systems for entry ways and cable vaults
  - Individual cabinet locks; master in NOC; key list from customer

1.7.2.3 Network Security

- Written network access security policies readily accessible
  - Password policies (such as not sharing, lengths, forced renewal, aging)
  - Acceptable use (ISP not allowed to run programs that are illicit or illegal; use of sniffers or cracking/hacking programs are not required
  - Documented user responsibilities on security in company policies and re-enforced by education – Asset protection
- Network security infrastructure in place:
  - Perimeter protection (firewalls, filtering router) – Intrusion detection
  - Authentication and authorization (passwords, RADIUS/TACACS, Secure IDs)

- Backup and recovery systems to restore after a problem, such as load balancing, failover protection
- Regular assessment of network infrastructure
- Assessment of network expansions or additions – Tape or media storage offsite backup
- Regularly scheduled security audits – Server antivirus software protection

1.7.2.4 Operations

- Database of all installed equipment and configurations
- Toll-free telephone support
- Supported monitoring:
  - 24x7 monitoring of dedicated servers and network equipment (note both frequency and method, such as PING, Simple Network Management Protocol [SNMP])
  - 24x7 monitoring of the health of the equipment with alarms and pager alerts for network failure and failovers – 24x7 monitoring firewall services available
  - Alternate NOC available
  - Second-tier support personnel located nearby
- Trouble ticket processes:
  - Created and logged for all unusual or unexpected events
- Automated case escalation procedures in place including escalation timeframes
- Reporting that provides trending statistics on trouble tickets and minutes (above) to facilitate quality and customer reports
- Performance reporting and end-user impact monitoring
- Periodic and exception reports provided to customers (including usage and problem reports)
- Spare equipment on site for key networking equipment available in case of hardware failure
- Business continuity plan: – Daily site backups
  - Tape vaults or other secure storage facilities on site in case of natural disaster – Onsite and offsite storage available
- Customer callout and escalation database
- Intercom system
- Written procedures for each customer on alarm handling

1.7.2.5 Backbone Connectivity

- Multiple direct connections to Tier 1 Internet carriers using high speed Cisco routers as gateways
- Border Gateway Protocol vs. 4 BGP-4 routing
- Class C Internet address blocks available
- All backbone services have Cisco Powered Network Program member designation
- Each carrier has a secure termination area, and location supported via the NOC or the carrier providing the termination

- Fiber enters the data center through diverse conduits or routes (for example, if a backhoe cuts though conduit, the network reroutes to minimize loss of service)
- Aggregate bandwidth sufficient to scale the network to meet customer's service demands
- Describe policy on facility utilization or over-subscription
- Provider must have private facilities connecting to other data centers, and a documented process
- Multiple Internet access
- Carrier XCONN and distribution system; separate carrier point-of-presence (POP) area
- Formalized SLA policies
- Roof rights and riser conduit right of way

1.7.2.6 Gateway/WAN Edge Layer

- High-end routers (such as Cisco 7500 or 12000 Series) in a redundant configuration
- Cisco Hot Standby Router Protocol (HSRP) implemented
- BGP-4 implemented
- Adequate total packet-per-second capacity for peak customer load
- Firewalls in place
- Network security team in place
- Remote firewall management offered

1.7.2.7 Core Layer

- High-end switches (such as Cisco Catalyst® 8500 or 6500 Series) deployed
- Switching and links entirely redundant with no single points or paths of failure
- Web cache redirection implemented
- Content and Transmission Control Protocol (TCP) offloading implemented via reverse proxy caching
- HSRP implemented for fail-over protection
- Intrusion detection implemented (such as Cisco Intrusion Detection System)
- Automatic notification of intrusion attempts in place

1.7.2.8 Distribution Layer

- High to mid-range switches (such as Cisco Catalyst 6500 or 6000 Series) deployed
- Switching and links entirely redundant with no single points or paths of failure
- Caching systems (such as Cisco 500 Content Engine or 7300 Series) implemented
- Server load balance (Cisco CSS 11000 Series) implemented
- Server content routing (Cisco 4400 series) implemented if multiple data centers
- Caching (Cisco Cache Engine 500 or 7300 series) implemented

1.7.2.9 Access Layer

- Mid-range switches (Cisco Catalyst 6000 or 4000 Series) deployed
- All servers dual homed

1.7.2.10 Cabling

- All cable runs located under raised flooring and appropriately marked
- All cable runs physically protected from damage via tie-downs or where appropriate in conduit
- All cabling designed to Category 6 specifications (to support 1-Gbps data rates)
- Communications cabling raceways separate from electrical; no intersections
- Shielded cabling for T1/T3s. DSX panels for XCONN, demarcation, and test points
- All cabling on raceways, tied down

1.8 Geographic Information System – GIS

GIS is an integral part of an environmental pollution accident emergency response and management system. For the system, GIS should provide the following functionality:

- Provide quick access to spatial data and attribute data and management functions.
- Quickly process large amounts of location and environmental data
- Provide high-speed data integration and management capacity for data queries, updates, statistics, simulation, and prediction and evaluation requirements.
- Provide a hierarchical visual display. of polluted location with information displayed graphically on the screen.
- Provide interaction between spatial and attribute data queries
- Provide interactive two-way query functionality that makes it easy to find sources of relevant information from pipelines
- Provide rapid evaluation of pollution hazards and facility maintenance information for potential environmental pollution accident class for spatial queries
- Display pollution incident maps
- Provides statistical analysis of the pollution and pollution incident data and location sources and related parameters for analysis or clustering analysis to ,Identify the causes of environmental pollution accidents
- Offers a variety of spatial decision-making functions such as graphic overlays including the following overlays:
    - Water/river pollution map overlays to determine the direction and the spread of pollution
    - Water/River sentiments pollution map overlay to determine where the pollution sentiment is located, possible pollution source location, and potential risk areas
    - Combine query results and evaluation results of the analysis to create thematic maps to provide emergency personnel with intuitive decision-making and choose the appropriate contingency plans and aid in the pollution accident rescue/recovery process
    - Best path analysis to determine the closest recovery assets
    - Buffer analysis to analyze the pollution degree of pollution in the area around the accident and results of the pollution evaluation

In addition to the above basic GIS functions, GIS must be combined with environmental pollution analysis and prediction modeling to build an effective decision support information system such as the GIS simulation of pollutants in a diffusion model, cellular model, expert knowledge systems, and other systems. In order to provide the full functionally to achieve the above functionally in a GIS system tailored to environment pollution accident response and management, the following steps are required:

- Develop a spatial database, an environmental database with corresponding monitoring data
- Install and configure an application to manipulate large amounts of data, multiple methods of analysis to develop a comprehensive, intelligent analysis of data processing methods
- Analysis and evaluation establishing a pollution simulation model to meet the requirements of pollution accident emergency response and management system incorporating environmental analysis modeling and the integration of the entire system

1.8.1 GIS Architecture: Environmental Pollution Accident Emergency and Management System

When the emergency pollution accident occurs, end users for the environmental emergency response and management system will need to use GIS to determine the type, location, and source of the environmental risk hazards. The end users would need to conduct on-site monitoring and data analysis, to develop and implement environmental emergency action plans and risk mitigation and management plans. The environmental emergency response and management GIS structure is listed below:

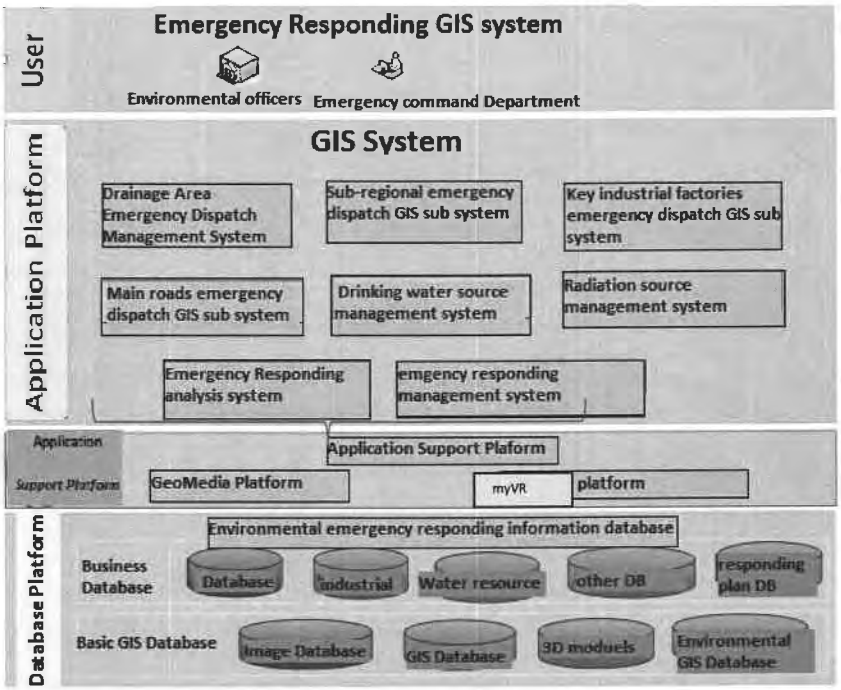


Figure 97 Environmental Pollution Accident Emergency Response GIS Architecture

Environmental pollution accident emergency response and management system GIS is sorted from lowest to highest. The overall structure can be divided into 4 levels: The data tier, the application support layer, business applications, and user layers.

1.8.1.1 The Data Tier

From emergency environmental pollution accidents, the GIS must integrate large amounts of spatial data and attribute data, legal information, models, multimedia information, etc.; therefore, the system database containing the spatial and attribute data to establish and manage collaborative management is the key to the system's construction. This requires the introduction of GIS data management feature. It is the basis of business application systems and provide a unified, standard data sources. It contains the business library and the underlying spatial databases. The business library contains event repository, repository of key enterprise information base, water resources, the monitoring of emergency resources and plan for data library and other databases. The spatial database contains remote sensing image database(s), a library of basic geographic elements, three dimensional scenes and models of new business rules and environment data libraries, and the links between data libraries and spatial libraries.

1.8.1.2 Application Support Layer

The application support layer is the foundation of environmental pollution emergency response and management GIS application development. It provides a uniform service component for the business application development which includes Intergraph's GeoMedia GIS platform and myVR. The pocket dimensional platform of service components provides the secondary development interface for environmental pollution emergency response and management GIS subsystem development.

1.8.2 Intergraph GeoMedia GIS Platform

GeoMedia GIS platform is an enterprise-level information management system that covers a very wide range of GIS functionally ranging from data acquisition, calibration and maintenance, information to data queries, reporting, business support, network analysis, features, historical data maintenance, job scheduling, mobile computing, web publishing and other work processes and system functions. Intergraph GeoMedia provides a full range of products and functional modules at all levels to support enterprise-level information management needs. Its product line is divided into core modules and expansion module. The extension module runs on a core module. The core module is either GeoMedia or the GeoMedia Professional version. The GeoMedia Professional includes the full functionality of GeoMedia extension modules used to extend the functionality of to meet the unique needs of professional enterprise-level applications.

1.8.2.1 GeoMedia Professional

For the Environmental Emergency Response and Management System, Intergraph's GeoMedia Professional or equivalent is recommended. It is the top-level tier product. It allows users to produce professional cartographic maps, conduct advanced feature editing, manage parcel holdings, conduct utility network analysis, validate your datasets, and monitor who changes what and when with feature collection, linear network management, and quality assurance tools.

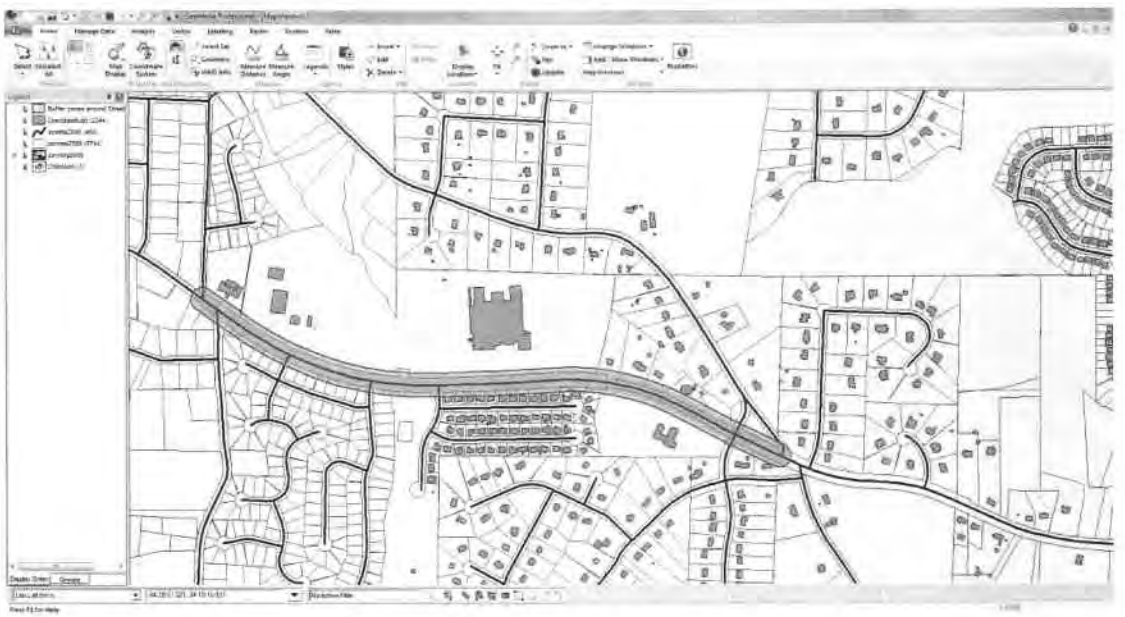


Figure 98 GeoMedia 2013 introduces the user to a new ribbon interface styled after other professional applications like Microsoft Office. The ability to customize the toolbar makes it easier for users to define the specific workflows.

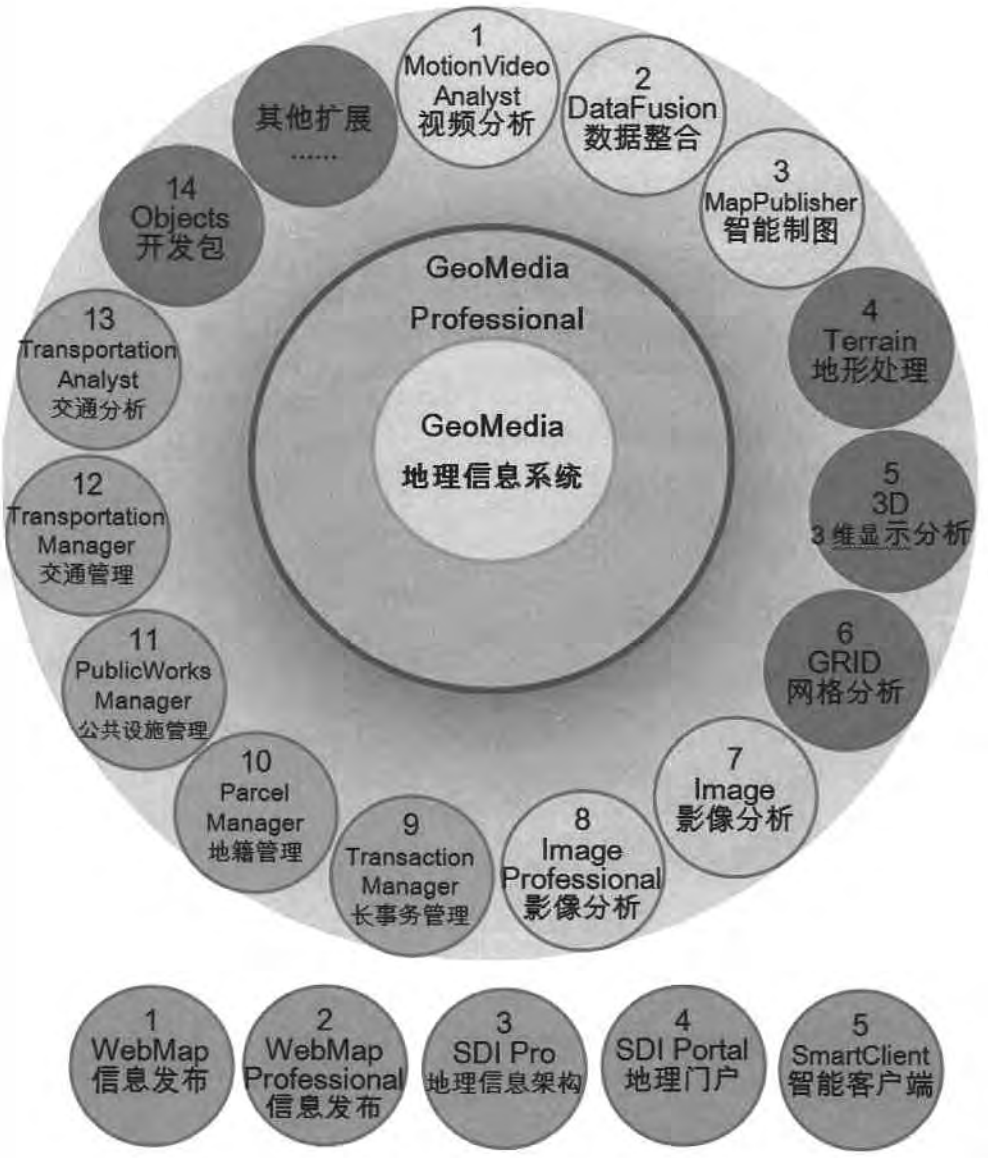


Figure 99 Intergraph GeoMedia GIS Platform

1.8.2.2 GeoMedia Extensions

- **GeoMedia Transportation Manager** provides tools to help professionals in municipalities, airports, seaports, departments of transportation (DOTs), rail companies, waterway agencies, and pipeline operations efficiently analyze their transportation infrastructure. This includes capabilities for tracking network information and performing specialized analyses. In addition, users can build a linear network model supporting both multi-level linear referencing system (MLRS) and vehicle routing applications.
- **GeoMedia Mapping Manager** enables enhanced cartographic capabilities and GIS mapping automation to produce map series products and construct cartographically accurate map products.
- **GeoMedia Database Manager** provides data management capabilities for feature data from various input sources and a database- centric solution for geospatial intelligence data warehousing.
- **GeoMedia 3D** enables 3D visualization in GeoMedia. It addresses the increasing demand for realistic three-dimensional views of geospatial data by adding a 3D map window through which you can visualize, navigate, analyze, and interact with 3D data in GeoMedia. The GeoMedia 3D map window blends seamlessly into the GeoMedia interface, permitting complete and simultaneous access to all GeoMedia's standard 2D analysis capabilities.
- **GeoMedia Data Acquisitions** allows analysis, mapping, from system development and customization of a complete set of solutions ensuring seamless integration with other enterprise business systems.
- **GeoMedia Objects** provides a full range of GeoMedia products GeoMedia Obiects components allowing for easier custom development reducing overall development costs
- **GeoMedia Motion Video Analyst** is a desktop motion video analysis tool that carries on the Image Scout tradition of geospatial intelligence analysis. The product geo-fuses motion video analysis with analysis of other forms of intelligence data: geospatial intelligence (GeoINT), human intelligence (HumINT), signals intelligence (SigINT), measurements and signatures intelligence (MasINT), and open source intelligence (OsINT). It also enables you to produce video clips and annotations regarding items or events of interest for use in generating motion video-related intelligence products.
- **GeoMedia Data Fusion** is designed for data editing, validation, and has integration tools allowing the user to create and maintain collections of geospatial feature data while providing a flexible work environment – enabling you to match the uniqueness of your data and working style.
- **GeoMedia Map Publisher** is used to produce specialized mapping and print outputs with information with layer overlays, image mapping other effects meeting the requirements of cartographic maps product. to enhanced cartographic capabilities and high levels of GIS mapping automation to produce map series products.

- **GeoMedia Terrain** adds terrain analysis and visualization to the GeoMedia environment. Capitalizing on GeoMedia's ability to display multiple geographic data types simultaneously without translation, GeoMedia Terrain delivers the ability to ingest terrain, feature, and image data to support a variety of terrain analysis applications. GeoMedia Terrain also includes components to generate three-dimensional terrain models and dynamically fly through those models.
- **GeoMedia Grid** provides seamless integration of vector and grid data formats for viewing and analysis. It is ideally suited for carrying out complex spatial analysis such as site location (locating the best site), corridor planning (finding best path between multiple locations), and hot-spot detection (spatial clustering of sparse points).
- **GeoMedia Image** provides a full set of image display, enhancement, and manipulation tools entirely integrated with other GeoMedia products. It allows the user to interact with vector and image data in a single, seamless, geo-fused environment. A specialized image enhancement toolbar supports simple and intuitive workflows. It allows the user to apply image processing algorithms simultaneously to multiple images on-the-fly without affecting the original images, or save them to disk as new images. Advanced image registration tools provide you with a detailed level of registration algorithms for improved registration accuracy.
- **GeoMedia Transaction Manager** is designed for organizations that have multiple users who simultaneously build and maintain geospatial data models within a department or across an enterprise. It introduces the functionality for long transaction management, versioning, and temporal data management for the GeoMedia Professional and Oracle9i environment. With Transaction Manager, organizations can manage the life cycle of data changes while safeguarding the integrity and validity of valuable enterprise geospatial information.
- **GeoMedia Parcel Manager** provides the ability to generate accurate cadastral maps in the timely manner required for the support of tax assessment. GeoMedia Parcel Manager lets you perform parcel geometry operations and interact with the GIS database while viewing the parcel map or neighborhood. The software provides tools to simplify the subdivision process, as well as other tools, to enhance the rapid capture and correction and integration of data. GeoMedia Parcel Manager is designed to work in a database environment and provides tools that let you interactively search or make queries on maps to produce information from the database.
- **GeoMedia Public** Works is designed to help manage many of the aspects of a complex water and wastewater project – from initial data entry to network analysis and reporting. GeoMedia PublicWorks Manager delivers productivity-enhancing tools that allow you to create, validate, maintain, and analyze your network data, all within the GeoMedia environment.
- **GeoMedia WebMap** provide Intergraph's GeoMedia geospatial technology in a fully scalable server solution. This solution may be deployed as Web services or interactive Web sites (thin-client solutions), including enterprise data access, sophisticated geospatial analysis, and map generation, thus reducing the overall cost of such solutions. By providing direct, real-time access to enterprise geospatial data with all of the spatial analysis functionality of GeoMedia, this

product lets you build a Web site that gives thin clients with only a Web browser access to a powerful, dynamic,

- **GeoMedia SDI** is for providers that need to manage and serve secure or licensed information using standards-based web services. Geospatial SDI offers an extensive set of web services, extending those offered in GeoMedia WebMap and GeoMedia WebMap Professional for SDI implementations.
- **GeoMedia SmartClient** enables users to seamlessly integrate geographic changes into customized workflows. End-users will be able to leverage advanced geospatial functionality via simple-to-use map-based tools, streamlining their processes and honing their expertise.
- **Hexagon myVR** three-dimensional platform supports multiple platforms, content, high performance two or three dimensional display applications and provides a development kit to develop a variety of platforms including desktop side, moving-side and browser-side for faster over the network browsing and viewing capabilities. myVRcan process a large amount of map data over the network displaying the data and maps-related features. myVR three-dimensional design workflow platform as shown below. It has two-dimensional and three-dimensional street view data published and three-dimensional models into intelligent tiles and provide a secondary development tool for mobile end-client, browser-side and desktop-side development of three-dimensional applications. The system can also support online and offline applications.

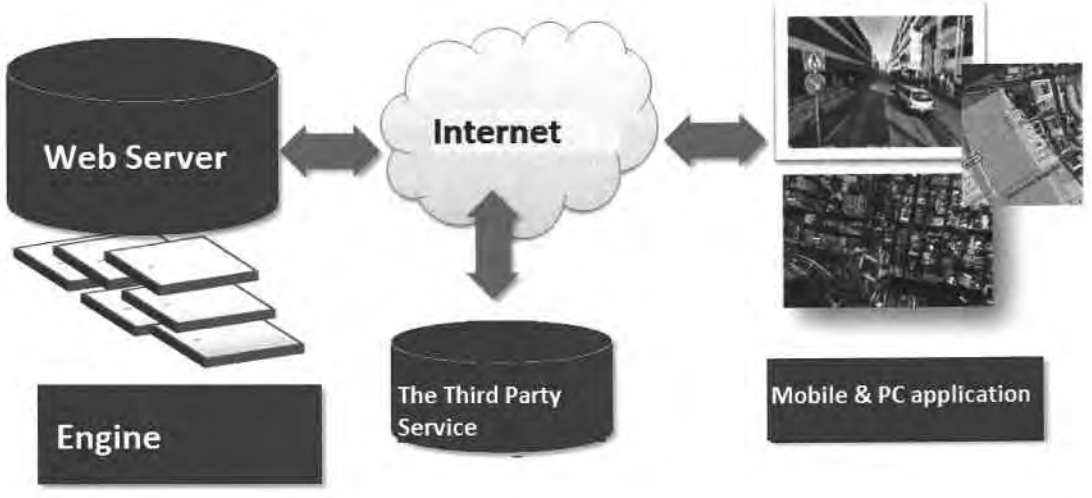


Figure 100 myVR three-Dimensional Platform Workflow

1.8.3 Business Application Layer

The business application layer includes the analysis of pollution accident emergency pollution accident emergency management subsystem and two other basic GIS subsystems. The other basic GIS subsystem needs to call an emergency polluted accident analysis of pollution accident emergency management subsystems and subsystem functions.

1.8.3.1 Analysis of Pollution Accident Emergency Response and Management System

The following diagram depicts the relationship of the pollution incidents and relationships between the base geo-data for including spatial analysis and GIS analysis of the formation of reports.

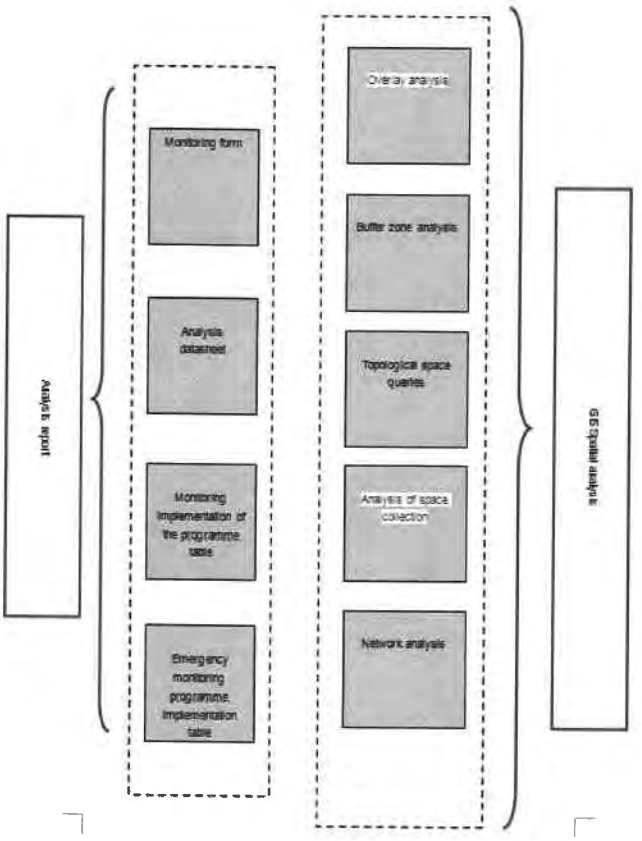


Figure 101 Analysis of Pollution Accident Emergency

1.8.3.2 Analysis of Pollution Accident Emergency Response and Management System Structure Design

The analysis of pollution accident emergency response and management system is shown in following figure. It depicts the analysis, virtual reality analysis and simulation of pollutant diffusion in three parts. Through this analysis, the final report on the formation and the other GIS subsystem function can be called.

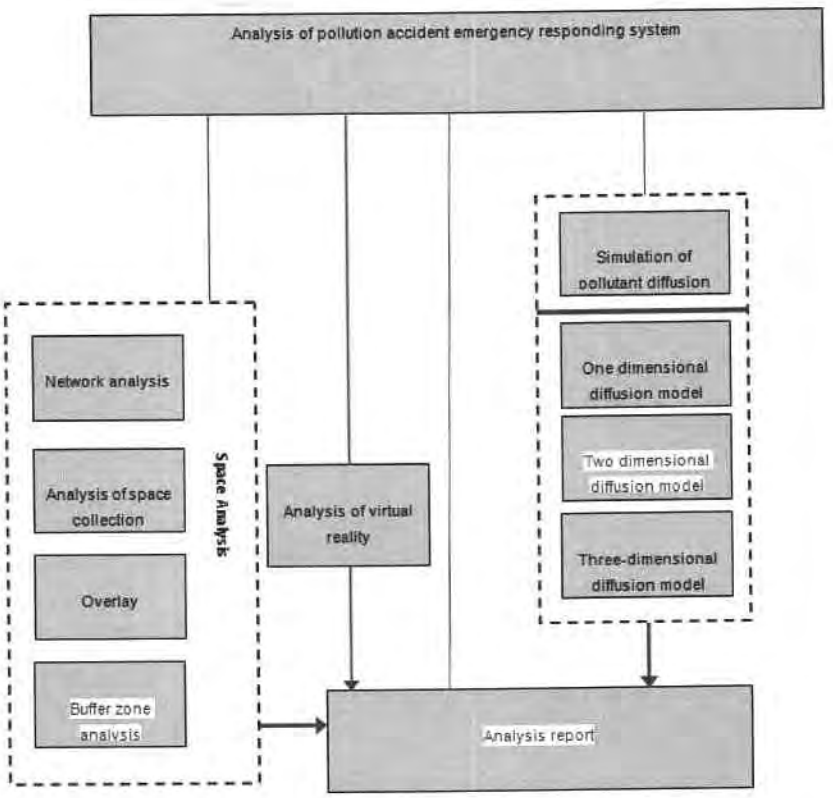


Figure 102 Analysis of Pollution Accident Emergency System Schema

1.8.4 GIS Subsystems

1.8.4.1 Drainage/River Area Emergency Dispatch Management GIS Sub-System

Drainage/river basin water pollution accident emergency response and management system GIS functions are primarily done through the dynamic modeling of pollution accidents. It is modeled by simulation of water flow diffused over time using queries that use GIS analysis modeling. The analysis will be displayed to identify excessive pollution in different locations and times. Within a short time after obtaining the information within the 10 minute time window, the system can provide an alarm/warning and a subsequent decision support options to the responsible parties by location allowing the parties to respond and mitigate the environmental accident. The simulation analysis of accidental pollution processes can be divided into 3 steps:

- Source editing of accidental pollution
- Dynamic simulation of accidental pollution
- Analysis of simulation results

Source editing

After obtaining the basic information of the accident, the staff will immediately add accidental pollution information and the location of the accident site with the set the properties into the system. The main fields will be the following: Name (marine pollution), Name of pollutants (phenols), concentrations of specific pollutants (100000 mg/L), Discharge Time (7200s). For the rest of the data such as accident location, it will be calculated using the number of nodes in the grid. The system will automatically match the topological analysis with the property data.

Figure 103 Sketch Map of Accidental Pollution

Dynamic simulation of accidental pollution

Depending on the specific requirements, the system will call from the model one dimensional, two dimensional or three dimensional dynamic mathematical model of water quality and compare this data with predetermined water quality standards to Simulate pollutants and water quality and water quality during accidents. This can be calculated after the accident and the pollution distribution can be measured over time.

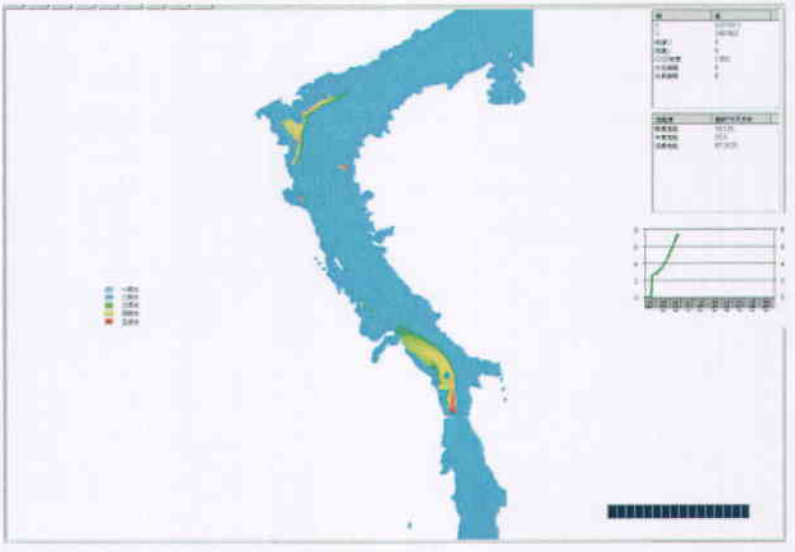


Figure 101A- Sketch Map of two Dimensional Simulation of Pollution Zone

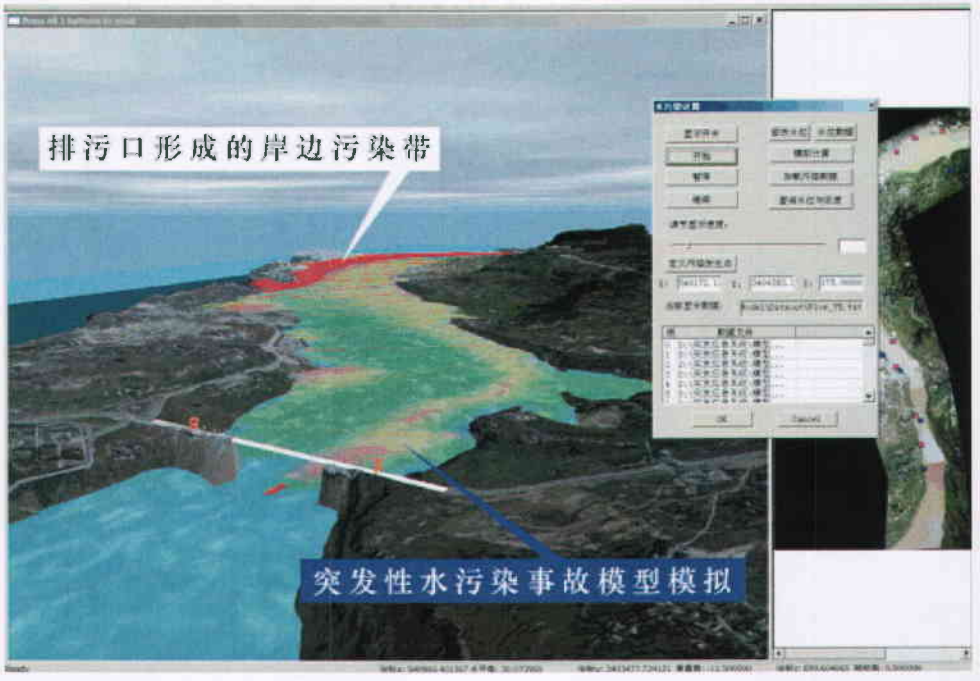


Figure 104 Sketch Map of Pollution with three-Dimensional Simulation

Analysis of simulation results

Query and analysis can be completed using components of the system, GIS, automatic analysis, and statistics when water quality values are in excess of standard values of water quality pollution caused by accidents. A pop-up warning dialogue box can be designated to inform users of environmental emergencies and accidents prompting authorities to take emergency measures and to notify the relevant government department and agencies.

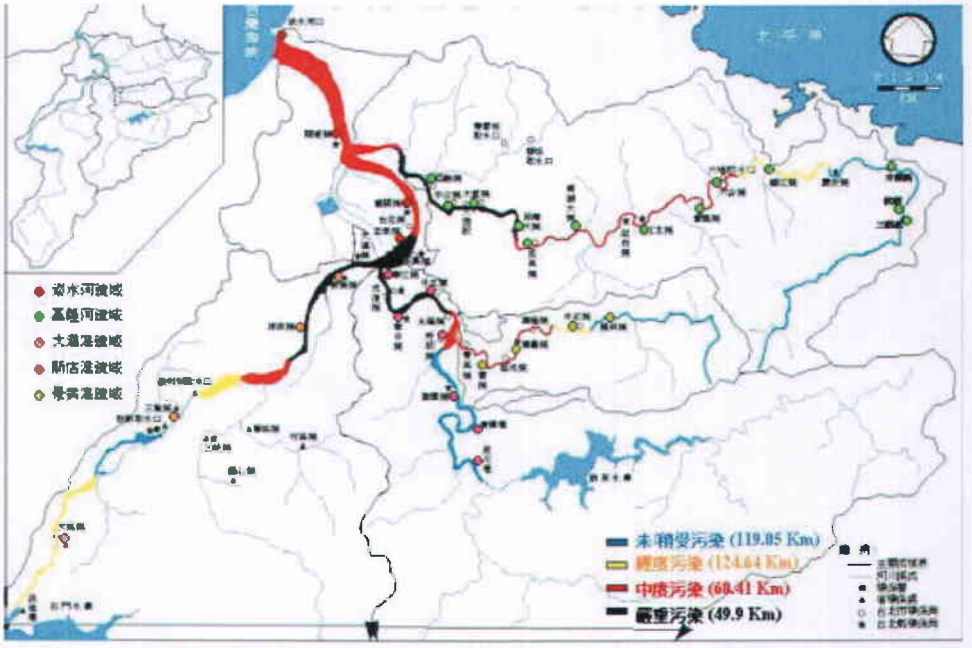


Figure 105 Sketch Map of Pollution Simulation Results Analysis

1.8.4.2 Sub-regional Emergency Dispatch GIS Sub System

Regional emergency management GIS subsystem is primarily regional air, water, and other pollution events that result in a need to escalate the response to the appropriate emergency management system. Regional emergency management will focus more on the economic and humanitarian aspect within each grid. The focus will be on providing air pollutant dispersion, diffusion model of water pollution, and determining the scope of evacuation and evacuation route planning while leveraging dynamic imaging technology of three-dimensional dynamic simulation forecasting the spread of environmental emergency/ pollution event

This subsystem operation also has base maps and query functions including best path analysis, diffusion analysis of river pollution, air pollution dispersion analysis, forecast and analysis of on-line monitoring

and management, environmental, and other relevant functions. This intuitive system will assist users to monitor environmental quality and pollution sources and environmental zoning violations.

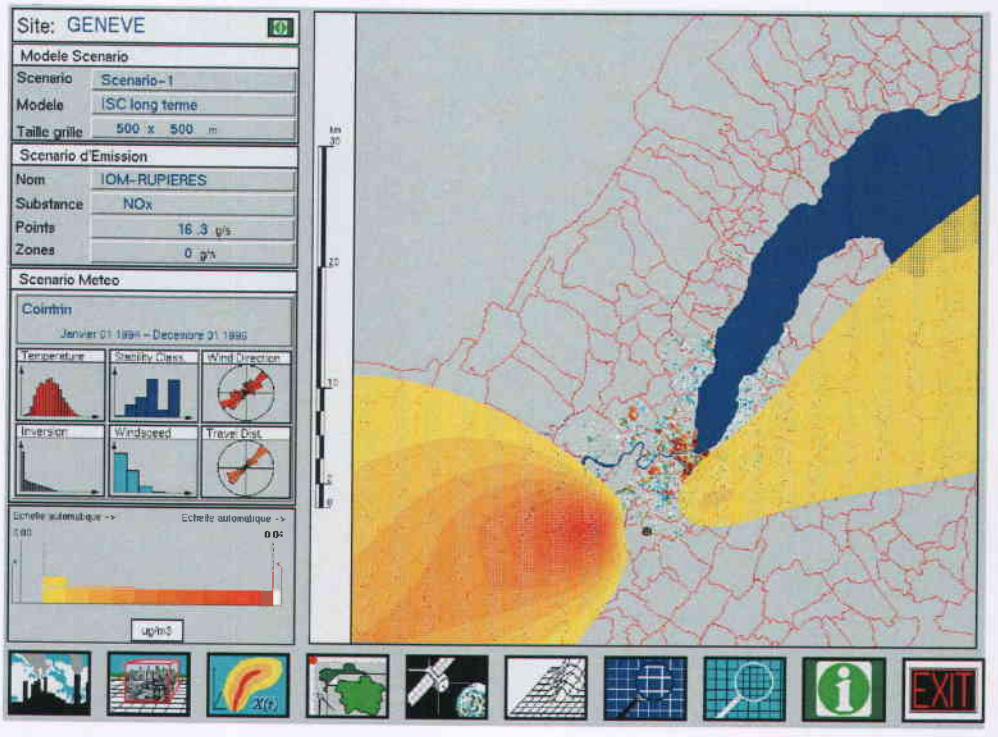


Figure 106 Sketch Map of Air Pollution Spread

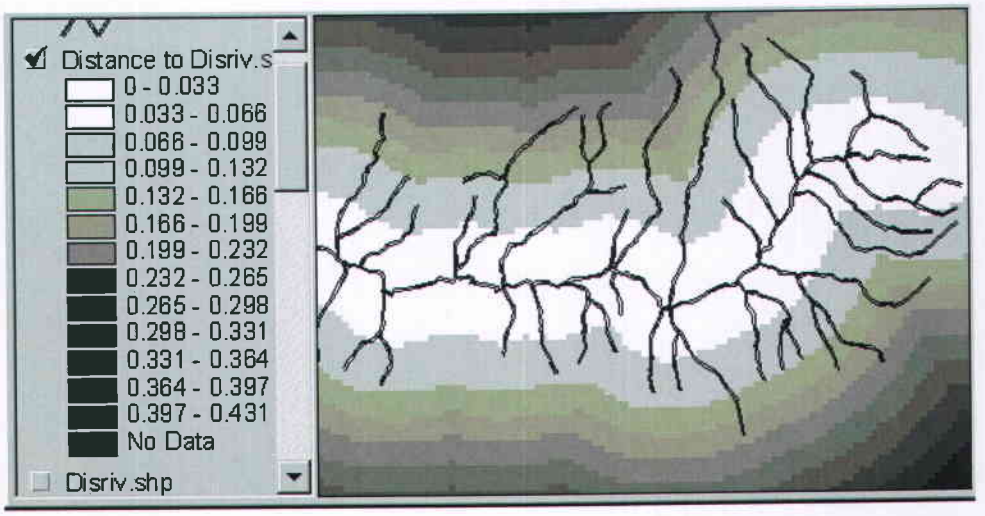


Figure 107 Sketch Map of River Pollution Spread

1.8.4.3 Key Industrial Factories Emergency Dispatch GIS Sub System

Key Industrial Factories Emergency Dispatch GIS Sub System contains the following features:

Information display function - Shows basic information including information about petrochemical facilities, major factories, industrial areas, road network, utilities and infrastructure, other facilities such as schools, hospitals, residential areas, basic geographic information such as rivers, terrain, and other features using a GIS spatial data management platform.

Thematic information display - Mainly used for displaying maps including the location and information of petrochemical facilities, major factories, industrial areas, road network, utilities and infrastructure, other facilities such as schools, hospitals, residential areas, basic geographic information such as rivers, terrain, and other features using a GIS spatial data management platform.

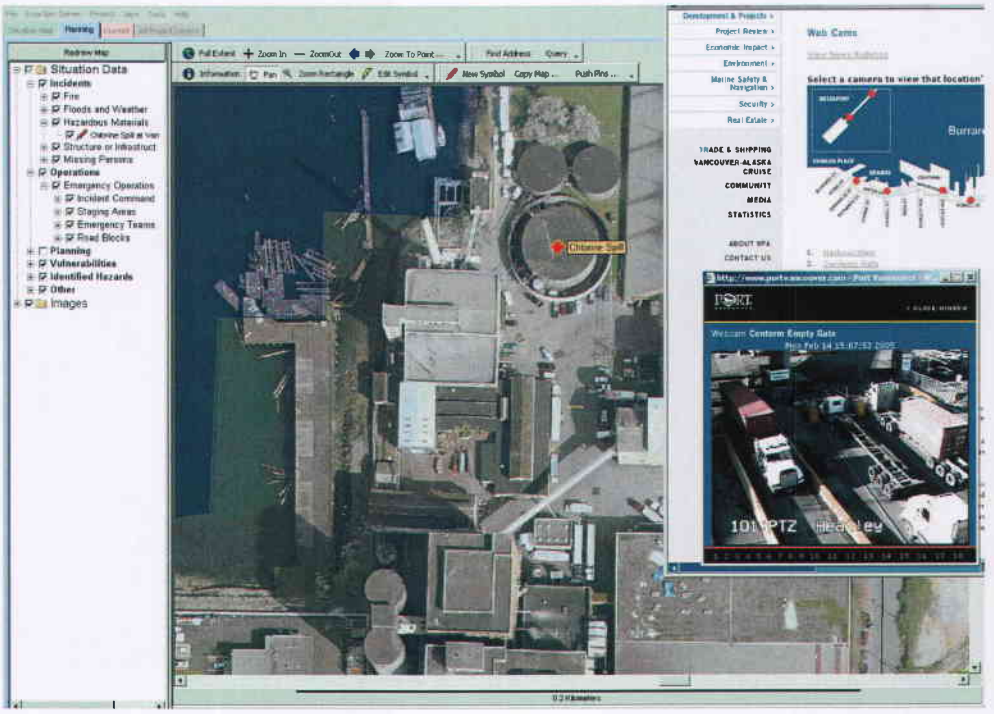


Figure 108 Sketch Map of Display of Enterprise Information and Control Schematics

Positioning function - During an environmental incident the map can be displayed allowing the user to select on equipment within a facility / industrial area to quickly navigate to devices and equipment viewing their profiles and peripheral device information.

Figure 109 Sketch Map of Industrial Areas and Equipment Positioning

Query functions - Allows the users to graphically query for property and facility information to query specific information to view spatial patterns, vector graphics, including production parameters, personnel and facility information, and equipment information.

Buffer analysis functions - Buffer analysis refers to points, lines, and surfaces based on the entity to create an automatic buffer polygons layers around a certain location and the establishment of the superposition of the layer and target layer for analysis. It is one of the spatial analysis tools used to solve the problem of proximity to identify sensitive areas that maybe or may become exposed to an environmental accident or event such as a school, residential area, or other environmentally sensitive area. The function would also allow the user to view video information in different directions around the site of the accident from more than one direction and perspective. In addition, the function would allow users to query the emergency responders in the immediate area.

Network analysis features - This feature will allow users to determine which emergency responders are best suited to response to the environmental emergency/accident/event and the best path/route to the incident.

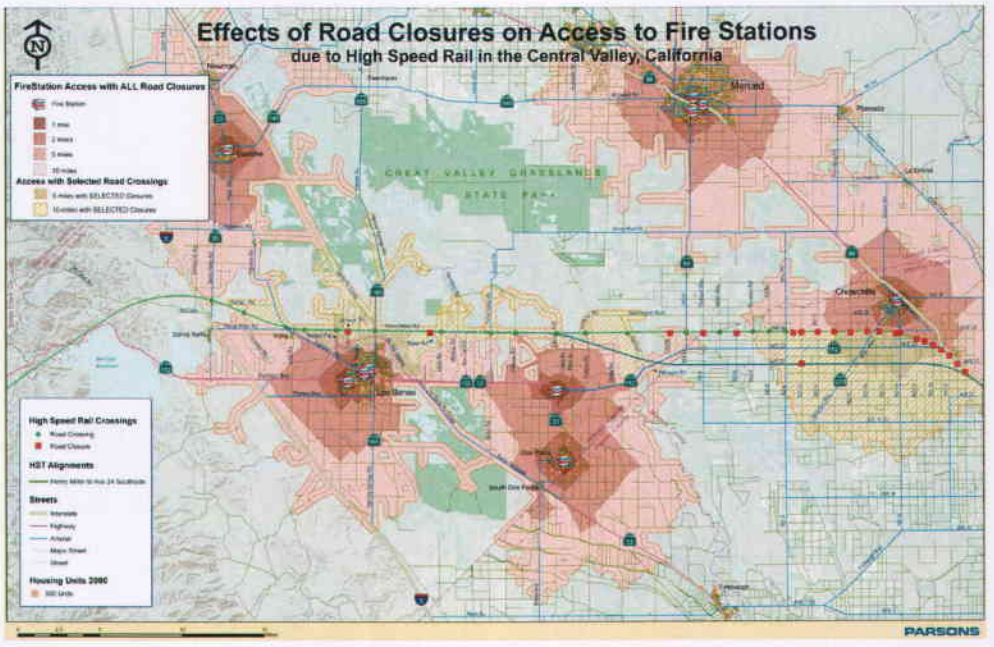


Figure 110 Sketch Map of Network Analysis

Accident simulation features - This feature is mainly used for simulation and prediction of the trend and prediction of chemical accidents integrating the physical and chemical nature of the accident, accounting for terrain conditions, chemical makeup, equipment and processing facility, weather conditions, accident nature - gas or liquid , and other factors. By taking full account of the accident analysis of spread model based on the above factors the model simulation results can be displayed in a vector map providing the basis for deploying emergency management and response.

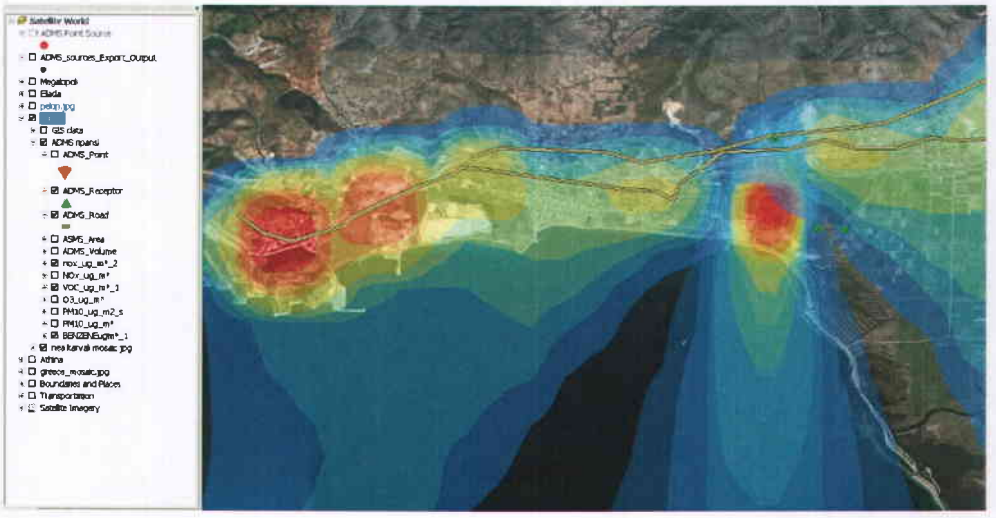


Figure 111 Sketch Map of Accident Simulation Schematic

1.8.4.4 Main Roads Emergency Dispatch GIS Sub System

This sub system will monitor traffic conditions through accurate visual interfacing with traffic monitoring systems to implement command and dispatching to respond to emergencies including statistical analysis for traffic management which contains following features.

- **Traffic monitoring, routing and control** - By providing timely and accurate visual information from real-time traffic conditions and enabling remote traffic control, the system will allow the user to visualize the traffic management platform based on the GIS system based system, to monitor traffic video feeds, to provide a transportation guidance system for emergency routing over the transportation network accounting for current traffic conditions and incident routing, enable command and dispatch personnel, via controlled transportation signal systems, integration with Chinese 122 transportation emergency responding system, integration of GPS vehicle positioning system to display emergency responders responding real-time.

Figure 112 Sketch Map of Traffic Monitoring

Figure 113 Sketch Map of Traffic Dispatching

Accident and emergency response command – This sub system will develop emergency responding plans in advance which, when traffic accident or fire accident occurs, will coordinate with traffic signal system, traffic video monitoring system, transportation information system and road monitoring system to implement emergency action plans for road emergencies.

1.8.4.5 Drinking Water Source Management GIS Sub

Drinking water source management GIS subsystem is aim to manage the water resources spatial data and property data which will at the same time provide spatial analysis and statistical data. It is capable of monitoring drinking water quality and providing a pre-alarm if drinking water quality falls below certain thresholds. It also would provide a basis for source contamination determination and location for environmental accident reconstruction. It contains some of the following features:

- **Water quality evaluation** – Water quality evaluation includes water source assessment, single-factor evaluation and comprehensive evaluation. Water source assessment is based on the database of water quality monitoring data and standard values for indicators for evaluation.

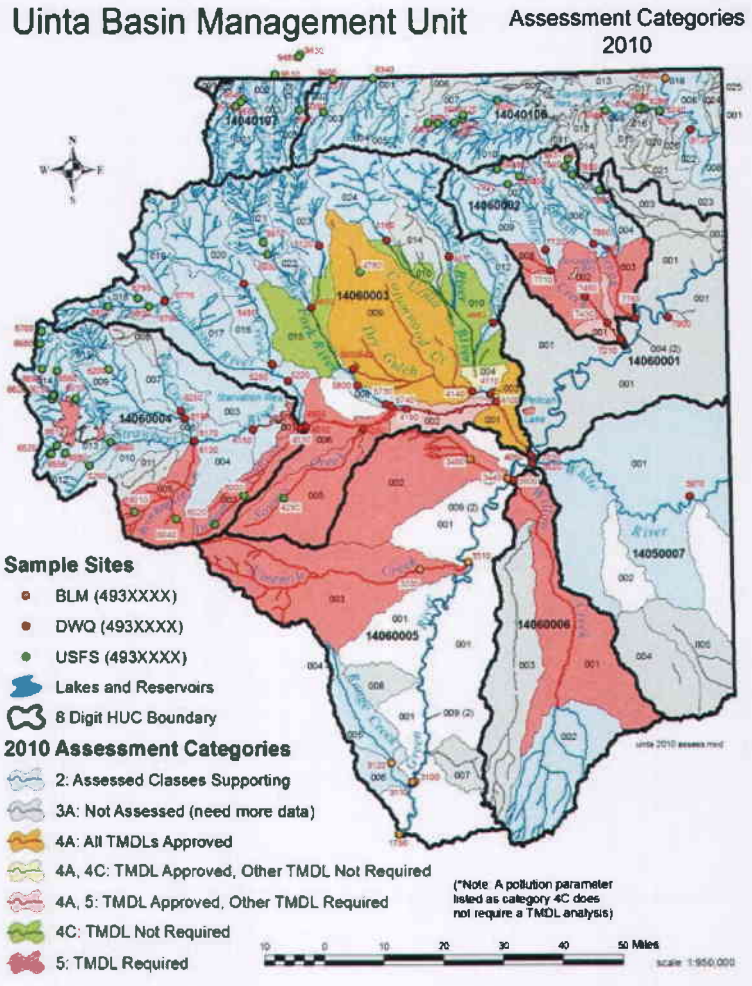


Figure 114 Sketch Map of Water Quality Evaluation

- **Statistical analysis features** - Statistical analysis will measure perimeter and area of polygons for each to analyze the water quality changing and tracking automatically generating graphs and information analysis of water quality based on location.

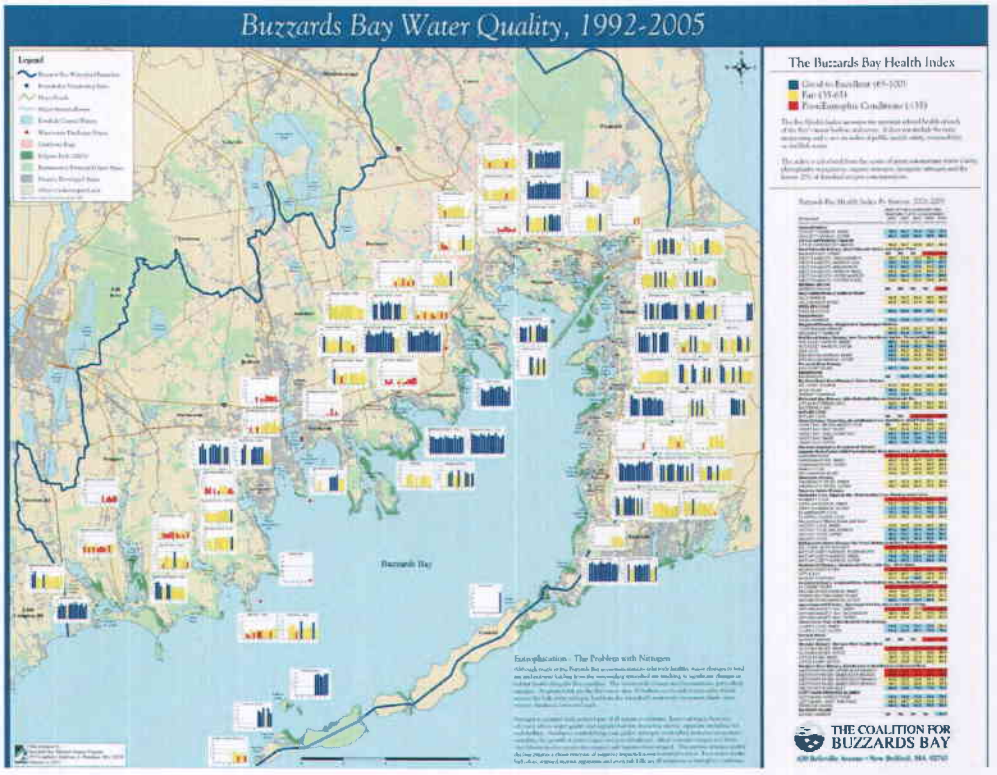


Figure 115 Sketch Map of Statistical Analysis of Water Quality

Spatial analysis functions - Spatial analysis includes analysis on buffer areas according to user-selected water source which would generate a buffer with different level of requirements based on land usage. In addition, spatial analysis would offer overlay analysis of surrounding soil and land usage.

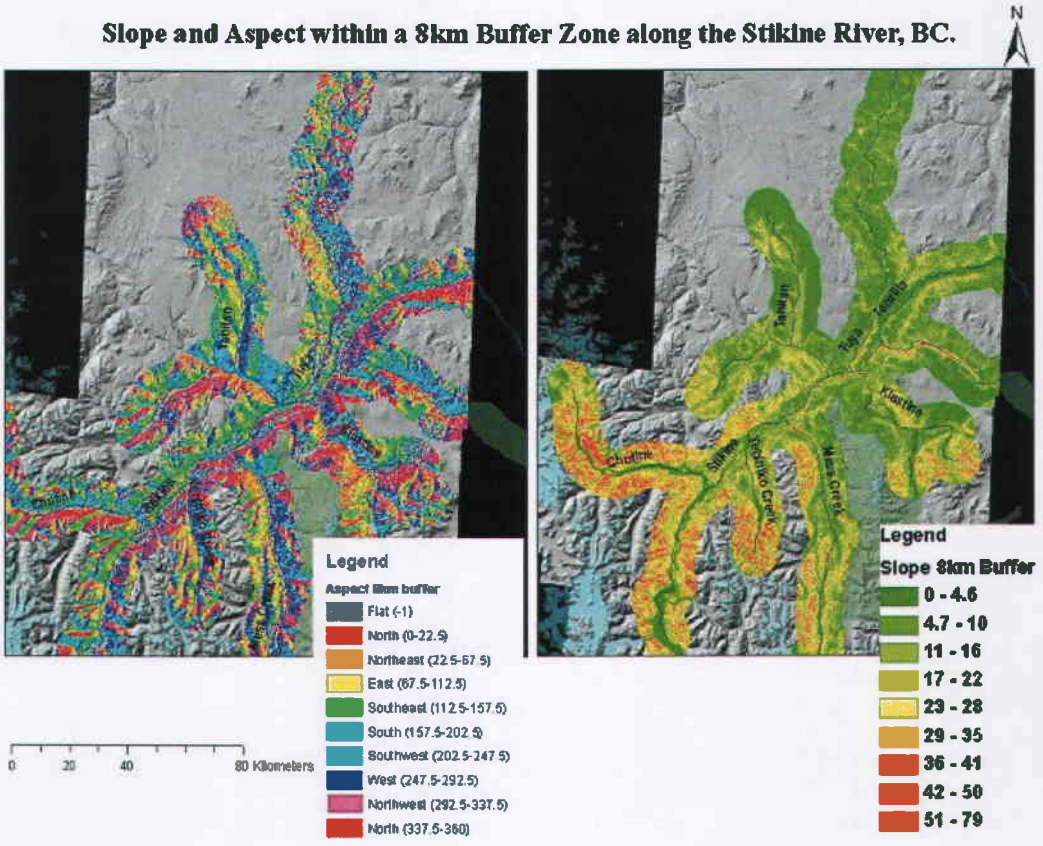


Figure 116 Sketch Map of Spatial Analysis of Water

1.8.4.6 Radiation Source Management GIS Sub System

Radioactive source management GIS subsystem can effectively track the radiation sources using dynamic data for improving the information level of radiation monitoring and response capacity for radiation contamination. It is capable of dynamic management of radiation source information, relative radiation unit information, and radiation safety emergency responding plans. It can provide tools such as positioning monitoring, video monitoring, radiation dosage monitoring, infrared monitoring, access control, RFID. By having GIS features, this system can visually display spatial distribution of radiation sources providing effective radiation emergency command decision support.

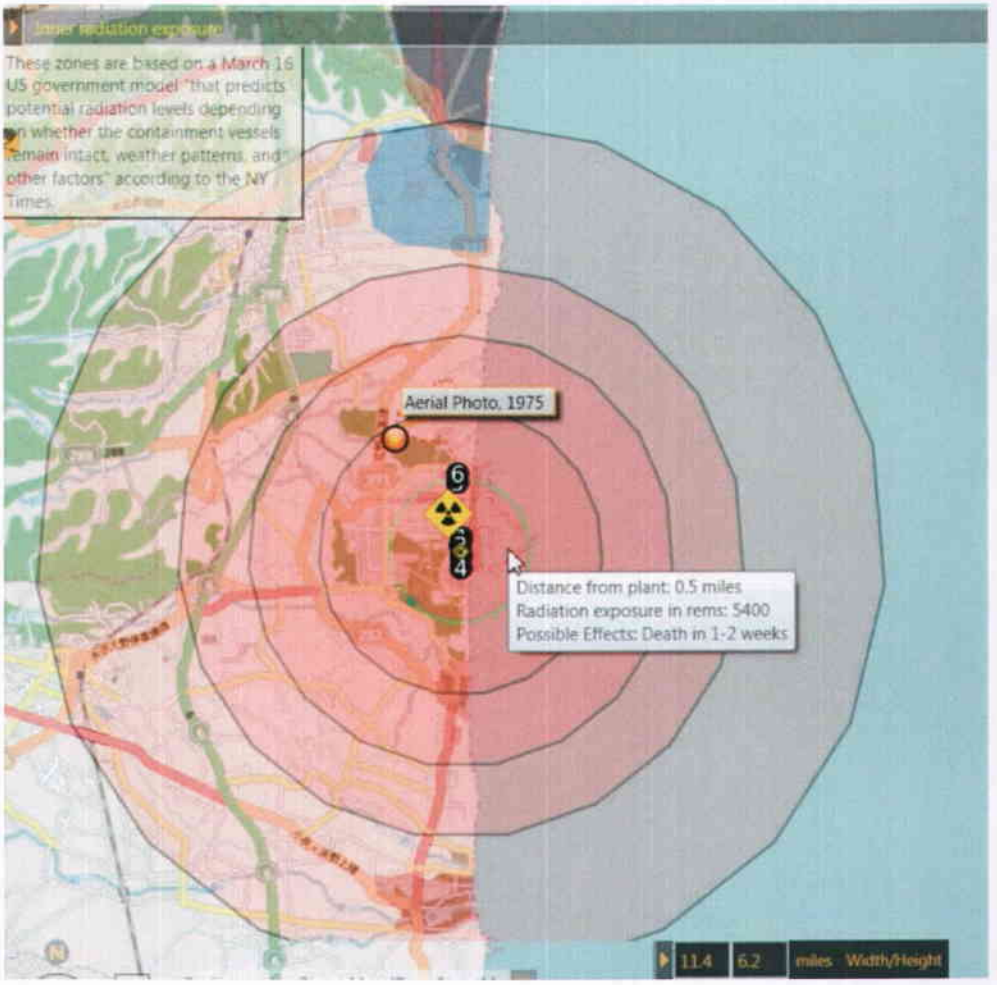


Figure 117 Sketch Map of Pollution Dispersion of Radioactive Sources

1.9 Database

1.9.1 System Hardware Specifications

Please refer to Appendix B for more detailed information regarding the I/CAD database server hardware specifications noted below. The specifications are organized by I/CAD System size in effective seats. Effective seats are computed via the following formula:

Effective seats = # of I/Dispatcher Clients + # of I/Calltaker Clients + (# of I/MDT Clients)/5 + (# of I/NetViewer Clients)/10 + (# of I/NetDispatcher clients)/2

As an example:

-a customer site with:

- 10 - I/Dispatcher Seats
- 5 - I/Calltaker Seats
- 100 – MDT Clients
- 50 - NetViewer Users
- 10 - NetDispatcher Users

Which would equate to: (10+5) + (100)/5 +(50)/10 +(10/2) = 45 Effective Seats

-Small Configuration: 1-50 Effective Seats

Note: There is no external storage for this Server configuration, consists of 14 internal disks

Item	Specification
Processors	2 Quad-Core, 2 GHz or better (Intel X5560)
Memory	32GB
Disk Qty: (12) RAID10 15K RPM SAS for database files plus (2) RAID1 10K RPM SAS for OS and log files	(2) -146GB 10K disks [1] (12) – 300GB 15K disks
Windows Server 64bit	Standard Edition
RDBMS 64bit	Standard Edition [2]

Item	Specification
Example Hardware	Please refer to Attachment C - Configuration Diagram

Medium Configuration: 51-200 Effective Seat

Note: There is no external storage for this Server configuration, consists of 14 internal disks

Item	Specification
Processors	2 Six-Core, 2 GHz or better (Intel X5670)
Memory	48GB[3]
Disk Qty: (12) RAID10 15K RPM SAS for database files plus (2) RAID1 10K RPM SAS for OS and log files	(2) -146GB 10K disks (12) – 300GB 15K disks
Windows Server 64bit	Enterprise Edition
RDBMS 64bit	Enterprise Edition
Example Hardware	Please refer to Attachment C - Configuration Diagram

Large Configuration: 201-500 Effective Seats

Note: For this Server configuration, consists of 6 internal disks, and 24 disks in external storage

Item	Specification
Processors	2 eight-Core, 2 GHz or better (Intel X6550)
Memory	64GB[3]
Internal Disk Qty: RAID1 15K RPM SAS for OS plus RAID10 15K RPM SAS for log files	6 -146GB 15K disks

Item	Specification
External Disk Qty: RAID10 15K RPM SAS for database files	24 - 146 GB 15K disks[1]
Windows Server 64bit	Enterprise Edition
RDBMS 64bit	Enterprise Edition
Example Hardware	Please refer to Attachment C - Configuration Diagram

[1] Hard drive size selection and total storage needs are dependent on call/report volume and data retention plans– high volume customers may require larger capacity disks.

[2] Enterprise Edition required for Oracle Data Guard implementations

[3] Windows Server Enterprise Edition required for server memory greater than 32GB

The usable storage capacity of a RAID 1+0 array is $(N/2) \times S_{min}$, where N is the total number of drives in the array and S_{min} is the capacity of the smallest drive in the array. It is recommended to use same size drive in the array.

Storage capacity examples:

24 - 146 GB drives with RAID 10 = 1752 GB total storage

The Interface-Communication Servers are as follows:

- Two Quad-core Xeon processors
- 16 GB Memory
- 6 - 146GB 15K RPM RAID disk drives
- Dual 1GB NIC Cards
- DVD drive
- 17" Flat Panel monitor, keyboard, and mouse (may be configured one per rack)
- Windows Server 2008 Standard Edition

Off Site Backup CAD Servers

- Configure the CAD off-site backup Servers identically to their production counterparts.

Test / Training / Archive CAD Database Servers

- Configure the test/training servers identically to their production counterparts, except OS and database can be Standard Edition.

Test and/or Training Interface Communications Servers

- Configure the test/training servers identically to their production counterparts

Interoperability Framework / BizTalk Server

Non High Availability / Single Server configuration

- Single or Dual Quad-core, 2.8Ghz Xeon processors
- 16GB Memory
- 6 - 146GB 15K RPM RAID disk drives
- Windows Server 2008 Standard Edition

High Availability / Four Server configuration – 2 BizTalk servers + 2 Database servers

BizTalk servers

- Single or Dual Quad-core, 2.8Ghz Xeon processors
- 16GB Memory
- - 146GB 15K RPM RAID disk drives
- Windows Server 2008 Standard Edition

Database servers – configured in a MS Cluster

- Single or Dual Quad-core, 2.8Ghz Xeon processors
- 16GB Memory- 146GB 15K RPM RAID disk drives
- Windows Server 2008 Enterprise Edition
- External Storage Array with (6) 146GB 15K RPM RAID disk drives

CAD Dispatcher / Calltaker Workstations

- 2GHz or faster Quad-core Intel processor, 64bit OS
- 6 GB Memory

- 250GB disk drive
- Dual 21" Flat Panel Display
- Multiple Monitor Support
- Monitor Sound Bar or External Speakers
- DVD drive
- Single 1GB NIC Card
- Tower configuration
- XP SP3 / Windows Vista SP1 / Windows 7 Professional (32 bit or 64 bit)

Mapping Workstation Specifications

General Map Dataset Size Guidelines: Small to Medium dataset

- Small to medium city or rural county
- Estimated street centreline count is less than 200,000 and address point count is less than 200,000

Large dataset

- Highly urbanized city/county, multi-county, or state
- Estimated street centreline count is greater than 200,000 or address point count is greater than 200,000

Type I Configuration – Small to Medium Dataset, database is local on map workstation

- Operating System (OS) – Window 7 Pro 64bit
- Quad Core Intel Xeon 2.4GHz or better
- 6GB, 1333MHz, DDR3 RAM or better
- 4 Hard Drive Configuration

C: 250GB 7200rpm HD or better for OS and Apps

E: 250GB 7200rpm HD or better for GeoMedia project folder

F: 250GB 7200rpm HD or better for SQL Server Map Staging Database

G: 250GB 7200rpm HD or better for SQL Server log file and primary page file

- 256MB Graphics Card or better
- Gigabit Network Card or better

Type 2 Configuration – Small to Medium Dataset, database is Client / Server

- Operating System (OS) – Windows 7 Pro 64bit
- Quad Core Intel Xeon 2.4GHz or better
- 6GB RAM or better
- 500GB 7200rpm Hard Drive or better
- 256MB Graphics Card or better
- Gigabit Network Card or better

Type 3 Configuration – Large Dataset, database is local on map workstation

- Operating System (OS) – Window 7 Pro 64bit
- Quad Core Intel Xeon 2.5GHz or better
- 12GB, 1333MHz, DDR3 RAM or better
- 4 Hard Drive Configuration

C: 250GB 7200rpm HD or better for OS and Apps

E: 250GB 7200rpm HD or better for GeoMedia project folder

F: 250GB 7200rpm HD or better for SQL Server Database

G: 250GB 7200rpm HD or better for SQL Server log file and primary page file

- 256MB Graphics Card or better
- Gigabit Network Card or better

Type 4 Configuration – Large Dataset, database is Client / Server

- Operating System (OS) – Windows 7 Pro 64bit
- Quad Core Intel Xeon 2.5GHz or better
- 12GB RAM or better
- 256GB Solid State Hard Drive or better
- 256MB Graphics Card or better
- Gigabit Network Card or better

Mobile Data Computers / Laptops

- Ruggedized IBM PC compatible
- Dual Core processor
- 4 GB of RAM
- 80 GB hard drive
- RS-232 for radio connection and also for AVL if desired
- 1024X768 resolution display
- Centronics Port for printing, if appropriate
- Network connection if to be docked on the network
- Touch screen is preferred

GPS Units

Note: Intergraph AVL products only support the protocols listed below. Devices that support one of these protocols should be compatible with the Intergraph I/Tracker product.

Protocols supported

- NMEA (National Marine Electronics Association)
- TAIP (Trimble ASCII Interface Protocol)
- OpenSky Subscriber Application Interface (M/A-COM Tyco Electronics – Revision 1.3)
- BlueTree (IO Management and Event Reporting for the BlueTree 4000 and 5000 Series – Version 1.0)

Business Intelligence Servers

BI - Application Server (Qty 1)

- One (1) Intel Xeon X5560 Quad Core, 2.8Ghz Processor
- 16 GB RAM
- Two (2) 146GB 15K RPM SCSI Hard Drives (in RAID 1 configuration)
- NIC: Two (2) Integrated Broadcom NetXtreme II 5708 Gigabit NICsTOE Capable
- Windows Server 2008 SP1 Standard Edition (64 bit)

BI - ETL and Database Servers (Qty 2)

- One (1) Intel Xeon X5560 Quad Core, 2.8Ghz Processor
- 32 GB RAM
- Six (6) 146GB 15K RPM SCSI Hard Drives (2 in RAID 1 for OS and 4 in RAID 5)
- NIC: Two (2) Integrated Broadcom NetXtreme II 5708 Gigabit NICsTOE Capable
- Windows Server 2008 SP1 Standard Edition (64 bit)

Business Intelligence Workstations

Minimum Hardware Requirement for Business Intelligence & Crystal Reports 2008

- 2.0 GHz Pentium 4-class processor
- 2 GB RAM
- 100 BaseT network card
- 4.9 GB hard disk space for BusinessObjects Enterprise

Supported Operating Systems

- Windows XP SP2 Professional (all 32-bit and 64-bit editions)

- Windows Vista (all 32-bit and 64-bit editions)

Supported Browsers (Required for Report Viewer and Web Intelligence)

- Microsoft Internet Explorer

*in*PURSUIT RMS Servers

- Dual, 8-core Xeon Processors
- 64 GB RAM
- 6 – 300GB, RAID1 or RAID10 with 15K RPM SAS
- Quad 1 GB NIC Cards

*in*PURSUIT RMS Database SAN storage

- RAID1 or RAID10 configuration
- TB Available Disk Space (minimum storage)

*in*PURSUIT FBR Server

*in*PURSUIT Interface Server

*in*PURSUIT Report Server/WebRMS/ Server

- Dual, 8-core Xeon Processors
- 16 GB RAM
- 6 – 146GB, RAID1 or RAID10 with 15K RPM SAS
- Quad 1 GB NIC Cards

*in*PURSUIT Workstations

- 4 GB Memory
- 2GHz or faster Quad-core Intel processor
- 250GB disk drive
- Single 1GB NIC Card
- 1024x768 minimum resolution
- Microsoft Office 2007 (Word and Excel)

System Software Specifications

CAD Version 9.1.x RADO/DBRecover systems

Operating system – CAD servers

- Windows Server 2003 R2 SP2 (x64 H/W and O/S)
- Windows Server 2008 SP1 (x64 H/W and O/S)
- Windows Server 2008 R2 (x64 H/W and O/S)
- Oracle Linux 5 x64 (for Oracle DB server only)

Operating system – Interface / Comm servers

- Windows Server 2003 R2 SP2 (x64 H/W and O/S)
- Windows Server 2008 SP1 (x64 H/W and O/S)
- Windows Server 2008 R2 (x64 H/W and O/S)

Database Software

- SQL Server 2008 SP2
- Oracle: 11.2.0.1 (11GR2)

Client Operating Systems

- Windows XP SP3 (32 bit and 64 bit)
- Windows Vista SP1 (32 bit and 64 bit)
- Windows 7 Professional (32 bit and 64 bit)

Browser: Internet Explorer 7.0 / Internet Explorer 8.0

CAD Version 9.1.x High Availability systems using SQL Server Mirroring or Oracle Data Guard

Operating system – CAD servers

- Windows Server 2008 SP1 (x64 H/W and O/S) – for either Oracle or SQL Server
- Windows Server 2008 R2 (x64 H/W and O/S) – for SQL Server and Oracle 11gR2 only

- Oracle Linux 5 x64 (for Oracle DB server only)

Operating system – Interface / Comm servers

- Windows Server 2003 R2 SP2 (x64 H/W and O/S)
- Windows Server 2008 SP1 (x64 H/W and O/S)
- Windows Server 2008 R2 (x64 H/W and O/S)

Database Software

- SQL Server 2008 SP2; For the Witness - SQL Server 2008 SP2 (Express Edition or greater)
- Oracle: 11.1.0.7 (11gR1) or 11.2.0.1 (11gR2) - Enterprise Edition required for Data Guard support

Client Operating Systems

- Windows XP SP3 (32 bit and 64 bit)
- Windows Vista SP1 (32 bit and 64 bit)
- Windows 7 Professional (32 bit and 64 bit)

Note: Windows 7 only supported for SQL Server or running Oracle client 11GR2 (32 bit and 64 bit). Oracle does not support the Windows 7 OS with 11GR1.

Browser: Internet Explorer 7.0 / Internet Explorer 8.0

CAD Database servers and comm servers were certified in a virtual environment with VMware vSphere 4

*in*PURSUIT RMS Version 11.5
Server Database Software

- Oracle 11g Standard Edition

Server Operating System Software

- Windows Server 2008 Enterprise Edition for RMS application servers (64-bit)
- Windows Server 2008 Enterprise Edition for FBR application servers (32-bit)
- Windows Server 2008 Standard Edition for Interface / Report servers (32-bit)
- Windows Server 2008 Standard Edition for WebRMS application (32-bit)

Client Workstation Operating System Software

- Windows XP & Windows 7 Pro (32-bit or 64-bit)

Operating System Best Practices

Overview:

How the operating system is configured can greatly impact the installation and setup of the Intergraph specific applications downstream. Taking steps early in the setup of the server to ensure a proper configuration will make later software installation and configuration far easier.

Machine Names:

Every computer is given a name that can be used to access resources on that machine. This is often referred to as the node name, NetBIOS name, or machine name. This is probably the one aspect of standard server configuration that is likely to be dictated by the customer. It is not uncommon for large IT organizations to have naming conventions in place (Called UNC – Universal Naming Convention) that they want applied to all devices within the span of their control.

The following table shows the desired server name conventions for a standard I/CAD

Installation should the customer have no preference:

Purpose	Suggested Node Name	Notes
Primary CAD Database	CAD01	
Secondary CAD Database	CAD02	
Primary Com/Interface	CADCOM01	
Additional Com/Interface	CADCOM02	Increment number as needed (CADCOM03, etc.)
CAD Training Server	CADTRAIN01	
CAD Test Server	CADTEST01	
Mapping Server	CADMAP01	

Machine names should be finalized before the database applications are installed. This is far more important in an Oracle setup that in SQL Server but is best to have the names cemented before application installation and setup occurs.

Domain:

If the customer is using an existing domain, the machines will have to be joined to the domain by a customer who has a domain administrator account. Intergraph does not generally provide domain setup for customers. If your site is standing up a domain for the first time, and Intergraph is responsible for its configuration, consult the domain setup document created by Intergraph for use in public safety.

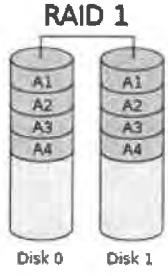
Note: If you are going to use SQL Server Database Mirroring as your high availability solution, it is important to obtain a domain login that can be used as a service account for running the database related services. The account will need administrator privileges on the local machines running the database applications, but do not need to be domain administrator accounts. The passwords should be set to never expire.

User Accounts:

The only user account Intergraph should configure on the server is the local administrator account. The password should be conveyed to Intergraph services staff. This allows all Intergraph staff working on the project to know a definitive way to access administrator privileges on the machine.

If the customer has a domain and the machines are joined to the domain, the customer may choose to create domain level logins for Intergraph personnel. If this is the case, then each Intergraph domain account should be added to the local administrator user group on each server and workstation in the I/CAD system. Intergraph personnel should not accept a domain administrator account from a customer. These accounts carry significant ability to alter core parts of the customers active directory structure, and we should avoid being in a position to have those responsibilities.

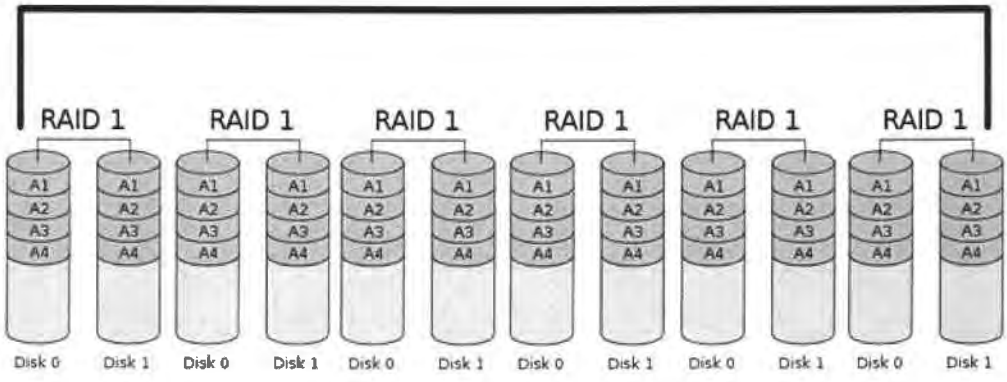
Small Configuration (1-50 Effective Seats)



RAID 1 Mirrored Pair for OS and Intergraph Files (2 disks)

RAID 10

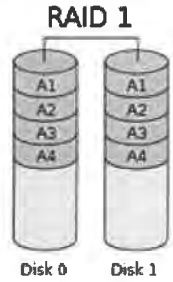
RAID 0



RAID 10 for Database Files (12 disks)

All drives are internal to the server

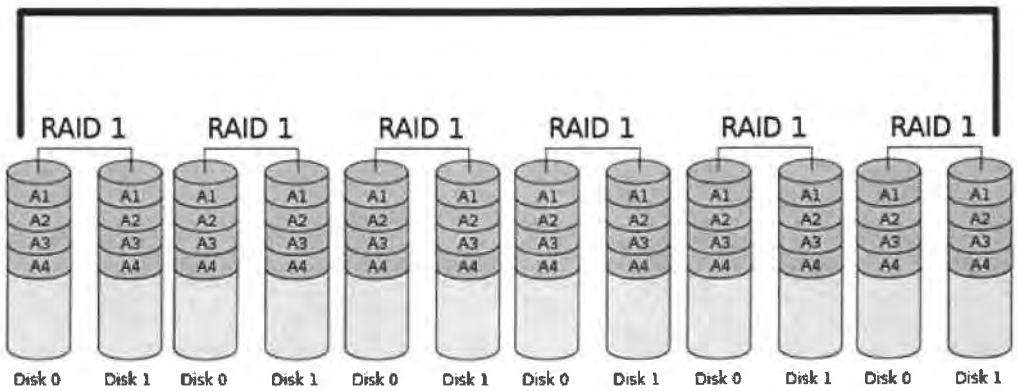
Medium Configuration (51-200 Effective Seats)



RAID 1 Mirrored Pair for OS and Intergraph Files (2 disks)

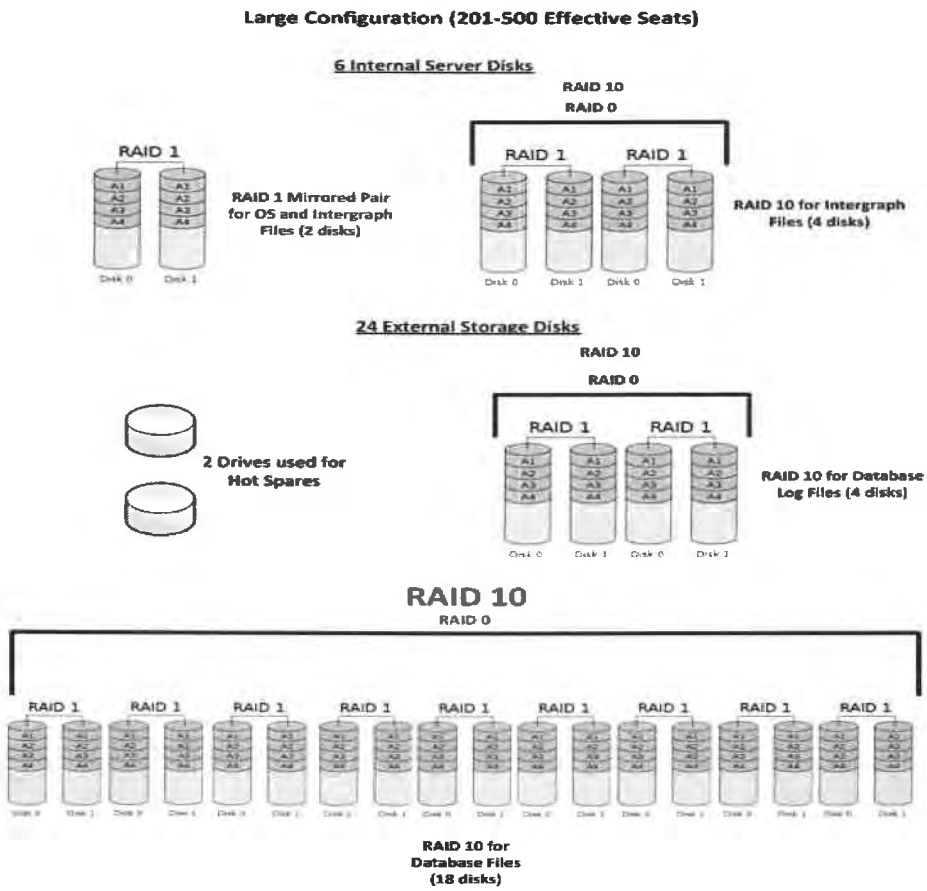
RAID 10

RAID 0



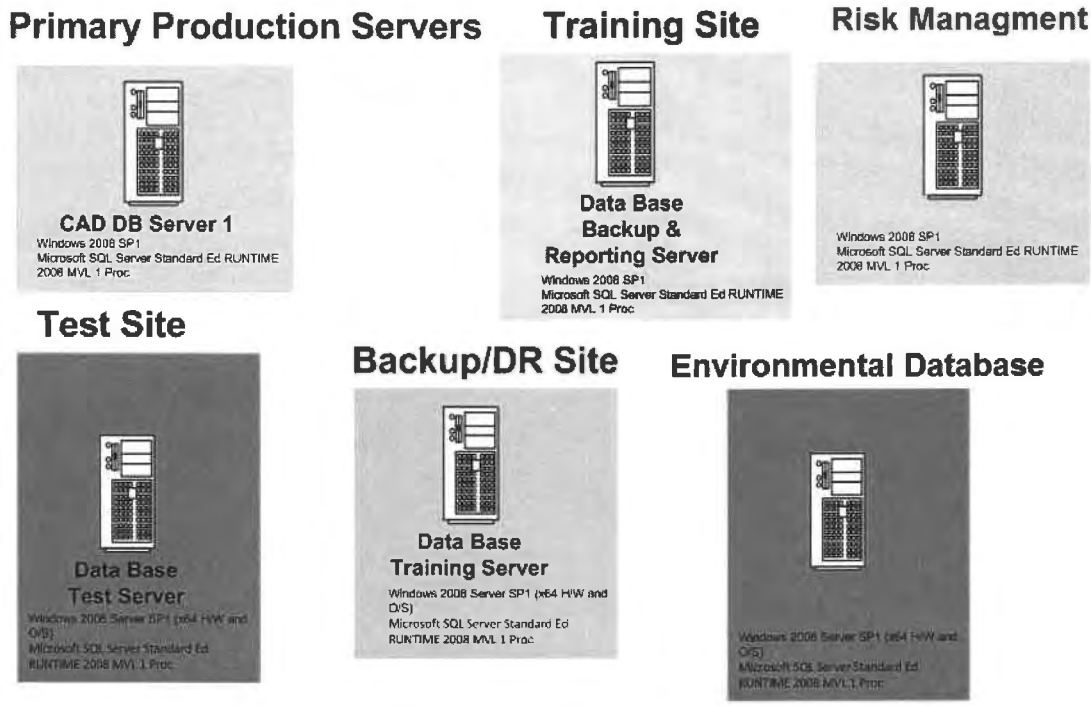
RAID 10 for Database Files (12 disks)

****All drives are internal to the server****



1.9.2 Database Requirements- Servers

Below is the recommended database servers and database software for the project:



1.9.3 Database Servers

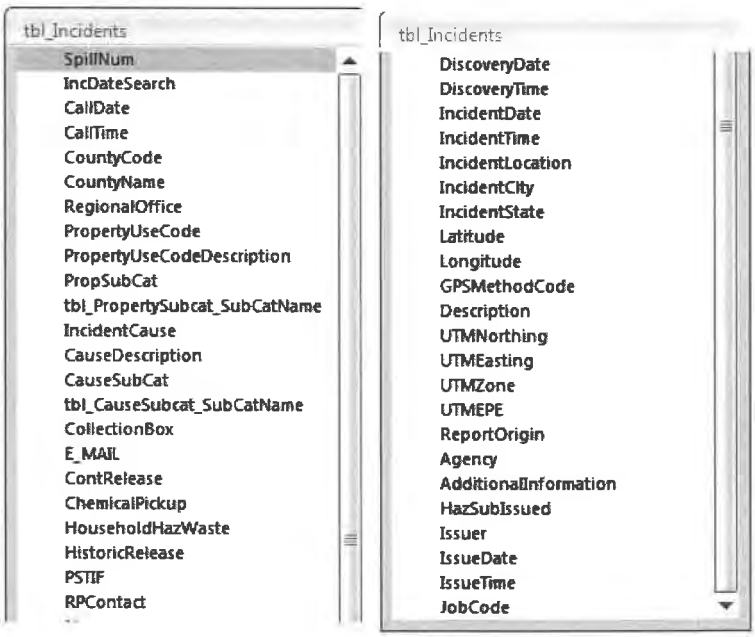
Database Servers			
Primary Server Components	**Part Number**	**Description**	**Quantity**
Database Server 1			
Server (OS - MS Windows Server 2008)	N/A	PowerEdge R710, RAID 10	1
Database Server 2			
Server (OS - MS Windows Server 2008)	N/A	PowerEdge R710, RAID 10	1
Data Base Backup & Reporting Server			

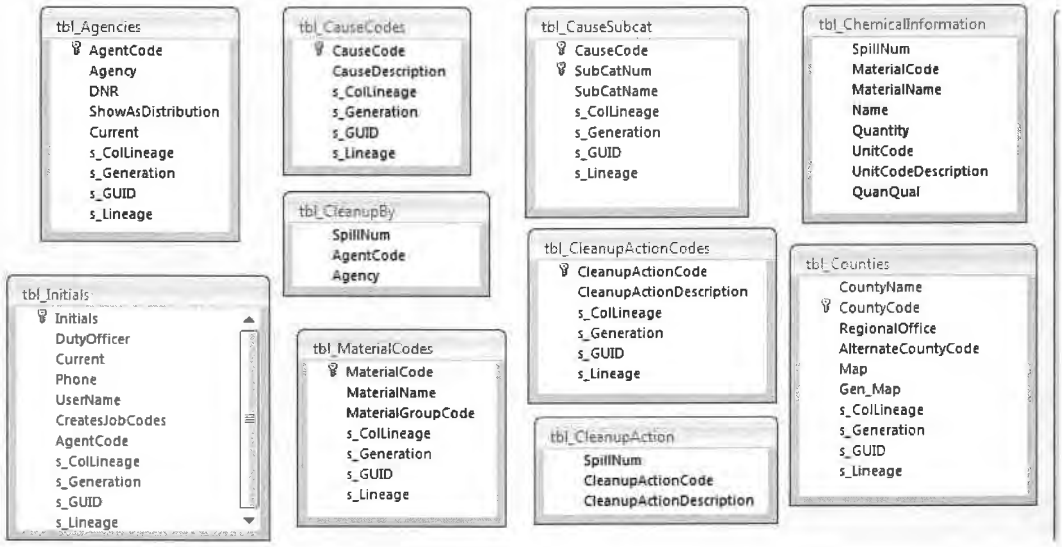
Database Servers			
Primary Server Components	**Part Number**	**Description**	**Quantity**
Server (OS - MS Windows Server 2008)	N/A	PowerEdge R710, RAID 10	1
Data Base Training Server			
Server (OS - MS Windows Server 2008)	N/A	PowerEdge R710, RAID 10	1
Data Base Test Server			
Server (OS - MS Windows Server 2008)	N/A	PowerEdge R710, RAID 10	1

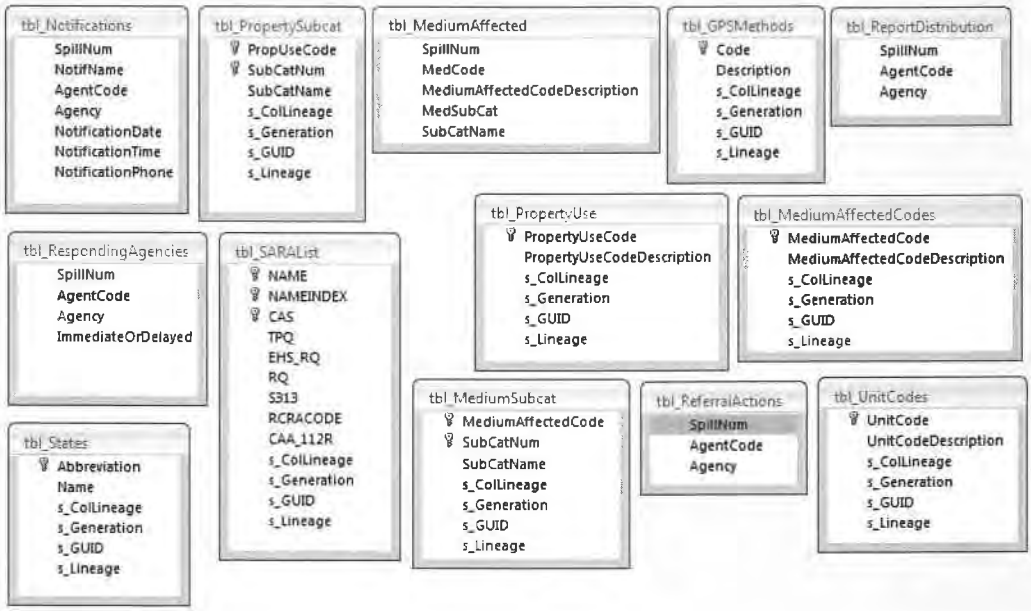
Ship to Address:				Bill to Address:
Description				
Generic R710 Poweredge Server				
SYSTEM COMPONENTS				
Generic R710 Poweredge Server		Qty	1	
Chassis for Up to 8, 2.5-Inch Hard Drives, Windows Server 2008 R2, Standard Edition,x64, Includes 5 CALS	Unit Price			
Catalog Number:	84 RCRC972329-2760526			

Module	Description	Product Code	Sku	Id
PowerEdge R710	Chassis for Up to 8, 2.5-Inch Hard Drives	R7108W	[224-8461]	1
Operating System	Windows Server 2008 R2, Standard Edition,x64, Includes 5 CALS	WSSE6C	[421-1622]	11
SHIP	PowerEdge R710 Shipping	SHIPGRP	[330-4124]	2
Memory	32GB Memory (4x8GB), 1333MHz Dual Ranked RDIMMs for 1 Processor, Advanced ECC	32RD1P	[317-2222]	3
Keyboards, Mice, Displays and Related Devices	USB Server Interface Pod, includes CAT 5 Cables	USBSIP	[310-9960]	4
Feature Upgrades for Embedded NIC Ports	Embedded NICs are TOE Ready with iSCSI Offload Enabled	ISCSI	[430-1764] [430-2970]	5
Processor	Intel® Xeon® X5560, 2.8Ghz, 8M Cache,Turbo, HT, 1333MHz Max Mem	X5560	[317-1202] [317-1224]	6
Additional Processor	Single Processor Only	1P	[311-3928]	7
1st Hard Drive	146GB 15K RPM Serial-Attach SCSI 6Gbps 2.5in Hotplug Hard Drive	146A156	[342-0427]	8
Internal Controller	PERC 6/i SAS RAID Controller, 2x4 Connectors, Internal, PCIe,256MB Cache,x8	P6IX8	[341-8712]	9
BIOS Setting	Performance BIOS Setting	HPBIOS	[330-3492]	10
Embedded Management	iDRAC6 Express	IDRCEX	[467-8649]	14
Internal Optical Drive	DVD ROM, SATA, Internal	DVD	[313-9092]	16
Bezel	Bezel	BEZEL	[313-7517]	17
Riser Card	Riser with 2 PCIe x8 + 2 PCIe x4 Slot	PCIEX8	[320-7886]	18
System Documentation	Electronic System Doc, OpenManage DVD Kit with Dell Management Console	EDOCSD	[330-3485] [330-5280]	21
2nd Hard Drive	146GB 15K RPM Serial-Attach SCSI 6Gbps 2.5in Hotplug Hard Drive	146A156	[342-0427]	23
Hard Drive Configuration	RAID 10 for H700 or PERC 6/i Controllers	MSR10	[341-8701]	27
Rails	ReadyRails™ Sliding Rails With Cable Management Arm	RRCMA	[330-3477] [993-2200] [993-8458] [993-8447] [989-3439]	28
Hardware Support Services	5 Year ProSupport and Mission Critical 4HR 7x24 Onsite Pack	U5IPME4	[988-5154] [988-4964] [993-8507]	29
Installation Services	No Installation	NOINSTL	[900-9997]	32
Power Supply	High Output Power Supply, Redundant, 870W	RDPSUHO	[330-3475]	36
	2x C13 to C14, PDU Style			

1.9.4 Recommended Tables and Fields -Examples




tbl_Agencies
AgentCode
Agency
DNR
ShowAsDistribution
Current
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_CauseCodes
CauseCode
CauseDescription
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_CauseSubcat
CauseCode
SubCatNum
SubCatName
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_ChemicalInformation
SpillNum
MaterialCode
MaterialName
Name
Quantity
UnitCode
UnitCodeDescription
QuanQual
tbl_CleanupBy
SpillNum
AgentCode
Agency
tbl_CleanupActionCodes
CleanupActionCode
CleanupActionDescription
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_Counties
CountyName
CountyCode
RegionalOffice
AlternateCountyCode
Map
Gen_Map
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_Initials
Initials
DutyOfficer
Current
Phone
UserName
CreatesJobCodes
AgentCode
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_MaterialCodes
MaterialCode
MaterialName
MaterialGroupCode
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_CleanupAction
SpillNum
CleanupActionCode
CleanupActionDescription


tbl_Notifications
SpillNum
NotifName
AgentCode
Agency
NotificationDate
NotificationTime
NotificationPhone
tbl_PropertySubcat
PropUseCode
SubCatNum
SubCatName
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_MediumAffected
SpillNum
MedCode
MediumAffectedCodeDescription
MedSubCat
SubCatName
tbl_GPSMethods
Code
Description
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_ReportDistribution
SpillNum
AgentCode
Agency
tbl_PropertyUse
PropertyUseCode
PropertyUseCodeDescription
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_MediumAffectedCodes
MediumAffectedCode
MediumAffectedCodeDescription
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_RespondingAgencies
SpillNum
AgentCode
Agency
ImmediateOrDelayed
tbl_SARAList
NAME
NAMEINDEX
CAS
TPQ
EHS_RQ
RQ
S313
RCRACODE
CAA_112R
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_MediumSubcat
MediumAffectedCode
SubCatNum
SubCatName
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_ReferralActions
SpillNum
AgentCode
Agency
tbl_UnitCodes
UnitCode
UnitCodeDescription
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_States
Abbreviation
Name
s_ColLineage
s_Generation
s_GUID
s_Lineage

1.1 Environmental Emergency Response and Management Platform

It is recommended that we use Hexagon H2O solution as the environmental emergency response and management platform.

1.1.1 System Architecture

The H^2O solution provides a platform where information can be intelligently harvested and presented from various Hexagon software products as well as any third-party applications that are integrated into the system. While each integrated application typically presents a user interface for a particular user type, the H^2O solution provides the following core applications:

H^2O Interoperability Platform

The Interoperability Platform contains a Rules Engine component that is the intelligence of the entire system, which defines how the system will act or react from the static or dynamic parameters of application modules installed in an implementation.

H^2O Dashboard Application

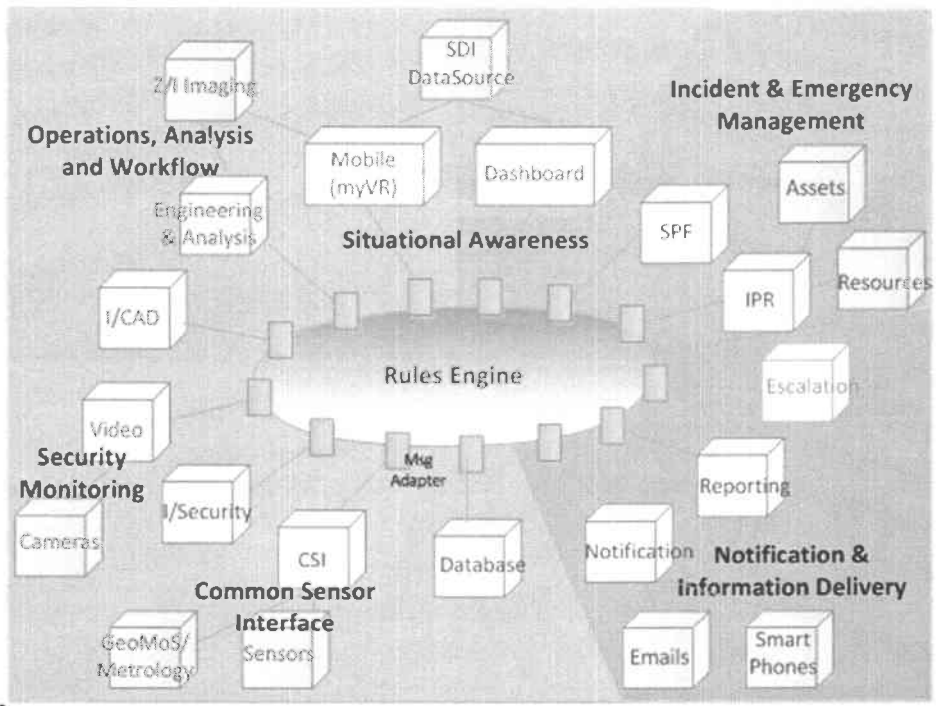
This is a native web service supporting customizable visual presentation of the system itself, including overall status, sensors, alarms, events, video, and so on. It is commonly used within the operational centre as well as staff and engineers at remote locations.

H^2O Mobile Application

This is a client application for mobile devices, providing users with information about the environment and its surroundings. This includes real time sensor readings, video camera feeds, and the ability to action tasks and conduct inspections on a mobile device.

To increase the value advantage of the capabilities the H^2O Solution offers, in addition to the core applications - H^2O Interoperability Platform, H^2O Dashboard, and H^2O Mobile – there are several other products that are tightly integrated together to provide a total enterprise solution. These products include H^2O Security Framework, H^2O Incident Command & Control, H^2O Disaster Planning & Response, H^2O Information Management, H^2O Video and H^2O Notification. The H^2O Solution allows users to configure rules and policies to materialize data share and information exchange among H^2O core products and integrated products.

As is shown in following figure, in the system actual or logical applications are connected to a centralized Rules Engine (part of the H²O Interoperability Platform) through message adapters. The Rules Engine allows users to configure workflows to produce useful information and operational actions as needed by your organization. The integrated applications will share and exchange data and information based on your configured rules and policies.



1.1.2 Module Descriptions

H²O Dashboard

The H²O Dashboard displays data in various formats such as raw data, analyzed data and also data on 2D and 3D geospatial displays. Main features of the H²O Dashboard are:

- 2D/3D Geospatial map, including 3D Models of Water Infrastructure
- System status and system messages
- Latest Sensor readings and status
- Real-Time system alarms

- Physical Resource status and their geographic location
- Video camera vision, and control of such cameras that have the capability
- Task management and execution
- Document management such as Standard Operating Procedures (SOP), Emergency Action Plans (EAP), Engineering drawings, manuals etc
- Review Inspection results

H²O Mobile

The H²O Mobile application allows users in the field or on mobile devices to monitor the environment and also conduct inspections. Main features of the H²O Mobile application include:

- 2D/3D Geospatial map, including 3D models of Water Infrastructure
- Latest sensor readings and status
- Real-Time system alarms
- Video camera vision
- Receive allocated tasks and task execution
- Conduct predefined inspections and upload to server
- Take photographs, videos and associate with an inspection

H²O Interoperability Platform

The H²O Interoperability Platform is the middleware of the H²O Solution that allows all the various applications to communicate with each other based on rules that are configured by the customer. The H²O Interoperability Platform enables the ability to provide intelligent convergence of data from all different types of sources.

- Rules Driven
- Configurable
- Integration Adaptors for
    - H²O Geospatial Engineering & Analysis
    - H²O Design Engineering & Schematics

- H^2O Real-Time Monitoring
- H^2O Image/Data Capture
- H^2O Security Framework
- H^2O Incident Command & Control
- H^2O Disaster Planning & Response
- H^2O Information Management
- H^2O Notification
- H^2O Video
- H^2O Flood Modeling

H^2O Security Framework

A safety and protection control room has alarms that are mostly triggered by sensors (perimeter control sensors, radar, intelligent CC-TV cameras, production-flow monitoring systems, etc.). The operator must be able to control the detection sensors (usually PTZ cameras) from a single, integrated environment and dispatch the response staff. The cartographic interface of the situational picture requires all the functions of an advanced GIS application and must be able to quickly detect alarms, estimate positions of intruders or incidents (triggered by sensors), and locate positions of the response teams (equipped with GPS, AVL terminals, etc.). The H2O Security Framework incorporates the following features into a common operational picture:

- Integrating data from a variety of systems and sensors
- Fusing that data into a common operating picture
- Combines elements of sensor monitoring, alarm processing, video analysis, and object tracking
- Processes alarms, automatically creating Incidents/Events and reporting them to H^2O Incident Command Control
- Defines the location, event type, and contact information related to the alarm that occurred
- Includes the alarm, access control, and target interfaces for communication with external sensor system

- Monitoring and interacting with moving objects via interfaces with sensors such as radar, RFID, intelligent video, or others sensors capable of detecting and reporting the location of moving objects of interest
- User interface for displaying and controlling live and recorded video through a variety of video management systems

H^2O Incident Command & Control

H^2O Incident Command & Control is an efficient and easy-to-use system, offering unprecedented communications integration, interoperability, and mobile capabilities for smarter, faster response. Incident Command & Control provides real-time incident awareness and dispatching to speed emergency response.

- Answer calls, verify locations, enter precise incident information, and forward calls to control room dispatchers.
- Automatic data feeds from alarm systems combined with the display of geographical location, address, and other information,
- Allow call-takers to rapidly identify where an incident is happening.
- Structured series of questions and answers that guide you through specific situations, allowing you to quickly assess and prioritize calls.
- Power to dispatch units and resources, as well as monitor incident status.
- Recommends resources based on incident and location, location arrival time, unit type, responder skills and availability, and other pertinent factors.

H^2O Disaster Planning & Response

The H^2O Disaster Planning & Response product is a configurable, modular solution to effectively support operational command, based on established practice and protocols.

- Portal
  - Central home page, Main navigation for workflows / processes, Key application / component launch and, Overview of the most important tasks, information and operations, Full text search, Information ticker
- Command

- Document Flow, Organization charts, Timeline, News summary, *Reports,* Reporting for situation reports, press releases, mission report (operation diary), Continuous audit logging of all information, facts, actions, etc.

- Map
  - Geographic Information System / Maps module, Definition and management of attribute data and geospatial information, Interface for online tracking, Library of tactical symbols in accordance with the organization-specific, applied regulations

- Resources
  - Management of materials and personnel, Shift planning, Management of action units / forces and their availability

- Interfaces
  - Interfaces to third-party command and control systems, communication systems and other applications

- Scenarios
    - Activity sequences to simulate particular operational situations for training purposes.

H^2O Information Management

H^2O Information Management is the "e-Engineering integration hub" for the Engineering Enterprise. This collaborative conduit ensures that valid, consistent, and high-quality engineering data is shared between applications and users when and where they need it. This engineering design basis is consistent and highly accurate on three fronts: 1) the physical asset information (what is there); 2) logical and functional information (what was designed to be there); and 3) regulatory and safety imperatives (what is required to be there). Information is the basis upon which real-time decisions are made. Engineering information is abundant, dynamic, and complex.

- Application integration to manage inconsistencies and reduce errors Engineering and technical data handover from execution into operations

- "Engineering companion" between operations, maintenance, and ERP systems for rapid decision support in time-critical situations

- Client and Regulator remote review portal to minimize Infrastructure startup and ensure continued operations

- Engineering Content Management, including document, and drawing management and control, list and sheet development, and exchange with suppliers and contractors
- Infrastructure configuration control and concurrent engineering to manage the evolving engineering design basis

H^2O Design Engineering & Schematics

The H^2O Solution provides a range of world class applications used for the design of large infrastructure in both 2D and 3D views. The applications can be used from the initial design stage to assist engineers design and draw complicated engineering drawings for the contractors to construct the environment or other infrastructure.

H^2O Solution's comprehensive engineering solution has been developed for today's 24/7 complex engineering environment. All engineering disciplines are intelligent and fully integrated — an engineering change in one area automatically triggers change in all associated objects, no matter where the change occurs. Designed to drive optimization, the rule-driven environment prevents engineering errors, thus avoiding shutdowns and lost production. The Solution is also an integrated design environment for construction that defines and manages the 3D model. The intelligent, rule-based 3D environment enables faster, silo-free design and engineering and better collaboration. Integration between process engineering and detailed engineering disciplines ensures true workflow-managed integration across the project enterprise.

- 3D Modeling & Visualization
- Analysis
- Engineering & Schematics
- Information Management
- Procurement, Fabrication & Construction

H^2O Geospatial Motion Video

H^2O Geospatial Motion Video enables agencies to have a high-productivity environment for analysis of full motion video taken from manned or un-manned aircraft. This is extremely powerful and useful during and post flooding events for situation and disaster assessment.

- Fully exploit video and imagery data in one seamless, geo-fused environment
- Leverage advanced video enhancement and stabilization capabilities
- Analyze LiDAR data to aid in the strategic and tactical assessment of your area of interest

- Determine equipment and personnel positioning with sophisticated line-of-sight and view shed capabilities
- Geographically track the movement of your aircraft, the camera angle, and other relevant geospatial information, in a single homogeneous environment
- Geo-fuse your video over vector data, raster maps, or other still imagery and watch it play across your map in context with other geospatial data
- Capture relevant snapshots of imagery and video for additional analysis
- Query your video data by attribute, annotation, or geospatial location
- Visualize and archive all geographic data relevant to your video
- Watch your video simultaneously in a video window and a map window
- Control your motion video with familiar DVR-like controls
- Mark your video for further analysis and historical query capabilities
- Extract image mosaics from your video data segments

H^2O Geospatial Engineering & Analysis

The H^2O Geospatial Engineering & Analysis tools enable engineers and analysts to conduct in-depth analysis, training exercises, simulations using all the all data available within the H2O Solution and analysing the data on geospatial displays.

- Better resource planning with 3D visualization of crime and incident locations
- Enhance disaster planning and response
- Visualize destination for first responders
- Amplify situational awareness with 3D common operating picture
- Strengthen skills training through realistic 3D simulations
- Improve overall data production quality
- Capture elevation data in realistic 3D views

H^2O Flood Modelling

The H^2O Solution provides the capabilities to integrate to a range of recommended Flood Modelling packages allow real time sensor values from H^2O Solution to be passed directly to the flood modelling software which can predict the inundation area and then potentially pass the inundation areas back to the H2O Dashboard to display on its geospatial display.

Some of the benefits from this modelling integration can include detailed simulation an analysis of (but are not limited to);

- River overbank flooding
- Unconfined alluvial fan flows
- Urban flooding with street flow, flow obstruction and storage loss
- Overland progression of tsunami and hurricane storm surges
- Mud and debris flows
- Watershed rainfall and runoff
- Surface and groundwater interaction
- Flood insurance studies
- Flood mitigation design
- NWS Breach embedded

H^2O Image/Data Capture

H^2O Solution's broad array of airborne sensors and integrated software solutions capture data efficiently, reference imagery accurately, measure easily, analyze and present spatial information in 3D.

- Co-registered imagery with equal resolution in panchromatic, color and color-infrared – even
- below 5 cm GSD
- Highest geometric stability, even in rough conditions.
- Increased data throughput allows simultaneous image acquisition for both photogrammetry and
- remote sensing
- Improved image data compression delivers even better image quality
- Spend less time processing and more time analyzing digital airborne imagery

- World's first medium format camera to provide superior multispectral imagery and highest accuracy
- Preferred choice as a standalone or oblique mapping solution, for integration with a LiDAR sensor and for operation onboard an unmanned aerial vehicle (UAV)

H^2O Real-Time Monitoring

Utilising world class real time monitoring hardware early detection of a potential problem allows repairs or remedial measures to be taken before a disaster occurs. Even if repair is not possible, with the early warning of a problem action may be taken to mitigate its effects.

- Topping instruments
- High Accuracy
- Monitoring with total stations, GNSS, tilt sensors, meteorology sensors and more
- Stable platform for continual monitoring
- Remote control multiple sensors, unmanned operation
- Display of status information and online charts, limit checks and messaging in real time
- Connection and control of geodetic and geotechnical sensors
- Support multiple communication modes
- Customizable with flexible options and open SQL database

H^2O Video

H^2O Video has the ability to integrate seamlessly with leading 3rd party Video Software Management Systems for comprehensive control of complex security and CCTV surveillance systems. Analogue and digital, network based CCTV components are operated via a user friendly GUI (graphical user interface) as a "single window application". H^2O Video allows manual camera-to-monitor switching or automatically presents camera pictures on specified monitors or monitor groups at an event. This way the system provides information only when the user's attention and intervention is needed. Staff workload is reduced from making decisions needed to control the security system. Instead, at an alarm the system consequently reacts to handle the alarm in the correct way, independent of the operator.

- Transparent graphical interface in complex security architectures
- Information only presented when relevant

- Connection of sub-systems via open interfaces
- Centrally controlled, networked digital picture recording and remote control
- Networked video matrix control with video routing
- Central administration and setup of all system resources
- Automatic camera cycles
- Remote control of cameras (PTZ)
- Supervision of all camera signals (sync signal and video signal monitoring) etc.
- Switch camera inputs to free monitor outputs
- Queue the alarm inputs if there are alarms still pending
- Give sound signal or switch a digital output in case of a particular alarm (type)
- Store camera pictures to the digital video recorder MultiScope II
- Log activities which must be acknowledged by the operator within a certain timeframe with time/date information
- Central camera arbitration for users from different operational posts with different privileges with queued, pre-empted and notification capability.

The backend design of H^2O video is vendor agnostic such that it would be straight forward to interface with other video vendors locally in regions.

H^2O Notification

Effective notification involves more than just sending a one-way alert. You must be able to quickly determine who needs to know what, and your message must be adapted as your contacts respond. H^2O Notification handles this complex task, rapidly launching a message to groups of any size, whether in one location or spread all over the world.

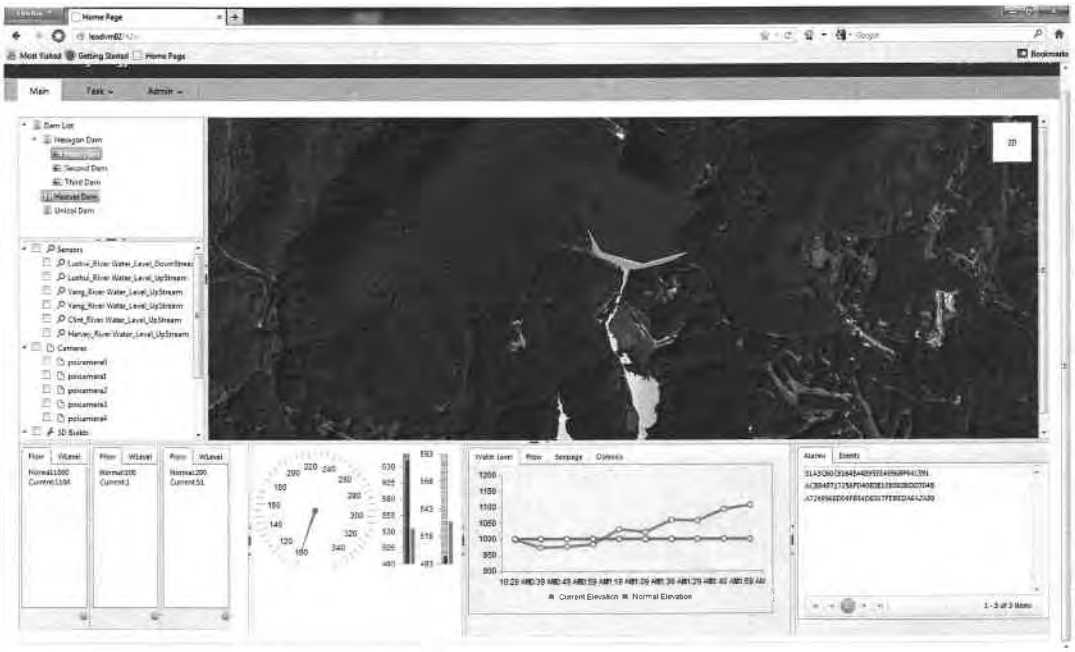
- Quickly launch mass notifications by Web, email or touch-tone phone
- Use existing message templates or create new ones in seconds
- Customize notifications in your own voice
- Allow recipients to respond by voice, text or menu choice

- Deliver multi-lingual text-to-speech notifications in many languages
- Initiate one-key conference calls
- Geographically target global notifications
- Least cost routing to reduce international telephony charges
- More than 30 international retrieval numbers
- Incident management to track and resolve issues
- Organizational hierarchy to manage multiple divisions and subdivisions
- Control access and security with permissions
- Easily integrate with popular business continuity platforms or other applications using our open API

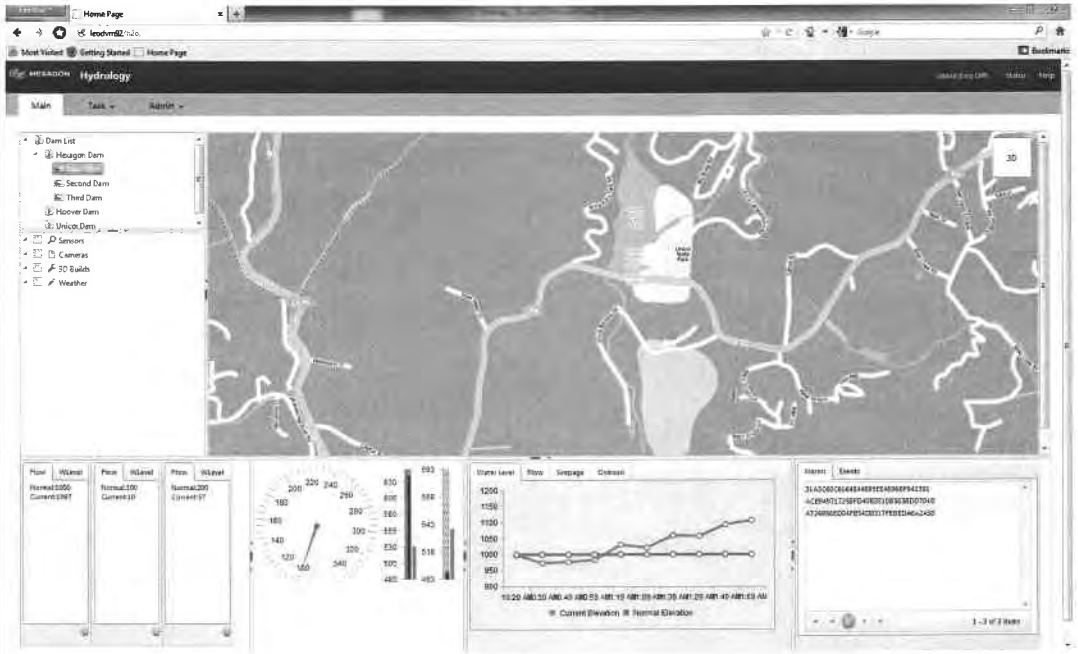
1.1.3 Example Screens

1.1.3.1 H2O Dashboard

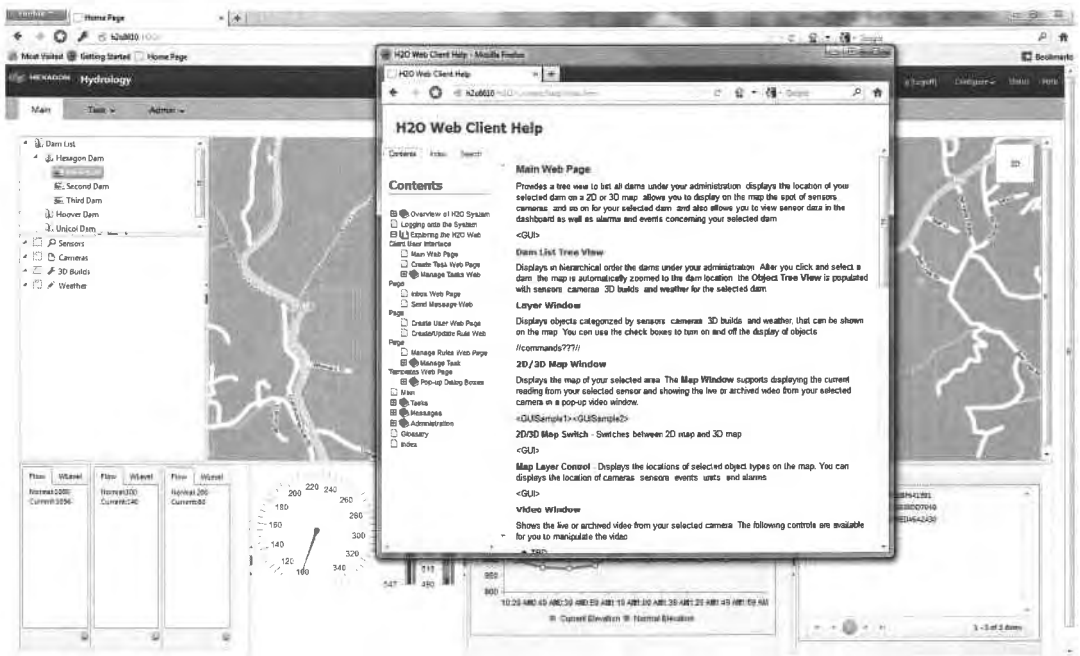
Main Dashboard Screen with 3D Geospatial view.



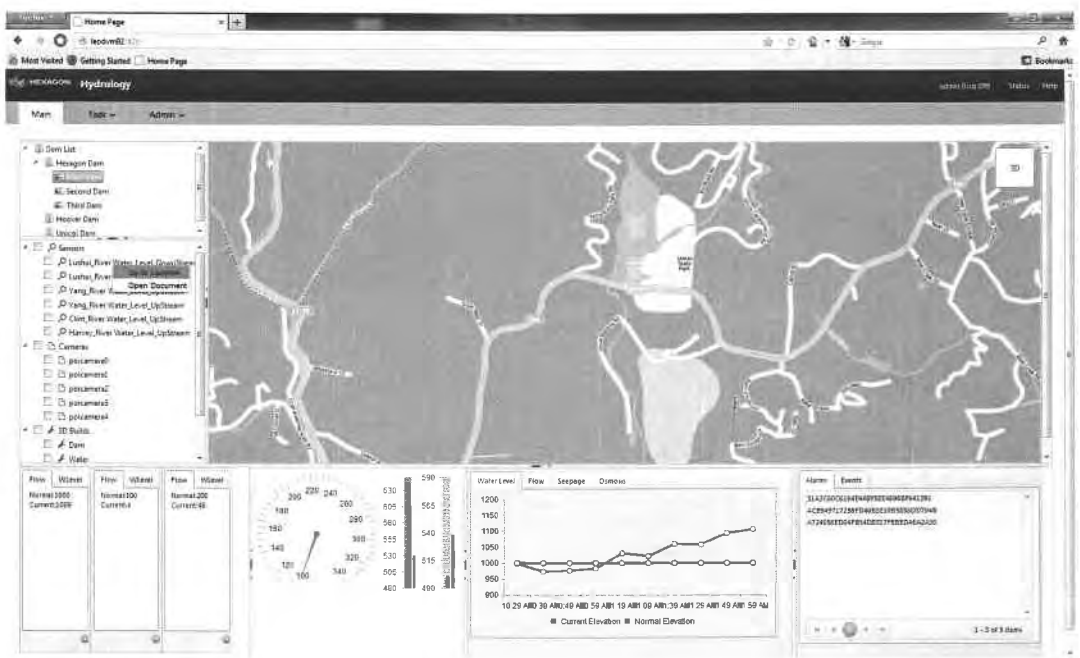
Main Dashboard Screen with 2D Geospatial view.



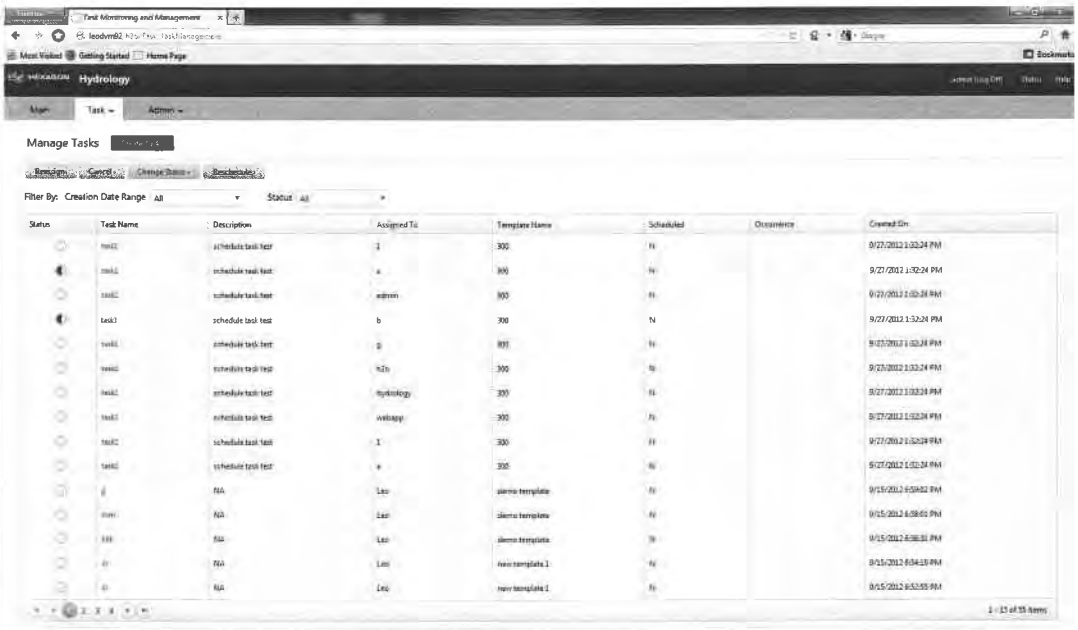
Integrated Online Help.



Menu driven integration to H^2O Information Management and other H^2O Solution integrated products.



Creation and Management of Tasks.



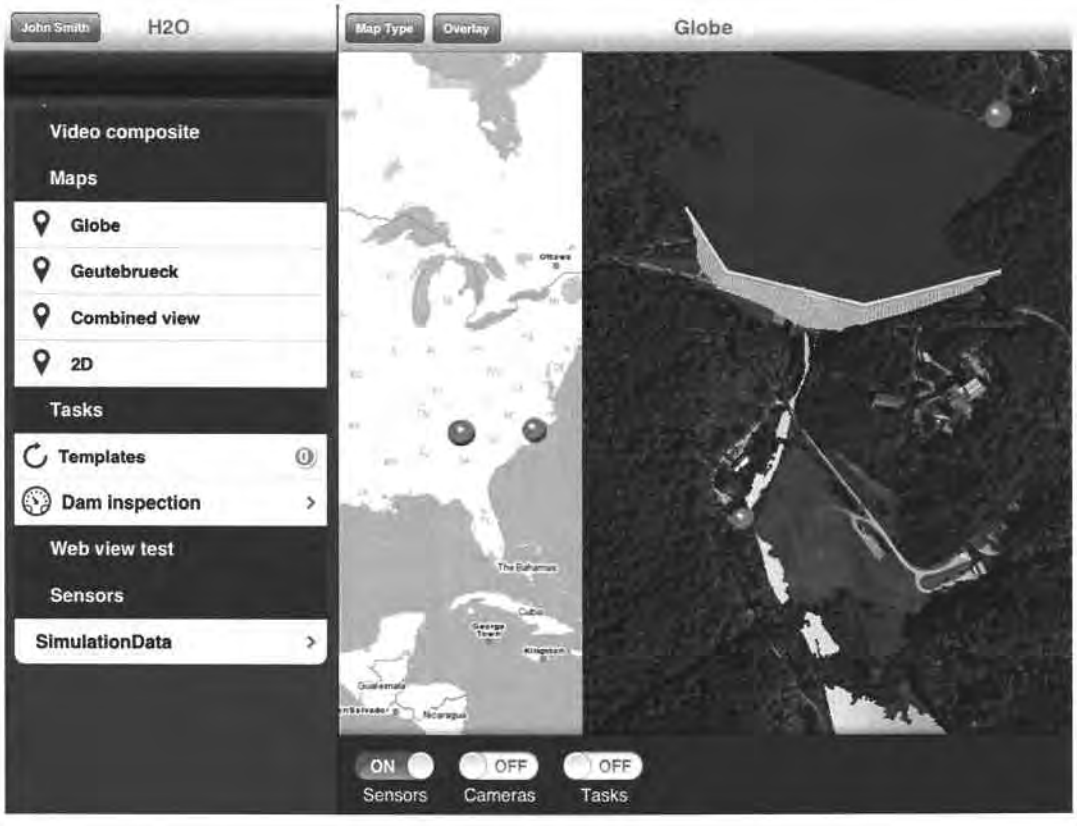
1.1.3.2 H2O Mobile

3D Geospatial Display.

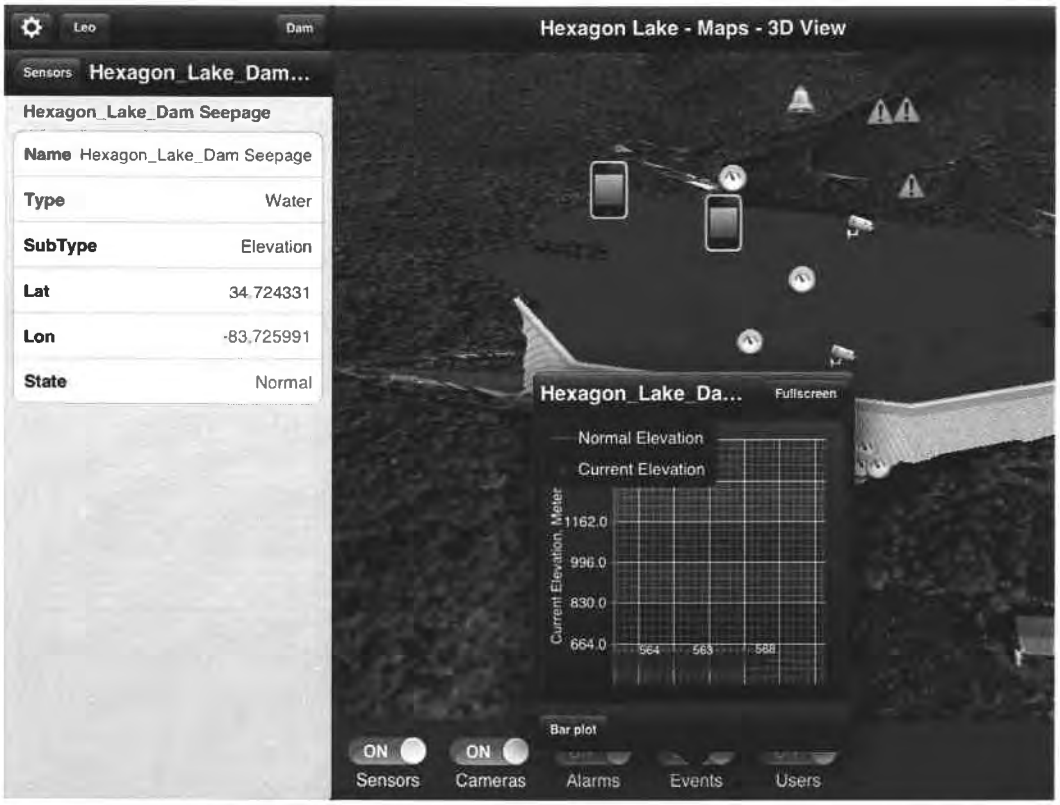
John Smith
H2O
Map Type
Overlay
Globe
Video composite
Maps
Tasks
Web view test
Sensors
ON
Sensors
OFF
Cameras
OFF
Tasks

2D Geospatial Display.

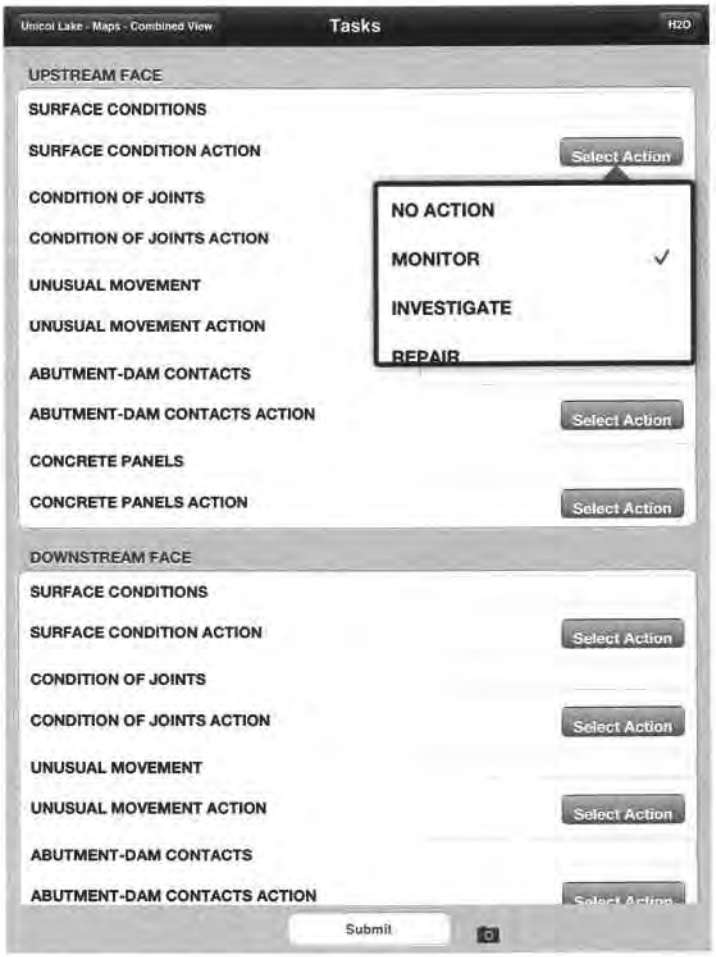
Combined 2D and 3D view with expanded menu.



Historical Sensor information in graph format.



Inspection Checklist.



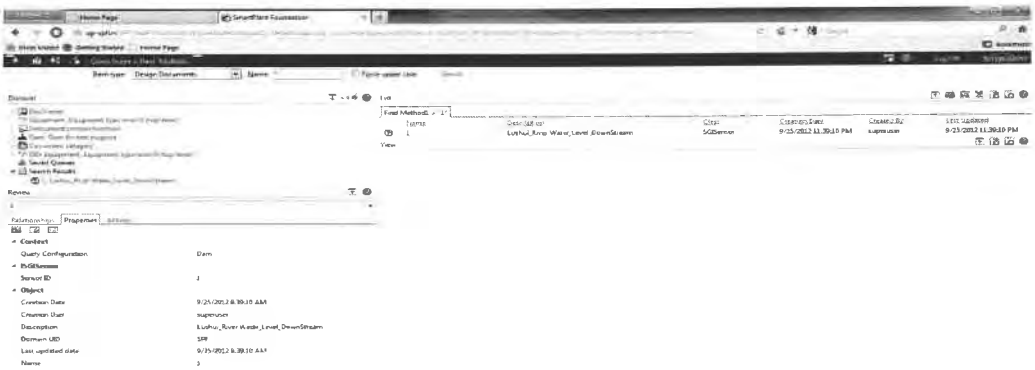
1.1.3.3 H2O Interoperability Platform

The H^2O Interoperability Platform allows integration to a variety of Hexagon and Third Party products, some examples below:

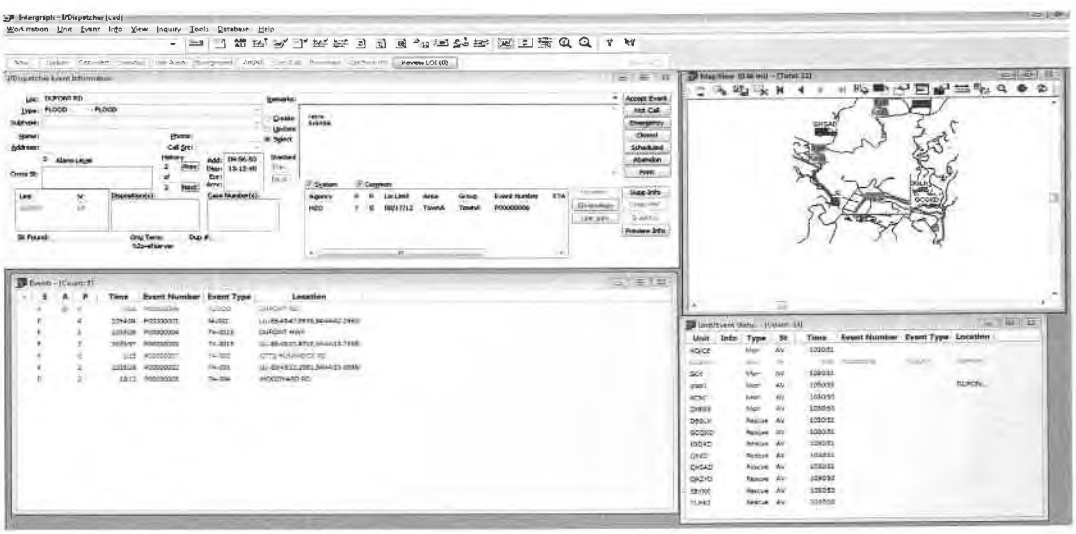
H^2O Security Framework (alarms transferred to other H^2O Applications, camera integration).

Video Surveillance Monitor
File View Tools Window Help
INTERGRAPH
Video/Touring Tree
Camera List (6)
GBGroup
GB19
GB20
GB21
GB22
GB23
GB24
Ungrouped Cameras
System Tours
User Tours
GB21
Request Control
2
1
Full FOV
Zoom
AutoFocus
GB22
GB23
GB24
GB21 --Selected--

H^2O Information Management (integrated document control, accessed for H^2O Dashboard and H^2O Mobile)



H^2O Incident Command and Control (Integrated emergency events, resource allocation, resource position with H^2O Mobile and H^2O Dashboard)



5 Financial Analysis

5.1 Introduction

This document will describe the major cost factors that need to be considered for the Shandong Environmental Emergency Response System (SEERS). Throughout the document are various items and individual costs that will make up the total cost for a project. The main items that are detailed in this document include labor for the various project phases, information technology hardware, software, and other technical and consulting services.

5.2 Overall Solution

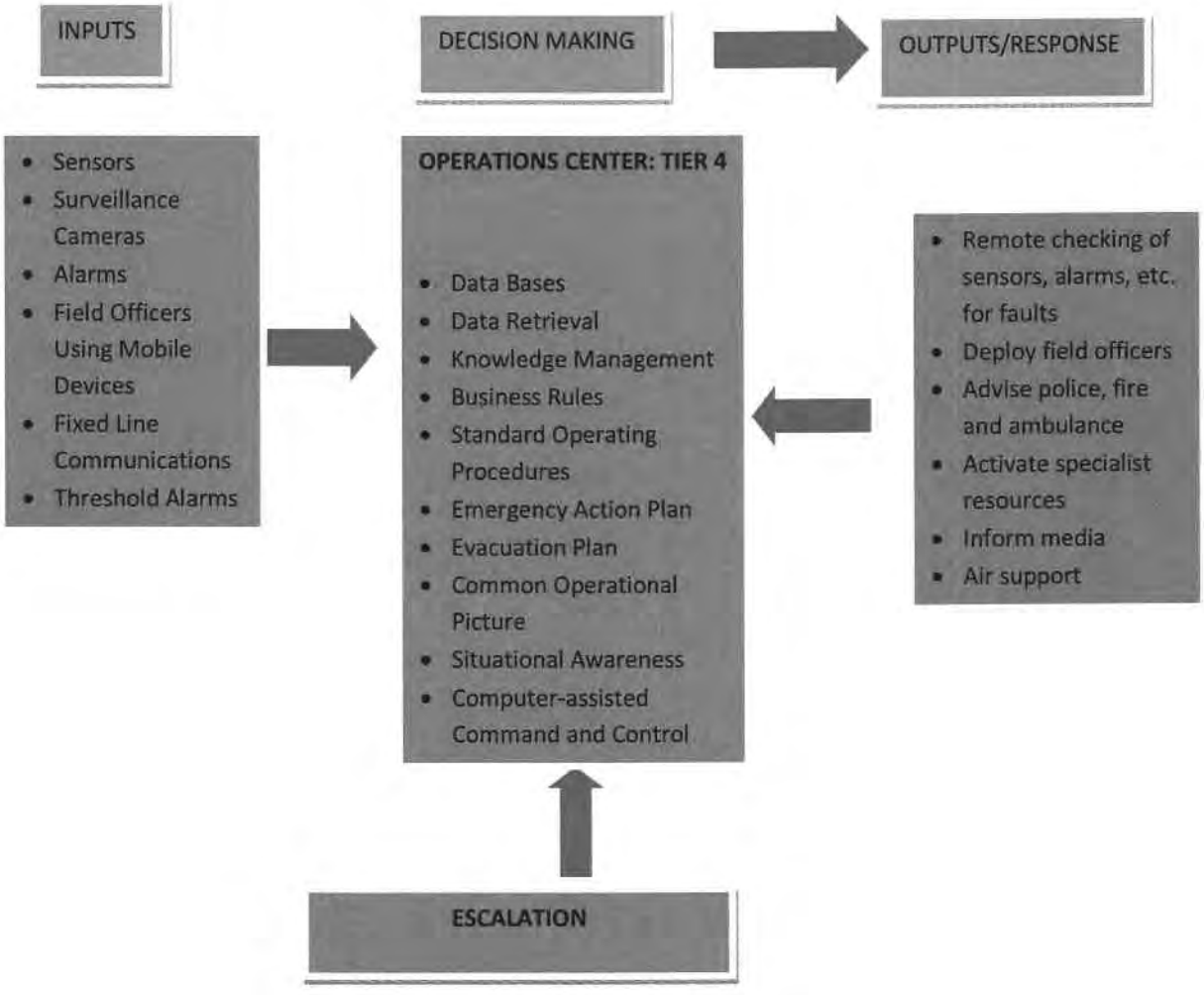
Shandong Environmental Emergency Response System (SEERS) will utilize hardware and software will reduce environmental accidents and raise the safety, security and management of the environment. SEERS, essentially, involves:

a) The deployment of a range of sensors, cameras and kindred monitoring devices monitoring the environment
b) The necessary infrastructure to transmit data from these devices to an operations center and data management system
c) Predictive and risk analysis layer to guide environmental risk reduction, mitigation, and planning
d) the visualization of the data geospatially on monitors to provide a common operating picture, giving a real-time view of the environment BMP to mitigate and response to environmental threats and accidents

In addition to routine monitoring, the various sensors activate alarms within the operations center when pre-determined threshold levels are exceeded, and all data is archived in databases for future retrieval and for knowledge management purposes. The System functions in accordance with a set of pre-determined rules.

The System has four main components; Inputs, Decision-making, Outputs/Response and Escalation.

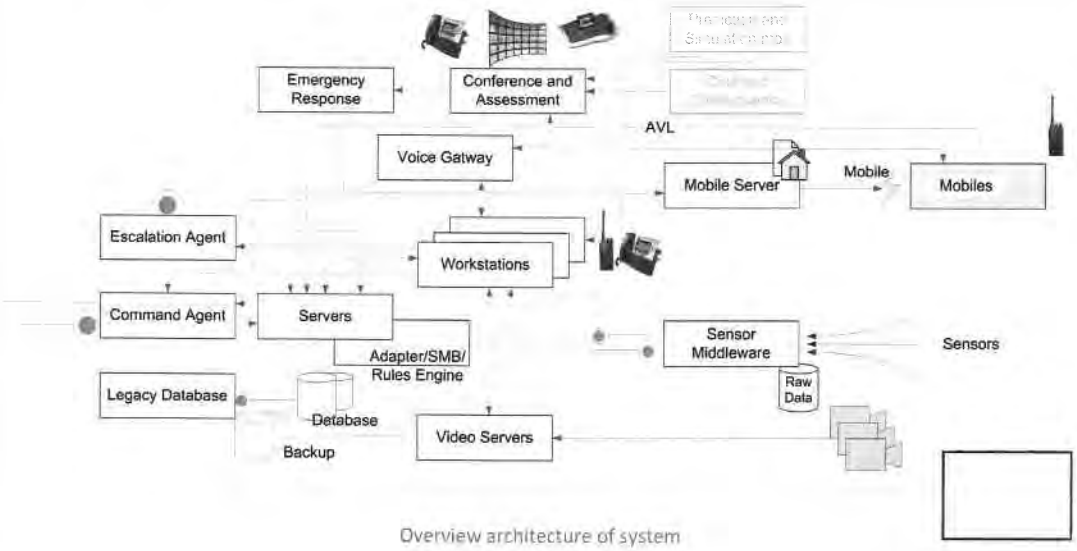
FIGURE 1: BLOCK DIAGRAM OF DSSEMS



5.3 Cost Factors

There are a range of cost factors which will make up the total cost to implement the Shandong Environmental Emergency Response System (SEERS) project. These items include a range of labor for consulting services, information technology equipment, buildings, building fit outs, cameras, different types of sensors and software to run the system.

Below is a high level architecture diagram showing some of the key components of the system, including some hardware and software.



Overview architecture of system

Major software pieces used in system

From a costing aspect, the system can be broken down into the following main elements:

Services

- Project Management
- Engineering Services
- IT Consulting Services
- Integration Services
- Environmental Modeling, Consulting, and Training
- Risk Management Consulting
- Technical Training
- Maintenance and Operations (5 Years)

Monitoring

- Automated Remote Stations with Water Quality Sensors
- Air Quality Stations
- Other Monitoring Equipment

Hardware and Equipment

- Communication and Networking Equipment
- Laboratory Equipment
- Mobile Laboratories
- Data Center

Software and Applications

- Incident Mgt and Decision Support System and GIS
- Emergency response database
- Operating Systems
- Risk Management / Predictive Analysis Software
- Integration Software
- Other

Civil Works and Infrastructure

- Laboratory Facilities Improvements
- Emergency Operating Center Improvements
- Other Civil Works

5.3.1 Services

5.3.1.1 Project Management

The project management costs are the typical costs to run and manage the project. These costs are associated with the overall management of the project. The estimate is close to 4-5% of the total project cost.

5.3.1.2 Engineering Services

Engineering services make up the cost associated with the engineering aspects of the project. This involves engineering of new networks, communication systems, civil works and infrastructure projects and other engineering efforts. This estimate was based on past cost history for other similar projects.

5.3.1.3 IT Consulting Services and Integration Services

IT consulting will be a major factor. The IT consulting is estimated to cover the installation and configuration of all of requirement software and applications. .The system integration will also be a major effort. The integration effort is detailed below:

5.3.1.4 Environmental Modeling, Consulting, and Training

SDEPA goal is to improve its ability to model and run analysis on the environmental data that we will delivered from the new system. SDEPA will need to increase its own environmental modeling capabilities and analysis including training of personnel. This cost is the following section.

5.3.1.5 Risk Management Consulting

Risk management will be a major emphasis for the emergency department at SDEPA. The focus will be to develop a risk management program to management the environmental risk in Shandong to reduce environmental accidents and emergencies.

Task	# of Personnel	Daily Rate	Days	Costs
Risk Management Consulting		$ -	-	$ -
Project Manager - Risk Mgt	1	$ [redacted]	40	$ [redacted]
Risk Mgt Specialist	3	$ [redacted]	150	$ [redacted]
Risk Mgt Application Specialist	3	$ [redacted]	110	$ [redacted]
Business Analyst	2	$ [redacted]	120	$ [redacted]
Total				$ [redacted]

5.3.1.6 Technical Training

Technical Training is a cost to consider in the project. This training would be for technical expertise for SDEPA personnel to operate the installed project equipment and run the project software. This cost is detailed below:

Task	Costs
Technical Training	
Risk Management	$ [redacted]
Incident Mgt	$
GIS	$
Integration	$
Emergency Mgt	$
Monitoring Equipment	$
Total	**$**

5.3.1.7 **Maintenance and Operations (5 Years)**

The O & M (operations and maintenance) costs for the project would be to cover all operations and maintenance for the project over five years.

Task	# of Personnel	Costs
Maintenance and Operations (5 Years)		
Year 1	10	$ [redacted]
Year 2	15	$
Year 3	30	$
Year 4	30	$
Year 5	30	$
Total		**$**

5.3.2 Monitoring

The SDEPA project calls for an increase in environmental monitoring capability. The main focus would be from water quality and air. These systems would be automated and remote.

Water Quality Monitoring - 200 New Stations

Automatic Water Quality Station Equipment: Parts List		
Item	Description	Qty
MB	**Main Body**	
MB01	Enclosure	1
MB02	XLite 9210	1
MB03	Data Logger	
SE	**Sensors**	
SE01	Rain Gauge	1
SE02	Constant Flow Bubbler	1
SE03	Radiation Shield - AT/RH Sensor	1
SE04	Water Quality Sensor	1
SE05	Temperature and Relative Humidity Sensor	1
MH	**Mounting Hardware**	
MH01	Enclosure Mounting Hardware	1
MH02	Rain Gauge - Mounting Plate	1
CO	**Communication**	
CO01	Antenna	1
CO02	Antenna Cable	1
CO03	GPRS Modem and Accessories	1
SP	**Solar Panel**	
SP01	Solar Panel - 50 Watt	1
SP02	Solar Panel Cable	1
SP03	Solar Panel Mount	1
SP04	Solar Regulator	1
TE	**Testing**	
TE01	System Testing - Manufacturer	1
	Total	$

Remote / Automated: Water Quality Station - Equipment (Parts List)					
Item	Item Number	Item Description	Qty	Price	Amount
001	N/A	water monitoring equipment	200	$	

Air Quality Monitoring - 200 New Stations

Remote / Automated: Air Quality Station - Equipment (Parts List)					
Item	Item Number	Item Description	Qty	Price	Amount
001	N/A	air monitoring equipment	30	$	

5.3.3 Hardware and Equipment Cost

The following section contains details of some of the likely hardware and equipment costs that need to be considered in when scoping a project implementation of the Shandong Environmental Emergency Response System (SEERS).

5.3.3.1 **Server Recommendations - Costs**

1 * Communications Server:

Similar to Dell PowerEdge T710 with

2 * 4 core Intel Xeon Processors

16Gb Memory

2 * 500Gb SAS HDD

Microsoft Windows Server 2008

Approximate Price Each : US $XXXXX

1 * Web Server:

Similar to Dell PowerEdge T710 with

2 * 4 core Intel Xeon Processors

16Gb Memory

2 * 500Gb SAS HDD

Microsoft Windows Server 2008

Approximate Price Each : US $XXXX

2 * CAD/Security Server:

Similar to Dell PowerEdge T710 with

2 * 4 core Intel Xeon Processors

16Gb Memory

4 * 500Gb SAS HDD

Microsoft Windows Server 2008

Approximate Price Each: US $XXXX

5.3.3.2 **Workstations - Costs**

I/CAD & I/Security Client:

Similar to Dell Precision T3500 with

1 * 4 core Intel Xeon Processor

4Gb DDR2 1333 Memory

2 * Nvidia Q600 video card, supports up to 4 screens

2 * 500Gb HDD

3 * 24" monitors with resolution of 1920 * 1200

Approximate Price Each: US $XXXX

Web, 3D & MVA Client:

Similar to Dell Precision T3500 with

1 * 4 core Intel Xeon Processor

4Gb DDR2 1333 Memory

2 * Nvidia Q600 video card, supports up to 4 screens

2 * 500Gb HDD

3 * 24" monitors with resolution of 1920 * 1200

Approximate Price Each: US$XXXX

A range of other computer related equipment could be required and will need to be assessed during the scoping and design phase, this could include items such as large panel displays, overhead projectors, specialist telephony equipment, specialist communication equipment etc.

5.3.3.3 **Network / Communication Equipment**

The system has minimum network requirements for it to operate at its optimum performance. The system requires an Ethernet local area network for the I/CAD and I/Security part of the solution, which in most circumstances would be located on the same site, in the same building. This local area network should have a bandwidth of 1 Gigabit. The requirements for access to the Enterprise Web Application are not as demanding compared to the backbone of the system mentioned in the previous paragraph. The minimum bandwidth required for connection to the Enterprise Web allocation. For users to make the most of the mobility

functionality in the system, such as inspection and emergency management from the IPad, there needs to be either wireless and/or 3G connectivity around the dam site where inspections will be conducted. The costing for network infrastructure cannot be determined as each location of the system implementation will be different and many different factors need to be taken in to account. As a part of the project scoping gathering stage for the project implementation an assessment of the current network infrastructure and a list determined of additional equipment that is required for a suitable network infrastructure to be setup.

5.4 Other Equipment

Monitoring sites, head office, and other sites will have different infrastructure installed and available at different sites, thus as a part of the scoping and design phase of the project each piece of required infrastructure will need to be assessed to see if firstly the infrastructure already exists and if it can be used, or if new items need to be purchased as a part of the project.

5.5 Infrastructure Cost

As a part of project scoping for the installation of a system, other infrastructure costs could be required to host and set up the system.

These additional costs could include items such as:

- New buildings or building upgrades
- Office fit out e.g. furniture, desks, chairs
- Computer room fit out e.g. server room, server racks

Each project will require very different infrastructure costs, and this should be evaluated at the project scoping and design phase of the project

5.6 Software Cost

The Environmental Emergency Management and Response System consists of a range of software including:

- Intergraph Core Application Software (such as I/Dispatcher, GeoMedia)
- Intergraph Custom Projectware (IPad mobile client, Enterprise Web Application)
- Operating Systems (such as Microsoft Windows)
- Other Third party software (such as Risk Management, Integration software/application, Oracle, Cisco Video Server etc)

This section outlines the major software components that need to be considered when costing a project to design, build and implement the system at a particular location.

5.6.1 Intergraph Software Cost

The software costs are broken up by system and then by workstation type, thus to calculate the full cost the number of each workstation needs to be determined. Annual maintenance will also need to be paid on and ongoing basis. There are some pieces of software that are mandatory for each system implementation. A fully

redundant system configuration is recommended thus two licenses of some software are required for automated failover.

Mandatory Software for each system are listed in the table below:

	Product	Part Number	Qty	Price(RMB)	Annual Maintenance (RMB)
Server Side					
•	**I/Executive –License per system**	IPS0001	1	XXXXXX	XXXXXX
•	**I/Tracker – Node Locked**	IPS0015	1	XXXXXX	XXXXXX
•	**I/Security Frame Server**	IPS1001	1	XXXXXX	XXXXXX
•	**I/Sight Server**	IPS1018	1	XXXXXX	XXXXXX
•	**I/MDT – Node Locked**	IPS0009	1	XXXXXX	XXXXXX
•	**I/Consequence**	IPS1014	1	XXXXXX	XXXXXX
•	**I/Asset**	IPS1015	1	XXXXXX	XXXXXX
•	**GeoMediaWebmap - Large**	SJCC678AAM0601A	1	XXXXXX	XXXXXX
•	**GeoMedia SDI Pro - Large**	SJCCA51AAM0601A	1	XXXXXX	XXXXXX
•	**GeoMedia SDI Portal**	SJCCA52AAM0601A	1	XXXXXX	XXXXXX
•	**TerraShare Automatic Data Ingest**	SJBY936AA-0203A	1	XXXXXX	XXXXXX
•	**TerraShare Server**	SFT00725	1	XXXXXX	XXXXXX
•	**TerraShare Web**	SFT00912	1	XXXXXX	XXXXXX
•	**Edge Frontier**		1	XXXXXX	XXXXXX

Multiple copies of the EdgeFrontier software may be required for each solution, as it is used to communicate between different tier systems and it is also used to act as middleware between the system and various sensors.

Once the server side software is purchased additional software is required for each workstation type, these are listed in the table below:

Product	Part Number	Qty	Price(RMB)	Annual Maintenance (RMB)
I/CAD & I/Security Workstation				
• **I/Dispatcher - NL**	IPS0002	1	XXXXXX	XXXXXX
• **I/Security Framework Client**	IPS1002	1	XXXXXX	XXXXXX
• **I/AlarmPlus Desktop - NL**	IPS1004	1	XXXXXX	XXXXXX
• **I/Sight Desktop - NL**	IPS1008	1	XXXXXX	XXXXXX
Motion Video & 3D Workstation				
• **GeoMedia Professional - CC**	SJBX690AA-0601A	1	XXXXXX	XXXXXX
• **GeoMedia Grid - CC**	SJBX880AA-0601A	1	XXXXXX	XXXXXX
• **GeoMedia Image Professional - CC**	SJBXA54AA-0601A	1	XXXXXX	XXXXXX
• **GeoMedia 3D**	SJBXA56AA-0601A	1	XXXXXX	XXXXXX
• **I/Map Editor**	IPS0063	1	XXXXXX	XXXXXX
• **GM Motion Video Analyst Pro - CC**	SJBXA51AA-0601A	1	XXXXXX	XXXXXX
• **TerraShare Image**	SFT00724	1	XXXXXX	XXXXXX
• **TerraShare Client**	SFT00725CAL	1	XXXXXX	XXXXXX

5.6.2 Additional Software Requirements – Third Party

The system would also use other third party software, as the Intergraph software uses these other pieces of software.

Additional required software listed below::

	Product	Part Number	Qty	Price(US$)	Annual Maintenance (US$)
Server Side					
•	**Oracle Database**			$ XXXXXX	$XXXXXX
•	**Cisco VSOM (software and support for 10 cameras)**		1	$ XXXXXX	$ XXXXXX
•	**Cisco VSOM (license per additional camera connection)**		1	$ XXXXXX	$ XXXXXX
•	**Windows Operating Systems** • **Windows 7** • **Windows Server** • **Other**			$ XXXXXX	XXXXXX

5.7 Labor Costs – Development and Configuration Costs

Intergraph have standard daily rates for professional services, below is a list of current daily rates, please note that these rates are subject to change and will vary depending if the resources used are local resources of international resources. As a part of the project scoping and design the most appropriately skilled and available staff should be utilized and charged accordingly to their original location. Throughout a project different roles will be spend different amounts of time on the project, as each person will have specific tasks they need to complete. The Project Manager will determine this during the project scoping phase of the project and then provide detailed costs for all professional services activities.

Role / Title	Daily Rate (US$)
Project Manager - International	$ XXXX
Deputy Project Manager	$ XXXX
Project Controller	$ XXXX
Deputy Project Controller	$ XXXX
Project Administrator	$ XXXX
GIS Industry Solution Consultants - International	$ XXXX
Public Safety & Security Solution Consultants - International	$ XXXX
Marketing/Business Case Development Consultants - International	$ XXXX
Water Industry Consultant - International	$ XXXX
Dam & Reservoir Safety Consultants - International	$ XXXX
Sensor / Measurement Consultant - International	$ XXXX
Solution Architects - International	$ XXXX
Project Support	$ XXXX
Technical Writers	$ XXXX
GIS Application Engineers	$ XXXX
CAD Application Engineers	$ XXXX
SDI Application Engineers	$ XXXX
Intergraph Product Trainers	$ XXXX
Interface Developers	$ XXXX
Application Developers	$ XXXX
Test Lead	$ XXXX
Testers	$ XXXX

Professional Services resources will work on a project from their home office at times and also on location at the project implementation site. The costs for a project need to include applicable travel costs for staff for the project, this will include multiple trips from the employees base residence to the project site. The costs below are just for local (same country) professional services team members to travel to project site. On specific projects there will also be international team members, and the costs for the travel from international members will be significantly higher due to the higher airfares. It is recommended to use International staff on a limited basis and schedule their number of visits to the project site to a minimum, and keeping them onsite for as long as practically possible for each visit, as this will lower the amount of airfare charges that need to be included in the project.

Estimated Local Travel Costs (per trip)	
Return Airfare between employees home location and project location	$ XXXX
Accommodation per night (600CNY)	$ XXXX
Daily Per Diem rate (400CNY)	$ XXXX

5.8 Training Costs

Intergraph recommend a train the trainer approach for all training. This approach is when the Intergraph trainers train nominated customer trainers. Once the customer trainers are skilled up, then they can conduct internal training courses. For the Environmental Emergency Management and Response System, Intergraph proposes two training courses, each run for a duration of 10 days, thus total of 20 days of training. The cost of training is US$ XXXX a day, and two days preparation for each course.

Total cost for the two courses, which a maximum of 10 students in each is:

Course 1 : ESSENTIAL		
Task	**Daily Rate (US$)**	**Total (US$)**
2 Days Preparation	$ XXXX	$ XXXX
10 days course duration	$ XXXX	$ XXXX
Total Cost for Course		$ XXXX

Course 2 : ADVANCED		
Task	**Daily Rate (US$)**	**Total (US$)**
2 Days Preparation	$ XXXX	$ XXXX
10 days course duration	$ XXXX	$ XXXX
Total Cost for Course		$ XXXX

Intergraph can schedule and instruct more courses at the request of the customer, these additional courses incur additional costs.

5.9 Recurrence Annual Software Maintenance, Support

All Intergraph software has an annual maintenance fee, this maintenance fee allows customers to keep up to date with software releases.

Intergraph also provides different offerings for supporting services, these levels are:

- 24 hour * 7 days support
- 8 hour (business hours) * 5 day (business day) support

The costs for these levels of support vary depending on the size of the system, location and also remote access capabilities.

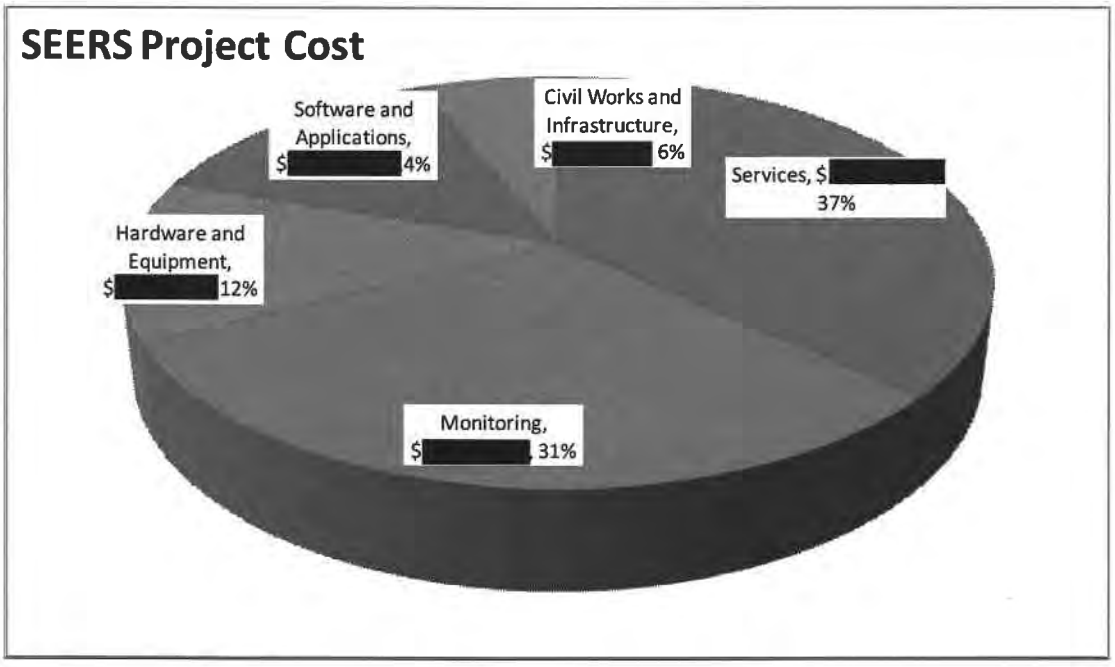
Approximate annual costs for support are:

- 24 * 7 support = US$ XXXXXX annually
- 8 * 5 support = US$ XXXXXX annually

5.10 Total Project Cost

Project Cost Estimate Shandong Environmental Emergency Response System			
Category	Subcategory	SubTotal	Total
Services	Project Management	$ [redacted]	
	Engineering Services	$	
	IT Consulting Services	$	
	Integration Services	$	
	Environmental Modeling, Consulting, and Training	$	
	Risk Management Consulting	$	
	Technical Training	$	
	Maintenance and Operations (5 Years)	$	$
Monitoring	Automated Remote Stations with Water Quality Sensors - 200	$	
	Air Quality Stations - 30	$	
	Other Monitoring Equipment	$	$
Hardware and Equipment	Communication and Networking Equipment	$	
	Laboratory Equipment	$	
	Mobile Laboratories	$	
	Data Center	$	$
Software and Applications	Incident management and decision support system; Geographic information system	$	
	Emergency response database	$	
	Operating Systems	$	
	Risk Management / Predictive Analysis Software	$	
	Integration Software	$	
	Other	$	$
Civil Works and Infrastructure	Laboratory Facilities Improvements	$	
	Emergency Operating Center Improvements	$	
	Other Civil Works	$	$
Total			$ [redacted]

Captial Costs			$ [redacted]



5.10.1 Total Project Budget

Budget Category	Amount	%
Services	$	37%
Monitoring	$	31%
Hardware and Equipment		13%
Software and Applications		14%
Civil Works and Infrastructure		6%
	$	100%

5.11 Project Financing, Self-Funding and Public-Private Cooperation and Investment

The project will be funded by SDEPA. The Chinese government's 12th fifth year plan calls for funding of environmental projects and capabilities to promote more sustainable development. In the future, SDEPA and other environmental agencies are looking at exploring the possibilities of funding environmental efforts by tariffs tied to environmental degradation by industrial polluters. This is still in the early stage of development and will not be considered at least not in the initial funding or early stages of the project.

6 Implementation Roadmap

6.1 Introduction

This document will describe the major factors that need to be considered for implementing for the Shandong Environmental Emergency Response System. The implementation plan will include a budget and the high level task and phasing that would be necessary to complete the project.

6.2 Implementation Plan

Intergraph recommends using the Prince2 Project Management methodology for all projects. As a part of the Prince2 project lifecycle there is a number of key phases to the project, these include design phase, build phase and also delivery phase. These phases are described in more detail below (Prince 2 Management).

DESIGN PHASE

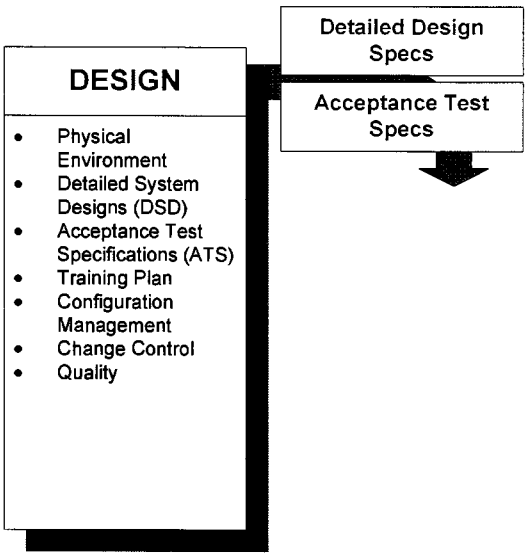


Figure: Design Phase

In the Design phase of the project (See Figure: Design Phase), the requirements and concepts from the Define phase are refined and embodied in a Detailed System Design that becomes the blueprint of the system. The design team pays close attention to design constraints, both business and technical, in order to produce a solution that meets the functional requirements and the business decision criteria established in the proposal. Detailed plans are developed to complete all of the project activities.

Physical Environment Design

The physical design addresses each major component of the system. Special care must be exercised to ensure that the synergy needed for overall success is not jeopardized by the design of any modules. The physical design converts the Functional Requirements Specification developed in the Define phase into the specific standard products or the information needed by the developers to support custom development. The design must address software, database, system design, user interface, hardware and operations.

Develop Detailed System Designs

The Detailed System Design specifications document how the delivered system will meet the requirements described in the Functional Requirements Specifications in terms by which system development and implementation staff are able to perform their tasks.

Develop Acceptance Test Specifications

To effectively judge whether the system meets requirements, it must be tested. It is important that for each functional model a robust Test specification be planned, developed and exercised and that the documented results of the test be accepted by the customer. Another important aspect of testing is the need for consistency and continuity of testing throughout the effort; the test plan must originate with the development of the requirements and culminate with the completion of the design. The tests exercised in the Build and Deliver phases are defined in the

Acceptance Test Plan which ensures that everyone involved, the developer and user, is measuring the system by the same 'ruler'.

Develop Training Plan

To effectively implement the system, the operational staff who shall run the system must be thoroughly trained and assessed. During the Design phase a detailed training plan is developed to build on the Training Needs identified during the Define phase. The Training Plan must detail the training outcomes required, in terms of the skills and level of operator competence, the training approach (i.e. classroom training, simulated training and on the job training), training modules required to achieve these and the method of assessment. The Training Plan may also include the requirements for periodic re-qualification as an operator.

Detailed System Design, the Deliverable

The deliverable from the Design phase is the Detailed System Design. This document captures the results of the design process including the results of all activities and describes in developer's terms **how** the system will do what it will do.

Configuration Management and Change Control

The Detailed System Design specifications will come under Configuration Management at this point, and the Project Initiation Document will describe how that configuration management is performed and the change control procedures that will oversee alterations to the requirements of the system where initiated by the customer or by Intergraph. Changes to requirements must be fed back through a Define Phase in order that the exact nature of the requirements change can be assessed, properly scoped, and reviewed for suitability in the light of the overall system design.

Design Review, the Exit Criterion

The contents of the Detailed System Design are formally reviewed with the customer. The exit criterion for the Design phase is an accepted Design Review.

BUILD PHASE

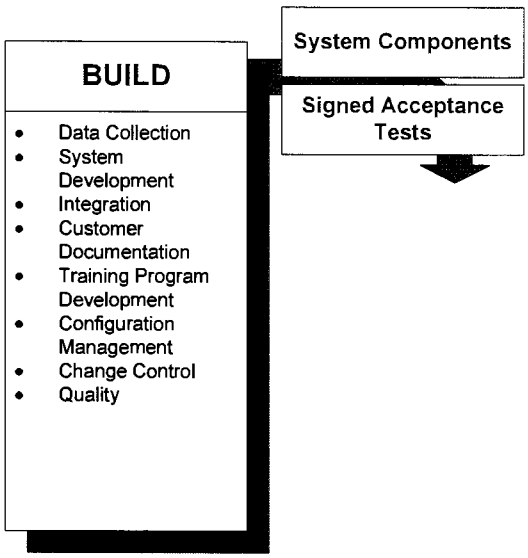


Figure: Build Phase

With clear requirements and a Detailed System Design describing how each requirement is to be met, Intergraph enjoys a distinct advantage in this phase because of its large number of off-the-shelf software products. This base of product offerings allows Intergraph to quickly integrate and customize the solution while containing costs and keeping the development schedule as short as possible. The workflows that provide the backbone for the overall solution design are also the basis for the system training programs. As the system moves into the Build phase (Figure: Build Phase), training program components are detailed and construction of the courseware begins.

Data Collection

Data collection, conditioning and conversion are a difficult but necessary part of the Project lifecycle. Data conversion costs may represent a large portion of project costs and a great investment of resources. Intergraph works closely with the customer to ensure that data collection and conversion meets the system requirements.

System Development

System development consists of translating the detailed system design into usable hardware components, adaptable interfaces and appropriate code. As noted earlier, with Intergraph's breadth of off-the-shelf software, this effort is much easier and more cost-effective than a ground-up development effort.

Integrate and Test

Integration consists of assembling the system, preparing the test platform and testing the system. Together with development, these activities produce the total solution designed specifically for the customer.

Customer Documentation

Unique solutions require individual, customized documentation in addition to the standard documentation to support off-the-shelf products. Intergraph develops this documentation during the Build phase to ensure that the documentation reflects the final system configuration. Typical custom documentation includes user guides, database manager guides, system manager guides and configuration guides.

Training Program Development

During this phase, a comprehensive training program is developed detailing the training to be provided and the training methodologies to be used for each training module identified in the Design phase. Timings, resources, staff and venues are also determined as part of the Training Program.

Configuration Management and Change Control

Completed system components and collected or converted data will come under Configuration Management at this point, and the Project Initiation Document will describe how that configuration management is performed and the change control procedures that will oversee alterations to the requirements of the system where initiated by the customer or by Intergraph. Changes to requirements must be fed back through Define and Design Phases in order that the exact nature of the requirements change can be assessed, properly scoped, and reviewed for suitability in the light of the overall system design.

System, the Deliverable

The Build Phase culminates in the provision of the customer's system. At this point, the Detailed System Design has materialized in the form of hardware and software. Theory has given way to actuality and the momentum is moving toward the delivery of the system into an operational environment.

With the strength of Intergraph's broad product line as a foundation and with the integration of third-party software and hardware, the custom system is constructed and thoroughly tested. Once complete, the system is retested against the Acceptance Test Specifications in a live site environment to ensure that it continues to meet the acceptance criteria.

System Verification Report; the Exit Criterion

The exit criterion for the Build phase is the completed Site Acceptance Tests that have been reviewed and accepted by the customer and by Intergraph.

DELIVER PHASE

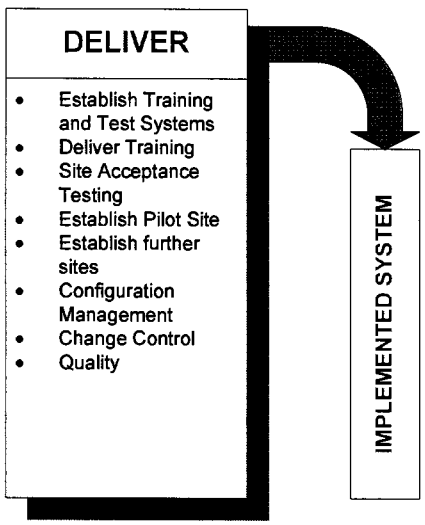


Figure: Deliver Phase

Delivering a system is more than just pulling a truck up to the door and dropping off a box of parts. The successful delivery of a system is the culmination of much effort and expense. It represents a logistical challenge to bring the various parts together and convert them into an operating entity. The 'Figure: Deliver Phase' shows the activities we use to accomplish this.

Deliver Training

Although training may have commenced during the build phase, completion of most of the required training will occur in the Delivery phase. The proper staging of training is critical to the immediate and ongoing success of the system.

Acceptance Testing

The System Acceptance Testing establishes that the system is ready to go into operation. It is performed as documented in the previously developed Test and Acceptance Plan. After it is complete, the customer can choose the timing for taking the system into full operation.

Establish the Pilot Site

As part of many projects, a pilot site is established to proof the system. The pilot site trials the system in an operational environment with minimal risk to the customer. Fine tuning of the system can be implemented quickly and easily and transitioned into the total configuration to ensure that the implementation of the total system will be trouble free.

Cut-Over to Live Operations

Intergraph will not walk away from its customers at the completion of the Acceptance Testing. Critical project team members remain on site throughout the transition from the old operational environment to full time operation of the new system. These staff provide invaluable support and experience in the problems associated with the transfer from the old to the new and will help to ensure that the transition is a success.

The Commissioned System; the Deliverable

The deliverable from the Deliver phase is the installed, functional, tested and signed off system cut-over into full operation.

System Acceptance Form; the Exit Criterion

The exit criterion from the Deliver phase is a System Acceptance Form that has been reviewed and approved by the customer and by Intergraph.

6.3 Budget

The budget for the project is approximately $64.6 million USD (see below).

Budget Category	Amount	%
Services	$ [redacted]	32%
Monitoring	$	27%
Hardware and Equipment		11%
Software and Applications		12%
Civil Works and Infrastructure		5%
Contingency		13%
	$	100%

6.4 Action Plan - Tasks, Roles, and Resources:

Phase	No.	Task	Role	Resource	Timing
Phase 0	1	Project Planning	Project Manager	TBD	March 2013
Phase 0	2	Risk Management	Risk Manager	TBD	May 2013 - end of project
Phase 0	3	Emergency Management	Emergency Director	TBD	May 2013 - end of project
Phase 0	4	Environmental Monitoring	Change Mgt Team Lead	TBD	May 2013 - end of project
Phase 0	5	Civil Works	Sr QA Analyst	TBD	May 2013 - end of project
Phase 1	6	Requirements and Design	Technical Project Manager	TBD	April 2013 -
Phase 2	7	System Build	Technical Project Manager	TBD	After Task 6
Phase 3	8	Test / Evaluation / Go Live	Technical Project Manager	TBD	After Task 7
Close	9	Close Project - Operational	Project Manager	TBD	January 2015

6.5 Implementation Schedule

The following is an estimated that the project would be implemented over 24 months.

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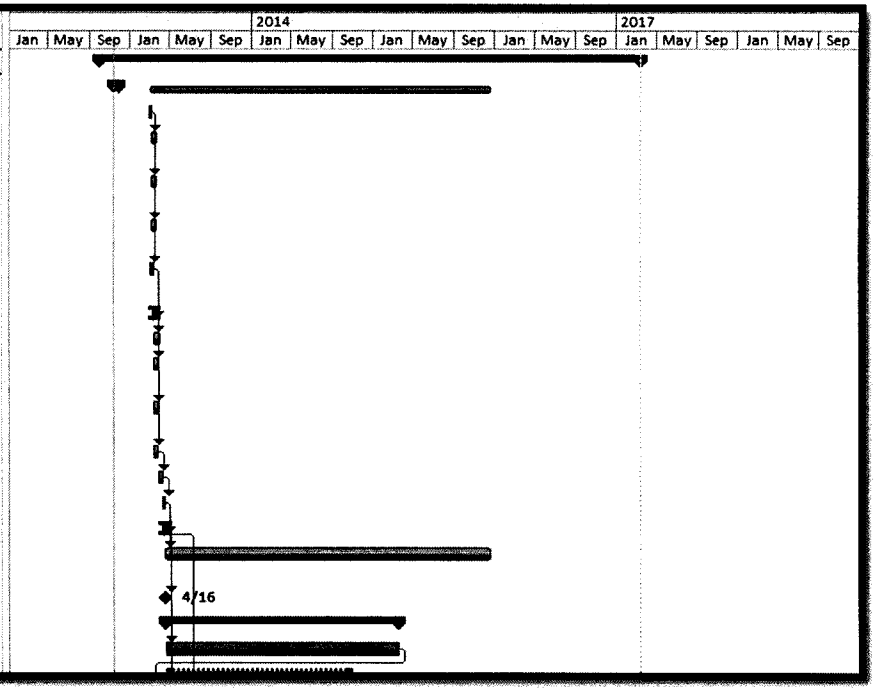
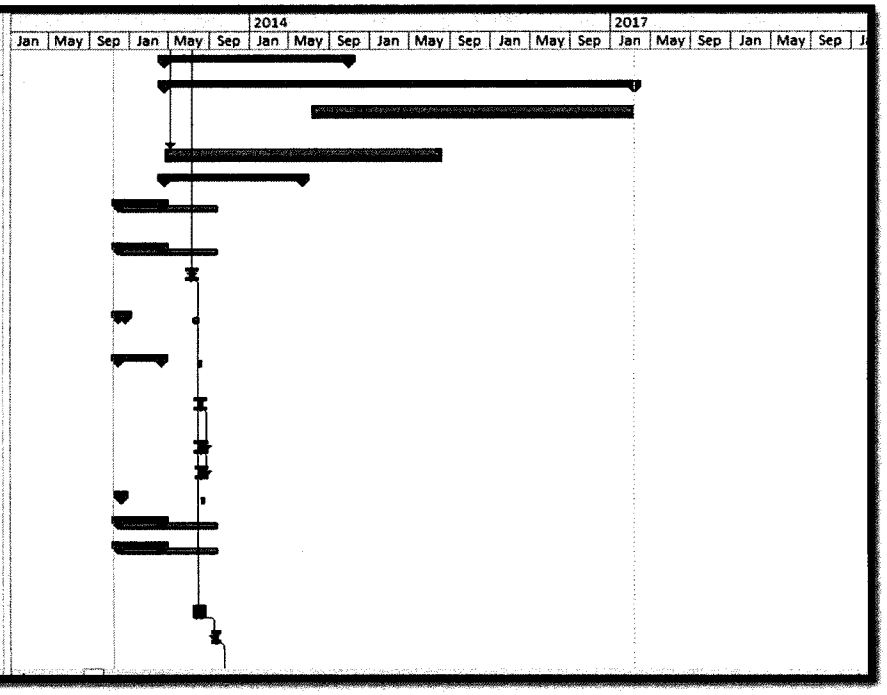
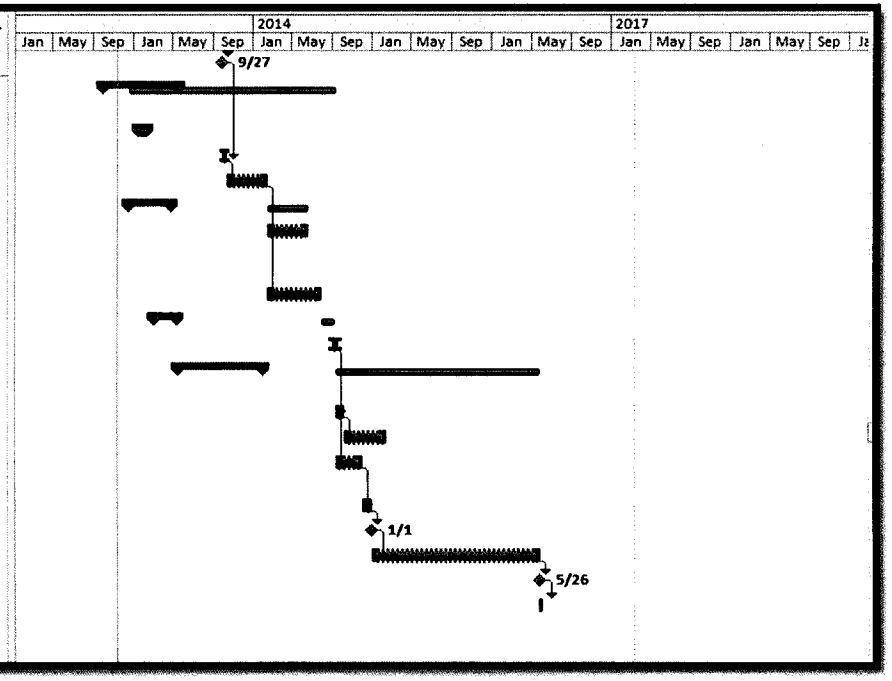
	Task Name	Duration	Start	Finish
1	**Project SEERS**	**1163 days?**	**Mon 10/1/12**	**Wed 3/15/17**
2	**Project Start / Project Management**	**10 days**	**Thu 11/15/12**	**Wed 11/28/12**
3	Project Start	1 day	Fri 3/1/13	Fri 3/1/13
4	Define Project approach, methodology, standards, and benchmarks	14 days	Mon 3/4/13	Thu 3/21/13
5	Review initial documentation, research, and policy - project	14 days	Mon 3/4/13	Thu 3/21/13
6	Review initial Background, Capabilities, Systems, Technical, and Organization	14 days	Mon 3/4/13	Thu 3/21/13
7	Identify initial requirements, risks, stakeholders, and project team	7 days	Mon 3/4/13	Tue 3/12/13
8	Mobilization of Resources	4 days	Wed 3/13/13	Mon 3/18/13
9	Project Review and Planning Review	14 days	Wed 3/13/13	Mon 4/1/13
10	Background information, studies and reports, systems, and current situation	10 days	Wed 3/13/13	Tue 3/26/13
11	Conduct interviews with stakeholders and the Sponsor project team	10 days	Wed 3/13/13	Tue 3/26/13
12	Develop high level project requirements	10 days	Wed 3/13/13	Tue 3/26/13
13	Develop high level design specifications	10 days	Wed 3/27/13	Tue 4/9/13
14	Deliver initial Project Plan	4 days	Wed 4/10/13	Mon 4/15/13
15	Project Kickoff Meeting	1 day	Tue 4/16/13	Tue 4/16/13
16	Update Project Plan / Project Mgt Ongoing	700 days	Tue 4/16/13	Mon 12/21/15
17	Deliverable: Project Management Plan	0 days	Tue 4/16/13	Tue 4/16/13
18	**Environmental Modeling and Training**	**500 days**	**Wed 4/17/13**	**Tue 3/17/15**
19	Environmental Modeling	500 days	Wed 4/17/13	Tue 3/17/15



	Task Name	Duration	Start	Finish
24	+ **Risk Management**	**400 days**	**Wed 4/17/13**	**Tue 10/28/14**
27	− **Monitoring**	**1021 days**	**Wed 4/17/13**	**Wed 3/15/17**
28	Install Water Quality Stations	700 days	Thu 7/10/14	Wed 3/15/17
29	Install Air Quality Stations	600 days	Wed 4/17/13	Tue 8/4/15
30	+ **Civil Works**	**300 days**	**Wed 4/17/13**	**Tue 6/10/14**
33	− **PHASE-1: Solution: Requirements Gathering, Definition and System & Design**	**93 days**	**Thu 11/29/12**	**Mon 4/8/13**
34	− **Requirement Study**	**93 days**	**Thu 11/29/12**	**Mon 4/8/13**
35	Project Start Presentation	1 day	Wed 7/10/13	Wed 7/10/13
36	+ **Inventory of existing Data and Data Sources**	**16 days**	**Fri 11/30/12**	**Fri 12/21/12**
40	− **System Data Integration and Needs Assessment**	**93 days**	**Thu 11/29/12**	**Mon 4/8/13**
41	User access and data access Security requirements	2 days	Fri 8/2/13	Mon 8/5/13
42	Administrative Tools requirements	2 days	Tue 8/6/13	Wed 8/7/13
43	Define Functional Requirements	2 days	Thu 8/8/13	Fri 8/9/13
44	+ **External services requirements**	**4 days**	**Wed 12/5/12**	**Mon 12/10/12**
47	− **Interface Definitions**	**93 days**	**Thu 11/29/12**	**Mon 4/8/13**
48	+ **Useability Definition - Interfaces and Functions -Mission, Inputs, Outputs and Stakeholders**	**93 days**	**Thu 11/29/12**	**Mon 4/8/13**
59	Risk Management requirements	28 days	Thu 7/11/13	Mon 8/19/13
60	Build an Integration Plan (data sources, applications, and systems)	10 days	Fri 9/13/13	Thu 9/26/13



	Task Name	Duration	Start	Finish
61	Requirements Plan Completed	0 days	Fri 9/27/13	Fri 9/27/13
62	**PHASE-2: Solution: Delivery of the Solution, Integration & Testing**	**163 days**	**Mon 10/1/12**	**Wed 5/15/13**
63	**Hardware Commission**	**20 days**	**Tue 1/15/13**	**Mon 2/11/13**
67	COTS Software License Available	10 days	Fri 9/27/13	Thu 10/10/13
68	Completion of Software Build	90 days	Fri 10/11/13	Thu 2/13/14
69	**Software Build Plan**	**93 days**	**Tue 12/18/12**	**Thu 4/25/13**
70	Load and Configure software (multiple software systems based on exact software/system specifications)	90 days	Fri 2/14/14	Thu 6/19/14
71	Custom Build - Software (if needed)	120 days	Fri 2/14/14	Thu 7/31/14
72	**Testing**	**51.9 days**	**Mon 3/4/13**	**Tue 5/14/13**
77	End of PHASE 2	1 day	Wed 9/10/14	Wed 9/10/14
78	**PHASE-3: Solution: Relocation, Training and Go Live**	**188 days?**	**Thu 5/16/13**	**Mon 2/3/14**
79	User Training	21 days	Thu 9/11/14	Thu 10/9/14
80	System Use and Demonstration	90 days	Fri 10/10/14	Thu 2/12/15
81	Data Collection For Validating Performance Criteria	60 days	Thu 9/11/14	Wed 12/3/14
82	Final System Report	20 days	Thu 12/4/14	Wed 12/31/14
83	Cut Over - Go live	0 days	Thu 1/1/15	Thu 1/1/15
84	Evaluation Phase	365 days	Thu 1/1/15	Wed 5/25/16
85	End of PHASE 4	0 days	Thu 5/26/16	Thu 5/26/16
86	Project Complete - Close Project	1 day	Thu 5/26/16	Thu 5/26/16



6.6 Success Factors

The following is a list of success factors for the project:

Success Factors
• Bringing expert integration software, IT services, and integration consultants to the project
• Create an operational executive dashboard that will display critical overall environmental risk parameters
• Incorporating expert best management practices in Emergency Management and Response and Risk Management into the solution and system design
• Procuring a world class system integrator / project management to integrate the various elements into the project such as risk management, environmental aspects, data management emergency response
• Working closely with SDEPA to understand their needs and requirements and to define the project scope early in the process
• Place emphasis on the risk management aspect including environmental risk management bet practices and a risk management software package as well as integrating the existing environmental data and future data into the risk management system
• Obtain buy-in from executive department residing over the various municipal departments
• Conduct informational meetings and cross team building activities between shareholders
• Clearly define project plan

6.7 Conclusions

A project to implement the SEERS Project needs to be assessed and planned due the complexity. Factors that impact the project include environmental monitoring and policy, risk management, emergency management, and integration. The scoping and design phase of the project is the key to a successful project as these stages produce accurate costs for completing the project from a hardware, software, infrastructure and labor perspective. In summary the approximate costs to implement the system is estimated at $XXX million USD with a budget of $XXX million USD over a 24 month period.

7 Impact Analysis and U.S. Export Potential

7.1 Project Impacts

7.1.1 Developmental Impact

China rapid economic expansion, development, and urbanization have led the nation to ever increasing need for energy and water. This in turn led to China's massive development of environmental issues the last half century. This development continues. This project will be a vital solution for environment, people, and industries from ever increasing demand from limited sources. This program will supply China with essential a system supply for emergency responding capacity. This system will also serve as a vital environment protection system to millions of Chinese. Despite the known costs of SEERS, it will play a vital role in Shandong development many years to come.

The massive environmental issues development has left China with a large amount of environmental problems all across China. As these problems and as China moves forward with its development, there has been a push by the Chinese government to address the needs to maintain and manage their massive emergency responding inventory. Authorities are looking for the best practices to manage environmental response efficiently and timely as possible. These authorities are looking to new management and safety monitoring systems to assist. The priority is high as the risk to lives, property, and economic impacts is equally high if the environmental protection fail or are damaged. The project will assist the Chinese authorities in developing solutions and partnerships to address environmental safety.

Development Impact

Category	Developmental Impact
Infrastructure	The SEERS Project would help protect and manage the Environment of Shandong and its emergency responding capacity. If successful the solution that the Project recommends could be rolled out nationwide to help protect vital environmental infrastructure across China.
Market-Oriented Reform	Externally, the SEERS Project would assist in helping other US firms to partner related projects in the future. Internally, the project would push authorities to open new sectors of the Chinese government procurement to foreign competition. For both sides and internationally, the project would help further cooperation, global partnership building between Chinese semiprivate agencies and global companies.
Human Capacity Building	The project would provide hundreds of jobs both domestically and

	internationally in the build out of the full scale project over five years. Applying the solution nationwide, would produce a much greater affect employing thousands over the next 5 to 10 years.
Technology Transfer and Productivity Improvement	The project would provide collaboration between the private companies and SDEPA giving both parties valuable insight to each other's respective industries and capabilities. The project would introduce advance environmental technology and monitoring capabilities to SDEPA and would help the U.S. companies to gain knowledge of environmental protection engineering and market. The project solution would provide an advanced responding management system greatly increasing productivity and allowing effective and efficient environmental management.
Future Market Opportunity	This project could be replicated across China to other environmental protection systems and represents enormous opportunity.
Quality of Life	Through more effective environmental management by receiving threat information faster, reacting to threats faster and providing a timely emergency response and mitigation plan, the project would protect lives, property, the economy, and the ecology.

7.1.2 Economic Impact

As the project would improve the environmental emergency responding system, it would result in greater economic activity and commerce and a better overall quality of life for the city's populace. Putting equipment will build up a more efficient and timely monitoring system which will help the environmental emergency responding capability and will better protect the environment. All this achievement will save the cost for dealing with environmental issues or potential problems. Also, a better quality led by the environmental management will be a great commerce opportunity for Shandong province; it will result in some investment of business, tourism, creating economic and job opportunities.

It is estimated that the Project will have a significant positive impact of the labor market both in China and the US. On the Chinese labor side, the Project will help support infrastructure upgrades, hardware and software upgrades, maintenance and operations, and training for the Project Sponsor. The US labor impact will consist of companies that will supply consulting services, software sales, monitoring and sensor equipment, and hardware for the project. Both of these impacts would expand exponentially with the probability that this solution is expanded to other dam and reservoir sites throughout China. This probability increases with the relationship building and partnering between the U.S. companies and SDEPA.

7.1.3 Environmental Impact & Other Impact

The environment impact is expected to be positive. The project is expected to have little impact by infrastructure upgrades or changes during its implementation. There will be a small number of permanent structure upgrades for the project as most of the project will involve installing monitoring equipment and hardware / software which will have very little negative impact on the environment. These small environmental impacts are easily overweighed by the overall benefit of the project. By providing a solution that allows authorities to monitor events such as water, air, or other potential threats to environment and react fast to those events by providing environmental mitigation alternatives in a timely manner, the project will greatly improve the environment and the ability of solving environmental problems. The solution will allow authorities to better mitigate environmental disasters or damage. The full impact is not fully known. This full environmental impact of the Project would be addressed in full project.

This full implementation on this project would provide better overall safe management of the environmental emergency response system. Also, the funding supports a project that offers the potential for an advanced solution to effectively and efficiently manage environmental issues and better control the potential of the environmental problems and throughout China. The Project would set precedence in the new evolving efficiency and capability of emergency responding system.

In addition, the SEERS project would act as a catalyst for applying the emergency responding solution developed in Shandong, China. US companies are anticipated to play a major role as a solution partner for the SEERS Project and the predicted expansion going forward. This represents a huge market opportunity for US firms. The funding of the Study would help make this happen.

Justifications for the Project include:

- High probability of funding directly by the Chinese Central Government
- Significant positive labor, environmental, and human impacts
- Huge market potential
- Development of market making solution
- US companies would play a significant role
- Development of Chinese government agencies relations and market inroads

7.2 U.S. Export Potential

These are a list of some of the companies that would have an opportunity to contribute to this project.

COMPANY	ADDRESS	EMAIL	PHONE NUMBER	FAX	CATEGORY
Intergraph	19 Intergraph Road, Huntsville AL 35678	Justin Justin.Schmidt@Hexagon.com www.intergraph.com	1(256)730-2000	+1(256)730-2048	Consulting and IT Company
CH2Mhill	22nd Floor, Tower B City Center No. 100 Zun Yi Road Shanghai, China 200051	John Quarendon John.Quarendon@ch2m.com	+86-21-6057-3000	+86-21-6057-3299	Consulting and Engineering Services
TetraTech	3475 East Foothill Boulevard Pasadena, California 91107-6024	info@tetratech.com Jim Wu- jim.wu@tetratech.com	+1-626-351-4664 +1-626-470-2844	+1-626-351-5291	Consulting and Engineering Services
Louise Berger Group	1250 23rd Street, NW Washington, DC 20037	Brian Moore bmoore@louisberger.com	(202) 303-2740	(202) 331-7775	Consulting and Engineering Services
Bechtel	Floor 11, Liantong Building, Changning Road, Shanghai	bcechr@bechtel.com	(86-21) 2205-4500	(86-21) 2205-4800	Consulting and Engineering Services/ Technical Training
Waterborne Environ. Inc.	897-B Harrison Street, SE Leesburg, VA 20175	rittera@waterborne-env.com	1 (703) 777 - 0005	1 (703) 777 – 0767	Consulting and Engineering Services
Riverside Tech Inc	Riverside Technology, inc. 2950 E Harmony Road, Suite 390 Fort Collins, CO 80528	info@riverside.com	1 (970) 484-7573	1 (970) 484-7593	Consulting and Engineering Services

COMPANY	ADDRESS	EMAIL	PHONE NUMBER	FAX	CATEGORY
Sutron	Chu Jen Chia A-1603 Roman Garden 18 Huixin West Street Chaoyang District, Beijing 10029 China	Chia@sutron.com	86 1064957611	86 1064957612	Communication Equipment
YSI	501 Sheng'ai Building, caoxi North Road, Shanghai, China	shanghai@ysi-china.com	(021) 6469-3325	(021) 6469-5775	Communication Equipment
Motorola	1303 East Algonquin Road Schaumburg, Illinois 60196 USA	investors@motorolasolutions.com	(021) 38784655	(010) 65668800	Communication Equipment
Geospatial Systems, Inc.	150 Lucius Gordon Drive West Henrietta, NY 14586	inquiry@geopatialsystems.com	(01-585) 427-8310	(01-585) 427-8422	Laboratory Equipment
GeoEye	2325 Dulles Corner Boulevard Herndon, VA 20171	analytics.sales@geoeye.com	+1.703.480.7500	+1.703.450.9570	Laboratory Equipment
ITT	1133 Westchester Avenue White Plains, NY, 10604	colleen.ostrowski@itt.com	+1 914 641 2000	+1 914 696 2950	Laboratory Equipment
EarthData	9a Huntingdale Drive Thornton NSW 2322	info@earthdata.com.au	+61 (2) 4922 5888	+61 (2) 4922 5889	Laboratory Equipment
Global Water Instr.	2440 Gold River Rd, Ste 210 Gold River, CA 95670	globalw@globalw.com	(979) 690-5560	(979) 690-0440	Monitoring Equipment
Stevens Water Monitor Sys.	12067 NE Glenn Widing Drive, Suite 106 Portland, OR 97220	Martin Iturri: miturri@stevenswater.com	(503) 445-8000	(503) 445-8001	Monitoring Equipment
Novalynx Corporation	Grass Valley, CA 95945-0240 U.S.A.	Joseph R. Andre,Jr.: nova@novalynx.com	(530) 823-7185	(530) 823-8997	Monitoring Equipment

COMPANY	ADDRESS	EMAIL	PHONE NUMBER	FAX	CATEGORY
Wescor Inc.	No. 24 Feibei Street Fengtai District Beijing Republic of China (Mainland)	dchen@springsci.com	8610 6385 0515	8610 6382 5983	Monitoring Equipment
Manning Environmental, Inc.	1968 South Austin Avenue Suite 101A Georgetown, Tx 78626	sales@manningsystems.com	(800) 863-9337	(512) 863-4472	Monitoring Equipment
EAI Technologies	1945 Old Gallows Road, Suite 310, Vienna, VA	N/A	+1 703-790-9715	+1 703-790-9715	Monitoring Equipment
Teledyne Isco, Inc.	4700 Superior Street, Lincoln, NE 68504, United States	iscoinfo@teledyne.com	(402) 464-0231	(402) 464-0231	Monitoring Equipment
HP	HP building, 112 Jianguo Road, Chaoyang District, Beijing, China	investor.relations@hp.com	010-65643888	010-65643999	Software / Hardware
Cisco	No. 2 Jianguomenwai St, Chaoyang District, Beijing (Levels 7 – 12, Yintai Building	emusbahu@cisco.com	86-10-85155000	86-10-85155000	Software / Hardware
Texas Instruments	12500 TI Boulevard Dallas, Texas 75243 USA	N/A	972-995-2011	972-995-2011	Software / Hardware
Microsoft	8 wangjing Street, Chaoyang District, Beijing China	N/A	010-59178888	01059258588	Software / Hardware
ESRI	Floor 19th Juran Building, No.3 South Street, East District, Beijing China	support@esrichina.com.cn	010-57632288	010-57632299	Software / Hardware
BOSS International	4100 Oakmede Lane White Bear Township, Minnesota 55110 USA	inquiries@mbossinternatioanl.com	+1 608-258-9910	+1 608-258-9910	Technical training

COMPANY	ADDRESS	EMAIL	PHONE NUMBER	FAX	CATEGORY
URS	600 Montgomery Street 26th Floor San Francisco, CA 94111-2728	Sam Ramraj: Investor_Relations@urscorp.com	+1.415.774.2700	+1.415.772.8290	Technical Training

8 Workshops

SDEPA - Workshops

Summary

Intergraph and SDEPA collaborated and worked together on the Environmental Emergency Management and Response System for Shandong province. Intergraph conducted a workshop which Intergraph IT & GIS experts met with SDEPA environmental experts and program personnel from various departments to discuss in detail SEPA's organization, its mission, processes, their KPIs, possible theme outputs for the group, and technology available to satisfy SDEPA's requirements for the project and system. SDEPA gathered information from different departments for their environmental emergency responding system requirements

The workshops were held in Jinan, Shandong China.
The general purpose of theme workshops conducted was to:

- Brief basic Geographical Information System (GIS) concepts and design processes, along with high-level GIS definitions
- Confirm the specific requirement of SDEAP
- Identify the mission for each participating SDEPA department
- Discuss with each participating department's role and capabilities to better understand the department operation

Brief Introduction

Mr. Chengjin Yuan, Director of Environment Safety & Emergency Management Division Department of SDEPA opened the workshop and gave a brief introduction of current situation of environmental protection and emergency management and response in the province of Shandong, the system requirements, and the cooperative efforts from the various SDEPA departments are involved in the project. The director pointed out that after the SARS ravaged China in 2003, China started to focus on the emergency response. In 2008, the Ministry of Environmental Protection established the Emergency Response Team. In 2010, SDEPA set up an emergency agency in charge of emergency response. In 2010, the emergency agency handled 11 cases of large environmental events, mainly in the watershed pollution and atmospheric pollution. Although there has been progress in recent years, Shandong still is facing increasing environmental challenges with air and water pollution, degradation to water, and soil contamination. Mr. Yuan hopes SDEPA would help to build up an environmental emergency response system which would set up an environmental database to provide a system to collect risk assessments of the existing companies and to collect the operating plans and environmental emergency plans in

order to prevent environmental accidents. The system will be capable for pre-alarm and hazard assessment and environmental recovery.

Consultants at Intergraph provided a project summary to the attendees. The updated program plan was introduced and showed different slides of key points as well as different steps to finish the program. The importance of communication between different partners for reaching the goal was emphasized. An overview of the current situation provided an overview of the current as well as the future trends in China's environmental emergency responding initiatives. He also introduced the American IT solution methods and technology including GIS technology, GPS technology and environmental monitoring. He said that the integration of different technologies can make the system a complete solution.

Mr. Chengyue Sheng, an environment expert consultant for Intergraph, presented a detailed overview of this environmental emergency response and management system from environmental perspective which includes treatment of heavy metal, water pollution and air pollution. Mr. Pan, GIS expert of Intergraph presented an overview of the system from his professional perspective of emergency command systems, emergency management and decision support systems, monitoring and dispatching systems and emergency communication network systems.

Final Report Meeting

A final report meeting will be held in Jinan, China at the SDEPA headquarters on June 3, 2013. Meeting details described below:

9 Appendix

9.1 National Environmental Emergency Requirements

The national building standard of the environmental contingency ability for environmental protection department:

All provinces, autonomous regions, municipalities directly under the central government environmental protection department (bureau), Xinjiang production and construction corps environmental protection agency:

To strengthen the national environmental contingency ability building, improve the respondent level to emergency environmental accidents, and also to regulate the emergency management agency, our organization of the national environmental protection department draw up this "the national building standard of the environmental contingency ability of environmental protection department", according to the law of the People's Republic contingency law "and the concerned requirements of "opinions on strengthening the environmental emergency management(ring method [2009] 130 date). Now distribute to you all, please observe and implement it.

"The national building standard of the environmental contingency ability for environmental protection department." In order to adapt to current severe environmental security situation, strengthen the environmental contingency ability, promotes the level of responding to emergency environmental accidents, and promoting the system building of China's environmental emergency management, according to the law of the People's Republic of emergency response, the state council " opinions about strengthening the work of emergency management" (of the hair [2007] no. 52), "opinions on the basic emergency team construction" (of the hair [2009] no.59 , for corresponding the requirement to the emergency team, we specially set formulated this standard.

The core of this standard is to improve provincial environmental emergency command ability, the key point is to strengthen different cities' coping ability to the emergency environmental accidents. Each has a focus on the formulations of building standard of the province, city and county levels. The content includes institutions and personnel, Hardware devices, and business building, etc. At the same time, according to the practical situation, we set up different standards into three different levels, as to province, city, in order to encourage the region with needs to further improve its building standards.

The building ability of monitoring implement of" the national environmental monitoring station construction standard ", and we will formulate the building standard nuclear and radiation environmental contingency ability separately.

Table 1.1: Institutions and personnel

Index content	Serial number	Provincial standards		
		Level 1	Level 2	Level 3
Environmental emergency management agency	1	The specialized agencies or department with the exercise of functions for environmental emergency.		
Staff size	2	31 or more	11-30 people	5-10 people
Personnel qualifications	3	100% with Bachelor degree or above	90% with Bachelor degree or above	80% with Bachelor degree or above
training rate	4	100%		

Table 1.2: Institutions and personnel

Index content	Serial number	Standard of city-level		
		Level 1	Level 2	Level 3
Environmental emergency management agency	1	The specialized agencies or department with the exercise of functions for environmental emergency.		
Staff size	2	16 or more	6-15 people	3-5 people
Personnel qualifications	3	80% with Bachelor degree or above	70% with Bachelor degree or above	60% with Bachelor degree or above
Training rate	4	100%		

Table 1.3: Institutions and personnel

Index content	Serial number	Standard of county-level		
		Level 1	Level 2	Level 3
Environmental emergency management agency	1	The specialized agencies or department with the exercise of functions for environmental emergency.		
Staff size	2	11 or more	5-10 people	2-4 people
Personnel qualifications	3	90% with junior college degree	80% with junior college degree	70% with junior college degree
Training rates	4	80%		

Notes:

1. The first "environmental emergency management agency" means the exercise of administrative functions of environmental emergency management, which can effectively prevent and properly respond to all categories of environmental emergencies, promoting the environmental emergency management of the whole process of the specialized agencies or departments;
2. The second item "size" means the specialized personnel working in environmental emergency management, not including part-time staff.
3. The third "personnel qualifications" means the new personnel qualifications;
4. The " training rate" means the staff ratio of people who already passed the national or provincial environmental protection Department of emergency management training and obtained certificate of competency;
5. Selected people who have high political and ideological consciousness, culture and business quality to meet the needs of working in the field of environmental emergency management work.
6. The personnel funding is approved in accordance with the national standard of wage, allowance, subsidies of staff who are in the establishment of government departments.
7. The environment in areas of high risk level based on the standard expansion size.

Table 2.1.1 Hardware devices

Category		Index content	Serial No.	Provincial standards		
				Level1	**Level2**	**Level 3**
Environmental Emergency Command System	Fixed command platform	emergency response command platform, integrated application system	**1**	1	1	1
		video conference system and video command scheduling system	**2**	1	1	1
	Mobile command and communic-ation systems	car emergency command system for mobile systems and data collecting and transferring	**3**	3	2	1
		portable communication terminal	**4**	6	4	2

Table 2.1.2 Hardware devices

Category		Index content	Serial number	Standard of city-level		
				Level 1	**Level2**	**Level 3**
Environmental Emergency Command System	Fixed command platform	emergency response command platform, integrated application system	**1**	1	1	Own custo-mized (OC)
		video conference system and video command scheduling system	**2**	1	1	OC
	Mobile command and communic-ation system	car emergency command system for mobile systems and data collecting and transferring	**3**	2	1	OC
		portable communication terminal	**4**	4	2	OC

Table 2.1.3 Hardware devices

Category		Index content	Serial number	Standard of county-level		
				L1	**L2**	**L3**
Environmental Emergency Command System	Fixed command platform	emergency response command platform, integrated application system	**1**	1	OC	OC
		video conference system and video command scheduling system	**2**	1	OC	OC
	Mobile command and communi-cation systems	car emergency command system for mobile systems and data collecting and transferring	**3**	1	OC	OC

		portable communication terminal	**4**	2	OC	OC

Table 2.2.1 Hardware devices

Category	Index content	Serial number	Provincial standards		
			L1	**L2**	**L3**
Emergency Transport	mobile command vehicles	**5**	**3**	**2**	**1**
	emergency vehicles	**6**	1/3 people	1/4 people	At least 2
	emergency monitoring high-performance car	**7**	**1**	**1**	**OC**
	multi-functional water (offshore) boats	**8**	**OC**	**OC**	**OC**

Table 2.2.2 Hardware devices

Category	Index content	Serial number	Standard of city-level		
			L1	**L2**	**L3**
Emergency Transport	mobile command vehicles	**5**	**2**	**1**	**OC**
	emergency vehicles	**6**	1/3 people	1/4 people	At least 1
	emergency monitoring high-performance car	**7**	**1**	**OC**	**OC**
	multi-functional water (offshore) boats	**8**	**1**	**OC**	**OC**

Table 2.2.3 Hardware devices

Category	Index content	Serial number	Standard of county-level		
			L1	**L2**	**L3**
Emergency Transport	mobile command vehicles	**5**	**1**	**OC**	**OC**
	emergency vehicles	**6**	1/4 people	1/5 people	At least1
	emergency monitoring high-performance car	**7**	**OC**	**OC**	**OC**
	multi-functional water (offshore) boats	**8**	----------		

Table 2.3.1 Hardware devices

Category	Index content	Serial number	Provincial standards		
			L1	**L2**	**L3**
Emergency protective equipment	gas-tight chemical protective clothing	**9**	6	4	2
	chemical protective clothing	**10**	16	10	4
	emergency on-site uniform (set)	**11**	2/1 people	2/1 people	1/ people
	emergency and explosive gas alarm installations	**12**	6	4	2
	gas detection alarm system	**13**	6	4	2
	Radiation warning assembly	**14**	6	4	2
	medical first aid kit	**15**	1/ people	1/ people	1/2 people

Table 2.3.2 Hardware devices

Category	Index content	Serial number	Standard of city-level		
			L1	**L2**	**L3**
Emergency protective equipment	gas-tight chemical protective clothing	**9**	4	2	2
	Chemical protective clothing	**10**	10	5	3
	emergency on-site uniform (set)	**11**	2/1 person	1/1 person	1/ person
	explosive gas alarm installations	**12**	4	2	2
	gas detection alarm system	**13**	4	2	2
	Radiation warning assembly	**14**	4	2	2
	medical first aid kit	**15**	1/ person	1/2 people	At least 2

Table 2.3.3 Hardware devices

Category	Index content	Serial number	Standard of county-level		
			L1	**L2**	**L3**
Emergency protective equipment	gas-tight chemical protective clothing	**9**	2	**OC**	**OC**
	chemical protective clothing	**10**	4	3	2
	emergency on-site uniform (set)	**11**	2/1 people	1/1 people	1/ people
	explosive gas alarm installations	**12**	2	2	2
	gas detection alarm system	**13**	2	2	2
	Radiation warning assembly	**14**	2	2	2
	medical first aid kit	**15**	1/ person	1/2 people	At least 2

Table 2.4.1 Hardware devices

Category	Index content	Serial number	Provincial standards		
			L1	**L2**	**L3**
Emergency protective equipment	Emergency power supply, lighting equipment	**16**	3	2	2
	Sleeping bag	**17**	10	6	4
	Tent	**18**	5	3	2
	cold-warm, oxygen therapy and other life support equipment	**19**	1/ High performance Range Rover		

Table 2.4.2 Hardware devices

Category	Index content	Serial number	Standard of city-level		
			L1	**L2**	**L3**
Emergency protective equipment	Emergency power supply, lighting equipment	**16**	2sets	1	**OC**
	Sleeping bag	**17**	10sets	4	**OC**
	Tent	**18**	8sets	2	**OC**
	cold-warm, oxygen therapy and other life support equipment	**19**	1set / 1 High performance Range Rover	**OC**	**OC**

Table 2.4.3 Hardware devices

Category	Index content	Serial number	Standard of county-level		
			L1	**L2**	**L3**
Emergency protective equipment	emergency power supply, lighting equipment	**16**	1	**OC**	**OC**
	Sleeping bag	**17**	4	**OC**	**OC**
	Tent	**18**	2	**OC**	**OC**
	cold-warm, oxygen therapy and other life support equipment	**19**	**OC**	**OC**	**OC**

Table 2.5.1 Hardware devices

Category	Index content	Serial number	Provincial standards		
			L1	**L2**	**L3**
Emergency investigation and evidence collection equipment	High - Precision GPS satellite positioning system	**20**	1/car	1/car	At least2
	laser range finder telescope	**21**	3	2	1
	emergency video equipment	**22**	5	3	1
	Emergency photography equipment	**23**	10	6	2
	cy recording equipment	**24**	10	**6**	**2**
	Riot radio	**25**	12	8	4
	drones	**26**	1set	OC	OC

Table 2.5.2 Hardware devices

Category	Index content	Serial number	Standard for construction of city-level		
			L1	**L2**	**L3**
Emergency investigation and evidence collection equipment	High - Precision GPS satellite positioning system	**20**	1	**2**	1
	laser range finder telescope	**21**	2	**1**	**OC**
	emergency video equipment	**22**	2	1	**OC**
	Emergency photography equipment	**23**	4	2	1

	cy recording equipment	**24**	6	**4**	**2**
	Riot radio	**25**	10	**6**	4
	drones	**26**	--		

Table 2.5.3 Hardware devices

Category	Index content	Serial number	Standard of county-level		
			L1	**L2**	**L3**
Emergency investigation and evidence collection equipment	High - Precision GPS satellite positioning system	**20**	1	**OC**	**OC**
	laser range finder telescope	**21**	**1**	**OC**	**OC**
	emergency video equipment	**22**	**1**	1	**OC**
	Emergency photography equipment	**23**	**3**	2	1
	cy recording equipment	**24**	**4**	**3**	**2**

	Riot radio	**25**	**6**	**4**	**2**
	drones	**26**	--		

Table 2.6.1 Hardware devices

Category	Index content	Serial number	Provincial standards		
			L1	**L2**	**L3**
Office equipment	Computer/desktop	**27**	1/people	1/people	1/2 people
	Landline phone	**28**	1/2 people	1/3 people	At least 2
	printer	**29**	**6**	4	**2**
	Fax machine	**30**	**5**	3	2
	Copy machine	**31**	**2**	**1**	**1**
	Wi-Fi laptop	**32**	1/2 people	1/3 people	At least 2
	portable print, fax, copy machine	**33**	5	3	At least 1

Table 2.6.2 Hardware devices

Category	Index content	Serial number	Standard of city-level		
			L1	**L2**	**L3**
Office equipment	Computer/desktop	**27**	1/people	1/2people	1/3 people
	Landline phone	**28**	1/3 people	1/4 people	At least 1
	printer	**29**	**4**	**2**	**1**
	Fax machine	**30**	**2**	**1**	**1**
	Copy machine	**31**	**1**	**1**	**OC**
	Wi-Fi laptop	**32**	1/3 people	1/4 people	At least 1
	portable print, fax, copy machine	**33**	3	2	1

Table 2.6.3 Hardware devices

Category	Index content	Serial number	Standard of county-level		
			L1	**L2**	**L3**
Office equipment	Computer/desktop	**27**	1/2 people	1/3 people	At least 1
	Landline phone	**28**	1/3 people	2	1
	printer	**29**	**2**	**1**	**1**
	Fax machine	**30**	**1**	**1**	**1**
	Copy machine	**31**	**1**	**OC**	**OC**
	Wi-Fi laptop	**32**	1/4 people	At least 1	**OC**
	portable print, fax, copy machine	**33**	1	OC	OC

Notes:

1. OC in the tables means own customized/decided
2. The 1st "emergency response command platform, integrated application system" means a national emergency response platform system requirements, include environmental risks source based information system, environmental emergency

stocks shared information systems and other environmental Foundation information integration, realization of emergency platform with government departments, lines of environmental protection departments emergency platform interoperability completing domestic emergency response platform system.

3. The 2nd items "video conference system and video command scheduling system", provincial needed equipped with MCU (more points control unit), and the audio switch control system (in principle access capacity does not below 128*128), and network management system, video conference Terminal and supporting peripherals (including camera, and speaker, and expansion sound device,); prefecture-level cities needed equipped with MCU (more points control unit), and the audio switch control system (in principle access capacity does not below 64*64), and network management system, and Video conferencing Terminal, as well as supporting peripherals (including cameras, speakers, sound reinforcement equipment); the County level should be equipped with video conferencing Terminal, as well as supporting peripherals (including cameras, speakers, sound reinforcement equipment, etc).
4. The 3rd "car emergency command system for mobile systems and data collecting and transferring" means Assembly in emergency vehicles on the move command and communications system. Include at least the electronic office equipment, wireless communications equipment, audio and video image acquisition equipment, transmission equipment, and to ensure that real time data information transmission between fixed command platforms.
5. The 4th "portable communication terminal" means a simple convenient for operation and personnel carrying communications equipment, at least for wireless communications, audio, image data acquisition, data transfer capabilities, and to ensure that fixed command data information transmission between the platform and the mobile command system.
6. The mobile command information systems should ensure that the scene can be achieved under harsh conditions and administrative command of real-time communication.
7. The 5th "mobile command vehicles" means the equipment moving car emergency command system and data acquisition and transmission system of mobile command vehicle, the printed "environmental emergency" were replaced by the identity. Provincial level, provincial level II, emergency command vehicles at the municipal level in 7 above.

8. The 6th "emergency vehicles" include commercial vehicles, and off-road vehicles, high-performance off-roader, printed with "environmental emergency" identity. Geographical complex areas could increase the proportion of off-roader, high performance off-roader configuration.
9. The 7th "emergency monitoring high-performance car" means under the State of emergency vehicles to the scene quickly monitoring, you can quickly monitor various contaminants including gaseous, solid and liquid, radiation, with airtight protection features, printed with "environmental emergency" identity. Emergency vehicle may delegate day-to-day management and maintenance of environmental monitoring sector.
10. The 8th "multi-functional water (offshore) boats", printed with "environmental emergency" identity, and in the Interior area of large area waters-free sector without equipment.
11. The 9th "gas-tight chemical protective clothing" and the 10th "liquid tight chemical protective clothing or dust-tight chemical protective clothing" are to include physical protection, respiratory protection, wireless communication sets of protective gear. Technical standards in the light of the General technical requirements for chemical protective clothing protective clothing (GB 24539-2009), the selection, use and maintenance of chemical protective clothing (AQ/T 6107-2008).
12. The 11th "emergency on-site uniform (set)" means a general contingency site overalls, including clothes, shoes, hats, gloves, mask, goggles or mirror equipment, clothing printed with "environmental emergency" identity.
13. The 15th "medical first aid kit" includes at least: cotton elastic bandages, wound dressing mesh elastic bandage, non-stick, waterproof bandage, compress absorbent cotton, triangle towel wound disinfection, alcohol cotton pad, cotton swabs, scissors, medical plastic gloves for medical use, artificial respiration isolation masks, suxiao jiuxin pill, etc.
14. The 19th "cold-warm, oxygen therapy and other life support equipment" includes winter clothes, heating furnace, oxygen tanks, field cooking utensils etc., can improve deployment in harsh environmental conditions of the area.
15. The 22th "emergency camera equipment" and the 23rd "emergency equipment" refers to the riot, HD, wide angle, long focal length, night photography features such as camera equipment and photography equipment.

16. The 26th "drones" refers to the use of radio equipment and bring your own program control device for manipulation of the unmanned aircraft, with aerial capabilities and data transmission systems, required supporting aerial data analysis system, operates by professionals.
17. The environmental emergency hardware equipment shall be kept in such good order, maintenance and upgrade as required, retire update, at any time in normal use condition.
18. To build environmental emergency stocks information repository, an environmental contingency stocks list, relying on local people's Government reserves for emergency relief supplies.
19. The indicators as the minimum configuration of the standard, everywhere on this basis, should raise the level of equipment according to the actual need for additional equipment.

Table 3.A1 Business building

Index content		Serial No.	Provincial construction standards			The construction standards at city level			The construction standards at the county level		
			L1	L2	L3	L1	L2	L3	L1	L2	L3
Administrative office area		1	Per capita cannot under 15 m^2			Per capita cannot under 12 m^2			Per capita cannot under 10 m^2		
Special business houses	environmental emergency command hall	2	400 m^2	200 m^2	200 m^2	200 m^2	100 m^2	OC	100 m^2	OC	OC
	environmental emergency conference room	3	300 m^2	200 m^2		200 m^2		OC		OC	OC
	Environmental emergency duty room	4	200 m^2	100 m^2	50 m^2	150 m^2	100 m^2	50 m^2	100 m^2	50 m^2	OC

	The secondary building	5	200 m^2	100 m^2	50 m^2	150 m^2	150 m^2	50 m^2	100 m^2	50 m^2	OC

Notes:

1. The 1st item "administrative office area" equipped with desk, chair, desktop computer, fax machines, photocopiers, printer and the Internet login equipment;
2. The 2nd item "environmental emergency command hall" equipped with video conference system, video, audio systems and big screen display system, desk, chair, ark and other office facilities;
3. The 3rd item "environmental emergency conference room," includes consultation room, emergency platform control rooms, and computer rooms;
4. The 4th item " Environmental emergency duty room " includes emergency dispatching room, and duty room at night;
5. The 5th item "secondary room" includes reserves, equipment, and operation rooms, etc.

9.2 Shandong Environmental Emergency Plan

Hazardous waste of sudden environmental pollution accident in Shandong province (case) emergency plan

Plan of Emergencies

For comprehensive follow-up implementation province environment agency emergency work measures requirements, ensure province dangerous waste management center in area within mega-environmental pollution event burst Shi, can fast response, ordered action, efficient disposal, reduced against, achieved protection public, and protection environment of purposes, according to national legal, and regulations and provincial government and province environmental Office related indicates requirements, combination dangerous tube center work actual, developed Shandong province dangerous waste environmental pollution accident and burst event emergency plans.

First: Basic Tasks

In the event of sudden environmental pollution emergency response efforts, the provincial crisis center task is assigned:

(A) is responsible for the identification of the sources of environmental pollution emergency or hazardous waste identification, further verifying the nature of the pollutants;

(B) determine the environmental impact, regional isolation, withdrawal and other protection recommendations;

(C) participate in the polluted area, water, building surface, such as eliminating the pollution and contaminated with chemical agents of biological warfare agents, goods and other rehabilitation treatment and disposal of hazardous wastes;

(D) complete the other tasks under the provincial EPA emergency response leadership teams.

Second: Dangerous Pipe Emergency Units

According to the provincial environmental protection department response requested, province hazardous waste management center into a dangerous emergency unit, subordinate

to the provincial Department of environmental emergency response leadership group. Compile as follows:

Captain: Wang Haomin

Vice-Captain: Liu Shiwen

Members: Li Zhonghe, Li Jianzhi, the Republic Lv Ruixue, Wang Xiubao, Xiong Yan open, and xiaoshangzhou

Driver: Yu June, and Yu Baoliang

Three: Emergency Boot

(A) the Office of the provincial environmental protection department received emergency notification

1 . According to the emergency notice requirements and related matters, immediately notify personnel, designated assembly sites, clear build-up time frames (contact telephone numbers table below);

2 . Other members received a provincial Department of environmental protection Office of the emergency response notification, shall immediately report to the captain or vice-captain, and directed by the captain, Vice Captain, emergency notification to the other personnel of the unit, identifying relevant requirements;

3 . All emergency personnel after receiving the emergency notification should be 40 minutes to emergency assembly points, expanded emergency preparedness;

4 . Basic assembly points for the West of Environment Protection Bureau, Office area, place of transit as the case may be.

(B) Receive leapfrog-ordered emergency notification

When dangerous pipe emergency units received relating to the superiors of emergency response agencies outside the provincial environmental protection department notification, should take the initiative and detail as possible about the situation; while actively engaged in emergency preparedness, rapid report to the provincial Department of environmental

protection Office of the emergency, which in accordance with the provincial environmental protection Bureau emergency led emergency preparedness work group's request, quickly made emergency preparations.

(C) received by the municipal environmental protection Bureau and other units when the relevant reports

When dangerous pipe emergency units received the municipal environmental protection Bureau or unit in charge of the environmental pollution of its subordinate units, accident report, should take the initiative and detail as possible about the situation initial judgement accident levels. Report immediately to the provincial Department of environmental protection Office of the emergency, if necessary, and quickly prepared for emergency starting work. Upon receipt of the provincial Department of environmental protection Office of the emergency response notification, started to work in accordance with the notification requirement when less accidents, damage is not too serious, or to be a general summary contingency routine reporting, you do not need to start the environmental emergency response system, do the work of filing in a timely manner.

Four: Emergency Preparedness

(A) the subject of emergency response tasks

Subject content of the tasks typically include: (1) The General information about the event; (2) The basic tasks of this unit, arrived at the emergency areas relating to the time limits and requirements; (3)Tasks of other units within the system; (4) Possible support and cooperation provisions; (5) Command relationships and reporting means to be contacted; (6) Higher command and Commander of position etc.

(B) the set plan of action

In analyzing the situation on the basis of, in conjunction with plans, emergency tasks and practices, set a plan of action to implement the emergency task, its contents typically include: (1) Undertake emergency tasks; (2) Neighbor tasks and collaborative requirements; (3) Emergency personnel into action, Division of labor and emergency disposal methods; (4) Required equipment and emergency equipment, personnel protection requirements; (5) Complete the pre-work and scene of the time limit; (6) Select a route, determine the general location of places of protection; (7) Accidents that may happen and disposal methods.

(C) check the preparation equipment

According to the plan of action needed to quickly prepare equipment, check the technical performance of instruments and equipment, implementation of emergency vehicles, the preparations prior to departure.

(D) to the contingency site into

In accordance with the provincial environmental protection department leading group for emergency action sequence in time to join formations, when moved in alone, according to the selected route March to emergency site in a timely manner, and flexible decisively disposed of on their way into the various situations, ensure timely arrival emergency locations.

(E) personal protective

When it reaches the contaminated areas near, should be based on the nature, scale, terrain, weather and other sources, choose the place of protection, wear masks for respiratory protection or partial protection, such as hands, feet, body protection wear protective clothing if necessary.

Five: emergency treatment and disposal

(A) determine the types of sources and nature of

1 . Contact and monitoring emergency response units, asking for and receiving emergency monitoring of relevant data;

2 . Swift identification and identification of instruments and equipment, monitoring unit in charge of emergency response units, accident or other emergency personnel in the field, with the assistance of command workers to find and timely detection of pollution;

3 . Qualitative identification of the sources and identification, accurate determination of types of pollution sources, nature, scale;

4 . To the Office of the provincial environmental protection Department of environmental emergency response or command groups reporting the results of identification and identification of, and make recommendations for disposal.

(B) determination contaminated areas of impact

Depending on the type and nature of sources of pollution and emergency monitoring unit report on the monitoring of data, to outline the scope of pollution or harm judgment, timely evacuations and protection suggestion.

(C) the Elimination of pollution

1. Under source type, nature, selection of appropriate disinfectants;
2. According to the scope of pollution, elements of topography and the disinfectant consumption standard, calculate the amount of disinfectant, allocation ratio determined;
3. Steering-related personnel modulation disinfectant, imposed on the polluted area and surface disinfection decontamination treatment;
4. Physically removed when other methods, such as disinfection, according to technical specifications organization and implementation;
5. Test results of the monitoring of disinfection and, if necessary, supplementation or complex energy dissipation extinction.

(D) the disposal of hazardous waste

1. Found hazardous waste category, confirm the need for disposal;
2. Select the processing method, preparing disposal tool, the selected disposal units and transport routes;
3. Hazardous waste packaging, loading, organization of transport;
4. Organization, transport and disposal of the warning;
5. The eventual total disposal of hazardous waste.

Six: Emergency Termination

(A) the removal, equipment, organization of contaminated instruments, equipment for disinfection and decontamination;

(B) guiding relevant departments and units identify reasons to prevent similar recurrences of the problem;

(C) the return of organization;

(D) emergency work, preparing contingency summary report, reported to the emergency situation.

(E) according to experiences, revising existing emergency plan, and reported that the Office of the provincial environmental protection department emergency approval, for the record;

(Vi) maintenance of equipment and instruments, so that it is always a good technique and tactics.

Seven: Emergency Safeguard

(A) the equipment support

Material support, including emergency identification equipment, protective equipment, communication equipment, elimination of decontamination equipment. For reusable equipment such as instruments and equipment, combining peacetime approach should be taken, as with maintenance, ensure that equipment is kept in good technical performance; various kinds of disposable consumable supplies equipment, quantitative Stockpiling, regular replacement approach should be taken to ensure quantity and quality consumable supplies equipment. Types and quantities of equipment are shown in annex.

(B) the communications guarantee

Full use of a wired telephone, LAN, interphone, mobile phone, personal cell phone, emergency startup, the radio joined the provincial environmental protection Bureau command network, maintain uninterrupted communications to ensure smooth communication and command information channels of communication open.

(C) vehicle protection

Dangerous pipe emergency units required emergency vehicles 3 Taiwan. , Command cars, monitoring, hazardous waste transport vehicles 1 , each vehicle usually must keep 300KM more traffic with oil.

(D) the life and health insurance

Emergency response personnel should bring cooked food of the day prior to departure, and have a certain amount of cash, or according to the unified deployment of the provincial environmental protection department emergency response leadership team organization security. If personnel during emergency poisoning or injury, can be sent to the nearest hospital for medical treatment, or to the emergency scene command designated hospitals, medical unit for treatment. After termination of emergency tissue transfer or continue to treat it as needed.

9.3 Terms of Reference - Shandong Environmental Emergency Management and Response System

The objective of the Study is to determine the feasibility of implementing an environmental emergency response system for the Environmental Protection Department of Shandong Province. The Environmental Protection Department of Shandong Province ensures environmental safety and protects public health. In Shandong heavy industry is an important aspect of economic activity and there is sharp contradiction between rapid industrial growth and the carrying capacity of the environment. Environmental incidents pose significant economic risks and a serious threat to the health and safety of the people and social stability. To systematically address these issues Shandong Province will establish an environmental early warning and emergency response command system. The system will improve real time data monitoring and analysis of environmental conditions; establish an emergency operations and incident response command center; and deploy an effective early warning capability for environmental hazards. The system will address technical response and information management requirements at the provincial, municipal, and county levels.

TASK 1: PROJECT KICK OFF

The Contractor shall launch the Study by defining the detailed scope of work, research methodology, data gathering requirements, roles and responsibilities, and project plan with milestones and specific timetable for deliverables. The Contractor shall launch the Project with initial research and discussions with the Grantee to clarify Project objectives and goals. The Grantee shall be responsible for supplying all supply all the reference material identified in the TOR that are needed for the Contractor to effectively implement all of the prescribed tasks.

1.1 Project Planning and Document Review

The Contractor shall:

- Define Project approach and methodology, documentation standards, project management reporting requirements, benchmarks and workflow.
- Design research framework and data collection requirements including stakeholder interview questionnaire and evaluation methodology, data formatting and presentation templates, analysis framework and knowledge management process.
- Review all relevant research materials, policy documents, and past and ongoing environmental emergency response initiatives in Shandong Province prior to initial field visits.
- Seek Grantee views of past success/failures related to environmental emergency response and hazard mitigation.
- Obtain and review national guidelines and published studies related to environmental emergency response in order to ascertain the state of the environmental emergency response sector in China.

1.2 Project Kick off

The Contractor shall:

- Meet with the Grantee to discuss overall project strategy, objectives and deliverables.
- Communicate, clarify and refine project objectives and scope.
- Form a joint Project team with the Grantee.
- Define the Grantee's and Contractor's roles and responsibilities and jointly prepare a Project plan.
- Obtain policy guidance from the Grantee.

Deliverable: The Contractor shall prepare a Feasibility Study Kick-off Report (5-10 pages) describing all the work performed under this Task 1, including a summary of initial observations and findings, detailed project methodology, benchmarks and timelines. The Contractor shall also summarize the Grantee's current operating state regarding the items and sources required under this task, and including the current technology and applications in use by the Grantee, and shall provide data organized and formatted to meet the needs of the Study as a whole.

TASK 2: SITUATION ANALYSIS

The Contractor shall perform a situational analysis of the current status of the environmental emergency response structure in Shandong including policies, organization, legal framework and technical systems currently deployed. The Contractor shall identify the problems, opportunities, and challenges in the current environmental emergency response system and comprehensively assess the potential for new applications and solutions based on information and communications technologies and tools.

2.1 Conduct interviews

The Contractor shall:

- Coordinate with the Grantee to identify and communicate with interview targets to comprehensively assess and document the current status of the following issues, at a minimum:
  - National and Provincial policy priorities
  - Organizations involved with environmental emergency response and their relationship to the Department of Environmental Protection
  - Key environmental risks in the Province and current mitigation strategies
  - Existing technology systems, processes, procedures and related assets currently in place to monitor and manage environmental hazards
  - Future plans for information and technology systems related to environmental monitoring, assessment, analysis and emergency response
  - Major academic and research programs underway related to ICT and environmental management and emergency response, and
  - Other topics as may be required to develop a comprehensive understanding of the local situation for environmental emergency response.

Deliverable: The Contractor shall prepare a Situation Assessment report covering findings from its discovery activity in Shandong. The report shall be of no fewer than 25 written pages and/or 50 Powerpoint slides that comprehensively addresses each of the sub tasks identified above. The Situational Assessment report shall be substantively complete in all areas and provide an inventory and analysis of existing systems, procedures and technologies currently in use.

TASK 3: U.S. BEST PRACTICES

Provide an overview of U.S. best practices for environmental emergency response.

The Contractor shall:

- Summarize U.S. policies, frameworks, technical standards and principle operating practices for the management of environmental hazards in the U.S. at the federal, state and community levels.
- Perform a high level gap analysis of U.S. best practices and the current situation in Shandong province
- Identify areas for potential improvement and explain observations in text, numeric and graphic presentation formats.

Deliverable: The Contractor shall prepare a comprehensive summary of U.S. best practices for environmental emergency management describing all the work performed under this Task 3, including the institutions and responsibilities, policies, operational doctrines and leading technological solutions and standards for environmental monitoring and emergency management in the U.S.

TASK 4: TECHNICAL PLAN

The Contractor shall produce a comprehensive technical feasibility report defining requirements and detailed specifications for an integrated information system architecture for environmental safety and emergency response. The goal is to establish the feasibility of constructing a fully interconnected and interoperable safety early warning system and incident response capability serving the provincial, municipal and county levels. The Study will address the potential for a new information network to interconnect the provincial level network

central node with 17 counties (cities, districts) support nodes and enterprise-level environment safety monitoring terminals, including more than 1000 key pollution sources and sewage treatment plants over time.

Based on feedback and discussion with the Grantee following the Situation Assessment report, the Contractor shall:

- Review Grantee plans, proposals, technical specifications and other materials and information to assist the Contractor to gain an accurate understanding of the Grantee's specific technical requirements.
- Develop an overall system and technical concept and high level specifications for the Shandong environment safety management system capable of monitoring critical environmental quality, pollution status and trends in real-time. The specifications shall include at a minimum:
  - Emergency operating center(s), including but not limited to:
    - Decision support system
    - Risk diffusion modeling (hazard maps)
    - Incident simulation
    - Communications networking requirements
    - Emergency dispatch system
    - Call center
    - Video conference system
    - Emergency command vehicles data collection, transmission, query and operation
    - Network architecture diagram with supporting written analysis
  - Incident management and decision support system, including but not limited to:
    - Monitoring of cross-sectional surface water quality
    - Atmospheric environmental monitoring focusing on heavy metals and other toxic and hazardous substances
    - Automatic monitoring network for major trans-boundary rivers
    - Key pollution sources including up to 20 large industrial enterprises believed to be leading polluters
    - Urban sewage treatment plants.
  - Monitoring and early warning, including but not limited to:
    - Sensor alarm and monitoring
    - Communications with existing provincial environmental monitoring centers

- Emergency messaging
- Video surveillance
- Decision support system
- Emergency roster (to be integrated into 12369 hotline call center)
- Warning indicators management
- Warning level management
- Warning update and release
- Warning distribution.

o Emergency communications network, including but not limited to:

- Interconnection between emergency operating centers, data centers, back-up facilities, and enterprise networks
- Collection and transmission of sensor data
- Communications between EOCs and emergency personnel including emergency vehicles
- Mobile monitoring and other new technologies.

o Data center(s), including but not limited to:

- Physical size
- Functional architecture
- Server capacity
- Storage capacity
- Virtualization requirements
- Other technology options
- Power requirements.

o Geographic information system, including but not limited to:

- *Drainage Area Emergency Dispatch Management GIS Sub-System*
- *Sub-regional emergency dispatch GIS sub system*
- *Key industrial factories emergency dispatch GIS sub system*
- *Main roads emergency dispatch GIS sub system*
- *Drinking water source management GIS sub*
- *Radiation source management GIS sub system*

o Emergency response database(s), including but not limited to:

- Propose a strategic approach to planning and managing database functionality focused on environmental quality monitoring and pollution, especially heavy metals and hazardous chemicals information.
- Recommend technology approaches appropriate for the designing and procuring databases.

Deliverable: The Contractor shall prepare a comprehensive Technical Feasibility Report covering each of the sub tasks above. The Report shall be of sufficient scope and depth to enable the Grantee to make informed design and procurement decisions.

Task 5: Financial Analysis

Make an analysis of funding requirements for the proposed environmental emergency management system.

The Contractor shall:

- Prepare a comprehensive cost model of capital expenses based on the solutions proposed and on inputs provided by the Grantee.
- Estimate cost of ownership and maintenance and related operating expenses over a five year period with inputs provided by the Grantee.
- Assist with the preparation of Grantee budget for the procurement of equipment and services.
- Identify opportunities for the solutions to be self-funding over time.
- Identify areas for potential public-private cooperation and investment.

Deliverables: Financial report and Excel forecast model. The Contractor shall prepare a Financial report and Excel forecast model estimating costs of implementing the Project, in accordance with the requirements under this task and including expansion of the system to include new users and applications for a period of five years. The analysis shall determine if the Grantee's own allocated financial resources are sufficient to cover project costs through full implementation and operation.

Task 6: Implementation Roadmap

Develop an implementation roadmap for the environmental emergency management system. The Contractor shall address business planning issues, contingencies, project risks and mitigation strategies, sequencing of tasks and investments and related planning considerations.

- Prepare detailed project management plan and schedule in Gantt Chart format in close association with the Grantee
- Identify metrics to measure success for the remaining stage of the project planning period, for the procurement phase, and for assessing project success over time
- With Grantee approval, notify U.S. companies of timetable for procurement.
- Considerations associated with installation, improvement, and establishment of essential hardware and software elements of the system
- Operation and maintenance plan for ensuring overall system sustainability
- Identify metrics to measure success for the remaining stage of the project planning period, for the procurement phase, and for assessing project success over time

Deliverables: In accordance with all the requirements under this task, the Contractor shall prepare an Implementation Plan recommending actions best suited to assure successful implementation of the Project. In addition to the items listed in the task above, the Implementation Plan shall include an Action Plan containing specific steps for each major implementation component and specifying for each step the priority, roles and responsibilities of each party, schedule, budget and staffing requirements.

TASK 7: IMPACT ANALYSIS AND U.S. EXPORT POTENTIAL

The Contractor shall conduct a preliminary review of the Project's anticipated economic, environmental, developmental, and trade impacts.

7.1 Development Impact Analysis

The Contractor shall provide a report on the developmental impacts of the Project in Shandong. While specific attention should be paid to the immediate impact of the Project, the Contractor shall include, where appropriate, any additional developmental benefits of the Project, including spin-off and demonstration effects. The analysis of potential benefits of the Study should be as concrete and detailed as possible. The Contractor shall provide estimates of the Project's potential benefits in the following areas:

- Infrastructure: A statement on the infrastructure impact, giving a brief synopsis.
- Market-Oriented Reform: A description of any regulations, laws, or institutional changes that are recommended and the effect they would have if implemented.
- Human Capacity Building: A description of the number and type of positions that would be needed to construct and operate the Project. The Contractor shall also describe the job alternatives needed for the job classes that may be reduced as well as retraining needs for staff.
- Technology Transfer and Productivity Enhancement: A description of any advanced technologies that will be implemented as a result of the Project. A description of any efficiency that will be gained (e.g. productivity gains, savings in transmission costs or lower production costs).
- Other: any other developmental benefits to the Project, including spin-off or demonstration effects.

7.2 Economic impacts

The Contractor shall explore and briefly report on any positive economic impacts that may be produced from the Project. The Contractor should seek to identify and quantify the economic benefits resulting from the program. The assessment should be made to the best of Contractor's internal abilities utilizing existing subject matter expertise. An exhaustive econometric forecast and analysis is not required.

7.3 Environmental & Other impacts

The Contractor shall prepare a preliminary environmental impact assessment.

The Contractor shall:

- Make a preliminary review of the Project's anticipated impact on the environment with reference to local requirements.
- Identify potential negative impacts, discuss the extent to which they can be mitigated, and develop plans for a full environmental impact assessment if and when the Project moves forward to the implementation stage.
- Identify steps that will need to be undertaken by the Project sponsor subsequent to the Study's completion and prior to Project implementation.
- Identify the impact of equipment use and future replacement, the use of sustainable sources of energy and the use of appropriate technologies and equipment for the particular environment.

7.4 U.S. Export Potential

The Contractor shall:

- Identify possible U.S. sources of supply including business name, point of contact for the party responsible for China sales, address, telephone, e-mail, and fax numbers for each source.

Deliverables: The Contractor shall prepare an Assessment of economic, environmental and developmental impacts in accordance with all requirements under this task, as well as a summary matrix of U.S. sources of supply and contact information.

Task 8: Final workshop

The Contractor shall present project findings to the Grantee in a one-day Final Workshop. The Workshop will be conducted at the Grantee's facilities and the Grantee will be responsible for selecting local attendees and covering Workshop costs (tea service, meals, etc.). Both parties shall provide and pay for their respective interpreters if required.

Deliverable: The Contractor shall deliver a final workshop in Jinan, Shandong for up to 50 participants to be held at the Grantee's facility in accordance with the requirements under this task.

Task 9: Final Report

The Contractor shall prepare and deliver to the Grantee and USTDA a substantive and comprehensive final report of all work performed under these Terms of Reference ("Final Report"). The Final Report shall be organized according to the above tasks, and shall include all deliverables and documents that have been provided to the Grantee. The Final Report shall be prepared in accordance with Clause I of Annex II of the Grant Agreement.

The Contractor will integrate the comments and feedback from the workshop into the final report and also include lessons learned from the workshop.

Additionally, the Contractor must provide five (5) hard copies of the Final Report to the Grantee. For the Grantee copies, all deliverables under Tasks 1 through 8 shall be translated into Chinese. Internal working memos and documents meant solely for group discussions and planning purposes shall not be translated into Chinese.

Each of the above tasks in this Terms of Reference must be distinctly set forth in the Final Report in a substantive and comprehensive manner, and shall include all corresponding deliverables, including any training materials provided to the Grantee. The Final Report, while aiming at optimum specifications and characteristics for the Project, shall also identify prospective U.S. sources of supply, including business name, point of contact, address, telephone, e-mail, and fax numbers for each source. The Final Report shall contain an executive summary and cover each of the itemized paragraphs described herein.

9.4 Works Cited

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9.5 Final Report Meeting - June 2013

Agenda

1. Purpose of meeting
2. Attendees
3. Project result
4. Final Report
5. Project Intro
6. Situation analysis
7. Best Practice
8. Technical Plan
9. Financial Analysis
10. Implementation Roadmap
11. Impact Analysis
12. Q&A
13. Follow- up
14. Conclusion

Attendees:

USTDA : Xiaolei Wan

SDEPA : Mr. Wang Wei, Mr.Yuan Chenjing

Intergraph: Yuan Hui, Li Bin; Xiang Zhengliang

Time: 2 :30 am – 5 :30 am, June 3rd, 2013 ;

Place: Jinan Shandong EPA Headquarters;

Purpose: Report meeting on the project - Shandong EPA - Intergraph: TDA Shandong Environmental Emergency Response System Feasibility Study (SEERS-FS)

The following are the slides for the presentation - final report meeting:

Meeting Jinan, China June 3, 2013

FEASIBILITY STUDY FOR THE SHANDONG ENVIRONMENTAL EMERGENCY RESPONSE SYSTEM PROJECT - SHANDONG EPA

山东环境应急响应系统可行性研究

FINAL REPORT

Project Final Meeting
June 2013
2013年六月

Purpose of the Meeting

Feasibility Study for the Shandong Environmental Emergency Response System Project - Shandong EPA

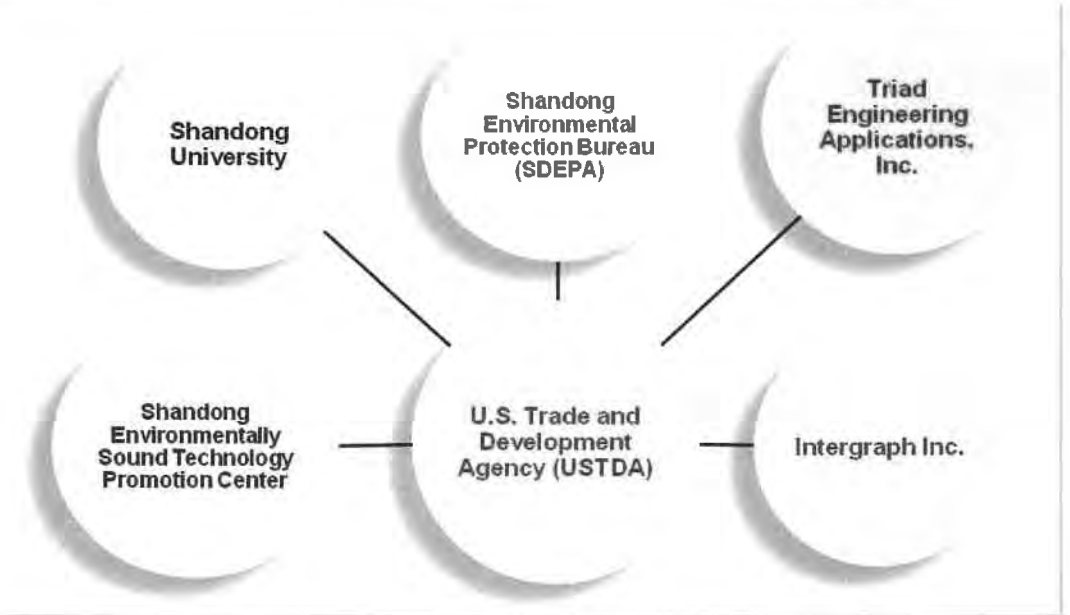
- ❑To deliver the final report – project
- ❑Demo EMS^2 (H2O)
- ❑To close the project

Agenda 议程

Final Report– Meeting: Agenda

Content	Sub-content	Schedule
Introduction	1.1 Purpose of meeting 1.2 Attendees 1.3 Triad 1.4 SDEPA-Emergency Department	2:00 pm–2:10pm
Final report	2.1 Project Intro	2:10pm–2:15pm
	2.2 Situation Analysis	2:15pm–2: 30pm
	2.3 Best Practice	2:30pm–2:40pm
	2.4 Technical Plan	2:40pm–3:00pm
	Break	3:00pm–3:10pm
	2.5 Financial Analysis	3:10pm–3:20pm
	2.6 Implementation Roadmap	3:20pm–3:30pm
	2.7 Impact Analysis	3:30pm–3:40pm
Demo	3.0 Demo– EMS^2	3:40pm–4:05pm
Q&A	4.0	4:05pm–4:20pm
Conclusion	5.0	4:20pm–4:40pm

Project Stakeholders and Partners



Project Introduction – Goals and Objectives

Project: Objectives and Goals

- **Goal:** to better protect the Shandong environment and populace by reducing the threat from environmental pollutants, accidents, and disasters
- **Objective:** to create a real-time environmental emergency response and management system

Feasibility Study: Goals and Objectives

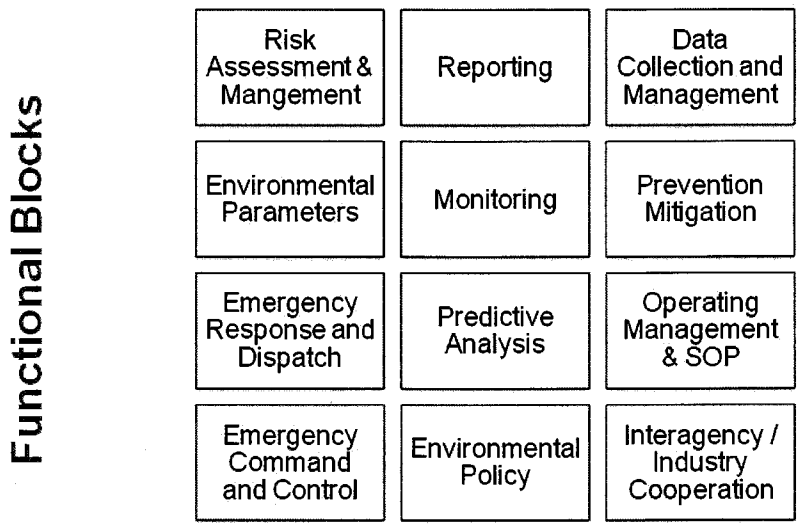
- **Goal:** to provide recommendations for the best approach forward for the project
- **Objective:** to assess and evaluate the feasibility of creating the following:
  - Real-time environmental safety and emergency management monitoring and detection network and system
  - Emergency early warning network and system for environmental safety
  - Emergency command and control center

Project Introduction – Seeks to Develop New System

The Shandong EPA seeks to develop:

- A real-time environmental emergency response and management system —
  - State-of-the-art communication network
  - Rapidly identify environment threats
  - Comprehensive decision support capabilities
  - Emergency environmental response and management

Project – Functional Blocks



Project Tasks - Final Report

Tasks

Task 1: Project Kick Off	Task 2: Situational Analysis	Task 3: Best Practices
Task 4: Technical Plan	Task 5: Financial Analysis	Task 6: Implementation Roadmap
Task 7: Impact Analysis and US Export Potential	Task 8: Final Workshop	Task 9: Final Report

Project Schedule

Schedule

Task	Completion Date
Project Kick-off	March 23, 2012
Deliverable: Kick-off Report	August 10, 2012
Deliverable: Situation Analysis Report	October 10,, 2012
Deliverable: US Best Practices Summary - Environmental Emergency Mgt.	October 8,, 2012
Deliverable: Technical Plan	October 25 , 2012
Deliverable: Financial Analysis and Forecast Model	November 25, 2012
Deliverable: Implementation Roadmap	November 25, 2012
Deliverable: Impact analysis and US Export Potential	November 25, 2012
Final Report Meeting	June 3, 2013
Deliverable: Final Report	June 10, 2013

Situation Analysis - SDEPA

- The Shandong Environmental Protection Agency - (SDEPA)
  - headquartered in Jinan, China
  - is responsible for the environmental protection of the province of Shandong China
- Environment - Shandong

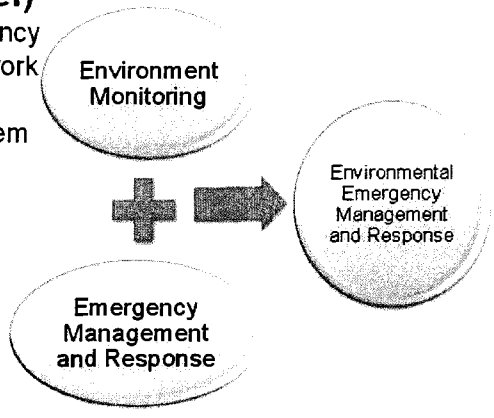
Situation Analysis – SDEPA Organization

Emergency Management Department	Environmental Protection Scientific Research and Design Institute of Shandong Province	Environmental Monitoring Central Station of Shandong Province	Green Schools and Training Centers in Shandong Province
Shandong Provincial Environmental Protection Information Center	Environmental Information and Monitoring Center in Shandong Province	Shandong Province Environmental Monitoring Corps	Hazardous Waste Management Center in Shandong Province
	Shandong Province Radiation Environment Management Station	Service Center of Shandong Province Department of Environmental Protection Authorities	

Situation Analysis – System Requirements
– High Level

System Requirements (High Level)

- ❑ Real-time environmental safety and emergency management monitoring and detection network and system
- ❑ Emergency early warning network and system for environmental safety
- ❑ Emergency command and control center
- ❑ Data management system (centralized)
- ❑ Command and control
- ❑ Problem / resolution matrix
- ❑ Decision support system needed
- ❑ Best practices identified
- ❑ Standard Operating Procedures- SOP

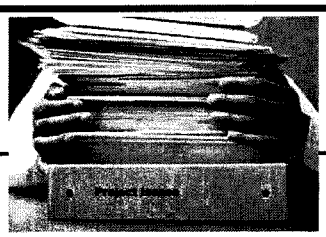


Situation Analysis

Project Status and Focus

- The project is in the early initiate phase.
- Major focus would be on environmental incident prevention and risk mgt
- Requires a predictive analysis element and decision support capability
- Requires a standard platform - centralize system data mgt system
- Risk assessment/ management effort to identify highest risk projects/companies

Situation Analysis



Projects Issues

- National monitoring standards are used to monitor air and water
- Project is environment management not just environmental emergency response.
- Emphasis is on the pre-alarm prevention aspect and risk management.
- Need to understand the process flow and possible scenarios.
- Stakeholders - internal departments within SDEAP, EOC China, city and county authorities, MEP
- Need standard procedures across departments
- Stakeholders - education about the environment - with policy
- Narrow down high risk of consequence
- Need to develop risk of consequence - risk management strategy

Situation Analysis

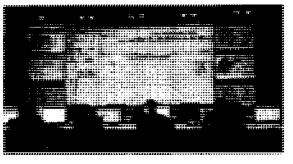
SDEPA: Environmental Safety and Emergency Management Division - (Emergency Department)

- The project is under the SDEPA - Environmental Safety and Emergency Management Division headed by Yuan Cheng Jin - Director
- SDEPA - Emergency Department has four groups
  - Inspection
  - Monitor
  - Response
  - Remediation
- The Emergency Department receives information from other departments - the monitoring, air, water, and hazardous waste departments
- The Emergency Department is currently collecting company/industry information and data to support the future project
- The Emergency Department will forward reports to various other departments within SDEPA such as air, water, and hazardous waste departments
- Last several years the emergency department team worked on major environmental emergencies in other provinces

Situation Analysis

Monitoring Center

- Data and Tasks
- Monitoring
  - Air - every minute
  - Water - every 2 hours; need to increase the frequency
  - Real-time points
  - Air - 144
  - Water - 59
  - Company 1000
  - Drink water 24
- Mobile - yes capability; 2 vans; small labs; 1 boat

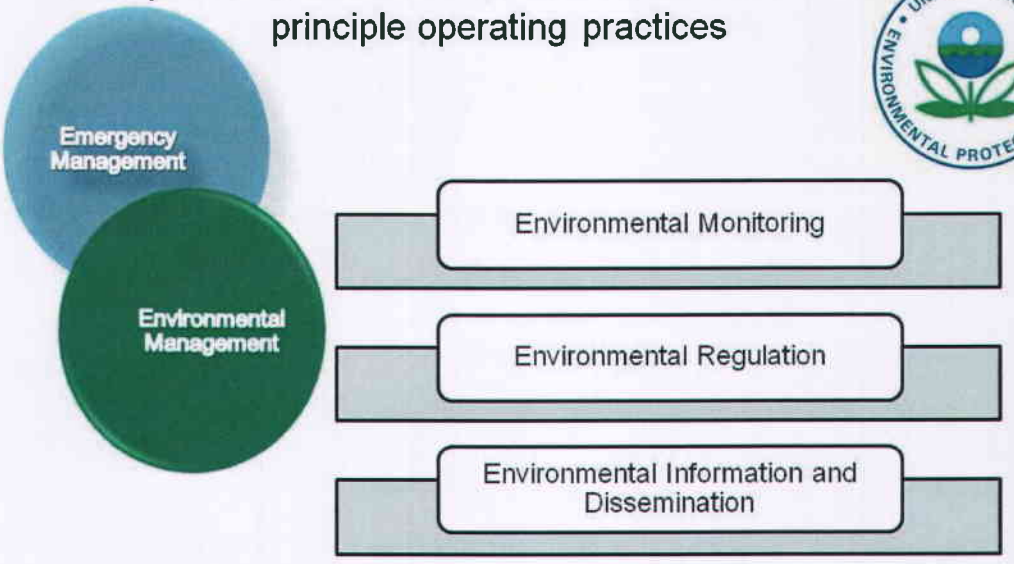


Monitoring Center -Future Needs

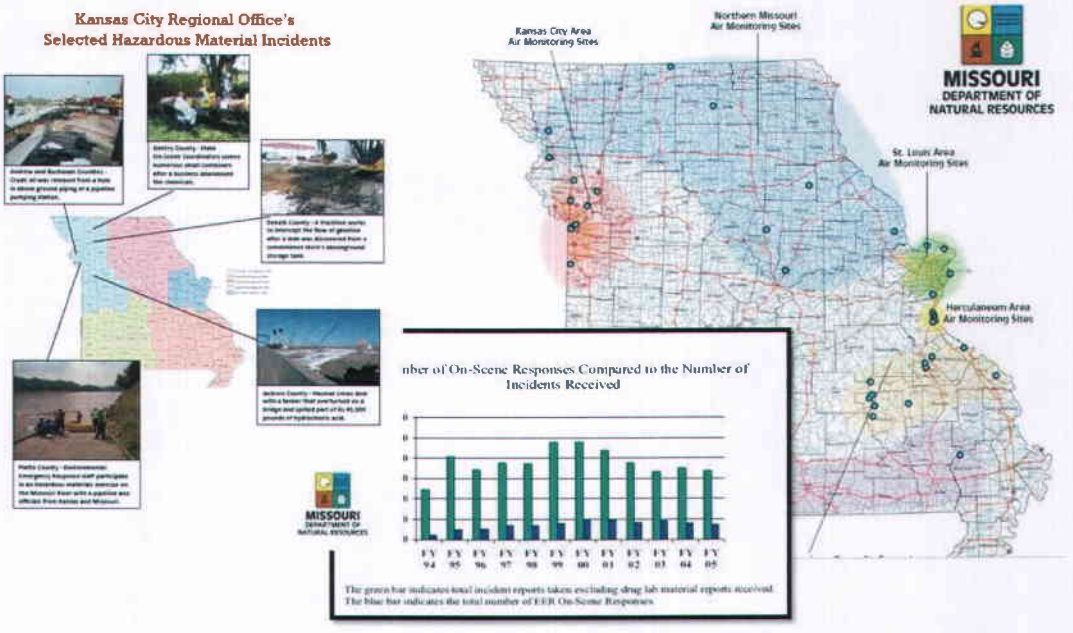
- Increase automated systems; add stations
- Facilities – addition and personnel - add resources
- Laboratory for heavy metals
- Need to increase capability to remotely adjust monitoring parameters
- Increase points in county and villages - rural areas
- Add more video and more data in real-time capabilities
- Need to boost their water quality capabilities

BEST PRACTICE

U.S. policies, frameworks, technical standards an
principle operating practices



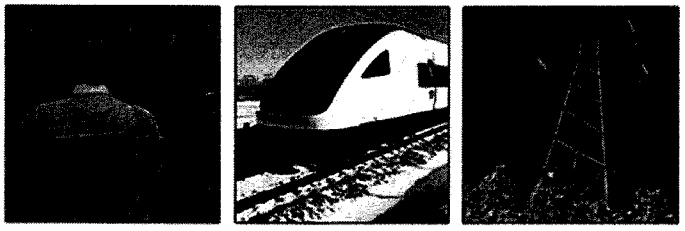
Best Practice – US State Agency



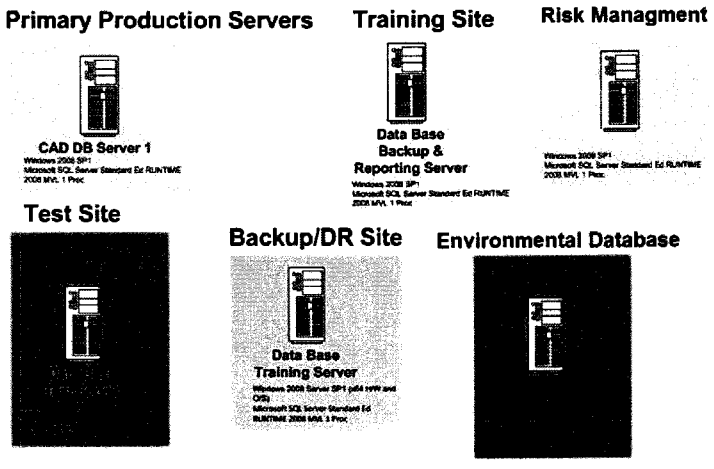
Technical Plan

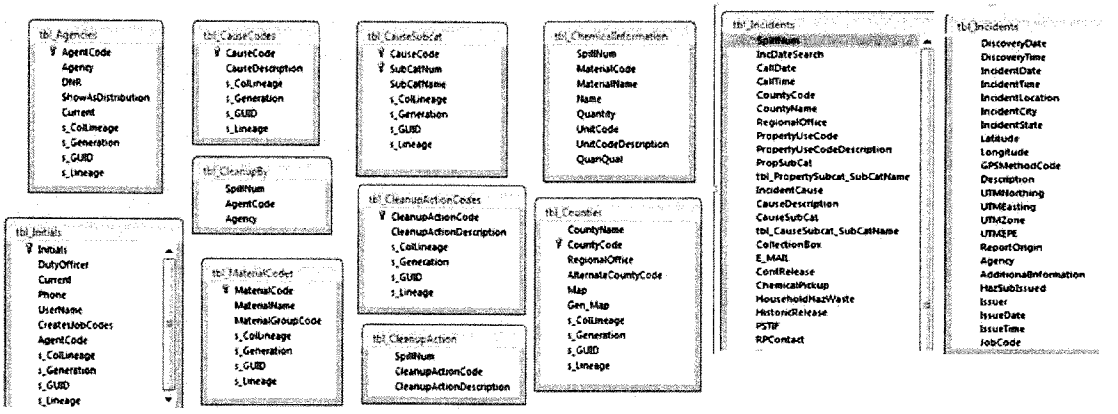
TECHNICAL PLAN

INTERGRAPH

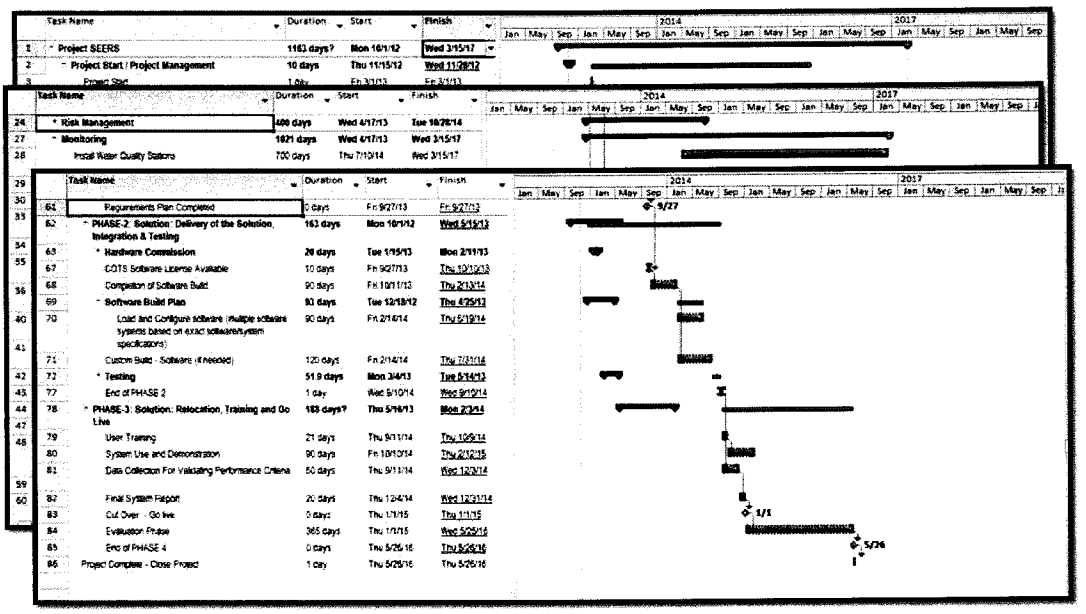


Security, Government & Infrastructure


Primary Production Servers
CAD DB Server 1
Training Site
Data Base
Backup &
Reporting Server
Risk Managment
Test Site
Backup/DR Site
Data Base
Training Server
Environmental Database


tbl_Agencies
AgentCode
Agency
DNR
ShowAsDistribution
Current
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_CauseCodes
CauseCode
CauseDescription
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_CauseSubCat
CauseCode
SubCatNum
SubCatName
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_ChemicalInformation
SpillNum
MaterialCode
MaterialName
Name
Quantity
UnitCode
UnitCodeDescription
QuanQual
tbl_Incidents
SpillNum
IncDateSearch
CallDate
CallTime
CountyCode
CountyName
RegionalOffice
PropertyUseCode
PropertyUseCodeDescription
PropSubCat
tbl_PropertySubcat_SubCatName
IncidentCause
CauseDescription
CauseSubCat
tbl_CauseSubcat_SubCatName
CollectionBox
E_MAIL
ContRelease
ChemicalPickup
HouseholdHazWaste
HistoricRelease
PSTIF
RPContact
tbl_Incidents
DiscoveryDate
DiscoveryTime
IncidentDate
IncidentTime
IncidentLocation
IncidentCity
IncidentState
Latitude
Longitude
GPSMethodCode
Description
UTMNorthing
UTMEasting
UTMZone
UTMEPE
ReportOrigin
Agency
AdditionalInformation
HazSubIssued
Issuer
IssueDate
IssueTime
JobCode
tbl_Initials
Initials
DutyOfficer
Current
Phone
UserName
CreatesJobCodes
AgentCode
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_CleanupBy
SpillNum
AgentCode
Agency
tbl_MaterialCodes
MaterialCode
MaterialName
MaterialGroupCode
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_CleanupActionCodes
CleanupActionCode
CleanupActionDescription
s_ColLineage
s_Generation
s_GUID
s_Lineage
tbl_CleanupAction
SpillNum
CleanupActionCode
CleanupActionDescription
tbl_Counties
CountyName
CountyCode
RegionalOffice
AlternateCountyCode
Map
Gen_Map
s_ColLineage
s_Generation
s_GUID
s_Lineage

Implementation Roadmap - Schedule



	Task Name	Duration	Start	Finish
1	Project SEERS	1163 days?	Mon 10/1/12	Wed 3/15/17
2	Project Start / Project Management	10 days	Thu 11/15/12	Wed 11/28/12
3	Project Start	1 day	Fri 3/1/13	Fri 3/1/13
24	Risk Management	400 days	Wed 4/17/13	Tue 10/28/14
27	Monitoring	1021 days	Wed 4/17/13	Wed 3/15/17
28	Install Water Quality Stations	700 days	Thu 7/10/14	Wed 3/15/17
29				
30				
62	Requirements Plan Completed	0 days	Fri 9/27/13	Fri 9/27/13
63	PHASE-2: Solution: Delivery of the Solution, Integration & Testing	163 days	Mon 10/1/12	Wed 5/15/13
34				
65	Hardware Commission	20 days	Tue 1/15/13	Mon 2/11/13
67	COTS Software License Available	10 days	Fri 9/27/13	Thu 10/10/13
68	Completion of Software Build	90 days	Fri 10/11/13	Thu 2/13/14
69	Software Build Plan	93 days	Tue 12/18/12	Thu 4/25/13
40	70 Load and Configure software (Multiple software systems based on exact software/system specifications)	90 days	Fri 2/14/14	Thu 6/19/14
41				
71	Custom Build - Software (if needed)	120 days	Fri 2/14/14	Thu 7/31/14
42	72 Testing	51.9 days	Mon 3/4/13	Tue 5/14/13
43	77 End of PHASE 2	1 day	Wed 5/10/14	Wed 9/10/14
44	78 PHASE-3: Solution: Relocation, Training and Go Live	183 days?	Thu 5/16/13	Mon 2/3/14
47				
48	79 User Training	21 days	Thu 9/11/14	Thu 10/9/14
	80 System Use and Demonstration	90 days	Fri 10/10/14	Thu 2/12/15
	81 Data Collection For Validating Performance Criteria	60 days	Thu 9/11/14	Wed 12/3/14
59				
60	82 Final System Report	20 days	Thu 12/4/14	Wed 12/31/14
	83 Cut Over - Go live	0 days	Thu 1/1/15	Thu 1/1/15
	84 Evaluation Phase	365 days	Thu 1/1/15	Wed 5/25/16
	85 End of PHASE 4	0 days	Thu 5/26/16	Thu 5/26/16
	86 Project Complete - Close Project	1 day	Thu 5/26/16	Thu 5/26/16

Impact Analysis

Category	Developmental Impact
Infrastructure	Protect and manage the environment of Shandong and its emergency responding capacity. Could be rolled out nationwide to help protect vital environmental infrastructure across China.
Market-Oriented Reform	Externally, the SEERS Project would assist in helping other US firms to partner related projects in the future. For both sides and internationally, the project would help further cooperation, global partnership building between Chinese semiprivate agencies and global companies.
Human Capacity Building	The project would provide hundreds of jobs both domestically and internationally in the build out of the full scale project over five years. Applying the solution nationwide, would produce a much greater affect employing thousands over the next 5 to 10 years.
Technology Transfer and Productivity Improvement	The project would provide collaboration between the private companies and SDEPA giving both parties valuable insight to each other's respective industries and capabilities.
Future Market Opportunity	This project could be replicated across China to other environmental protection systems and represents enormous opportunity.
Quality of Life	Improve quality of life by more effective environmental management

FEASIBILITY STUDY FOR THE SHANDONG ENVIRONMENTAL EMERGENCY RESPONSE SYSTEM PROJECT - SHANDONG EPA
山东环境应急响应系统可行性研究

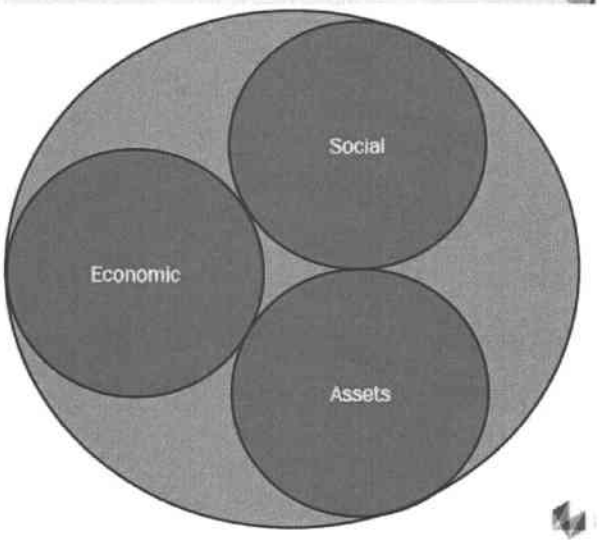
EMS² - ENVIRONMENTAL MANAGEMENT SYSTEM DEMO

Meeting: Final Report

June 2013

Demo: EMS^2 - Environmental Management System (H2O Framework)

Managing & Reducing Risk



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Demo: EMS² - Environmental Management System (H2O Framework)

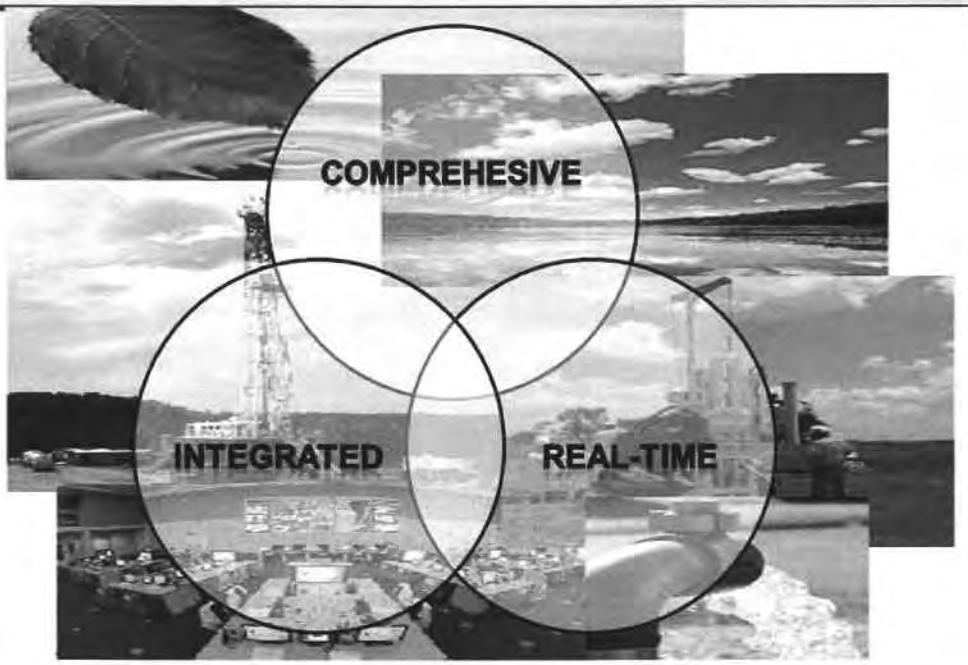
H²O Solution Value

- Comprehensive
- Integrated
- Real-Time

- Smarter Engineering Results in Safer Construction
- Real-Time Monitoring Improves Operational Decision Making
- Integrated Data & Documents Streamline Asset Inspections & Maintenance
- Integrated Sensor and CC-TV Networks with GIS Ensure Security
- Real-Time Monitoring & Integrated Sensor Networks provide Early Warning
- Comprehensive and Integrated Systems Result in Effective Response

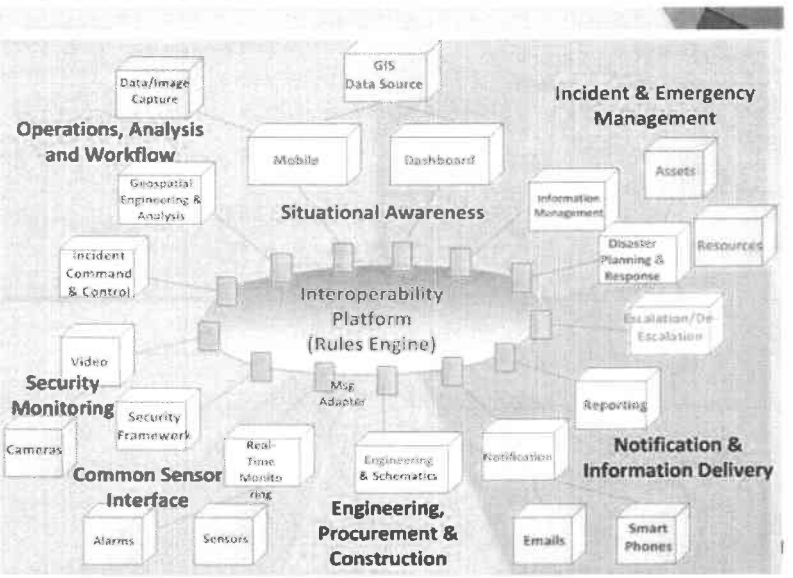
The key to H²O Solution is that it ties all this complex technology and information all together through the **Interoperability Platform**, help clients visualize this complex information using the **Dashboard & Mobile** applications in a very intuitive and effective way that is role based, and helps guide each user step by step through the actions they need to do based on their role especially during Emergency situations – **Actionable Intelligence**"

EMS 2 – H2O Framework



Environmental Emergency Management and Response System

H^2O Solution Value



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Demo: EMS² - Environmental Management System (H2O Framework)

H²O Solution Modules

- **H²O Real-Time Monitoring**
  - Structural Real-Time Monitoring of Dam/Water Infrastructure, Real-Time Monitoring of Landslides near Dam/Water Infrastructure reservoir

Large earth fill and concrete dams are a critical infrastructure for continuous water supply and power generation. Loading and unloading forces on a dam cause stress on the structure and must be monitored. The stress can be due to fluctuations in the water level, settlement of the structure, nearby landslides or seismic activity. Early detection of a potential problem allows repairs or remedial measures to be taken before a disaster occurs. Even if repair is not possible, with the early warning of a problem action may be taken to mitigate its effects.

- ✓ Topping instruments
- ✓ High Accuracy
- ✓ Monitoring with total stations, GNSS, tilt sensors, meteorology sensors and more
- ✓ Stable platform for continual monitoring
- ✓ Remote control multiple sensors, unmanned operation
- ✓ Display of status information and online charts, limit checks and messaging in real time
- ✓ Connection and control of geodetic and geotechnical sensors
- ✓ Support multiple communication modes
- ✓ Customizable with flexible options and open SQL database
- ✓ Highly customizable, additional functionality can easily be added later

Demo: EMS^2 - Environmental Management System (H2O Framework)

H^{2}O Solution Modules

- **H^{2}O Information Management**

Demo: EMS² - Environmental Management System (H2O Framework)

H²O Solution Modules

- **H²O Dashboard**
  - Real-Time Monitoring, Sensor Measurement & History, Safety Appraisal Inspection Results, Alarms, Events, Video Analysis, Task management, 2D/3D Geospatial Views, Immediate Link to Standard Operating Procedures & Emergency Action Plans, System Administration

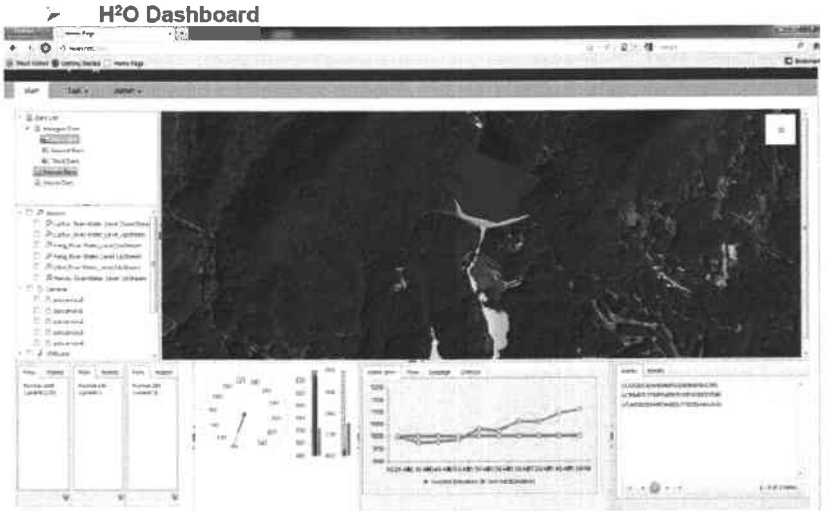
The H²O Dashboard displays data in various formats such as raw data, analyzed data and also data on 2D and 3D geospatial displays. Main features of the H²O Dashboard are:

- ✓ 2D/3D Geospatial map, including 3D Models of Water Infrastructure
- ✓ System status and system messages
- ✓ Latest Sensor readings and status
- ✓ Real-Time system alarms
- ✓ Physical Resource status and their geographic location
- ✓ Video camera vision, and control of such cameras that have the capability
- ✓ Task management and execution
- ✓ Document management such as Standard Operating Procedures (SOP), Emergency Action Plans (EAP), Engineering drawings, manuals etc
- ✓ Review Inspection results

Demo: EMS^2 - Environmental Management System (H2O Framework)

H^{2}O Solution Modules

- H^{2}O Dashboard



Environmental Emergency Management and Response System

Secure & Monitor

Environmental Emergency Management and Response System

H^2O Solution Modules

- **H^2O Security Framework**
  - **Infrastructure & People Safety & Security, 24x7 Video Surveillance and Alarm Monitoring**

A safety and protection control room has alarms that are mostly triggered by sensors (perimeter control sensors, radar, intelligent CC-TV cameras, production-flow monitoring systems, etc.). The operator must be able to control the detection sensors (usually PTZ cameras) from a single, integrated environment and dispatch the response staff. The cartographic interface of the situational picture requires all the functions of an advanced GIS application and must be able to quickly detect alarms, estimate positions of intruders or incidents (triggered by sensors), and locate positions of the response teams (equipped with GPS, AVL terminals, etc.). A GIS application with these features is defined as a common operational picture

- ✓ Integrating data from a variety of systems and sensors
- ✓ Fusing that data into a common operating picture
- ✓ Combines elements of sensor monitoring, alarm processing, video analysis, and object tracking
- ✓ Processes alarms, automatically creating CAD Events and reporting them to Intergraph's I/Dispatcher software
- ✓ Defines the location, event type, and contact information related to the alarm that occurred
- ✓ Includes the alarm, access control, and target interfaces for communication with external sensor system
- ✓ Monitoring and interacting with moving objects via interfaces with sensors such as radar, RFID, intelligent video, or others sensors capable of detecting and reporting the location of moving objects of interest
- ✓ User interface for displaying and controlling live and recorded video through a variety of video management systems

Environmental Emergency Management and Response System

H²O Solution Modules

- **H²O Security Framework**

Demo: EMS² - Environmental Management System (H2O Framework)

H²O Solution Modules Related 3rd Party Products

- **H²O Notification - MIR3 Intelligent Notification System**

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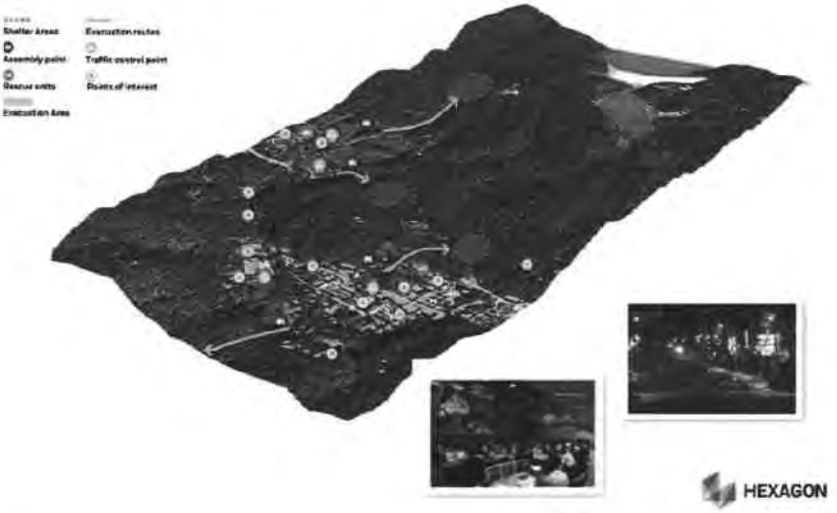
Demo: EMS² - Environmental Management System (H2O Framework)

Prepare & Respond



HEXAGON

June 2013

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Demo: EMS² - Environmental Management System (H2O Framework)

H²O Solution Modules

- **H²O Emergency Operations Center**
  - **Situation Assessment (GIS Map), Investigation & Monitoring, Planning, Decision / Evaluation, Issuing of Orders, Disaster Response, Asset Management, Organization Management, Multi-Agency Coordination, Standard Operating Procedures and Checklists, News and Messages Summary**

The H²O Disaster Planning & Response product is a configurable, modular solution to effectively support operational command, based on established practice and protocols.

- *Portal*
  - ✓ Central home page, Main navigation for workflows / processes, Key application / component launch and, Overview of the most important tasks, information and operations, Full text search, Information ticker
- *Command*
  - ✓ Document Flow, Organization charts, Timeline, News summary, *Reports*, Reporting for situation reports, press releases, mission report (operation diary), Continuous audit logging of all information, facts, actions, etc.
- *Map*
  - ✓ Geographic Information System / Maps module, Definition and management of attribute data and geospatial information, Interface for online tracking, Library of tactical symbols in accordance with the organization-specific, applied regulations
- *Resources*
  - ✓ Management of materials and personnel, Shift planning, Management of action units / forces and their availability
- *Interfaces*
  - ✓ Interfaces to third-party command and control systems, communication systems and other applications
- *Scenarios*
  - ✓ Activity sequences to simulate particular operational situations for training purposes

Demo: EMS² - Environmental Management System (H2O Framework)

Environmental Management and Emergency Response System

Demonstration using EMS² (powered by H2O)

Scenario

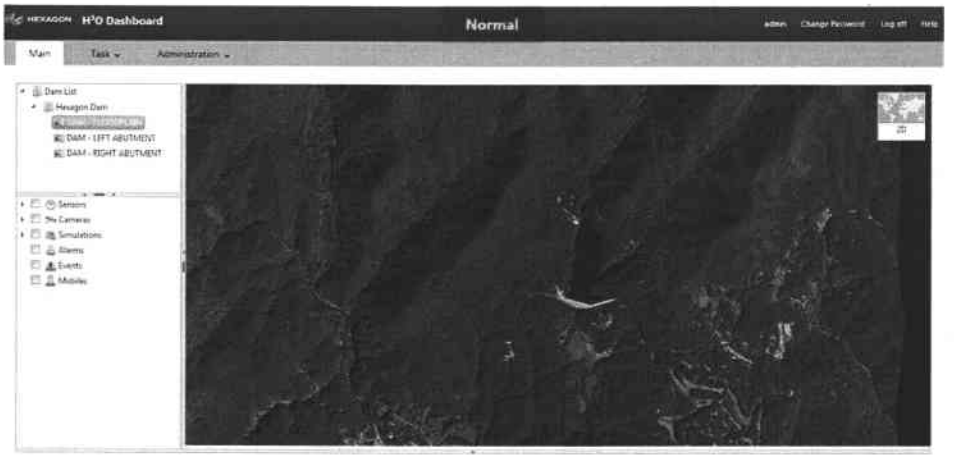
- **Environmental Event** - Possible flooding event in industrial chemical area
- **Chemical Plant** is located in the possible flood zone
- **Environmental Risk** - If flooding occurs at the plant, there is potential for hazardous chemicals to be released into river / reservoir which serves as drinking water supply for New Town
- **System EMS²** operator is alerted by system to take action to minimize and mitigate the possible environmental threat

Demo: EMS^2 - Environmental Management System (H2O Framework)

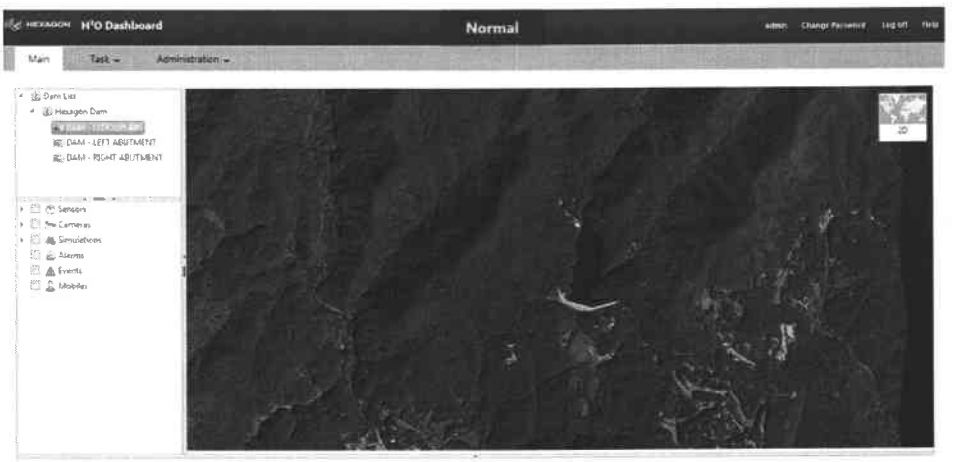
Flood Events

Environmental Incidents and Risks

Demo: EMS^2 - Environmental Management System (H2O Framework)



Demo: EMS^2 - Environmental Management System (H2O Framework)



Demo: EMS² - Environmental Management System (H2O Framework)

Scene ID	Situation	EMS2 - H2O User/Operator
01	Massive rain event in the area triggering possible flooding event at the Hexagon Lake area location	An alarm alerts the EMS2 operator of a high water possible flooding event at the Hexagon Lake area location. Operator visually identifies alarm.
02	Operator follows Environmental- SOP for flooding in Hexagon Lake area. The SOP indicates that there is a chemical plant near the lake/reservoir area. The plant is due to be decommissioned and its hazardous chemicals contained in tanks within the plant disposed of next year. The plant area is identified in the risk assessment as a high risk entity. Flooding is identified as an environmental threat to the plant and could cause substantial environmental damage. The plant is identified as a high risk- high consequence environmental entity/target. If a flooding event occurs, the hazardous chemicals could enter the reservoir and threaten the local area's drinking water supply.	Operator turns on the simulated 10 year flood which indicates that the plant is in the possible flood zone. The operator turns on the upstream sensor and drags it into the sensor box to identify the latest water level readings and historical averages via of a visual graph. The graph indicates that the water level is rising fast. The operator turns on the local video camera and views the plant from across the lake. The operator changes the status from normal to warning and a message is sent to the local environmental (EPB) authorities, local emergency management authorities, and the plant operators.
03	Notification is received at the plant location indicating a possible flooding event. The SOP evacuation procedures are followed. It calls evacuation and immediate removal of hazardous materials in the lower levels and securing of the higher tanks to prevent damage during the flood and possible leakage.	The operator contacts the plant and turns on possible evacuation routes on the dashboard and informs the plant manager.
04	The local operator is dispatched to the plant scene to use a mobile device to record the evacuation.	The operator at the center monitors the situation via video and local user updates.
05	Plant is evacuated and secured. Environmental incident is averted; no environmental damage due to flooding at the plant.	

Demo: EMS² - Environmental Management System (H2O Framework)

Flood Events

Environmental Event

Demo: EMS² - Environmental Management System (H2O Framework)

Scenario – Environmental Event / Flooding Event

- **Environmental Event** - Possible flooding event in industrial chemical area
- **Chemical Plant** is located in the possible flood zone
- **Environmental Risk** - If flooding occurs at the plant, there is potential for hazardous chemicals to be released into river / reservoir which serves as drinking water supply for New Town
- **Solution** - EMS² environmental management
- **System EMS²** operator is alerted by system to take action to minimize and mitigate the possible environmental threat

Environmental Management and Emergency Response System
Demonstration using EMS²
(powered by H2O)

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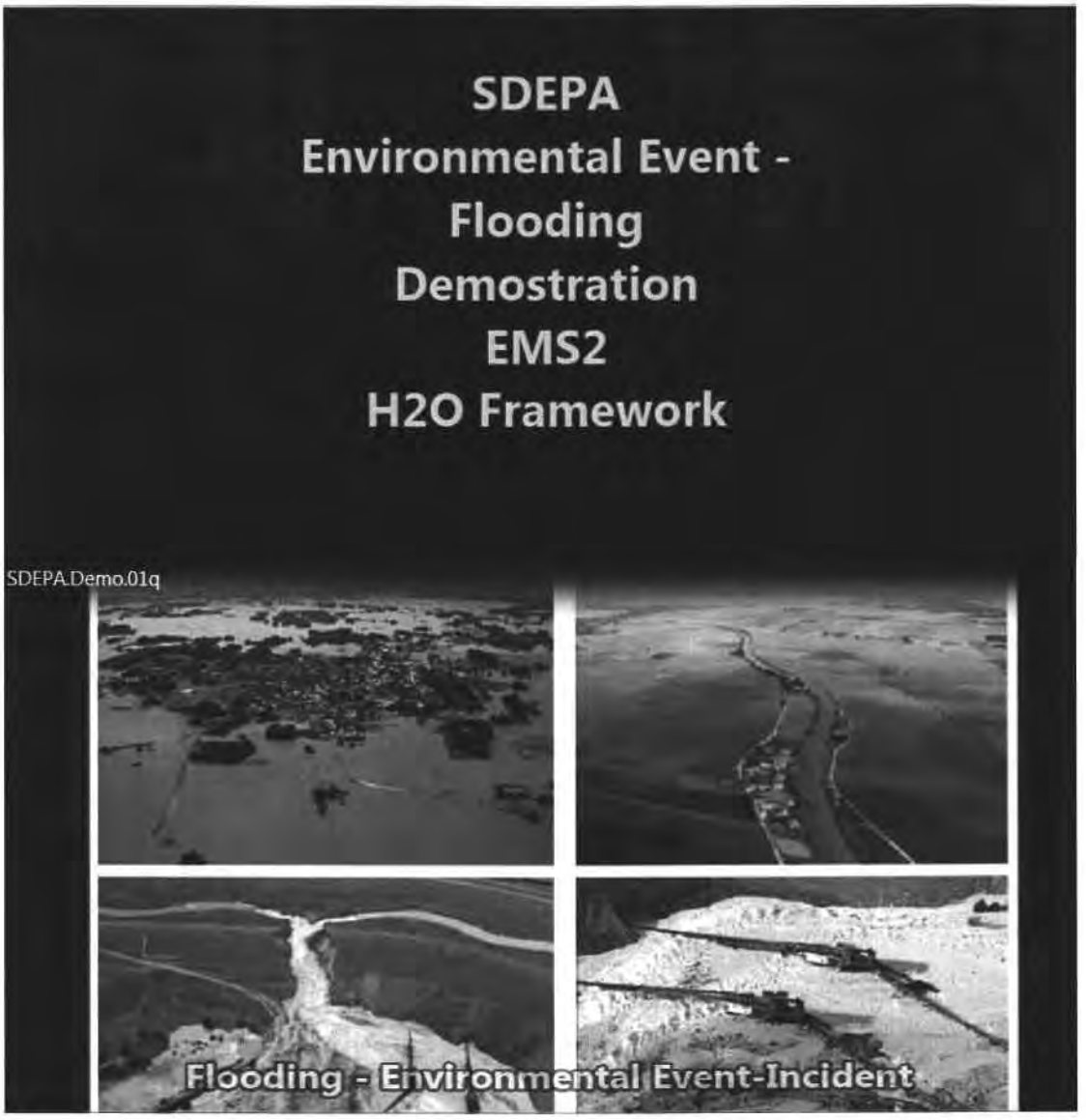
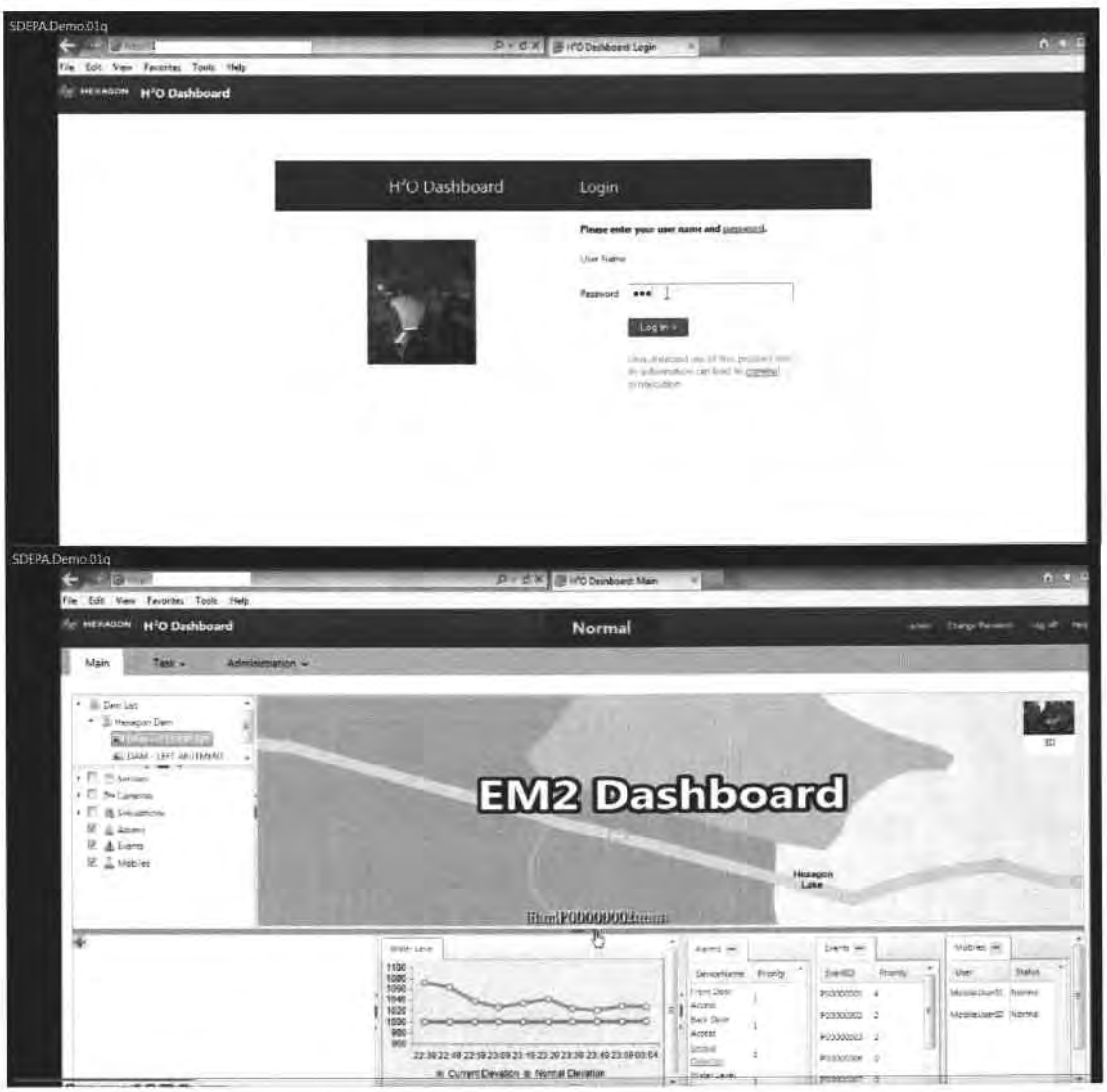
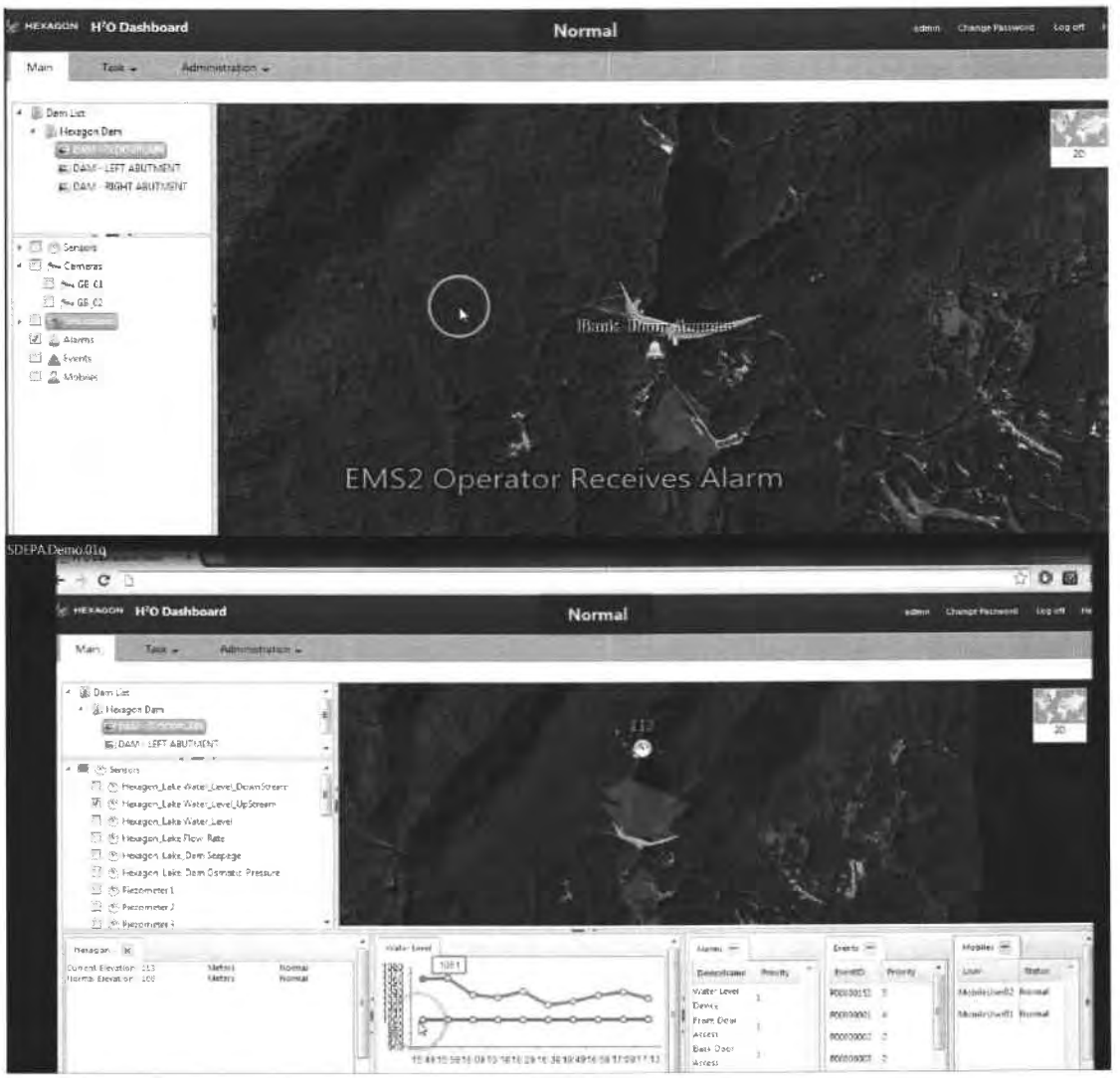

SDEPA
Environmental Event -
Flooding
Demostration
EMS2
H2O Framework
SDEPA.Demo.01q
Flooding - Environmental Event-Incident

SDEPA.Demo.01q
Location: Shandong Province, China - Hexagon Lake Area - Chemical Plant

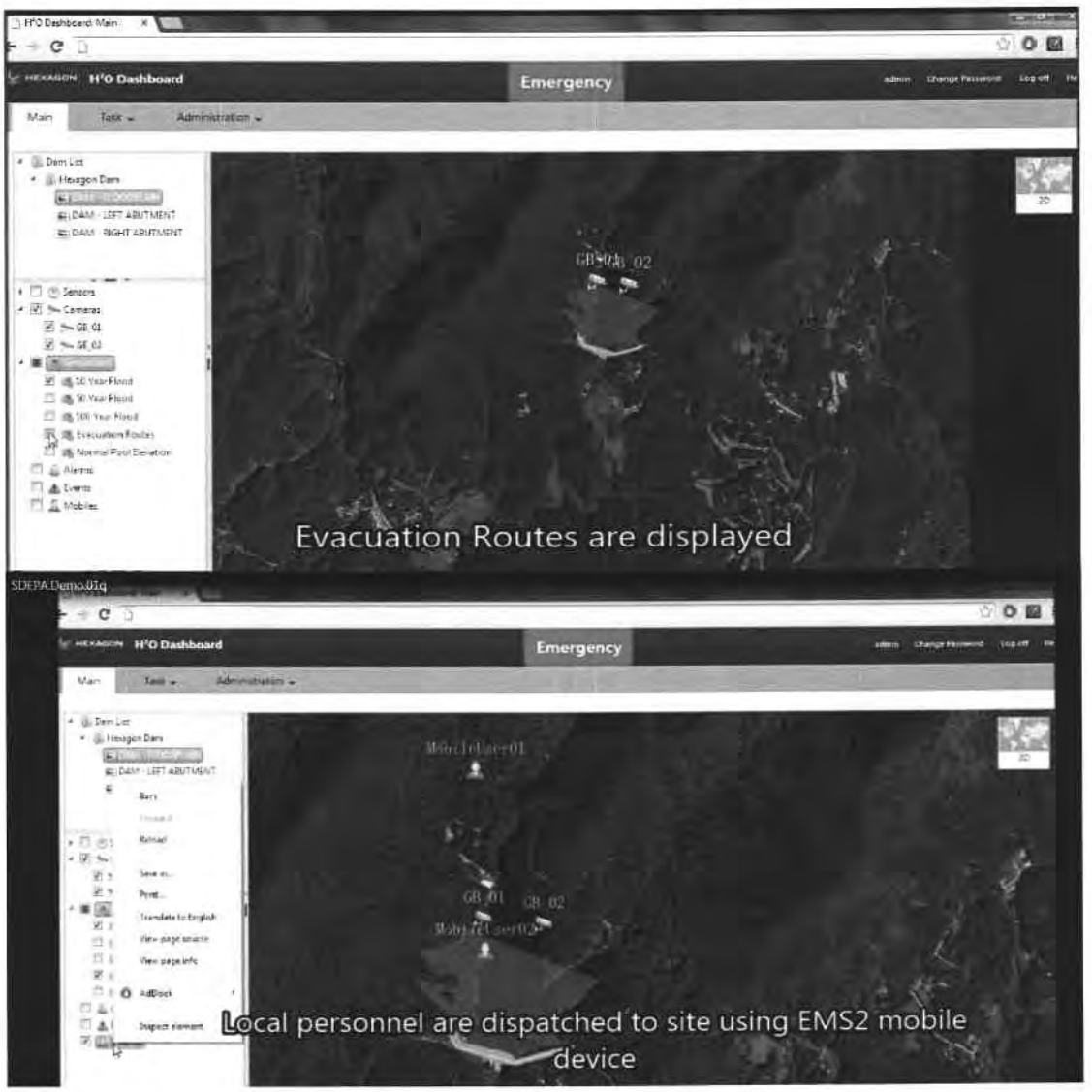
SDEPA.Demo.01q
Scenario –
Environmental Event / Flooding Event
Chemical Plant
Location: Shandong Province, China - Hexagon Lake Area - Chemical Plant


SDEPA.Demo.01q
H²O Dashboard
H²O Dashboard Login
SDEPA.Demo.01q
H²O Dashboard
Normal
Main
Task
Administration
EM2 Dashboard
Hexagon Lake

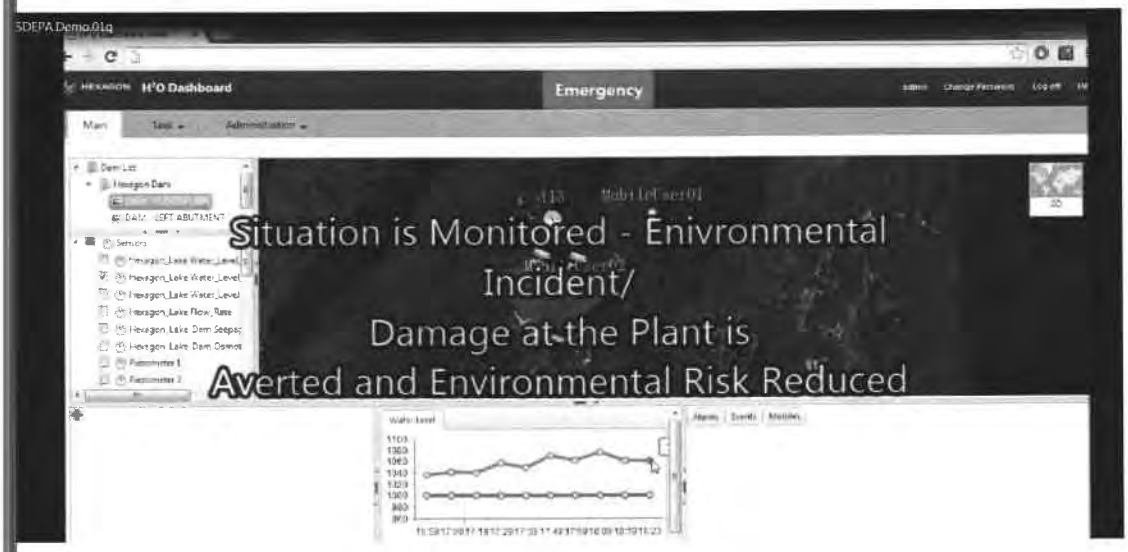
SDEPA.Demo.01q
Onsite Chemical Plant -
H²O Dashboard
Normal
Alarm Possible Flood Warning Lake Hexagon Area


H²O Dashboard
Normal
Main
Task
Administration
EMS2 Operator Receives Alarm
SDEPA Demo 010
H²O Dashboard
Normal
Main
Task
Administration

SDEPA.Demo.01q
H²O Dashboard
Normal
Main
Task
Administration
Emergency
Change System Status
System Status
Emergency
Change Status
Message is sent via phone text - "Warning: Flooding warning near xxx facility at location xxx. Prepare evacuation based on SOP 54-A"


H²O Dashboard
Emergency
Evacuation Routes are displayed
SDEPA Demo.01q
H²O Dashboard
Emergency
Local personnel are dispatched to site using EMS2 mobile device

SDEPA.Demo.01q
Flooding Event Continues
and is Monitored


SDEPA.Demo.01q
H'O Dashboard
Emergency
Main
Situation is Monitored - Enivronmental
Incident/
Damage at the Plant is
Averted and Environmental Risk Reduced