

Preparing for Bioterrorism through Widespread Information Sharing and Complex Modeling

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Abstract: - Terrorism is a clear danger to the world. Terrorists launch attacks against population centers, economic and government infrastructures. They adapt to security and protective preparations continuously implemented. Sharing information, implementing deterrents and acquiring the ability to respond and manage incidents are key goals to protect the population and way of life. This presentation describes information technology applications for early disease detection and for setting up linked prophylaxis clinics and emergency operations centers. It also discusses interoperability of medical facilities, law enforcement and health departments, emergency response resources, intelligence collection/situational reporting and mobile command vehicles through the specification of global requirements and standards. Links to moving and stopped mobile command centers are established using grid wireless networks. Collection of pre-bio-terrorism indicators is combined with medical symptoms reporting to provide early warning and medical preparedness. There is a great challenge to develop a network of interconnected models that trigger early warnings and construct situational pictures for emergence response units. Models employ Bayesian methods to interpret symptoms from differing sources to estimate likely bioterrorism incidents. Behavioral models of terrorist groups and pre-incident operations provide early warning alerts for positioning security and medical resources. A unified framework is presented that integrates interoperable systems, communications (voice and data), software tools and procedures to achieve an early warning and integrated response capability for homeland security. This framework is applicable to detection, protection and response to other types of incidents such as chemical and nuclear weapons attacks as well as conventional bombing events. An example is described of a system implementation that demonstrates these concepts. This system was recently tested in a smallpox exercise to ensure interoperability and early warning readiness as well as ensuring that all citizens are inoculated in the necessary timeframe.

Keywords: - Interoperable communications, early warning, decision tools, knowledge management, bioterrorism, terrorism

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1 Introduction

This paper describes interoperable communications, intelligence and emergency response centers that prepare for terrorist attacks and either prevent or minimize their effects. With the integration of the homeland security and healthcare these centers address threats from terrorist using weapons of mass destruction (employing biological, chemical, and nuclear materials). This interoperable system is explored by focusing on the threat from biological agents.

Terrorism is a clear danger to the world affecting innocent people not directly associated with combating terrorism. Terrorists launch attacks against population centers, economic and government infrastructures. They adapt to continuously implemented security and protective preparations as well as learning from their own actions [1].

Biological weapons agents can be produced at small, covert facilities carried in small vials and dispensed into water and food supplies. Hundreds of people could be infected before medical establishments discover the situation. An example of how fast a disease could go undetected is the SARS epidemic in Toronto where the city was shut down to visitors [2]. Biological agents such as anthrax, botulism, plague, smallpox, and tularemia are transmitted by food contamination, infected animals, fleas, inhalation and infected humans [3]. They all lead to death.

Over \$80 million has been spent on homeland security at the national level [4]. With a portion of this Federal funding finding its way to the local levels, it is time for the security at the local levels to be strengthened and linked to the national security network. The key challenges were identified through the responses to the attacks of 9/11 and preparedness evaluations performed during lessons-learned exercises. The 9/11 Commission has held a series of

hearings to understand shortfalls in security prior to 9/11 [5].

Collin County, north of Dallas, Texas [6], has taken on these challenges by developing an over-all strategic plan for implementing homeland security capabilities, and for developing working relationships with surrounding cities, counties, universities, businesses and State and Federal agencies. The primary focus is on preventing bioterrorism incidents using information sharing and modeling to provide early detection of possible events. This paper describes the plan and actions undertaken by Collin County; and possible future enhancements. It also discusses applicability of the plan to other locations or countries.

The strategic planning and actions undertaken could not have been accomplished without the visionary thinking and support of the County Judge and County Commissioners. The implementation has been accelerated by the County's Director for Homeland Security and leaders in law enforcement, fire departments and health departments and emergency medical response organizations. Further, proactive efforts by local universities support the implementation of the plan, especially the University of Texas at Dallas in its early efforts to help organize meetings of stakeholders and implement a multidisciplinary homeland security curriculum.

The homeland security capabilities in Collin County address interoperable, mobile communications, monitoring of emergent diseases, detection of threats to population, preparation of public notices for a range of scenarios, coordinated response, redundant high bandwidth computer networks, intelligence monitoring and early warning, intelligence data sharing and for referencing data in a geospatial framework. The capabilities also address response to incidents such as integrated emergency

operations management and rapid prophylaxis clinics.

Major hurdles addressed include: 1) small Federal grants not aligned with County goals, 2) gaps in collecting necessary health data to detect early indications of biological, chemical and nuclear incidents, 3) lateral data collection and analysis for simulation, hypothesis and risk models to generate warnings of impending or possible terrorist attacks, 4) identification of vulnerabilities and their dependencies to assess potential targets and consequences of attacks, 5) early detection especially for biological attacks, 6) real-time incident monitoring to coordinated responders and understand the unfolding of events, and 7) sharing of data, information and maps.

As the response to the attacks on 9/11, interoperable communications between various responding organizations been shown to have significant gaps. Further, because terrorist groups increasingly utilize global information's technologies and unconventional weapons, conventional forces on the street methods are insufficient to head off attacks. Enhancements for prevention and protection can be achieved through incorporation of simulations and models that estimate terrorist threats, develop hypotheses and courses of action providing course of action options, and develop risk assessments and methods handling of risks. These additions enhance general preparations, improve knowledge of possible options and capabilities, and develop training scenarios. They also educate stakeholders in the events that might unfold and procedures that would be followed in cases of certain incidents.

This paper describes a *homeland security blueprint* for Collin County that can monitor and detect terrorist attacks, large-scale industrial accidents and natural disasters where mass casualties could result. Some of these capabilities have been implemented, while others take longer-term implementation times. The paper also

describes how such capabilities are applicable to local areas as well as small countries.

2 Characterization of the Plan

The characteristic of the homeland security plan provide the goals and guidelines for moving forward. They also set guidelines for requirements and standards that must be adopted to ensure adequate implementation and operation. The major focus is on prevention and providing adequate response with the realization that the local governments are typically first to respond to attacks.

Preventing attacks necessitates early detection and warning to minimize casualties. Early detection is achieved through educating the population to be on the alert for suspicious activities, developing diagrams of vulnerabilities and their dependencies, executing simulations to evaluate possible threats, developing and assessing hypotheses at both the strategic and tactical levels, and utilizing multimedia collection and analysis for patterns and hidden relations and indicators of single events against vulnerable critical infrastructures.

Adequate response requires interoperable communications, real-time incident monitoring and integration and coordination of resources and decision support capabilities that operate over space and time as well as across participants. Developing a series of scenarios of possible attacks or incidents is used to assess risks and generate courses of action. Some of these options might be automated to ensure rapid response to mass casualties.

Biological agents could be deposited in the local water or food supplies. Chemical plumes could result from explosions set off by terrorists at any of over 1500 chemical plants [7]. Prevention and response require interfaces with State and Federal organizations at all levels.

Some Federal agencies provide information about bioterrorism agents and provides some alerting capabilities (e.g., the Center for Disease Control’s EPI-X and www.promedmail.org), but local organizations must also monitor and recognize their symptoms. The local level is usually the first group to respond to attacks, industrial accidents or natural disasters. In cases of symptoms of biological agent diseases, the State of Texas Health Department and possibly the Center for Disease Control (CDC) are consulted from the investigation phase. The State performs clinical testing services as well as supplies any vaccines. Points of contact are

specified to ensure optimum efficiencies. Collin County recently and successfully tested these interfaces during a bioterrorism exercise by setting up a prophylaxis clinic.

Setting up these contacts and resources is critical for both early warning input and rapid response to incidents. When combined with clear procedures on when and who to contact under given circumstances this network is quite powerful.

The characteristics of this homeland security blueprint integrate prevention, communications, early detection and decision support tools (Table 1).

Table 1. Characteristics of the homeland security blueprint are listed with the category in the left column and attributes in the right column. The attributes, enclosed in parentheses, have naming conventions used in this paper.

| Characteristic Category | Attributes |
|---|---|
| Focused on prevention and protection | <ul style="list-style-type: none"> • Develop preparations and courses of actions based on sets of scenarios (Proactive Preparation) • Continuous multimedia monitoring and collaboration of data that can lead to threat indicators (Proactive Monitoring) • Continuous daily situational reports • Vulnerability and dependency identification (Vulnerability Assessment) • Risk assessment and procedures for handling of risks linked to courses of action • Identify potential threats from analysis of terrorist profiles (Threat Profile Assessment) • Simulations and hypotheses that utilize observables to estimate threats |
| Interoperable, mobile communications | <ul style="list-style-type: none"> • Interoperable radio systems for first responders (Interoperable radios) • Interoperable IP-based wireless mobile systems linking radios and computer systems that travel with response teams (Interoperable, Mobile Networks) • Low profile transmitters that minimize potential terrorist disruptions • Redundant communications networks |
| Multidisciplinary monitoring and analysis | <ul style="list-style-type: none"> • Collect data from wide range of sources (Lateral Collection) • Analyze all media types (Multimedia Analysis) • Analyze using multidisciplinary teams and resources using lateral thinking and analysis techniques (Multidisciplinary Analysis) |
| Early warning solutions | <ul style="list-style-type: none"> • Daily situational reports tailored to decision timelines (Focused Reporting) • Health alerts input from Health Departments, World Health |

| Characteristic Category | Attributes |
|----------------------------------|--|
| | Organization and other agencies (Worldwide Alerts) <ul style="list-style-type: none"> • Terrorist threats against specific target types (Target Threats) • Real-time monitoring of incidents to measure how the incident is unfolding (Incident Rollout) |
| Geospatial information framework | <ul style="list-style-type: none"> • Geospatial referencing of data (Geospatial Referencing) • Interactive access to facilities, routing, and resources through maps (Interactive Maps) • Evacuation planning and action (Evacuation Planning) • Training reference (Training Reference) |
| Decision focusing models | <ul style="list-style-type: none"> • Models define types, formats and ranges of data for input and output (Data Defining Models) • Metrics of the quality of the information and algorithms to reduce uncertainties • Models come into play during specific circumstances (Model Patterns) |

3 Focus on Prevention and Response

Previous efforts have focused on response to incidents such as increasing equipment for Fire Departments (gas masks, chemical suits, radios, etc.). The Office of Domestic Preparedness has issued grants to states for preventative actions; however this funding is available in very small increments of about \$1 million or less. Collin County has defined an overall strategy to help focus such grants to allow implementation of

system components. The homeland security system is organized around coordination centers (Table 2). These centers may be virtual, taking advantage of existing facilities and resources. They link to existing emergency management organizations and provide a resource multiplier. This utilization of existing resources helps to bring the full capabilities to an operational level as soon as possible and using minimal funding.

Table 2. Coordination centers of the Collin County Homeland Security Plan utilize existing resources to provide a rapid startup capability which communicate with existing first responder organizations, medical facilities and charities.

| <i>Coordination Center</i> | <i>Functions</i> |
|-----------------------------------|---|
| <i>Intelligence Center</i> | <ul style="list-style-type: none"> • Headed by Collin County Director of Homeland Security • 24 x 7 continuous monitoring of threats • Verifies threats • Develops strategic plans such as evacuation plans, or mass casualty response plans • Issues alerts and public information to collaborating centers and outside organizations • Interfaces with politicians and Government organizations • Coordinates preparedness activities and exercises • Coordinated response • Coordinate communications resources |

| <i>Coordination Center</i> | <i>Functions</i> |
|-------------------------------------|---|
| | <ul style="list-style-type: none"> • Intelligence data sharing across County, region, State and United States as necessary |
| <i>Medical Coordination Center</i> | <ul style="list-style-type: none"> • Headed by County Department of Health • Interfaces with area hospitals and out of area hospitals • Collects and monitors health threats and analyzes data for disease trends • Verifies health threats through case by case investigations • Interfaces with epidemiologists and clinics • Coordinates responses to mass casualties • Prepares public notices |
| <i>Traffic Management Center</i> | <ul style="list-style-type: none"> • Headed by Department of Traffic Management • Day-to-day management of traffic flow to minimize congestion • Coordinates response to traffic incidents and major chemical spills • Supports evacuation planning • Interfaces with Geospatial information System (GIS) Department to prepare ingress and egress routes for emergency response teams |
| <i>Data Management Center</i> | <ul style="list-style-type: none"> • Hosted by County GIS Department • Archive and manage databases • Serve out data and maps to other centers and organizations and public • Data sharing with surrounding regions, cities and State and Federal organizations |
| <i>Private Sector Collaboration</i> | <ul style="list-style-type: none"> • Develop associations of companies and businesses which exchange information on building vulnerability assessments and strengthening protection of infrastructures • Companies develop information that can be shared in times of crises • Companies work agreements to share information so that dependencies can be identified |

Continued meetings of stakeholders and developing system level requirements are resulting in tailoring of the plan to specific needs of the participating stakeholders.

Most cities in the County use Motorola radios except parts of McKinney (Table 3) [8]. The issue comes when these cities must communicate with first responders and emergency response groups that come from outside the County (especially Dallas County) where different radio systems are used.

4 Interoperable Mobile Communications

Table 3. Trunked radio systems and frequencies in Collin County

| <i>Region</i> | <i>Type</i> | <i>Frequencies</i> |
|---|---------------------------|--|
| <i>Anna</i> | LTR Regular | 451.4375, 452.1875, 452.5125, 453.0125 |
| <i>Collin County Public Safety System</i> | Motorola Type II Smartnet | 866.225, 866.725, 867.225, 867.725, 868.125 |
| <i>McKinney</i> | LTR Regular | 461.9500, 463.3750, 463.4500, 464.0250, 464.7000 |
| <i>McKinney Public Safety System</i> | Motorola Type II Smartnet | 856.3625, 857.3625, 858.3625, 859.3625 |

| <i>Region</i> | <i>Type</i> | <i>Frequencies</i> |
|-----------------------------------|---------------------------|--|
| <i>Plano Public Safety System</i> | Motorola Type II Smartnet | 866.0625, 866.1500, 866.6500, 866.9625, 867.0625, 867.1700, 867.6500, 867.6750, 867.9625, 868.0625, 868.2750, 868.3000 |

As a result, many cities and county in the North Dallas region cannot directly communicate with each other. They must communicate through central switches and dispatcher units.

Collin County has initiated a process to link all radio systems within the County to an Internet Protocol system allowing both voice and data information. This interface solution allows interoperability to external systems. For redundant and assured communication's networks a combination of fiber, radios and wireless technologies are being integrated.

4.1 Fiber Access

Agreements with local colleges and Universities have been forged to provide Collin County access to high bandwidth fiber for high speed communications across County Government offices, and local hospitals. Links to hospitals across the State are being negotiated. Multiple networks will offer redundancy.

4.2 Local Wireless Networks

Collin County is evaluating wireless technologies for wide spread use across the County. The wireless technologies provide interfaces with computer networks as well as existing radio systems such as Motorola. They also operate from high speed vehicles while responding to emergencies [9].

The relay antennas for these systems are small units about 0.7 x 0.2 meters that can be attached to existing light poles along city streets. In addition to the antennas, cameras can be attached to the underside of the antennas or along side the antennas and connected to the network for remote monitoring of freeways or other areas of interest. By connecting to a network that

can pass data, the television data can be displayed on any networked computer. This approach reduces the issues of laying cables and having video switches.

4.3 Texas Intelligent Transportation Systems

The Texas Department of Transportation (TxDOT) is constructing regional communications networks for managing traffic. An example is TransGuide, an Intelligent Transportation System was designed by the San Antonio District of TxDOT. This system provides "information to motorists about traffic conditions, such as accidents, congestion and construction". Collin County is working with TransGuide to evaluate the network concept as a means of communications for incidents other than traffic management. For example, coordinating evacuations in large metropolitan areas could be aided by such a network. This network has high bandwidth, covers large geographic areas and is connected to sensors (cameras and in the future other sensors).

5 Interdisciplinary Monitoring and Analysis

Continuous monitoring of pre-incident indicators and indications of emerging diseases provides early warning as well as prepares emergency response groups. Monitoring on a multidisciplinary level means that all information is viewed and analyzed for many points of view jointly. Models and hypotheses are developed to test collected data for relationships. The models focus the data collection by pulling information collected initially without much filtering. Models employ pattern and hidden relationship identification, extraction of entities (names, places and

organizations), classification of structured and unstructured data.

For example, a model might consist of the types of steps necessary for a terrorist to bomb the opening ceremony of the 2004 Olympic Games in Athens. Terrorist agents would scope out the facility or surrounding area, most likely posing as tourists. They might live in Athens for some time prior to the event, say over one year. They would need to have a place to meet, organize and construct the explosives. They would need to have a delivery truck or other delivery mechanism. They might need a means of escape, unless they planned to die in the process. Each of these steps and more has associated observables that could be given to the local law enforcement to detect. Some of these sub-statements would instantiate if the observable was measured. The pattern constructed by multiply fired model components would indicate a certain outcome. Metrics on information quality and percent of triggered components is used to quantify the outcome.

The monitoring and analysis takes place at each center in their areas of expertise. The results are integrated in the Intelligence Center. Two areas of focus are currently being implemented in Collin County. The first concerns bioterrorist attacks and the second concerns detection of potential terrorist activities.

5.1 Bioterrorist Emergent Disease Detection

Detection of emerging diseases caused by the outbreak of bioterrorist attacks is achieved through epidemiological monitoring and analysis. Data is collected from local hospitals, Medical Examiners (death certificates), 911 calls, Federal and World Health Organization epidemic alerting sources and health departments. The Collin County Health Department examines the data for trends and signatures of emerging diseases. They also perform

validation of any threat by interviewing patients or investigating cases.

Analysts at the Intelligence Center take this information and initiate searches for possible correlations with possible terrorist activities. Patient(s) could have recently entered the United States. Possible delivery mechanisms are investigated. Investigation of similar outbreaks is pursued. These investigations are tempered through models and hypotheses covering the range of biological agents, availability, manufacturing capabilities, storage and handling and delivery of the agent into the society.

Due to the disparate nature of the collected health data, the integration is accomplished using Bayesian models. A Bayesian network consists of nodes corresponding to symptoms, possible diseases and methods of disease propagation. A probability table is associated with each node. Once specific reported symptoms are reported, the probability of specific diseases results from the model. There are many software products that allow Bayesian model development by domain experts instead on computer scientists.

5.2 Terrorist Activities Detection

In addition to monitoring for disease symptoms, the Intelligence Center will carry out continuous monitoring and analysis of criminal reports from local law enforcement, 911 calls, and input from the local Federal Bureau of Investigation's (FBI) High Intensity Drug Trafficking Activity (HIDTA) office. The HIDTA communicates with the FBI Headquarters, all FBI field offices and other Federal agencies. With this indirect link to the FBI, Collin County can receive information and alerts from across the country and from international tip offs. Normal law enforcement investigations are left to law enforcement. However, the data is correlated using simulations, models and GIS mapping tools to search for indicators

and patterns. The data is also correlated with vulnerability and dependency databases to assess potential attacks against infrastructures such as water supplies, utilities, public buildings, and key businesses. Positive indicators are reported to HIDTA and local law enforcement offices for early warning protection to Federal agencies.

5.3 Continuous Collection and Extraction of Key Data

An investigatory effort under way is to evaluate the potential of extracting information on threats from open and other sources. The extraction methods are model-based pulling to detect evidence of impending single occurrence events and those that form patterns after watching terrorist actions over time [10]. This approach utilizes the integration of four underlying software components: 1) data collection against selected types of web sites, 2) indexing of collected files and other databases, 3) extraction on names and organizations and detailed reports on extracted items, and 4) information management and presentation for tailoring results to decision makers as well as integrating models to organize extracted information. Additional applications to display information in GIS formats, and visualization of complex data are added as an application/user interface layer on top of these four basic components.

The test implementation of this capability is the automated generation of daily situation reports. The reports include lists of names and organizations with detailed reports and references, latest news about terrorism, prioritized target threats, important links as well as user annotations of new information that is immediately emailed to selected groups. The concept for a situational reporting capability is also being investigated for detecting epidemic outbreaks [11].

Models are used to focus information for decision makers. For example, information about specific targets allows prioritizing targets based on perceived threat levels. There is also a model of World Terrorism Metric (WTM) shows sensitivity to global terrorism levels and is used to augment the Homeland Security threat level. WTM is computed daily [12].

The models provide estimates of quality of the information for uncertainty evaluation and risk assessments to support course of action options. The output of the models feeds information components to the daily situational report.

6 Early Warning Methods

Whether it is natural disasters, or emergent diseases, early warning and preparation can save lives. Early warning is based on intelligence collection and analysis and development of scenarios that help responders foresee possible events as situations unfold. This approach applies scenarios and underlying models that guide participants on possible futures, and mechanisms to communicate threats, events and courses of action. The approach to scenario models will be discussed shortly.

This section describes the methods of communicating early warning. The ongoing means of communications is through 911 calling services and the Collin County web site at www.co.collin.tx.us. The web site provides normal Government announcements. The Homeland Security section of the web site shows the primary point of contact for terrorist related incidents – the Director of Homeland Security. The address, email and phone numbers are provided. Most of the information currently is informational. The bioterrorism sub-section explains the definition of bioterrorism and describes what the Government is doing to prepare for a bioterrorism attack.

6.1 Bioterrorism Early Warning

A current Texas Department of Health Bioterrorism Grant is evaluating a bioterrorism early warning capability. Data on emerging diseases will be collected from many sources. As part of this solution, a network is being established between the County Department of Health and all County hospitals to collect information on diseases as new patients check into emergency rooms. The Health Department has access to global health alerting sources from the Center for Disease Control (EPI-X) and www.promedmail.org. These external alerting sources help to provide information on travel alerts and emerging health threats.

The first priority in issuing an early warning is to contact everyone on a call list. This includes all health departments, nurses at all clinics, hospital emergency rooms, emergency response personnel, fire chiefs, first responders and the Intelligence Center. These people proceed to execute pre-planned steps defined by scenarios which have been refined for the specific event.

A bioterrorism health alerting web site is being evaluated that will integrate data from various sources both at the local level and from State and Federal reporting sources. Reports are investigated by Health Department personnel to confirm cases and to assess the degree of any threat. Once an outbreak is confirmed plans or actions are published for treatment schedules, and quarantine operations. Inventories of vaccines, drugs and medical resources are requested and compared against existing database values.

A daily situational report is initiated to provide frequent assessments and alerting of the status. Other functions allow coordination of Emergency Management Personnel.

Requirements for the web site are being refined prior to implementation. Two issues must be solved for adoption of the web site: 1) getting potential users to digitize their operational data, and 2) getting participants

to use the web site on a daily basis as well as in times of crisis.

The Collin County Bioterrorism Team (CCBT) has initiated an effort to change processes from paper to digital forms. The conversion process will include the county Medical Examiner who currently records all findings in a journal which the Health Department must tediously read. Others are the clinics and physician's offices. These participants will utilize the proposed Health Alert Web Site to submit their findings.

The web site will be accessible via web browser. This approach allows installation of the capability on the user's existing computers. This follows the results of a University of Texas at Brownsville and Department of Energy initiative to monitor diseases that cross from Mexico into Texas (conversation with the University of Texas at Brownsville). The system was not adopted because a separate system was installed at each user site.

The proposed web site has many levels of access. Each user type (Fire Chiefs, First Responders, Health Departments, Hospitals, Medical Examiner, pathologists, and the public will see a subset of functions tailored to their needs and access. The information can also be tailored for the crisis level, reducing the amount of clutter in times of high crisis events.

6.2 Early Warning of Terrorist Attacks

The Collin County Intelligence Center (CCIC) has the responsibility for assessing and issuing early warnings of possible terrorist attacks, industrial accidents and natural disasters. These warnings are issued to first responders, other centers in the network, Government officials, health professionals and others as necessary. In the case of a bioterrorism incident, the County Department of Health has already notified many of these groups. The CCIC adds any information that has been gathered on related threats and actions. This initial

warning is currently carried out by telephone using the commercial telephone provider or the backup wireless system or radios, whichever is functional.

The Intelligence Center functions as the nerve center for the County,

- Interfacing with external organizations,
- Ensuring communications networks viability,
- Issuing public statements on the threat and its status,
- Coordinating evacuations,
- Coordinating responses and calls for regional, State and Federal assistance,
- Monitoring vulnerabilities, dependencies and determining possible targets,
- Generating GIS maps and products for dissemination,
- Running simulations and models to assess risks
- Determine options for decision makers

Early warning messages will be issued on the CCIC web pages of the Collin County web site, broadcast television and radio and over local resources such as the law enforcement and food safety alerting system of Primemedia in Carrollton, Texas [13].

Early warning does not stop at the first signs of an attack. It continues throughout the crisis. Real-time incident monitoring to confirm locations of terrorists, Government officials and staffs, first responders, emergency management personnel, health professionals and population distribution is necessary to follow the development of an incident. Real-time monitoring can identify new threats as a situation unfolds. The ability to issue ongoing warnings and alerts is vital to maintain control of a situation and calm in the population.

7 Geospatial Information System

The geospatial information system (GIS) is the foundation for presenting information to participants and briefing the public and media. GIS data consists of maps that may show

- Locations of emergency response and first responder resources in real-time and times to reach certain destinations,
- Lines of communication and their operational status,
- Locations of public buildings, emergency response facilities, medical facilities, schools and areas used for evacuations,
- Traffic routing for evacuations,
- Major building infrastructure data for fire department applications,
- Locations of hazardous materials
- Population distributions
- Water and gas utilities

GIS products include three dimensional (3-D) renderings of city areas to support planning of first responder approach and egress, as well as for hostage rescue planning. Weather data is rendered onto GIS maps and 3-D products. Finally, specialized model outputs such as plume spread, chemical spill drainage are represented in maps for understanding the threat to the local population.

GIS is also interactive. Maps can be published electronically to computers and hand-held devices to allow emergency response personnel to point and click on specific intersections, buildings, and other features to retrieve the latest information about that location or the latest events occurring there. Information can also be inserted into the GIS databases to inform other responders.

Medical bar code tagging technologies can be used to tag mass casualty patients and their belongings so that medical personnel can view their status in real-time and view their location on GIS interactive maps [14]. This same technology applies to equipment and resources as it moves around the County. Management of resources and the logistics of getting the optimum resources to the right location is enabled via GIA and tracking technologies.

8 Decision Focused Models

As the operational tempo changes from normal to crisis conditions, the type and amount of information required for decision making becomes focused on near-term (tactical) courses of action. In the normal conditions, information is being collected; personnel are training and performing their normal duties. An incident starts a chain reaction of actions, some of which must be nearly automatic in the short time scales presented to the decision makers and responders. Decision Focused Models are scenarios coupled with procedures, actions, consequences, impacts to critical infrastructures and risk analyses to lay out best courses of action for a given incident.

The scenario is a description of a possible event such as a bioterrorism attack where the agent is injected into the population via a specified mechanism. The groups comprising the Collin County Homeland Security Network have specific responsibilities and roles based on the charters and procedural guidelines. These procedures specify communications protocols, and steps in dealing with the incident, recording steps undertaken for post incident analysis. Due to the complex interactions between the groups, population, businesses, media and terrorists a table of consequences is constructed for each possible action. Risks to the successful protection of the population and way of life are also tabulated against these actions. Critical infrastructures, their vulnerabilities and interdependencies, affect what a terrorist might do and the consequences of actions by first responders to counteract terrorist attacks. The continued functioning of basic infrastructures is critical to ongoing economic and living activities as well as to the recoverability of infrastructures attacked.

These models can be developed for normal applications to help first responders and emergency response personnel deal with non-terrorist related incidents. They can be extended and refined for terrorist attacks.

By developing models for normal activities, they can be evaluated and refined in everyday use. Thus, if a large-scale terrorist incident occurs, the models will have been tested.

9 Testing the System

Simply building a system is not sufficient for assured protection. Education, training and procedures must be developed to ensure that stakeholders and participants understand their roles and responsibilities. The system should be tested and assessed at two levels. The first level is at the component level. Each center or component must be tested by running exercises to evaluate procedures and information flow and efficiencies of operation. Once each component is evaluated, then a system level test is necessary to ensure proper interoperability and flow of data and information across the components. System level tests must be carried out using realistic scenarios with participants acting in system stressing roles. An evaluation of the exercises following completion provides lessons learned.

10 Adapting the Plan to Other Regions

The strategic homeland security plan for Collin County was started through discussions with the County Commissioners and their recognition of the terrorist threats to the local population. It has been evolving as more stakeholders get involved in the process. The driving goal is to have capabilities to protect the local population against terrorist attacks, industrial accidents and natural disasters. Given the terrorist attack on 9/11, the urgency to complete a baseline capability is high.

An approach to applying this plan to other regions (or countries) is to start with the Collin County plan because it has some maturity. The first step should include a series of brainstorming sessions, where

1. Inventories of current resources is collected,

2. Resources in common with Collin County are identified,
3. Unique infrastructures are identified,
4. Unique resources are identified,
5. Communications between stakeholders is defined,
6. A list of scenarios are identified,
7. Procedures of the stakeholders for each of these scenarios is discussed and defined, and
8. Health resources are identified.

The second step is to begin refining a plan for the region. The plan can be divided into sections devoted to communications, intelligence, and medical response, protection of the population, protection of infrastructures and continuance of society. These components can be worked on by sub-committees to ensure an accelerated schedule.

The third step is to develop a requirements document that specifies what is to be implemented. The requirements document is a guide to the stakeholders and vendors who will work together to ensure that all components of the final system will be interoperable and coordinated. A group should be instantiated to ensure that the system is constructed in compliance with the requirements and that is to have the desired operational capabilities.

Interfacing with key personnel who developed the Collin County plan and system will also accelerate the implementation process. The plan should be considered a living document that evolves with the needs and resources of the region.

11 Closing Remarks

The increased uncertainties caused by terrorist around the world, especially to western nations and large-scale sporting events (such as the Olympic Games or World Cup) make it imperative to develop and implement capabilities to protect the population against such attacks. Such

capabilities should be constricted with the types of disasters that occur from industrial accidents (e.g., chemical spills) and from natural disasters (e.g., earthquakes, tornadoes or hurricanes). Developing scenarios, models and procedures for non-terrorist related incidents, the stakeholders can gain experience and confidence of their ability to minimize damage and loss of life when terrorist attacks occur. Continued infusion of technologies and process improvements will ensure that the best protection and preventative steps have been taken.

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