

Can Rhode Island Effectively Respond to a Major Hazardous Materials Incident?:

Deficiencies and Recommendations

by

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Abstract

Can Rhode Island Effectively Respond to a Major Hazardous Materials Incident?

Deficiencies in trained response staff, dedicated response equipment, and inter-jurisdictional training puts the population and environment of Rhode Island at risk in the event of a release of hazardous materials. This thesis evaluates Rhode Island's compliance with the requirements of Federal legislation, assesses the current capability of emergency response to hazardous materials, assesses the potential risk of a major incident in the state, and makes recommendations for improvement.

A review of Federal laws and regulations shows Rhode Island to be out of compliance with the requirements to protect the public from hazardous materials incidents. A mail survey was conducted of response agencies in the Federal, State, Municipal, and Private sectors, which reveals deficiencies, particularly in the Municipal sector, which by both current practice and State protocol has primary responsibility for hazardous materials incident response. A computer model of a hazardous material incident in the City of Providence predicts grave consequences if such an incident were to occur. A comparative model demonstrates the capability to reduce exposure and casualties with an effective response system in place. An analysis was carried out of the Commonwealth of Massachusetts Hazardous Materials Response Program, which utilizes Regional Response Teams. I suggest an adaptation of the Massachusetts program, for the State of Rhode Island to include personnel training, support, and equipment procurement. Alternatives for initial funding are presented, with the goal of making the proposed system self-sustaining through a cost-recovery program.

Current state protocol relegates primary responsibility of hazardous material incident response to the municipal sector. I believe that the responsibility should rest with the State government and that a statewide regional response team should be developed, with proper training, equipment, and support. My research shows that such a system can be self-sustaining and can reduce the impact and risk of hazardous materials incidents on the population and environment.

Introduction

On December 3, 1984, a pesticide factory owned by the Union Carbide Corporation leaked poisonous methyl isocyanate gas into the surrounding community of Bhopal, India. During the night over 4,000 people suffered a horrible death, and hundreds of thousands of residents were left blind, disabled, or otherwise injured. As of October 1994, 15,000 deaths were directly linked to the chemical release in Bhopal and more than 500,000 people had filed claims with the court system in India.¹ This event captured worldwide media attention and brought chemical manufacturer's facilities and procedures under close public scrutiny. The Bhopal disaster was also the impetus in the United States for the passage of the Community Right to Know and Emergency Planning Law in 1986, also known as Title III of the Superfund Amendments and Reauthorization Act (SARA). Enactment of SARA placed the onus on states and municipalities to develop plans to prevent or confront a "Bhopal" type of situation, and required chemical manufacturers, transporters, and users to make available information about the chemicals in their possession to the general public and to emergency response personnel.

This thesis demonstrates that the State of Rhode Island is inadequately prepared to battle a major hazardous materials incident, and that if such an event were to occur, there would be grave consequences. Recommendations are made for the development of a regional response team specifically trained and equipped to deal with such a situation. With such a program implemented both the risk of a hazardous materials incident and an

incident's impact on the population and the environment can be reduced.

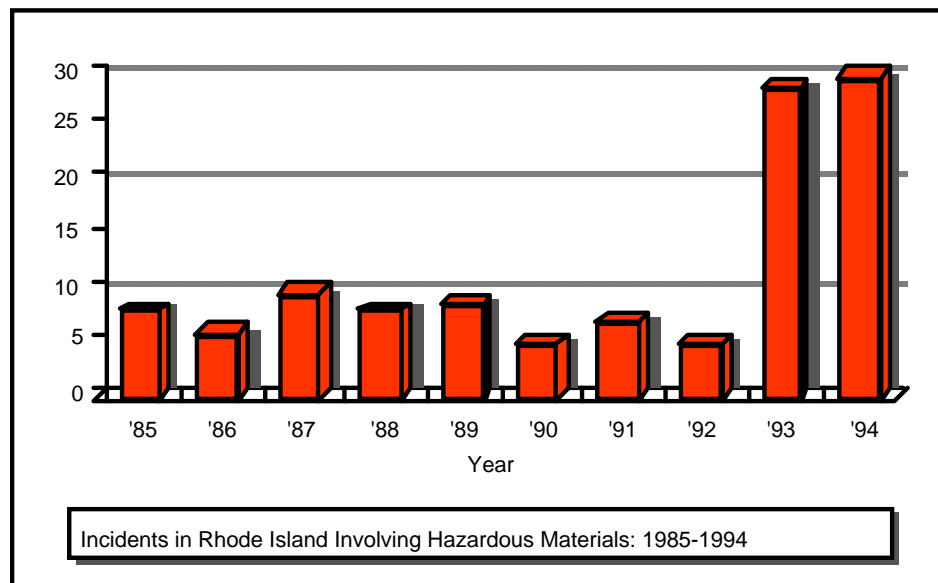
¹ Cohen, Gary, *The Bhopal Union Carbide Massacre*, Right to Know Network Web Page,
<http://rtk.net/E6199T660>

In November 1990, a leak of poisonous ethylene oxide occurred in the sterilization room at Memorial Hospital in Pawtucket. Firefighters who arrived on the scene lacked both the equipment and the training necessary to enter the room and stop the leak. Backup teams from the City of Providence were also unable to enter. Finally, John Leo, a chemist and hazardous waste engineer for the state Department of Environmental Management, arrived. Armed with the proper training and a sealed safety suit, Leo was able to enter the room and stop the leak.

State safety experts say the situation wouldn't be much different if it happened today...Rhode Island still has very limited resources to deal with hazardous materials accidents.

Barbara Polichetti
Staff Writer
Providence Journal-Bulletin
Pg. 1C; January 12, 1994

Hazardous Materials Incidents on the Rise in Rhode Island



Source: U.S. Dept. of Transportation Hazardous Materials Information System

Chapter 1 - Legal Aspects

A. Enacted Federal Legislation and Requirements.

On October 17, 1986, the U. S. Congress enacted Public Law 99-499, entitled the *Superfund Amendments and Reauthorization Act of 1986*. (SARA) The purpose of the Act was “to extend and amend the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, 42 USC 9601), and for other purposes.” Title III of the Act known as *The Emergency Planning and Community Right-to-Know Act of 1986* was to provide for safety information, emergency planning and notification programs to strengthen public protection from industrial use of hazardous chemicals².

Subtitle A, entitled *Emergency Planning and Notification* mandated that all states develop a system for response, and notification of the general public in the event of a hazardous materials incident. The stipulated method of implementation was outlined in the sections of Subtitle A. Section 301 required each state governor to appoint a state emergency response commission (SERC), which in turn would appoint local emergency planning committees and would supervise and coordinate the activities of such committees. The SERC would also designate emergency planning districts in order to facilitate the preparation and implementation of emergency plans. In addition, the SERC would appoint local emergency planning committees consisting of representatives of local law enforcement, civil defense, firefighting, first aid, health, environmental, hospital, media, and governmental organizations and representatives from facilities that manufacture, generate, transport, receive, or utilize hazardous substances.

² CIS/INDEX Legislative Histories, Jan-Dec. 1986 p.361

Section 302 designated which substances and facilities were subject to the requirements of Subtitle A. Initially, all substances listed in Appendix A of the Environmental Protection Agency's publication *Chemical Emergency Preparedness Program Interim Guidance* were deemed extremely hazardous substances and any facility that possessed more than two pounds of such a substance was deemed to have exceeded the threshold planning quantity, and therefore was subject to the requirements of Subtitle A.

Section 303 required each local emergency planning committee to prepare and annually review a comprehensive emergency response plan. Each plan had to include: identification of facilities subject to the requirements of Title III; identification of routes used for transportation of extremely hazardous substances; identification of other facilities subject to additional risk due to their proximity to hazardous facilities or routes; substance release response procedures; designation of emergency coordinators; public notification procedures; procedures for the calculation of areas and population affected; evacuation plans; equipment inventories and locations; and training and exercise procedures. This section also required an initial review of each emergency plan by the SERC, but had no requirements for further or periodic review.

B. State Response to Legislation

Appointment of the SERC was required within six months of enactment of SARA. Rhode Island Governor Edward DiPrete established the Rhode Island State Emergency Response Commission by Executive Order # 87-6.1, appointing to it the members of the Rhode Island Civil Preparedness Advisory Council, as it was already their duty to advise the governor and the director of the state emergency management agency on all matters pertaining to disaster preparedness. The Civil Preparedness Advisory Council (Appendix A) was created by the Rhode Island Defense Civil Preparedness Act (RIGL 30-15, 1967), to protect life and property from natural or man-made catastrophes and to coordinate disaster management and response planning and activities. This law provides for the creation of the Rhode Island Emergency Management Agency and for a 29-member Civil Preparedness Advisory Council drawn from various sectors of private industry and governmental and non-governmental organizations. It names the Lieutenant Governor as the Chairperson of the Council and specifies the positions from which the other members are drawn³. The law also requires regular meetings of the council, provides for review of emergency management plans, and outlines the Governor's powers and responsibilities in the event of a state of emergency. As of April 1996, the Rhode Island SERC had not met for over one year⁴, and records of its meetings were not available,⁵ particularly its annual list of priorities,

³ Letter from the Office of Lt. Gov. Robert Weygand, 3/22/96

⁴ Phone interview with Anna Praeger, Wakefield, RI, 4/3/96

⁵ Inquiry at the Office of Lt. Gov. Robert Weygand, 3/8/96

which is to be made public, as required by law.

In accordance with Section 301 of SARA's Subtitle A, the state has been divided into nine emergency planning districts (EPDs): one for Providence, one for East Providence, and seven that are multi-jurisdictional. (Appendix B). Each EPD has a local emergency planning committee (LEPC) made up of various members of municipal agencies and local resident representatives. Each LEPC has submitted at least a draft of an emergency plan. Section 303(e) of SARA Title III requires the SERC to review each LEPC emergency operations plan initially. According to the Rhode Island Emergency Management Agency's Hazardous Materials Program Manager this has not been completed. The primary reason given for non-compliance was inadequate staffing necessary to conduct the reviews.⁶

The state Emergency Management Agency (EMA, formerly Civil Defense Agency) has promulgated the State of Rhode Island Emergency Operations Plan. Annex J to this plan addresses Hazardous Materials Operations and the requirements of SARA Title III in identifying hazardous facilities and transportation routes. The initial printing of the plan listed 222 sites as using extremely hazardous substances, and the current printing lists 175 facilities.⁷ (see Appendix C) It is noteworthy that although the number of facilities in the state using extremely hazardous substances has dropped, the number of hazardous materials incidents occurring in the state has been on the rise. (See chart on page 2.) Additionally State highways 1, 2, 3, 4, 6, 44, 102, and 138, and Interstates 95, 195, and 295, have been designated primary routes for the transportation of hazardous

⁶ Interview with John Aucott, RIEMA Hazardous Materials Program Manager, 2/16/96.

⁷ Appendix 7, Assessing Hazardous Material Transportation in Rhode Island, Sustainable Habitats and the URI Urban Field Center, August 1995

materials with the potential for release incidents.⁸

Section 3(o) of Annex J states “Fire Service personnel are not trained to enter the hot zone (i.e., the immediate area of contamination and danger) of an incident. Rhode Island personnel are trained to recognize hazardous materials and to withdraw to a safe distance until appropriate personnel arrive.” “Appropriate personnel” are not defined or identified.

The intent of the *Emergency Planning and Community Right-to-Know Act of 1986*, was to provide a proactive planning process for the protection of the public in the event of a hazardous materials incident. The State of Rhode Island has taken numerous steps towards compliance with the letter of the law, however a diminished emphasis on emergency planning, combined with the budget reductions by the current state administration have left the State in a vulnerable position. Planning units are being “downsized” and priorities rearranged. In the last year alone the Governor has fired the Executive Director of the Emergency Management Agency⁹, had the Agency and its Emergency Operations Center removed from the State House, and relocated it to the state National Guard Headquarters on New London Avenue in Cranston. In addition Governor Almond placed the EMA under the control of the Adjutant General of the State of Rhode Island, Brigadier General Reginald Centraccio, ARNG. General Centraccio’s military background in artillery and civilian background in insurance do not make him the ideal candidate for management of civilian emergency response operations, particularly in hazardous materials incidents. The position would have been better filled with a

⁸ Annex J, State of Rhode Island Emergency Operations Plan, RI Emergency Management Agency, February 1995

⁹ Garland, Russell, *Almond fires emergency management chief*, Providence Journal-Bulletin, March 12, 1996, p. B1

candidate with experience in contingency planning, hazard mitigation, disaster management, and a background in chemical, biological, and radiological sciences.

The EMA Emergency Operations Manual Annex J for hazardous materials requires activation of the Emergency Operations Center when a major incident with the potential for perilous consequences occurs, which would mean that General Centraccio would be the Incident Commander (IC). However, the annex also states that the ranking fire officer on scene will act as Incident Commander and direct on scene operations. This dichotomy will surely lead to conflict as was demonstrated at the October 22, 1997 Unified Response Exercise in the Port of Providence when there was a dispute between the commanding officer of the Coast Guard Cutter *Ida Lewis*, designated as the Federal On-Scene Commander, and Providence Fire Chief Wentworth, designated as the Incident Commander as to who was in charge of prosecuting the incident at the scene. At a time when federal and state governments are moving towards reduced regulation of industry, vigilance for an unexpected disaster should be heightened, not relaxed.

Chapter 2 - Hazardous Materials in Rhode Island

A. Transportation of Hazardous Materials in the State.

In August 1995, a report commissioned by the Rhode Island Emergency Management Agency entitled *Assessing Hazardous Material Transportation in Rhode Island* was prepared by Sustainable Habitats, a private consulting firm specializing in planning and social policy, and the University of Rhode Island's Urban Field Center. The purpose of the study was to determine the flow patterns of hazardous material within and through the State, in order to provide a basis for developing methods and procedures to enhance emergency preparedness for local hazardous materials incidents. The study was based on a 1993 request by the Local Emergency Planning Committees. The study consisted of an analysis of existing federal and state databases, collection of data from roadside surveys, and the results of a questionnaire sent to fixed facilities in Rhode Island that were likely to ship or receive hazardous material.

Although the study contained a detailed analysis, its focus was on transportation by truck, as reporting facilities cited trucks as their primary mode of transportation of hazardous materials (98.3%)¹⁰. The study did not review other methods of transportation such as rail car or marine transport. While these methods may not account for significant numbers of transports of hazardous materials, the volumes of materials transported are substantial, and therefore warrant particular attention. According to John Aucott, Program Manager for Hazardous Materials at the Rhode Island Emergency Management Agency, the Narragansett Bay Commission typically has three rail cars

¹⁰ *Assessing Hazardous Material Transportation in Rhode Island*, Sustainable Habitats and URI Urban Field Center, August 1995, p. XII

(approximately 90 tons) of chlorine standing by and available for use in disinfection at the Fields Point Wastewater Treatment Facility in Providence. Chlorine has the potential for rapid expansion and is toxic.

B. Examples of Hazardous Materials Incidents in other states.

i. Alberton, Montana

The mode of transportation and amount of chlorine at Field's Point recall an incident in which five Montana Rail Link railcars carrying chlorine derailed April 11, 1996, in Alberton, Montana, a small town 35 miles west of Missoula. More than 100,000 gallons of chlorine were released, over 250 people were sent to the hospital and emergency managers evacuated Alberton and closed Interstate 90, a major thoroughfare, for more than two weeks. The response required more than 300 emergency workers from federal, state and local agencies¹¹.

ii. Northern New Jersey

The potential of a hazardous materials incident in a metropolitan area was demonstrated from the leak at an American Cyanamid plant in northern New Jersey near New York City on October 6, 1984. Federal and state environmental officials were called after an outdoor tank at American Cyanamid overheated, causing a steel cover to blow off. The tank was holding malathion, a commonly used pesticide described as extremely dangerous when inhaled in its pure form. A chemical cloud from the ruptured tank spread over at least 10 New York and New Jersey communities, prompting more than 60 people to seek medical treatment. Breezes carried the fumes south and southeast to communities

¹¹ U.S. Rail News, May 21, 1996, Volume 19, No. 9

as far as 18 miles away from the site of the leak. Police received thousands of telephone calls from people worried about the odor. Residents with respiratory ailments were advised to leave their homes and others were told to keep their windows shut. Police in the New Jersey communities of Perth Amboy, Linden, Woodbridge, Carteret, Edison, South River, South Amboy, Sayreville and Old Bridge reported receiving thousands of calls about the fumes¹². While malathion is used commonly against mosquitoes and is not as harmful as chlorine, this demonstrates the anxiety experienced by the public when faced with an unknown threat and the burden it places on the public safety agencies.

iii. Weyauwega, Wisconsin

All 1,700 residents of the town of Weyauwega, Wisconsin were evacuated March 4, 1996, when a Wisconsin Central Ltd. freight train derailed about 100 feet from a Wisconsin Gas gate station and less than 1,000 feet from several industrial sites and parts of the residential portion of Weyauwega. Fourteen of the train's tanker cars were carrying a total of 1 million pounds of propane and in the wake of the derailment, four cars started to burn. Given the fact that the propane was liquefied and under pressure, the chance of a rupture and explosion were very real.¹³ An immediate evacuation of the town's residents was ordered due to fear that the leaking gas would cause an explosion that would destroy the town. Beginning March 9, fire crews pumped gas from the derailed tankers into an underground pit, where it was set on fire. The 600 residents who lived more than a mile from the wreckage were allowed to return to their homes March

¹² The San Diego Union-Tribune, October 7, 1984, Pg. A-30

¹³ American Gas, July 1996, Vol. 78, No. 6 Pg. 36-37

18, and the remainder of the residents were allowed to return March 22¹⁴.

iv. Little Pigeon River, Tennessee

On May 22, 1996 in the first of two incidents, Sodium Hypochlorite, a form of chlorine used to disinfect swimming pools, was released from a water park adjacent to the Little Pigeon River in Tennessee. A ruptured tube on a chlorine holding tank was the source of the chemical spill which resulted in the deaths of 4,530 fish of at least 25 different species. A second incident in the same location, on July 20, 1996, killed over 3,100 fish and was caused by human error when an employee filling a sodium hypochlorite tank walked away, and returned to find it overflowing. Unaware of the proper procedures for dealing with the spill the employee disposed of the spill by rinsing it into a storm drain, leading to the Little Pigeon River.¹⁵

¹⁴ Facts On File World News Digest April 25, 1996

¹⁵ Fraser, Thomas, *7,674 Fish Killed by Ogle's Water Park Chlorine Spills*, Tennessee Green Web Site, <http://tn.areaguide.com/newspapers/tngreen/issue011/ogle.html>

C. Potential for Similar Incidents in Rhode Island

An incident involving the chlorine stored for sewage disinfection at Fields Point could have much greater repercussions than the incidents described above, since it would occur in Providence, a medium-sized metropolis of 100,000, and not a small town such as Alberton, population 354. The sheer numbers of people affected due to the proximity of residential areas in South Providence, Warwick and Cranston as well as the major travel routes of US 1 and I-95 would be well beyond the capabilities of area medical and hazardous materials response teams. Depending on prevailing winds, portions of the East Bay or downtown Providence could be involved as well.

If the spill of chlorine in Alberton sent 250 people to the hospital and required the closing of Interstate 90, a major spill at Fields Point could send thousands to the hospital and require shutting down Interstates 95, 195 and US 1, which would essentially shut down commerce in the State of Rhode Island. The Providence Fire Department currently has one special hazards unit with one in reserve and has five rescue units to serve the entire city. The special hazard units are not equipped to handle either this size or this type of catastrophe. A major spill of chlorine may require the evacuation of all people within 1.9 miles of the spill site¹⁶. An incident at Fields Point, depending on prevailing winds, could include major portions of East Providence, the Pawtuxet section of Warwick, the Elmwood, Washington Park, and South Providence sections of Providence, including Roger Williams Park and most importantly the Rhode Island Hospital Complex. The number of people involved in an evacuation of these areas as well as the

¹⁶ *1996 North American Emergency Response Guidebook*, U.S. D. O. T. Research and Special Programs Administration, 1996, p. 300

major transportation routes that would have to be shutdown would paralyze the greater Providence area if not the State. The proximity of the Rhode Island Hospital Complex in this scenario is significant for two major reasons. Rhode Island Hospital is the only state level 1 trauma center equipped to handle major casualty inflow. Removal of this resource would be extremely taxing on other area medical facilities and would require the other hospitals to immediately implement their disaster plan. Second, an evacuation of non-ambulatory patients from the complex would be difficult, expensive, and extremely time-consuming to the point of being infeasible. As Rhode Island Hospital might have up to 450 admitted patients at any one time, appropriate facilities would have to be located in nearby municipalities such as Pawtucket, Woonsocket, Fall River, Worcester, Norwood, and Boston.

Even closer to the Rhode Island Hospital complex than the Fields Point facility is the Port of Providence. Shipments are continually being received of various commodities, including hazardous materials such as liquid propane gas. In 1994, there was a fire onboard a freighter stopped for delivery in the Port of Providence. It took several hours for port officials and the City of Providence to determine that there were no hazardous materials onboard. However, if one of the liquid propane gas tankers or holding tanks was to explode, there would be a disaster akin to the one that occurred in Wisconsin. (c.f. pg. 11)

State Pier #1 is approximately one half mile from Rhode Island Hospital, and the Harbor Junction Pier is approximately one mile away. A major leak and explosion of liquid propane gas from a tanker or holding tank in this area would certainly call for the evacuation of patients and residents at the hospital complex; the next nearest level 1 trauma centers equipped to handle such situations are in Boston.

In the report *Assessing Hazardous Material Transportation in Rhode Island*, 84 hazardous materials accidents are listed for Providence alone in the period 1985 - 1994. The materials involved include gas, oil, chlorine, cyanide, ammonia, and nitric acid. The potential for a major hazardous material accident clearly exists in Rhode Island and the consequences could be dire without proper planning, training, and equipment.

D. The Woonsocket Hazardous Materials Exercise.

A scenario similar to the Fields Point example was the subject of a recent hazardous materials exercise conducted in Woonsocket in June 1996:

Several city agencies collaborated in a three-hour disaster drill at the wastewater treatment plant, off Cumberland Hill Road, that stretched as far as Landmark Medical Center, where "victims" were treated, and included the nearby Oakland Grove Nursing Home and the CVS/Mark Stevens plant, where occupants were sheltered from the "leak." In the scenario, a cylindrical steel tank containing a ton of chlorine - a greenish-yellow poisonous gas with a disagreeable odor - is lying on a loading dock at the wastewater plant, leaking the gas. Two injured men are lying beside the tank. The cylinder has two valves; one leaks [chlorine] gas and the other leaks liquid chlorine. Both the gas and liquid forms of chlorine are highly toxic. The city's [Woonsocket] Police and Fire Departments responded to the scene, and police cordoned off a half-mile area around the plant. In the event of a real chlorine leak, federal regulations call for an evacuation of the area within a half-mile radius of the plant, but Adel Barnoub, director of the regional wastewater plant said it would be too risky to evacuate the nursing home and the hospital. As the drill unfolded, two observers took notes: John Aucott, for RIEMA, and Suzanne Leduc, chairwoman of the Odor and Noise Advisory Committee, a watchdog group of [Woonsocket] residents. Outside, near the mock leak - dramatized by a smoke machine that simulated the gas - Leduc was upset. She timed the sequence of events, and 30 minutes after the exercise began, the tank was still "leaking." "I am concerned," she said. "I am concerned with the time. I live near here, and I am concerned."

Aucott, who was standing nearby, said: "Even though it seems like it is taking a long time, other communities don't have the luxury of this kind of training and the kind of expertise Woonsocket has. In those towns, a lot of the people needed wouldn't be here yet."

Leduc was not assuaged. "We want an emergency siren to alert people to turn on their radios and televisions to get instructions about what to do," Leduc said as she looked at her watch again and then at the smoke being spread by the wind. "I'm not concerned, I'm scared to death." The delay was caused by the time it took the Fire Department to inflate three children's wading pools, in

which hazardous materials workers would stand while firefighters washed chlorine residues off their suits. They finally capped the leak at 10:22 a.m., more than one hour after the disaster erupted. That's too long, Barnoub and Deputy Fire Chief Robert J. Cornell agreed¹⁷.

The unexpected delays and potential for injuries and public panic of this exercise demonstrate what the potential is for a leak from the Fields Point facility or any of the other 150+ sites in the state of Rhode Island.

Chapter 3 - The Somerville Incident

A. History of an Incident in a Heavily Populated Area.

Accidents with hazardous materials in transit are a much bigger safety concern than a possible mishap at a nuclear power plant, the head of the Federal Emergency Management Agency (FEMA) John W. Macy Jr. said in Boston, addressing safety experts at the National Fire Prevention Association. "The government is concerned about the public's worry over a possible nuclear power plant accident, but the transportation of hazardous chemicals presents a much greater danger than that public realizes."

Macy's top aide, Gordon Vickery, head of FEMA's Fire Administration said, "There are three accidents a day with hazardous materials in this country. This presents a grave danger to the public because these accidents usually happen in heavily populated areas."¹⁸

While attending a conference sponsored by the Harvard Medical School and the National Disaster Medical System in April of 1996 on the medical consequences of terrorism, I queried participants and presenters as to potential improvements for hazardous materials response capability. Several respondents, including Mark Kiessling of the Yale University Emergency Medicine Faculty and Dr. Robert Knouss of the U.S. Public Health Service Casualty Care Research Center and the National Disaster Medical

¹⁷ Joseph R. LaPlante; Staff Writer, Providence Journal-Bulletin, June 5, 1996, p. 1C

¹⁸ Mahoney, G. Frank, *Chemical Transit Worries Safety Group*, Boston Globe, May 20, 1980

System pointed to the new program under development in Massachusetts. Mr. Kiessling said that Connecticut was very similar to Rhode Island in its lack of response capability, but that the new Massachusetts program would become a role model for the region.

The decision by the Commonwealth of Massachusetts to implement improvements in its hazardous materials response capability, with a command structure, centralized resources, training, equipment, and personnel was precipitated by the worst chemical accident in Massachusetts' history. A rail tank car spill of phosphorus trichloride spewed forth clouds that injured more than 100 people and forced officials to evacuate a 1 1/2 square-mile area in Somerville and Cambridge, an area where an estimated 23,000 people live or work. The release of chemicals had such an effect on public fears and opinions that the spill would eventually be responsible for the development of the Massachusetts Hazardous Materials Response Program within the state's Executive Office of Public Safety.

At 9:05 a.m. on April 3rd, 1980 a tank car numbered TLOX 113009, owned by Monsanto Chemical Company, was being pulled through the Boston and Maine (B&M) railroad switching station off Joy Street in Somerville. The tank car was filled with 13,600 gallons of phosphorus trichloride, and was on the final leg of its journey from the Monsanto plant in East St. Louis, Illinois to another Monsanto plant in Everett, Massachusetts. The substance is used in the manufacture of other chemicals, for textile finishing, electroplating, and in the production of pesticides and gasoline additives. Another tank car filled with phosphorus trichloride was hitched just aft of TLOX 113009. At the same time a 38-car freight train was moving slowly along a track away from Boston. The switching engine with the chemical tank cars had apparently paused while the engineer stopped to throw a switch that would allow the tank cars to be moved on

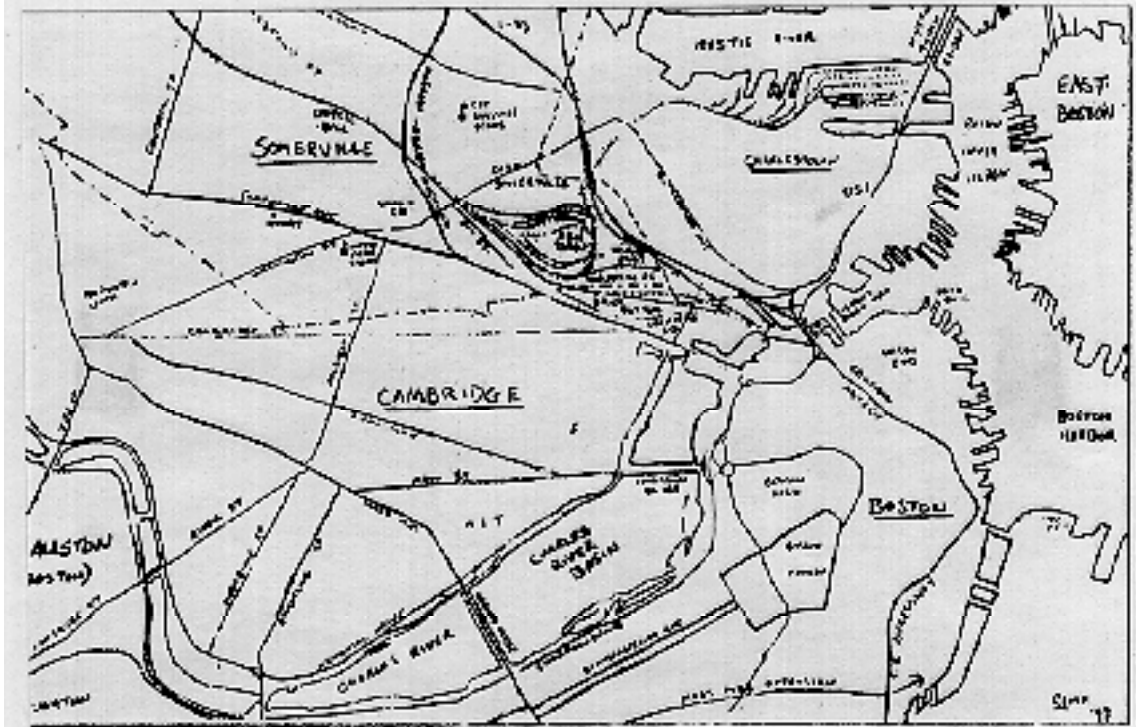
through the “hump yard,” a rail car switching center. In this temporary position the rear tank car was tangentially in the path on the on-coming engine on its way west. The driver of the freight train reportedly had called for clearance but had not received it. The train, moving at a creeping speed, sideswiped the tank car, ripping a gash in the 7/16” steel skin of the tank car three inches wide by about 20” long.

“Something went wrong... we had a collision,” B&M safety manager Robert Currier told the Journal. Phosphorus trichloride began to pour from the tank at a rate of 25 gallons per minute. The personnel of the switching engine unhitched and pulled away. The driver of the out-going engine and the train personnel jumped for safety. B&M employees made the first call to the Somerville Fire Department at 9:10 a.m., as the chemical, reacting with the moist ground, began to form the gaseous cloud which would threaten the city for more than 12 hours.¹⁹

The initial response of the Somerville Fire Department (SFD) was to send three engine companies and two ladder companies. Shortly after their arrival SFD Deputy Chief John Brosnahan was on the scene. Brosnahan knew the escaping chemical was toxic based on information from B&M dispatchers who had checked bills of lading, but he took one look at the gray fluids running into storm drains and began to envision toxic fumes coming up from sewer drains from Joy Street to Boston Harbor. Firefighters turned their hoses on the fluid and created a giant cloud of noxious particles, hundreds of feet into the air, drifting toward Boston in the light breeze.²⁰

¹⁹ Powers, Barbara, *What happened?*, Somerville Journal, p. 6, Vol. 110 No. 15, April 10, 1980

²⁰ McMillan, Gary, *Somerville Begins Probe, Mop-Up; Toxic Gas Leak Spawns Inquiry*, Boston Globe, April 4, 1980



Area Map of Somerville Incident

After being told of the contents of the rail car, Deputy Chief Brosnahan consulted with his SFD dispatcher. The dispatcher retrieved a hazardous materials handbook and informed Brosnahan that a strong spray of water directly aimed at the spill could cause an explosion and that the fumes in the gaseous cloud were dangerous.

In fact, according to the U.S. Department of Transportation's 1990 Emergency Response Guidebook, phosphorus trichloride can be poisonous if inhaled or swallowed, can cause burns to the skin or eyes, has a violent reaction with water, can ignite combustible materials, and runoff to sewers may create fire or explosion hazards. The guide recommends using a fine spray to reduce the vapor, but explicitly precludes the use of direct water spray on a spill. It also calls for a dike to contain the spill until removal

apparatus is available.²¹

As the Deputy Fire Chief had firefighters put on their protective self-contained breathing apparatus (SCBAs), the Somerville Police Department (SPD) sent officers all over the local industrial area to determine the extent and the intensity of the fumes from the spill. Reports were made back to SPD headquarters. A command post was set up in a B&M trailer near the spill site, and within minutes the Somerville Mayor Eugene Brune, as well as the Somerville Public Health director, Fire Chief, and Police Chief were on scene and trying to determine the extent of the incident. Firefighters ordered B&M workers to dig a ditch near the bottom of Joy Street where the chemical was cascading to contain it, and prevent it from dumping into a nearby wastewater catch basin. B&M personnel with bulldozers and backhoes arrived in minutes and began to dig a 12-foot deep, 30-foot diameter pit to catch the seeping fluid. Hours later, three feet of the liquid would lie in that pit.

After the command post was activated, communications were initiated to notify state health and environmental officials and to notify public officials of adjacent and nearby municipalities. A Monsanto Chemical Company chemist was called in to determine what was contained in the cloud that formed when the chemical contacted ground moisture and the fine water vapor the firefighters were using. The chemist reported that the cloud would be mainly composed of hydrochloric acid and phosphoric acid. When phosphorus trichloride is let loose into the air, a two-stage chemical reaction occurs. First, air coming in contact with the phosphorus trichloride creates phosphorus pentoxide, forming the large white plume or cloud that was seen over the accident site.

²¹ *1990 Emergency Response Guidebook DOT P 5800.5*, guide 39, Research and Special Programs Administration, U.S. Department of Transportation, Washington D.C., 1990

Almost simultaneously, the phosphorus trichloride combines with water vapor in the air to form droplets of two acids, hydrochloric and phosphoric - both potent, although not usually life-threatening in vapor form. Both acids are highly irritating, capable of causing skin burns and eye irritation. If inhaled, the vapors can cause internal burning of mucous membranes in the nose, throat and lungs. According to Dr. Roy Magnuson of the Boston University Chemistry Department, the exothermic reaction with water creates a molecule of phosphine for every molecule of phosphoric acid created. Although the phosphoric acid in dilute concentrations may only be an irritant, phosphine is a highly toxic gas that was used as a chemical warfare agent in World War I. Symptoms from phosphine exposure include nausea, convulsions, paralysis, coma, and death. When queried whether circumstances at the accident site could have caused the formation of phosphine, Dr. Magnuson replied, "Quite possibly, yes."²²

The acids were formed when firefighters sprayed water on the liquid phosphorous trichloride, increasing the chemical reaction already occurring as vapors from the liquid were combining with moisture in the air. The acid fumes are easy to detect in the air, even in concentrations too small to form a visible mist, because they have a biting odor, according to Dr. Robert A. Alberty, professor of chemistry and dean of science at the Massachusetts Institute of Technology. Additionally, both acids are highly corrosive, capable of eating away at many metals and fabrics.²³

At 9:30 a.m. Somerville Mayor Brune made the decision to start evacuation procedures. He ordered the evacuation of the Industrial Park and Inner Belt areas

²² Herson, Bob, *What is Phosphorus Trichloride and what is it used for?*, Science in New England, (special supplement to the Somerville Journal), p. 7, Vol. 110, No. 15, April 10, 1980

²³ Ibid.

adjacent to the B&M switching yards and had all students bussed out of the Pope, East Somerville, Lincoln Park, and Technical Trade High schools. Police cars were sent to the affected areas to broadcast the evacuation orders over their public address speakers. Individual officers went door to door to notify residents and to aid those who could not evacuate themselves. The mayor contacted the cities of Boston and Cambridge to notify them of the growing gas cloud that threatened their cities due to the wind blowing the toxic cloud towards the Southwest, reaching Cambridge along the Charles River and the Allston section of Boston.

By 9:45 a.m. every SFD company had been called to the scene, putting some 46 firefighters into the effort. The SFD sent out mutual aid requests to the surrounding communities to request assistance both at the scene and to backfill vacated stations. Immediate response came from Boston, Arlington, Medford, Cambridge, and Everett. The Metropolitan District Commission Police sent several units to assist the SPD in patrolling the area and Red Cross and Civil Defense personnel arrived on-scene to assist in disaster preparations.

After being notified of potential mass casualties, Somerville Hospital implemented its disaster plan at 10 a.m. to recall personnel and to prepare equipment and facilities for a full-scale disaster operation. A similar drill began at Massachusetts General Hospital, Boston City Hospital and seven other hospitals, one as far away as Lawrence, near the New Hampshire border.

At 11:00 a.m. State Fire Marshal Joseph O'Keefe determined that the cloud posed a threat to commuters and transportation, and told police to start evacuating people as far as Lechmere Square. Then he told the State Police to start closing access to the city and ordered the closing of Interstate Route 93 and the Mystic-Tobin Bridge (the two major

transportation routes into Boston from the North), as well as other smaller highways.

The Massachusetts Bay Transit Authority's (MBTA) Green Line to Lechmere was shut down, and commuter railroad lines to Woburn and Lowell were closed because they ran close to the accident scene. MBTA buses carried passengers around the area.

Around 11:30 a.m. when winds threatened to shift, the mayor ordered additional evacuations in the East Somerville area including all elderly housing and nursing homes. Evacuation centers were set up at two schools in areas unaffected by the fumes.

By 1:00 p.m. the command post had representatives from the Environmental Protection Agency, Massachusetts Civil Defense Agency, Department of Environmental Quality Engineering, the Metropolitan District Commission, B&M, Monsanto Chemical, and city officials from the Fire, Police, Public Works and Civil Defense were on hand to assist the mayor in making decisions regarding evacuation, response, and disposal of the chemicals. Shortly after this, state engineers on-scene reported that the leak had stopped, and that about 9500 gallons of the chemical had escaped, mostly contained in the pit. It was suggested that firefighters lay a fog-like spray of water on the ground around the pit to ensure that the chemical would not be picked up by the breeze and blown toward more people. At the moment firefighters turned on the fog nozzle, the wind picked up and the spray hit the pit exactly as if it had been aimed there.

Another cloud sprang up, scattering hundreds of firefighters, police officers, spectators and officials. It drifted toward Central Hill, where those evacuated earlier were still congregated, and another evacuation began. This time the evacuated area was west, as far as Pearl Street, blocks away.

A chemical spill clean-up crew from Jet Line Inc. of Brockton, a firm responsible for hazardous-waste cleanup on contract with the state, was on the scene, as had been

requested by SFD. The liquid chemical in the pit on Joy Street was pumped into dry tank trucks and taken to Monsanto's plant in Everett. Tank trucks also pumped out what remained in the tank car, below the level of the puncture, and took it to Monsanto, where the cargo had been destined in the first place. Conferring with officials, the mayor made an initial decision to fill the now empty pit with water and make plans for further evacuations if the need arose.

During the early afternoon the wind again shifted, from northwest to east, causing the acid cloud to waft in the opposite direction. Instead of moving toward the Industrial Park, Lechmere Square and Boston, it began moving toward the populated Brick Bottom area. Additional evacuations were ordered between Union Square and School, Medford, and Washington Streets. Additional evacuation centers were set up at the Jackson Gym at Tufts University and at the city Armory.

Not wanting to require another evacuation and risk more lives, a joint decision was made at the command post to forgo the plan to fill the pit with water and instead fill it with sand and soda ash obtained from the nearby Boston Sand and Gravel Company (BS&G). By 8:00 p.m. trucks from BS&G began to arrive and started to fill the pit. Finally, officials decided to douse the pit and ground with massive amounts of water. Chemical engineers said laboratory tests had shown this kind of chemical can be broken down if it is saturated quickly with water. The engineers admitted, however, that another cloud would inevitably come from the pit and so still another evacuation was called. The perimeter of the closed-off area expanded to Broadway and police cars were dispatched as far as Medford, North Cambridge and Arlington to warn people to stay indoors until the emergency was over.²⁴ At this time, investigators from the National Transportation

²⁴ Langner, Paul, *News in Brief*, Boston Globe, April 9, 1980

Safety Board (NTSB) arrived on scene to begin inquiries into the cause of the incident.

By 11:30 p.m. the pit was filled with sand and soda ash, and the SFD began an eight hour dousing of the pit with water. Representatives from the DEQE planned to sink test wells to see how much of the residue, if any, was being dispersed through the soil.

At 1:00 a.m. the mayor, with advice from the command post staff, announced that people who had been evacuated could return to their homes. At 7:37 a.m. on the morning of Friday, April 4th, 1980 the SFD gave the all-out signal indicating that immediate hazards were mitigated.

B. The Aftermath

Official estimates of the number of people evacuated were between 13,000 and 17,000. Officials were prepared to evacuate another 20,000 had they decided to pour water directly into the pit.

Over six hundred victims were seen at ten area hospitals and at least eleven were admitted. Most of those taken to hospitals complained of eye and throat irritations and all but a few were released after treatment. State trooper Leonard Thomas was overcome by fumes while diverting traffic from the entrance to Route 1 from Interstate 93 during the evacuation efforts.²⁵

At Somerville Hospital, 457 patients exposed to fumes from the spill showed a twenty-percent liver abnormality rate, suggesting potential liver damage. Tests were repeated on many people for up to three weeks until levels returned to normal or could be attributed to another cause.

Beyond the immediate actions and health problems brought on by the spill incident was the enormity of the cost incurred, particularly by the City of Somerville. For an incident of less than 24 hours duration in a small city with a 1980 fiscal year budget of \$47,432,949.84²⁶, city management estimated the costs at well over \$500,000 to city departments and another \$500,000 to departments and agencies from outside the city. The cost to the city alone would require a four-dollar increase in the tax rate.²⁷ Most of the costs were attributed to overtime for city emergency and administrative

²⁵ Langner, Paul, *News in Brief*, Boston Globe, April 9, 1980

²⁶ Telephone call with Michele Jewelry, Somerville City Auditor, December 23, 1997

²⁷ Powers, Barbara, *Aftermath...the Cost*, p. 7, Somerville Journal, Vol. 110, No. 15

personnel and to equipment damage to fire and police equipment. Like most municipalities at the time Somerville did not have proper equipment or training for decontamination and response to hazardous materials incidents. Metal harnesses on SCBAs and metal buckles on firefighter's turnout gear began corroding from exposure to the chemicals. One fire engine close to the scene suffered severe corrosion to its exterior fittings and finish to the extent that it was considered a total loss.

Initially it appeared that Somerville would have to bear the brunt of this cost alone. B&M was already in bankruptcy and under the control of court-appointed trustees. Any claims made against the company would have to be sought before the bankruptcy court, and as the company was already one million dollars in arrears to the city in back taxes, hope for reimbursement was slim.

Mayor Brune applied to the FEMA for disaster funding. Federal officials told him that there were no federal funds available to defray the cost of the chemical spill. The best the US government could do, said Brendon Bailey, a representative of FEMA, was to study the Somerville incident and use it as a basis for future federal legislation to allow the federal government to assist local communities. Mayor Brune asked FEMA representatives to supply the city with proper equipment, plans and training to deal with any future incidents.

"We were prepared to the best of our ability," Brune said, "but we need more of it (equipment) if it happens again, or to help out others if it should happen, say, in Medford or Cambridge." He suggested that Civil Defense be supplied with plans and training to assist communities.²⁸

Mayor Brune also requested assistance from the state. In July of 1980 the legislature approved a \$250,000 aid bill to assist Somerville in defraying the costs of the

²⁸ Langner, Paul, *News in Brief*, Boston Globe, April 9, 1980

spill. In January 1981, the city raised its tax rate to a record \$292.15 per \$1000 assessed. However, the city also adjusted their fiscal year, which formerly matched the calendar, year so that both the city and its residents could spread out the costs over three years and take an initial federal tax deduction for the 1980 tax year.²⁹

C. Lessons Learned from the Somerville Incident.

Some good did come from the incident in Somerville. A FEMA report issued in May 1980 recommended a model hazardous material spill plan, comprehensive training for those charged with dealing with spills, an emergency alert system for communities through which hazardous materials are transported and labeling all containers carrying the material. Some of the training programs were developed at FEMA's own Emergency Training Institute and at the National Fire Academy in Emmitsburgh, Maryland.³⁰

The NTSB initial investigation report on the spill was released in January of 1981. It found that firefighters were misled by U.S. Department of Transportation (US DOT) and the Association of American Railroads Bureau of Explosives emergency guidelines when it used water to try to prevent the spilled chemical from entering the sewer system. It also blamed a Monsanto Co. chemist for initially advising the firefighters to flood the collection pit with water. EPA officials had also given erroneous advice on reducing the noxious cloud with a water curtain. The NTSB report concluded with three recommendations:

(1) that the US DOT review its emergency guidelines for accuracy and adequacy

²⁹ Davidson, Terry, *Tax Rate At Last*, p. 1, Somerville Journal, Vol. 111, No. 2, January 8, 1981

³⁰ Langner, Paul, *Spill Report Backs Him, Says Somerville Mayor*, Boston Globe, May 14, 1980

for response to hazardous materials incidents;

(2) that the US DOT in particular clarify their ambiguous language on the use of water in large phosphorus trichloride spills; and

(3) that training for emergency response personnel in hazardous materials be improved.³¹

In reaction to the spill, Governor Edward King appointed an ad-hoc committee of the Fire Chief's Association of Massachusetts to make recommendations. Those recommendations led to legislation for the reorganization of the Massachusetts Executive Office of Public Safety and the creation, funding, and development of the Massachusetts Hazardous Materials Response Program, located at the site of the State Fire Training Academy in Stow, Massachusetts.

In hindsight many officials felt that the incident could have been much worse. The potential for a much larger number of casualties and both short and long-term damage to adjacent neighborhoods was high. Fortunately, some factors, such as the weather, having railroad employees immediately available, and a bit of luck helped to prevent the development of a much worse situation, than was already encountered. Health officials pointed out that the dry air and the wind were ideal conditions for dissipating the fumes. High humidity would have held the cloud close to the ground and made it much more dangerous.

Somerville Fire Chief Charles Donovan said: "We were lucky. Railroad men were on the scene when we got there and they told us what was leaking. We used the Association of American Railroads Explosives handbook and the Department of Transportation's hazardous materials handbook for guidance on our initial attack.

"The only sign on the tank was the black and white placard which

³¹ *Fed Guidelines hindered SFD in containing spill*, p.1, Somerville Journal, Vol. 111, No. 2, January 8, 1981

indicated the material inside was corrosive. There was no other readily available means of identification that we knew of and nothing to tell us that water would turn it into a flammable and poisonous gas that could explode.

"If that leak had happened during the night or if a knowledgeable person had not been there when our first engine arrived, I don't know what the results might have been."³²

³² Mahoney, G. Frank, *Chemical Transit Worries Safety Group*, Boston Globe, May 20, 1980

D. Massachusetts Office of Public Safety Reorganization

After the phosphorus trichloride spill in Somerville, the Fire Chief's Association of Massachusetts, charged by Governor Edward King to make recommendations for improving hazardous materials response in the Commonwealth of Massachusetts, took a long look at the capability of municipal response. Taking several years to collect information and to develop recommendations, in 1990 they made an initial report to the state legislature and executive for improvements to the then almost nonexistent system for hazardous materials response. Reviewing the Somerville incident, the report found that there were very limited resources, training, and equipment available to emergency response personnel for the mitigation of this type of incident. They found that the failure to have an emergency evacuation plan in place was a major problem. The study also found that the extent of contamination of firefighters and their equipment necessitated the replacement of all exposed equipment, and raised great concern for the health of the firefighters.

The task force recommended that a regionalized approach to response would be most effective. The state was divided into six hazardous materials regions (see Appendix D), grouped by fire districts, and response teams were selected from current district staffs. Management of the teams would be overseen by the local fire districts which also provided funding for some equipment. Compensation for team members would be provided by their home communities. Other costs would be recovered by a law enacted under chapter 21E of the Massachusetts General Laws, which allowed for billing of responsible parties for the costs incurred during the mitigation of a hazardous materials incident. Parties would be assigned joint and several liability, and could have liens placed against all their properties in the state, if they are unable or refuse to pay.

The recommendations were implemented and the Massachusetts Emergency Management Agency purchased six used Coca-Cola Bottling Corporation beverage trucks, which were loaded and prepositioned with minimum available equipment. The teams began responding to incidents, but several problems surfaced. The costs of responding to some hazardous materials incidents were not reimbursed, as companies refused to pay or went bankrupt and similar incidents were billed at different rates. Flaws in the systems led to a review and further recommendations by the Fire Chief's Association. There was a need to standardize operating procedures, equipment, personnel training, and cost recovery throughout the state.

After reviewing the situation, the Fire Chief's Association teamed up with the Professional Firefighters of Massachusetts, the Massachusetts Association of Hazardous Materials Technicians, and the Executive Office of Public Safety to develop a proposal. In 1994, a proposal was presented to the state administration and to the legislature for the establishment of a funding mechanism to create a standardized regional response system for the mitigation of hazardous materials incidents and for consolidation and reorganization of various state agencies with fire safety related activities under the Executive Office of Public Safety. A \$13.6 million bond fund was issued to create a five-year program to create and fund the statewide standardized Hazardous Materials Response Program. After the five years the program would become a line item in the governor's budget. This bond was the first in the history of the Massachusetts Legislature to receive unanimous passage in both houses.³³

The associated legislation, signed by Governor William Weld, effective July 1, 1996, created the new Department of Fire Services under the Executive Office of Public

³³ Interview with James D. Weed, November 1, 1996

Safety. It consolidated the Massachusetts Firefighting Academy, the Massachusetts Fire Training Council, the Office of the State Fire Marshall, and the Underground Storage Tank Program as well as absorbing the new Hazardous Materials Response Program into one agency.

E. Hazardous Materials Response Program Implementation

A policy board staffed by representatives from the Fire Chief's Association teamed up with the Professional Firefighters of Massachusetts, the Massachusetts Association of Hazardous Materials Technicians, and the Executive Office of Public Safety to oversee the Hazardous Materials Response Program. The board hired a director and staff to manage operations, removing this burden from the individual fire districts. The director was charged with establishing a cost-recovery system to consolidate and standardize mitigation billing and reimburse local communities. Included in cost recovery is vehicular depreciation, team compensation and benefits, training costs, use and replacement of equipment, maintenance, insurance, and administrative costs. Also covered was the cost of replacement personnel when Hazardous Materials Team Members are paged to respond to an incident while on duty at their home fire department.

A comprehensive medical surveillance program was established to provide federally mandated medical monitoring of team members for initial, pre-entry, and post-entry phases. Baseline information is obtained prior to team assignment and blood samples are frozen and information is stored until 30 years post-employment. Then follow-up examinations can be compared to baseline information to determine if an exposure occurred, the extent of the exposure, and the severity of threat to health, if exposure causes a change in blood chemistry, such as a pathogenic exposure.

Each of the six regional teams is composed of 45 technicians and 15 support personnel, a state certification developed for team members and standardized training implemented. Each technician has to attend a 160-hour initial training program (see

Appendix E) and each support person must attend a 40-hour “no hot zone” (i.e., entry restricted to areas outside the contamination “hot zone.”) training program. All team members train eight hours each month and also whenever new equipment or procedures are introduced.³⁴ The training has four foci: (1) transportation releases; (2) fixed site releases; (3) fire suppression including testing and control of runoff and smoke and decontamination of firefighters and equipment; and (4) preplanning to include site inspections, municipal building codes, and for appropriate areas, defense base closures.³⁵

The program also established Standard Operating Procedures for all response techniques, reporting procedures within the Massachusetts Fire Incident Reporting System (MFIRS), and utilization of the Unified Command/Incident Command System (UC/ICS). The ICS is already in place in most fire departments to coordinate large incidents. By using the Unified Command System the Hazardous Materials Response Program can provide coordinated, comprehensive response to any hazardous materials incident. It coordinates the effort of the regional response teams with the Massachusetts Department of Environmental Protection, the Department of Public Health, the Division of Industrial Hygiene, the Criminal Justice History Systems Board, the National Guard, the EPA, and environmental health and safety engineers from the private sector. These agencies work together within the UC/ICS to provide a safe comprehensive, efficient hazardous material response program which will provide expeditious mitigation and ensure the least possible impact on the environment. These agencies also work together to create a Multi Agency Cooperative (MAC) System to coordinate all activities beyond response, including training, planning, reporting systems, database development, site

³⁴ E-mail from Mike Castro, coordinator for Region 2 Team

³⁵ Interview with James D. Weed, November 1, 1996

inspection, and intra-region drills.

The Commonwealth of Massachusetts' Regional Hazardous Materials Emergency Response Program is funded through fiscal year 2000 and is projected to earn enough through cost recovery to become self-sufficient as a line item in the governor's executive budget. The program has become a national model in the approach to regional response and is serving as resource for other states' program development.³⁶

With the reliable funding the board was able to plan for purchase of state-of-the-art equipment. The board made a careful analysis of the response regions and decided that the current vehicles needed to be upgraded and new specialized vehicles should be purchased. The program director and his staff consulted with board members and other advisors over a period of eleven months to develop the specifications for three new types of units. The specifications were put out to bid and the contract was awarded to Hackney Emergency Vehicle Company of North Carolina.

³⁶ Weed, James D., *Hazardous Materials Emergency Regional Response*, Commonwealth of Massachusetts Department of Fire Safety, May 12, 1996

The first type was the Operational Response Unit that would replace the aging beverage trucks then in use. These would be supplied with dedicated hazardous materials incident response equipment as well as providing 10 Kilowatt generators, a pressurized air station to refill responders SCBAs, and high intensity lighting.



The cost of procurement for each of these units was \$167,000, approximately \$250,000 fully loaded with the equipment, with one going to each of the six regional teams.

The next type of unit procured was the Tactical Operations Module, a high-tech command post, with three computer workstations, two fax machines, four cellular phones, a weather station, a multi-band radio communications suite, and an alphanumeric group pager transmitter to advise team members and others in the UC/ICS of incident status.



The computers have direct or remote access to 183 databases with chemical and

response data and could access all remotes within 45 seconds. The computers are also loaded with CAMEO and ALOHA (which will be defined below) to help responders develop plans. Also on board are environmental monitors to ensure that occupants do not exceed limit thresholds, a telescoping high intensity lighting unit, and a telescoping video camera unit with low light and infrared capability on a 34 foot 360 degree rotating pneumatic mast. This is tied into a video documentation system that can record the incident as it unfolds and can make instant color hard copies of any observed scene. Cost of each unit was \$350,000 when loaded with the equipment package, and one unit was procured for each of the six teams.

Additionally each of the current beverage trucks will be overhauled and returned to service as Operational Support Units to hold excess equipment, and large equipment such as overpack drums and containment booms.

Procurement of the Tactical Operations Modules and the Operational Response Units is complete. When overhauls of the Operational Support Units are complete each of the regional teams will have three state-of-the-art vehicles to respond to incidents.

Additional procurements include dedicated training vehicles and training equipment, that can be reused and thus will reduce the cost of purchasing new equipment. Expired response suits and equipment that can no longer be used in active service are forwarded to the training division where the equipment will still find use.

An Incident Command and Communications Suite (ICCS) has also been ordered, but not yet delivered. The ICCS is based on a 45 foot truck chassis and has a scientific unit, communications unit, as well as an 8 seat conference room with satellite videoconferencing capability. Only one of these units will be procured and it will be based at the program office in Stow, Massachusetts.

The program is also looking into the purchase of a Multi-mission Module in which the aft section of the vehicle would have up to six different modules which could be used depending on the type of incident (e.g., explosion, biological release, terrorist attack, etc.) This vehicle would also be located in Stow, but the funding and procurement are not yet definite.

F. Incidents since Program Implementation.

Since their establishment, the teams have worked extremely well. Between January 1st and September 27th, 1996 the teams documented 42 responses in the Commonwealth. Here is a sample of their work:

At approximately 10:44 hours on July 31st [1996], the Waltham Fire Department contacted Metrofire Control to request a limited hazmat team response. Team "D" was notified by pager to respond to Polaroid Corporation, 868 Winter Street as a result of a fire involving hazardous waste. First arriving team member Mike Castro assumed the position of team leader and met with the Incident Commander, Captain Jim Kelly and Polaroid representatives. As other team members arrived a briefing was held to discuss the situation. Earlier that morning Polaroid employees had discovered two containers of hazardous waste in the rear of the building that had begun to react. Alertly they moved the containers outside near the loading dock with a forklift and contacted the Fire Department. The 4' X 4' cardboard containers hold instant film battery waste material.

Material Data Safety Sheets [MSDS] were requested from the environmental people on site to review and it was determined that the waste included Zinc Dust, as well as Poly Vinyl Chloride, Aluminum, and cardboard used in the making of the instant film batteries. According to the MSDS, Zinc Dust was actually reactive with Chlorine based material above 492 degrees F. It was concluded that during a boiler shutdown that condensation on the heating pipes had leaked into the containers and had begun to react with the Zinc. This was consistent with the material provided, which had also stated that the appropriate extinguishing agent should be Class D, as Zinc is water reactive.

One of the containers containing the PVC film had completely burned to a large ball prior to the team's arrival and the other continued to burn near a dumpster on the side of the building. Team members contacted Kean Fire Equipment - a local fire extinguisher service company and it was agreed that "Met-L-X," a class D agent containing Sodium Chloride was compatible with the materials involved and could be used for

extinguishment. After meeting with the DEP, and Polaroid representatives, team members recommended that firefighters in full turnout gear and SCBA pull the pile of waste apart using long plaster hooks to speed up the reaction and mitigate the incident. Three man teams began the task with Class D extinguishers on hand, rotating every few minutes. The process took approximately two hours, allowing time for the material to burn.

Eventually the entire pile was consumed at which point all firefighters were directed to a gross decon[tamination] set up for their turnout gear, masks, and tools. The storm drain in the bermed area was connected to a holding tank on site. An incident debriefing was held for all fire personnel and the team. Copies of the MSDS and CAMEO response information were turned over to the Fire Department and health concerns were discussed. A separate critique was held to include Polaroid employees and the incident was terminated at approximately 16:00 hours.³⁷

Although dissimilar to the Somerville incident this example demonstrates the advantages of a prepared response with specialized equipment and trained personnel. The advance in use of equipment, data, and operational planning is very evident. The training and scene management have transformed what could have been a confusing situation for a municipal fire department to handle into a routine event for the Regional Response Team. Just one of many successfully handled incidents, this shows that the investment into the development of a Hazardous Materials Response Program provides outstanding returns, and demonstrates why the Massachusetts program is now a national model.

³⁷ Castro, Mike, *Waltham Waste Fire Incident*, Massachusetts Association of Hazardous Materials Technician Web Page, www.channel1.com/mahmt/incWaltham073195.html

Chapter 4 - Assessment of Response Capability in Rhode Island

A. The Field's Point Scenario

In order to assess the consequences of a major hazardous materials incident in Rhode Island, through the courtesy of John Aucott, the Rhode Island Emergency Management Agency's Hazardous Materials Program Manager, I was allowed to use EMA's Macintosh Computer with three integrated programs to create and analyze a hypothetical scenario. The first program was Computer Aided Management of Emergency Operations (CAMEO) which contains a chemical database of over 4,700 chemicals, 70,000 synonyms, trade names, and other labeling conventions. It has a powerful search engine that allows users to find a chemical instantly and links each one to a Response Information Data Sheet (RIDS) that details specific information on fire and explosive hazards, health hazards, firefighting techniques, cleanup procedures, and protective clothing. The database information is drawn from five private sector sources and six federal sources. The second program is Areal Locations of Hazardous Atmospheres (ALOHA) developed by the EPA and the National Oceanic and Atmospheric Administration. The program provides heavy gas and neutrally buoyant gas modeling, estimates source strength with complex algorithms from gas, estimates releases from tanks, puddles, and pipes, and calculates indoor air filtration. The program also estimates gas cloud area and concentration over time, under varying environmental conditions and can use weather data input either directly by the user or with a weather station interface, to plot a gas plume footprint onto area maps. The third program is Mapping Applications for Response and Planning of Local Operational Tasks (MARPLOT) which employs area maps using digitized data generated from 1990 U.S.

Bureau of the Census TIGER/Line files. This allows users to search and display roadways, street addresses, waterways, railroads, census blocks, and political boundaries. Users can design custom maps overlaying displays of facilities, with chemical information, locations of special populations such as hospitals, nursing homes, and public schools, from user data input, and develop hazards' analysis vulnerability zones. Using data from CAMEOs databases on chemicals and toxic cloud footprints generated by ALOHA, MARPLOT can create a graphic representation of a scenario based on given data input by the user.³⁸

In order to create a realistic, tenable scenario for the state of Rhode Island, I decided to focus on the rail cars filled with chlorine mentioned earlier. I selected this because in Rhode Island large amounts of toxic material are routinely stored in areas of high population density, and I have already demonstrated that rail car hazardous materials incidents are not uncommon.



The rail cars are located at the Fields Point Waste Water Treatment Facility operated by the Narragansett Bay Commission and contain some 90 tons of liquid chlorine gas each. The chlorine is used as a disinfection agent during the treatment of waste water,

before it leaves the facility.

³⁸ Data from Environmental Health Center Web Site of the National Safety Council, www.nsc.org

I ran two trials to compare the response currently available to the response that would be available from a qualified response team. Currently if the spill was not able to be contained by Narragansett Bay Commission personnel, they would call 911, and be immediately referred to the Providence Fire Department. A large group of PFD personnel and equipment would be dispatched to that area, and the first arriving unit would make a determination of a staging area based on the prevailing winds at the time. At the same time mutual aid rescue units would be called in from surrounding communities using the Inter-City Fire radio channel as injuries and exposure occurred. A call would have to be placed to the State Spill Response Line to activate both the Emergency Management Agency and the Department of Environmental Management response personnel and give them location, spill, and response, information. If the chlorine kit from the NBC were not available, due to being in a site that was exposed to the spill or having been tried and not successfully used, an additional chlorine kit would have to be located and then transported to the site. The PFD Special Hazards unit located on Allens Avenue would be able to stage and provide initial assessment and recommendations, but due to the nature of the spill would be limited in its response capability, and would be primarily used as a medical monitoring and decontamination station. Other PFD units would be assigned to assist the Providence Police with evacuation procedures and decontamination of victims/patients prior to hospital transport. Due to the potentially 50,000 people exposed, further alarm calls would be made to all adjacent communities and statewide to provide for mass casualty response. As a member of the Rhode Island Disaster Medical Assistance Team who has participated in both actual and simulated events, I know that the recall of personnel can take several hours

even using a paging/call-in system. Once personnel with proper equipment were available and a chlorine kit was located and transported to the site, action could proceed to contain and secure the leak. However, the resources of rescue units and hospitals would be taxed beyond their limits and transfer of evacuees and patients would continue for several days as alternative treatment sites and shelters were located and transportation made available. The delay in being able to take action against the spill could cost numerous lives, injuries, and contamination to homes, buildings, and other structures, that may have been able to be prevented had more rapid suitable response been available.

If the same scenario was to happen after the development and implementation of a Hazardous Materials Response Program in Rhode Island, events may unfold differently. A 911 call could be directly transferred to the response team notification through the Inter-City Fire channel. With directly- provided information the Response Team could immediately send an alphanumeric page to all its personnel notifying them of the location, type, and severity of the spill, as well as the prevailing conditions at the site. Thus, within a few minutes of initial notification, the team has relayed all necessary information to all team members. Updated information can be provided as often as necessary. Concurrently, team personnel at the central facility could initiate response with the dedicated vehicles, activating environmental monitors and the weather station en route. State Police would be requested to halt traffic on major roadways into a control area within a predetermined radius of the spill site. Travel distance from the proposed central facility to the spill site is approximately 6.2 miles, so at a conservative 45 miles per hour the transit would take less than 10 minutes. During transit, equipment could be readied within the response vehicles and personal protective equipment could be donned. Upon arrival at the scene and after an initial assessment, personnel and equipment could

be immediately sent in to combat the spill. All the personnel and equipment from the team would be dedicated to managing the spill site, freeing other response units to assist in evacuation, transportation, and rescue and decontamination of the public. Support staff from Hazardous Materials Response Team would be responsible for the medical monitoring and decontamination of operational team members. In this scenario, response and resolution of the incident is much quicker because of the use of a dedicated team for just such an incident. Since members of the team are educated, experienced, and have the proper equipment they can begin control procedures as soon as they arrive on scene and complete an initial assessment. There would not be any delay while waiting to locate the correct equipment or personnel. The time saved in abrogating the incident would reduce the number of the public and the area exposed, as well as the severity of the exposure.

The resources used in the first scenario to perform response duties could be reassigned rescue and containment duties to further diminish the impact of the spill. The use of the Massachusetts model in this scenario would be of great benefit to the public in Rhode Island and could demonstrate its cost-effectiveness in just one incident. The fiscal burden to the public would be negligible compared to the cost a major hazardous materials incident.

To get a comparative model, I ran the integrated programs, using data for a situation without a response program and situation with a comprehensive program in place. Data required for program calculations included atmospheric information, and source strength information. The integrated program would have or would calculate all other necessary information such as site data, chemical information, footprint information, and time dependent information. Trying to stay with typical Providence,

Rhode Island weather, I selected a day with a relative humidity of 75%, cloud cover of seven tenths and a temperature of 50.3 degrees Fahrenheit. (Mean temperature year round for Rhode Island is 50.4 Fahrenheit.)³⁹ The ground roughness was set to urban. For the source strength information, the container was set for a horizontal cylindrical rail tank car, 85% full with liquid chlorine gas. The internal temperature matched the ambient at 50.3 degrees F. Wind direction and speed selected were to match a Beaufort scale light breeze parallel to the direction of upper Narragansett Bay as it flows around Fields Point. The wind was set out of 135 degrees true at a speed of 8 miles per hour.

This type of rail tank car has two outlet pipes passing through the center apex, one to vent chlorine gas from the top, and one to vent liquid chlorine from the bottom. For the scenario I selected a rupture in the pipe valve that vents the liquefied chlorine gas, one of the most probable occurrences if an incident was to happen.⁴⁰ Duration of the release was one hour for the first trial without the response program implemented, and 40 minutes for the second trial with the response program in place. As there were several hospitals in the vicinity, I selected two different building air exchange rates for calculation.

The program initially generated a text summary (see Appendix F) which delineated specifics of the release. Included in this was the maximum release rate of 500 pounds per minute and the total amount released which was 30,000 pounds. When pressure on the liquid chlorine gas is released, it expands to a gaseous state at a ratio of

³⁹ *Weather Statistics*, 1996 Rhode Island Almanac, p. 13, Providence Journal Company, Providence, RI

⁴⁰ Interview with John Aucott, Hazardous Materials Program Manager, Rhode Island Emergency Management Agency, Cranston, RI, September 18, 1997

495:1⁴¹. The gas would create a plume that would be Immediately Dangerous to Life and Health (IDLH - the maximum concentration in air from which one could escape within 30 minutes without any escape-impairing symptoms or irreversible health effects - 10 ppm per the Occupational Safety and Health Administration). The footprint window (see Appendix H) displayed a two-dimensional image of the plume that was 1.3 miles long by approximately 0.1 mile wide with a confidence interval of 0.5 miles wide at the far end, within 13 minutes.

Two concentration windows were produced using 5 building air exchanges per hour, which would be typical for the hospitals and affiliated buildings in the immediate area. (To prevent intrafacility transmission of disease hospitals usually employ engineering controls to reduce transmission risk. Included in these engineering controls are frequent air exchanges to remove pathogens from their environment.)

In the first trial, without the response program, at a location one half mile from the incident site occupants would be exposed to a concentration level at IDLH within five minutes, to a maximum concentration of 67.7 ppm at the end of one hour. People outside would be exposed to concentrations IDLH within three minutes to a maximum of 68.3 ppm at five minutes. The maximum concentration occurred at approximately 2000 yards from the release site which is the approximate distance from the Waste Water Treatment Facility to the Rhode Island Hospital complex.

A geographical plume overlay was developed from the digitized mapping data that showed that the plume would encompass a swath of residential and commercial sections of Providence. (see Appendix I). The Rhode Island Emergency Management Agency requires an evacuation for any areas that are exposed to levels that are equal to or

⁴¹ Interview with Joe LaPlante, Operations Supervisor, Narragansett Bay Commission, December 4, 1996

greater than 10% of the IDLH level, in order to provide a safety buffer and protect those more susceptible to injury (i.e., the elderly, very young, chronically ill, and infirm.) This would greatly increase the size of the affected area, and include many nursing homes and public schools.

A Census Population Data summary was produced which broke down the affected areas into age, ethnicity, and type of household. For the first trial 2,566 people in 611 households in a 1.2 square mile land area would be exposed to the IDLH level in the first concentration window, without response team intervention.

A Census Population Data summary was also produced to determine the area required to be evacuated by the Emergency Management Agency's 10% of IDLH level safety buffer, 49,424 people were projected to be exposed to the plume and concentration levels that were 10% of IDLH within a land area of 6.7 square miles, and thus would be required to evacuate.

In the second trial, assuming that a comprehensive response program was in place, building occupants would be exposed to concentrations IDLH within five minutes, but the maximum concentration would diminish to 64.1 ppm and would drop back under the level IDLH at 64 minutes, resulting in a greatly reduced exposure from the first case. A Census Population Data summary for the second trial estimated that population exposure would be reduced 45% to 1413 people in 383 households in a 0.9 square mile land area. This reduction in direct exposure is significant particularly if evacuation efforts and medical aid are not immediately available. As in the first trial, people outside would be exposed to concentrations IDLH within three minutes, however the maximum concentration would be reduced to 66.6 ppm from the 68.3 ppm in the first trial. The

exposure would be sustained for approximately 39 minutes and then be dissipated by the ambient wind, to levels below IDLH. This would be a significant reduction for both indoor and outdoor exposures.

Initial evacuation efforts would be the same as the first trial, because the Emergency Management Agency would assume a worst-case scenario until actual definitive results were confirmed, and then the evacuation would be modified and reduced as appropriate.

From the Somerville incident we have seen the chaos caused when a much more minor accident occurred and initial evacuation notification did not occur for one half hour. In that incident 10 hospitals were utilized to take in some 600 patients who suffered relatively minor exposure to a chemical that was released at an irritant level.

In the above scenario over 2500 people would have been exposed to concentrations of chlorine that were IDLH within minutes. Almost 50,000 people would have required evacuation or safe haven in the safety buffer plume that enveloped seven hospitals including Rhode Island's only Level 1 Trauma Center at Rhode Island Hospital. Evacuation of critical patients would take numerous hours while alternative uncontaminated sites are located for them. Decontamination of equipment and facilities would take several days before some were usable again. Major thoroughfares such as Interstates 95, 195 and US1 would have to be closed until the situation was mitigated. The financial impact and disruption of business and lifestyle could be enormous for the entire greater Providence area. A table comparing the two trial results is provided below:

TRIAL COMPARISON WITHOUT AND WITH RESPONSE PROGRAM

Trial 1 - No response

Trial 2 - Response prog.

Maximum Indoor Conc.	67.7 ppm	64.1 ppm
Maximum Outdoor Conc.	68.3 ppm	66.1 ppm
Outdoor Exposure Time	> 60 minutes	39 minutes
Indoor Exp. > IDLH	> 60 minutes	59 minutes
Population Affected	2566	1413
Area Affected	1.2 square miles	0.9 square miles

The Narragansett Bay Commission does maintain a response team at its Field's Point facility. There are eleven total personnel on the team with two to three on duty at any one time. Team personnel do have hazardous materials response training, and the team is equipped with Level A (the highest level with 3 non-gas-permeable suits and 6 SCBAs) response equipment and Chlorine C-Kits to alleviate large chlorine container spills. According to Joe LaPlante, Operations Supervisor, the on-duty team members can be on-scene to a chlorine leak within 15 minutes to start containment procedures. (In my experience it has taken 15 minutes to suit up in Level B equipment once one was at the equipment storage site. Level A requires putting on fully encapsulated oversuits on top of the Level B suits.) Mr. LaPlante stated that the chlorine tank cars have eight remote sensors attached that provide early warning of any leak. He did state however, that on-duty team members may not be directly on site at all times, and that if they were in a different area of the facility and spotted a large yellowish-green cloud of chlorine gas, they were to "check in and report, and then run the other way." He also stated that in case of a leak one of the team's first actions would be to notify the Providence Fire and Police Departments to start a 10-mile evacuation downwind of the leak. He said that the Fire Department's Special Hazards Unit's only responsibility in case of chlorine leak at the site was to provide medical monitoring and decontamination, not actual mitigation

procedures.

The storage of chlorine at the Narragansett Bay Commission facility poses a realistic threat to the many residents and the environment of the greater Providence area. A leak in any direction would tax the resources and capabilities of present response units to handle and contain the leak.

B. Survey of Response Capability

To determine the hazardous materials incident response capability in the State of Rhode Island, I conducted a mail survey (see Appendix J) that was sent to 61 various response teams in the municipal, state, federal, and private sectors. (see Appendix K) The survey was developed utilizing the response procedures in Annex J of the Rhode Island Emergency Operations Plan, the U.S. Coast Guard Marine Safety Office Providence Area Contingency Plan, and guidelines to determine competency of hazardous material incidents responders as published in the National Fire Protection Association standard 472. Development of the survey was guided and reviewed by Professor Harold Ward of the Brown University Center for Environmental Studies.

I received responses from 100% of the federal and state sectors, 75% of the private sector, and 36.5% of the municipal sector. Within the sectors, the responses were similar, with the exception of the federal sector, due to the low number of agencies involved (two) and their differing functions. In the federal sector, the U.S. Coast Guard Marine Safety Office has some qualified personnel but limited response equipment (mainly environmental monitors) and capability. This is due to their role primarily as a consulting group in the event of a major incident. They can assume the role of the Federal On-Scene Commander if the incident is large and justifies federal intervention, or if so requested by the Governor. They also have the capability to call in one of the three strike teams from the Coast Guard's Strike Force, a national pollution incident emergency response group. These teams consist of highly trained and qualified personnel, and dedicated, pallatted equipment that can be transported onboard a C-130 aircraft to an airport location near a major incident. Unfortunately the nearest team from the Strike

Force is the Atlantic Team, located at Fort Dix, New Jersey, and it would require a minimum of eight hours, and more likely 24 hours, to be on-scene with response personnel and equipment. That may be satisfactory and beneficial if the incident involved a medium-weight oil spill, but would be far too late for a gaseous chemical leak that was immediately dangerous to life and health. A locally-based team that is immediately dispatchable would be far more effective and would significantly reduce the response time.

While the role of the Coast Guard Marine Safety Office is primarily consultative, the Response Team at the Naval Education and Training Center (NETC) in Newport has a role of direct response. The team is well equipped, staffed, and trained. The team has dedicated vehicles, an ample supply of equipment, and a crew that is all certified through the NFPA 472 hazardous operations level, (a national standard certification level requiring a minimum of 40 hours of didactic and practical training) and has several members who are certified to the technician or incident commander level. (These two national standard levels are achieved by additional training, up to 160 hours, beyond the operations level.) The team has a mutual-aid agreement with the adjacent communities of Newport, Middletown, Portsmouth, and Jamestown, and has both exercised with and responded to actual incidents in these municipalities. The team would be willing to respond to a distant part of the state if requested to do so by the head of the involved municipality or an officer from the State executive branch, however it would need permission from both the commanding officer of the Naval Base in Newport and its parent command in Groton, CT. Obtaining the necessary authorization could take a significant amount of time and delay response. Response time to an incident in the Greater Providence area would be approximately two hours from notification, at a

minimum. Although a well-prepared and equipped team, it would also be unsuitable for a rapid response to an incident in the Greater Providence area. It would be suitable however, for incidents in Washington (South) and especially, Newport counties due to their closer proximities. Analysis of the survey data (see Appendix L) showed that the private sector response teams are the best equipped and staffed. This is mainly due to the fact that private corporations are willing to put money into response teams to reduce their liability in the event of a spill or incident. However this liability also restricts their willingness to respond to incidents outside their limited jurisdiction. The Providence and Worcester (P&W) Railroad Response Team will only respond to rail incidents but will respond to any rail incident, whether or not P&W is involved. The response team from George Mann & Co. in Providence, a manufacturer and distributor of industrial heavy and specialty chemicals, will not provide outside response, but will loan response equipment if requested. The Hoechst Celanese Chemical Emergency Response Team, in Coventry, will respond if requested.

The state sector has three components with varying degrees of capability. The Narragansett Bay Commission (NBC), as stated before, has a team for its own treatment facility, but they are restricted to on-site response. The Emergency Management Agency has some personnel who could provide technical advice, similar to the Coast Guard, and a mobile command post. The Department of Environmental Management has a few well-trained personnel with appropriate equipment and has responded to 122 incidents over the last five years. However, they do not have mutual-aid agreements with any of the municipalities and do not drill with any of them on a regular basis. Their senior responder, John Leo, will be retiring within one year, and the state will be losing a major resource of knowledge and skill.

Primary responsibility for hazardous materials is assigned to the local fire commander according to Annex J, Hazardous Materials, from the State of Rhode Island Emergency Operations Manual. The municipal sector including city departments, fire districts, and volunteer groups already handles most of the hazardous materials response in the state. I received responses from less than half of the municipal agencies (I was forewarned that municipal fire chiefs or their designates would be reluctant to respond, as it might bring their capabilities under critical scrutiny)⁴², and they reported that they had been responsible for 108 incident responses over five years. The municipal teams were also some of the least trained and least well equipped. Of the entire group of responses from the municipal agencies there were only two teams that had Level A response capability (Portsmouth and Smithfield, for a total of eight encapsulated response suits). There was also a wide variety of responses to questions regarding mutual aid, from one Chief stating he had no knowledge of a hazardous materials response program, to others subscribing to a statewide mutual aid system (two respondents). Most municipal agencies limited themselves to responding to adjacent communities (9 responses).

The U.S. Agency for Toxic Substances and Disease Registry's publication *Managing Hazardous Materials Incidents, Volume I: A Planning Guide for the Management of Contaminated Patients*, recommends the establishment of mass screening and decontamination centers in the event of a chemical mass casualty incident. It further advises that patients should be decontaminated prior to transport to hospital emergency departments. Since the main resource for decontamination of personnel rests primarily with the local response agencies, particularly the fire departments, their priority in a mass

⁴² Interview with East Providence Fire Chief Gerald Bessette, President of the Rhode Island Fire Chiefs Association, February 6, 1996

casualty situation should be the decontamination of the injured and exposed, so that they can receive further medical care. A dedicated agency responsible directly for response operations for hazardous materials incidents, that does not have to be preoccupied by other responsibilities, such as patient decontamination, would be more effective, than multiple small agencies with a variety of responsibilities.

Capt. Thomas, director of hazmat response and training for the Fire Department (PFD) of the City of Providence, the state's largest city and its capitol, was very candid while being interviewed. He said that because the City has numerous sites that use hazardous materials and because all major state transportation routes pass through it, the City is seriously lacking in response capability. When queried regarding the PFD's Special Hazard Unit, he responded that it should more accurately be called a Heavy Rescue Unit. He said that while the men have some of the necessary training, they do not have the equipment necessary for a major or dangerous hazardous materials incident. He also pointed out that the City would not pay for the medical monitoring costs of hazardous materials responders as required by federal law. Capt. Thomas stated that while the PFD occasionally participates in drills, usually at T.F. Green Airport in Warwick or with the area hospitals, his crews are not capable of providing adequate response without additional funding and support for equipment, training, and support functions. In a time where the City already has one of the highest tax rates in the state, and firefighter pension costs are skyrocketing, city officials would be hard pressed to propose tax rate increases for additional response funding.

For an adequate response program to exist, efforts need to be coordinated and costs spread and managed to be reasonable to all. As NETC Chief Westcott told me, "I can't understand why everyone in Rhode Island is so parochial!"

C. Analysis of Response Data

To compare and contrast the response capability within the various sectors, I compiled the survey response data and evaluated the advance response capability per sector. To determine the advance response capability I created four criteria generalized to serious hazardous materials incidents and one specific to chlorine incidents. The first criterion was a percentage of the designated response personnel who were trained to the advanced NFPA 472 (Standard for Professional Competence of Responders to Hazardous Materials Incidents, 1992) levels of Hazardous Materials Technician or Specialist. I selected these levels because these personnel would be proficient at dealing with major incidents due to their advanced education and training. These personnel by definition would have the training to control and contain a major incident. Unlike personnel trained to the lower levels of First Responder Awareness, who can identify incidents and alert personnel, or First Responder Operations, who can take measures to keep incidents from spreading, personnel trained to the Technician or Specialist levels can take all necessary action until a major incident is concluded. As these are the people directly taking action to contain and mitigate an incident, which typically is very strenuous due to the heavy and bulky personal protective equipment, there should be sufficient personnel trained to this level to rotate out in shifts and provide personnel recovery periods. At a minimum, three teams of five should be available to provide a sustained, effective response. Of the teams responding to the survey, only the Providence Fire Dept., Jamestown Fire Dept., Hoechst Celanese Chemical Co., the P&W Railroad, and the Newport NETC could provide responders to meet this criterion.

The second criterion was the percentage of designated response personnel who were trained to the NFPA 472 Incident Commander level. By definition the Incident Commander is the person who is responsible for directing and coordinating all aspects of a hazardous materials incident. As the Incident Commander will be the single person who has accountability for the safe conclusion to such an event, a person certified and designated as an Incident Commander should have a high level of education, proficiency and skill. Thus, an agency that has at least three persons certified at this level would be in a much better position to handle a major incident. Teams meeting this criterion in their survey response are: Providence Fire, Bristol Fire Rescue, Central Falls Fire, Harmony Fire, Jamestown Fire, Oakland-Mapleville Fire, Portsmouth Fire, the USCG Marine Safety Office, the NETC Fire Dept., RIDEM, RINBC, and all three private sector teams.

The third criterion was the number of Self Contained Breathing Apparatus (SCBA) available per designated response personnel. This number is very important because battling a major incident will usually take many trained persons several hours. The time that SCBAs can supply air varies by the age and type of SCBA, as well as the demand of the user, but the typical maximum of newer SCBAs is one hour. Therefore to battle a major incident properly, an agency should have sufficient SCBAs to provide responders with air over a long period of time. If an agency also has a portable pressurized cascade system with which they can refill SCBA tanks at the scene, this both extends the agency's time on scene, and reduces the number of SCBA tanks that the agency needs to have on hand and decontaminate post-incident. A minimum of 30 SCBAs should be available, to provide a second for each of the minimum 15 personnel responding, allowing second entrance to the incident scene and refilling without waiting if a cascade system is available. Of the survey respondents only Bristol Fire Rescue,

Cranston Fire, and Central Falls Fire met the criterion.

The fourth criterion was the number of Level A response suits available per designated response personnel. To be equipped properly to fight any major hazardous materials incident, a team must have Level A suits that are fully encapsulating, chemical resistant suits with SCBAs that are non-gas permeable for a minimum of one hour. Level A suits provide the highest level of respiratory, skin, eye, and mucous membrane protection and should be used whenever the most dangerous chemicals are encountered or if the chemical is unknown and severe effects are observed or suspected. Some of the agencies surveyed based their purchase of Level A, B, or C suits on the chemical inventory of users in their jurisdiction. This is shortsighted, as an incident may be initiated when a very hazardous chemical is transported through the jurisdiction or in the event the agency is called upon to provide mutual aid to another municipality. Level A suits are expensive, costing between \$1-2 thousand per suit, making purchase of multiple suits cost-prohibitive for many agencies. At a bare minimum, however, there should be a level A suit for every one of the minimum 15 responders. This response on the survey was very revealing as only seven agencies had any level A suits at all, and the only team with more than 10 was the Hoechst Celanese Chemical team. Of the municipal sector, only Portsmouth Fire and Smithfield Fire reported having any level A suits.

Because of the widespread use of chlorine or derivatives in wastewater treatment and other applications, I included a fifth criterion which is the number of chlorine kits per response team, within the various sectors. Although I specified in the survey the type (i.e., size) of kit, (A, B, or C), I included an agency if it had any size kit for chlorine incident response. Each agency should have at least one chlorine kit, of a type determined at the discretion of the agency head. Of the survey respondents, all three

private sector respondents had chlorine kits; only Narragansett Fire and Portsmouth Fire in the municipal sector; and the NETC and NBC both had kits in the Federal and State sectors, respectively.

A summary of the five elements sorted by sector is listed in the table below:

Advance Response Capability per Sector

Sector	S+T/Pers.IC/ Pers.	SCBA/ Pers.	Level A/ Pers.	CI Kits/Team	
Private	84.48%	33.62%	0.224	0.431	2.000
Federal	22.64%	08.89%	0.278	0.333	0.677
State	91.30%	30.43%	0.304	0.435	0.333
Municipal	06.41%	04.81%	0.252	0.006	0.158

S+T/Pers. - Percentage of Response Personnel trained to advanced levels of Technician or Specialist

IC/Pers. - Percentage of Response Personnel trained to advanced level of Incident Commander

SCBA/Pers. - Number of Self Contained Breathing Apparatus (SCBA) per Response Personnel

Level A/Pers. - Number of Level A suits available per Response Personnel

CI Kits/Team - Number of Chlorine Kits (A, B, and/or C) available for teams within sector

These data show two significant features. The first is that of the four sectors analyzed, the private and the state sectors are the best prepared for significant hazardous materials incidents in both personnel training and equipment. The second is that the municipal sector (which also includes fire districts) is severely under-equipped and untrained to handle major incidents. There are few personnel trained to the advance hazardous materials response levels and very few Level A response suits. Unfortunately, in most major incidents, both by past experience and by protocol from the state Emergency Operations Plan, the municipal sector will have primary responsibility for response to hazardous materials incidents. Two of the three private sector companies responding to the survey have indicated that they would not respond to outside requests, and the third is in a remote location within the state. Of the state agencies, only the RIDEM could provide any significant response capability, and the maximum number of personnel they could supply for response would be seven, if all were available. The Federal sector, has two agencies, with one primarily consultative and one capable of response. However the NETC response team would need to wait for authorization from their parent command and once authorization was secured response time to the scene of

an incident in Providence would be two hours.⁴³

Since immediate response, in time to prevent or diminish major detrimental effects to the public effectively is going to fall on the shoulders of the municipal responding agencies, it follows that these agencies should be the best prepared in terms of personnel, training, and equipment. However, with the fiscal realities of creating and maintaining such teams, and the difficulties of revenue generation in the municipal sector, the most effective and proven way to proceed is to develop a team similar to the regional response teams in Massachusetts.

⁴³ *Rhode Island and Southeast Massachusetts Area Contingency Plan*, U.S. Coast Guard Marine Safety Office Providence, Annex F Appendix 1 Tab A Page 13, 1995

Chapter 5 - Improvements for the State of Rhode Island

A. Development of a Regional Response Team.

When contacted in November 1996, John Leo at the Rhode Island Department of Environmental Management stated he had responded to 419 hazardous materials incidents in the state in the last 35 months. As his retirement was approaching he knew he wouldn't be responding much longer and expressed a need for the state to devise a better process for response in case of such incidents. One such incident had happened just a few Sundays prior at the Davol Chemical Company on Sockanosset Crossroads in Cranston. A small leak in a 50-gallon chlorine container had caused an area of the plant to be evacuated. Cranston Fire Department (CFD) officials arriving on the scene determined they did not have the appropriate equipment to respond, so they allowed the plant manager to reenter the facility with a handkerchief over his nose and mouth. Within seconds he emerged coughing and wheezing from exposure to the chlorine fumes. CFD allowed him to reenter again with an SCBA on he borrowed from them. Again he emerged coughing and choking. CFD had to wait for several hours to locate a chlorine A-kit to contain the leak. One was located at Quonset Point and was transported to the scene by the North Kingstown Fire Department. The situation was then resolved.⁴⁴ This incident happened directly adjacent to the state Youth Training Facility and just a few blocks away from both the Adult Correctional Institute (ACI) and the Institutes for Mental Health (IMH). Had this been a significant chlorine leak, there would have been insufficient time to evacuate the inmates and patients in these facilities. This is

⁴⁴ Interview with John Aucott, Hazardous Materials Program Manager, Rhode Island Emergency Management Agency on December 4, 1996

confirmed by the fact that when a fire broke out in the medium security facility in October of 1994, it took over eight hours to evacuate the inmates to a safe and secure location. Had the chlorine leak been significant with a strong southerly wind all the inmates and patients at the ACI and IMH could have been exposed to chlorine levels that were deleterious. This situation happened six months ago. It is obvious that the state of Rhode Island needs a comprehensive centralized response program to deal with hazardous materials incidents. The development of a program based on the Massachusetts example would be a fruitful investment and would provide needed protection to the citizens and environment of Rhode Island.

On September 8, 1995, Rhode Island Governor Lincoln Almond signed the Performance Partnership Agreement for Emergency Management between the State of Rhode Island and the United States Government. In this agreement he agreed to reduce Federal Involvement in disaster response and recovery and develop a stronger state, local, and private role and capability.⁴⁵ Development of a Hazardous Materials Response Program that would successfully coordinate the various sectors and provide efficient response to protect the people and the environment would be a major step towards compliance with the Performance Partnership Agreement.

As previously stated, during my attendance at a conference sponsored by the Harvard Medical School and the National Disaster Medical System, the new Massachusetts system was recommended as a prototype for the region and possibly, the nation. The Commonwealth of Massachusetts' new Hazardous Materials Response Program has demonstrated, in the short time it has existed, to be very successful. It could

⁴⁵ *Performance Partnership Agreement for Emergency Management between the State of Rhode Island and the United States Government*, p. 6, Para. III. A. 2

serve as a paradigm for Rhode Island to develop its own response program, on a smaller basis. Each of the Massachusetts Hazardous Materials Response Regions, with the exception of the Metro Boston team, is larger in area than the state of Rhode Island (see Appendix D). One centrally located response team in Rhode Island could provide adequate response capability for the entire state. A location such as the Rhode Island National Guard Headquarters which is co-located with the state Emergency Management Agency on New London Avenue in Cranston would provide easy access to Green Airport, Interstates 95, 195, and 295, US1, US44, and state routes 4, 6, and 10, as well as the Port of Providence and the Rhode Island Hospital complex. The Rhode Island Emergency Management Agency has divided the state into ten groups of Priority Planning Areas to comply with SARA Title III. These tiers are based on population, hazardous material use and transportation, and response capability. The Cranston location would locate the team centrally, since the Rhode Island Priority Planning Areas' first tier municipalities consist of Providence, Cranston, Pawtucket, and Woonsocket, and second tier municipalities are Warwick, East Providence, and Cumberland.⁴⁶

Procurement of one Operational Response Unit and One Tactical Operations Module would provide state-of-the-art equipment for the team and also provide an adequate platform from which to manage any incident. Initial cost for procurement would be approximately \$600,000.

To develop a single team of 60 members consisting of 45 responders and 15 support personnel would require first-year outlays for comprehensive physical examinations, initial technician level training (160 hours for the responders) or support

⁴⁶ *Map of Priority Planning Areas in Rhode Island: Emergency Planning and Community Right to Know Act (SARA Title III)*, R.I. Emergency Management Agency

staff training (40 hours), pagers for all personnel, references, personal protective gear, and mitigation and screening supplies for all members. As FEMA picks up most of the cost for the initial training, the first year start-up costs would amount to approximately \$2000 per person on the team.⁴⁷ In subsequent years, costs should be slightly reduced, to an average of \$1500 per person. Initial personnel funding for a five-year period would amount to approximately \$600,000. Salaries and benefits would be paid by the team member's home department, who would also be responsible for backfilling their vacancy when Hazardous Materials Response Team members are called out for Team service. These departments would then be reimbursed through cost recovery by billing the responsible parties for each incident.

As the State of Rhode Island is much smaller than the Commonwealth of Massachusetts, I believe management of the program could be overseen by one director with a part time deputy director and an administrative assistant. A combined salary and benefits package for the staff of approximately \$200,000; or \$1,000,000 over an initial five year period.

With current downsizing of the state workforce by Governor Almond, space for physical facilities in existing state buildings should not be a problem. A small outlay for restructuring (e.g. modular furniture, phone and data taps, etc.) of the physical facility may be necessary. Therefore, for an initial capital outlay of approximately \$2,300,000, a team could be developed that would be eventually self-sustaining when the cost recovery program was initiated. It is important to provide initial funding for five years to allow the system to be implemented and to allow time for the cost-recovery system to take

⁴⁷ Keffer, William J., *So You Want to Start a Haz Mat Team*, pp. 237-253, Hazardous Materials Response Handbook, National Fire Protection Association, Quincy, MA, 1989

effect and generate sustainable revenue.

Estimate of Startup Costs

Item	Estimated Cost
Operational Response Unit	\$250,000.00
Tactical Operations Module	\$350,000.00
Operational Support Unit	\$50,000.00
Team Member Funding (5 years)	\$600,000.00
Staff Funding (5 years)	\$1,000,000.00
Physical Facility Development	\$50,000.00
Total Estimated Startup Cost	\$2,300,000.00

The initial costs to start the team could be presented to the state legislature as a bill to create and appropriate funds to sustain the team initially. A similar bill passed both houses unanimously in Massachusetts to create their response program. If legislators are not willing to create and fund the team without voter consent, they could present it to the public as an advisory referendum. This would allow the public to give input to the legislature on their perception of the importance of such a system for the public safety and for the environment.

On Tuesday, November 5th, 1996, voters in the state of Rhode Island went to the polls and voted on eight statewide referenda, seven of which were bond referenda seeking funds to improve the state's infrastructure, environmental resources, and higher education facilities. The bond referenda asked for \$80 million for transportation projects, \$40.6 million and \$33.8 million to improve telecommunications and physical facilities at the state's public higher education institutions, \$50 million and \$22 million for freight rail and facility improvements at Quonset Point/Davisville Industrial Park, \$4 million for

purchase of open space, \$5 million for clean-up of polluted industrial sites, and \$18.5 million for improvement to state buildings including compliance with the Americans with Disabilities Act (ADA). The total amount asked for in the bond referenda was \$254 million dollars, a record request in a single year. Figuring in interest, the total rises to approximately \$411 million dollars.⁴⁸ Since the State of Rhode Island's public debt is already among the highest per-capita in the nation, due mainly to the credit union crisis from the late '80's and the operation of the Convention Center, one might expect voters to be frugal and very selective when considering another quarter to half billion dollars worth of debt. The most expensive request, for transportation projects, particularly highway and bridge repairs, comes after a state Bureau of Audits report lambasted the state Department of Transportation (DOT) for its expenditure and contracting practices which led to the DOT going well over budget and beyond the level reimbursable by the federal government.⁴⁹ The seven questions gave voters wide latitude as to where they wanted to see their tax dollars spent.

Voters approved five of the seven bond referenda. All referenda but numbers 6 and 7 passed incurring \$230.6 million worth of additional debt. When interest is figured in this equates to over \$373 million. When the taxpayer is willing to incur over a third of a billion dollars worth of debt for quality of life issues, many of which may not affect them directly, I believe it is reasonable to assume and ask that they approve a nominal sum to protect their lives.

⁴⁸ Kadzis, Peter, Ed. *Vote no on #1 and #8*, p. 10, Providence Phoenix, Vol. IX, No. 44, November 1, 1996

⁴⁹ *Ibid.*, p.10

B. Resurrection of the SERC.

The State also needs to resurrect the Emergency Response Commission. Not only is it federally mandated, but its composition provides a unique resource in mitigation and response planning. With the Lieutenant Governor as the chair it would definitely have a significant voice. As the SERC is also responsible for developing an annual priority list, they could start with a review of all the local plans to determine if they are satisfactory, and would provide feedback to the LEPCs. This would also satisfy the requirement to review local emergency response plans. Subsequently, the priority tiers as developed by the EMA could be addressed and methods to mitigate potential severe hazards could be developed, such as alternatives to certain chemicals, or relocation to sites with less potential impact on the environment and public health.

The current composition of the Preparedness Advisory Council is a good start, but additional personnel could be added to improve the knowledge base in certain areas. Scientists with a background in biological and chemical toxins would provide a resource with knowledge of specific hazards, along with ways to mitigate them and methods for handling exposures to response personnel or the public. If the Regional Response Team were developed, members of the team including the director should have seats on the SERC to provide the insight from their experience. Similarly, hospital and health personnel who will have direct front-line responsibility for triage and treatment of the exposed populace and will be responsible for transfer and stability of patients in the event that their hospital is in the evacuation zone, should be on the SERC, as well. A resurrected SERC could develop subcommittees with appropriate members to develop plans for specific scenarios such as evacuation, or the current media and government

priority topic: terrorism. With the current public feeling of vulnerability after the World Trade Center and Oklahoma City bombings and tensions in the Middle East, particularly Iraq, the government is pouring millions into counterterror programs, mostly focusing on chemical and biological attacks.⁵⁰

Both of these recommendations are important in reducing the potential impact of hazardous materials incidents on the environment and the public health of the state of Rhode Island. The first provides a definite tangible and proactive measure to battle these incidents when they occur, and as shown, would be substantive in diminishing the effect of such incidents. The second recommendation, much of which is already required by federal law, would provide important resources for the development of planning and mitigation policies. Enactment of both of these recommendations would be very progressive for the State, beneficial not only in actual ability to reduce risk and respond to emergencies, but also in the arena of public opinion. Within the State the feeling of vulnerability would be assuaged, and other states could look at Rhode Island as a leader in development of response programs.

⁵⁰ Nelan, Bruce W., *America the Vulnerable*, p. 50, Time Magazine, Vol. 150, No. 22, November 24, 1997

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