

# **THREE**

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## **THE TRANSPORTATION OF HAZARDOUS MATERIALS (HAZMAT) AND THE NEED FOR HEIGHTENED SECURITY**

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The catastrophic events of 9/11 exposed the vulnerability of critical infrastructure and key assets to terrorist attack, and since then the U. S. government has engaged in a concerted effort to significantly bolster the protection and preparedness of these entities. Various means of transportation of individuals, commodities, and substances, all of which play a vital role in the operation of modern society, have received particular emphasis. With attention focused on the multitude of threats facing the nation and the ability of critical infrastructures to confront such dangers, many experts have become increasingly concerned with the transportation of hazardous materials (HAZMAT) within U.S. borders. These materials, when stored in large enough quantities, present the possibility of a cataclysmic loss of life if failure or attack were to occur. Federal agencies such as the Department of Transportation and the Transportation Security Administration have taken important steps to strengthen the protection of HAZMAT transit. However, this critical infrastructure still remains extremely vulnerable. As a result, lawmakers and other officials must immediately address the dangers that the transportation of HAZMAT present and take all appropriate policy measures to ensure the adequate security of this sector.

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## **I. INTRODUCTION**

Since the catastrophic events of 9/11 exposed the vulnerability of critical infrastructure and key assets to terrorist attack, the United States government has engaged in a concerted effort to significantly bolster the protection and preparedness of these entities. Various means of transportation of individuals, commodities, and substances, all of which play a vital role in the operation of modern society, have received particular emphasis. With attention focused on the multitude of threats facing the nation and the ability of critical infrastructures to confront such dangers, many experts have become increasingly concerned with the transportation of hazardous materials (HAZMAT) within U.S. borders. Millions of tons of volatile chemicals are transported in over 800,000 shipments each day by means of trucking, rail, air, pipeline, and sea. These materials, when stored in large enough quantities, present the possibility of a cataclysmic loss of life if failure or attack were to occur. Federal agencies such as the Department of Transportation (DOT) and the Transportation Security Administration (TSA) have taken important steps to strengthen the protection of HAZMAT transit, including the implementation of increasingly thorough employment screening of operators and the use of risk assessment in modeling the sector. However, this critical infrastructure still remains extremely vulnerable. As a result, lawmakers and other officials must immediately address the dangers that the transportation of HAZMAT present and take all appropriate policy measures to ensure the adequate security of this sector.

## **II. AN EXPLANATION OF HAZMAT TRANSPORTATION**

According to the United States Department of Transportation Code of Federal Regulations 49, a hazardous material is one that is capable of posing an immediate “risk to

health, safety, and property” when transported for commercial or personal use.<sup>1</sup> Its improper release would threaten human life and environmental well-being. The agency has also constructed a nine-class categorization system used for record keeping and for display on placards of HAZMAT in transport. The classes are as follows: explosives, gases, flammable liquids, flammable solids, oxidizing materials, toxic materials, radioactive materials, corrosive materials, and miscellaneous dangerous goods. These materials are transported by nearly every mode of transportation, including truck, rail, pipeline, water, and air at a rate of approximately 800,000 shipments and 8.5 million tons each day. The use of commercial trucks is the most frequent, representing 93 percent of shipments and 43 percent of tonnage transported. In addition, aviation handles nearly 5 percent of daily shipments and less than .05 percent of total tonnage. Finally, HAZMAT is transported by rail, pipeline, and water at a rate of 2 percent of all shipments, while carrying 56% of the daily tonnage.

With toxic chemicals moving with such frequency, volume, and on virtually every major mode of transportation, these substances have a pervasive presence throughout the United States. HAZMAT transportation represents an extremely unique, complex, and important system that involves millions of participants and personnel, including vehicle operators, the staff of private shipping industries, government officials, first responders, and the general public. Due to the sheer number of targets present within this sector and the complexity inherent to effective and efficient operations, the transportation of HAZMAT presents significant criticality and vulnerability for decision makers whom create regulations impacting the welfare of society as a whole.

### **III. THE CRITICALITY OF HAZMAT**

Hazardous materials are utilized in many facets of society and by multiple critical infrastructures. For instance, the agriculture and food sector is reliant upon HAZMAT agents such as ammonium nitrate and potassium oxide for the production and use of fertilizers, which significantly aid in the growth of crops. Water utility infrastructure uses vast quantities of chlorine for purification purposes. The energy sector also relies heavily upon chemicals such as propane, hydrogen, and uranium for the production of various forms of power, including electric and nuclear; without them, the ability for industries to meet consumer demand would greatly diminish. Finally, the public health infrastructure depends upon chemicals such as nitroglycerine, benzoyl peroxide, and potassium for the production of pharmaceuticals and the use of various treatments. Although other critical infrastructure sectors also depend on HAZMAT, these four clearly illustrate the fact that our society relies both on hazardous substances and their safe transportation.

The timely and safe transportation of HAZMAT is vital for sustaining the U.S. economy. Nearly every industry heavily relies upon the use of certain chemicals for the production of goods and the maintenance of facilities, the absence of which would significantly hinder business operations. The production, transport, disposal, and sale of over 70,000 chemicals contribute approximately \$450 billion annually to the national economy and aids in the production of countless goods and services (Stephenson 2005, 2). If a failure were to occur during the transportation, the sector itself, along with the sustained economic vitality of the HAZMAT industry, could be jeopardized. As a result, the financial contribution of the transport of HAZMAT, coupled with its interdependencies with other infrastructures, forces policymakers and the general public to view HAZMAT transportation as a critical issue.

#### **IV. THE VULNERABILITIES OF HAZMAT**

In addition to being essential to the continued operation of various infrastructures, the transportation of HAZMAT is also highly vulnerable to incursion and failure. With the operation of nearly 50,000 companies that transport HAZMAT, with millions of employees, traveling million miles of interstate, rail, air, and water passages, it must be noted that the sector possesses many susceptible targets (Field 2004, 317). Although the DOT and the TSA have issued a series of regulations governing the issuance of licenses for individuals that transport dangerous substances, the labeling of containers, and a number of en route procedures, there still remains little to no security for these products along the vast network of routes. Further, these two federal agencies should play important roles in providing oversight of this sector, expanding their jurisdiction in the wake of 9/11. In essence, the DOT and TSA have dual authority over HAZMAT transportation and both are compelled to issue regulations that increase the safety and preparedness of the sector, directly providing a benefit to the overall security of the nation.

Failures within the system have the potential to result from human or technological error or from malicious attack at the hands of terrorist organizations. Since the events of 9/11 and the growth of homeland security infrastructure within the U.S., policymakers have devoted a great deal of attention towards the latter threat. However, there has been no incident or attempted terrorist attack upon transported HAZMAT. Instead, the greatest damage within this sector is the result of accidental human and technological failures.

In December 2000, DOT estimated that on average, two dozen deaths and more than four hundred injuries occur annually due to a total of over 13,000 unintentional releases of HAZMAT in transportation, resulting in \$213 million worth of damages (Rothberg 2000, 1). In addition, the number of failures within the sector has been steadily increasing in recent years. In 1992, there

were 283 accidents or derailments reported to DOT, which jumped to a figure of 388 in 2001, an increase of 73 percent (Field 2004, 318). Such failures have generally been the result of vehicle collision, improper handling, and mechanical malfunctions. While none of these incidents have produced a cataclysmic loss of life by conventional definition, the malfunctions in this infrastructure have been the result of human error. It is vital to note, however, that the operations of HAZMAT transport are also threatened by malicious attack. Although these origins are quite different, it is necessary to analyze them simultaneously to illustrate the consequences of failure and the need for heightened protection of HAZMAT in transit. By instituting increased safeguards and preparedness measures, the sector may better identify and track vulnerabilities and take needed strides in reducing the likelihood that human error or terrorist attack could trigger a massive catastrophic event.

Further, although there is no evidence that terrorist organizations have targeted this sector for attack, government officials and private industry have not instituted the safeguards necessary for adequate protection. Extremist groups such as al-Qaeda have recently demonstrated a propensity to use various modes of their enemies' transportation infrastructure due to the fact that they are considered "soft" targets. On 9/11, aircraft were used as bombs, and in Madrid in 2004 and Great Britain in the summer of 2005, public trains and subways provided conduits for attack. According to the Department of Justice, the risk of a malicious chemical release in the foreseeable future is "both real and credible." Through the theft of these materials or through targeted release, terrorists have the potential to negatively impact the health and safety of millions, disrupt local, regional, or national economies, and incapacitate other infrastructures such as drinking and wastewater treatment systems (Stephenson 2005, 2).

The omnipresence of human error and the threat of terrorist attack illustrate two specific areas of vulnerability within this sector. With thousands of vehicles traveling on the nation's extensive transportation networks that have little to no security present en route, there currently exists a large ease of access to points of disruption within the system, either as a result of accident or sabotage. Specifically, areas of access represent locations in which unauthorized individuals may come in direct contact with containers or controls, such as at railroad crossings, exposed pipelines, and truck stops. To compound these protection deficiencies, very little knowledge or sophistication is needed to cause a large-scale failure that would threaten communities.

Generally speaking, HAZMAT is transported in easily penetrable steel containers, which would require the use of a small amount of explosives to create a massive spill. Further, in accordance with DOT regulations, vessels containing dangerous chemicals are clearly marked with placards indicating their contents. While practiced for the safety of travelers and for information purposes of first responders, this labeling system alerts potential terrorists with clear indications as to the presence and type of HAZMAT. As a result, the ease of access and lack of sophistication needed to cause a failure represents key components of the high vulnerability of this sector.

Finally, the interdependencies inherent in this infrastructure represent another facet of vulnerability. Specifically, the shipment of HAZMAT heavily relies upon the effective operation of the transportation sector. Threats that would create a failure within the system include large-scale events such as the collapse of a bridge or tunnel, the crash of an aircraft or destruction of an airport, and the disruption of pipeline systems. While the HAZMAT transit may not be the most pressing concern in the event of such incidents, the effect they may have upon the sector must be

accounted for. Seemingly benign issues such as potholes, improper snow or debris removal, and malfunction of railroad crossings also present serious hazards to the transport of chemicals. Each of these selected deficiencies within the transportation infrastructure possesses the potential to initiate an unintended release of HAZMAT that would endanger the lives of individuals within the geographical vicinity.

In addition, this sector remains heavily dependent upon the emergency services infrastructure for response to and containment of events that do occur. The various fire, rescue, and police organizations that operate in every jurisdiction within the U.S. provide the front line of defense against the perils occurring after the release of a chemical agent. In every major city and in some small localities, the fire and rescue squads house HAZMAT response teams, equipped with protective gear, extensive training, and knowledge of emergency management practices. This sector offers the ability to contain the physical elements of spills while coordinating possible evacuations of residents within the vicinity, greatly mitigating the potential loss of life inherent in incidents involving HAZMAT. Without the proper operation of emergency services and the assistance they provide, the transportation of dangerous substances would be placed in greater risk.

Although HAZMAT transit is dependent upon a number of other critical infrastructures, the need for maintenance of transportation and emergency services is of utmost importance. Due to this heavy reliance upon other vital sectors, the ease of access to possible targets of terrorism, the lack of sophistication needed to initiate a failure, and the presence of both human error and malicious intent, the vulnerability of this sector should be considered extremely high.

## **V. THE THREATS POSED BY FAILURE**

According to many experts within the field, no single target presents a greater threat to human life than hazardous materials (Falkenrath 2005, 9). Specifically, toxic-inhalation-hazard (TIH) industrial chemicals, such as chlorine, ammonia, phosgene, methyl bromide, and hydrochloric acid, have the potential to be extremely fatal over large areas and cause catastrophic events. In truth, these same chemicals were infamously utilized as weapons on the Western Front during World War I (Falkenrath 2005, 9). Generally transported in high quantities in pressurized containers, these chemicals possess the potential to trigger large explosions, vaporize, and disperse in a cloud that can affect an area several miles wide, depending upon the wind and weather conditions at the time. In addition to a massive blast, the most toxic of these materials such as chlorine and ammonia can cause swift death by effectively attacking and shutting down the respiratory and central nervous systems. In this vein, experts have compared the transit of HAZMAT to a poorly guarded arsenal of weapons of mass destruction (Flynn 2005, 2). As further illustration of this threat, in 2002, the Brookings Institution placed the release of noxious chemicals behind only biological and atomic attacks, in terms of the fatalities that could be achieved by sabotage (Stephenson 2005, 2).

While the mass media and lawmakers have begun to warn of the dangers posed by the latter modes of attack, judging by the lack of public debate and mass media coverage, citizens have seemingly not come to terms with the scope of damage and death that HAZMAT poses. In recent years, the Environmental protection Agency (EPA) and the Department of Homeland Security (DHS) have conducted extensive risk assessments to approximate the number of locations most vulnerable to attack within this sector and to predict the extent of destruction that may ensue. According to this data, there are 123 sites in 24 states, adjacent to major metropolitan

areas, where a release could potentially threaten the lives of more than a million citizens. Further, the nation includes 600 sites in which a similar breach could endanger over 100,000 persons (Stephenson 2005, 3). While these figures represent stationary sources, HAZMAT transit equipment also carries enough tonnage of toxic chemicals to cause a devastating event.

Of further importance, the security of these substances en route is significantly less than that present at fixed facilities. If a coordinated attack upon multiple localities were to be simultaneously implemented, as was the case during 9/11, the fallout could negatively impact the well-being of millions of individuals. Clearly, due to the extreme toxicity of HAZMAT, the immediate danger to human health, and the presence of hundreds of locations of high consequence, the transportation of these substances presents an astonishing threat to the nation.

To fully illustrate the perilous effects of an unintentional HAZMAT release, it is helpful to discuss the disaster that occurred on December 3, 1984 in Bhopal, India. In this incident, 43 tons of methyl isocyanate, leaked from a tank at a U.S.-owned pesticide plant, was released in gas form into the air, creating a cloud that descended upon the city. Within weeks of exposure, approximately 3,000 individuals died, and 200,000 were seriously injured. What is particularly striking about this event is that the amount of HAZMAT released was quite small and would easily fit into a single rail car (Merritt 2005, 1).

This event also highlights the dangers posed by a lack of preparation, planning, and coordination of community officials and first responders. Emergency crews arrived at the scene shortly after failure without proper protective equipment or a strategy to initiate measures that would stifle the spread of toxic gases. In addition, law enforcement and fire authorities swiftly went door-to-door, forcing residents to evacuate on foot to avoid contact with the substance. Instead of reaching safety, many ran directly into the noxious cloud, resulting in almost certain

death. If emergency officials had properly gauged the direction of the wind and likely areas to be effected, prudence would have dictated a shelter-in-place order, which many engaged in on their own volition and survived the incident (Merritt 2005, 1). This infamous event illustrates the volatile interaction between a HAZMAT release and a lack of planning, protection, and preparedness of the community, a combination that clearly leads to unnecessary casualties.

Incidents that possess the potential for damaging consequences are not only relegated to developing nations; they can and have occurred recently on U.S. soil. On January 6, 2005, a Norfolk Southern locomotive traveling at 45 miles per hour and carrying 42 cars (five containing HAZMAT), missed a railroad switch, crashing into a parked train outside of a textile mill in Graniteville, South Carolina, creating an immediate derailment and a breach in several of the cargo holds. The collision occurred because the operators of the parked train had failed to manually switch the track back to the main line after use, leading the oncoming locomotive into peril.

One of the punctured cars contained 90 tons of pressurized liquid chlorine, which began to leak, creating a large cloud that descended upon the town. Over a dozen of the 400 workers inside the textile mill responded to the scene, alerting supervisors, contacting local fire and rescue, and helping to evacuate colleagues. Emergency crews reached the scene within an hour's time, lacking protective equipment, and thus exposing themselves to the chlorine gas. Local officials initially ordered residents to shelter-in-place, but once it was determined that the toxic cloud loomed over a majority of the town, the evacuation of 5,400 citizens was implemented. Exposure to the substance resulted in the immediate death of six individuals, with two others dying from exposure weeks and even months later. In addition, over 500 residents sought medical attention for injuries (Mitchell 2005).

This disaster, with approximated costs of \$40 million, was undoubtedly tragic; however, it created far less damage than possible. The sheer tonnage of material present in the damaged container was double that of the incident in Bhopal, yet resulted in significantly fewer fatalities. Fortunate circumstances, such as the slow release of chlorine gas and favorable weather conditions, prevented the cloud of chlorine from consuming the town of Graniteville. While not a catastrophic event, the South Carolina case further illustrates the dangers present in the transportation of HAZMAT and how human error can trigger a massive crisis.

Examples like Bhopal, India, in 1984 and Graniteville, South Carolina, in 2005 clearly and convincingly demonstrate the adverse effects that large chemical spills can cause. Similar incidents, triggered by malicious attack rather than accidental error, possess the potential for still greater devastation. If an immediate release of toxic substances were to occur, initiated by terrorist-implemented explosion, the spill created and the resulting cloud may well affect a large urban center and the human exposure to HAZMAT can potentially be in the hundreds of thousands. These examples, coupled with the aforementioned dangers of chemicals and the presence of a vast network of susceptible targets, indicate that the threat posed by HAZMAT transportation is absolutely real and warrants increased attention and protective measures.

## **VI. PREVIOUS REGULATORY AND POLICY EFFORTS**

Prior to the events of 9/11, federal agencies paid little attention to the threats to HAZMAT transportation posed by malicious attack, focusing instead upon the dangers resulting from human and technological error. Since the 1970's, the DOT has issued strict and detailed rules governing the labeling of chemical containers and the manner in which they were to be transported. Specifically, the placarding system, in which vessels are clearly marked with

graphical symbols of threats, was initiated (Field 2004, 318). The agency also regulated the issuance of licenses for conductors, drivers, and other operators that would be leading individual HAZMAT shipments, conferring a certification upon them once a background check was completed. Within the DOT, the Research and Special Programs Administration (RSPA) and the Office of Hazardous Materials Safety (OHMS) were delegated responsibility for rulemaking, adjudication, and the issuance of federal HAZMAT regulations (HMR) for all issues surrounding the security of chemicals on each mode of transportation including random site visits to ensure compliance by the shipping industry. Concurrently, the National Transportation Safety Board (NTSB), an independent commission, was given authority to conduct investigations of incidents of derailment or accident, to determine root cause and issue reports back to DOT.

Generally speaking, prior to 9/11, if HAZMAT carriers were in compliance with HMRs focused upon the proper handling of toxic substances, the federal and state governments allowed free operation with little to no additional regulation for security purposes. Further, state and local governments played relatively minor roles in the regulatory process, with the primary responsibility of conducting inspections of HAZMAT transports, which has been funded through federal grants since the early 1980's (Field 2004, 3198). Also, since the early 1990's, OHMS has made approximately \$6.4 million available annually for local governments to conduct HAZMAT training and develop detailed emergency plans. Finally, DOT has estimated that 48 of the 50 U.S. states have developed regulations in this field that either match or are quite similar to those issued at the federal level, providing the needed uniformity in the governance of this sector (Rothberg 2000, 3).

These practices were drastically altered in the wake of 9/11, as DOT and the Federal Motor Carriers Safety Administration (FMCSA) implemented measures to increase the

awareness of terrorist threat for chemical transportation companies. In late September 2001, FMCSA began security sensitivity visits to inspect protection, compliance, and to identify serious security risks. Of the approximate 36,000 inspections, FMCSA reported 280 findings of serious suspicious activity, including false personnel information and citizenship irregularities, with 126 of those being reported to federal law enforcement for criminal prosecution (Field 2005, 318). In addition, private industry responded to the growing threat by identifying points of vulnerability and conducting detailed risk assessments. Specifically, the National Association of Chemical Distributors implemented a quality-control program for members, which offered a screening tool for selecting proven transport companies (Field 2005, 318).

Another vital policy initiative that has occurred in recent years is the creation of the Transportation Security Administration (TSA) and the powers conferred to it under the USA PATRIOT Act. This department, created in November of 2001, was charged primarily with bolstering the security of aviation. Its scope of duties is quite broad, including the protection of every mode of transportation within the U.S. While not confronting the issue of HAZMAT transportation directly, the USA PATRIOT Act directed DOT, later passed to TSA, to institute specific and rigorous methods of identification and certification of chemical transit operators. With the institution of comprehensive background checks and the extension of disqualifying crimes to include terrorism, dishonesty, and improper handling of HAZMAT, the 3.5 million current operators are placed under greater scrutiny when obtaining or renewing certification.<sup>2</sup> This system has created long waiting periods for authorization, representing increased cost upon individual drivers and the tens of thousands of transportation companies. In this dangerous field, which historically has had difficulties in attracting staff, the efficiency and effectiveness of the industry has paid the price for increased security. While these efforts, coupled with the past work

of DOT and TSA, have made advances in the protection of HAZMAT transportation, such policy and regulatory actions fall well short of providing the assurance needed within this sector.

Finally, the Hazardous Materials Safety Requirements HM 232, issued in 2003 by RSPA, the DOT division, instituted federal regulations mandating that companies involved in the transport of HAZMAT must develop detailed individual security plans, collectively enhancing the overall protection of the industry. Elements that must be contained in these documents are (1) personnel security, representing the measures taken to ensure the identification of employees and how staff will physically handle HAZMAT; (2) unauthorized access, meaning the steps taken to ensure that individuals with malicious intent cannot gain control of dangerous substances; and (3) en route security, signifying a detailed plan regarding how HAZMAT will be handled during transit.<sup>3</sup> These documents are not submitted to RPSA for review; however, during random site inspections, companies may be forced to produce them. If found not to be in compliance, businesses face relatively subjective fines that are generally less than \$5,000, but hold the potential to be much higher.

## **VII. THE SHORTCOMINGS OF POLICIES AND REGULATIONS**

While the efforts taken by DOT and TSA must be viewed as appropriate steps in the direction of heightened security of HAZMAT transportation, a great deal of work is still needed to institute the strongest safeguards. Regulations including random inspections, risk assessments, and the construction of detailed security plans have been useful, but too much vulnerability remains, due to the freedom that chemical transit corporations have in implementing protection procedures. In recent years, federal agencies have worked closely with private industry to provide financial assistance, convey information regarding protection, assess vulnerabilities, and

recommend increased security procedures (Stephenson 2005, 12). However, no stringent federal regulation has been passed to compel the HAZMAT transportation industry to significantly bolster protective measures. The increases that have occurred have primarily been the result of voluntary actions taken by the largest companies, as a means to prevent accidents that could cost the corporation millions of dollars. However, it is extremely difficult to rely upon profit-maximizing industry to engage in such actions under their own volition, as large security investments diverts capital from other vital areas, possibly placing these firms in a competitive disadvantage in the market (Falkenrath 2005, 13). In addition, executives have expressed concern regarding the liability of business-led security measures, because a breach of the corporation's system could trigger an onslaught of litigation against the companies (Flynn 2005, 3).

Further, many scholars and practitioners feel that lawmakers and federal officials have insufficiently addressed this issue, choosing instead a laissez-faire approach assuming that industry will correct security shortcomings. Congress has appropriated billions of dollars to DOT and TSA to address these issues, which illustrates a focus on inputs instead of desired outcomes (Falkenrath 2005, 12). By engaging in reactionary policymaking, funds have been given to agencies with little guidance or direction to address the myriad of vulnerabilities present within the industry. Not until recently, in April of 2005, did Congressional committees entertain detailed testimony from experts regarding the threats posed by the transportation and storage of HAZMAT, resulting in the proposal of various legislative initiatives to address these issues. While these events offer a great deal of promise, the regulations and policies created in the wake of 9/11 have clearly failed to accurately address the threats to this sector and the nation.

### **VIII. A COURSE OF ACTION**

Due to the insufficient policy actions in response to the transportation of HAZMAT many key steps must be taken to augment the security and preparedness of this sector. From more detailed regulation to tax incentives for businesses to comply, lawmakers, private industry, and federal, state, and local officials must act now, utilizing a framework that relies upon vulnerability identification and risk assessment. While the President has the authority to direct executive-level agencies to take action, federal lawmakers should introduce these measures through legislation. With pressure from Congress and the support of the President, departments such as TSA and DOT would have the power to greatly increase security within this sector.

#### **Federally Led Risk Assessment**

First, federal agencies such as DOT and TSA must be compelled, by legislative mandate, to assess the entirety of the HAZMAT transportation system and identify the most critical and vulnerable areas where a failure could trigger a catastrophic event, labeling them as high priority. These measures would advance the work initiated by the DHS and the TSA by examining all high-volume transportation routes and points of access, allowing for improved modeling and understanding of the system. To accomplish this task, the vulnerabilities present and the risks facing these areas must be quantified, to be able to compare sites against each other to form a hierarchical ranking. With this in mind, the areas that would most likely place high on this list are major metropolitan jurisdictions.

Concurrently, any geographical area through which the most volatile chemicals, such as TIH industrial products, are transported must also be assigned a high ranking. To properly conduct such a process, either federal agencies or third party organizations must engage in extensive inspections of the transportation equipment and routes of travel to assess points of

access and potential failure within the system. A study under these basic guidelines, placing focus upon the most deadly substances and the most vulnerable locations, would provide federal agencies and lawmakers with vital information to guide the issuance of regulations and the provision of funds to increase security. Due to the fact that hundreds of thousands of targets exist, providing additional protection for all locations would be futile; therefore, such a system of identification and ranking is necessary.

### **Increased Surveillance and Law Enforcement Tactics**

Parallel with such efforts, Congress must enact legislation that allocates funding for federal agencies to establish more stringent security measures along the most vulnerable transportation routes, generally occurring within large population centers. Included in this area would be the placement of surveillance and monitoring equipment such as cameras and sensors to detect threats such as the hijacking of transit vessels and the placement of explosive devices. In addition, DOT and TSA must coordinate with state and local law enforcement to develop an increasingly rigorous method for police to patrol and first responders to gain access to vulnerable areas. Under this subset, law enforcement should consider the use of additional inspections of HAZMAT transports, while also ensuring the presence of effective routes for the deployment of emergency services to reach the scene of possible incidents. Finally, in terms of the physical placement and security of chemical transit, Congress should direct federal agencies to examine the possibility of diverting shipments away from major urban areas. Because thousands of tons of HAZMAT travel through our nation's cities on a daily basis, a failure of the system occurring in a densely populated area would reap disastrous consequences. While such action may not be possible for municipalities that have end users within city limits, shipments that merely bypass the locality must be considered for diversion. Therefore, studies should be conducted by DOT

and TSA to determine the feasibility of rerouting chemical shipments, in the forms of truck, rail, and water, away from metropolitan areas. With increased surveillance tactics, law enforcement patrols, and the avoidance of dangerous materials flowing through major population centers, amplified security measures would be applied to this vulnerable sector. Similar methods have been utilized for aviation post 9/11 such as the airspace restriction placed for the entirety of Washington, D.C. While these measures are undoubtedly appropriate, the implementation of like standards must be explored in relation to the transportation of HAZMAT.

### **Novel Policy and Regulatory Measures**

Congress must direct increased funding and support for research and development efforts in many of the facets within the transportation of HAZMAT, while also mandating the inclusion of advanced regulation. As advocated by Richard A. Falkenrath, former Deputy Homeland Security advisor to President Bush, lawmakers must direct DHS and DOT to implement increased policy, regulatory, and funding initiatives within this sector. First, DHS must require chemical shippers to track the movement of all hazardous chemical in real time through the use of Radio Frequency Identification (RFID) technology. As RFID tags transmit location to the individual companies, this data should be shared with DHS, specifically TSA, allowing the federal agency to monitor movements and detect discrepancies (Falkenrath 2005, 12).

Federal agencies must be given funding to explore the use of biometrics, namely fingerprint identification technology, to be placed on all points of access to HAZMAT. This added layer of protection offers assurance that only authorized personnel have access to harmful chemicals. Concurrently, a portion of this increased funding should be allocated to the research of novel materials to bolster the physical resilience of chemical containers (Falkenrath 2005,22).

The investigation of using reinforced steel or other synthetic materials in chemical shipments may ensure that rudimentary explosives or firearms could not spark a large spill.

Further, Congress must direct DOT to immediately revamp the dated placarding system, which essentially advertises the location of HAZMAT to all (Falkenrath 2005,22). The development of new symbols marking the presence of chemicals must be thorough in practice, in addition to being well communicated to state and local governments, law enforcement, and emergency services. These entities must know the labeling scheme so that if a failure or attack were to occur, responders would be able to recognize what substance they were dealing with.

Finally, lawmakers must significantly increase the civil and criminal penalties for noncompliance with all previous and new regulations put into place by federal agencies (Falkenrath 2005,21). Currently, as previously stated, private chemical firms face fines generally less than \$5,000, which is hardly a deterrent for disobeying mandates. Instead, DHS and DOT must place heightened monetary forfeitures and possible criminal prosecution in rules pertaining to noncompliance. When taken together, these novel policy and regulatory measures represent vital strides that Congress must consider, as they would advance the preparedness and security of HAZMAT transportation.

### **Private Sector Incentives**

While increased regulation and policy measures are needed to strengthen the protection of toxic chemicals in transit, these steps will undoubtedly result in higher costs for private firms within this sector. During current times of economic uncertainty and market fluctuations, the dedication of vital resources will prove unduly burdensome for these companies. In turn, costs will likely be passed to both business and individual consumers, driving up the prices of products from household cleaning supplies to pharmaceuticals. These increased costs, depending upon the

severity, have the potential to at least marginally detract from the financial competitiveness of corporations that depend upon HAZMAT in the global marketplace. Such a scenario is both problematic and unnecessary, as Congress can and must take all appropriate actions to aide the private sector in confronting security issues.

First, lawmakers must pass legislation that provides a suitable level of indemnification for HAZMAT transportation firms, allowing for protection from frivolous litigation providing the company has complied with federal mandates (Flynn 2005, 4). If a terrorist is successful in executing an attack upon chemicals in transit, a firm must be protected from civil liability if they followed all security guidelines. However, this indemnification would not protect companies from prosecution in cases involving misconduct or accidents caused by human error. These steps would quell many of the concerns of the private sector and offer important benefits for compliance. In addition, tax incentives for research, development, and the implementation of improved security methods must be extended to businesses within this area to further spur cooperation. Coming either in the form of credits or reasonable deductions, these steps will ease the financial burden that will be placed upon chemical transportation firms and possibly prevent an increase in costs for consumers.

The private sector will be one of the key stakeholders in these suggested regulatory and policy efforts, and the participation of firms is central to any success that may be achieved. In the years since 9/11, leading corporate firms and executives have participated in a number of homeland security initiatives. However, their roles have primarily been relegated to serving on industry and government advisory groups that engage in strategic analysis of the threats facing businesses. While this function is vital in assessing sector vulnerabilities, many private sector firms have been less than willing to divulge security related information for fear of

compromising proprietary knowledge. As a result, a certain level of incentives must be extended to ease the pain of compliance and to ensure effective operation.

### **Increased Coordination with State and Local Government**

The chemical releases in Bhopal and Graniteville illustrate how the lack of preparation and planning on the part of emergency services and local officials can extend the scope and duration of a dangerous event. Every emergency is first and foremost a local issue; the federal government, and even state resources will not be able to respond immediately. Therefore, communities throughout the United States must be provided the tools and training to confront harmful incidents that may occur as a result of a failure in HAZMAT transportation. No state or locality is exempt from this need, as noxious substances pass within and through their borders each day.

To spur growth in preparation efforts, Congress must allocate additional funding to agencies such as DHS and DOT to be made available to each state for these purposes. Officials would benefit greatly by relying upon the rank-ordered risk assessments to determine which states require the largest amount of resources. In turn, the emergency management department of state governments would then be required to work closely with municipalities under their jurisdiction, establishing comprehensive training programs that teach first responders how to deal with chemical releases and mitigate the resulting damage. Further, state officials must communicate with local leadership to implement comprehensive security plans that will guide their actions in managing disasters and engaging in effective risk communication with the public. Finally, this federal funding must also be directed towards the purchase of equipment necessary during chemical incidents. While these resources may not need to be made available to each locality, they must exist in plentiful supply for various regions throughout the state. By taking

these steps, each community in the U.S. will be acutely aware of the dangers presented by the transportation of HAZMAT and have access to the resources needed to prepare for and manage events that may occur.

The regulatory and policy measures recommended here represent a snapshot of the work that bureaucratic and elected officials need to engage in across all levels of government. While extensive in scope, each of these initiatives must be taken into consideration, modified to fit organizational and budgetary structure, and implemented with great haste to ensure the heightening of HAZMAT transportation security. In addition, every single step must involve increased communication and coordination between agencies such as DHS and DOT to ensure the active participation of key stakeholders such as the private sector and lower levels of government. In recent years, one of the primary criticisms of DHS, and subsequently TSA, is that they have failed to effectively share information within the agency, with state and local governments, industries that own and operate existing infrastructure, and the general public. Such deficiencies must be corrected and all subordinate entities involved must be viewed as equal partners in protection and preparedness measures. Without communication between disparate entities and private businesses, the system in question will invariably fail, possibly placing the lives of millions of citizens in jeopardy. With information sharing firmly in place in each of these recommended steps, the federal government places itself in a position to realize a swift increase in safety within the transportation of HAZMAT.

**IX. CONCLUSION**

The transportation of HAZMAT represents a complex system that is uniquely critical, extremely vulnerable, and capable of creating a catastrophic event. While previous policy and regulatory initiatives have made strides in bolstering the security of this sector, much more work is needed to ensure preparation and protection. The general public would greatly benefit from politicians and federal officials entertaining the aforementioned recommendations, enacting legislation that relies upon the participation of all levels of government and the private sector. The need for attention and focus in this area could not be more vital, and if a rapid response were to take place, the overall safety and security of that nation would be significantly enhanced.

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**ENDNOTES**

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<sup>1</sup> United States, Department of Transportation, Code of Federal Regulations (U.S. Department of Transportation: Washington, D.C.).

<sup>2</sup> 107<sup>th</sup> Congress, H.R. 3162. Washington, D.C.: GPO, 2001: Sec. 1012.

<sup>3</sup> Research and Special Programs Administration, “HM-232 Frequently Asked Question”. U.S. Department of Transportation. Washington, D.C.: 1. Available at [hazmat.dot.gov/riskmgmt/hmt/Security Q & A.pdf](http://hazmat.dot.gov/riskmgmt/hmt/Security%20Q%20&amp;%20A.pdf) (Accessed on 3 November 2005).