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# Creating A Secure Future: Understanding and Addressing the Threat to TIH Rail Cargoes

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### Overview

Since September 11, 2001, and especially in the last three years, numerous articles, op-eds, and analyses have suggested that potential terrorist attacks against tank cars on freight trains transporting a specific type of hazardous material (hazmat) known as Toxic Inhalation Hazards (TIH) pose a grave threat to the American public. A growing number of observers have suggested that the rail industry, Federal government, local communities, and others should take a range of actions to reduce this threat, from fencing and guarding the nation-wide network of tracks and rail yards, to banning shipments of TIH by rail through specific cities, and others.

Toffler Associates has examined this issue and we believe that the threat of a terrorist attack on a TIH tank car, while real, is much more modest than many assert. Unfortunately, in the current climate of debate around TIH and freight rail, it is difficult to arrive at that conclusion. Well-meaning concern about the potential consequences of such an attack

is obscuring some important facts about the threat and painting a picture of the threat that we believe does not conform to reality. For example:

- Many conflate the threat to TIH tank cars with the threat to passenger rail, when in fact they are quite different. In doing so, we fail to appreciate a number of attributes of freight rail operations that differentiate them from passenger rail operations and that actually mitigate the threat of terrorist attack on these TIH cargoes considerably.
- Many perceive an attack on a TIH railroad tank car as something that more or less any sufficiently motivated terrorist organization (or individual) could execute successfully, when in fact it would require extremely sophisticated capabilities. In doing so, we fail to appreciate the variety of security and safety measures present in the rail system as well as the complexity of targeting a specific cargo on a specific railcar, hardened for accident safety, in the midst of a vast and dynamic network of tracks and rail operations.

# Overview

- Many base their evaluation of the threat of an attack on a TIH railcar on scenarios involving hundreds of thousands of consequent casualties, when in fact the demographic, climactic, and other conditions required to create these scenarios are exceptional, and impossible for a would-be attacker to control. In doing so, we fail to appreciate that avoiding moving TIH railcars when such conditions pertain is part of the planning for freight rail operations.
- Many base their assessment of the threat of a terrorist attack on a TIH railcar largely on what terrorists might be thinking and planning, when in fact neither the historical record nor current intelligence suggest terrorists actually have made these targets, or any targets in the freight transportation system, a priority. In doing so, we fail to appreciate both the strategic and the more “utilitarian” calculus that evidence suggests terrorists engage in to determine how they will wage their war against us. Of course, it is dangerous to place all our bets about future terrorist targets and attacks on what terrorists have done in the past – but it is dangerous as well to ignore this evidence and base our assessments and our decisions solely on what we believe our adversaries might do.

No one in the homeland security and law enforcement community, the rail industry, or the public at large should make the mistake of dismissing the potential for terrorist attacks on TIH railcars. We believe a threat exists, and none of our analysis should be understood to minimize the imperative of our nation taking prudent steps to diminish that threat. But we believe that, as a nation, we are failing to understand the real nature, dynamics, scope, and scale of the threat. As a result, we are at risk of taking the wrong actions vis-à-vis that threat, and are at risk of misallocating resources in our efforts to secure our homeland. Some of the actions being advocated are feasible and likely would further reduce what we believe is

already a modest threat, and responsible rail industry and government officials should consider them, and implement them. Other actions would have little effect other than palliative. Still others could actually be counter-productive and increase the risk we face.

Toffler Associates has looked at this issue because we believe our nation’s treatment of the potential terrorist threat to TIH railcars and their cargoes is emblematic of larger problems in our approach to the war against terrorism. We believe it is important to understand this threat for what it really is and to address it proactively and strategically, rather than with an array of non-integrated tactical responses. Considerable investment in improving security in another part of our national transportation system – passenger air – clearly has demonstrated benefits, plus made Americans *feel* more secure, but much of it has been reactive and tactical, and in some ways has shifted the threat as much as reduced it. We cannot afford to continue taking the same approach. In a world of finite resources and a seemingly infinite numbers of targets, our investments in security must be appropriate to the actual risks we face, and our actions must be infinitely wise. In the case of the threat of attacks against TIH railcars, we must understand the complexity of the freight rail system and how that complexity can actually protect us at the same time that we are at risk from it, *if* we are smart enough to use the complexity to our advantage. Similarly, we must understand the complexity and the true nature of the range of threats we face in order to make the right decisions about how to address them. In conducting this study and writing this paper, we hope to inform and shape not only the decisions that government and industry are making about how to secure TIH railcars and their cargoes, but also the larger debate about how to secure our homeland against the range of potential terrorist threats.



Source: Department of Homeland Security.

## Methodological Note

Our charge was to create an objective, data-based assessment of the degree to which TIH railcars and their cargoes in the U.S. freight rail system are likely targets for terrorism. Our approach was to rely on both primary and secondary source research to illuminate the history, current perspectives on, and the assessed characteristics of terrorism with respect to freight rail transportation and other terrorist means. We used previously existing Toffler Associates intellectual property (primarily studies we have conducted on related topics for national security and intelligence agencies of the Federal Government and for select commercial clients) as well as materials published by the rail industry and other transportation industries, by government agencies and Federally-Funded Research And Development Centers (FFRDC), and by academia (encompassing universities and other educational institutions as well as “think-tanks” of various kinds). We also relied extensively on numerous interviews we conducted with officials responsible for homeland security and counter-terrorism, and with relevant subject matter experts from a wide range of industry, government and academic organizations. Upon completing our data-gathering, we analyzed and synthesized our findings and wrote a draft report summarizing our initial conclusions. To help ensure the objectivity of the study and ensure against the possibility of bias or factual error, we submitted the draft report to a blind assessment by two independent third-party reviewers (one individual and one organization, subject matter experts in transportation, terrorism, and national security) and asked for their fact-based, critical assessment of our work to elucidate data gaps,

rebuttable assumptions, logic problems, or evidentiary flaws that demanded we conduct further research and analysis and revise our report. By the design of the study and the terms of the arrangements with the independent third-party reviewers, we accepted their feedback with no counterpoint from Toffler Associates, using their findings and guidance “as-is” to revise our work. The revised report, reflecting the additional research and analysis dictated by the independent third-party review, is the document that follows.

## The “Yin and Yang” of Freight Rail Vulnerability

A first important thing to consider when assessing the threat to freight rail, and particularly to railcars transporting TIH cargoes, is how freight rail is like passenger rail, how it is *unlike* passenger rail, and what those similarities and differences mean in practical terms. Both freight rail and passenger rail are inherently “open” systems. In order for the freight rail system to serve its purpose, people and goods must have easy access, and the trains must traverse the length and breadth of the country, including passing through our major cities. The same of course is true for passenger rail. Tens of thousands of people “touch” both systems, quite literally, every day, in locations so numerous and dispersed that comprehensive guarding, fencing, or other securing by some other means is impossible. Indeed, neither system could function if security safeguards limit openness substantially. Juxtaposed with this fundamental similarity is an equally fundamental difference between freight and passenger rail. Because passenger rail exists solely to transport people, an attack on any passenger train anywhere in the country at any time would have a high degree of probability of killing or injuring a substantial number of innocent people, and thereby of having a powerful shock effect that serves the terrorists’ objectives. Because it exists to transport things and its proximity to masses of people is secondary, generating the same kind of effect by attacks against freight rail requires the terrorist to focus on very specific “point targets” such as TIH railcars which we’ll see are difficult to find and successfully attack, for a number of reasons. It is this “complexity” of the freight rail system as a



Figure 1: Map of Class I Railroads (Source: U.S. Geological Survey, National Atlas of the United States)

target, relative to passenger rail and other elements of the national transportation system, that makes all the difference and makes successful attacks against TIH railcars and their cargoes considerably less of a risk than some observers believe. While the openness of the passenger rail system is purely a vulnerability, we can see that the same openness represents a vulnerability in the freight rail context but also is its own form of “safeguard” or “deterrent” at the same time. A few examples of some specific attributes of freight rail that are intrinsic to system operations illustrate that the picture is more complex than it appears, and that this complexity results in a lower level of threat or risk than one might immediately perceive.

On the one hand, the freight rail industry carries a significant volume and variety of hazardous materials, including TIH. More than 1.7 million carloads of

hazmats are transported by rail annually, including 105,000 railcar loads of TIH substances (chlorine, etc.).<sup>1</sup> The TIH loads are a particular concern given that a minute amount of chlorine gas released from a tankcar (and each loaded tankcar carries on average 90 tons of the gas)<sup>2</sup> to the air can quickly spread and injure or kill people close enough to inhale it. These TIH tankcars and other railcars carrying hazmats are moved by more than 500 different railroads across more than 140,000 miles of track throughout the U.S. that is all but impossible to effectively fence, patrol, or light (see Figure 1).<sup>3</sup> As a result, individuals can get close to the trains, tracks, crossings, and railyards quite easily most anywhere in the system. A reporter in Pittsburgh, PA frames the problem starkly when he describes how he “penetrated 48 plants and the freight lines that service them to reach potentially catastrophic chemicals in populated parts of Seattle,

<sup>1</sup> Rail Hazmat Transportation, [http://www.aar.org/rail\\_safety/hazmat.pdf](http://www.aar.org/rail_safety/hazmat.pdf) (Association of American Railroads (AAR), 2005)

<sup>2</sup> Rail industry operations executive, Toffler Associates interview

<sup>3</sup> U.S. Freight Railroad Statistics, (AAR, Policy and Economics Department, 2006).

<sup>4</sup> Carl Prine, “Terror on the Tracks,” *Pittsburgh Tribune-Review*, 14 Jan. 2007

<sup>5</sup> Toffler Associates analysis of data supplied by AAR and data compiled in the U.S. Department of Transportation, Bureau of Transportation Statistics 2002 *Commodity Flow Survey* (Washington: 2004)

<sup>6</sup> Rail yard manager, Toffler Associates interview

<sup>7</sup> Toffler Associates review of Class I railroad company websites. Many provide approximate departure and arrival dates/times and their general locations.

<sup>8</sup> The Carnegie Mellon Software Engineering Institute, CERT Coordination Center cites 137,529 attacks (one attack can involve one site or thousands of sites) on Internet-connected systems in 2003 alone. Attacks against Internet-connected systems have become so commonplace that counts of the number of incidents reported provide little real or usable insight on the scope and impact of attacks, leading the Institute to stop reporting incident-count statistics in 2004.

freight rail system that are loaded with TIH that are of strategic interest to the terrorist. The sheer mathematics associated with finding the particular car of the particular train that is carrying chlorine gas is daunting.

Other factors related to the scope and openness of the freight rail system further complicate the picture for the would-be attacker. Just as important as the small number of railcars carrying TIH cargoes is the fact that tens of thousands of miles of routing represent a tremendous field in which these relatively few trains can “hide.” Even if there were many more TIH-loaded cars, it would be difficult for the terrorist to pinpoint their location at a particular time in the nationwide labyrinth of tracks, railyards, and switching stations. Of course, despite the size and breadth of this infrastructure web, some have argued that knowing which trains are where at what time is nonetheless relatively simple – one rail employee we interviewed, for example, noted that “there are specifically scheduled times for eleven daily trains to be through”<sup>6</sup> the yard where he manages operations. Indeed, for some freight rail companies, arrival and departure schedules for their trains actually are posted on the Internet for anyone to see.<sup>7</sup> And statistics on the increasing ease and occurrence of Internet crimes suggest that even those rail companies that keep schedules off the public electronic “airwaves” are vulnerable to having their internal communications systems hacked by a determined terrorist.<sup>8</sup>

But the fluid nature of the schedule of train movements, railcar on-loads and off-loads, and so on belies the idea that tracking trains through the nationwide system would be straightforward even for relatively sophisticated terrorists. Even if they could determine the presence of a specific cargo on a specific train, choosing an opportune specific time would be extremely difficult because of the many unplanned changes in scheduled daily train operations. Once each train begins its journey, the certainty and predictability of its location in the system diminishes, in some cases rapidly. Trains get behind schedule, or ahead of schedule, as they make

RAIL PLACARDS			
Class	Division		
Class 1 Explosives	1.1 Explosive	1.2 Explosive	1.3 Explosive
Class 2 Gases	2.1 Flammable Gas	2.2 Non-Flammable Gas	2.3 Poison Gas
Class 3 Flammable Liquids	3 Flammable Liquid	Combustible Liquid	
Class 4 Flammable Solids	4.1 Flammable Solid	4.2 Spontaneously Combustible	4.3 Dangerous When Wet
Class 5 Oxidizers	5.1 Oxidizer	5.2 Organic Peroxide	
Class 6 Poisons	6.1 Poison Liquid	6.1 Poison Liquid	6.1 Keep Away From Food
Class 6 Poisons	6.1 Poison Inhalation	6.1 Poison Inhalation	
Class 7 Radioactive Materials	7 Radioactive		
Class 8 Corrosive Materials	8 Corrosive Material		
Class 9 Miscellaneous Hazardous Materials	9 Misc. Haz. Mat.	9 Misc. Haz. Mat.	9 Misc. Haz. Mat.

Figure 2: Parts of a Placard (Source: CSX Form Rev 2-98)

frequent stops in rail yards to pick up additional railcars and drop off others for delivery to their ultimate destinations.<sup>9</sup> In fact, on average, trains wind up ahead or behind the intended schedule approximately 40-80% of the time,<sup>10</sup> making it difficult for an attacker to know with confidence that a particular tankcar loaded with chlorine or other TIH substances will be where they want it to be in order to mount an attack. In contrast, the scheduling imprecision of passenger rail is not nearly the same concern for the would-be attacker. Because each passenger train will carry innocent citizens, it matters little in their horrific calculus if they miss the opportunity to attack any particular one. Terrorists in search of TIH railcars in the dynamic freight rail system certainly have more clues available to them than someone searching for the needle in the haystack. For one thing, the cars are “advertised” as they wind

<sup>9</sup> Rail industry executive, Toffler Associates interview

<sup>10</sup> Rail industry manager, Toffler Associates interview

<sup>11</sup> 49 C.F.R. § 174.59, Marking and placarding of rail cars: No person may transport a rail car carrying hazardous materials unless it is marked and placarded as required by this subchapter.

<sup>12</sup> Edward R. Hamberger, President and CEO, Association of American Railroads, stated before the U.S. House of Representatives, Committee on Transportation and Infrastructure, Subcommittee on Railroads, June 13, 2006 that “In 2004, U.S. railroads transported 105,000 carloads of TIH to hundreds of [known] origin-destination pairs throughout the country.”

their way through the system – by law, railcars carrying TIH or other hazmats are marked with symbols that convey the contents of the cargo (see Figure 2).<sup>11</sup> These markings are vital for firefighters, safety personnel, and others to know at a glance what they are dealing with in the event of an emergency situation involving a railcar. Of course, it is open knowledge, including to terrorists, what these symbols look like and what they mean, and so anyone can tell which cars are carrying TIH and which are not. But the fact that TIH tankcars are marked only makes them easier to *recognize*, it doesn't make it any easier to *find* these recognizable cars among the thousands of other cars moving across the nation on any given day. Moreover, there is no way for the terrorist to know from the presence of the placard whether a particular tankcar is loaded with TIH or empty.



Another “clue” is routing. TIH tankcars routinely travel from known origin locations (the relatively small number of facilities in the U.S. that manufacture TIH substances) along known routes to known end-user-related destinations (such as factories in industries that rely on these chemicals to manufacture their own products).<sup>12</sup> Observers can safely assume railcars coming into or out of these facilities are loaded with TIH (or that they recently contained TIH substances and still retain residue). At the same time, the trains on which these TIH tankcars travel also carry dozens or even hundreds of other railcars loaded with every imaginable cargo, and as we've seen, the pickup and drop-off of all these cars routinely gets the trains not only off schedule, but also sometimes on to routes other than those anticipated and planned at the origin.<sup>13</sup> Attacking the tankcars as they depart known manufacturing facilities, when the certainty of cargo matches the certainty of target location at or near 100%, is an option for the terrorist; fortunately, security also is greatest at these points of origin, provided by the manufacturer or shipper up to the fence line, and often augmented outside the fence line by shipper-supplied private security forces, railroad police, local law enforcement, and others.<sup>14</sup> The overall effect is to mitigate any advantage a terrorist might obtain from the fact that origins, routes, and destinations of TIH tankcars are knowable and observable.

Even if finding a particular railcar on a particular train at a particular time in the rail system were less of a challenge, we must also consider that TIH tankcars possess design features that limit the likelihood of a successful attack (success to the terrorist being a breach of the tankcar resulting in a release of deadly TIH gas). Stringent Department of Transportation (DOT) design specifications and other quality assurance efforts protect railroad tankcars from damage and rupture in the event of an accident or incident.<sup>15</sup> For example, tankcars are fitted with pressure-relief devices that protect the contents when exposed to pool fire for 100 minutes or a

<sup>13</sup> Rail industry manager, Toffler Associates interview

<sup>14</sup> United States General Accounting Office, *Homeland Security: Federal Action Needed to Address Security Challenges at Chemical Facilities*, GAO-04-482T (Washington, DC: 2004) states that “although the federal government requires certain chemical facilities to take security precautions directed to prevent trespassing or theft, these requirements do not cover a wide range of chemical facilities and may do little to actually prevent a terrorist attack. At the same time, the report also states “The American Chemistry Council now requires, as a condition of membership, that facilities conduct security vulnerability assessments and implement security improvements.” The ACC states that since 9/11, their member companies have invested nearly \$3 billion on facility security enhancements such as intrusion prevention/detection and perimeter protection, screening employees and improving cyber-security ([http://www.americanchemistry.com/s\\_acc/sec\\_mediakit.asp?CID=258&DID=632](http://www.americanchemistry.com/s_acc/sec_mediakit.asp?CID=258&DID=632))

<sup>15</sup> 49 C.F.R. § 179.1 - 49 C.F.R. § 179.500-18

<sup>16</sup> Rail industry executives, Toffler Associates interview, 2005

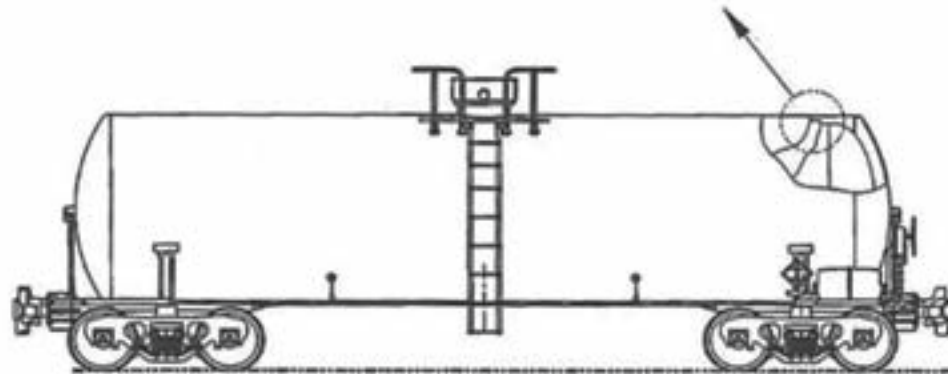
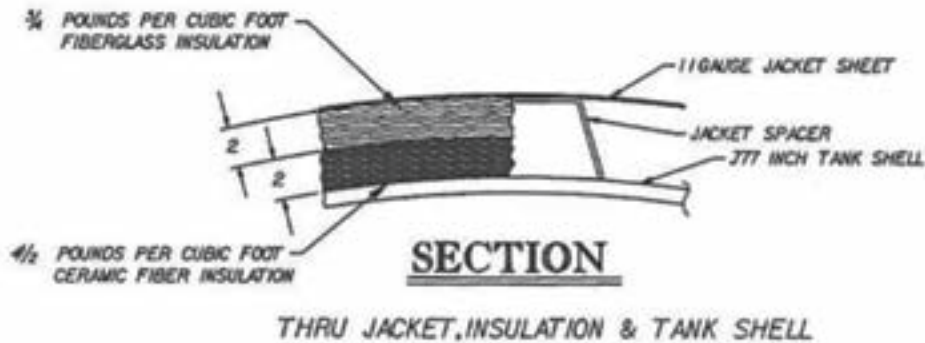


Figure 3: Tank Car Specifications (Source: Department of Transportation, Federal Railroad Administration)

torch fire for 30 minutes, and possess steel-head shields that provide protection from punctures. One industry engineer interviewed for this study, an expert in clean-up and consequence management of rail accidents involving tankcars loaded with hazardous materials, stated “we’ve seen derailments of a 268,000 pound car at 59 miles per hour ... that’s a lot of energy to be released, and still no rupture” of the tank car.<sup>16</sup> Data and reports on accidents involving TIH tankcars amplify that causing a release of the toxic gases they contain is no mean feat. Of the 1002 rail hazmat incidents (16,752 across all modes of transportation) reported in 2005, only 100 were considered serious incidents, with only eight involving poisonous gas.<sup>17</sup> Of course, the conditions that pertain in an accident vary considerably, in a number of ways, from those that likely would pertain in a terrorist attack. Still, experts generally agree that the tankcar designs are sufficient to withstand the kinds of conditions a terrorist attack might create with the capabilities at their disposal. According to one rail

industry hazardous materials officer, for example, “we’ve done tests and you can explode a truck next to one of these cars and it’ll just dent it.”<sup>18</sup> And today, the design standards are becoming even more stringent, further lowering the risk that an accident or deliberate assault on a tankcar could breach the car and cause a deadly release of TIH gas. In testimony to the U.S. House of Representatives Committee on Transportation and Infrastructure, the American Association of Railroads (AAR) explained industry efforts to improve tankcar design and construction. For instance, the Tank Car Safety Research and Test Project, funded by railroads, tankcar builders, and tankcar owners, is analyzing accidents involving tankcars and continually updating a comprehensive database on the nature of damage to tankcars. This data is being used to improve researchers’ ability to identify the causes of tankcar releases and to inform research on improvements to tankcar materials and design specification, development of which the Tank Car Safety Research and Test Project also is funding.<sup>19</sup>

<sup>17</sup> Toffler Associates analysis of the Bureau of Transportation Statistics, 2005 Hazardous Materials Incident Data. (<http://hazmat.dot.gov>). A serious incident is defined by one or combination of the following: a fatality or major injury caused by the release of a hazardous material, the evacuation of 25 or more persons as a result of release of a hazardous material or exposure to fire, a release or exposure to fire which results in the closure of a major transportation artery, the alteration of an aircraft flight plan or operation, the release of radioactive materials from Type B packaging, the release of over 11.9 gallons or 88.2 pounds of a severe marine pollutant, or the release of a bulk quantity (over 119 gallons or 882 pounds) of a hazardous material.

<sup>18</sup> Rail industry executive, Toffler Associates interview

<sup>19</sup> *Hearing on Railroad Tank Car Safety*, Statement of Edward R. Hamberger, President and CEO, Association of American Railroads, Before the U.S. House of Representatives, Committee on Transportation and Infrastructure, Subcommittee on Railroads, June 13, 2006

Finally, we must consider the complexity that climatic and other conditions add to the calculus regarding risk associated with potential terrorist attacks on TIH tankcars. On the one hand, as some have argued in some of the most widely-distributed articles and monographs on TIH threats on the railroads, factors such as wind speed or amount of precipitation in the air could turn a terrorist's breach of a chlorine or anhydrous ammonia tankcar into the equivalent of a "weapon of mass destruction," with deadly gas spreading over a large, populated area killing large numbers of people. Analysts such as Dr. Jay Boris, a senior scientist at the Naval Research Laboratory, have estimated that "more than 100,000 people are at risk within just the first 15 to 30 minutes of a catastrophic accident or attack" on a tankcar carrying chlorine gas through Washington, D.C. Boris has warned that "lethally exposed people can die at the rate of 100 per second" in such an attack.<sup>20</sup> Numerous other concerned individuals and organizations have cited this work, to include the Brotherhood of Locomotive Engineers and Trainmen and the Sierra Club, calling for new actions to control or eliminate the shipment of toxic chemicals by rail.<sup>21</sup>

At the same time, we must consider the extreme dependence of such analyses on assumptions of "perfection" in the climatic conditions, and the rarity of such "perfect" conditions. For example, in the most commonly cited TIH tankcar attack scenario, terrorists successfully create a chlorine gas release from a tankcar crossing the rail bridge adjacent to the Washington D.C.'s 14th Street Bridge on the Fourth of July when there are 250,000 people on The National Mall, all evenly spaced fifteen feet apart, with a "brisk breeze" blowing from the southeast. There are certainly times like July 4th when such mass crowds are gathered in Washington for holiday or other observances, though they are relatively few, discrete, and known well in advance. Moreover, prevailing winds in the area around Washington are from the west much of the time throughout the year. The wind speed equating to a "brisk breeze" is undefined, but the presentation itself states that "the brisk breeze here is a worst case," and the computational model used in this analysis assumes that the exploded

tankcar essentially acts as an infinite supply of chlorine gas. All these assumptions in combination allow the tankcar in the model to continue spewing gas over a huge crowd until the cloud stretches over half the District of Columbia, in order to produce the cited casualty tolls and rates of 100,000 and 100-per-second.<sup>22</sup>

It's important to be clear about our own "assumptions" here, in addition to anything we conclude about the assumptions underlying worst-case scenario analyses like these. A successful terrorist breach of a loaded chlorine tankcar or other TIH tankcar, even in highly "imperfect" weather and other conditions, would kill and injure innocent people. Whether the number killed and injured is one or 100,000, we cannot abide such barbarous acts – anyone harmed is too many harmed. Still, in deciding what actions to take to increase our security, and what threats to guard against in what ways, we cannot consider only the worst-case analyses. There are simply too many worst cases we can posit, involving too many kinds of targets in addition to TIH railcars and their cargoes, and every effort we expend to secure ourselves against one represents resources we cannot devote to securing ourselves against others. Responsible security planning demands we consider worst-case scenarios, alongside a range of other scenarios, and in context, to help ensure we are focusing the right attention on the right risks at the right time.

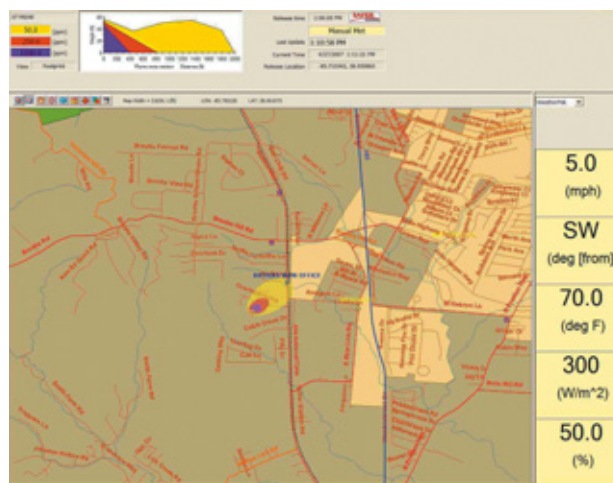


Figure 4: Computer Model of Air Dispersion of a Chemical Release (Source: Center for Toxicology and Environmental Health)

<sup>20</sup> Testimony of Dr. Jay Boris, Laboratory for Computational Physics and Fluid Dynamics, U.S. Naval Research Laboratory, before the District of Columbia City Council, October 6, 2003

<sup>21</sup> Sierra Club, Washington, DC Chapter (<http://www.dc.sierraclub.org/conservation/toxics.htm>); Brotherhood of Locomotive Engineers and Trainmen (<http://www.ble.org/>), *High Alert: Workers Warn of Security Gaps on Nation's Railroads*

<sup>22</sup> Toffler Associates analysis of the testimony of Dr. Jay Boris, Laboratory for Computational Physics and Fluid Dynamics, U.S. Naval Research Laboratory, before the District of Columbia City Council, October 6, 2003

We also must consider how the terrorists themselves might view the need for “perfect” demographic and climactic conditions, and consider the degree to which they might find TIH tankcars somewhat *unattractive* as targets given their inability to control the wind, rain, and other conditions required to create “mass effects” with any degree of certainty. While some argue that even a slim prospect of killing as many as 100,000 people will make TIH tankcars attractive to terrorists as targets, it would be a grave mistake to assume terrorists are not “rational actors” looking for a “high rate of return” when it comes to selecting the targets for their attacks. As we’ll see, the historical record suggests that terrorists of all stripes tend to target and attack the same kinds of things with the same kinds of means again and again, and experts suggest this is in part because those targets and tactics are “proven.” As one official consulted for our study put it, “they don’t want to fail, so they want an operation they can be sure will be successful.”<sup>23</sup> In the pursuit of operational success, terrorism experts point out that “terrorists always go after the weak link” and that it is “typical of groups like al-Qaeda to go back to targets and improve their techniques on past attacks.”<sup>24</sup> An attack on a TIH-loaded tankcar could, in the right conditions, have the massive, ghastly effects that some models and simulations imagine – or if the conditions are less than ideal, it could have quite limited effects. In assessing the threat of such attacks, we must consider the degree to which terrorists (and, as feasible, specific terrorist organizations) are inclined toward “risk taking” versus the “sure thing” when it comes to devoting their own finite resources to planning and executing an attack.

### Capabilities: Who Poses the Biggest Threat and How Are We Equipped to Counter?

If we are to realistically assess the threat we face, it is critical to do as we have above and take into account some of the attributes of the freight rail system and

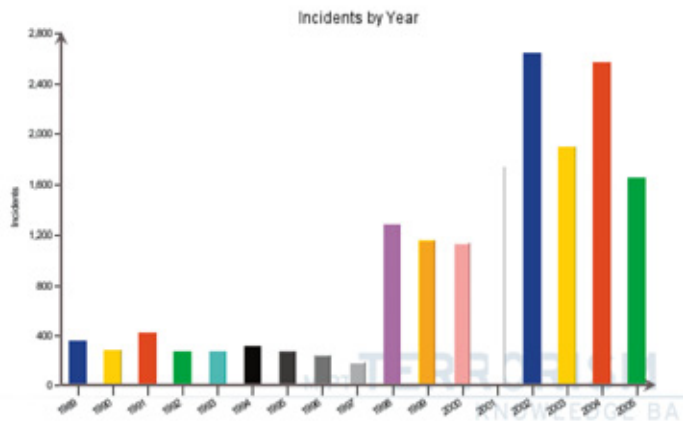


Figure 5: Global Terrorist Incidents (Source: MIPT Database)

operations that present vulnerabilities, or that mitigate the risk of successful attack against tankcars carrying TIH cargoes. Understanding these attributes and the dynamics of freight rail operations helps illuminate what terrorist organizations might be inclined to do based on their own assessment of likelihood of success. But another critical element of assessing the threat, and one that is lacking in much of the attention being paid to this issue, is considering who specifically might attack these cargoes and what capabilities they have that may pertain to such attacks.

Precedent is one lens on the question of terrorist capabilities and the related intentions for using those capabilities. Historically, terrorists have focused little attention on the transportation system (globally or U.S.), less attention on the rail sector (freight or passenger), and have never (seemingly, at least until January-February 2007 when insurgents in Iraq attacked trucks carrying chlorine gas) attempted to use TIH as weapons of mass destruction (WMD).<sup>25</sup> Indeed, of the 26,083 terrorist attacks carried out around the world between 1989 and the end of January 2007 (see Figure 5), only 1398 (approximately 5%) targeted transportation systems and related infrastructure, and only 30 or 0.12% of the total terrorist attacks over

<sup>23</sup> Toffler Associates interview, senior domestic counter-terrorism executive, Washington DC, 21 September 05

<sup>24</sup> “Airplanes Still Targets of Choice,” *The Seattle Times*, August 11, 2006 (Nation and World) at [http://seattletimes.nwsources.com/html/nationworld/2003190835\\_plothistory11.html](http://seattletimes.nwsources.com/html/nationworld/2003190835_plothistory11.html). Regarding the persistence of some terrorist organizations, the article states “Bruce Hoffman, an expert on terrorism at RAND, notes that it’s typical of al-Qaeda to go back to targets and improve their techniques on past attacks. The successful attack on the USS Cole in 2000 followed a failed bid to sink the USS Sullivan in 1999. The 9/11 attacks came eight years after the limited attack on the World Trade Center in 1993.”

<sup>25</sup> On two consecutive days, February 20 and 21, 2007, insurgents in Baghdad, Iraq attacked trucks carrying chlorine gas, resulting in at least 14 confirmed deaths and leading more than 200 people to seek hospital care for treatment of reported symptoms including breathing problems, vomiting, and stinging eyes. In responding to reporters’ inquiries about the attacks, Pentagon officials reportedly said the attack represented at least the third time the tactic had been used, following an earlier incident on January 28 when a truck carrying explosives and a chlorine tank blew up in Anbar province. See Associated Press (online), Brian Murphy, “Nine Killed When Gas Tanker Bombed In Iraq,” February 20, 2007; Associated Press (online), Brian Murphy, “Iraqi Insurgents Use 2nd ‘Dirty’ Bomb,” February 21, 2007; National Public Radio, “Iraq Insurgents Turn to Chlorine Bombs,” February 22, 2007.

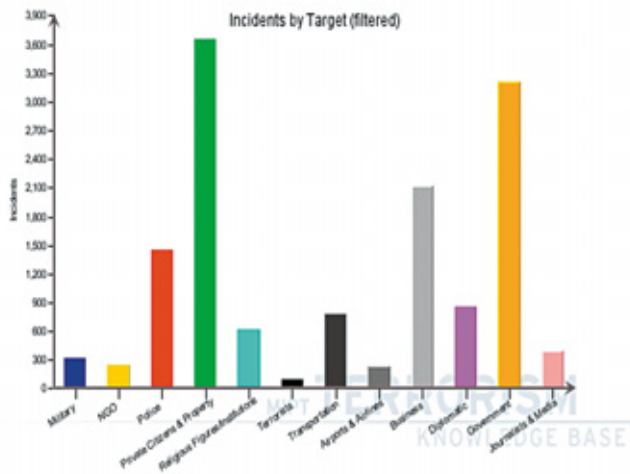


Figure 6: Terrorist Incidents By Target Type (Source: MIPT Database)

that period were against freight rail targets.<sup>26</sup> Attacks on private citizens and property and on government targets are by far the most frequent terrorist objective. Transportation system targets, of which freight rail is a subset, represent only the seventh most popular type of target for terrorist attacks out of twenty-one types of targets by which the Memorial Institute for the Prevention of Terrorism (MIPT) organizes its Terrorism Knowledge Database. The six types of targets more frequently attacked collectively represent more than 75% of the total terrorist attacks since 1989.<sup>27</sup> Moreover, of these seven types of targets most frequently attacked by terrorists, attacks on trains and other elements of the U.S. and other nations' transportation systems have risen the least rapidly over time.

When we zero in more closely on those attacks that terrorists have visited on transportation targets, we find that attacks on the passenger conveyances (trains, buses, commercial airliners) are the clear preference and much more frequently attacked than freight, reminding us again of the important distinctions between the two modes. The bombings of passenger trains and stations in Madrid in March 2004, London

in July 2005, and Mumbai in July 2006 are only among the latest in a tragic history of attacks on passenger transportation targets that far exceeds the history of attacks on freight.<sup>28</sup> Among the attacks on passenger transportation, buses account for the highest number at 416, while passenger rail and passenger air have suffered 146 and 70 attacks respectively. The majority of attacks against rail are attacks on passenger trains in areas of frequent civil unrest and political instability (for example, Pakistan, India, Indonesia), where trains are a primary main passenger transport mode and rebel groups routinely bomb or attempt to derail trains by sabotaging tracks. In contrast, we have seen only 60 attacks on the freight transport system globally in nearly twenty years, with 30 of these against freight rail (along with six on air freight, eleven on maritime freight, and thirteen on freight trucking).<sup>29</sup>

Narrowing our focus even further to consider which terrorist attacks on the freight and commercial cargo system have involved hazardous materials cargoes, the precedent is even less for the kinds of scenarios that some envision. Of the sixty recorded attacks on freight transport through late January 2007, only sixteen involved hazmats (six against commercial trucks, six against rail, and four against maritime freight transports). All sixteen of the recorded attacks on hazmat-loaded freight deliveries involved petroleum.<sup>30</sup> To put it simply: there has never been a recorded attack involving TIH and railroads, in the U.S. or abroad.<sup>31</sup>

Clearly, the recent attacks on chlorine-laden trucks in Iraq are a new precedent, and a troubling one. While it is not proven that the attackers deliberately targeted the gas with the aim of waging chemical warfare and creating mass casualties, it is certainly reasonable to believe this was their intent. According to reports, and as we would expect, U.S. and Iraqi authorities were "left questioning whether the bombing could signal a

<sup>26</sup> Toffler Associates analysis of data compiled from the Memorial Institute for the Prevention of Terrorism (MIPT), Terrorism Knowledge Database, [www.tkb.org](http://www.tkb.org), for the time period January 1, 1989 through January 26, 2007. Transportation systems and infrastructure includes the following MIPT target types: Transportation, Airports and Airlines, and Maritime. Terrorism databases are subject to frequent revision that might affect the results of subsequent analysis. The figures in this paragraph do not include the recent attacks on chlorine-laden trucks in Iraq.

<sup>27</sup> Toffler Associates analysis of MIPT Terrorism Knowledge Database statistics for the time period January 1, 1989 through January 26, 2007

<sup>28</sup> Memorial Institute for the Prevention of Terrorism (MIPT), Terrorism Knowledge Database

<sup>29</sup> Toffler Associates analysis of MIPT, Terrorism Knowledge Database statistics for the time period January 1, 1989 through January 26, 2007. The figures in this paragraph do not include the recent attacks on chlorine-laden trucks in Iraq. Statistics cited here include only those incidents determined to directly target and/or affect a vehicle or vessel. Statistics on terrorist attacks against or incidents involving transportation infrastructure are as follows: rail infrastructure (240), commercial trucking infrastructure (4), bus system infrastructure (97), maritime transportation infrastructure (8), airline and airport infrastructure (178), roadways and/or bridges (133).

new tactic by militants,” and spokesmen quoted U.S. military leaders in Iraq as saying “we are watching the development . . . in terms of it being a trend, we’ll obviously keep an eye on that.”<sup>32</sup> As we’ve suggested above and will explore more below, terrorists tend to repeat what has proven successful, and planners and security officials have no choice but to consider carefully the degree to which, if any, these attacks may make attacks on TIH tankcars in the U.S. freight rail system more likely. Homeland security officials, and security officials at the railroad companies and elsewhere, must now be looking more actively than before for signs of planning for such attacks, and hopefully they already are doing so. Thankfully, while the Iraqi insurgents’ and other terrorists’ methods have indeed evolved rapidly and insidiously to encompass more and more new types of weapons and new forms of attack, to date we have seen little “export” of these methods to the U.S. Moreover, one expert, interviewed for this study prior to the 2007 attacks, offered a perspective that suggests we are unlikely to see much of it in the future. “The tactics these guys are picking up in Iraq and Afghanistan aren’t good urban terrorism tactics for here,” he said – “there, it’s a much more permissive environment, there’s much less security, they know the local language so it’s easier for them to fit in, blend in with crowds, etc – there are all kinds of advantages they have there that don’t translate here, so the concern about them applying tradecraft from the current insurgencies to here, we should take it seriously of course, but we should understand the prospects for what they really are.”<sup>33</sup>

Of course, focusing on precedent, even very recent precedent like this, is looking backward. While the past may be prologue, by no means is it predictive, and we would be foolish to think that, just because we haven’t seen it before, we won’t see TIH tankcar attacks or other freight attacks (or the export of insurgent tactics to U.S. soil) in the future. But as we think about the risk of future attacks, we must keep in mind what we know about the terrorist preference for “proven” targets and methods, alongside the dearth of precedent for attacks

on TIH tankcars. The record of past attacks, as well as judgments of intelligence community experts and others consulted for this study, affirm that terrorists are disposed to go back again and again to what they know from experience they can attack successfully.

Looking at the threat through a different lens – the lens of what capabilities terrorists have to use in the future – may be even more illuminating than looking at what terrorists have done in the past. To understand the potential future threat, we must appreciate that using TIH tankcars as a form of “WMD,” as some scenarios do, requires extremely sophisticated capabilities on the part of the terrorist organization. Different adversaries’ capabilities vary widely, and capabilities matter vitally in assessing the threat.

There are many ways to characterize and understand the range of terrorist groups and the kinds of threats these groups pose.<sup>34</sup> Based on our analysis, several factors are important to consider to arrive at a realistic assessment of our terrorist adversaries’ ability to attack TIH tankcars and their cargoes. If we consider these factors, we see further evidence suggesting that a risk of such attacks exists but is considerably narrower than some believe. Leveraging again the database of the Memorial Institute for the Prevention of Terrorism, we can see that more than 883 terrorist organizations have been identified throughout the world – how many of them would be able to attack a chlorine tankcar in the freight rail system if they wanted to? Just as we consider the precedent for terrorist attacks on freight rail in general, and for attacks involving TIH or other hazmats, precedent is a first factor we must consider in the context of specific terrorist adversaries – that is, who is out there and what have they done in the past that demonstrates a capability (or even desire) to attack freight rail or TIH tankcars. Separately, but clearly related, we must also consider that, of all the terrorist organizations our intelligence and law enforcement officials have identified, some are actively operating in the United States and some are not (indeed, many

<sup>30</sup> The figures in this paragraph do not include the recent attacks on chlorine-laden trucks in Iraq. Of those three reported attacks, two were against pickup trucks rather than commercial vehicles, and when they are eventually included in the MIPT database likely will be counted in a category other than “Transportation,” most likely “Private Citizens and Property.”

<sup>31</sup> Toffler Associates analysis of MIPT, Terrorism Knowledge Database statistics for the time period January 1, 1989 through January 26, 2007. The number of attacks against hazmat cargoes cited here includes only those incidents recorded by MIPT that explicitly describe the freight cargo disrupted or targeted by the attack.

<sup>32</sup> See Associated Press (online), Brian Murphy, “Nine Killed When Gas Tanker Bombed In Iraq,” February 20, 2007; Associated Press (online), Brian Murphy, “Iraqi Insurgents Use 2nd ‘Dirty’ Bomb,” February 21, 2007; National Public Radio, “Iraq Insurgents Turn to Chlorine Bombs,” February 22, 2007.

<sup>33</sup> Senior executive and analyst, counter-terrorism and homeland security think-tank, Toffler Associates interview

known terrorist organizations have never operated in the U.S.). That is, there may be some adversaries who have demonstrated a desire and/or capability to attack TIH tankcars, but who may not have those capabilities available in the United States and may not be operating at all on our shores. Tracking by experts like MIPT shows that only sixteen terrorist entities are known to have conducted or sponsored an attack of any kind on any target on American soil in the last ten years, including Al-Qaeda, the Animal Liberation Front, the Jewish Defense League, Ku Klux Klan, and the Mujahedin-e Khalq Organization. Of these, only four have attacked any targets in the U.S. national transportation system, none of which were freight rail and none of which involved hazmat cargoes.<sup>35</sup>

A third factor to consider is ideological motivation in each potential attacker and how that may drive them to build or acquire capabilities to attack tankcars carrying TIH as opposed to any other kind of target they might select. Broadly, we can think of at least three types of terrorist adversaries: military-type organizations (groups, sometimes state-sponsored such as Hezbollah, applying terrorist means in support of a government that represents them in some manner); disenfranchised groups that focus on changing the policies or behavior of external governments (for example, independence or separatist movements such as the IRA, or radical ideological groups such as Al Qaeda); and issue-specific groups operating independently to change societal behaviors in a specific area (for example, violent anti-abortion activists like the Army of God). Military-type terrorists appear to have the weakest purely-ideological motive to attack TIH tankcars in the U.S., given the weak connection between the target type and their specific agendas. On the other hand, certain issue-based groups logically have a higher degree of motive. For example, radical environmental protection organizations could see advancement of a broad cause (like ridding the nation of toxic chemicals) in the public horror that would result from attacking

railcars carrying those chemicals through or near highly-populated areas.<sup>36</sup> The disenfranchised groups are the “wild card” in this calculus, since any American target may be as “good” from their standpoint as any other, so long as the power and prestige and sense of security of the U.S. is undermined by their attack.



More salient even than precedent, presence and capabilities on U.S. soil, or ideological objective in assessing the real threat to TIH tankcars and their cargoes are the actual capabilities that active, motivated terrorist groups could bring to bear, relative to the difficult targets these railcars represent. As we’ve seen above, finding the loaded TIH tankcar in the nationwide system and striking at precisely the right time requires extremely sophisticated reconnaissance and surveillance capabilities. Planning such a complex attack, and ensuring the security of this planning against intelligence and law enforcement officials working constantly to infiltrate terrorist organizations and expose their operations, requires an extremely sophisticated “cell” or other organizational structure with superb command and control capabilities. Assuming the capabilities exist to plan and mount the attack, breaching the hardened tankcars requires weapons of considerable explosive and/or ballistic power. Acquiring such capabilities in the first place, and sustaining them in the face of concerted efforts by U.S. homeland security officials to render them ineffective, requires considerable financial and other resources.

<sup>34</sup> For example, see Kim Cragin and Sara Daly, “The Dynamic Terrorist Threat,” RAND Corporation, 2004. Many other frameworks also attempt to characterize terrorism and terrorist capabilities. The relatively simple framework we employ in this paper is based on a range of these models and frameworks including RAND’s, the Memorial Institute for the Prevention of Terrorism, government entities such as GAO and the National Counter-Terrorism Center, and Toffler Associates’ ongoing dialogue with experts and officials in the U.S. intelligence community.

<sup>35</sup> Toffler Associates analysis of MIPT, Terrorism Knowledge Database statistics for the time period January 1, 1989 through January 25, 2007

<sup>36</sup> According to a recent DHS report citing FBI analysis, “special interest extremism has increased. For example, the Animal Liberation Front (ALF) and the Earth Liberation Front (ELF) ... have targeted the auto, fur, and timber industries—including bombing work sites and auto dealerships on at least three occasions. These groups may consider freight rail that moves goods such as sport utility vehicles and lumber as possible targets, although there is no reporting to date to suggest that attacks are either imminent or planned.” See Homeland Infrastructure Threat and Risk Analysis Center (HITRAC), “The Terrorist Threat to the U.S. Commercial Passenger and Freight Rail System, 24 May 2006, p.5

Terrorist Group	Ideology	Sophistication			Weapons			Resources	
		Network	ISR	C2	WMD	Bomb	Arms	Personnel	Funds
Al-Qaeda	High	High	High	High	High	High	High	High	High
Hezbollah	High	High	High	High	Low	High	High	High	High
Yemen Islamic Jihad	Moderate	High	High	High	Low	High	Moderate	High	High
Mujahedin -e Khalq Organization	High	High	Moderate	High	Low	High	High	High	High
Aryan Nations	Moderate	High	High	High	Low	High	Moderate	Moderate	Moderate
Aryan Resistance Army	Moderate	High	High	High	Low	High	Moderate	Moderate	Moderate
Al-Fuqra	High	High	High	High	Low	High	Moderate	Low	Moderate
Cambodian Freedom Fighters	Low	Moderate	Low	High	High	High	High	Low	Moderate
Ku Klux Klan	Moderate	Moderate	Low	High	High	High	Low	Moderate	Moderate
American Front	High	Moderate	Low	High	High	Low	High	High	High
Army of God	High	Moderate	Low	High	High	Moderate	High	Moderate	High
Hammerskin Nation	High	Moderate	Low	High	High	Low	High	High	Moderate
Animal Liberation Front	High	Moderate	Moderate	High	High	Low	High	High	High
Jewish Defense League	High	Moderate	Low	High	High	Moderate	High	High	High
Earth Liberation Front	High	Moderate	Low	High	High	Low	High	High	High
Coalition to Save the Preserves	Moderate	Low	Low	High	High	Low	High	High	High

Figure 7: Assessment of Known Terrorist Organization Capabilities



Our analysis reveals little evidence that any more than a handful of terrorist organizations have or can reasonably be expected to acquire the kinds of capabilities necessary to mount a successful attack on TIH tankcars in the United States. We can evaluate or “rank order” the known terrorist entities according to what we know about them in each of these capability dimensions, and we’ve attempted to do so in Figure 7.<sup>37</sup> Of course, we must be careful not to take this evidence and this analysis too far – we are looking here at *known* terrorist organizations and their *current* capabilities. To paraphrase what former Defense Secretary Donald Rumsfeld said in a different but related context, we “don’t know what we don’t know” with regard to terrorist organizations who may be operating today but have never been identified as such, or organizations that haven’t even yet formed, or the capabilities that known or unknown organizations might acquire in the future. At the same time, we must

consider what we do know about the ability of our adversaries to cause us harm, and specifically their ability to attack TIH tankcars and their cargoes, in making our risk assessments and determining what actions are reasonable and necessary to protect ourselves.

This assessment of terrorist capabilities vis-à-vis the threat to TIH tankcars on the railways is affirmed by our own dialogues with a variety of officials in the intelligence and homeland security arenas, and by published reports from DHS and other responsible organizations. For example, a May 2006 report from the U.S. Department of Homeland Security’s “Homeland Infrastructure Threat and Risk Analysis Center” (HITRAC) notes that “a terrorist attack against freight rail would require ... complex planning, timing, and execution to cause high casualties or costly economic damage,” and suggests that obtaining and employing the capabilities to execute even less complex attacks

<sup>37</sup> Graphic representation by Toffler Associates of our own analysis of information in the MIPT database

<sup>38</sup> Homeland Infrastructure Threat and Risk Analysis Center (HITRAC), “The Terrorist Threat to the U.S. Commercial Passenger and Freight Rail System, 24 May 2006, p.4

<sup>39</sup> Senior executive, U.S. domestic counter-terrorism agency, Toffler Associates interview

<sup>40</sup> Senior executive and analyst, counter-terrorism and homeland security think-tank, Toffler Associates interview

on passenger rail are challenging, even for terrorist organizations as sophisticated as Al Qaeda.<sup>38</sup> According to one senior domestic counter-terrorism official interviewed for this study, “it’s really hard for these guys to obtain things these days” that would make them effective in attacking TIH tankcars ... in no small part because “we’re making things difficult”<sup>39</sup> with our counter-smuggling efforts, penetration of terrorist financing networks, and other tactics.

Similarly, a nationally-recognized terrorism and homeland security expert we spoke with explained that “they just don’t have good infrastructure and capabilities here to pull off attacks like that” – while difficult in the first place, “it’s become even harder for them to ... plan and execute attacks like these that take elaborate reconnaissance” and other sophisticated capabilities.<sup>40</sup> Ultimately, terrorists’ intentions and the inherent vulnerabilities in the freight rail system all matter, but capabilities to bring the “what if” scenarios to fruition are just as important, or more, in understanding the reality of the threat to TIH tankcars in the U.S. freight rail system.

What about *our* capabilities – the technologies and procedures and other resources that freight rail operators and local, state, and Federal law enforcement and counter-terrorism forces have to secure the rail system, and TIH tankcars in particular? What some of our terrorist adversaries can bring to bear in some conditions is formidable, but at the same time, substantial direct and indirect investments by “friendly forces” provide a considerable level of proactive and defensive counter-capabilities.

In the estimation of many, these capabilities significantly mitigate the vulnerability of the system. For example, the foundation of the freight-rail industry’s means for preventing and countering terrorist attacks is a security plan developed in the immediate wake of 9/11. Approved on December 6, 2001, the plan’s development

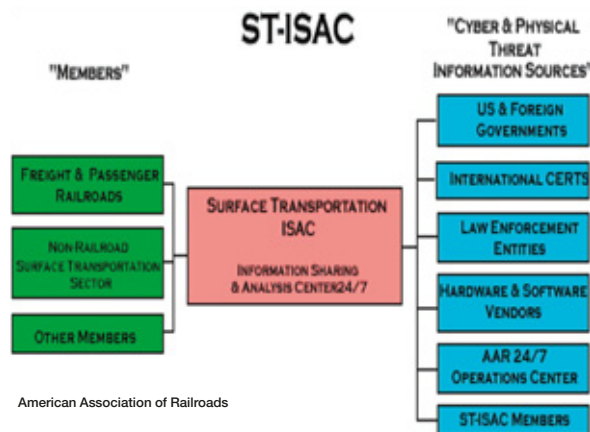
involved more than 100 railroad-industry, government-security, and intelligence personnel who outlined what capabilities were already in place and how to employ them, and what capability enhancements were necessary, in five primary areas: tracking and securing hazardous materials during the “door to door” transport process; securing basic train operations (scheduling, car off-and on-loads, intermodal “handoffs” of cargoes, etc); liaison with the military and intelligence communities; information technology and cyber security (protecting the systems that convey scheduling, routing, and other security-relevant information from hackers); and protecting critical infrastructure. While details remain classified as “Sensitive Security Information,”<sup>41</sup> industry officials have revealed to us that the plan identifies different capabilities and procedures for four different levels of security threat or situation: baseline, elevated, confirmed threat, and following an actual act of terrorism against the U.S. Limited publicly available information about the plan indicates that actions under the different conditions include moving dangerous cargoes away from fences, closing certain entrances to rail yards and other sites, adding police, deploying “car knockers” (inspectors) to inspect trains, and others.<sup>42</sup> Underlying the plan is a detailed vulnerability assessment that classified thousands of bridges, rail yards, and other infrastructure and assets as “critical,” “high-value” etc, and defined capabilities and procedures for securing them at each level of threat.



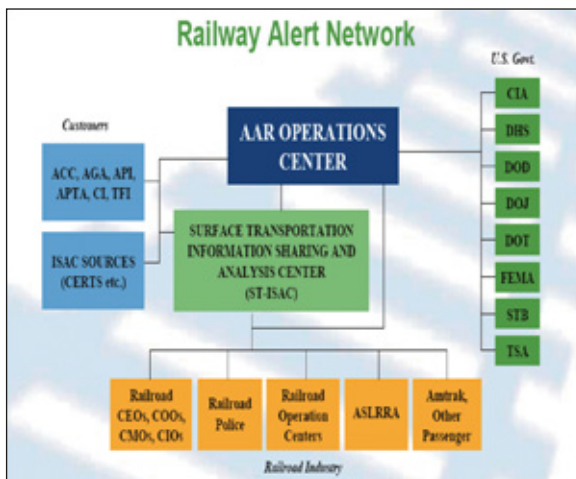
<sup>41</sup> Under the Aviation and Transportation Security Act (ATSA) of 2001 (P.L. 107-71), the Under Secretary of Transportation for Security transferred authority for the existing Federal Aviation Administration regulations to the Transportation Security Administration on February 22, 2002. TSA incorporated these into its Transportation Security Regulations (TSRs) which contain rules on administration, procedure, and security for air, land, and maritime transportation. Subchapter A, titled “Administrative and Procedural Rules,” contains Part 1520, which addresses Sensitive Security Information (SSI), defined as including “information about security programs, vulnerability assessments, technical specifications of certain screening equipment and objects used to test screening equipment ... and other information.” In particular, Section 1520.7(h) covers the release of information that TSA “has determined may reveal a systemic vulnerability of the aviation system, or a vulnerability of aviation facilities, to attack” and Section 1520.7(i) protects “information [released by TSA] concerning threats against transportation.”

<sup>42</sup> Toffler Associates interviews with senior executives and security planners at U.S. and non-U.S. Class I railroads

Numerous government officials and others have had high praise for the rail industry's security plan and the capabilities underlying that plan. Shortly after it was completed, Lieutenant General Steven Blum, then the Chief of Staff at U.S. Northern Command (NORTHCOM), the military command responsible for homeland defense, said that, "[built on] a voluntary, intense, and robust risk and vulnerability analysis ... the National Railroad Terrorism Risk Analysis and Security Management Plan is a model ... [that] the public and private sector should consider ... for wider adoption throughout the nation."<sup>43</sup> Greg Feith, a former accident investigator with the National Transportation Safety Board, has commended how the freight rail industry "took it upon themselves to do a security check, determine their vulnerabilities, spend the money, and implement security procedures which they abide by ... as an industry."<sup>44</sup> Importantly, the capabilities and procedures that form the basis of the security plan are periodically evaluated by the industry based on evolving threats and security technologies, and by intelligence and counter-terrorism officials who are cognizant of emerging terrorist adversary capabilities.



24/7 operations center that monitors, evaluates and communicates intelligence on potential threats to the rail transportation system.<sup>45</sup> Similarly, the Surface Transportation Information Sharing and Analysis Center (ST-ISAC) was established to collect, vet, and consolidate threat information from multiple sources (federal, state, local government, industry, law enforcement, academia, and others) and to sanitize classified information for distribution to industry members.<sup>46</sup> And in this same vein, since 9/11 a rail police officer has sat on the FBI's National Joint Terrorism Task Force, and several rail experts have been permanently posted to two Department of Homeland Security intelligence offices to help evaluate data at the Top Secret level.<sup>47</sup> Of course, numerous reports cite continuing struggles with regard to integrating the information and other capabilities of Federal, state, local, industry, and other officials responsible for homeland security,<sup>48</sup> and we should not assume that the capabilities created to monitor, find, and intercept terrorists plotting against TIH tankcars and their cargoes are immune to these problems, or that they are orders-of-magnitude better than the larger national system of which they are a part. At the same time, there are considerable assets and procedures in place to counter the capabilities of those terrorist organizations sophisticated enough to pose a credible threat to TIH shipments in the U.S. freight rail system, and incremental improvements to the industry's capabilities appear to be improving



Several important new security and counter-terrorism capabilities emerged from the freight rail industry's post-9/11 planning. Among these are the Railway Alert Network (RAN) a DoD-certified,

<sup>43</sup> American Association of Railroads, Freight Rail Security Briefing, 2006

<sup>44</sup> American Association of Railroads, Freight Rail Security Briefing, 2006

<sup>45</sup> Testimony of The Honorable Allan Rutter, Administrator, Federal Railroad Administration, Before the U.S. House of Representatives, Committee on Transportation and Infrastructure, March 5, 2004

<sup>46</sup> Surface Transportation Information Sharing and Analysis Center (ST-ISAC), <http://www.st-isac.org/>

the overall security picture on an ongoing basis. In addition to these specific post-9/11 security capability enhancements, other capabilities that have long been part of rail industry operations also help secure the system directly and indirectly. The rail industry has a number of longstanding capabilities and procedures that were designed to protect cargoes and infrastructure from theft and accidents, and many serve the dual purpose of also deterring terrorism. For example, each Class I railroad maintains its own police force and special agents, including some SWAT-type forces, explosive-detection dogs, and other advanced capabilities.<sup>49</sup> Normal day to day safety procedures (including railcar inspections at stops, at crew changes, and at least every 1,000 miles) limit a terrorist's ability to reconnoiter targets without detection. In addition, all tracks are inspected for safety problems, manually, several times each week and once a month by detector railcars, and these inspections can detect willful tampering with tracks that may have been perpetrated by terrorists. Finally, the freight-rail industry has over 20,000 employees that act as "eyes and ears." Extensive security training has always been part of "standard operating procedures" for railroad employees, and these training programs have increased and expanded every year since 9/11. Moreover, in an age of increasing transience, the railroad workforce is remarkably stable – industry executives, rail "fans" (also known as "trainspotters"), and others all noted to us in interviews and other forums that many of today's railroad workers are second-, third, even fourth-generation members of "railroad families." The tight-knit nature of this workforce limits the ability of would-be attackers to infiltrate and gain access to critical information and equipment (ironically, it is not unlike the closed-community nature of terrorist cells that homeland security experts sometimes cite as an attribute that makes those organizations resilient and hard for U.S. counter-terrorism forces to infiltrate).<sup>50</sup> Key rail jobs, such as engineers and yardmasters, have a low turnover also in part because the pay and benefits

outstrip many others in the transportation industry.<sup>51</sup> Of course, the expanding economy and growth in international trade are increasing demand for freight-rail services, and the resulting increase in railroad worker hiring to meet the demand could undermine this stability and potentially increase vulnerability. Hiring a large influx of new employees in a hurry increases the chance that a "sleeper" terrorist might be hired – though industry practices are already in place, and are increasing, to do background checks of hire candidates to help ensure a high level of security.<sup>52</sup>

Overall, when we compare the capabilities of the potential terrorist attackers to those of the industry and the counter-terrorism forces of Federal, state, and local governments, the picture appears balanced at worst, and in some ways skewed in favor of the "friendly forces." Terrorist capabilities certainly are a concern, and the record shows that they have used these capabilities against transportation targets, including rail targets, albeit infrequently. Continued prudent investment in bolstering our own capabilities remains important, but we must make our decisions about what to invest in and what procedural and other changes to make based on a realistic understanding of the adversary capabilities we face

### **But What If It Happened? Effects of Terrorist Attacks**

Our analysis above suggests that the threat of terrorist attacks on tankcars carrying TIH cargoes in the U.S. freight rail system exists but is relatively modest when we consider the deterrents in system operations alongside the vulnerabilities, and when we consider the real capabilities of specific adversaries relative to our own counter-capabilities. But because the threat is greater than zero, we are obliged to think about the potential effects should such an attack nonetheless occur.

<sup>47</sup> American Association of Railroads, Freight Rail Security Briefing, 2006

<sup>48</sup> U.S. Government Accountability Office, *Rail Security: Some Actions Taken to Enhance Passenger and Freight Rail Security, but Significant Challenges Remain*, GAO-04-598T (Washington, DC: 2004); and see updates from GAO in this continuing analysis in Testimony before the Committee on Commerce, Science, and Transportation, U.S. Senate (January 18, 2007, GAO-07-225T) and Testimony Before Congressional Subcommittees (March 7, 2007, GAO-07-583T)

<sup>49</sup> Rail industry executives, Toffler Associates interviews

<sup>50</sup> Rail industry executives, Toffler Associates interviews

<sup>51</sup> U.S. Department of Labor, Bureau of Labor Statistics, Rail Transportation Occupations (<http://www.bls.gov/oco/ocos244.htm>)

<sup>52</sup> Rail industry executives, Toffler Associates interviews

Terrorist attacks can have two primary kinds of effects: economic and psychological. Economically, the effects involve potentially substantial losses in revenue and/or competitiveness for industries and markets that are vital to the U.S. economy. Psychologically, terrorist attacks erode confidence of citizens in their safety and security, and in the ability of their government and law enforcement officials to ensure safety and security. We have to consider the scope and scale of the potential economic and psychological effects of attacks on TIH tankcars, but it helps if we understand them in context, meaning how they compare to the effects that might result from attacks on other kinds of targets, including transport modes that also carry TIH.

Each transportation mode has attributes that differentiate it from others, and our analysis suggests these differences would have some bearing on the effects that would result from a terrorist attack on each mode. These differences make it a challenge to find ways to “compare apples to apples” when we look across the spectrum of potential targets. To aid in this, we devised a simple “model” which considers what effects would result from a three-day total shutdown of each freight transportation mode, the length of time America’s airlines were grounded in the immediate aftermath of the 9/11 attacks while officials determined what was happening and what if any other immediate threats our nation faced.<sup>53</sup> To assume that freight rail, or trucking, or any other mode of freight transportation similarly would be shut down for three days in the wake of an attack on that mode admittedly is an artificial analytical construct. Numerous differences between passenger airlines on the one hand and the various modes of freight transport on the other suggest that the response might be different. Additionally, we have learned a great deal since 9/11 and put many security and related measures in place that might obviate the need for a three-day shutdown, or might make it an ill-advised response. But making the assumption enables us on at least a basic level to compare and understand the scope and scale of the effects of potential attacks

on different kinds of freight transport and TIH in railroad tankcars and in other forms of conveyance.<sup>54</sup>

From an economic perspective, attacks anywhere in the freight transport system could have major direct impacts on the U.S. economy due to the loss of revenues, disruption of commodities trade, and destruction of infrastructure. Freight transportation moves 11 billion tons of commodities valued at \$8 trillion annually.<sup>55</sup> The indirect costs of an attack could be equally or more significant if we consider the cascading impacts on import-exports and peripheral industries. Whether terrorists attacked rail or trucking or maritime or air freight, a three-day shutdown of any component of the multi-modal national freight transportation system would disrupt billions of dollars worth of these commodities and harm the millions of manufacturers, shippers, and end-users of these commodities.

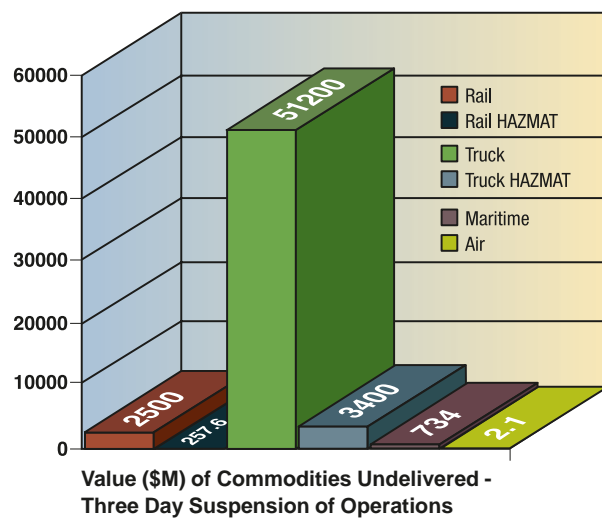


Figure 8

Significant differences in what each freight transport mode carries, and the end-recipients and users of those cargoes, would drive differences in economic impact at home – that is, the specific commodities each mode carries and the sheer volume of goods shipped by one mode versus another would result in widely varying domestic economic impacts. In the rail case, by forcing a three-day shutdown, a terrorist attack on a TIH

<sup>54</sup> We must also appreciate, of course, that the ability to implement and monitor a three-day shutdown would vary from mode to mode. For example, because more than 7 million trucks operate daily on a nationwide network of highways even more vast and open than America’s rail tracks, a three-day shutdown of trucking would be considerably more difficult to enforce than a shutdown of rail, air, or maritime freight shippers operating on fixed infrastructure with a finite number of “nodes” more amenable to the sudden imposition of Federal, state, and local law enforcement control.

<sup>55</sup> U.S. Department of Transportation, Bureau of Transportation Statistics, *2002 Economic Census, Transportation, 2002 Commodity Flow Survey*, Issued December 2004. This is the latest economic data from the Bureau of Transportation Statistics; Title 13 of the United States Code, Sections 131, 191, and 224, directs the Census Bureau to take the economic census only every five years, covering years ending in “2” and “7.”

tankcar would affect approximately \$2 billion worth of commodities, while an attack on trucking would affect more than twenty-five times that dollar value of cargo (\$51 billion).<sup>56</sup> This substantial difference appears to be driven in part by the fact that industries more reliant on time-urgent deliveries of their goods (for example, fresh food, home heating oil) overwhelmingly use trucking to move those goods “the last mile” to American end-user consumers. These industries have substantially more products on the road on any given day than industries that rely more on rail because their shipments are less-frequent, larger loads, and different kinds of commodities such as coal, industrial chemicals, etc.<sup>57</sup> Of course, these figures speak only to the economic impact on the industries that ship their goods by rail or truck. When we look at the impact on the shipping modes themselves (the rail and trucking companies that move these goods), the difference is not as great – \$342 million in revenue losses for rail versus \$1.4 billion for trucking based on a three-day shutdown of operations.<sup>58</sup>

Considering these same factors of volume and type of commodities shipped suggests that the impact of an attack on maritime or air freight would be substantially less, at least in terms of domestic commerce and the domestic economy. These modes of freight transport are employed far less than rail or trucking for moving goods within the United States, and so the value of commodities disrupted by a three-day shutdown of maritime shipping and air freight would be only approximately \$118 million and \$22 million respectively.<sup>59</sup> At the same time, attacks on these modes would have a greater impact on global trade and on the revenues and other economic benefits that accrue to the companies engaged in this trade, given the volume of imports to and exports from the U.S. and the fact that most of these goods are shipped by sea or to a lesser extent air. Maritime transports carry more than 45% of U.S. imports (by value) into our nation’s ports and approximately 27% of our exports out to

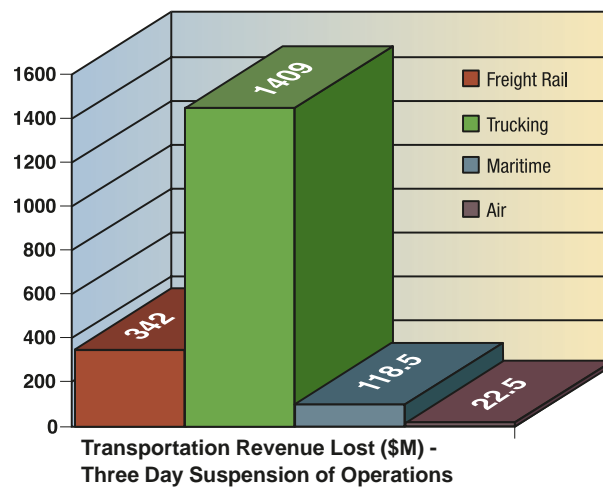


Figure 9

their overseas destinations. Air and trucking together account for the shipping of approximately 60% of U.S. exports (the majority of trucking’s share being loads driven into Canada and Mexico).<sup>60</sup> If we assume a three-day shutdown of air freight shipping or maritime freight operations, a terrorist attack would disrupt between \$4.2 billion (air) and \$5.9 billion (maritime) in import-export commodities, versus \$3.2 billion and \$764 million for trucking and rail respectively.<sup>61</sup>

Understanding the psychological effects of terrorist attacks is a different kind of calculus. We can begin by appreciating, through a substantial and growing body of academic literature, that different kinds of “disaster events” in and of themselves have different kinds of effects on those who experience them directly or vicariously. In these studies psychologists observe that, in order of severity, the worst effects result from incidents of large-scale violence caused by malicious human actions. The second most severe psychological impacts stem from natural disasters such as earthquakes or tornadoes, while “technological disasters” caused by human error (for example, an accident at a nuclear power plant) rank third.<sup>62</sup> In light of this, clearly terrorist attacks are significant threats to our “national psyche.” Other studies in the wake of the 9/11 attacks

<sup>56</sup> Toffler Associates analysis of [2002 Commodity Flow Survey](#)

<sup>57</sup> Toffler Associates analysis of [2002 Commodity Flow Survey](#) and of Association of American Railroads, “Policy and Economics Department, Freight Commodity Statistics, 2004.” For example, trucking moves 85% of prepared foods and 50% of fuels to U.S. end-users while rail transports 68% of the nation’s coal.

<sup>58</sup> Toffler Associates analysis of [2002 Commodity Flow Survey](#)

<sup>59</sup> Toffler Associates analysis of [2002 Commodity Flow Survey](#)

<sup>60</sup> Toffler Associates analysis of U.S. Department of Transportation, Bureau of Transportation Statistics, “U.S. International Trade and Freight Transportation Trends, 2003”

<sup>61</sup> Toffler Associates analysis of U.S. Department of Transportation, Bureau of Transportation Statistics, “U.S. International Trade and Freight Transportation Trends, 2003”

<sup>62</sup> National Center for PTSD and The Center for Mental Health Services, [50,000 Disaster Victims Speak: An Empirical Review of the Empirical Literature, 1981 – 2001](#), September 2001, prepared by Fran H. Norris, Georgia State University



illuminate some of the scope and endurance of these psychological effects and how they manifest.<sup>63</sup> Just as we can try to understand the range of economic effects from attacks on TIH tankcars in the freight rail system and on other modes of freight transportation, we also can, and should, understand how attacks on the different modes would play out psychologically.

Using “proxies” for some factors that appear to substantially influence the potential psychological effects of a terrorist attack can help. We considered, for example, the trauma that Americans might experience as a result of disruption in the economic and social transactions that underpin their daily lives. A terrorist attack that resulted in a three-day shutdown of any mode of the national freight transportation system obviously would impede (perhaps significantly) citizens’ access to food, water, shelter, and other basic needs. One way of measuring the severity or scope of this psychological effect is to consider (as we did above in looking at economic impacts) the volume of such “life necessity” cargoes carried by each freight transport mode. A second factor that likely would influence the degree of psychological impact has to do with the perceived predictability of the attack. Studies and logic both suggest that people will be more shocked and traumatized by an attack “they never saw coming” than they will by something for which the potential has been widely publicized and debated.

Related to this but different is a third factor – the perceived “preventability” of the attack – and here the psychological mechanism appears to work almost in reverse. That is, if the potential for a particular type of attack is widely publicized and debated, people may not be surprised when it happens, but they are *more* likely to be outraged should that attack occur, feeling (some would say justifiably) that government and law enforcement and the officials of the industry affected had ample warning and failed to act. Finally, we can consider a “personal vulnerability” factor – the degree to which any individual might feel that they or someone they love could be a victim of a particular kind of attack, by virtue of their proximity to the target. Here a useful “proxy” to consider might be the “ubiquity” of the target in question – in terms of potential attacks on the freight system, how much a part of one’s daily life is the mode that suffers the attack, how often do we see and “experience” that mode of transportation?<sup>64</sup>

Viewed through the first lens, trauma from disruptions to the social and economic underpinnings of daily life, attacks on those freight transport modes carrying the greatest volume of “life-necessity” commodities like food, energy, and medicine would create a greater impact than attacks on other modes. “Maslow’s hierarchy” suggests that any real, or even perceived, threat to a person’s access to the basic necessities of life can be psychologically damaging. If so, then citizens would feel the greatest stress over access to basic necessities following an attack on trucking, given as we’ve seen that trucking carries a substantially higher percentage of these “life-necessity” commodities than any other freight transport mode (including 97% of seafood and meat products, 86% of all prepared foods, 85% of breads and grains, and 71% of pharmaceutical products).<sup>65</sup> In contrast, rail tends to carry commodities (for example, 10% of all grain, 21% of chemicals, 67% of coal) requiring substantial processing by manufacturers before they *become* “life necessity” products.<sup>66</sup> Disruptions to these commodities

<sup>63</sup> “World Trade Center Disaster Health Effects Among Survivors of Collapsed and Damaged Buildings,” *Morbidity and Mortality Weekly Report*, April 7, 2006 / 55(SS02); 1-18

<sup>64</sup> Definition of these “psychological effect factors” and “proxies” for measuring them come from Toffler Associates analysis based on several sources including “Preparing for the Psychological Consequences of Terrorism: A Public Health Strategy;” (Committee on Responding to the Psychological Consequences of Terrorism, Adrienne Stith Butler, Allison M. Panzer, Lewis R. Goldfrank, editors), 2003; Eliot Aronson, *The Social Animal* (9th Ed, 2004); Norris et al, “50,000 Disaster Victims Speak: An Empirical Review of the Empirical Literature 1981-2001 (Sep 01); and others.

<sup>65</sup> Toffler Associates analysis of [2002 Commodity Flow Survey](#)

<sup>66</sup> Toffler Associates analysis of [2002 Commodity Flow Survey](#)

certainly would impact a large number of Americans, but the immediacy of the impact would be far less, and more outside the day-to-day thinking of the average citizen, suggesting that the resulting impact on a psychological or emotional level would be less.

Assessing the perceived predictability and preventability of an attack on a TIH tankcar or a TIH cargo on any other mode of freight transport requires that we consider the amount and nature of public attention to threats against these targets. Americans are more highly sensitized today than ever before to the wide range of terrorist threats, in part because of extensive media coverage, frequent government and law enforcement warnings, analyses by think tanks and public activist organizations, and other sources. When we look specifically at freight transport as a potential terrorist target, the threat to rail (and particularly to TIH tankcars in the freight rail system) has gotten considerably more attention, particularly in the last few years, than any of the other modes. Numerous news articles around the country, campaigns by environmentalist and other concerned citizen groups, definition by the TSA of “High Threat Urban Area” cities and recommendations for new freight rail security measures – these and many other stimuli have made the potential for attacks on freight rail an issue very much on the public’s mind.<sup>67</sup> It is reasonable to assume, then, that should such an attack occur, it would not be a “surprise” to the many who have been paying attention to the story, and that this would moderate to some degree the psychological effect of the attack. At the same time, the perception that the attack should have been *preventable* likely would be quite high, precisely because of all this very public discussion, and the corresponding psychological impact of that outrage probably would be high as well.

Funding levels for security in different elements of the national transportation system could play a role in the predictability and preventability “perception calculus”

as well. On the one hand, higher levels of investment in security measures raise public expectations of our ability to pre-vent terrorist attacks. When we look at government funding as just one metric for this, we see the potential for very different perceptions on the part of Americans of the predictability and preventability of different kinds of attacks. For FY2007, of the \$35.5 billion the U.S. Government allocated to the Department of Homeland Security, \$4.6 billion was for aviation security, \$37 million for surface transportation security, \$154 million for maritime security, \$5 million for truck security grants, and \$150 million for rail security grants.<sup>68</sup> Industry investments are a factor as well. It is widely known that the airlines have spent considerable sums to implement new security measures since 9/11, both by mandate and voluntarily – estimates put the figure in the billions annually.<sup>69</sup> While fewer among the general populace know what the rail, trucking, and maritime shipping industries have spent and are spending on security, the sums are substantial – estimates suggest hundreds of millions since 9/11 in each industry, and more than \$200 million in the rail industry.<sup>70</sup> In terms of how these spending levels might influence public perceptions of preventability and predictability of terrorist attacks, given the imbalance of spending toward air security, we can assume that the greatest psychological effects (in the form of outrage) would result from a successful attack on air freight, with correspondingly less severe effects should the attack come on a different mode of freight transport.

Other than funding as a proxy, the influence that our “perceived predictability” and “perceived preventability” factors could have on the psychological effects of attacks on different freight transport modes is more mixed. An attack on air freight, arguably, would be relatively unsurprising (more predictable) to many simply because the distinction would not be that great between that attack and an attack on commercial passenger air, to which unfortunately many have become all-too-

<sup>67</sup> Transportation Security Administration, Freight Rail Security Action Items ([http://www.tsa.gov/what\\_we\\_do/layers/trip/freight\\_rail\\_security.shtm](http://www.tsa.gov/what_we_do/layers/trip/freight_rail_security.shtm)); Testimony of Fred Millar, Ph.D., before the Washington, D.C. City Council, Committee on Public Works and the Environment, January 2004

<sup>68</sup> Budget of the United States Government, Fiscal Year 2007. Maritime data from DOT, Maritime Administration budget; Rail and Truck grant data from DHS, Preparedness Budget; Aviation data from DHS, TSA budget

<sup>69</sup> For example, testimony to the Senate Commerce, Science & Transportation Committee in 2004 from the President and CEO of the Air Transport Association (ATA) made reference to approximately \$2.5 billion from fees that airlines and their passengers pay to help fund DHS operations, and unreimbursed out-of-pocket expenditures of approximately \$739 million for regulatory mandates.

<sup>70</sup> Rail industry executive, Toffler Associates interview.



accustomed. Little media attention has focused on the prospects for an attack on the trucking industry (despite the fact that commercial trucking also carries TIH cargoes), so citizens might not have a similar sense that “we ought to have known and done more to prevent it.” On the other hand, terrorists could conceivably create a significant psychological effect with such an attack precisely because it would be more of a surprise to those whose focus has been on rail, air, and other kinds of targets. While some public concern centers on the potential for terrorist nuclear weapon use and/or smuggling in our nation’s major seaports, the degree of attention focused to date on maritime freight suggests a relatively low potential for psychological impact related to perceived predictability or preventability. The personal security factor, as we’ve suggested, has much to do with how much or little freight rail or trucking or other modes of freight transport are a part of our daily lives. Looking through this lens, it is reasonable to assume that many would be struck hard psychologically by an attack on air freight or commercial trucking. In the case of air freight, while few of us deal very directly with it on a daily basis, here again conflation between passenger and freight may play a role. In 2006, 656 million people traveled on airlines in the U.S., and an attack on any type of plane would likely call to mind for many of these individuals their own experience with air travel, the proximity of their homes to airports, and so on.<sup>71</sup> Commercial trucking is, arguably, even more ubiquitous. More

than eight million commercial trucks traversed more than four million miles of American highways and roadways in 2004,<sup>72</sup> and millions of Americans see or drive past these trucks on a daily or even more frequent basis. The psychological effect could be considerable for many, thinking about that frequent proximity.

When we consider rail, it is passenger rail that is far more a part of our daily lives. More than 11 million passengers in 35 metropolitan areas and 22 states use some form of rail transit (commuter, heavy, or light rail) each weekday,<sup>73</sup> suggesting that the psychological effects of an attack against passenger rail could be severe. Alternatively, freight rail has only about 23,000 locomotives and 475,000 railcars in service in total throughout the nation.<sup>74</sup> Of course, conflation in many people’s minds between passenger and freight rail could play a role here similar to conflation between passenger and freight air. And the public attention to the threat of TIH tankcar at-tacks has contributed to a growing sense among Americans that they indeed are “too close, every day” to these potential terrorist targets, as evidenced by the ongoing efforts of cities including Washington DC, Boston, Chicago, Cleveland, and Cincinnati to ban TIH shipments by rail.<sup>75</sup> Like freight rail, from a personal security standpoint terrorist attacks on maritime shipping likely would be less of a source of psychological trauma than would attacks on air freight or commercial trucking. Far fewer Americans have regular experience with or cause to think much about our nation’s major seaports (which number only a fraction of the number of airports or commercial trucks) or the 15,819 merchant vessels in service.<sup>76</sup>

What is the meaning or the value of these comparisons of freight transport modes and the different effects that could result from attacks on each? On the one hand, it should inform our thinking and planning about what resources to devote to security. Understanding that the economic disruption from a successful attack on one mode would be three or five or ten times the disruption from an attack on another mode should help us think

<sup>71</sup> U.S. Department of Transportation, Bureau of Transportation Statistics, Airline Activity: National Summary (U.S. Flights), <http://www.transtats.bts.gov/>. Data encompasses the 12 months ending October of each year.

<sup>72</sup> U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Statistics 2004, February 2005

<sup>73</sup> United States General Accounting Office, *Passenger Rail Security: Enhanced Federal Leadership Needed to Prioritize and Guide Security Efforts*, GAO-07-225T (Washington, DC: 2007). According to the report, the American Public Transportation Association compiled the fiscal year 2003 ridership data from FTA’s National Transit Database and are the most current data available. Rail transit systems in the District of Columbia and Puerto Rico are included in these statistics.

through the kinds of tradeoffs that any planner must consider. On the other hand, some might argue that the resulting picture is too confusing, that looking at the effects through these multiple lenses makes it even harder to determine what we should and shouldn't do to protect TIH cargoes on railroad tankcars or on any other mode of our nation's freight system. Both thoughts have merit, but going back to a basic premise that led us to conduct this study, in our view the latter may be the even more important point to take away. Determining the level of threat and the scope and scale of the effects that could result from these potential terrorist attacks is an exceedingly complex business, and we are at risk of focusing our attention and our resources on apparent solutions that are much too simple to be effective. We have to think about these second- and third-order effects of these attacks, and also think about the second- and third-order effects of what we propose to do to guard against them. We have to think about how to ensure that actions we take in one sphere do not put us at greater risk of even greater harmful consequences in another sphere. Banning TIH shipments on one mode forces us to ship those cargoes by another mode which might be less secure or might result in worse effects should the substitute mode suffer an attack. Banning them in certain places may simply force us to ship them through other places where security or safety measures may be less effective. So what is the answer? There is no simple answer, which is why we must avoid the urge to embrace



simple answers. Our efforts to secure TIH tankcars and their cargoes should not diminish, certainly not because the effects of a successful attack on some other mode might be greater. In fact they should not diminish for any reason, and they probably should be increased. But those efforts must be more strategic, and more mindful of more factors than simple answers take into account.

### Thinking and Acting Strategically

We believe the right set of actions on the part of industry, government, and citizens can help make the relatively modest threat of terrorist attacks on TIH tankcars even smaller than it is today. The key to what is "right" is to think and act strategically, commensurate with the multi-dimensional realities of the threat which we've endeavored to describe. Our analysis suggests, as a point of departure, two thrusts that meet that criterion: 1) work to take better advantage of the defenses that already are inherent in rail operations (and may also be present in the operations of other freight transport modes), and 2) manage the effects an attack on a TIH tankcar could have, should such an attack be successful.

### Complicating the Terrorist Calculus: Some Ideas Related to Inherent Defenses

As we've seen, TIH tankcars can be anywhere in a 143,000 mile track system at any time, being on-loaded or off-loaded from any one of thousands of trains, each of which may be on or off the published schedule. Finding them is already a complex challenge, but we can and should make it even harder for any terrorist or other adversary that might wish to find them and attack them. Deliberately "randomizing" the timetables, routes and locations would make the terrorists' tracking and targeting that much more complicated and difficult and further reduce the likelihood of a successful attack. Because we know that more sophisticated terrorists are making more sophisticated use of information technology and other means to learn about schedules and other aspects of freight operations, deliberate *disinformation* about timing and location of shipments would have additional benefits.

<sup>74</sup> Association of American Railroads, Policy & Economics Department, Class I Railroad Statistics, November 2006

<sup>75</sup> Leslie Miller, "Government Proposes Rail Security Plan," Associated Press, 14 December 2006

<sup>76</sup> U.S. Department of Transportation, Maritime Administration, World Merchant Fleet, 2005



Our discussion in this paper of the rail industry has made only passing reference to the thousands of “rail fans” and “trainspotters” across the United States who study and converse about the history, infrastructure, and operations of the system.<sup>77</sup> Many of these individuals track the movements of trains and know in intimate detail numerous other facets of train operations. Some railroads already have considered the prospects of “deputizing” these individuals and taken some steps to do so, making them formally part of the eyes and ears that are guarding the system.<sup>78</sup> We can and should think more creatively about how to make them more effective in that type of role, and about other innovative ways of complicating any potential terrorists’ planning. Giving these rail fans secure means of communicating (so they don’t do so over the open Internet), involving them in deliberate disinformation efforts to thwart terrorists who might be trying to “listen in,” and other ideas all are worth considering. Background checks for rail fans, similar to those for granting Defense Department and intelligence agency security clearances, could have additional benefits, and would make penetrating the network increasingly difficult for terrorists.

Last year, the TSA outlined a set of voluntary actions for the rail industry to implement to enhance security.<sup>79</sup> Many of these have already been embraced by industry, and others could be made workable with the collaboration, and in some cases the funding assistance, of government at the federal, state, and local levels. But as we implement these actions and changes in procedures, railroad operators, local law enforcement officials, and others must consider how to do so in ways that take further advantage of the inherent “deterrents” we’ve seen are present in freight rail operations. For example, designating and securing temporary storage locations for loaded tank cars makes sense, but makes even more sense if we make these locations “mobile” rather than fixed – that is, change the locations periodically, perhaps frequently, so that terrorists have a difficult time discerning any patterns that could help them target and time attacks. Similarly, new procedures or processes for determining the location of TIH tankcars in classification or storage yards, perhaps leveraging current and emerging information and communications technologies, could have benefits, and could have greater benefits still if we use the same processes and technologies to thwart terrorist planning and targeting by purposefully communicating disinformation about the locations of TIH tankcars and their cargoes.

<sup>77</sup> See [www.railfan.net](http://www.railfan.net). Toffler Associates interviewed several of these self-professed “rail fans” in the course of this study

<sup>78</sup> Rail industry executive, Toffler Associates interview

<sup>79</sup> Transportation Security Administration, Rail Security Action Items, [http://www.tsa.gov/what\\_we\\_do/layers/trip/freight\\_rail\\_security.shtm](http://www.tsa.gov/what_we_do/layers/trip/freight_rail_security.shtm)

<sup>80</sup> Testimony of Edward Hamberger, President & Chief Executive Officer, Association of American Railroads, Before the U.S. House of Representatives, Committee on Transportation and Infrastructure, June 13, 2006 ; United States General Accounting Office, Homeland Security, DHS Is Addressing Security at Chemical Facilities, but Additional Authority Is Needed, GAO-06-899T (Washington, DC: 2006); In 2004, Rick Hind, Legislative Director, Greenpeace Toxics Campaign discussed in a letter to the Maryland Secretary of Transportation the need to consider alternatives to transporting hazardous materials, including substitution of “toxic by inhalation” chemicals.

## Reducing the “Payoff” for Terrorists: Some Ideas Related to Managing the Effects

As we’ve seen, a successful attack on a TIH tankcar could have substantial impacts on the economy and on the national psyche. An attack on a railcar carrying a “benign” cargo – paper, pet food, electronic devices, whatever – would be disruptive and have real material costs, but likely would not have the cascading and enduring effects of an attack on a TIH cargo. Given this, the most direct and potentially valuable way to manage the effects of an attack on the freight rail system would not be just to get the deadly cargoes out of major cities, but to get them off the trains entirely. A truly strategic approach would not stop there, since ridding the railroads of TIH would simply put more TIH on our highways or onto some other mode of freight transport. A strategic approach would be to get the TIH cargoes out of circulation, and the most effective way to do that is to reduce their presence in our industrial and consumer processes and other dimensions of our economy. The rail industry and environmentalists – ironically, the frequent “opposing camps” in the TIH and terrorism debate – both have talked about “product substitution” as a long term solution,<sup>80</sup> but it is one that we would do well as a nation to consider more seriously and begin moving toward. Consider an analogy. Some analysts of international affairs suggest that U.S. national and homeland security would benefit if we reduced our reliance on fossil fuels, because our role (whether real or perceived) in Middle Eastern politics, driven in part by our reliance on imported oil, is a spur to terrorist hatred and attacks.<sup>81</sup> If we reduced our reliance on TIH chemicals, thereby obviating any need to put them into tankcars and onto a railroad system that terrorists with sufficiently sophisticated capabilities could reconnoiter and attack, the terrorists wouldn’t be able cause the thousands of deaths or billions in economic losses we fear.

Of course, “product substitution” is more easily said than done – today. Numerous industrial processes rely on chlorine and other TIH substances. Businesses and private citizens throughout the nation, including in the communities that seek bans on TIH tankcar shipments, benefit from the use of these chemicals. The cost of research and development on substitute chemicals or other substances will be considerable, and results won’t happen overnight. But collaboration can be important to success, and innovative ideas for how to generate and apply the investment capital will be critical. One approach could be for government to tax today’s TIH shipments (“spreading the pain” among manufacturers, shippers, and end-users) and use the money to fund research on a range of substitutes. A more direct approach to government subsidies for acceleration of product substitution could be to devote some of the



<sup>81</sup> See, for example, Securing America’s Future Energy (SAFE), “Brief: Oil Dependence – A Threat to U.S. Economic and National Security,” December 2006; Energy Security Leadership Council, “Recommendations to the Nation on Reducing U.S. Oil Dependence,” A Project of SAFE, December 2006; for a different perspective focused on how reliance on fossil fuels potentially makes U.S. military forces more vulnerable and less capable of ensuring national security, see “Reducing DoD Fossil-Fuel Dependence,” Report of JASON, The MITRE Corporation, December 2006 (study sponsored by the Office of the Deputy Under Secretary of Defense for Science and Technology)

Department of Homeland Security Advanced Research Projects Agency's (DHSARPA) efforts to developing substitutes, alongside the other kinds of R&D the agency conducts on explosive detection technologies and other more "traditional" aspects of homeland security innovation. The rail industry and manufacturers of TIH chemicals can work together to identify still other means of collaboratively accelerating the R&D necessary to make product substitution feasible, and the other modes of the transportation sector could and should take part, investing some of their own money. The end result, if we take our creative thinking further, could be a new industry in "safe chemicals," potentially as profitable for those who create it as the TIH manufacturing and shipping businesses are today.

From the psychological effects standpoint, one factor we've discussed that influences the impact of an attack (even a threatened attack) is the extent to which people may feel the attack was preventable or predictable. In our analysis, the increasingly public and vocal attention being paid to the issue of attacks against TIH tankcars is, rightfully, making people feel that government, industry, and others ought to be doing something more about the threat. It probably also is making some assume (rightly or wrongly) that these responsible officials are already doing more than they in fact are doing. Should a successful attack occur, both these dynamics in the "national psyche" suggest many will be outraged and terrified, and the terrorists will have been successful in creating one of the psychological effects they desire.

One simple and effective way to manage this is: take the debate behind closed doors. Concerned citizens want to be part of this debate and want to be heard – and they must. But they should be part of it more in private with the rail industry, government officials at the federal, state, and local levels, and others, and less on the front pages of our daily newspapers. A fundamental



precept of good security is secure communications – think back to World War II and the warnings that "loose lips sink ships." We know in the 21st century, in an age of proliferating and uncontrollable information flow through the Internet and other means, that the terrorists are listening and watching, making this is more important than ever before. Arguing about the threat in public runs the risk of providing potential attackers insight into what concerns us most, which are precisely the things they wish to target. It also risks revealing sensitive information about our security practices, information that responsible citizens groups and others *should* know so that they can be constructive elements of a collaborative industry-government-public solution. One could say that our own analysis in this paper is an example of the kind of public dialogue about the TIH tankcar threat that should be much less public – and that may be true. But perhaps it will help convince those at the center of the issue to change their behavior going forward.

## Conclusion

The recommendations above are simple, and just a start. We would not suggest that they represent “the solution” to the problem we’ve examined in this paper. Solving the problem was not our intent – it will take the collaborative efforts of many with greater expertise in rail operations than us to do that. What we’ve shown, we hope, is that the terrorist threat to TIH tankcars and their cargoes in the U.S. freight rail system is a considerably more complex issue than many believe, and also that the threat is considerably more modest than many believe. We’ve shown, we

hope, that the issue is an important one to look at and understand in a new way, because we believe it is emblematic of a broader set of issues lying at the heart of America’s homeland security efforts. Strategic thinking is critical to rise above the threats we face and to create a truly secure future for freight rail, the larger freight (and passenger) transportation system, and our nation. The time is now, and we hope our work inspires those responsible for and concerned about the threat of attacks against TIH tankcars to work with each other and with us to create that future.



Creating A Secure Future: Understanding and Addressing the Threat to TIH Rail Cargoes



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