Vulnerability of Petroleum Terminals in Green Bay to Terrorist Attack

David Siegel

May 30, 2012

Terrorism Awareness and Planning

32 FST 321 707

Spring Quarter 2012

College of Engineering and Applied Science

University of Cincinnati
CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expression, or writings of another.

David A. Siegel
ABSTRACT

In the post-9/11 United States, there is a heightened awareness of further terrorist attacks. Prominent amongst these concerns are attacks against infrastructure intended to disrupt the US economy, defense and society through destruction of power supply, bridges, highways, ports, sewer and water supply. In particular, the US depends on petroleum fuels. Disrupting petroleum fuel supply would clearly fulfill the goals of a terrorist attack.

In Green Bay, Wisconsin, there are six petroleum fuel terminals that serve several million people in portions of three states. These terminals distribute about one billion gallons of fuel each year. A pipeline carries product from refineries in Chicago to large storage tanks in Green Bay from which finished product is loaded onto semi-truck tankers for distribution to the ultimate destinations such as gas stations.

A terrorist attack could seek to disrupt the petroleum fuel supply. For this paper, several key features of this system were identified, such as electrical power, loading rack mechanisms and pipeline system. In addition, mitigation of a successful attack is discussed.

Prevention of an armed terrorist attack is examined. While it is possible to provide armed security that could repel an attack, it is not practical. Petroleum fuel supply is only one of many possible infrastructure terrorist targets. To protect each would be a massive undertaking and prohibitively expensive.

Overall, disrupting petroleum fuel would have a dramatic effect on the economy and society of the region. While protection at the tactical level is not pragmatic, there are reasonable approaches to deter an attack.
### TABLE OF CONTENTS

- Certification Statement .............. 2
- Abstract .................................. 3
- Introduction ............................. 5
- Background and Significance ....... 6
- Literature Review ....................... 7
- Procedures ............................... 7
- Results .................................. 8
- Discussion ............................... 9
- Recommendations ...................... 12
- References ............................... 13
INTRODUCTION

The terrorist attacks of 9/11 had a profound effect on the United States. While the horror of nearly 3,000 deaths was prominent, there is a more subtle and long-term effect. Most notably, airport security has dramatically increased since 2001. As an example, passengers and luggage are more closely scrutinized. However, this is achieved at a substantial financial cost for detection and monitoring equipment and the numerous security personnel necessary. This cost is passed on to the consumer-flyers. In addition, air travel is now more difficult, time-consuming and stressful. While not as dramatic as mass murder, this adverse effect on US life was a particular goal of the terrorists.

Air travel is only one possible US infrastructure target of terrorists. Any system that is necessary for American economy, defense or society is a potential target. There are other travel modes that could be targeted such as trains, buses, subways and ships. Also, power supply is critical, such as natural gas, gasoline, diesel fuel, heating fuel, cooking fuel and electrical supply. The supply of clean, potable water is also critical. Lastly, sewer and even garbage collection is critical. A disruption of any one of these critical infrastructure systems would have a drastic effect on US life.

Green Bay, Wisconsin is the location of a major petroleum fuel distribution hub. There are six petroleum fuel terminals that serve the needs of several million people in Northern Wisconsin, most of the Upper Peninsula of Michigan and parts of Northern Minnesota (1). Products provided are gasoline, diesel fuel, heating fuel and airplane fuel. A single pipeline carries the products from source refineries in Chicago to Green Bay. Next, a distribution system moves the product to the respective terminal where it is stored in large above-ground tanks. Each terminal adds proprietary ingredients or in the case of
gasoline ethanol. Each terminal also has a loading rack where semi-truck tankers are loaded with product. These semi-truck tankers then carry the product to the desired destinations in the region.

For this paper, the vulnerability of the petroleum fuel infrastructure system in Green Bay was evaluated. Facility personnel were interviewed to identify the vulnerable and critical features of the system. Additionally, actual and potential security measures were discussed. Lastly, the means and methods to mitigate a disruption of petroleum fuel supply were examined.

BACKGROUND AND SIGNIFICANCE

There is substantial precedence for terrorist attacks against infrastructure. The 9/11 hijackings of four passenger airliners forever changed air travel. Similarly, the derailment of an Amtrak train in 1995 in Arizona, subway and bus bombings in London in 2005, the train bombings in Madrid in 2004 and the frequent suicide bombings of buses in Israel are attacks against transportation infrastructure. While killing was a major goal, the terrorist chose planes, trains and buses partially because of the density of people but also because of the critical nature of transportation in these societies.

Other types of infrastructure have been targeted by terrorists. During the Insurrection in Iraq, fuel trucks were common targets of attacks. Fuel tankers blazing along roadways were a common TV news image. Similarly, the water supply in Iraq was a particular target of attacks. Indeed, even in the United States, power lines in Minnesota in the 1970s were destroyed as part of a protest against the utility company (2).
Similarly, environmental terrorists in the United States were apprehended destroying power lines in Arizona in 1989 (3).

Thus, attacks against infrastructure are a reasonable possibility. Given the dependence of the US economy, defense and society on petroleum fuel, disrupting the supply would have a profound effect and is thus a particularly lucrative target. Therefore, it is entirely reasonable to predict that terrorists also see petroleum supply as a potential target.

LITERATURE REVIEW

Since the terrorist attacks, much consideration has been given to protecting infrastructure in the United States, including the petroleum industry. A literature search found a comprehensive document specifically for this industry, “Security Guidelines for the Petroleum Industry” (4). This guide advocates the use of a Security Vulnerability Assessment which serves to “assist management in identifying and prioritizing security risks and determining the appropriate type and level of protection required at the local asset level.” This is accomplished through a stepped system in which the facility is characterized, threats and vulnerabilities are identified and risks are evaluated as are mitigation options. It is unknown how extensively this system is utilized through the petroleum industry.

PROCEDURE

Through the author’s function as Training Officer for the Green Bay Fire Department Hazardous Materials Response Team, a working relationship was already
established with Mike Woessner, General Manager of the Marathon Oil Company terminal in Green Bay. An interview was conducted to discuss vulnerable aspects of the terminal, actual and potential protective measures and means of deterrence as well as response to an attack in order to mitigate the effect. Mr. Woessner was confident that although he cannot speak for every terminal, the general observations would apply to all six Green Bay petroleum terminals.

Another interview was conducted with Mike Brunette, the General Manager for Westshore Pipeline, the company that operates the pipeline moving product from Chicago refineries to the Green Bay terminals. The same issues were discussed regarding the pipeline.

RESULTS

Potential targets were identified based on pivotal or central function. Mostly, targets were identified based on ease of attack. For example, although bombing the large storage tanks would completely disrupt terminal function, there are a total of fifty tanks in all six terminals (1). Thus, that many or more bombs would be necessary. Therefore, targets were identified based on simplicity or ease of attack.

The first target identified was electrical power supply. All operations are completely dependant on electricity provided by the power company. None of the terminals have back up generators. Destroying just a few power poles would completely cut off electrical supply to the terminals.

The second potential target is the loading rack. This is a structure into which the semi-tanker trucks drive into and are loaded with product. It is a very dangerous
operations and as a result a very complex mechanism. There is extensive piping, including vapor recovery and various safety systems. A moderate size bomb or act of sabotage would readily destroy the loading rack. Each terminal has only one loading rack. Thus, loss of loading rack operation would shut down operation at a terminal.

The last target identified is the pipeline system. Product is moved through the pipeline to a distribution hub in Green Bay where a large and complicated manifold system directs the product to the appropriate terminal. A small bomb or act of sabotage at the manifold would prevent the terminals from receiving product.

DISCUSSION

A terrorist attack at any of the three identified targets would interrupt terminal operations. So, means to overcome effects of a successful terrorist attack were identified.

Destruction of electrical supply would be the easiest to overcome. New power lines could be established by the utility company. This is actually a fairly routine operation for the utility company because the same repairs are often necessary after storms. If only the power lines were damaged, power could be restored in a few days.

Destruction of a loading rack would be very difficult to overcome. These are very complicated mechanisms requiring extensive piping and machinery. It would take several weeks or months to return a destroyed loading rack to service.

Surprisingly, the pipeline system in Green Bay is fairly simple. There is only a manifold that directs product to the desired terminal. If destroyed, the manifold could be returned to service in a couple of weeks. In contrast, the pumping mechanism for the pipeline is much more complex, although no part of the pumping system is in Green Bay.
In the event of any attack that disrupts operation at any or all Green Bay terminals, there would still be the need to supply the region with petroleum fuel. If distribution out of Green Bay is reduced, other terminals throughout the region can still provide product. As before, semi-truck tankers would continue to haul product but over longer distances. This would certainly add to the cost for the ultimate consumer. Also, it is likely that shortages may occur. Both factors would adversely affect the economy and social function in the region.

Lastly, security at these facilities was examined. More specifically, actual and possible security measures were considered. Since 9/11, security has increased at these facilities. Better fencing was installed, electronic security added and personnel made more security conscience. For example, anyone loitering near the terminals or seen driving-by repeatedly are reported to law enforcement. Significantly, the petroleum terminal manager only allowed the interview because he already knew the author of this report to be a Green Bay firefighter. An unknown person contacting him would have been turned away and reported to company security.

Although security conscious, the terminals are very vulnerable. There are no dedicated security personnel; only terminals workers. None are armed and there is no armed response capability. In fact, these terminals are unmanned portions of the day, weekends and holidays. Thus, terrorists could enter the terminal property without the likelihood of encountering anyone else. They could potentially carry out an attack without resistance.

In contrast, the author was part of a hazmat team tour of a nearby nuclear power plant in Kewaunee, Wisconsin. Security was impressive. Weeks before the tour, all
Petroleum Terminal Vulnerability

Hazmat team members were subjected to a background check. At the site, large boulders cordon off the property as well as razor-wire topped fencing. There are numerous armed guards throughout the facility, including a heavy machine gun tower guarding the approaching driveway. Everyone passes through metal detectors.

Ironically, petroleum fuel supply is as critical to US economy, defense and society as electrical supply. However, while the nuclear power plant has extensive security, the petroleum terminals have almost none. Similarly, the coal-fired electrical power plant in Green Bay has security similar to the petroleum terminals; nowhere near that of the nuclear plant. This highlights the reality of perception over practicality. While all electrical power and petroleum supply is a potential terrorist target, the nuclear plant is afforded generous protection. But, that level of security is not extended to other critical infrastructure components.

However, it is not reasonable to expect or recommend that the petroleum terminals have facility security similar to that of the nuclear power plant. There are 1400 petroleum terminals in the United States as well as thousands more related facilities such as refineries, bulk storage centers, pipelines and production sites (4). It would be monumentally costly to adequately protect each site similar to that of a nuclear power plant. In addition, other critical infrastructure facilities are also potential terrorist targets such as fresh water, sewer, natural gas and electrical. High level security can be justified that all of the locations. However, there are probably tens of thousands of potential sites through the United States and guarding each would be incredibly expensive. Thus, providing armed, high-level security to prevent or repel an armed terrorist attack is cost-prohibitive, whether at a petroleum terminal or any other infrastructure facility.
RECOMMENDATIONS

First, while it is not practical to provide armed security to prevent or repel an armed terrorist attack, there are other measures that can be done to deter an attack on the petroleum terminals. For example, any attack would require knowledge of the facility which would necessitate reconnaissance of the location. Terrorist would need to visually examine the location and probably take pictures. Anyone seen loitering or taking pictures of the terminals should be reported to law enforcement and company security. This requires diligence on the part of terminal employees. So, facility security should be emphasized regularly through company training.

Secondly, in the event of a successful terrorist attack, a plan should be ready to deal with this contingency. Estimations should be made regarding likely damage and necessary repairs. Additionally, plans should be made to continue the supply of petroleum products to the region in the event Green Bay terminals are attacked. This would include routing semi-truck tankers to other terminals and ensuring those terminals receive adequate product to meet increased demand.
REFERENCES

1. Summary sheet for Green Bay area petroleum terminals, provided by Marathon Oil at a Green Bay Fire Department training event, February 16, 2012.

2. CU Project Controversy, retrieved May 27, 2012 from:

3. 3 Arrested in Alleged Power Line Sabotage, Los Angeles Times, June 6, 1989, retrieved May 27, 2012 from:


6. Pipeline Security Guidelines, Transportation Security Administration, April 2011, retrieved May 19, 2102 from: