

The Keystone XL Pipeline: A Threat Assessment

By David M. Cooper

Command Master Chief SEAL (Retired), Naval Special Warfare Development Group

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Rationale for this threat assessment

On April 16, 2013, some person or persons opened [fire on an electrical substation in California](#). The culprit, or culprits, then disappeared one minute before police arrived at the scene. No arrests have been made.

Besides being deplorable, this incident is interesting in several respects. While no FBI or government official will be quick to use the term “terrorism” to define such an event (and they have valid reasons for not doing so), the fact remains that events such as this one are, by their nature, terrorism. And while no single event can of itself be considered a trend, combined with an uptick in terrorist attacks against energy infrastructure around the world, this event could very well prefigure other, similar attacks against our energy infrastructure.

In other words, momentum for such attacks can start right here in our own country with a single incident, particularly a successful one. Yet one of the difficulties in thwarting such attacks is in predicting where they might occur (along with determining who, what, when, why and how).

The very nature of Keystone XL’s newsworthiness, should it ever be built, increases its attractiveness as a target to terrorists: Keystone XL, aside from being a “soft” target just like any other pipeline, has a built-in emotional impact that can’t be denied or wished away. That simple fact, a newsworthy proposal that engenders strong passions, should clue in pipeline owners and government officials to the very real possibility of intentional attack. They should plan, prepare and regulate accordingly.

The emotional impact of hitting such a high-profile target can’t be stated quantitatively, though it would likely be significant. In the eyes of a terrorist, perhaps, the Keystone XL represents not necessarily a quantity target, but a quality target.

Pipelines are themselves viable and attractive targets in any war, to include a war such as the one our country faces between our sovereign state and multifarious non-state actors. One has only to review the [over 460 attacks on Iraq’s pipeline infrastructure from 2003-8](#) to understand a major pipeline’s pull on those seeking to inflict not just damage, but damage of a sensational nature, damage that seeks to convey the message: You are not safe, and neither is your economy. While the

analogy has its limits – Iraq was then involved in a full-scale war – the sheer number of attacks highlights both the attractiveness and the “softness” of such a target.

This tendency is based in part on an *optimism bias* that leads us to feel safer and more secure than we generally are. The dismissal of such threats as improbable, even inconceivable, leaves federal and local governments with little recourse but to react to them only after the fact. This is not a judgment, merely a fact. It took the [1983 Marine Headquarters bombing](#) in Beirut before the [Inman Standards were conceived](#), and the 1998 bombings of US Embassies in Kenya and Tanzania before they were adopted wholesale, at least overseas (and with notable exceptions). It took the 9/11 attacks to invigorate the codification of anti-terrorism building codes here in the continental United States; and it took the Exxon Valdez oil spill in 1989 before Congress required private corporations to devise facility response plans (FRPs).

The purpose of this assessment, then, is to highlight the security challenges posed by the Keystone XL pipeline. The fact that the Keystone XL transports tar sands crude, or more technically diluted bitumen (dilbit), [REDACTED]

[REDACTED] merely offers an added incentive to terrorists. By definition, the Keystone XL is a “soft” target, and as long as such soft targets exist the threat against them exists.

Executive Summary

Since 2001, many professional and governmental organizations, like the General Services Administration and the Department of Defense, have labored to devise and implement stricter codes to ameliorate the effects of terrorist attacks against buildings.

While this is both admirable and necessary, it also unintentionally plays into the very randomness of terrorism itself: When one set of targets (e.g. buildings) becomes less vulnerable and harder to target, terrorists will seek out newer, softer targets, perhaps such as our national energy infrastructure. In short, terrorists will adapt and pivot; they will plan and prepare. And, when the time is right, they will raise the stakes and strike.

If we as a country want to stay ahead of threats, rather than address them after the next attack, we need to be realistic about what targets are the most appealing – those “soft targets” that could be attacked with catastrophic affect.

No small part of the discussion of the controversial Keystone XL pipeline is about its safety. Proponents make a **safety** argument – that pipelines are a safer (and more efficient) way to transport oil than shipping oil by truck or rail.

However, as a veteran of more than 20 years in U.S. special operations forces operations, I was surprised to see how little discussion there has been of **security** of the proposed pipeline. I was genuinely curious about how much of a “soft target” would be presented by this pipeline (and others like it), given that it is arguably the highest profile piece of energy infrastructure that has yet to be built.

Safety and security are often used interchangeably, though they are anything but equal. Confounding the two, even unintentionally, has in the past resulted in not simply the loss of property but lives as well.

In order to add the appropriate security element to the national consideration of this project, I accepted an offer by NextGen Climate to conduct a threat assessment of the Keystone XL pipeline.

In conducting this assessment, I:

- Combined readily available online information and a site visit to a working, similar pipeline near Keystone XL's proposed route;
- Was unable to find much in the way of security steps at existing, similar pipelines, including the one that I visited; and
- Found that a handful of terrorists could use just four pounds of explosives at each of three pump facilities located [REDACTED] to cause explosions that could trigger a catastrophic spill of 7.24 million gallons of dilbit (with its highly toxic chemicals) [REDACTED]

My goal is to point out security weaknesses that could result in a series of devastating, even catastrophic, attacks along the length of the Keystone XL, while stopping well short of providing a playbook for would-be terrorists.

I offer no opinion on the Keystone XL pipeline's merits. In fact, the security risks might still be worth the benefits – something that Secretary of State John Kerry, President Obama and the American public will have to decide.

However, I think that the questions of how and if this 1,100-mile piece of infrastructure could be reasonably protected should be an important part of both the policy discussion and the National Interest Determination currently being made by Secretary Kerry.

And, it should have us thinking through as a country how to protect the energy and industrial infrastructure that we have in order to get ahead of terrorist threats, which will surely come in the future.

Methodology

To keep safety distinct from security, in this assessment “safety measures” refer to any and all means that guard against accidents (such as spills). Any and all means that guard against intentional disruption of service or destruction of infrastructure shall be referred to as “security measures.”

Assessment Perspective

There are a number of assessment methods to look for weaknesses in extant policies and procedures used by various agencies within the US government. This particular assessment takes a purely “Red Cell” (or adversarial) approach, designed to showcase weaknesses in the current reality by exploiting the same information to which an outside terrorist group would have access.

Therefore, no attempt was made to contact TransCanada or relevant federal agencies, nor did this assessment have access to company or federal government policies, procedures, past threat assessments or current contingency plans. The extent of these plans’ development could be anything from robust to non-existent, but still irrelevant to Red Cell approaches. Red Cell scenarios are typically conducted in the absence of insider information in order to:

- Challenge the assumption that a target will be secure;
- Devise an operational plan to test that security; and
- Conduct a penetration (in this case notionally) to physically test security.

Terrorists could simply pick any site on the Keystone XL to attack. Or, they could gather what information they could about the pipeline. This information would very likely highlight certain weaknesses in security, and these weaknesses, then, would “pull” the terrorists to select them as soft targets. Additionally, terrorists would look particularly for those sites that offer a significant emotional impact if attacked successfully. These would include populated areas [REDACTED] and ecologically sensitive areas deemed “[high consequence area](#)” (HCA) by the State Department. (In this assessment these areas will occasionally be referred to as critical vulnerabilities.)

The research done by terrorists would “pull” their selection of their sites, hence the “pull” approach taken in this assessment. This assessment takes just such a “pull” (or reconnaissance pull) approach. Online information was gathered about Keystone XL’s route, materials and design, and that information was then used to pull the site selection for walk-through on the extant Keystone 1 pipeline in [REDACTED] — a walk-through that could just as easily have been the actual terrorist mission.

Maps and walk-through site location

No special maps were used during this assessment, only those readily available on the Internet. While some disagreement in map choices exists, this assessment made use of [REDACTED]

Moreover, [REDACTED]

[REDACTED] This fact makes that stretch of pipeline through the Sand Hills region of Nebraska a more likely target for a possible terrorist attack, given the additive effects of terrorism and, presumably, environmental disaster. (This region, and others, has been deemed an HCA by the State Department, though not necessarily a [High Volume Area](#), a designator that would compel TransCanada to respond to a spill in 6 hours versus 12.)

In military parlance, the site visit at [REDACTED] was a “cold shot,” done with no advance preparation or planning, using only information and intelligence gathered from publicly available sources. [REDACTED] was selected because it has both a valve and pumping station for the operational Keystone 1, it is somewhat near Keystone XL’s route, and it is roughly similar to the proposed Keystone XL – with presumably the same level of security as the proposed pipeline.

Data sources

All information gathered for the purpose of this assessment was gleaned from publicly available sources, namely:

- Keystonepipeline-xl.state.gov-the State Department’s official website for the proposed project;
- TransCanada.com (Keystone XL Pipeline Project);
- A worst-case spill analysis by John Stansbury, Ph.D., which can be found at watercenter.unl.edu/downloads/2011-Worst-case-Keystone-spills-report.pdf;
- An emergency response analysis available at plainsjustice.org/files/Keystone_XL/Keystone%20Pipeline%20il%20Spill%20Response%20Planning%20Report%202010-11-23%20FINAL.pdf; and [REDACTED]

The numbers in the spill scenarios regarding shutdown times, drain down volume, drainage factor, etc. are all those made publicly available by TransCanada.

Also, because this is not an academic paper, readers wishing to check the accuracy of this assessment are free to peruse the sources listed above, or list other sources that might challenge information used in this assessment.

Treatment of available policies and procedures

While it's not the intent of this assessment to directly test policies and procedures mandated by the federal government, nor TransCanada's internal policies and procedures (some of which, like the facility response plans, are indeed mandated by the federal government). The assessment also does not evaluate TransCanada's claims of facility response plans or spill response capabilities. For the purposes of this assessment, TransCanada will be taken at their word, at least as far as shutdown and emergency response times go. However, those policies and procedures readily available in open source reporting were examined, and thus indirectly assessed. This was done solely in an effort to establish what critical vulnerabilities existed in the pipeline, and then to assess whether or not those vulnerabilities were targetable — could a terrorist action against them actually be carried out?

Findings

The available policies and procedures for pipelines mostly confront safety issues — generally an accidental spill caused by a handful of likely events. The policy requiring TransCanada to perform, say, an environmental study, and the procedures used to conduct that study, are of little use to a threat assessment such as this one — except to point out environmental hot spots: those areas that, if successfully attacked, will cause significant physical and emotional damage to people, property, or both.

The environmental studies and the discussion about them mention time and again the [REDACTED] more generally, the Sand Hills region of Nebraska. Those studies also inadvertently divulge intelligence requirements, seemingly innocuous tidbits, such as the pipeline's route, the thickness of the steel used in its construction, and the general locations of valve and pumping stations. This disclosure of "tactical intelligence" (i.e. information that terrorists could act upon without further vetting and verification) is seemingly unavoidable, yet nowhere is there even remotely a discussion about security concerns. This avoidable omission is concerning.

This assessment deemed 3 sites in the northern Great Plains critical vulnerabilities—sites that if successfully attacked would create significant disruptions across the regions. These sites— [REDACTED] [REDACTED] were selected because of their:

- [REDACTED]
- Remoteness, which facilitates ease of access – almost impunity – for terrorists and increases the difficult for emergency response crews to reach and stop the spills quickly; and
- [REDACTED]

[REDACTED] By definition, then, they are high-profile, or “high value,” targets.

Notable in the available plans was the lack of specificity in Pipeline and Hazardous Materials Safety Administration (PHMSA) and Department of Homeland Security (DHS)-mandated facility response plans, particularly with regard to type, amount and location of personnel, equipment, supplies and other resources. Much, it seems, is left up to pipeline owners to figure out on their own.

Some might point to Enbridge’s rapid response to its spill near Kalamazoo, Michigan, as a demonstration of the adequacy of the current spill response standards. However, it should be noted that this particular spill happened near a populated area, with overlapping regulations from the EPA and US Coast Guard that required the repositioning of emergency response personnel and equipment, not to mention capabilities of Kalamazoo (a mid-sized city) for handling a sizable logistics burden.

The Kalamazoo River spill could be said to serve as an example not of good planning and preparation, but of good fortune (at least for PHMSA if not Enbridge, too). It remains to be seen whether such a rapid response to a major spill in a remote area could be enacted with the same vigor. As regards to contingency plans of any sort, while planners must strive to maintain flexibility, they should also strive to be as specific as possible.

It’s debatable whether or not TransCanada (or its contractors) will pre-position emergency response personnel and equipment near critical vulnerabilities (high consequence areas located near not only populated areas but remote areas as well), and doing so would not stop a terrorist attack.

TransCanada’s track record of spill responses needs to be carefully examined in light of their claims – i.e., how they have trained, instead of their expressed expectations.

All that need be said of prepositioning well-trained emergency response teams comes to us from an ancient axiom I used in the SEAL Teams: “We do not rise to the level of our expectations, but fall to the level of our training.” [TransCanada asserts a rapid reaction to any spill](#), even those taking place in remote areas of the northern Great Plains—this amounts to an expectation. Whether or not they truly can respond rapidly to remote-area spills, however, remains to be demonstrated in actual practice.

In all fairness to TransCanada, while this assessment focuses on its proposed pipeline, and while they are legally bound to clean up accidental spills, they are not responsible for protecting the pipeline from a terrorist attack. The burden of protecting Americans and their interests ultimately falls to local, state and federal governments.

However, any rupture from an attack will likely be deemed accidental at first – if only from habit – at least until site exploration determines otherwise. Spill response plans and responders will likely be driven by TransCanada (or its contracted spill removal companies and/or local fire and police departments), and should be evaluated thoroughly in light of security needs. Because the first few hours following a spill will prove to be a key factor in ameliorating the damaging effects of an attack that triggers it. The strength of spill response plans and readiness is worth considering when evaluating the security risks and the security measures that should be taken to address them.

Little evidence of current security planning or actual security

It's possible that scarcity of publicly available information on security tactics, techniques and procedures could be purposeful. Advertising security measures could cede the security upper hand to those actively seeking to damage the pipeline or its ancillary components (pumping stations, valve stations, tank farms, etc.).

And, my field visit ("*walk-through*," or "*dry run*") to the Keystone 1 pipeline [REDACTED], showed no sign of any active security program whatsoever. I was able to freely approach, then stand at a Keystone 1 pump station for over 15 minutes snapping photos. I was not approached, questioned or even noticed at any point.

There was no actual penetration or property damage, of course, during this walk through. I merely used Internet sources to determine the general location of the pipeline, valve station, and pumping station. I then physically visited the area to determine exact locations and assess security measures. The process of determining the exact location of the pipeline, and the valve and pumping stations took approximately 30 minutes from the time I entered [REDACTED]

It is worth noting that putting the pipeline underground, while it does shield the pipe from the corrosive and eroding effects of weather, doesn't significantly decrease the threat of attack or the ease with which an attack could be carried out.

While the entirety of the pipeline can never be free from the threat of attack, special consideration can and should be given to those areas deemed vital to the environment, the economy and the lives of those people living in or near these areas.

A catastrophic attack would be easy to execute

And while an attack could take many forms, this assessment explores only one such option: a coordinated, improvised explosive attack against not only the pipeline at [REDACTED] but against their valve stations [REDACTED]

A coordinated attack on the vulnerable Keystone XL at [REDACTED] [REDACTED] would be relatively easy. [REDACTED] with minimal knowledge of homemade explosives and basic machining in order to trigger a spill of as much as 7.24 million gallons of tar sands crude dumped into [REDACTED] [REDACTED] surrounding area.

Anyone with a modest amount of knowledge regarding homemade explosives (which can unfortunately be found on the Internet), or with access to military-grade explosives, can walk up to the pipeline, [REDACTED] [REDACTED]

These threat scenarios are discussed in greater detail below.

Threat Scenarios

It must be remembered that no pipeline, no matter how small, can ever be completely secured—there's simply too much ground to cover, either for remote surveillance equipment or for actual guards who might patrol its length. This is particularly true for a pipeline the size of the Keystone XL.

It must also be remembered that the Keystone XL is not in the ground yet, so the following threat scenarios are but hypothetical—but *eminently executable once the pipeline is in the ground and operational*. The construction of the pipeline would chart its route for any terrorists interested in attacking it later.

For the purposes of designing a charge to rend a significant hole in the pipe, if not completely cut it in half, the thickness of the pipe was determined to be [REDACTED] [REDACTED]. A single charge would weigh in the neighborhood of 4lbs. How it would be constructed, what its shape might be, and where the precursors could be obtained will not be discussed. Suffice it to say that this type of bomb is 1960s era technology, and is still used today to [REDACTED]

The precursors for this type of homemade explosive are commercially available [REDACTED] [REDACTED] to set off the explosive mixture. All that's required to optimize such a charge, other than a basic knowledge of homemade explosives, is some simple machining skills and access to some basic machining tools (or a machine shop). Moreover, since certain constituents in [dilbit are highly volatilizable](#), this will likely compound the effects of any explosion.

Most Likely Scenario

[REDACTED]

If this were to successfully occur, TransCanada's control center would receive instant notification, at which point it would take them 11.5 minutes (best advertised shutdown time) to [REDACTED]

[REDACTED] This means that 60% of the oil in that [REDACTED] (TransCanada uses a drainage factor of 60%, meaning 40% of the oil would remain in the pipe, pooling at low points or simply be resistant to flow due to viscosity). The volume of a 36-inch diameter pipe, 5 miles long = 186,515 cubic feet. The volume that would spill out given the drainage factor: $186,516 \times .6 = 111,909.6$ cubic feet, or 19,932 barrels (bbl) of oil. Consider, too, that pumps will keep running for 11.5 minutes, adding another 4,312.5 barrels of oil to the spill (this figure is the pump rate volume, and was arrived at by multiplying $900,000 \text{ bbl/day} \times 1 \text{ day}/24 \text{ hours} \times 1 \text{ hour}/60 \text{ minutes} \times 11.5 \text{ minutes} \times .6 \text{ drainage factor}$).

This amounts to **1.02 million gallons** of oil spilled into the environment from a single successful attack. *(Of note: an 11.5-minute shutdown times assumes perfection on the part of TransCanada, no interpretation of data, just a single alarm bell and the shutdown process begins. In the Enbridge spill near Kalamazoo, it took control room operators several hours to affect a shutdown in spite of numerous alarms from the field. Still, for the purposes of this assessment, TransCanada will be given the benefit of the doubt.)*

Most Damaging Scenario

[REDACTED] would be the most damaging course of action. An attack of this magnitude means 60% of the oil from a [REDACTED] [REDACTED] would drain into the environment.

Using the same calculation method as above, this amounts to **1.35 million gallons** of oil spilled into the surrounding environment.

[REDACTED] potential attack

[REDACTED]

[REDACTED]

[REDACTED] a successful attack means that oil from a 17-mile stretch of pipeline could drain out [REDACTED]. This amounts to **3.03 million gallons** of oil being spilled into the surrounding environment.

Most Damaging Scenario

[REDACTED] is also the high point in the terrain, the above scenario is also the most damaging scenario. [REDACTED]

[REDACTED] potential attack

[REDACTED]

Most Likely Scenario

[REDACTED] oil from a 16-mile stretch of the pipeline, [REDACTED] could drain out. This amounts to **2.86 million gallons** of oil conceivably being spilled into the surrounding environment.

Most Damaging Scenario

Once again due to the terrain, the most likely scenario is also the most damaging, specifically with regard to targeting [REDACTED] an additional **1.02 million gallons** of oil into the

environment, it would not do so [REDACTED] What the indirect effects of such a spill might be is beyond the scope of this assessment.

Totals

A successfully coordinated attack [REDACTED] could result in as much as **6.91 million gallons** of dilbit erupting into the environment. Take into account the most damaging scenarios, [REDACTED], and that total gushes to **7.24 million gallons** of hazardous dilbit.

Conclusion

This assessment also cannot speak for the innumerable and valiant efforts of our intelligence agencies, those who strive daily to defeat terrorists “upstream” before they can actually act on their designs. Their persistent actions in our defense could very well thwart any such pipeline attack during the terrorists’ observation, orientation and decision phases. Still, no collection of intelligence agencies, no matter how robust, is perfect.

That successful attacks have been carried out in this country in the past is likely a sign that at least some terrorists will succeed again in the future. The unending task of our intelligence collection agencies is one of rethinking, refining and reframing our enemy’s intent. Weaknesses in our own systems will become apparent, and rather than deny that they exist, we should endeavor instead to improve upon them, just as we constantly endeavor to improve upon our many strengths.

While these numbers might be shocking, at least to some, the vulnerability of our energy infrastructure has been there for some time: The shock is how little it’s been discussed.

These numbers should, however, serve to give us renewed pause: It’s time for a more comprehensive look. A coordinated attack at several critical points would not only wreak havoc [REDACTED] it would likely overwhelm the existing engineering capability needed to clean it up.

The bigger takeaway that can be drawn is that our pipelines are *still* vulnerable, and, given the spate of pipeline attacks throughout the rest of the world, the appetite to target them is likely growing. These scenarios, rather than being forgone conclusions, are illustrative of what could happen to Keystone XL and other forms of energy infrastructure, should the threat be ignored.

Without belaboring the point, it would behoove the federal government to conduct such an assessment of its own; and not only that, but to actually gauge the

emergency response to it, particularly in those remote areas that do not have prepositioned emergency response personnel and equipment nearby.

The fact that such an attack at the scale described here hasn't occurred yet should provide no comfort, yet workable approaches are not out of the question.

What will be required is new thinking. In the meantime, the proposed pipeline represents a significant tactical problem: namely, if a position can't be reasonably defended, then in general it shouldn't be taken. As the Secretary of State completes his National Interest Determination, he should ask the hard questions that resolve that problem.