NYSDEC OHMS Document No. 201166576-00024

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

In the Matter of the Application of:

Application No: 8-4432-00085

FINGER LAKES LPG STORAGE, LLC
Underground Storage Facility Town of Reading, Schuyler County; DEC Facility. 8-4432-00085

ALJ McClymonds

I. Preliminary Statement

This *amicus* brief and attached exhibits are submitted by Schuyler County Legislators Van A. Harp and Michael L. Lausell. From their position as legislators elected in November 2013, and serving on the Schuyler County Legislature for a term of four years commencing on January 8, 2014, their firsthand knowledge of the deliberations and actions of the Schuyler County Legislature, particularly as it relates to the revision and modification of the Schuyler County Comprehensive Emergency Management Plan, can provide important information to the Department of Environmental Conservation (DEC) regarding the permit application of Finger Lakes LPG Storage, LLC (Finger Lakes LPG) for the proposed LPG storage facility located within Schuyler County.

II. Interest of *Amici*

Schuyler County Legislators Van A. Harp and Michael L. Lausell petition for party status and set forth as follows under the requirements of 6 NYCRR §624.5(b)(1):

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(i) The proposed party will proceed under the name Two Schuyler County Legislators, and will consist of Schuyler County Legislators Van A. Harp and Michael L. Lausell.

(ii) Under Article 2-B, § 23, 1. of the New York State Executive Law, "each county is authorized to prepare comprehensive emergency management plans." The county legislature bears the responsibility of periodically reviewing and updating the Comprehensive Emergency Management Plan (CEMP) to "provide that county and local governments will take appropriate actions to prevent or mitigate effects of hazards and be prepared to respond to and recover from them when a disaster or emergency occurs." Schuyler County Comprehensive Emergency Management Plan, http://www.schuylercounty.us/DocumentCenter/Index/912, Section I-2 (last visited January 14, 2015). Petitioner's environmental interest in the proceeding relates to the statutory duty to plan to prevent or mitigate the effects of hazards within the county.

(iii) Petitioner seeks party status under 6 NYCRR Part 624.4(b) under which an Administrative Law Judge may consider issues based on new information upon a showing that such information was not reasonable available. The new information was not previously available because off site rail traffic was not addressed in Finger Lakes LPG's Draft Supplemental Environmental Impact Statement (DSEIS) and because the local Schuyler County government has not taken

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appropriate actions to anticipate, and prevent or mitigate the effects of the proposed hazards.

(iv) The party is petitioning for *amicus* status.

(v) Petitioner's precise grounds for opposition to the issuance of the permit to Finger Lakes LPG are the specific dangers of the proposed railroad transport to and from the facility through Schuyler County, and the failure to adequately identify or mitigate the risks involved by Finger Lakes LPG.

Schuyler County Legislators Van A. Harp and Michael L. Lausell petition for party status and set forth under the requirements of 6 NYCRR §624.5(b)(3):

(i) The legal and policy issue to be briefed is the inadequate identification and mitigation of the risks involved in railroad transport of LPG to and from the proposed facility through Schuyler County. Under the requirements of 6 NYCRR §624.4(c)(1)(iii) petitioner is submittiing the issue for adjudication because applicant's DSEIS has not adequately addressed the issues stated. The issue is substantive as will be set forth below because the dangers and safety concerns are of a magnitude that a reasonable person would require further inquiry. The issue is significant as it has the potential to result in the denial of a permit, a major modification to the proposed project or the imposition of significant permit conditions to reduce the hazards that are set forth herein.

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(ii) As legislators that have actively participated in the deliberations and actions of the Schuyler County Legislature during 2014, including regular attendance at the meetings of the Public Safety Committee to which the County Emergency Management Coordinator reports, attendance at all legislative sessions, and through interaction with county legislators and county employees, Legislators Harp and Lausell are uniquely qualified to provide information to the Department of Environmental Conservation in two areas: 1) the failure of Finger Lakes LPG's DSEIS to address safety issues as they relate to specific features within Schuyler County, and 2) to provide information on the adequacy of the measures the Schuyler County government has taken to protect the safety of local residents and visitors to the county, and to safeguard the economic security of the local community.

As the Schuyler County Legislature has deliberated under the assumption that the safety precautions at the Finger Lakes LPG facility itself are the responsibility of Finger Lakes LPG, Legislators Harp and Lausell have no information to offer regarding the adequacy of Finger Lakes LPG's plans or precautions at the facility, nor an opinion on the geologic integrity of the salt caverns to be utilized and their possible effect on the salinity of Seneca Lake through underground migration of brine from the caverns into Seneca Lake.

III. Summary of Argument

Finger Lakes LPG's proposed activities within Schuyler County will significantly increase rail traffic on the Norfolk Southern Railroad line that traverses

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the county from north to south. In the Draft Supplemental Environmental Impact Statement (DSEIS), Finger Lakes LPG is requesting approval of a six track siding with the capacity to load 24 tank cars in a twelve hour period. With an additional storage area for 8 tank cars, Finger Lakes LPG anticipates 32 loaded tank cars either entering or leaving the facility on one daily train. The maximum number of cars on the train would be 72. Draft Supplemental Environmental Impact Statement, http://www.dec.ny.gov/docs/permits_ej_operations_pdf/fngrlkdseis.pdf, pp.125-128 (last visited January 14, 2015). The DSEIS states that once a train has left the facility "En route safety is the responsibility of the rail companies". Id at 166.

Of concern to the county is the section of track that leaves from the facility in a southbound direction. The track passes along an east-facing slope above the Village of Watkins Glen, where an accident involving the release of LPG would likely spread downhill toward the village. Of particular concern is the trestle where the railroad traverses the Watkins Glen Gorge. Finger Lakes LPG acknowledges the possible danger of the trestle in the DSEIS where they state that the Norfolk Southern "Bridge Department conducts regular annual inspections of all structures on the Norfolk Southern system with the Watkins Glen Gorge structure receiving special attention". Id at 131. The DSEIS is silent on why this trestle might require special attention. Aside from the 75 foot drop from the trestle to the rock gorge below, the DSEIS fails to mention that the gorge is at the very heart of the Watkins Glen State Park.

Watkins Glen State Park is the second most visited state park in New York, second only to the Niagara Falls State Park. Last year it received over half a million

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visitors. From a parking lot in the Village of Watkins Glen, visitors ascend along a trail that was opened to the public in 1863, and purchased by New York State in 1906. Since 1924, the park has been under the management of the New York State Department of Parks, Recreation and Historic Preservation. As visitors hike through the park, they can appreciate the spectacular gorge, at times less than 100 feet wide, but encased in near vertical walls that rise over a hundred feet high on either side. Down the center, a stream descends through waterfalls and pools. At a few places, steep stone staircases afford visitors the opportunity to ascend out of the gorge and hike on the park trails that travel along the rims of the gorge, affording views down into the gorge. The trails travel westward, until the point a mile west of the parking area where they pass under and over the Norfolk Southern trestle. The trail along the southern rim is designated part of the popular Finger Lakes Trail that passes through the Finger Lakes region.

For the county, the possibility of an accident along the rail bed raises significant concerns. However, an accident at the Watkins Glen Gorge trestle raises the specter of a disaster of near unimaginable dimensions. A derailment, bridge failure or act of terrorism at the trestle would easily cause numerous loaded rail cars to crash to the rock stream bed below, releasing gases which would descend through the narrow streambed or if ignited would cause a massive explosion. On a summer day, with the gorge filled with tourists, hundreds could die from asphyxiation or from the blast and heat of an explosion. On a winter day when the state park is closed for the season, if gases traveled unignited down the narrow gorge, they could spill out into the center of the Village of Watkins Glen, onto the

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lawn of the historic County Courthouse. The courthouse encompasses numerous county offices, the courts, county jail, sheriff department, and the office of emergency management. As gases mixed with the atmosphere an encounter with any ignition source within the village would result in a massive explosion. An accident of this magnitude would devastate the Village of Watkins Glen and could require months to remove ruptured tank cars from the narrow gorge, requiring prolonged evacuation of the center of government, along with limiting movement across the two bridges that connect the two halves of the Village of Watkins Glen.

IV. Procedural Background: Overview of Measures Taken by the Schuyler County Legislature to Prepare an Emergency Plan

This section relates the activities of the Schuyler County Legislature during year 2014 regarding activities relating to the Schuyler County CEMP. At the start of 2014, Legislator Harp was appointed to serve as a member of the Public Safety Committee. While each legislator was appointed to three committees for the year, it is common practice for most legislators to attend the meetings of the five standing committees.

Legislator Lausell attended the Emergency Management Planning session of the Office of Emergency Management in Albany on February 5, 2014, and inquired, given the dangers described in the preceding section, as to the duty of the county government to anticipate and prepare for the dangers envisioned. The answer from the county executives and Office of Emergency Management personnel was clear, one must absolutely anticipate the dangers involved. Legislator Lausell reviewed the Schuyler County CEMP and Hazard Mitigation Plan and noted that the CEMP was

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last revised in 2011 and the Hazard Mitigation Plan in 2008. Legislator Lausell introduced a resolution at the February 24, 2014 meeting of the Public Safety Committee to form a committee to review the county's emergency plans. At the March 3, 2014 meeting of the Legislative Resolution Review Committee, where all resolutions are discussed prior to the regular monthly legislative session, Legislator Lausell was persuaded to withdraw his resolution with assurances that the Emergency Management Coordinator, William Kennedy, was in the process of conducting a review of the emergency plans.

On May 12, 2014, Legislator Lausell distributed a letter to other members of the legislature raising concerns over the adequacy of the existing process for review of the CEMP, particularly noting the necessity of anticipating the risks of the proposed operations of Finger Lakes LPG in the county. Exhibit A. The letter was placed on the agenda of the Public Safety Committee meeting of May 28, 2014 and discussed in detail with county emergency management personnel.

At the Legislative Resolution Review Committee meeting of June 4, 2014, Chairman of the Legislature, Dennis Fagan, introduced individually a RESOLUTION SUPPORTING FINGER LAKES LPG STORAGE'S LIQUID PETROLEUM GAS PROJECT AND CALLING FOR GOVERNOR CUOMO TO ALLOW THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION TO ISSUE NECESSARY APPROVALS. Minutes – 2014, http://www.schuylercounty.us/DocumentCenter/View/2149, Page 94 (last visited January 14, 2015). Legislator Lausell noted that the resolution stated "WHEREAS the legislature considers the safety and wellbeing of its residents and the economic value of the tourists to be among its greatest priorities and is satisfied

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that the proposed project will not adversely impact either." Id at 95. Legislator Lausell moved to table the resolution until the wording of the resolution could be validated through the completion of a review of the county emergency plans. That motion failed. Legislator Harp moved to amend the resolution to include the following language, "BE IT FURTHER RESOLVED, that Schuyler County's Emergency Management Director is hereby directed to prepare and incorporate an appendix to the Hazardous Materials Plan addressing transportation related incidents involving the release of hazardous materials, specifically Liquid Petroleum Gas." This motion passed and was included in the final resolution. Id at 96.

At the June 9, 2014 legislative session, when the Resolution came up for consideration, Legislator Harp made the motion that the resolution be tabled until the appendix had been received and incorporated in the Emergency Response Plan. Id at 96. The minutes fail to report that the motion was seconded by Legislator Lausell and that the motion failed, 4 – 4. Chair Dennis Fagan's resolution in support of Finger Lakes LPG was approved by a 5 – 3 vote. Id at 97.

Legislator Lausell was approached by a local constituent, D. Rob Mackenzie, MD, FACHE, that offered assistance in preparing a Quantitative Risk Analysis of the proposed Finger Lakes LPG facility. This analysis addressed the statistical probability of an accident occurring either at the Finger Lakes LPG facility, or from train and truck transport of LPG. The report was completed on August 4, 2014, and presented to the Schuyler County Legislature. The report was received, with no further discussion regarding Finger Lakes LPG's proposed activities until the Public Safety Committee meeting of October 27, 2014, when Emergency Management

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Coordinator William Kennedy informed the committee that he had completed two projections using computer software to calculate the two specific scenarios addressed in Legislator Lausell's May 12, 2014 letter, and Mr. Kennedy stated that a draft plan would be ready soon.

At the Public Safety Committee meeting of November 24, 2014, Legislator Barbara Halpin commented that she had reviewed the draft plan and asked Legislator Lausell's opinion of the plan. The plan had only been distributed to committee members, and upon request, Legislator Lausell was provided with a copy of the plan. Exhibit B. The plan contains the two simulations raised in the May 12, 2014 letter to the legislature. The first simulation involved a truck accident at the curve where the long downgrade on Route 14 southbound enters the Village of Watkins Glen establishing that the ensuing gas cloud would engulf the local four-story waterfront hotel. Exhibit B at Page 33. On December 2, 2014, Finger Lakes LPG filed an amendment to their permit application with the DEC removing all plans for truck transport of LPG through the county from their application. On December 21, 2014, D. Rob Mackenzie completed a modified Quantitative Risk Analysis, removing the risk of truck transport of LPG from his report. Exhibit C.

V. Finger Lakes LPG's Quantitative Risk Assessment and the Schuyler County Draft Emergency Plan Inadequately Addresses the Risk of Rail Transport of LPG Through the County

As stated above, Finger Lakes LPG's application does not adequately address the dangers of LPG transport over the Watkins Glen Gorge trestle. The DSEIS places all responsibility for rail transport safety once LPG has left the facility on the local railroad.

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Regarding the Schuyler County Draft Emergency Plan, the simulation of a rail accident at the Watkins Glen Gorge trestle is based on the derailment of one tanker car. Exhibit B at Page 31. This simulation is unrealistic, as train derailments frequently involve multiple cars. Analysis of Severe Railway Accidents Involving Long Duration Fires (NUREG/CR-7034), http://www.nrc.gov/reading-rm/doc-collections/nuregs/contract/cr7034/ (last visited January 14, 2015). While the 25 mph speed limit of the Norfolk Southern line might limit the severity of a derailment, the deep gorge and the lack of any containment on the bridge would greatly increase the likelihood that multiple cars would derail into the gorge. If one car were to derail and uncouple, as the cars behind pushed it off the trestle, it could easily compromise the integrity of the railbed, ensuring that subsequent cars would also fall into the gorge below. Photograph of Watkins Glen gorge trestle. Exhibit D. Along with projecting only a single rail car falling into the gorge, the simulation does not appear to take into account the effects of the particular geography of the gorge. Photograph of the Watkins Glen State Park gorge. Exhibit E. In the simulation, the gas dispersal cloud spreads over level terrain. Multiple rail cars falling into the gorge would release their contents into a tightly contained watercourse, where the liquid gas would remain concentrated, and initially - heavier than air - migrate swiftly downstream toward the Village of Watkins Glen.

It must be noted that Schuyler County is also the home of the Watkins Glen International Racetrack. The track regularly hosts mass gatherings with crowds of 30,000 persons. The Norfolk Southern railroad track passes at a somewhat safer distance from the racetrack of approximately one mile away, but is a threat that

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should also be adequately studied. During the regularly scheduled mass events the Village of Watkins Glen and surrounding roads are filled with vehicular traffic and pedestrians in the village itself. These mass gatherings heighten the risk of a disaster due to an accident or an act of terrorism that could cause mass hysteria at the crowded racetrack, or greatly increase the number of fatalities within the Village of Watkins Glen.

VI. Hazardous Activity Within a New York State Park

Finger Lakes LPG's proposal, and the permitting requirements for which the DEC is responsible, must be balanced with the DEC's responsibility to mange and ensure the safety of visitors to the State Parks of New York. It is well settled that the DEC oversees many aspects of the management of state parks. Finger Lakes LPG's DSEIS is required to list any effect their proposed activities may have on state parks. DSEIS, Page 134. Although the proposed facility itself does not affect the Watkins Glen State Park, the DEC should address the collateral effects that rail traffic to the proposed facility will have on a state park that is located under a railroad route servicing the facility.

The Quantitative Risk Analysis For The Finger Lakes LPG Storage Facility examines the effects of a gas explosion. Quantitative Risk Analysis For The Finger Lakes LPG Storage Facility, http://www.dec.ny.gov/docs/legal_protection_pdf/20120216questqra.pdf, Section 3-2 (Last visited January 14, 2015). When one transfers these projections into the narrow confines of the Watkins Glen State Park gorge, it is clear that any incident at the park would involve a conflagration unacceptable by modern standards. A review of the Quest QRA, prepared for Finger Lakes LPG,

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establishes that a gas explosion involves two factors of physiological exposure, thermal radiation and overpressure. The remedy to heat exposure is the ability to quickly move away. Id. at 3-2. To visitors in the state park, this option would not be available due to the steep geography and the limited steep stairway access out of the gorge. As to overpressure - the physical effect of the blast of explosive gases - the report notes that there is no time to move away and that this effect is greatly exacerbated by the behavior of an explosion in a tightly confined area. Id. at 3-3 to 3-7. Any explosion, concentrating explosive power as it reverberated down the glen, would cause catastrophic harm to anyone caught within its close confines.

The Department of Environmental Conservation must weigh the responsibility of issuing industrial permits for activities that can have a significant impact on the environment, while protecting the safety and wellbeing of visitors to the New York State Parks. The effects of rail transport in regard to a permit application have been found appropriate for adjudication in an Issues Conference. Akzo – Interim Decision, January 31, 1996, http://www.dec.gov/hearings/10946.html (Last visited January 14, 2015). The DEC's duty to evaluate the potential for adverse impacts to aesthetic resources such as the Watkins Glen State Park extends even to visual impacts when reviewing a permit application. DEC Program Policy, Department ID: DEP-00-2, http://www.dec.ny.gov/docs/permits_ej_operations_pdf/visual2000.pdf (Last visited January 14, 2015). The juxtaposition of the transport of LPG by railroad through an aesthetic resource such as the Watkins Glen State Park creates a heightened duty to carefully balance a permit application's proposed activities with the safety and security of the surrounding community.

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VI. Conclusion

Finger Lakes LPG's proposed rail transport through Schuyler County will create risks that have not been adequately identified or mitigated. In addition, to expose visitors to the Watkins Glen State Park to danger, danger that should an accident occur, is inescapable, is tantamount to building a crowded theater with no emergency exits. To do so violates the principles of sound pubic policy. The unique geography of the Watkins Glen gorge and the rail line that crosses through the Watkins Glen State Park militate against granting a permit that will greatly increase train traffic. Were an accident to occur due to derailment, bridge failure or terrorism, the gorge would create a deadly situation for visitors to the park, county employees and for the residents of Schuyler County.

The Schuyler County government has been slow to anticipate and address the dangers that Finger Lakes LPG's facility will bring into the county. Faced with the initiation of a discussion of the risks, the Chair of the Legislature introduced a resolution in support of the facility, and was able to secure its passage by a slim majority. The review of Schuyler County's emergency plans has not been completed. The Schuyler County Legislature has decided not to file for party status at the DEC Issues Conference. Legislators Harp and Lausell petition for party status as individual legislators to present important information that can aid the Department of Environmental Conservation in rejecting or modifying the Finger Lakes LPG permit application.

* * * * *

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Respectfully submitted,

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THE PROPOSED CRESTWOOD GAS STORAGE FACILITY

From: Michael Lausell, County Legislator
To: County Legislators Halpin, Barnes, Fagan, Field, Gifford, Harp, and Howell

Crestwood's proposal, to store fossil fuels in abandoned salt caverns located in the Town of Reading will require that Schuyler County adequately address the safety hazards these activities will create. The decision on whether Crestwood's permit application will be approved rests with the Town of Reading, the Federal Energy Regulatory Commission and the New York State Department of Environmental Conservation. The responsibility for the County Emergency Management Plan and its implementation rests squarely with the Schuyler County Legislature.

Scientists have expressed concerns over the geologic defects of the caverns and the effects the activities may have on the water quality of Seneca Lake, a source of drinking water for many communities from one end of the lake to the other. Their testimony is causing the public officials who have attended the presentations to question the desirability of the proposed facility. I propose that the legislature invite the scientists to present their findings, along with Crestwood representatives, to foster an informed debate on this issue.

Along with questions regarding the facility itself, the county legislature would benefit from the testimony of an expert on the transportation of hazardous materials, to address the hazards of transporting gas through the county to and from the facility. The gas will be transported by pipeline, rail car and tanker truck. Trucks will load at the facility and travel through our county and the villages of Watkins Glen and Montour Falls, adding to the existing truck traffic the hazards of transporting explosive materials on a daily basis.

Rail transport will move greater amounts of gas over the railroad line that runs from north to south through our county. Under normal conditions, railcars built for the transport of explosive gases do not rupture in minor accidents. However, tank cars traveling over the high trestle that traverses Watkins Glen State Park are a far greater risk.

Tank cars falling 75 feet onto a rock streambed will rupture. The narrow geography of the glen will hinder the dissipation of the gas. My preliminary research from industry sources indicates that at concentrations of 10%, natural gas can cause asphyxiation, and the vaporizing gas is initially heavier than air. It is entirely conceivable that an accident at the trestle will release gases down the glen into the center of the village, with the threat of asphyxiation, or if the gases ignite, a massive explosion.

Our present county emergency plans, the blueprints used by emergency management personnel to effectively handle local disasters, must be revised to anticipate these new dangers. I am aware that Bill Kennedy, our Emergency Management Coordinator is currently working on the review of our plan. It is my opinion that the county legislators could facilitate this process by authorizing the technical assistance of a hazardous materials expert, attending the meetings that Mr. Kennedy will be organizing and actively encouraging other public officials, public employees and local businesses to participate in the process.

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I have attended two trainings by the New York State Office of Emergency Management, one in Albany in February and one within our county in March. Training sessions provide public officials with the opportunity to discuss disaster scenarios in relation to five core capabilities: prevention, protection, mitigation, response and recovery from both natural and manmade disasters. I have learned that it is our duty to anticipate the dangers of the proposed transport of explosive material in the community. Emergency management officers evaluate dangers based on scope, magnitude, demographics and geography. Consideration of these factors results in a 95% to 5% analysis of possible catastrophes, where the 5% are the events no one ever wants to see, such as the World Trade Center terrorist attack or Hurricane Sandy.

To illustrate the analysis, periodically a tractor-trailer truck loses its brakes on a hill. A loaded truck leaving the Crestwood facility and traveling into Watkins Glen could lose its brakes, and if unable to navigate the sharp curve at the foot of the downgrade, overturn on North Franklin Street. Even if it ruptures, the gas explodes, ten buildings are leveled, and fifty people die – that disaster does not meet the severity of the 5% analysis. It is a limited incident where damage is quickly identified and recovery can begin.

A disaster where rail cars fall from the trestle into the glen, whether from a derailment, bridge failure, or terrorism, could reach the 5% threshold. The location is remote and difficult to access, even to assess the number of rail cars that might have ruptured. In winter, when the state park is closed, the first warning could be the gas pouring out of the gorge and onto the courthouse lawn. We would need to evacuate the county offices, the jail, the sheriff's department and the emergency management office. The spreading gases could require the closing of the bridges that tie the two halves of our town together, the evacuation of the developmental disabilities center, the elementary, middle and high schools and many businesses and residences in the village.

In summer, with the glen full of tourists, an incident would trap hundreds within the narrow confines of the gorge trails with nowhere to escape. While the likelihood of a multiple rail car accident can be classified as relatively low; the severity, duration and recovery time would be significant. We could see hundreds dead, the aftermath of an explosion, an evacuation that could last for weeks and a community that might never recover from such a horrific incident. Yes, this scenario would definitely fall within the 5%, an event that we never want to see in our county.

We must then ask, what are the benefits the proposed facility may offer the county, justifying the risks involved. By Crestwood's own admission, the benefits are few, 8 to 10 jobs with little increase in sales tax, the gas itself would not be sold within the county. Plainly stated, Crestwood's interest is to store gas in the cheapest and most profitable way possible.

In contrast, the Watkins Glen State Park is a cornerstone of our local economy. It is the second most visited state park in New York State. Last summer 1,100 buses brought visitors to the state park, contributing to the over half a million visitors that see the park each year. The park has just been awarded a five million dollar grant by the State of New York to improve the entrances to the park and

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utilize the vacant lot across the street for additional parking. The visitors to the park contribute significantly to the local economy, generating sales tax and room tax revenue.

As county legislators, along with our duty to keep residents and visitors safe, we share a duty to protect our local economy from harm. An accident will inflict harm on our citizens and our economy. Some may question the need to discuss a danger that might seem remote, of inciting fear in our community. Emergency managers are trained to take a hard and critical look at dangers, to mitigate possible threats, protect from the foreseeable and ensure that emergency personnel are ready to respond swiftly and effectively to any disaster. Emergency managers review recent disasters to evaluate how to be better prepared, dedicated public servants addressing the dangers that most of us would choose to ignore, and ultimately, they risk their own lives to protect ours. They do not back away from asking the hard questions, searching for the worst-case scenario to understand the true dangers. They then analyze the likelihood of an event, and the cost of prevention and mitigation measures that might lessen the harm, knowing full well that we live in an imperfect world where tragedies will occur despite our best efforts.

My purpose is not to create fear or sway opinion based on emotion. If the facility is built, it will always be the county legislature's task to foresee, mitigate and respond to the hazards that ensue. Once the facility is built, there is no turning back. The storage depot will be part of our community. As a member of the Schuyler County Legislature I urge the objective evaluation of the risks and possible rewards of the proposed venture.

Regarding the facility itself, the decision on approving the facility lies in the hands of others. The County Legislature is responsible for an emergency plan to cope with the dangers the facility, if approved, will bring into our community. The County Legislature is certainly entitled to express an opinion whether in support or opposition to the facility based on the best interests of our community in regard to both the safety of our citizens and the security of our local economy.

Respectfully submitted,

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Schuyler County

Appendix to the Hazardous Materials Plan

Transportation of Liquefied Petroleum Gas LPG

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Scope

This appendix to the Schuyler County Hazardous Materials Plan is to address the transportation incidents involving Hazardous Materials. All incidents shall be managed as outlined in the Schuyler County Hazardous Materials Plan. The focus shall be on Liquefied Petroleum Gas, (LPG). This appendix will look at characteristics of LPG, modes of transportation, transportation routes, potential incidents, mitigations strategies, and response guidance.

Overview

The Schuyler County Hazardous Materials Plan provides a management plan for emergencies involving the release of hazardous materials. This document serves as a coordination plan which defines the roles and responsibilities of various agencies, groups and individuals during such a declared emergency. This appendix will serve to provide more insight to the transportation of Hazardous Materials with emphasis on LPG transportation.

Many unknown products are transported through the county each and every day. The transportation of LPG is known to be transported through the county with greater amounts and frequency due to the fact of a storage and truck filling station located on State Route 14. There is a potential for increased quantity to be transported with the proposed storage and transportation depot located in the Town of Reading.

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Characteristics of LPG

LPG is an acronym for Liquefied Petroleum Gas. There are a number of gases that fall under the "LPG" label, including propane, butane, propylene, butadiene, butylene and isobutylene, as well as mixtures of these gases.

LPG is a gas that can be compressed into a liquid. LPG is produced during natural gas processing and petroleum refining. Propane does not occur naturally. Following its refinement, LPG is stored as a liquid under pressure until its use at which time it becomes a gas or vapor.

Boiling Point: greater than -40 ° F at 760.0 mm Hg (USCG, 1999). It stays a liquid because it is under pressure in a gas cylinder. As a liquid it looks a lot like water. It is colorless and odorless in its natural state. The distinctive smell of LPG comes from an odorant that is added to LPG, for safety and leak detection reasons. Caution should always be used to avoid direct exposure, as a liquid LPG is cold enough to cause severe cold burns on exposed skin. Note: odorant is only added when product is distributed to the end user and not used in bulk transport of LPG>

LPG expands to 270 times the volume when it goes form liquid to gas.

Flame Temperature – An LPG flame burns at 1980°F

Flash Point: Propane: -156° F (cc); butane: -76° F (cc). (USCG, 1999)

Flammability Limits – The percentage of gas needed in a gas/air mixture to support combustion. Lower Explosive Limit (LEL): Propane: 2.2 %; butane: 1.8 % (USCG, 1999)

Upper Explosive Limit (UEL): Propane: 9.5 %; butane: 8.4 % (USCG, 1999)

Auto ignition Temperature: Propane: 871° F; butane: 761° F (USCG, 1999)

Heat Value - According to NFPA 58, the Heating Value for Propane (vapor) is 2,488 BTU per cubic foot.

Vapor Pressure: greater than 1 atm (NIOSH, 2003)

Specific Gravity: 0.51 to 0.58 at -58.0 ° F (USCG, 1999)

Molecular Weight: greater than 44 (USCG, 1999)

Water Solubility: Insoluble (NIOSH, 2003)

IDLH: 2000 ppm (NIOSH, 2003)

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Modes of Transportation for LPG

There are several modes for Transportation of LPG through Schuyler County.

Bulk shipments are done primarily through Pipeline in and out of the county. Trains and Trucks provide the other Bulk shipments. Bulk home delivery trucks travel on almost every road in the County. Small tank delivery trucks carry tanks under 100lbs for home and business delivery. Small cylinders like that used on back yard BBQ's are routinely carried in personnel vehicles, back of pick-ups, back seats of cars and trunks.

Pipelines

There are 20.9 miles of pipeline in Schuyler County carrying LPG.

There are 180,000 miles of liquid petroleum pipelines to safely and efficiently move energy and raw materials throughout the country. Pipelines range in diameter from 6 to 42 inches with pressures from 300 to 1500 psi. Pipeline companies are responsible for the safety of pipelines, operating under a comprehensive series of regulations from construction to operation and maintenance. Federal and state pipeline inspectors evaluate whether operators are being diligent in meeting regulatory requirements, conducting proper inspections, and making necessary repairs. The following agencies provide oversight for the industry

- U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA)
- National Association of Pipeline Safety Representatives (NAPSR)
- U.S. National Transportation Safety Board

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From 1999-2012, the number of spills from onshore liquid petroleum pipelines was reduced by about 62% while volumes spilled were reduced by about 47% based on reports from pipeline operators to the Pipeline Performance Tracking System, an industry pipeline release data base.

Rail Transport

Railroad tank cars are a principal means of moving bulk propane from refineries to bulk storage and disbursement facilities. The rail car is a large cargo tank on a rail car chassis, with capacities between 11,000 and 34,500 gallons.

U.S. Department of Transportation Federal Railroad Administration has the enforcement authority and responsibility to ensure the safe transportation of hazardous materials.

U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration provide for the specifications for the construction of tank cars.

49 CFR C – Specifications for pressure tank cars (Classes DOT-105,109, 112, 114 and 120)

U.S. Department of Transportation classification is DOT 112 Pressure cars, uninsulated, no bottom openings.

Bulk Trucks

This section will provide an overview of the primary methods of transporting propane in bulk transportation vehicles and containers. Bulk propane vehicles are an integral element in the propane transportation and distribution system. Key elements of this system are (1) the bulk transport cargo tank truck, which primarily moves propane from production, storage, and distribution facilities to propane marketers, and (2) the bobtail delivery vehicle used by marketers to transport and deliver propane to the end user. Although there may be differences in the truck or trailer chassis to which the propane tank is attached (e.g., truck chassis, semi-trailer, etc.), there are virtually no differences in the fundamental design, construction, and safety features of the cargo tank itself. Cargo tank truck specifications are established and enforced by the U.S. Department of Transportation (DOT). Like DOT portable tanks, propane cargo tank trucks are built to strict design specifications and codes established by both the

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American Society of Mechanical Engineers (ASME) and DOT. Since 1967 propane cargo tanks have been constructed to the MC-331 cargo tank specification.

Semi-Trailer Unit —The bulk cargo tank trailer is one of the prime methods for delivering propane to bulk plants and marketing facilities. Tank capacities range from 9,000 to 14,500 gallons, although cargo tanks as large as 17,000 gallons may be found in some states (e.g., Michigan). Tandem cargo tank trucks or "pups" may also be found in certain parts of the United States. Federal and state vehicle weight limits—rather than volume restrictions— are the primary criteria for determining vehicle loads and capacities.

Bobtail Single-Tank Delivery Vehicle

The "workhorse" of the propane marketing business, it is used to transport and deliver fuel to customers who use propane containers that are filled onsite. Capacities can range from 750 to 6,500 gallons.

The other mode of propane movement is by that of portable tanks. LPG home delivery companies use Cylinder delivery vehicles to transport cylinders to and from customer sites or retail stores. These companies follow strict safety standards for transport of tanks.

The final mode of transportation is in private vehicles when cylinders are being transported to and from filling or to point of use site. Many small tanks are transported in personal vehicles unrestrained or lay down. Private vehicle transportation also includes the tanks that are used with campers and motorhomes.

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SAFETY FEATURES

Propane cargo tank trucks will have a number of safeguards, ranging from pressure relief valves and excess flow valves, to an emergency remote shut-off. These are outlined next.

Internal Safety Valves

—Each tank will usually be equipped with a cable or air actuated internal safety valve. However, the Flowmatic® valve is a pressure differential actuated valve and uses neither a cable nor air actuation to open. Since a propane cargo tank will contain both liquid and vapor propane, both a liquid and vapor valve will be found. This spring-actuated valve is normally closed and will require either cable activation or air pressure to a pneumatic actuator to remain open. In an emergency, the internal safety valve can be closed by manually actuating the remote emergency valve control or by heat actuating a fusible device and releasing tension on the cables or pressure on the air system.

The liquid internal safety valve is normally a 4 inch valve, while the vapor valve is typically a 2 inch valve. Many older vapor valves are 1-1/4 inch. Some propane cargo tanks may contain an additional exterior liquid loading fitting, which is connected to an internal “spray fill” at the top of the tank. Loading the liquid product through this spray fill helps to condense vapors in the tank back into liquid. Propane tanks with this feature may have two liquid connections one designed for unloading and the other designed for loading. The vapor valve will be connected to an induction tube that extends into the vapor space of the container. It is important to recognize that if a propane cargo tank is overturned, the valves will now be reversed. That is—the liquid valve will now be in the “high” position and will function as the vapor valve, and vice-versa. If the cargo tank is resting on its side, both valves may be in the liquid or vapor space, depending upon the attitude/position of the cargo tank and the amount of product being transported. To assist with identification, some propane companies color-code these valves and their associated piping. Color-code schemes include orange (liquid) and yellow (vapor), and dark blue (liquid) and light blue (vapor). Color-coding is not universal. DOT regulations require that the internal safety valve be protected against mechanical stress and accident damage. As a result, the plug-type valve actually sits inside the cargo tank. Within four inches of the tank shell is a “shear cut” section of piping, which is designed to break under mechanical stress, such as when a vehicle goes under the cargo tank. This shear cut reduces the thickness of the piping by approximately 20%. If a collision causes stress at that point, the piping should fail at the shear point while the internal valve remains intact within the tank shell, thereby minimizing the release of liquid propane.

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Transportation Routes

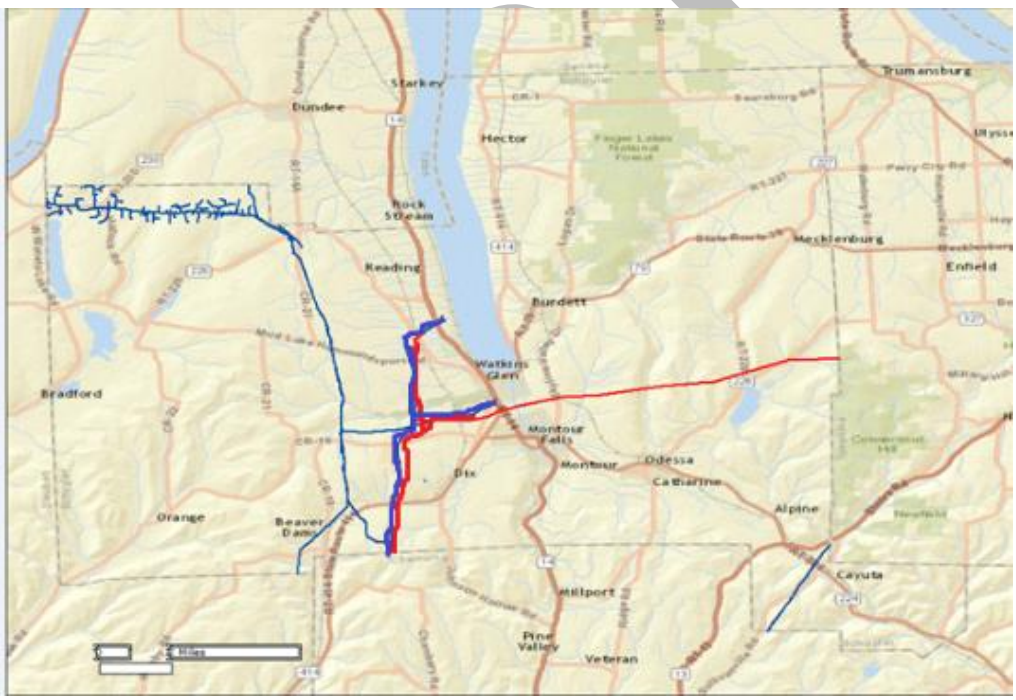
Any and all public and private roads have a potential for some transportation of LPG throughout the county. For the purpose of this plan we will only be looking at the routes used for bulk transportation.

Pipeline

There are 20.9 miles of pipeline in carrying LPG.
There are 45 miles of pipeline carrying Natural Gas not including the gathering lines from the storage fields or distribution lines providing home delivery of Natural Gas.

Pipeline Operators in Schuyler County

- Arlington Storage Company
- Dominion Transmission
- Enterprise Products
- Columbia Gas Transmission
- Empire Pipeline



Map of pipelines in Red – LPG Blue - Natural Gas

Natural Gas pipelines are used to transport Natural Gas to storage in Schuyler County as well as a means to move product to destinations beyond the county line. There is several gas wells located in Schuyler County that us small gathering lines to bring gas to compressor stations that route the gas into the larger pipeline infrastructure. Natural Gas is delivered to Schuyler County for storage in the town of

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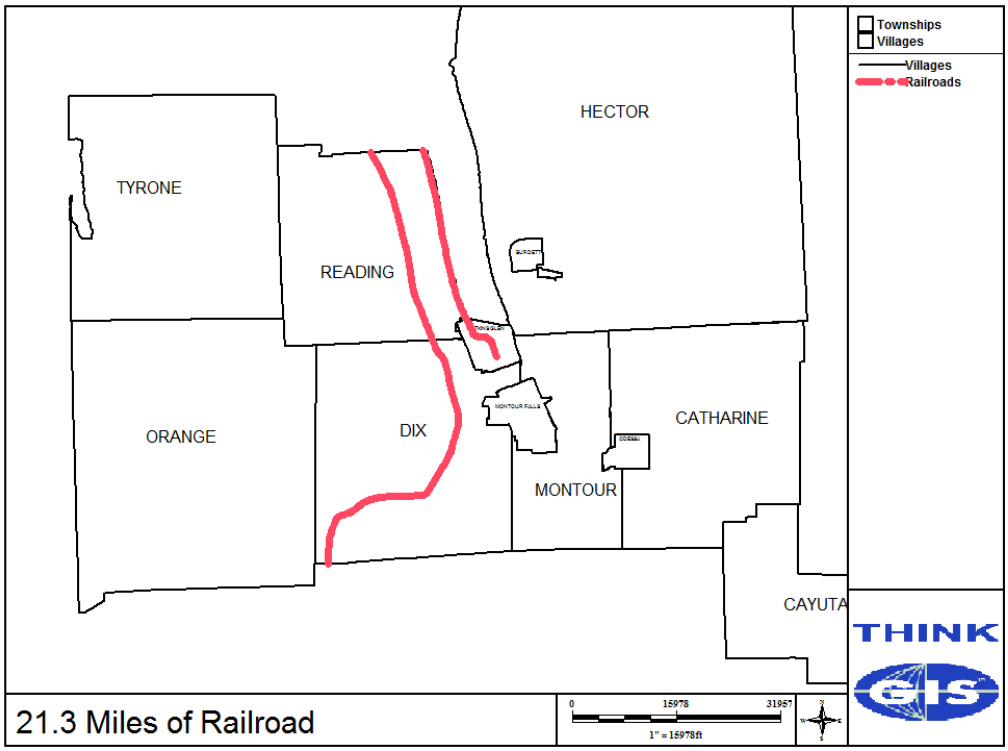
Tyrone where it is stored in depleted gas wells. It is also stored in salt caverns in the town of Reading. Natural Gas is routed by pipeline from storage to distribution systems throughout the Northeast.

LPG is delivered to Schuyler County for storage in at the Enterprise facility in the town of Reading. From the storage facility LPG is shipped by pipeline and by bulk cargo tank trailers to retail distributors.

Railroads

Schuyler County has one rail line that transverses the county from south to north, with a spur that starts in Himrod, Yates County and travels down along Seneca Lake to the village of Watkins Glen. The primary commodity that is transported on the spur is Salt. On the main line various commodities are transported through the county including hazardous materials Ethanol and Propane.

Norfolk Southern Corporation operating the rail that transverses the county north to south while Finger Lakes Railway operates the spur that descends into Watkins Glen from Himrod.



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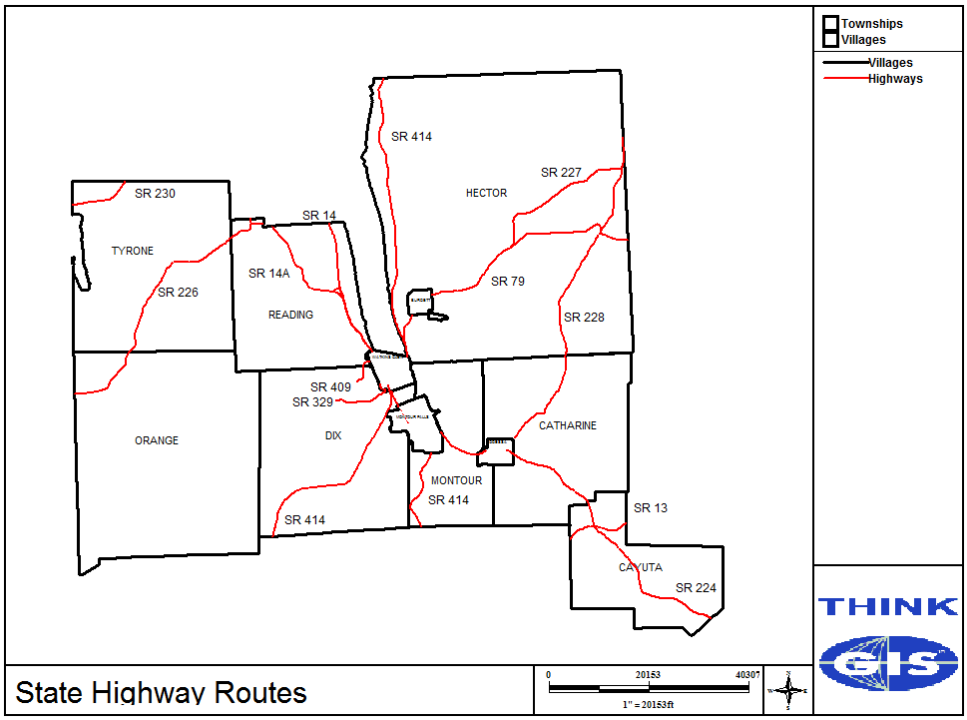
Highways

Bulk LPG is transported through Schuyler County on a daily basis. Bulk cargo tank trailers are loaded at the Enterprise facility in the town of Reading for transport to retail distributors throughout the region. According to Enterprise, approximately half of the transports head north out of the facility, the other half head south.

There are an approximately 100 miles of State highways in Schuyler County. The primary routes used to transport LPG from the storage facility in Reading are:

State Route 14 North to county line - 3.6 miles
State Route 14 N to 14A to county line - 6 miles
State Route 14 N to 14A to 226 South to county line - 16.2 miles
State Route 14 South to county line - 10 miles
State Route 14 S to 224 South to county line - 20 miles
State Route 14 S to 414 South to county line – 11.5 miles

There are 67.3 miles of highways used as primary routes to transport LPG from the Storage facility to retail distribution centers. Approximately half of all transport trucks are only using 6 miles or less when leaving the storage facility.



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Potential Transportation Related Incidents

Pipelines: Since 1986 the pipeline incidents causing death or major injuries have declined. The long term trend is an average decline of 10 percent every three years. Pipeline incidents can be caused by a number of factors including corrosion, equipment failure, as well as damage from excavations, incorrect operation, and natural forces. Currently available data covers the period from 1991 through 2011.

Historically, excavation damage is the leading cause of most serious pipeline failures. Accident information is grouped into eight cause categories: excavation damage, corrosion, natural forces, other outsid

The main hazard from a pipeline is the loss of containment leading to a product leak, fire, explosion and toxicity. The variables that affect the impact of a breach include: size of pipe, size of breach, line pressure, weather, ignition source and location. Location along the pipeline has a very significant effect as to the impact of an incident, including accessibility, terrain, proximity to buildings and the population within the area.

Railroads: Railroads have a strong record for safely moving hazardous materials (hazmat), with 99.998 percent of all shipments reaching their destination without a release caused by an accident. Railroads have lowered hazmat accident rates by 91 percent since 1980, and 38 percent since 2000.

The movement of hazardous materials is highly regulated, involves specialized employee and local first responder training, and is done with the utmost care to reduce safety and security risks.

The federal government has comprehensive regulations covering the safety and security of the movement of hazmat by rail – including the Federal Railroad Administration (FRA), Pipeline and Hazardous Materials Safety Administration (PHMSA) and Transportation Security Administration (TSA). The federal government also directs railroads to route hazardous materials on lines posing the least

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overall safety and security risk, and identifies the risk factors railroads should take into account in determining the best routes.

The potential incidents related to rail transport of LPG include: derailment that can cause leaking product, vapor clouds, fire, and explosions. Fire impinging on other tank cars can cause a boiling liquid expanding vapor explosion (BLEVE). Other potential incidents would include leaking product, and over pressurization of a tank car.

Potential causes to train derailments: Poor and improper maintenance of tracks, collisions with other trains, collisions with vehicles at crossings, excessive speed of trains, mechanical failures of train engines or rail cars and poor weather conditions.

Highways: Truck that carry LPG are specifically designed to survive a rollover crash, even with the truck design the potential for an accident to cause a leak of product, vapor clouds, fire, and explosions. The impact of a crash is dependent on location, weather and population proximate to crash site.

Factors that contribute to or cause motor vehicle crashes: Drive fatigue, speeding, drive unfamiliar with area, weather, mechanical failure, and other drivers. Highway routes, design and type of construction can play a role in highways vulnerability to crashes.

Mitigation Strategies:

Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters.

Pipeline Hazard Mitigation Strategies:

Federal pipeline safety regulations 49 CFR 192.616 and 49 CFR 195.440 require pipeline operators to develop and implement public awareness programs that follow the guidance provided by the American Petroleum Institute (API) Recommended Practice (RP) 1162, "Public Awareness Programs for Pipeline Operators"

- Pipeline awareness - education and outreach, pipeline operators must provide the affected public, fire, police, and other public officials with information about how to recognize, respond to, and report pipeline emergencies.
- Excavation damage prevention and the importance of using the one-call (811) notification system prior to excavation are to be emphasized for all stakeholders.
- Land use and development planning near transmission pipelines is an area in which local governments can implement mitigation relief to pipeline hazards is the adoption of risk-informed planning for land use and development near pipelines.
- Emergency response planning for pipeline emergencies.
- Affected municipalities, school districts, businesses, and residents must be advised of pipeline locations.

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Railroad Hazard Mitigation Strategies:

- Rail inspections: The Federal Track Safety Standards require railroads to regularly inspect track conditions, and to also conduct separate rail inspections with specially equipped hi-rail motor vehicles that operate over rail tracks. This equipment employs ultrasonic technology to identify internal rail defects that could potentially lead to an accident. Data is collected in real-time.
- Speed limit: the speed limit on the track through Schuyler County is 25 MPH.
- Educational outreach to increase awareness about grade crossing safety.
- Enforcement of trespass violations on railroad property. (Law Enforcement should strictly enforce)
- Railroads are required to implement a bridge management program to include at least annual inspections of railroad bridges to be conducted under the direct supervision of a designated railroad inspector.

Highway Mitigation Strategies:

- Hazardous Materials drivers are credentialed to higher safety standards than other operators
- State route 414 has a weight restriction of 9 tons for trucks coming north into the village of Watkins Glen, (Law Enforcement should strictly enforce)
- State route 224 has a mandatory brake check at the top of the hill prior to descending the hill into the village of Montour Falls, (Law Enforcement should strictly enforce)
- State route 14 has two staged speed reduction prior to entering the village of Watkins Glen from the north, (Law Enforcement should strictly enforce)
- DOT regulations require that MC-311 cargo tanks must be visually inspected and leak tested by a registered DOT approved inspector on an annual basis

General Incident Mitigation Strategies:

- Promote use of Emergency Notification systems
    - NY-Alert all county
    - Ping4 alerts all county
    - Code Red Village of Watkins Glen
- Enhance the emergency radio communication system
    - The after action report from every incident include the need for better communication of first responders: Schuyler County is currently upgrading the emergency communication system to enhance the ability to alert responders and their ability to manage incidents.
- Recommended advanced training for responders
    - Flammable Gas Emergency Response Workshop
    - Cargo Truck Hazardous Materials Specialist
    - ICS to the 300 level

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- Preplans for potential incidents should be in place.
    - All Fire Departments in Schuyler County have Pre-determined 2nd alarms set up based on the location within their district
    - Schuyler County Fire Departments have automatic mutual aid established

Response Guidance:

The primary responsibility for responding to emergencies rests with the local governments of town's villages and cities, and with their Chief Executive.

As mandated by federal statue, all hazardous materials incidents within Schuyler County shall be managed by utilizing the National Incident Management System (NIMS) – Incident Command System (ICS).

Any and all response shall be in accordance with the Authority Having Jurisdiction (AHJ) polices procedures and plans.

All incidents shall be managed as outlined in the Schuyler County Hazardous Materials Plan.

Emergency Responders should follow the Emergency Response Guidebook (ERG). Emergency Response Guidebook provides first responders with a go-to manual to help deal with hazmat accidents during the critical first 30 minutes

- ERG's should be in all emergency services vehicle
- **ERG 2012 Mobile App**
  The Pipeline and Hazardous Materials Safety Administration has developed a free, mobile web app of its Emergency Response Guidebook 2012 (ERG). The new safety tool provides the nation's emergency responders with fast, easily accessible information to help them manage hazardous material incidents. For more information visit http://phmsa.dot.gov/hazmat/library/erg

  Propane uses Guide 115

Activation and Responsibilities

Schuyler County 911 center will notify the Fire Department that has jurisdiction of the location of the incident.

Fire Department Responsibilities
Upon arrival the officer of the first arriving units shall assume the duties of the incident commander (IC) until relieved by the arrival of a more senior ranking officer.

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- The IC shall implement the local hazardous materials response plan and has the initial responsibility for initial assessment of the situation, identification of materials involved, incident coordination, securing the site, rescue and medical treatment of the injured if safe to do so, defensive measures or containment if properly trained to do so, and/or evacuation of people if endangered.

Police Agencies Responsibilities

The appropriate police agency, having jurisdiction, in addition to the responsibilities they have at the scene of transportation incidents, they shall assist the incident commander in carrying out the following tasks which shall include but not limited to:

- Set up and maintain exclusionary zones, maintaining access and egress for emergency response personnel
- Provide security on-scene for emergency response operations
- Control and contain crowds
- Assist in evacuation the area surrounding the site of the incident, if appropriate, sufficient to protect the public from the dangers posed by the substance.
- Assist with perimeter control as needed

Fire Coordinators Office Responsibilities

The responsibilities shall include but are not limited to:

- Coordinate with other agencies to ensure that when there is an incident the hazardous material will be contained and controlled and the incident is handled in a manner that will minimize hazards to the populations of the county.
- Maintain participation in the Central NY Hazmat Consortium to lavage regional assets in planning and response to incident.
- Establish and serve as a liaison with the New York State Office of Fire Prevention and Control.

Emergency Management Office Responsibilities

The responsibilities shall include but are not limited to:

- The EMO acts as principal aide to, and may be delegated authority to act for, the Chairman of the Schuyler County Legislature. The EMO coordinates all activities with county departments and other agencies and organizations so to keep the chairman apprised of the current situation. Periodic briefings will be held to include county departments and other agencies as required.
- The EMO shall coordinate operating departments of the government with non-governmental groups and emergency organizations.

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- The EMO shall maintain continuous coordination with the New York State Office of Emergency Management (OEM) and with other governmental agencies as needed.

Chief Elected Official Responsibilities

The Chief Elected Official shall be duly elected official of a political jurisdiction, or his/her designated successor, as defined by the jurisdictions policies.

The Chief Elected Official's responsibilities include but are not limited to:

- Declare state of emergency when needed in accordance with New York State Executive Law 2B
- Provide the public with information related to the incident in conjunction with the public information officer.

Emergency Equipment

Standard structural firefighting equipment is required to control incidents that involve LPG. All fire departments in Schuyler County possess the equipment needed. The size of the incident may require the use of mutual aid to assist the primary response agency with the control of an incident.

Some of the equipment need include but are not limited to:

- Master stream with a Deluge gun or Fire monitor
- Large diameter hose (5 inch hose is standard can supply 1000 GPM)
- Tanker trucks
- Structural Firefighting PPE
- SCBA's
- Air Monitoring equipment
- Communication equipment

Evacuation Routes and Procedures

The precise evacuation zone and route used to address a transportation incident will vary by a multitude of factors surrounding the incident such as location, weather, time, amount or size and type of incident, i.e. leak, fire, etc.

- In the event that the evacuation of residents of the area surrounding the emergency scene is necessary, the evacuation order will be issued by the Incident Commander unless a State of Emergency has been declared, in which case the order shall be issued by the Local Chief Executive.

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- Notification to the public will be made using one or more of the following systems Ping4 alerts, NY-Alert reverse 911, social media, door to door canvassing as appropriate, mobile public address systems, EAS broadcasts and radio and television broadcasts, Code Red (village of Watkins Glen only).
- Evacuation routes shall be selected to avoid exposure to the hazard.
- In the event that large numbers of individuals must be evacuated, notification will be made to the American Red Cross.

Training and Exercise

Training requirements are the responsibility of the local authority having jurisdiction, and all responders shall follow their agencies policies and procedures.

Hazardous Materials First Responder Operations is included in the initial Firefighter 1 course meeting training requirement of OSHA 1910.120 for first responders. There are several advance courses that prepares emergency response personnel to effectively and safely respond to and stabilize incidents involving hazardous materials.

The following are additional trainings that are available including but not limited to:

- Flame Gas Emergency Response Workshop
- Hazardous Materials Incident Command
- Hazardous Materials Incident Safety Officer
- ICS 200 & 300
- Hazardous Materials Technician – Basic

All responders are required to annually review and refresh the competencies covered in OSHA 1910.120 HAZWOPER for Frist Responder Awareness and Operations Level Responders.

Schuyler County Exercise program requires EMO participate in a minimum of 3 exercises per year. All exercises conducted must be managed and executed in accordance with the Homeland Security Exercise and Evaluation Program (HSEEP). An After-Action Report/Improvement Plan (AAR/IP) must be prepared and submitted to DHSES following every exercise, regardless of type or scope.

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GUIDE 115 GASES - FLAMMABLE (Including Refrigerated Liquids)

POTENTIAL HAZARDS

FIRE OR EXPLOSION

- **EXTREMELY FLAMMABLE.**
- Will be easily ignited by heat, sparks or flames.
- Will form explosive mixtures with air.
- Vapors from liquefied gas are initially heavier than air and spread along ground.

CAUTION: Hydrogen (UN1049), Deuterium (UN1957), Hydrogen, refrigerated liquid (UN1966) and Methane (UN1971) are lighter than air and will rise. Hydrogen and Deuterium fires are difficult to detect since they burn with an invisible flame. Use an alternate method of detection (thermal camera, broom handle, etc.)

- Vapors may travel to source of ignition and flash back.
- Cylinders exposed to fire may vent and release flammable gas through pressure relief devices.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

HEALTH

- Vapors may cause dizziness or asphyxiation without warning.
- Some may be irritating if inhaled at high concentrations.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire may produce irritating and/or toxic gases.

PUBLIC SAFETY

- **CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.
- Always wear thermal protective clothing when handling refrigerated/cryogenic liquids.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 800 meters (1/2 mile).

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.

EMERGENCY RESPONSE

FIRE

- **DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.**

CAUTION: Hydrogen (UN1049), Deuterium (UN1957) and Hydrogen, refrigerated liquid (UN1966) burn with an invisible flame. Hydrogen and Methane mixture, compressed (UN2034) may burn with an invisible flame.

Small Fire

- Dry chemical or CO_2.

Large Fire

- Water spray or fog.
- Move containers from fire area if you can do it without risk.

Fire involving Tanks

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.
- Do not direct water at spill or source of leak.
- Prevent spreading of vapors through sewers, ventilation systems and confined areas.
- Isolate area until gas has dispersed.

CAUTION: When in contact with refrigerated/cryogenic liquids, many materials become brittle and are likely to break without warning.

FIRST AID

- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- Clothing frozen to the skin should be thawed before being removed.
- In case of contact with liquefied gas, thaw frosted parts with lukewarm water.
- In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

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Emergency Incident Log

CALL TIMES: Initial Call _____ Time of Incident _____

Time at Scene _____

Chemtrec Called _____

Shipper to Scene _____

CALLER: NAME/ORGANIZATION/NUMBER _____

INCIDENT PROBLEM: Type Incident _____

Time _____

Details/Injuries _____

Incident Stage _____

PRODUCTS/EQUIPMENT INVOLVED: Equipment _____

Quantity _____

Plant _____

LOCATION: City/State _____

Directions _____

POTENTIAL LOSSES: Populated Area _____

Rural Area _____

Industrial Area _____

MODIFYING CONDITIONS: Weather _____

Temperature _____

Nearest Airport _____

CONTROL PERSONNEL ON SCENE:(or called)

Fire/Units _____ Police _____

OTHER _____

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CONTROL EQUIPMENT: Wreckers, Crane, Straps, Air Bags, Etc. _____

_____

SHIPPER: Carrier - Name & Type _____

Rail Car - Owner/Lease-holder, Number & Size _____

_____

Consignee _____

Origin/Destination _____

B/L - Waybill Number _____

COMPANIES CALLED: Telephone Number _____

Person(s) Contacted _____

AGENCIES CALLED: CHEMTREC (1-800-424-9300) _____

NTSB (202-314-6120 _____

FRA (202-426-2748) _____

BOE (202-835-9500) _____

DOT/MTB (202-426-0656) _____

FHA (202-426-1700) _____

Other _____

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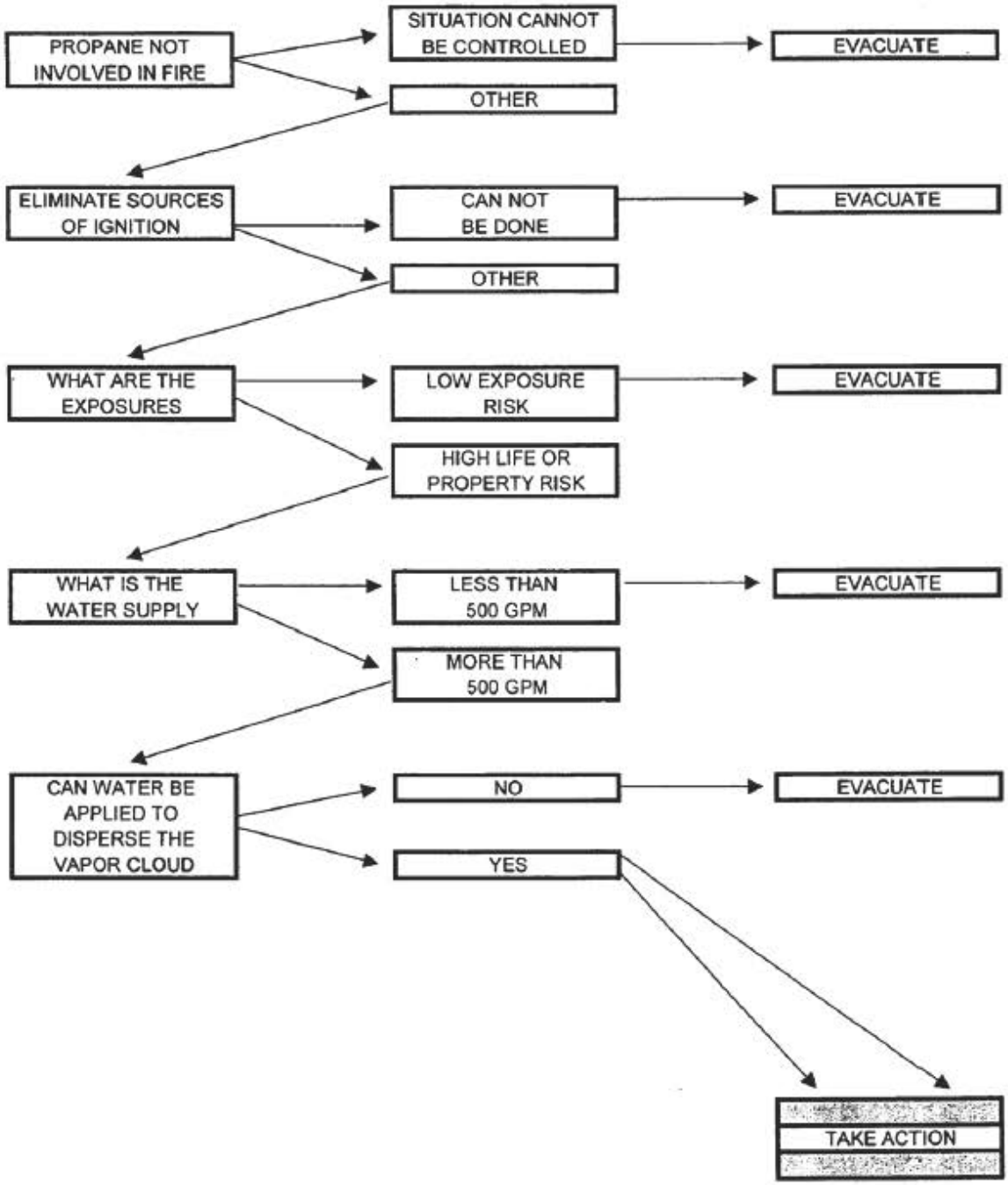
Fire Fighter Emergency Response Decision Tree

Propane Vapor Leak & Control



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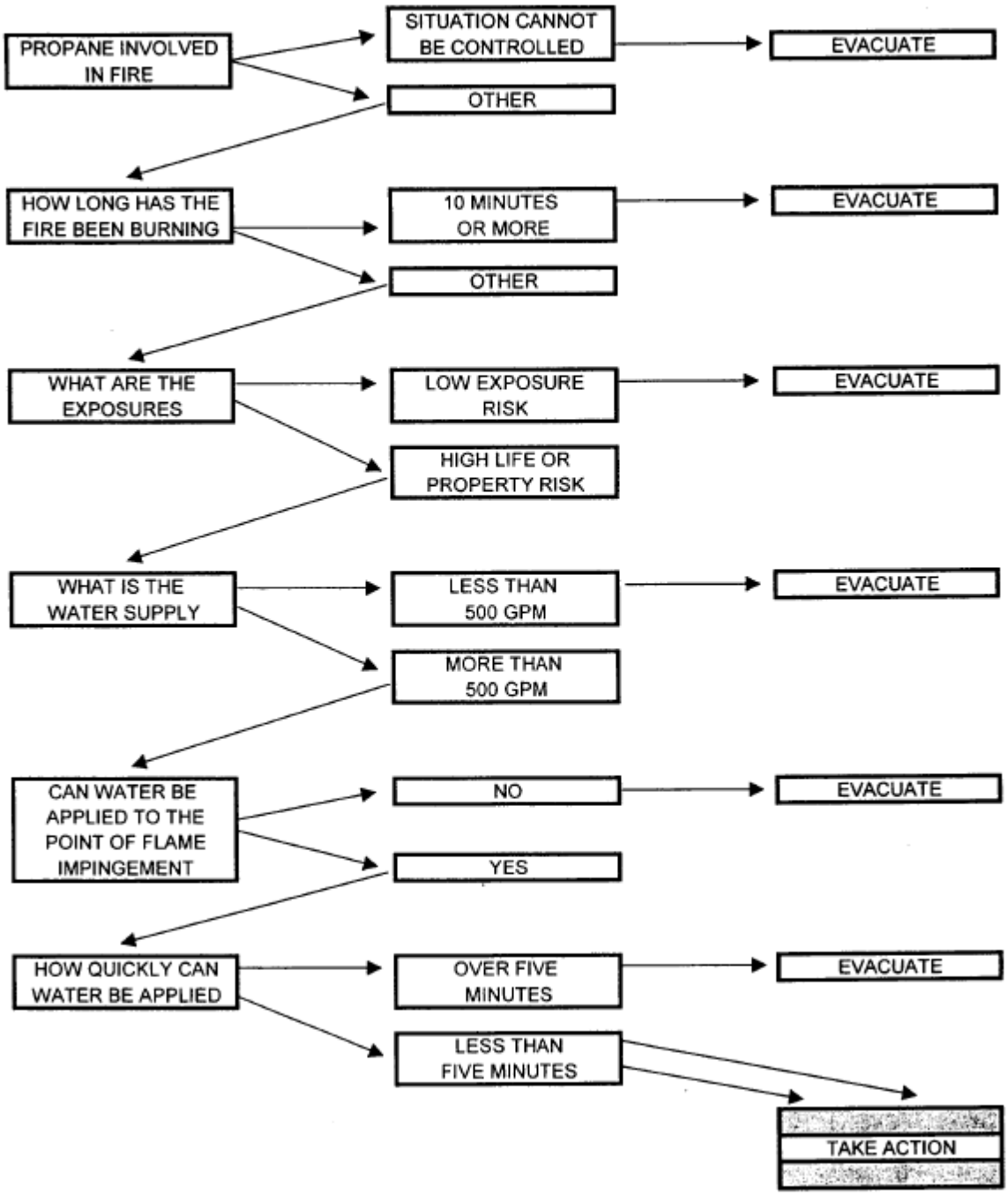
Fire Fighter Emergency Response Decision Tree

Propane Involved in Fire



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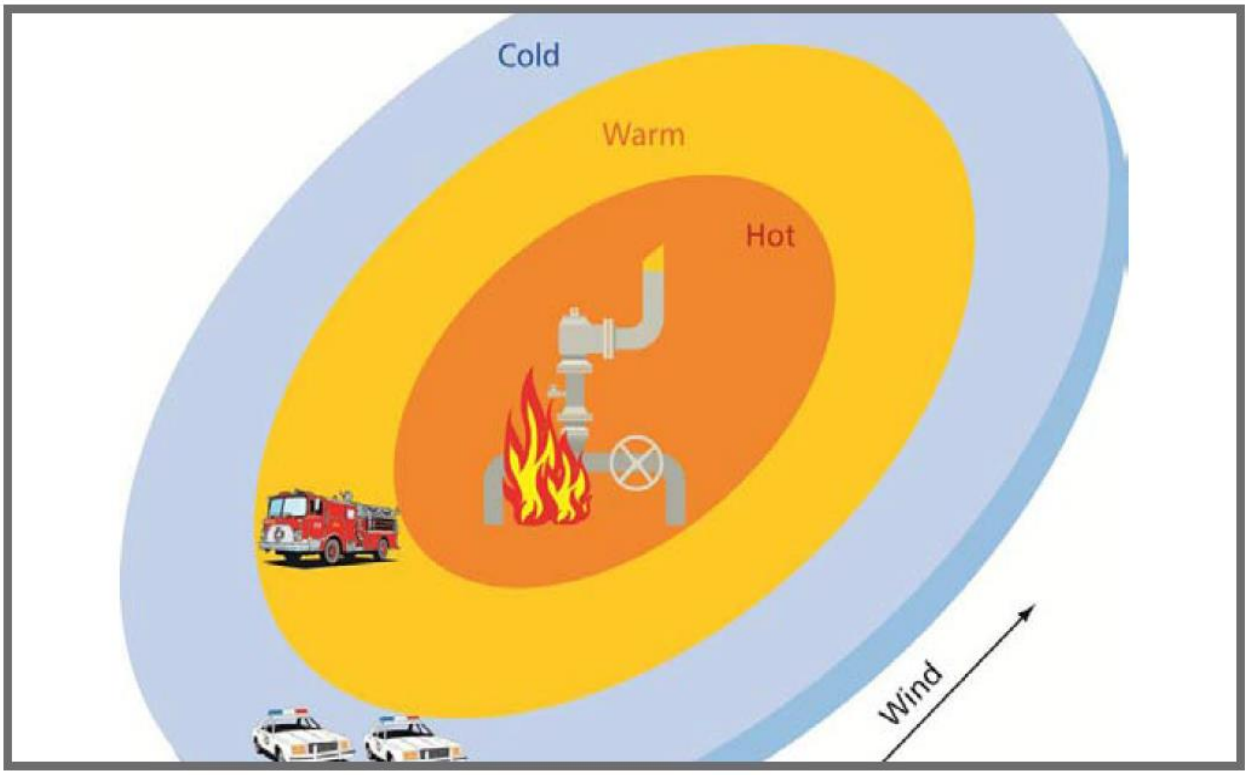
Emergency Response Tactics: Establishment of Hazard Control Zones

Isolation of the area surrounding a hazardous materials incident is a critical step to protection resoponders and the public. There are numerous factors that affect establishment of Hazard Control Zones. The diameter of the Hot Zone is large enough to protect persons from exposure to the harmful effects of the hazardous materials.

- The Hot Zone or "Exclusion Zone" contains a hazardous material with a potentially serious rish. Entry into the Hot Zone is only by responderss wearing protective equipment, and clothing appropriate for the hazards based on a thorough risk assessment.
- The Warm Zone or "Contamination Reduction Zone" adjoins the Hot Zone and serves as an area for decontamination of response personnel and equipment.
- The Cold Zone, or "Support Zone" borders the Warm Xones and contains support activities for the response which do not require personal protective equipment such as the Command Post, equipment donning and doffing areas, rehabilitation and treatment funtions, and staging area



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Emergency Contact information	**Emergency**	**Non-emergency**
Schuyler County Emergency Services (all police, fire, & EMS)	911	607-535-8222
Schuyler County Emergency Management	911	607-535-8200
New York State Watch Center		
(Emergency Contact for all State Agencies)	518-292-2200	
DEC Spill Hotline	800-457-7362	
National Response Center	800-424-8802	
Enterprise Products	888-883-6308	888-806-8152
Columbia Gas Transmission	800-835-7191	607-243-8160
Crestwood	866-243-7473	817-339-5570
Empire Pipeline	800-444-3130	716-686-6123
Arlington Storage Company LLC	877-689-0195	817-339-5570
Dominion Transmission	888-264-8240	800-362-7557
New York State Propane Gas Association		518-383-3823
Finger Lakes Railway		315-781-1234
Norfolk Southern	800-453-2530	855-667-3655
Propane Retailers Serving Schuyler County		
Ferrellgas		800-437-4856
Griffith Energy - Lodi, NY		607-582-6707
Bath, NY		607-776-2145
Big Flats, NY		607-562-8451
AmeriGas		888-727-7171
Suburban Propane		800-776-7263
DiSanto Propane		800-776-8192
Ira Wyman		315-536-2378
Phelps Sungas		315-789-3285
Ehrhart Propane & Oil		607-987-8111
Midway Propane		607-243-7885

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C.H.I.T.

Chemical Hazard Information Team

Contact Listing

CHIT Member	Phones		
	Home	Work	Cell
Joe Bird 208 W. Mill St. Horseheads, NY 14840	796-9555	535-2721 xt 201	731-7952
Michael Bowles 410 Euclid Ave. Elmira, NY 14905	201-8064	378-1419	215-2369
Sharon Burke 1657 Dachshund Dr. Corning, NY 14830	524-6416	814-628-6065	227-7152
Carol Christian 73 Carpenter Rd. Elmira, NY 14903-7930	562-8253		
Brenda L. Coolbaugh 525 W.2nd Street Elmira, NY 14901-2645	254-5085	592-7069	
Benjamin L. Hall 4272 Hornby Rd. Corning, NY 14830	937-9643	974-0416	738-6798
Reeve B. Howland 1415 W. Water St. Elmira, NY 14905	732-5844	737-8220	738-0003 857-5596
David Jessick 1113 N. Main St. Elmira, NY 14901	733-0988	retired	426-7962
Chad M. Kehoe 231 McCarthy Rd. Lindley, NY 14858	524-6736	732-2214	(585)755-2251
Merrill Lynn	562-8019		

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16 Olcott Rd.
Big Flats, NY 14814

	Home	Work	Cell
Deb Marlatt 1110 Cty. Road 85 Addison, NY 14801	359-3510		259-7882
Caroline Masia 99 Morningside Dr.. Elmira, NY 14905	846-0887(C)	732-2909	846-0887
Dale Powers 4708 Clawson Drive. Campbell, NY 14821	527-1027	974-3451	329-5307
Bill Pratt 305 Watkins Rd. Horseheads, NY 14845	739-2069		481-3869
John Short 1244 Trescott Dr. Pine City, NY 14871	732-7735	732-2909	731-1163
Brian Tyndell 10 Maple Ave Addison, NY 14801	359-4708		769-3841
Rob Winkky 252 W 19th St. Elmira Heights, NY 14903	732-1712	732-2909	425-8053

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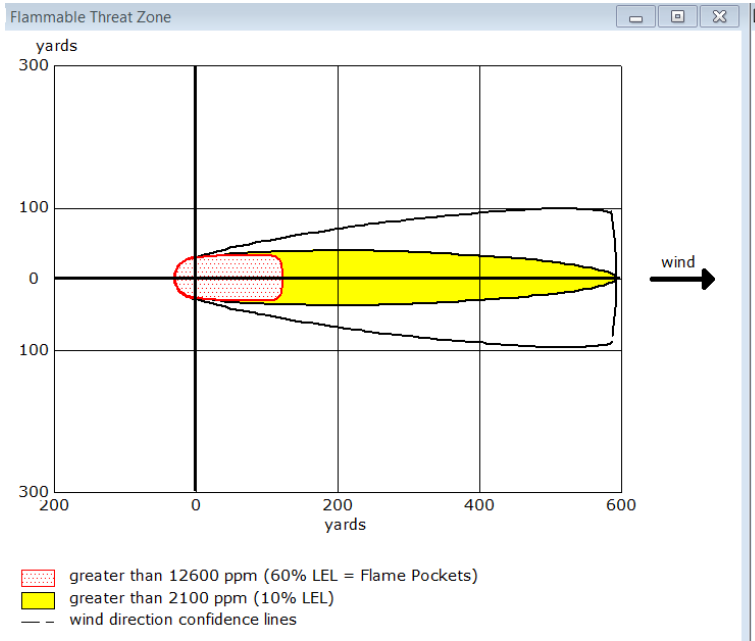
Potential Areas Affected by a Release –

Any area within the transportation system has the potential to be affected by a release.

For planning purposes we looked two areas that could have the greatest impact should a transportation related incident occur.

Using computer modeling ALOHA software with overlays onto a Google map we run the following Flammable Treat Zones.

Example 1: Rail Tanker that would derail and fall into the Watkins Glen State Park



Text Summary

```
SITE DATA:
  Location: WATKINS GLNE, NEW YORK
  Building Air Exchanges Per Hour: 0.95 (unsheltered single storied)
  Time: October 21, 2014  1406 hours EDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: PROPANE                  Molecular Weight: 44.10 g/mol
  AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min): 33000 ppm
  IDLH: 2100 ppm     LEL: 21000 ppm       UEL: 95000 ppm
  Ambient Boiling Point: -44.4° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 10 miles/hour from w at 3 meters
  Ground Roughness: urban or forest       Cloud Cover: 5 tenths
  Air Temperature: 45° F                  Stability Class: D
  No Inversion Height                     Relative Humidity: 50%

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 12 feet                  Tank Length: 40 feet
  Tank Volume: 33,841 gallons
  Tank contains liquid                    Internal Temperature: -46° C
  Chemical Mass in Tank: 66.7 tons        Tank is 80% full
  Circular Opening Diameter: 15 inches
  Opening is 3.00 feet from tank bottom
  Ground Type: Water                      Water Temperature: 45° F
  Max Puddle Diameter: Unknown
  Release Duration: 18 minutes
  Max Average Sustained Release Rate: 15,500 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 101,384 pounds
  Note: The chemical escaped as a liquid and formed an evaporating puddle.
  The puddle spread to a diameter of 56 yards.

THREAT ZONE: (GAUSSIAN SELECTED)
  Threat Modeled: Flammable Area of Vapor Cloud
  Model Run: Gaussian
  Red    : 124 yards --- (12600 ppm = 60% LEL = Flame Pockets)
  Yellow: 594 yards --- (2100 ppm = 10% LEL)
```

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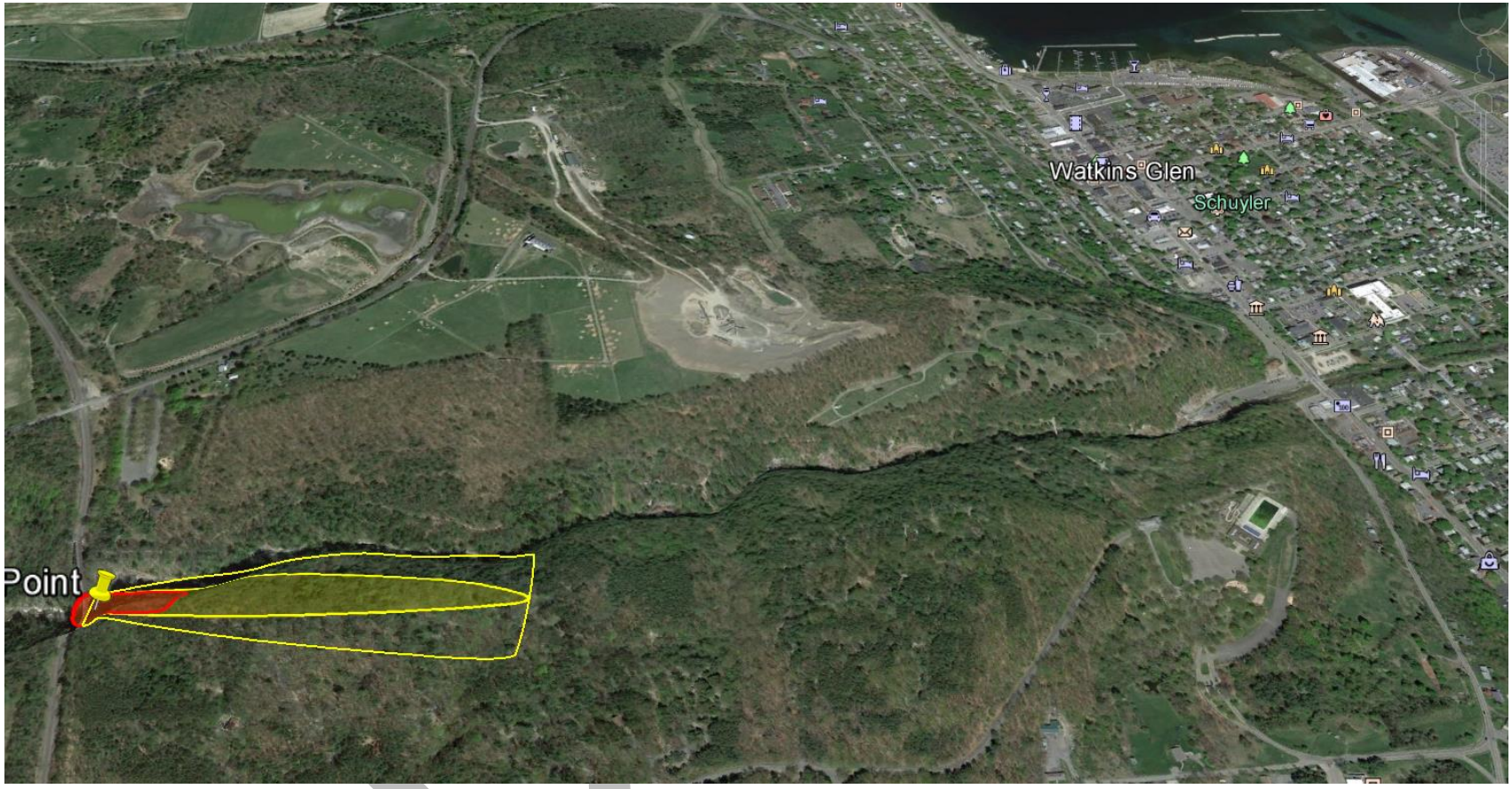
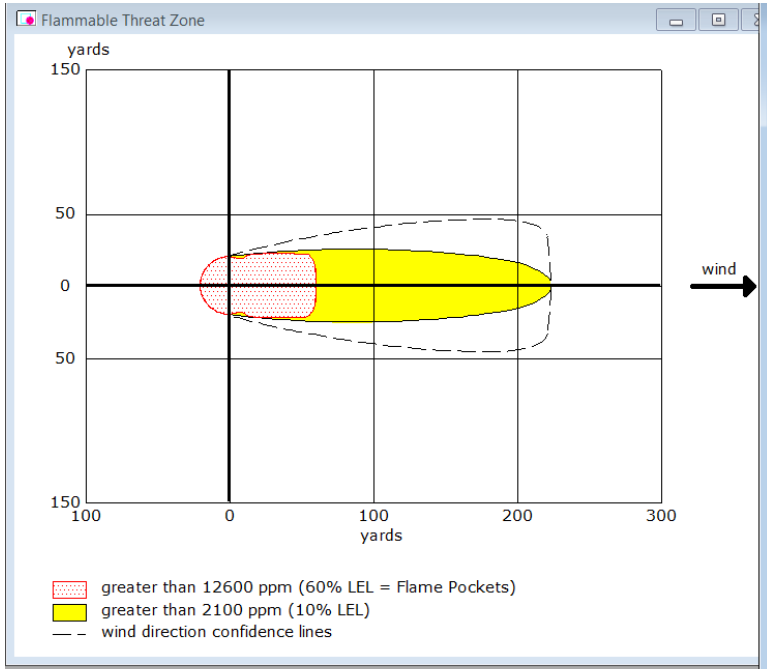


Example 2: Bulk Tanker truck accident north end of Watkins Glen at the intersection of Division Street and N Franklin.



Text Summary

```
SITE DATA:
  Location: WATKINS GLNE, NEW YORK
  Building Air Exchanges Per Hour: 0.95 (unsheltered single storied)
  Time: October 21, 2014  1406 hours EDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: PROPANE                  Molecular Weight: 44.10 g/mol
  AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min): 33000 ppm
  IDLH: 2100 ppm     LEL: 21000 ppm       UEL: 95000 ppm
  Ambient Boiling Point: -44.4° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 10 miles/hour from w at 3 meters
  Ground Roughness: urban or forest       Cloud Cover: 5 tenths
  Air Temperature: 45° F                  Stability Class: D
  No Inversion Height                     Relative Humidity: 50%

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 7 feet                   Tank Length: 40 feet
  Tank Volume: 11,515 gallons
  Tank contains liquid                    Internal Temperature: -46° C
  Chemical Mass in Tank: 22.7 tons        Tank is 80% full
  Circular Opening Diameter: 10 inches
  Opening is 1.61 feet from tank bottom
  Ground Type: Concrete
  Ground Temperature: equal to ambient
  Max Puddle Diameter: Unknown
  Release Duration: 15 minutes
  Max Average Sustained Release Rate: 3,820 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 35,715 pounds
  Note: The chemical escaped as a liquid and formed an evaporating puddle.
  The puddle spread to a diameter of 40 yards.

THREAT ZONE: (GAUSSIAN SELECTED)
  Threat Modeled: Flammable Area of Vapor Cloud
  Model Run: Gaussian
  Red    : 60 yards --- (12600 ppm = 60% LEL = Flame Pockets)
  Yellow: 223 yards --- (2100 ppm = 10% LEL)
```

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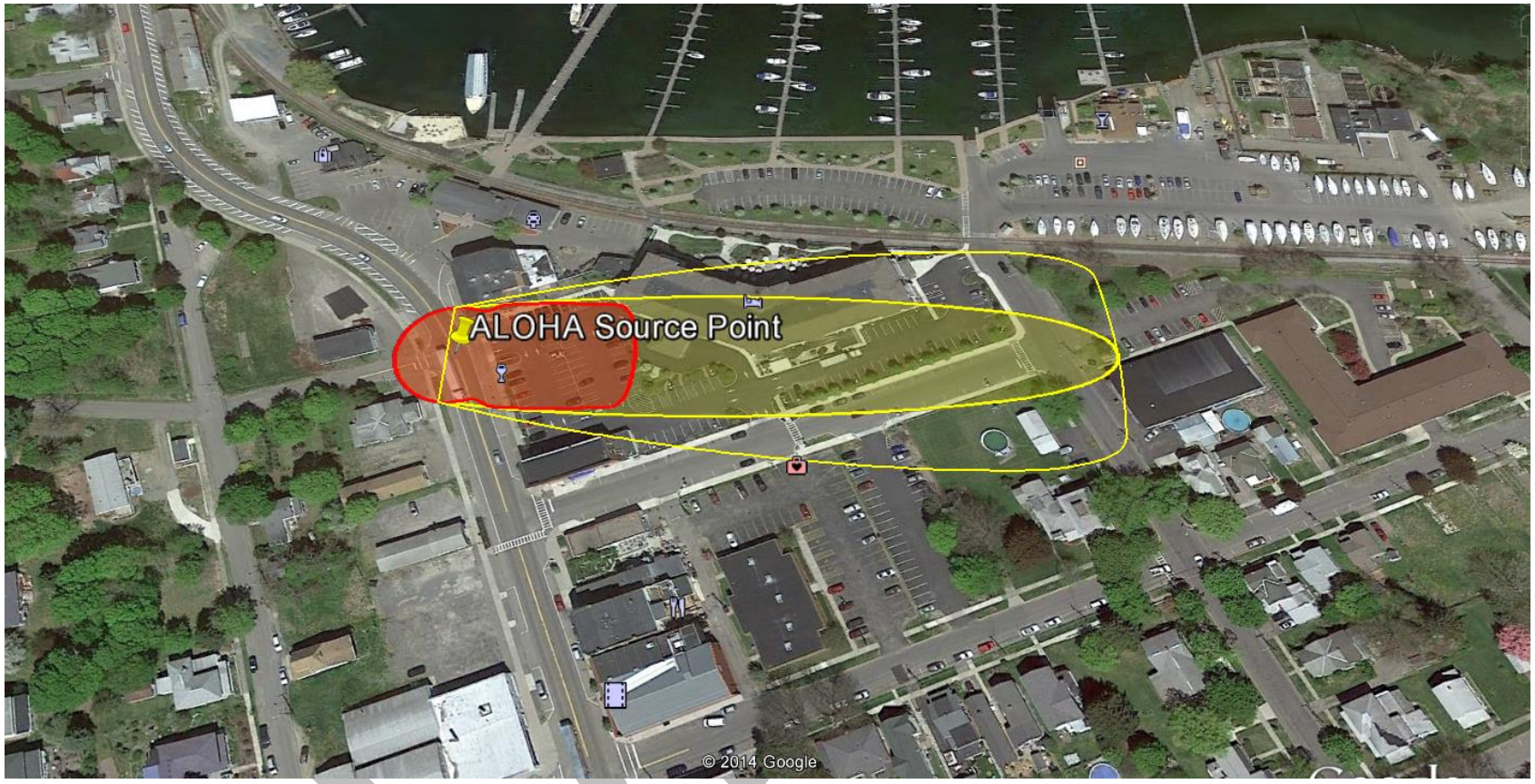

NYSDEC OHMS Document No. 201166576-00024

Independent High-Level Quantitative Risk Analysis
Schuyler County Liquid Petroleum Gas Storage Proposal
(revised for amended transportation expectations)

D. Rob Mackenzie, MD, FACHE
6252 Bower Road
Trumansburg, NY 14886
December 21, 2014

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Quantitative Risk Analysis:
Schuyler County Liquid Petroleum Gas Proposal
Revised
December 21, 2014
D. Rob Mackenzie, MD

Executive Summary

An independent, high-level quantitative assessment (QRA) was performed in August 2014 to evaluate the major risks associated with a proposal by Finger Lakes LPG Storage, LLC to store liquid petroleum gas (LPG) in dormant Schuyler County solution-mined salt caverns. The risks of events associated LPG rail transport, truck transport, and salt cavern storage were evaluated using standard methodology, a twenty-five year exposure interval, and publicly available sources. In December 2014 the company amended its expectations for LPG transport modes to indicate no need for truck transport, less need for rail transport, and increased need for pipeline transport. The former QRA has been revised to take into account these new expectations.

Rail transport events are now scored a very low likelihood at 2-3%, but risk reduction efforts should be still considered because of possibly extreme consequences. Pipe transport events are now scored a moderate likelihood at 23% and risk reduction efforts should still be considered because of possible moderate consequences. Salt cavern storage events remain scored a medium likelihood at 35%, and are an unacceptable risk because of extremely serious consequences. The very low likelihood of major salt infiltration into Seneca Lake with extreme consequences, and the fact that the salt cavern is located in bedded plane geology rather than in salt domes, add to that risk.

In aggregate, the likelihood for a liquid petroleum gas event of moderate to extremely serious consequences within the county in the next twenty-five years is more than 50%; the likelihood of a salt cavern disaster of serious or extremely serious consequences is more than 35%. From the perspective of community safety based on this analysis, the Finger Lakes LPG Storage, LLC proposal still carries an unacceptable risk. Because risk mitigation efforts in salt cavern storage have thus far proven unsuccessful in significantly reducing the frequency of serious and extremely serious incidents, an alternative plan should be considered.

Introduction

Risk assessment work starts with a prioritization process, based on the likelihood and consequences of identified untoward events. For events of extreme seriousness and high likelihood, the risk is ordinarily deemed unacceptable, and efforts are made chiefly to reduce or eliminate the risk. For events of minor consequence and low likelihood, the risk may be deemed acceptable, and a response plan is developed. A matrix is commonly used to display the combination of consequence and likelihood:[1] [2]

MATRIX FOR RISK ASSESSMENTS at NTNU

CONSEQUENCE						
	Extremely serious	E1	E2	E3	E4	E5
	Serious	D1	D2	D3	D4	D5
	Moderate	C1	C2	C3	C4	C5
	Minor	B1	B2	B3	B4	B5
	Not significant	A1	A2	A3	A4	A5
		Very low	Low	Medium	High	Very high
		LIKELIHOOD				

Principle for acceptance criteria. Explanation of the colours used in the risk matrix.

Colour		Description
Red		Unacceptable risk. Measures must be taken to reduce the risk.
Yellow		Assessment range. Measures must be considered.
Green		Acceptable risk Measures can be considered based on other considerations.

Figure 1 – Sample Risk Matrix

In a high-level quantitative risk analysis I have applied this process to evaluate the risk of the Schuyler County compressed natural gas (LPG) storage proposal submitted by Finger Lakes LPG Storage Company, LLC (FLLPG).

Brief summary of LPG storage proposal:

FLLPG's DEC application for a Schuyler County liquid propane and butane gas storage facility, as revised on December 2, 2014, calls for 1785 inbound and/or outbound rail tank cars per year to deliver propane or butane to or from storage in a US Salt cavern from which salt is no longer being solution-mined. The plan now calls for most inbound and all outbound propane to be transported by pipeline.[3]

I limited my revised analysis to three contingencies. Stated as questions:

(1) Is LPG transportation by rail an acceptable risk?
(2) Is LPG transportation by pipeline an acceptable risk?
(3) Is salt cavern storage of LPG an acceptable risk?

Tools and techniques for risk assessment scoring in the petroleum and natural gas industries include guidelines from the International Organization for Standardization (ISO) and other energy sector sources.[2 4]

To assign probabilities on the continuum from "very low" to "very high" likelihood I used an ISO risk matrix with an exposure interval of 25 years, which is standard in the occupational health literature[5] and appropriate for longer-term community planning.

RISK ANALYSIS

Rail Transportation Risk:

LPG rail ingress from the south would proceed north from the southern tier corridor at Corning on the Norfolk Southern Railroad on Class II ("regional") track.[6] It would cross Watkins Glen State Park gorge on a trestle constructed in the 1930's and terminate at a proposed new rail siding at the FLLPG site.

The most serious risk in LPG rail transportation is derailment with overturned tank cars, when puncture and leakage of fuel is common.[7] In the decade 1995-2004 there were 17 serious incidents of U.S. train derailment, tank fracture, hazardous gas release, or chemical reaction, resulting in 9 dead, 5000 injured, and 10,000 evacuated.[8] It has been speculated that if a similar accident were to occur on the trestle over the state park, the relatively heavy propane gas would flow like a liquid down the gorge or the hill in two to four minutes and spread out in the town below, and that ignition from vehicle exhaust, etc., would then almost certainly cause an explosion, propagate a blast wave, and start fires.[9]

In my literature review and in discussions with fire officials I found this catastrophic scenario credible, but rare. One instance would be the small-town LPG railroad tank-car derailment that occurred in Viareggio, Italy in 2009.[10] In that horrific case there were many flattened buildings and 30 fatalities. Computer modeling after the fact indicated that it likely took the propane gases 100 seconds to reach the furthest-away incinerated house, even with flat local terrain and under calm weather conditions. Because of the fast spread of gas, emergency response in Viareggio was limited to evacuation and after-the-fact injury care. These types of crashes would be scored **extremely serious** on the ISO risk matrix.

From industry-published rates the probability of rail tanker derailment with

overturnment within the county over twenty-five years is between 2 and 3%,[11] assuming an average schedule of 150 trains yearly. This estimate could be further refined by looking at speed, number of cars, class of track, and the integrity of bridges and other rail infrastructure. Without such evidence I have placed this event in cell E1, **very low likelihood**. This cell indicates "assessment range," so ways to reduce risk further should be still considered **because of the possibly extreme consequences**.

CONSEQUENCE					
Extremely serious	TRAIN RISK	E2	E3	E4	E5
Serious	D1	D2	D3	D4	D5
Moderate	C1	C2	C3	C4	C5
Minor	B1	B2	B3	B4	B5
Not significant	A1	A2	A3	A4	A5
	Very low	Low	Medium	High	Very high
			LIKELIHOOD		

Color	Description
Red	Unacceptable risk. Measures must be taken to reduce risk
Yellow	Assessment range. Measures must be considered
Green	Acceptable risk. Measures can be considered based on other considerations

Figure 2 -- Train Risk

Pipeline Transportation Risk:
LPG pipeline transportation would occur via the existing network of Schuyler County liquid hazard pipelines.[12]

The most serious risk in U.S. pipeline transportation in 2013 was pipe disruption caused by failure material or welds (43%), excavation damage (23%), corrosion (13%), natural force damage (7%), other outside force damage (7%), incorrect operation (3%) or other cause (3%).[13] In the decade 2004-2013 such disruptions in pipelines carrying highly volatile, flammable, and toxic liquids such as propane and butane resulted in 278 significant incidents with 7 fatalities, 27 injuries, and more than $95 million in property damage according to industry sources.[13]

These significant incidents, however, were distributed over a pipeline network of approximately 63,000 miles[13]. Because of the moderate proximity to population centers, the relatively low potential for evacuation, and the moderate number of casualties this would be scored as a **moderate consequence** on the ISO risk matrix. Over a 25-year exposure interval the risk for Schuyler County's 21 miles of LPG pipeline is approximately 23 percent, or **medium likelihood**.[14]

I have therefore placed pipeline events in cell C3. This cell indicates "assessment range," so ways to reduce risk further should be still considered **because of the**

possible consequences.

CONSEQUENCE						
	Extremely serious	E1	E2	E3	E4	E5
	Serious	D1	D2	D3	D4	D5
	Moderate	C1	C2	**PIPELINE RISK**	C4	C5
	Minor	B1	B2	B3	B4	B5
	Not significant	A1	A2	A3	A4	A5
		Very low	Low	Medium	High	Very high
				LIKELIHOOD		

Color		Description
Red		Unacceptable risk. Measures must be taken to reduce risk
Yellow		Assessment range. Measures must be considered
Green		Acceptable risk. Measures can be considered based on other considerations

Figure 3 -- Pipeline Risk

Salt cavern risk:

Event rates

As of 2012 there were 414 underground gas storage facilities in the US. Most are in depleted oil and gas fields; a few are in aquifers, and 40 are in "salt cavern" facilities.[15] Most salt caverns have been developed over several decades from naturally occurring, globular, so-called "salt domes" in the Gulf states. Nine have been added since 2007. A few salt caverns are in "bedded salt" deposits like Schuyler County's, which itself has been used in the past for LPG and natural gas storage. Safety oversight of underground gas storage is performed by both federal and state agencies.

Despite this supervision, between 1972 and 2012 there have been 18 serious or extremely serious incidents in salt cavern storage facilities.[8 16] With the average number of facilities in operation through most of the last two decades close to 30,[15] the US incidence is about 60 percent (compared to 40 percent worldwide[17]), and the frequency is about 1.4% per year. Causes of failure have included corroded casings, equipment failure, brine erosion leading to breach, leakage into other geologic formations, and human error.[8 16] Worldwide, the percentage of incidents *involving casualties* at salt cavern facilities as a percentage of the number of facilities operational in 2005 was 13.6 percent, compared to 0.63% for gas and oil fields, and 2.5% for aquifers.[8]

Nine of the salt cavern incidents were accompanied by large fires and/or explosions. Six involved loss of life or serious injury. In eight cases evacuation of between 30 and 2000 residents was required. Extremely serious or catastrophic property loss occurred in thirteen of the 18 cases.[8 16] The likelihood of a serious,

very serious, or catastrophic incident over twenty-five years is 35 percent.[18] This would be initially scored a **medium likelihood**, with the potential for at least **serious** consequences, and possibly **extremely serious** consequences, and thus an **unacceptable risk**.

Salt infiltration

Seneca Lake is the saltiest of the Finger Lakes at 150-170 parts per million chloride, (versus 20 to 50 ppm for the other Finger Lakes), probably because its basin intersects the same salt strata from which the caverns are derived[19].

The geologist responsible for Seneca water quality monitoring has raised a concern that salt-solution mining has been partially responsible for Seneca Lake's increasingly elevated chloride levels since 1900, that natural gas salt cavern storage may have caused the dramatic spike in lake chloride levels seen in the late 1960s, and that further pressure on the salt caverns could aggravate that process.[20] In that event, remediation for large-scale salt contamination could well take decades or be impossible, jeopardizing the source of drinking water for about 100,000 people.[21] Other long-term water sources could be needed, or else large populations would be obliged to move.

Few salt caverns are adjacent to a large lake. I could find no reported cases of catastrophic brine leakage in fuel storage facilities, but "brine gushers" have occurred in capped brine caverns.[8] While a disaster resulting from accelerated geologic salt infiltration into Seneca Lake would be scored a **very low likelihood**, it would certainly have **extreme consequences**. When considered together with the other extremely serious incidents, it raises the consequence of salt cavern events into the **extremely serious** range.

Geology

Much concern has also been raised about the geology of the solution-mined caverns proposed for natural gas storage. There has been a great deal of discussion over faults, partial roof collapses, rubble piles, undiscovered uncapped wells, and so on. In its detailed and very considered approval of a related company's application to increase natural gas storage in Schuyler County, the Federal Energy Regulatory Commission (FERC) acknowledged the serious concerns raised by independent geologists as to the stability of the Schuyler County salt caverns, but chose to support the company geologists' reassurances and test results, merely requiring the company to monitor for gas leaks, ground subsidence, and the like.[20]

Likewise, the New York State Geologist is obliged by statute to rule on the integrity of caverns used to store hydrocarbons, Earlier this year, an official in

that office did vouch for the "long track record" of the salt caverns in a half-page document.[22] I do not have the expertise to evaluate such concerns, reassurances, rulings, or requirements.

However, I would reiterate that it is not necessary to get into such detail for this level of analysis. From the risk assessment perspective it is enough to recall that standard and additional regulatory recommendations, routine mechanical integrity testing, and every other careful industry precaution have failed to prevent the eighteen serious or extremely serious salt cavern incidents. Some have been quite recent, and some have occurred in caverns with long safety track records.[8] Simply put, the available literature provides no good reason to assume that regulation in today's resource-constrained environment will be more successful in preventing such incidents tomorrow than it was in preventing them yesterday.

It should also be noted that both oversight and industry literature report that using the salt cavern subset of bedded salt deposits like Schuyler County's is riskier than using the salt domes common in the Gulf, perhaps for geologic reasons like those mentioned above, and especially when single well-bore holes are used,[8] as planned in this case. The most instructive incident in this connection occurred at the Yaggy salt cavern facility seven miles northwest of Hutchinson, Kansas, a town of 44,000. Gases that escaped from the salt cavern due to human error traveled along sedimentary layers, erupted in the town itself, and resulted in fire, explosion, two deaths, one injury, and more than 250 evacuations. A detailed summary, map, and photos are appended. The unfavorable geology and irregular cavern shapes generally associated with bedded salt deposits[8] probably push the likelihood of salt cavern failure somewhat higher in the **medium likelihood** category.

Risk tolerance

This level of consequences per facility over twenty-five years--major fires, explosions, collapses, catastrophic loss of product, evacuations--is an unusual level of risk. Most other regulated industry sub-segments with a persistent serious to extremely serious facility incident rate of over thirty percent would be shut down or else voluntarily discontinued, except in wartime. Even in the petroleum industry, which is widely known to tolerate higher risks than most others, the rate of events per facility involving casualties is more than 20 times higher in salt caverns than in the alternative--depleted oil and gas fields.[8]

In most other industries, including healthcare, automotive, and nuclear power, to name a few prominent ones, severe regulatory sanctions are imposed for catastrophic failure rates that are many, many times less than in salt cavern facilities. Salt caverns provide less than ten percent of U.S. working gas

storage,[15] so even though salt caverns have shorter cycle times and may be closer to market, the depleted oil and gas option alternative is clearly the better safety option from a national perspective.

To be sure, there have been many advances in assessment, extraction, storage, and transportation technology over the years in which salt caverns have been used for natural gas storage. Yet those advances have not yet led to a significant reduction in the rate of serious and extremely serious incidents.[23] This may in part be lag time; the interval from commissioning to events has often been a decade or more. As in oil drilling, however, there may also be an increased tolerance for riskier project selection. Experience from NASA, nuclear power plants, car manufacturing, and healthcare consistently shows that to improve safety the critical requirement is not better technology but cultural change.

There have been scattered other reports and articles praising the safety of underground storage. The flaws and biases in those analyses from the point of view of Schuyler County are listed in the notes.[24]

CONSEQUENCE					
Extremely serious	**TRAIN RISK**	E2	**SALT CAVERN RISK**	E4	E5
Serious	D1	D2	D3	D4	D5
Moderate	C1	C2	**PIPELINE RISK**	C4	C5
Minor	B1	B2	B3	B4	B5
Not significant	A1	A2	A3	A4	A5
	Very low	Low	Medium	High	Very high
			LIKELIHOOD		

Color	Description
Red	Unacceptable risk. Measures must be taken to reduce risk
Yellow	Assessment range. Measures must be considered
Green	Acceptable risk. Measures can be considered based on other considerations

Figure 4 – Train, Pipeline and Salt Cavern Risks

Other risks:
Diesel air pollution, noise pollution, loss of jobs in tourism and wineries from "industrialization," and many other risks have been discussed widely in community forums. They are not included in this analysis because they are unlikely to require emergency response, but they may well have health or other consequences that are more difficult to quantify.

Risk summary and Conclusion:
None of the three possible types of events—rail, pipeline, and cavern--is

contingent on either of the other events, so for probability purposes they are considered "independent" risks. Combining the two independent probabilities, **the likelihood for an LPG event of *moderate to extremely serious* consequence within the county in the next twenty-five years is more than 50%[25], and the risk of a LPG salt cavern event *of serious to extremely serious* consequence within the county is more than 35%.**

CONSEQUENCE					
Extremely serious	E1	E2	**LPG**	E4	E5
Serious	D1	D2	**STORAGE**	D4	D5
Moderate	C1	C2	**RISK**	C4	C5
Minor	B1	B2	B3	B4	B5
Not significant	A1	A2	A3	A4	A5
	Very low	Low	Medium	High	Very high
			LIKELIHOOD		

Color	Description
Red	Unacceptable risk. Measures must be taken to reduce risk
Yellow	Assessment range. Measures must be considered
Green	Acceptable risk. Measures can be considered based on other considerations

Figure 5 – LPG Storage Proposal Risk

Worst case scenarios are not hard to imagine. They would involve some combination of loss of life, loss of the lake as a source of drinking water, and/or temporary or permanent evacuation. Each of these scenarios has happened in other salt cavern facilities. Fortunately for the nation, but of no help to Schuyler County, most of the other events occurred in locations more isolated from population centers than ours.

By its very nature, there are large uncertainties in any risk assessment estimate. For the sake of argument, though, even if each of the two probabilities has been overestimated by 75 percent, the likelihood for serious or extremely serious consequences over twenty-five years is still more than 30 percent.[26]

From the perspective of health safety, based on this independent analysis, I conclude that the Finger Lakes LPG Storage Co, LLC proposal carries an unacceptable risk of extremely serious consequences.

Plans should always be made for acceptable risks. And some unacceptable risks can be made acceptable through mitigation. Other municipalities have reduce rail accidents, for example, by enacting ordinances to regulate train speed within

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their borders.

It is not yet clear, however, that any regulatory or mitigation effort to date has been effective in reducing serious and extremely serious salt cavern incidents frequency to a significantly lower level. Strong consideration should therefore be given to an alternative course of action.

Rob Mackenzie, MD, FACHE

[1] Matrix risk analysis is used worldwide and in many industries. This typical example is from innsida.ntnu.no, a Norwegian university.

[2] *Guidelines for Chemical Transportation Safety, Security, and Risk Management*, Center for Chemical Process Safety, John Wiley & Sons, 2008.

[3] http://www.dec.ny.gov/docs/materials_minerals_pdf/20141202bsktodec.pdf

[4] ISO 17776:2000(en)Petroleum and natural gas industries--guidelines on tools and techniques for hazard identification and risk assessment at: https://www.iso.org/obp/ui/#iso:std:iso:17776:ed-1:v1:en
(emphasis on off-shore, but much still applicable)

[5] Mullai, Arben, *Risk Management System—Risk Assessment Frameworks and Techniques*, DaGoB publication series 5:2006.

[6] www.nys.dot.gov.

[7] Lee's Loss Prevention in the Process Industries : Hazard Identification, Assessment, and Control, Elsevier Butterworth-Heinemann, 2005.

[8] Health and Safety Executive of the United Kingdom*, An appraisal of underground gas storage technologies and incidents, for the development of risk assessment methodology,* at:http://www.hse.gov.uk/research/rrpdf/rr605.pdf

[9] Michael Lausell, county legislator, at a meeting of the Schuyler County Legislature held on 7/14/14.

[10] Brambilla, Sara, Roberto Totaro, and Davide Manca, *Simulation of the LPG release, dispersion, and explosion in the Viareggio railway accident, at* www.aidic.it/CISAP4/webpapers/36Brambilla.pdf.

[11] The Canvey report from 1978 cited in Lee's Loss Prevention, 2005, appendix 7/9 gives the frequency of rail tank car derailment as 1 x 10^{-6}/ km (= 1.6 x10^{-6}/mi), and the probability of overturning (when rupture is most likely to occur) as 0.2. This frequency is lower than US data from the 1970s, but the US data has dropped and is now similar, at 2 x 10^{-6}/mi. I used the lower Canvey data, and ignored return-trips with empty tankers, the risk of which would be of lower consequence. GoogleMaps shows the rail distance from the south county border to the Crestwood site to be about 12 mi. FLLPG estimates between 6.8 and 32 cars per trip, and between 56 and 261 trips per year; I based my calculation on an average 150 trips per year. Calculation: 1.6 x 10^{-6} derailments/km x 0.2 overturnments/derailment x 12 mi/trip x 1.6km/mi x 1 trip/day x 150 days/yr x 25

years = 0.0230 = 2.3%.

[12] National Pipeline Mapping System map for Schuyler County, New York, at: https://www.npms.phmsa.dot.gov/PublicViewer

[13] Significant pipeline incidents by cause, Pipeline Safety Stakeholder Communications, Pipeline and Hazardous Material Safety Administration, U.S. Department of Transportation at: http://primis.phmsa.dot.gov

[14] calculation: 28 significant incidents/yr/63,000 miles pipeline x 21 miles Schuyler County pipeline x 25 years = 0.233

[15]www.eai.gov

[16] Hopper, John M., *Gas Storage and Single Point Risk,* in Natural Gas, at www.documbase.com/Gas-Storage-And-Single-Point-Failure-Risk.pdf

[17] The lower world-wide incidence is thought by some to reflect under-reporting in Europe and the former Soviet Union.

[18] Calculation: 1.4% incidence per year x 25 yrs = 35%

[19] Limnology and Water Quality—*Seneca Lake at:* http://www.gflrpc.org/Publications/SenecaLakeWMP/chap6a.pdf

[20] 147 Federal Energy Regulatory Commission ¶ 61,120: Arlington Storage Company, LLC, May 15, 2014.

[21] Halfman, John D. *Water Quality of Seneca Lake, New York: A 2011 Update* at http://people.hws.edu/halfman/Data/2011%20Seneca%20Report.pdf

[22]Andrew Kozlowski, Acting Associate State Geologist, to Peter Briggs, Director, NYSDEC, March 15, 2014.

[23] Industry sources cite a reduction in incident frequency in the 1990's, but this reversed with a spate of incidents in the early 2000's.

[24] Such flaws include:

- failure to separate out salt caverns from other forms of underground storage
- among salt caverns, failure to separate out bedded salt geology from salt domes
- claims that salt cavern storage is safer than above-ground storage, which may be true but is beside the point

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- claims that the total number of casualties in underground storage incidents is lower than the corresponding number for other parts of the petrochemical distribution chain, without calculating incidence or frequency rates per facility, per mile, etc.
- claims that human error and technology failures because they are potentially correctible, should be discounted from the risk analysis
- failure to include transportation risks and other risks in analysis
- desire to promote other types of underground storage
- petrochemical industry funding

[25] Calculation: (1-((1-0.023)*(1-0.23)*(1-0.35)) = 51.1%

[26] Calculation: 1-((1-0.013)*(1-0.13)*(1-0.2))= 31.3%

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An appraisal of underground gas storage technologies and incidents, for the development of risk assessment methodology, Health and Safety Executive, United Kingdom, 2/2008, pp 161-164:

Hutchinson – aka Yaggy, Kansas (USA)

The town of Hutchinson, with a population of around 44,000, lies around 11 km (7 miles) SE of the Yaggy Storage Field (Figs. 25&35), and provides the location for perhaps the most publicised and notorious UGS incident. The area is underlain by the Hutchinson Salt Member, which has been mined and extracted at Hutchinson since the 1880s and in which caverns had been created for storage purposes. At the time of the incident, the Yaggy storage facility played a key role in the supply of gas in central Kansas and was thus of national importance. It was one of 30 "hubs" in the USA national gas distribution system and one of 27 such cavern storage fields in the USA. The incident has been extensively reviewed elsewhere and so will only be outlined here, with emphasis on the history of the facility to illustrate the background to the disaster.

The Yaggy field was originally developed in the early 1980s to hold propane. The storage caverns were formed by salt dissolution using brine wells, drilled to depths between 152 m and 274 m in the lower parts of the Lower Permian Hutchinson Salt Member of the Wellington Formation (Fig. 35). The top of each cavern was located about 12 m below the top of the salt layer to ensure an adequate caprock that would not fracture or leak and the wells were lined with steel casing into the salt. The Wellington Shale Formation is overlain by the Ninnescah Shale, both of which dip to the west and northwest and form the bedrock to 15 m or more of the sands

161and gravels of the Equus Beds. These unconsolidated deposits underlie (Fig. 35) and provide the municipal water supply for the city of Hutchinson, and the city of Wichita to the east.

Decreasing financial viability eventually led to the closure of the propane storage operations in the late 1980s. The wells were cased into the salt and later plugged by partially filling them with concrete. In the early 1990's, Kansas Gas Service, a subsidiary of ONEOK of Tulsa (Oklahoma), acquired the facility and converted it to natural gas storage. The existing caverns were re-commissioned, which required drilling out the old plugged wells, whilst further wells were drilled to solution mine additional caverns.

Mention is made of the Yaggy Storage Field consisting of 98 caverns in the Hutchinson Salt Member at depths greater than 150 m. It appears that at the time of the 2001 incident, the facility had about 70 wells, of which 62 were active gas storage caverns, at depths greater than 152 m. More than 20 new wells had been drilled and were being used to create new caverns for expansion of the facility (Allison, 2001a). The wells, with 90-120 m spacing, are located on a grid. A group of wells are connected at the surface via pipes and manifolds, allowing gas to be injected or withdrawn into all the caverns in the group simultaneously. The capacity of the Yaggy field was circa 90.6 Mcm (c. 3.2 Bcf) of natural gas at around 600 psi.

The incident at Hutchinson occurred on the morning of January 17th, 2001, when monitoring equipment registered a pressure drop in well S-1, which connected to a cavern being filled. The cavern could hold 1.7 Mcm of gas at an operating pressure of about 4.65 MPa (675 psi). This could, however, range from 3.8 to 4.7 MPa (550 to 684 psi). Later that morning a gas explosion occurred in downtown Hutchinson, around 11 km (7 miles) away and was followed by a series of gas and brine geysers, up to 9 m high, erupting about 3.2 km (2 miles = c. 9 miles from the storage site) to the east along the outskirts of Hutchinson (Fig. 35). The following day (18th January), a gas explosion at the Big Chief Mobile Home Park killed 2 and injured another (Fig. 35). The city promptly ordered the evacuation of hundreds of premises: many not returning to their homes and businesses until the end of March 2001.

An investigation into the incident led by the Kansas Geological Survey (e.g. Allison, 2001a&b), found the leak was the result of a large curved slice in the casing of the S-1 well at a depth of 181.4 m, just below the top of the salt and 56 m above the top of the salt cavern. The damage to

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the casing resulted from the re-drilling of the old cemented well when re-opening the former propane salt cavern storage facility. Furthermore, ONEOK computer operators in Tulsa had overloaded the storage field caverns with natural gas, causing the initial leak. For at least 3 days the casing leak allowed natural gas at high pressure to escape and migrate upwards through the well cement and fractures in rocks above the salt. On reaching a permeable zone formed by a thin bed of micro-fractured dolomite near the contact between the Wellington Formation and the overlying Ninnescah Shale at around 128 m, the gas was trapped by overlying gypsum beds, preventing further vertical movement. The dolomite was fractured in the crest of a low- amplitude, asymmetric, northwesterly plunging anticlinal structure and the pressure of the escaping gas induced parting along the pre-existing fracture system. The gas migrated laterally southeastwards up-dip along the crest of the anticline towards Hutchinson, where it ultimately encountered old abandoned and forgotten brinewells that provided pathways to the surface (Allison, 2001a; Nissen et al., 2003 & 2004).

Geological investigations of the area suggest that the fractures in the dolomites were related to deep seated fractures that caused faulting in the overlying strata. These fractures then appear to have permitted undersaturated water to penetrate down and dissolve the Hutchinson salt, causing variations in thickness of the halite beds. Faulting in strata overlying the halite beds is greatest where dissolution has taken place and the edge of this dissolution zone trends NW close to the crest of the anticlinal structure. The dissolution of the halite appears to have locally enhanced structural relief, which led to further stresses, fracturing and preferred zones of weakness in the overburden, providing pathways for gas migration along the trend of the anticline (Watney et al., 162

2003a; Nissen et al., 2004b). Shut in tests on vent and relief wells following the incident revealed that with reduced gas pressures, fracture apertures were reduced and closed as pore pressures declined.

Basic volumetrics of the fracture cluster were calculated (Watney et al., 2003b):

· Length – 14 km (8 miles)

· Width – 300 m (1000 ft)

· Height – 0.9 m (3 ft)

· Porosity – 2%

· Fracture volume – 78,000 m^3 (2.8 Mcf)

· Estimated volume of gas released – 4.04 Mscm (143 Mscf) = 99,109 m^3 (3.5 Mcf) at 4.14 MPa (600 psi), 12°C (54°F)

Other storage facilities exist around Hutchinson and provide some useful information on storage pressure gradients. In late 1996 to 1997, Western Resources Inc. who operated a hydrocarbon storage well facility to the west of Hutchinson, submitted requests to the Kansas Department of Health and Environment (KDHE) to increase the maximum storage pressure gradient at their facility. KDHE regulate gas storage operations and operated a 'rule of thumb' that the maximum storage pressure gradient at such facilities in the Hutchinson area was limited to 0.75 psi/foot of depth. This was in order to prevent fracturing of the salt deposit. Following tests on rock cores, Western Resources Inc. requested increasing the pressure from 0.75 psi/foot of depth to a pressure gradient of 0.88 psi/foot of depth, which was actually close to the average fracture pressure gradient of 0.89 psi/foot of depth. One rock sample actually had a fracture pressure gradient of 0.72 psi.foot of depth (KDHE, 1997).

The original downtown explosion site was related to a mineral water well in a basement that had provided mineralized waters for a hotel spa. The second explosion occurred at the site of an old abandoned brinewell. Images of a blazing well in the ruins of a building are available on the Kansas Geological Survey website (http://www.kgs.ku.edu/Hydro/Hutch/CUDD/2nd/set01.html). The same was found to be true for the numerous gas and brine geysers to the east of the city and the explosion at the Big Chief trailer park. When drilled, most old brine wells were only cased

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down through the shallow Quaternary "Equus beds" aquifer. The deeper parts of the wells were open-hole and thus provided ready pathways for the gas to escape to the surface. As many as 160 old brinewells are thought to exist in the Hutchinson area, either buried purposely or by subsequent development. It is unlikely that the well casings of these wells, if they exist, are sufficiently gas tight to prevent gas escapes and would present problems if future leaks were to occur.

Following the operations to trace and deal with the January leak incident, a second event occurred around six months later on the afternoon of Sunday, July 7, when one of the vent wells (Deep Drilled Vent well 64) suddenly started venting gas at high pressure (Allison, 2001c). The following day, the flare was reported at about 4 m in height and a pressure of 2.3 MPa (330 psi). Mechanical modifications to the surface pipework were made with the result that the flare reached an estimated 9 m - 30 to 12 m in height by Monday evening. Pressures had dropped to only 0.04 MPa (6 psi) by the following Wednesday; when the well was temporarily shut in. However, the pressures then increased quickly again.

Three possible causes for the flare-up were identified (Allison, 2001c):

· formation or near-well-bore damage – this is caused by the flow of water and gas through the near-well-bore environment. The permeability of the rock near to the well is reduced by the plugging the rock with fine materials, chemical alteration, or by changes in relative permeability as the volume of gas drops relative to the volume of water. Such "damage" routinely occur in oil and gasfield wells and is readily corrected.

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· segmented pockets or fractures of gas remained - when the gas first entered Hutchinson it was under sufficiently high pressure that it may have forced open previously closed fractures in the rock layers or pushed its way into areas of 'tight rocks', i.e. less permeable rocks. As pressures dropped, it is possible that some fractures would have closed up again, isolating small amounts of gas in separate pockets, which over time, could have worked their way back into the main accumulation and into the vent well.

· another source of gas besides the Yaggy field exists – a scenario thought to be unlikely as well DDV 64 sits in the midst of a swarm of vent wells and it is hard to project a new source of gas that would affect only this one well.

The causes of the resurgence of gas were still being investigated in late 2001/early 2002. However, the results of this investigation, although it is likely that they have been published, have not been found during this study.

The incident in 2001 was not the first time that there had been problems with a cavern and well at the Hutchinson storage facility. On September 14, 1998, a shale shelf collapsed inside the field's K-6 cavern, trapping a gamma-ray neutron instrument that had been used for monitoring purposes. Downhole video surveys revealed the casing on the verge of collapse at about 183 m, with the camera unable to go below 205 m, due to the blockage. In October 1998, a plan was established to remove gas from the cavern over the winter. In the spring of 1999, the radioactive tool was buried under 1.2 m of concrete and the cavern's main pipe was relined with bonding cement to block any possible leaks. The cavern is still monitored for radiation leaks.

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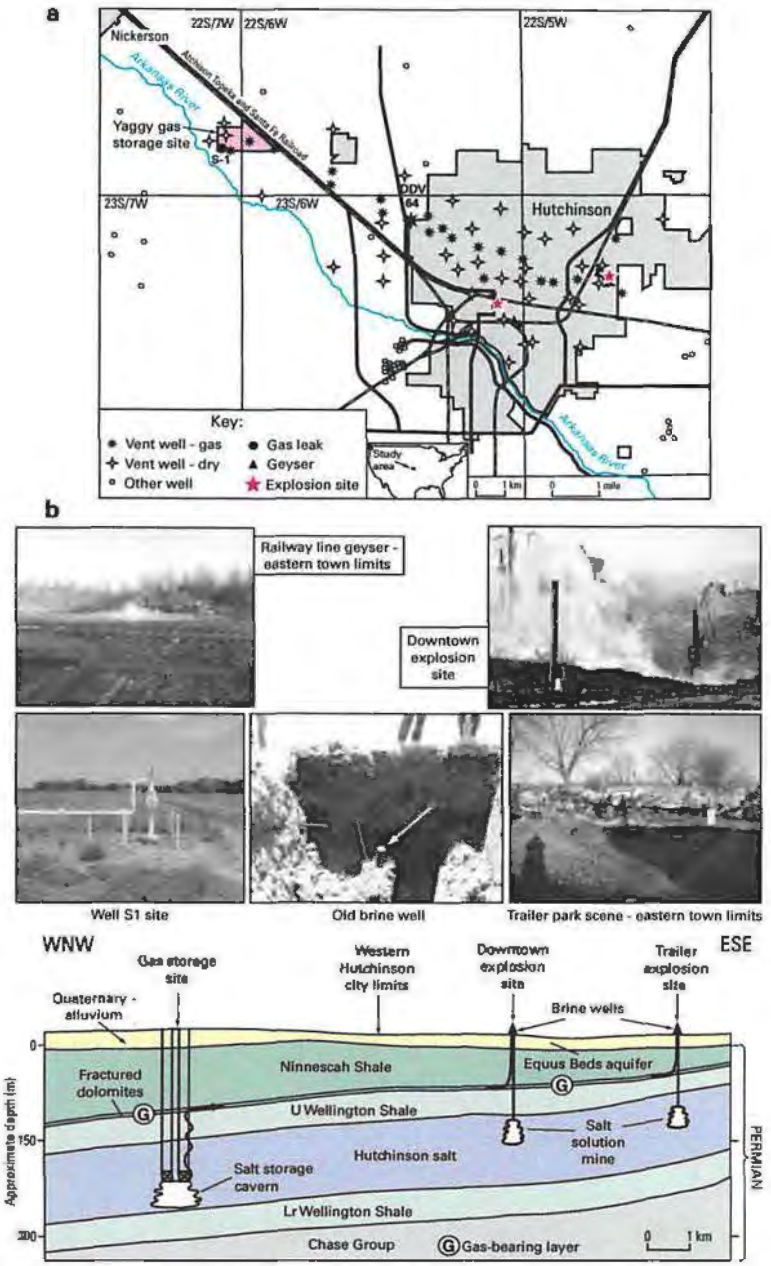

After Hutchinson Fire Department, Kansas Geological Survey, CUDD Drilling and Shannon Pope of RPC Inc) BGS©NERC. All rights reserved

Figure 35. Details of the Hutchinson incident. (a) location map illustrating the site of the storage facility circa 11 km (7 miles) NW of the town of Hutchinson (b) WNW-ESE cross section showing the stratigraphy and structure of the area and the route taken by the gas from the storage cavern to the town (after Kansas Geological Survey). Images shown courtesy of Chief Forbes, Hutchinson Fire Department; Kansas Geological Survey; Kansas Department of Health and Environment, CUDD Drilling and Shannon Pope of RPC Inc.

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