Geologist Says Feds Made “Incredible Error” Ignoring Huge N.Y. Salt Cavern Roof Collapse

By **Peter Mantius**, on January 29th, 2014

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The salt and storage wells of the Watkins Glen brine field lie 2,000 feet below the network of small roads just north of the US Salt plant on Seneca Lake in New York. The Village of Watkins Glen is just outside the picture to the south.

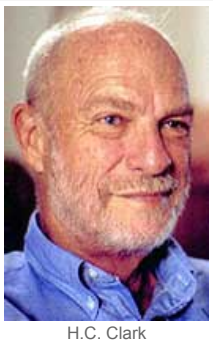
In the 1960s, a 400,000-ton block of rock fell from the roof of an old salt cavern in the Finger Lakes region of New York — a cavity that new owners now want to reopen and use to store highly pressurized natural gas.

The Midwestern energy company that seeks a federal permit for the storage project has denied knowing the roof failure ever happened. And the Federal Energy Regulatory Commission (FERC), which is poised to rule on the company’s permit application, has never publicly acknowledged the event.

But a Houston geologist hired by lawyers for opponents of the project characterized the omission by Arlington Storage Co. and FERC as “an incredible error” that heightens safety concerns about the project next to Seneca Lake, less than three miles from the Village of Watkins Glen, population 1,860.

“Clearly, Arlington’s application and FERC’s conclusions are compromised by this error,” H.C. Clark wrote in a Jan. 15 letter that is now part of FERC’s public record in the case.

In the **letter**, Clark, who holds a Ph.D. in geophysics from Stanford and taught the subject for years at Rice University, analyzes a “400,000-ton fault block cavern roof failure” and rock faults surrounding the cavern. Clark draws on a series of long-suppressed reports written more than 50 years ago by a geologist for the company that then owned the cavern.



H.C. Clark

The fallen chunk of rock — roughly four times as massive as the U.S.S. Nimitz supercarrier — now sits on the floor of the cavern, leaving an unsupported rock roof roughly the size of a football field. The roof collapse created an irregular cavity that may soon hold pressurized methane drawn from natural gas wells in nearby northern Pennsylvania.

Both federal and state regulators are responsible for scrutinizing all plans for underground storage of volatile hydrocarbons. Salt cavern storage presents not only risks of human error in operating a complex industrial site, but also two categories of geologic risk: cavern collapses and leaks.

Geologic risks are slight in regularly-shaped cavities surrounded by pure salt, which is nearly impermeable. But when the cavity is highly irregular in shape and its boundaries are made up of more complex elements, including heavily faulted shale rock, risks can rise substantially.

When salt cavern accidents do occur, they can be devastating. Major fires and explosions struck at salt caverns holding LPG in 1980, 1984, 1985 and 1992, killing or

seriously injuring people in three of those cases. Catastrophic accidents hit salt caverns holding compressed natural gas in 2001, 2003 and 2004.

More recently, in August 2012, the sudden collapse of a salt cavern wall near Bayou Corne, La., 75 miles west of New Orleans, has created a 26-acre sinkhole. The crisis is nowhere near resolved because energy companies store natural gas, liquid butane and various chemicals in adjacent salt caverns.

Several hundred residents who were forced to evacuate immediately have not been able to return to their homes in a year and a half. The state of Louisiana is now offering to buy out dozens of them as it copes with the latest threat: the buildup of explosive gases in the local aquifer.

This fire that followed natural gas explosions in downtown Hutchinson, Kan., in 2001 was traced to gas leaks from a salt cavern storage facility seven miles away.

The dangers of gas leaks from salt caverns along rock faults was shockingly demonstrated in Hutchinson, Kan., in January 2001. Several explosions at seemingly random sites occurred as far as seven miles from a ruptured cavern. The blasts caused fireballs in downtown Hutchinson and havoc at the Big Chief Mobile Home Park outside town, where John and Mary Ann Hahn were killed.

The Hutchinson catastrophe set off alarms at the New York State Department of Environmental Conservation, which, along with FERC, has jurisdiction over the Watkins Glen brine field. The brine field, developed over 120 years for salt mining, contains more than 60 wells, may of them abandoned. A series of companies have used a few of the resulting caverns for hydrocarbon storage. Arlington and affiliated companies now own the entire brine field, including an active salt mining company, U.S. Salt.

The DEC noted similarities between the Watkins Glen brine field and the brine field in Kansas. In a June 4, 2001, **letter** written “in response to the Hutchinson, Kansas, incident,” Kathleen F. Sanford, then chief of the DEC’s permits section, asked the owner of a portion of the Watkins Glen site to “please prepare a report which documents the integrity of each of these wells.”

Sanford’s letter to New York State Electric and Gas Corp. referred to several wells it was using to store natural gas and several others it saw as potential gas storage wells — all of which NYSEG sold to Arlington in 2011. The group included Well 30, which suffered the massive roof failure in 1969.

Well 30 was drilled in 1958 by Akzo Nobel Inc., and at least four other companies have operated it since then, either as owners or leasers: International Salt, Teppco, NYSEG and Arlington. Several decades ago, Well 30 was connected to its neighbor, Well 31, by hydraulic fracturing along a rock fault. It is that combined cavity that Arlington now plans to use for natural gas storage. The company calls it “Gallery 2.”

New York State Department of Environmental Conservation
Division of Mineral Resources
Bureau of Oil and Gas Regulation, 2nd Floor
625 Broadway, Albany, New York 12233-6500
Phone: (518) 402-8056 - FAX: (518) 402-9032
Website: www.dec.state.ny.us

June 4, 2001

Mr. Mark A. Cole
Project Manager
New York State Electric and Gas Corp.
Kirkwood Industrial Park
P.O. Box 5224
Binghamton, NY 13902-5224

Re: Well Integrity At Galleries 1 and 2, Watkins Glen

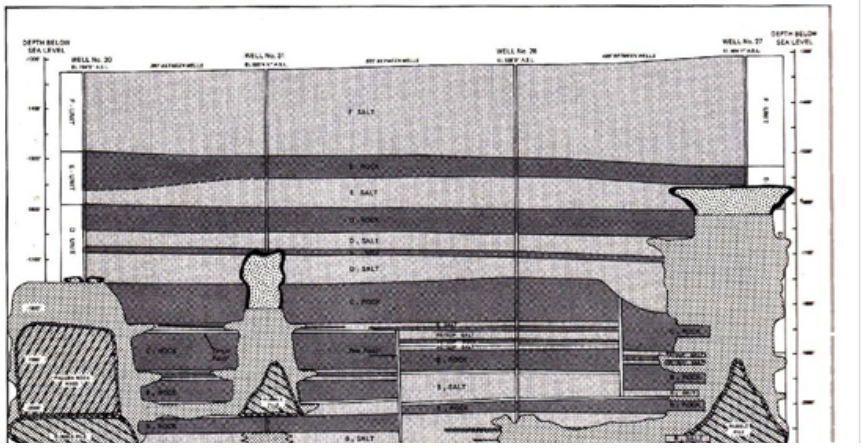
Dear Mr. Cole:

This is to confirm our telephone conversation of June 1, 2001, during which I described the Department's need to reconfirm the integrity of specific underground natural gas storage wells at New York State Electric and Gas Corp.'s ("NYSEG") Watkins Glen facility.

As we discussed, the Department's actions are in response to the Hutchinson, Kansas, incident where a significant amount of natural gas presumably leaked from an underground storage well and/or caverns constructed in salt at the Yaggy storage field operated by Kansas Gas Service. It is the Department's understanding that the well suspected of leaking may have been damaged and its integrity compromised during the re-entry and conversion process.

While we recognize the significant geologic, operational and well design differences between your operation and the Yaggy field, the two facilities do have one common aspect in that plugged wells were re-entered at both sites. Furthermore, the Department is currently investigating the possible existence of several unplugged International Salt wells dating back to the early 1960's located along Seneca Lake, less than one mile southeast of NYSEG's storage caverns and wells. As you know, unplugged solution mining wells in Hutchinson are believed to have served as the escape route for storage gas which leaked at Yaggy.

Our objective is to reassess and ensure the integrity of re-entered wells at NYSEG's active storage cavern Gallery No. 1 and potential storage cavern Gallery No. 2. The Department's files indicate that re-entered wells in these galleries include Well Nos. 28 (API 31-097-03092), 46 (API 31-097-6126?), and 30 (API 31-097-03188). Please prepare a report which documents the integrity of each of these wells. The report must, at a minimum, provide



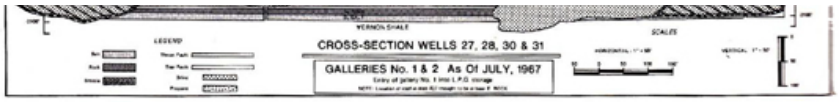
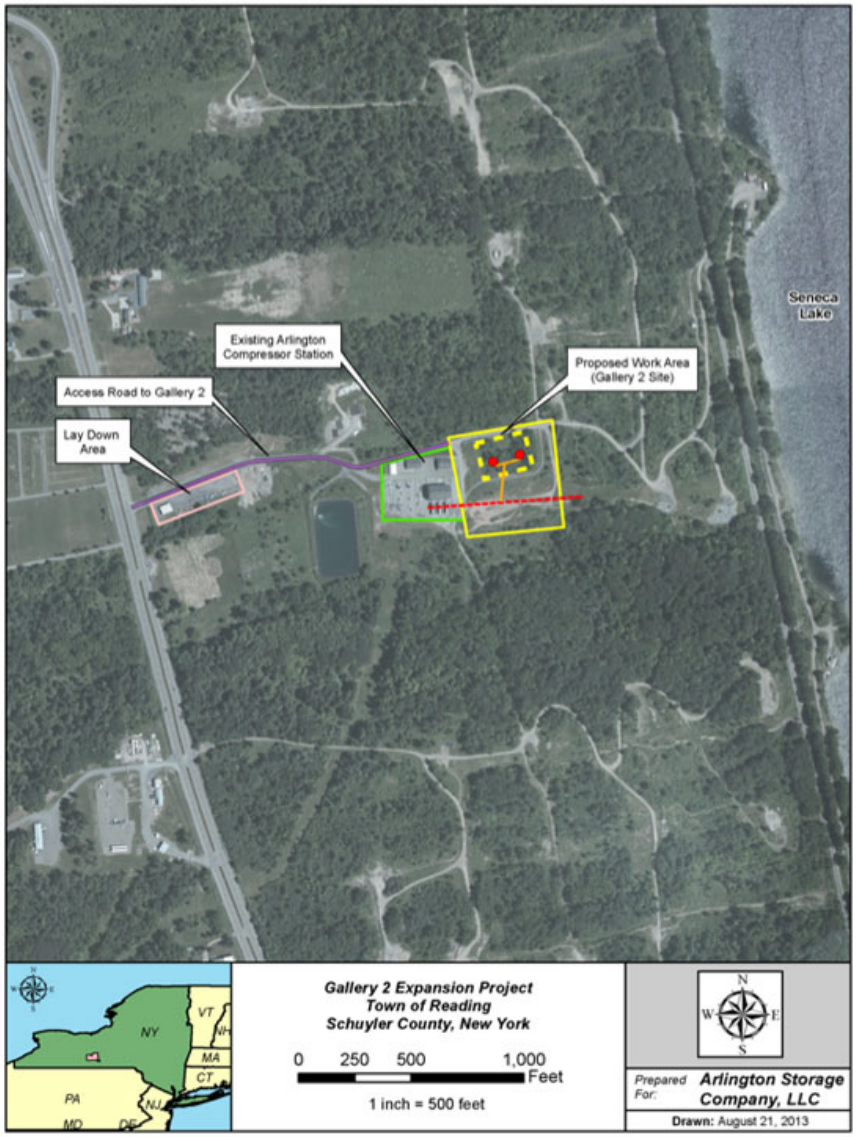


Figure 3.

This cross section diagram of salt wells 30 and 31 shows the size of rock fell from the roof of well 30.

From 1964 to 1984, Teppco stored LPG in the well 30-31cavern, without reported incident — although the 400,000-ton roof collapse did occur during that period. In 1984, Teppco moved its LPG storage activity from the salt cavern to a new cavity that it dug into rock and lined — nearby but outside the brine field. The company declined to say why it went to the expense of moving its storage operation. The DEC, which granted Teppco an underground storage permit for the new facility, told DCBureau.org last year that it had no records of the reason the company made the move.

The well 30-31 cavern, or Gallery 2, was plugged and abandoned in 1989 and left as a brine-filled cavity. About a decade later, when NYSEG controlled the cavern, it won FERC approval to store natural gas in it. But the company never followed through and eventually gave up its permit.



Arlington Storage Co. LLC is seeking approval from FERC to store pressurized natural gas in “Gallery 2” within the Watkins Glen brine field.

NYSEG did store natural gas in another cavern several hundred feet to the east. When Arlington bought NYSEG’s portion of the brine field in 2011, it continued that operation in what it now calls “Gallery 1.”

Arlington initially flirted with the idea of seeking DEC permission to use Gallery 2 for LPG storage, but it abruptly changed course and turned to FERC for a new gas

storage permit instead.

In its review, FERC asked Arlington on May 15, 2013, for engineering details of Gallery 2's structure. Clark, the Houston geologist, concluded that the company's answers were evasive.

For example, FERC asked the company to provide "the size and volume of the rubble pile" in the hydraulically fractured link between Wells 30 and 31. The company, in its June 3 response, did not quantify the rubble pile, and FERC let the issue drop.

All of the caverns Arlington and its affiliates have earmarked for hydrocarbon storage have large rubble piles caused by roof and wall collapses.

"The rubble pile remains an unknown," Clark wrote of the fallen rock along the drilled connection between wells 30 and 31. "It is particularly important when a cavern system is of this advanced age and is as involved with faulting as this one is, that the dimensions of all components, including the cavity and rubble pile between caverns 30 and 31, be know to the fullest extent."

FERC also asked Arlington the following question: "In response to commenters' concerns regarding roof failure, please state if this has ever been an issue in either Gallery 1 or Gallery 2 or if you have knowledge of any roof or wall failures in any of the caverns within the Watkins Glen brine field."

The company responded as follows on June 3: "To Arlington's knowledge, there have been no cavern roof failures in Galleries 1 or 2, or in any other cavern within the Watkins Glen brine field in which natural gas or natural gas liquids have been stored."

FERC had asked about "roof or wall" — not simply roof failures and "any other cavern" — not simply storage caverns. But even more significantly, Arlington's answer sidestepped **reports** written between 1962 and 1973 by **Charles Jacoby**, a geologist for International Salt, that provided detailed analysis of the Well 30 roof collapse and extensive faulting throughout the brine field. One report Jacoby wrote in 1969 focused on wells 30 and 31 specifically, describing the 400,000-ton roof collapse and illustrating it with cross-section diagrams of the cavern.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ABSTRACT

INTRODUCTION

The 1969 Jacoby paper had circulated in international geological circles and had been referenced in a filing by the Earthjustice law group in FERC's public record of the case in May 2013 – a month before Arlington stated that it had no knowledge of a cavern roof failure. Clark said Arlington presumably had access to all the Jacoby reports as a successor company to International Salt, which produced them. Arlington has provided state and federal regulators with certain Jacoby reports, though not necessarily the key 1969 report.

"Perhaps the Arlington representative who wrote the answer (to FERC's question) was unaware of the work Jacoby did on the specific caverns of the proposal," Clark wrote. "Earthjustice, however, found the (1969 Jacoby report) easily and sent it to me as part of their file of basic background references."

Clark noted in a footnote that Jacoby's papers "have been taken down in the last few months" from the website Earthjustice had cited in its FERC filing.

FERC has yet to acknowledge either the massive roof failure or the 1969 Jacoby report. Last September, FERC issued its final Environmental Assessment of the Arlington project. The document provided summary conclusions about the geology of Well 30 that Clark said were at odds with Jacoby's findings.

Craig Cano, a spokesman for FERC, accepted emailed questions from DCBureau.org about Arlington's application a day before he stated that FERC does not comment on pending cases.

Debbie Hagen, a spokeswoman for Arlington's parent company, did not return phone calls or answer or acknowledge emailed questions about the case.

Arlington is a limited liability subsidiary of Crestwood Equity Partners LP, the new name of Inergy LP, which merged with Crestwood last year. "Midstream" affiliates of Kansas City-based Inergy and Houston-based Crestwood that operate pipelines and store natural gas and LPG have also merged.

While Arlington's gas storage application has triggered dozens of negative comments to FERC, opposition to a related proposal to store LPG in the Watkins Glen brine field has been even more intense.

In 2009, Inergy, operating through its limited liability subsidiary Finger Lakes Storage, sought the DEC's permission to store liquid propane and butane in caverns several hundred feet west and north of Arlington's Gallery 2. The pending application is now in its fifth year.

The LPG proposal has spurred spirited opposition from a citizens group called Gas Free Seneca, which claims support of more than 125 local businesses and

thousands of individuals. Group members have testified to the DEC, led vociferous protest marches through Watkins Glen and even gone to jail to protest the LPG project. High on its list of concerns has been potential geologic risk. The group also hired Earthjustice, which retained Clark.

“Gas Free Seneca has been saying for almost three years that 60-year-old abandoned caverns that were created by solution mining for salt were never engineered or created for the purpose of storing compressed natural gas or liquefied propane and butane under high pressure,” said Joseph Campbell, co-founder of the group opposed to both the LPG and gas storage proposals.


Larry Sevenker

Finger Lakes Storage proposes to store 600,000 barrels of pressurized liquid butane in a cavern known as Well 58 and 1.5 million barrels of liquid propane in a cavern close by. Well 58 had been plugged and abandoned in 2003 after a cavern engineer, Larry Sevenker, deemed it “unsuitable for storage.”

Sevenker had written a 2001 report for his employer, U.S. Salt, that said Well 58’s roof had collapsed. His boss at U.S. Salt and DEC officials concurred with his conclusion and with his recommendation to close and abandon the well. In interviews with DCBureau.org, Sevenker also stated that Well 58 had been drilled through a major rock fault.

Days after DCBureau.org published Sevenker’s comments in January 2013, an official at U.S. Salt (now owned by the Crestwood/Inergy combination) called Sevenker to urge him to write a letter recanting his previous positions. Sevenker, who said he was still being paid by U.S. Salt, acknowledged that he agreed to sign a letter with wording provided by the company official.

Then a public relations firm hired by Inergy made cold calls to several local media outlets offering the company-crafted Sevenker letter as evidence refuting claims that Well 58 was unsuitable. An Inergy lawyer forwarded the letter to the DEC.

For years, Inergy has tried to prevent the public from viewing a “reservoir suitability report” on its proposed LPG caverns on the grounds that the history of the caverns is a proprietary trade secret. And in 2010, Inergy had addressed Sevenker’s analysis in a confidential report, writing, “There is no reason to believe now that a roof cavern collapse did in fact occur.”

For the most part, regulators have deferred to the company’s request to keep the geology of the caverns secret. Although the DEC, FERC and the federal Environmental Protection Agency have all been criticized for that stance, there is some legal justification for it. The federal Freedom of Information Act, written in 1966, contains a specific exemption for “geological and geophysical information and data, including maps, concerning wells.” It has been rarely invoked.

But lawyers for Arlington did cite the FOIA exemption last year in a bid to prevent Clark from reviewing its confidential files under a strict non-disclosure agreement. FERC denied the company’s bid, and Clark has reviewed certain confidential files.

Working as a consultant to Earthjustice, Clark wrote his public findings in the Jan. 15 letter filed with FERC. He also wrote a separate confidential report to FERC.

Clark’s public letter takes a fresh look at Sevenker’s conclusions from 2001 about Well 58 being “unsuitable for storage” because of a roof collapse.

“The parallel between the fault block cavern roof failure in Cavern 30 (Arlington’s proposed gas storage site) and the roof collapse in Cavern 58 (Finger Lake Storage’s proposed liquid butane site) is obvious,” Clark wrote.

“It is clear that researchers working on caverns in the Watkins Glen brine field have encountered cavern roof failures and attributed these failure to fault situations. It is essential that cavern roof failure in the Watkins Glen brine field be recognized.”

Clark also concludes that FERC has given faulting in the brine field “short shrift,” reflecting Arlington’s statement that faulting, “if it exists” in the area, tends to seal rock.

Jacoby, who is deceased, had a different take. He identified thrust faults, tear faults and a major strike-slip fault surrounding Well 30. He noted that the strike-slip fault, in particular, had demonstrated its capacity to act as a conduit. Brine from a deep well had travelled along the strike-slip fault and been observed seeping out of the ground a half-mile north of its underground source, Jacoby noted.

FERC dismissed the strike-slip fault without discussion, saying that it passed to the east of Well 30. Neither did it address the tear faults or thrust faults.

Clark found FERC’s analysis inadequate. “The materials reviewed by FERC are incomplete, and its impressions about the caverns are incorrect,” he concluded.

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Peter Mantius

Peter Mantius is a reporter in New York. He covered business, law and politics at *The Atlanta Constitution* from 1983-2000. He has also served as the editor of business weeklies in Hartford, CT, and Long Island. He is the author of *Shell Game* (St. Martin's Press 1995), a nonfiction book on Saddam Hussein's secret use of a bank office in Atlanta to finance billions of dollars in arms purchases from Western countries before the 1991 Persian Gulf War.

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I think all who live near salt caverns -- and that's a lot of us in central New York -- should read this article.

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Celeste Froehlich · a month ago

Big business does not always win! Our same community of activists that just won a ban on fracking in the state of New York will win this battle too.

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vosehrbrtvs · a year ago

I think all of you affected should either fight this to death, or move. Big business ALWAYS wins; they pay off all our elected officials.

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DACrea · 7 months ago

The Figure 3 that Jacoby's draftor prepared for his paper is a "cartoonish drawing" to today's geologists, as they well-understand that rock-layers DO NOT collapse during solution-mining as is shown there. It is also clear from the record that the rock-layer collapse (NOT "Roof" but "Rock-Layer"!) was due to the use of Fresh Water (not Brine) to displace the stored propane over several prior years. The water simply solution-mined further salt from the layer under the rock, until it fell down, piece by piece and layer by layer, forming an expanded-volume "Rubble-Pile" in the cavity, until the cavity itself progressed-upward into the next salt layer. As it did so, the casing became "pinched" a common experience in this business. This rock-collapse caused nothing more than the need for a "Well Work-Over" as a result of the casing being pinched by the rock, which stopped propane-discharge at an inconvenient-time in late-winter. As a result of this early storage-experience, later-practice was to use only SATURATED BRINE so that mining did not continue

concurrently with Propane Storage operations. Critical analysis finds that Jacoby's "400,000-ton Rock Fall" wasn't necessarily true, but WAS a bit of sensationalizing, as he was prone to like to publish, get his name out in the industry, and have a good-excuse to go to these Salt Symposiums. Also, Jacoby was excited about the application of the early SONAR technology to map the cavity after the rock-fall occured. That technology was just coming-of-age to be useful to geologists in 1967, and has been highly-refined since, with better hardware and software for 3-D views of cavities. EarthJustice's hired-gun geologist H.C. Clark's work is trumped-up criticism, which FERC sliced-and-diced in the text of their Permit for Gas Storage at Cavity 2 -- see pages 9-12 here: http://www.ferc.gov/whats-new/...

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Suzanne ➚ DACrea · a month ago

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