Approved:
Date March 1, 2001

MINUTES OF THE SENATE UTILITIES COMMITTEE.

The meeting was called to order by Chairman Senator Stan Clark at 9:30 a.m. on February 27, 2001 in Room 313-S of the Capitol.

All members were present except:

Committee staff present: Raney Gilliland, Legislative Research
Tom Severn, Legislative Research
Bruce Kinzie, Revisor of Statutes
Ann McMorris, Secretary

Other Legislators sitting with the committee:
Senator Dave Kerr
Rep. Laura McClure
Rep. Janice Pauls
Rep. Mary Kauffman
Rep. Carol Beggs
Rep. Joann Freeborn
Rep. Joe McLeland

Conferees appearing before the committee:
Dr. Joe Ratigan, Consultant, Houston
Dr. Lee Allison, Kansas Geological Survey
Karl Mueldener, Kansas Department of Health and Environment
Gene Dubay, President, Kansas Gas Services
John Rose, Northern Natural Gas, Omaha
Bill Diamond, Solution Mining Research Institute, Encinitas, CA

Others attending: See attached list

Chairman Clark opened the session and introduced President of the Senate Dave Kerr. Senator Kerr welcomed the presenters. He told those present that we need to know if Kansas has in place the laws, regulations and monitoring of natural gas storage to be able to tell Kansans that living in the vicinity of this type of storage is safe. This hearing today is for the purpose of gathering information on all aspects of natural gas storage.

Underground Solution-mining and Hydrocarbon Storage

Joe L. Ratigan, Ph.D., consulting Geologic Engineer, Senior Vice President and Principal Consultant for Sofregaz US, a hydrocarbon storage engineering and construction firm in Houston, TX. He began providing consulting services to the City of Hutchinson on January 19, 2001. He described the technology of storing liquid and gaseous hydrocarbons in solution-mined salt cavers, the state regulation of such technology, and the Kansas regulations and how they compare to those in other states. His belief is that Kansas needs to revise their rules for underground storage of hydrocarbons. He further provided a brief description of (1) North American salt formations, (2) salt as a construction material, (3) solution mined caverns for hydrocarbon storages, and (4) the history of regulation and regulations in other states.

In discussing Kansas regulations, the KDHE rules for underground storage wells and caverns are contained in Kansas Administrative Regulation 28-45. The significant weaknesses in the KDHE rules are (1) the rule does not require a Mechancial Integrity Test nor does it require any sort of casing inspection log; (2) it does not address the reentry or drilling out of plugged and abandoned wells; (3) it does not address how close caverns can be to one another and this is important for pressurized gas storage caverns; (4) it does not require Emergency Shutdown Valves at the wellhead; (5) it requires minimal information to be reported to KDHE by operators compared to other states. He noted KDHE has been working for several years with industry to revise the rules He offered several questions that should be addressed in studying revision of Kansas regulations. (Attachment 1)

Geology of Natural Gas Pathways and Accumulations under Hutchinson, Kansas
Dr. Lee Allison, Ph.D, R.G., State Geologist and Director, Kansas Geological Survey, University of Kansas, noted Kansas Geological Survey's role in the Huthinson situation was to conduct geological investigations. He displayed large charts of the geographic strata and explained the information gained from 3.5 mile seismic reflection line and a 1/4 mile line in Hutchinson. (Attachment 2)

Information on Hutchinson Gas Incident
Karl Mueldener, Kansas Department of Health & Environment Bureau of Water, described Kansas facilities, regulatory program history, history of wells, state regulatory authority and regulation plans. (Attachment 3)

Kansas Gas Service Company
Eugene Dubay, President, Kansas Gas Service Company, talked about the role that natural gas storage plays in the timely, cost-effective distribution of natural gas to consumer. Throughout the Hutchinson crisis, KGS was committed to (1) ensuring the community's safety by investigating any potential natural gas leaks and drilling vent wells in the area; (2) returning the evacuees to their homes as soon as safely possible; and (3) determine what caused natural gas to be present below Hutchinson and to fully understand that chain of events that led to the two explosions. (Attachment 4)

Natural Gas Storage Service
John Rose, Senior Reservoir Engineer for Northern Natural Gas, addressed the development and operation of their two natural gas underground storage facilities in Kansas located near Lyons and Cunningham which originally were producing natural gas fields. (Attachment 5)

Solution Mining Research Institute, Inc
Bill Diamond, executive director of Solution Mining Research Institute, Inc., felt a key step to preventing another happening like Hutchinson, will be updating the Kansas rules for underground storage of Hydrocarbons. His opinion was that the investigation needs to be conducted by an organization that is able to subpoena witnesses and obtain records. He provided a background on SMRI and offered assistance in both the investigation and rule making. (Attachment 6)

Chairman opened for questions.

Questions were posed on:
(1) number of wells per professional
(2) separate regulations for three types of underground storage
(3) study on new regulations started in 1996 - what progress has been made
(4) monitoring system used by Kansas
(5) Does KDHE ask for ideas from the industry?
(6) Determining integrity of pipelines under pressure
(7) Internal regulations of industry in addition to rules and regulations of the area.
Dubay agreed to provide a copy of the internal regulations of his company to the committee.
(8) What period of time is covered in getting new regulations approved?
(9) What role does FERC have? Do they inspect. No - they set rules and regulations only on pipelines operating in interstate commerce. There is some overlap between KCC and FERC.
(10) What monitoring time schedule is included in the rules and regulations? KDHE related various time periods for various categories.
(11) What agencies are involved in other states? Department of Natural Resources in most.
(12) Discussed the time lapse between the first indication of trouble in Hutchinson and the actual happening.
(13) Number and type of storage areas that are under the regulation of KCC.
(14) Who owns Yaggy? Mid Continent Market Center.
(15) How were the regulations divided between KCC and KDHE?
(16) Are more detailed statutes needed? Statutory authority is in place.
(17) What regulatory body has the most stringent rules, regulations and guidelines?
KDHE has asked other states for their rules but no comparion study has been made.
(18) What were the symptoms of the Hutchinson trouble? Pressure drop. Discussion on the steps taken to isolate the cause of the pressure drop.
(19) What formula is used to determine rate of movement of the gas? Dr. Allison responded.
(20) Discussed fracture gradient tests.
(21) Are there any warning systems that would notify the immediate populace? None.
(22) Discussed devices and systems used to locate abandoned wells. .

Chairman Clark announced the committee would next meet on February 28 to discuss further the information presented and to possibly make a series of recommendations to the appropriate state agency and study funding.

Adjournment.

Respectfully Submitted,

Ann McMorris, Secretary

Attachments - 6

SENATE UTILITIES COMMITTEE GUEST LIST

DATE: **February 27, 2001**

Name	Representing
Tom Cook	Williams
Jim Nichols	Williams
Jim Thomas	Williams
Rosemary Foreman	KCC
Jeff Wagaman	KCC
Leo Haynos	KCC
Mike Ohrt	Pinegar - Smith
Susan Mahoney	Governor's Office
Lee Eisenhauer	Propane Marketers Assn of KS
George Petersen	Deacon Geology Inc
John DeCoursey	Kansas Gas Service
[illegible]	"
Barbara Stokes	"
Randall Kooiman	Koch Hydrocarbon Co.
Janelle Reese	" " "
Steve Mims	" " "

SENATE UTILITIES COMMITTEE GUEST LIST

DATE: **February 27, 2001**

Name	Representing
Darrell Oblenburger	Myself
Dennis Carlile	CMS Energy
Jack Glaves	" "
Mike Cochran	Kansas Dept. Health & Environment
Donald Carlson	Ks. Dept. of Health & Environment
Bill Bryson	Kans. Geol. Survey
Joe Fund	KDHE
Denise Eck	KWCH-TV Wichita
Peter Votypka	Self-Interest
Ed Williams	Reno County
Bill Guy	Reno County Emergency Management
Darren Dick	Myself
Scott Case	Myself
Bob Krehbiel	KIOGA
Ken Peterson	KPC
Alan Esterline	Baker Atlas

SENATE UTILITIES COMMITTEE GUEST LIST

DATE: **February 27, 2001**

Name	Representing
Eric Sexton	WSU
Tammy Allen	WSU
Chuck Banks	U.S. Senator Pat Roberts Office
Whitney Damron	KS Gas Service/ONEOK, Inc.
Brad Dixon	Ks Gas Service
Louis Salinas	El Paso Corp.
Anthony Trinko	CIG
Steve Etchison	Williams.
Ron Gaches	GBBA

NATURAL GAS STORAGE PRESENTATIONS

before the

SENATE UTILITIES COMMITTEE

February 27, 2001 - 9:30 a.m. to Noon
Room 313-S - Old Supreme Court Room

PRESENTERS:

Dr. Joe Ratigan, Consultant, Houston

Dr. Lee Allison, Kansas Geological Survey

Karl Mueldener, Kansas Department of Health and Environment

Gene Dubay, President, Kansas Gas Services

[redacted]

John Rose, Northern Natural Gas, Omaha

Bill Diamond, Solution Mining Research Institute, Encinitas, CA

TESTIMONY
BEFORE THE KANSAS SENATE UTILITIES COMMITTEE
TOPEKA, KANSAS

By

Joe L. Ratigan, Ph.D.
Sofregaz US, Inc.
Houston, Texas

February 27, 2001

Good morning. I wish to thank you for the opportunity to provide this testimony.

My name is Joe Ratigan. I am a consulting Geologic Engineer, Senior Vice President, and Principal Consultant for Sofregaz US, a storage cavern engineering and construction firm in Houston, Texas. I hold bachelor and master degrees in mechanical engineering and a Ph.D. in geologic engineering. I am a Registered Professional Engineer in Texas and South Dakota. I provide consulting services to the underground solution-mining and hydrocarbon storage industry. The services include geomechanical studies and facility permitting.

I am also the Research Coordinator for the Solution Mining Research Institute, a professional organization of solution-mining and underground storage owners, service companies, and researchers. Additionally, I serve on a rules committee for the Louisiana Department of Natural Resources Injection & Mining Division, the organization responsible for developing revised salt cavern storage rules.

I am appearing today on behalf of the city of Hutchinson. I began providing consulting services to the city of Hutchinson on January 19, 2001.

My testimony today addresses the current Kansas Department of Health and Environment (KDHE) rules for underground storage and whether these rules need revision. In my testimony, I wish to describe the technology of storing liquid and gaseous hydrocarbons in solution-mined salt caverns, the state regulation of such technology, and the Kansas regulations and how they compare to those in other states.

This testimony is not intended to be a comprehensive review of the Kansas regulations nor is it a comprehensive review of the regulations of other states. It is, rather, a detailed introduction to the issues that need to be addressed as a result of the incidents in Hutchinson. It is my belief that Kansas needs to revise their rules for underground storage of hydrocarbons. I believe my testimony will convince the committee to adopt that same position.

My testimony today consists of a brief description of (1) North American salt formations, (2) salt as a construction material, (3) solution-mined caverns for hydrocarbon storage, and (4) the history of regulation and regulations in other states. I then conclude the testimony with a discussion of Kansas regulations.

NORTH AMERICAN SALT FORMATIONS

Salt formations are distributed throughout North America, as shown in Figure 1. There are two basic types of salt formations – salt domes and bedded salt.

Salt domes are very large bodies of salt (up to several miles in diameter and many miles "tall") consisting of nearly pure sodium chloride (usually >95 percent). Hundreds of salt domes in the United States are located along the Gulf Coast in the states of Alabama, Mississippi, Louisiana, and Texas. All of the salt domes in the Gulf Coast developed from a very deep (>30,000 feet) bedded salt called the Louann salt.

Bedded salt formations differ significantly from salt domes. Bedded salt formations consist of "layers" of salt interbedded with nonsalt rocks, such as shale, dolomite, and/or anhydrite. Bedded salt formations can vary considerably from one another. Additionally, a bedded salt formation within a specific basin can vary from one part of the basin to the other. For example, the Hutchinson bedded salt unit is only 40 to 50 percent salt in Oklahoma; whereas, in central Kansas, the Hutchinson salt unit can be as much as 80 percent sodium chloride. The principal "impurity" or nonsalt rock in the Hutchinson salt formation is shale. These impurities exist in small percentages within the salt beds, but primarily exist as distinct geologic units separating beds or layers of salt within the salt formation.

The only salt formations usable for storage caverns in Alabama, Mississippi, and Louisiana are salt domes. Texas is the only state that has both bedded salt and salt domes (at usable depths). The only salt formations in Kansas, Oklahoma, Ohio, Michigan, New York, and Pennsylvania are bedded salt formations.

SALT AS A CAVERN CONSTRUCTION MATERIAL

Salt is an excellent construction material for hydrocarbon storage caverns. It is easily, economically, and predictably mined (through solution mining) and is essentially impermeable at moderate pressures. The nonsalt interbeds that exist in bedded salts are, however, not impermeable and must be given consideration when developing storage caverns in bedded salt formations.

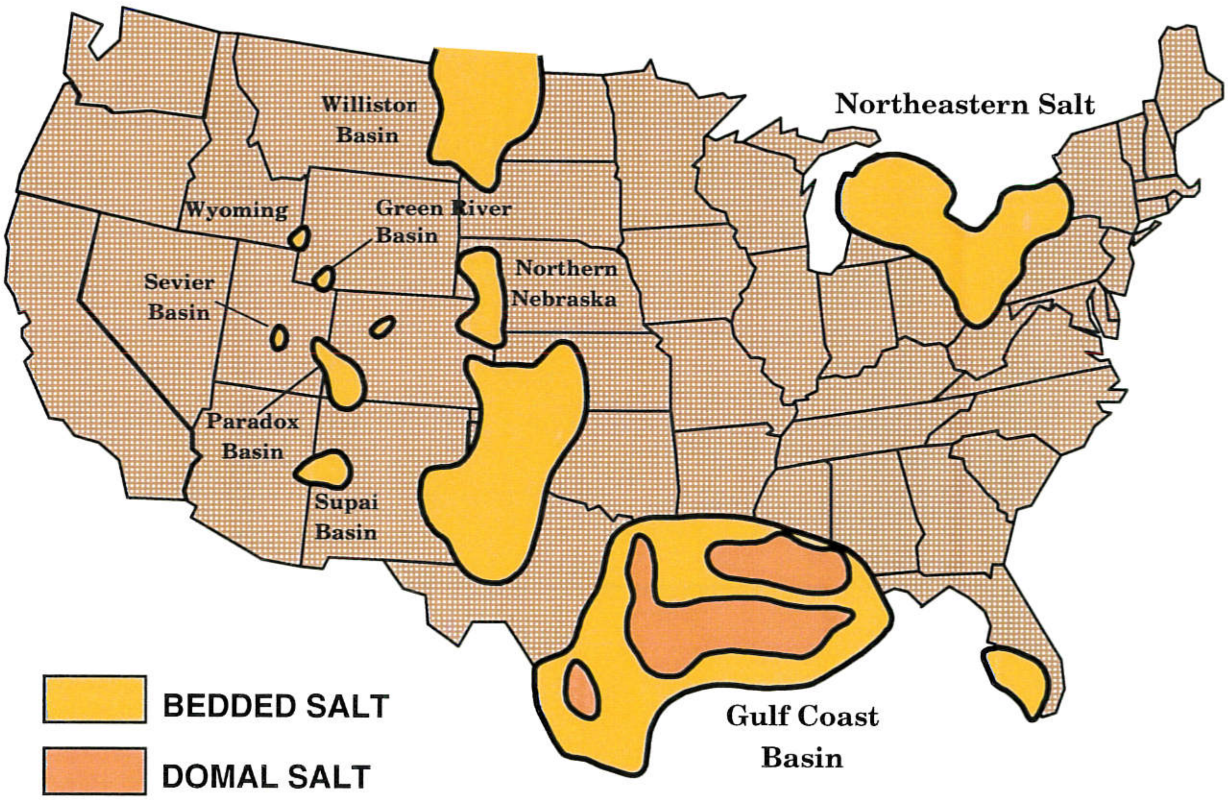

Figure 1. Salt Formations in North America.

1-3

Like any other construction material, properties and in situ conditions[1] must be determined for the salt and nonsalt rocks in which a storage cavern is to be developed. These properties and conditions must be used in concert with the operating conditions of the intended storage cavern to ensure a successful storage project. For example, the fracture gradient[2] in the nonsalt units of the Hutchinson salt unit must be determined to establish a safe maximum gas storage pressure for a gas storage cavern developed in the Hutchinson unit.

SOLUTION-MINED CAVERNS FOR HYDROCARBON STORAGE

Salt has been mined by "solution-mining" since the late 1800s. The Hutchinson area was one of the first areas in the United States where solution mining of salt was practiced. In the late 1940s and early 1950s, the oil and gas industry realized that the cavities created during salt solution mining could be used to store natural gas liquids (NGLs) or liquefied petroleum gases (LPGs)[3]. The NGLs/LPGs could be injected into the solution-mined caverns and brine would be displaced as the NGLs/LPGs were injected. Similarly, when the cavern owner wanted to recover the NGLs/LPGs from the cavern, he could merely inject brine back into the cavern and NGLs/LPGs would be produced at the surface. Figure 2 provides a schematic illustration of a NGL/LPG storage cavern in a bedded salt formation.

Again, Hutchinson was on the leading edge of the hydrocarbon storage technology as Cities Service Oil Company developed propane storage caverns southwest of Hutchinson in the very early 1950s. Kansas currently has more NGL/LPG salt storage caverns (more than 600) than any other state in the Union. Texas ranks second in the number of NGL/LPG salt storage caverns.

About the same time that the oil and gas industry began exploiting solution-mined caverns for storing liquid hydrocarbons in bedded salt formations, the same development was going on in the salt domes along the Gulf Coast. Today, over 500 caverns in salt domes are used for storing NGLs/LPGs.

The solution-mined caverns in Kansas are very different from the solution-mined caverns used for LPG storage in the Gulf Coast. Specifically, the Kansas caverns are much smaller and are much shallower. A typical Kansas cavern has a volume of about 100,000 barrels (4.2 million gallons) and is located at a depth of about 600 to 800 feet. A typical Gulf Coast cavern is at least 10 to 20 times larger than a Kansas cavern and is usually located at a depth of more than 1,500 or 2,000 feet. Gulf Coast salt dome caverns used to store crude oil for the United States' Strategic Petroleum Reserve (SPR) are each 100 times the volume of a single typical Kansas cavern. One single SPR cavern has more volume than all of the Yaggy caverns combined.

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[1] In situ conditions are conditions "in the ground," such as temperature and stress state.

[2] The fracture gradient for a formation is a common term in the oil and gas industry. It is the pressure (in pounds per square inch) required to "fracture" a formation at a certain depth divided by the depth (in feet).

[3] NGLs or LPGs are hydrocarbon compounds that can be stored as liquids if pressurized slightly.

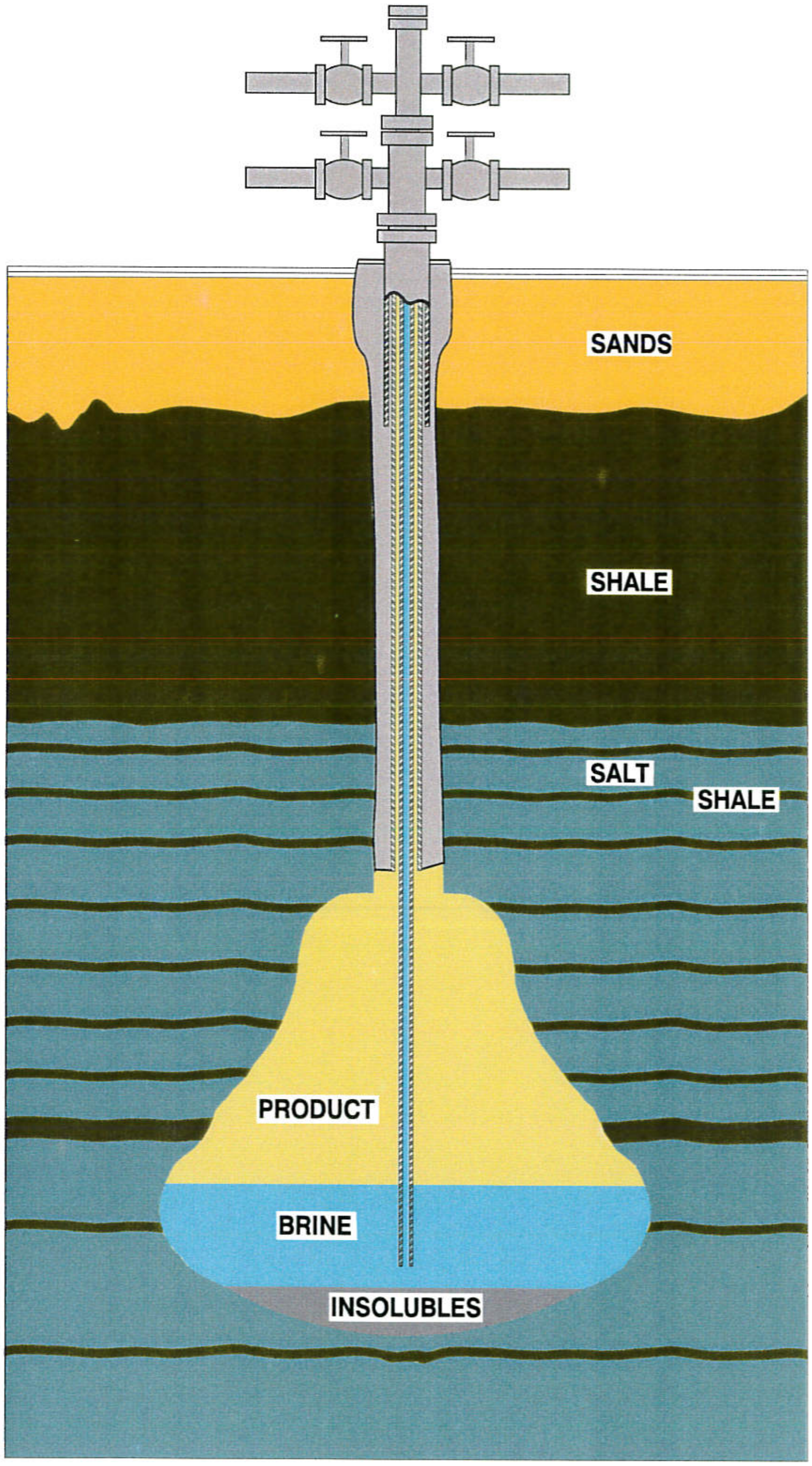

Figure 2. Schematic Illustration of a NGL/LPG Storage Cavern in a Bedded Salt Formation.

In the 1960s, the gas industry began to use solution-mined caverns in salt formations for storing compressed natural gas. Significant development of this technology for storing natural gas did not really take off until the deregulation of the natural gas industry in the early 1990s. Today, there are several hundred natural gas storage caverns in salt in the United States. Again, Kansas has more natural gas storage caverns than any other state in the Union. Gas stored in salt caverns can be delivered to the market place much faster than gas stored in depleted oil and gas reservoirs. Thus salt cavern storage is designed to respond to the peak demand market more so than to the seasonal demand market.

Natural gas is stored in solution-mined caverns in a much different way than LPG is stored (see Figure 3). In an LPG cavern, the cavern is always "full of liquids." The liquids are LPG and brine with the lighter LPG always on top of the heavier brine.

There is essentially no liquid in a natural gas storage cavern. Initially, the brine in a solution-mined cavern is removed by first installing tubing inside the casing. Gas is then injected down the annulus, forcing the brine up the tubing and out of the cavern. Thereafter, the cavern is operated "dry." The pressurized gas in the cavern is injected and removed by "free flowing" the gas through the well or by using compressors on the surface, as needed.

While the pressure in a LPG cavern is nearly always constant, the pressure in a compressed natural gas storage cavern can vary significantly. The pressure in the cavern is proportional to the amount of gas in the cavern. Some gas must always be left in the cavern "to hold up the cavern roof and walls." This amount of gas is called the "cushion gas" or the "base gas." The amount of gas that can be removed from the cavern and sold to the marketplace is called the "working gas." The sum of the *cushion gas* and the *working gas* is the total volume of gas that is injected into the cavern. The higher the maximum allowable pressure, the more gas that can be injected into a cavern. The lower the allowable minimum pressure, the less *cushion gas* in the cavern and thus, the greater the volume of *working gas*.

HISTORY OF REGULATION AND REGULATIONS IN OTHER STATES

Even though solution-mined caverns have been used for hydrocarbon storage for about 50 years, contemporary regulations are not nearly as mature. The first state regulation specifically dealing with solution-mined caverns for hydrocarbon storage was promulgated less than 25 years ago. Current rules in states with solution-mined storage caverns used for hydrocarbons are generally less than about 10 years old. Table 1 provides a list of many of the current state regulations and the dates the rule became effective.

The development of many state regulations for storing hydrocarbons in solution-mined storage caverns has generally occurred following an industrial accident at a storage facility. The current regulations in Louisiana (Statewide Order 29-M) followed a fire that occurred during the initial oil filling in a Strategic Petroleum Reserve cavern in the West Hackberry salt

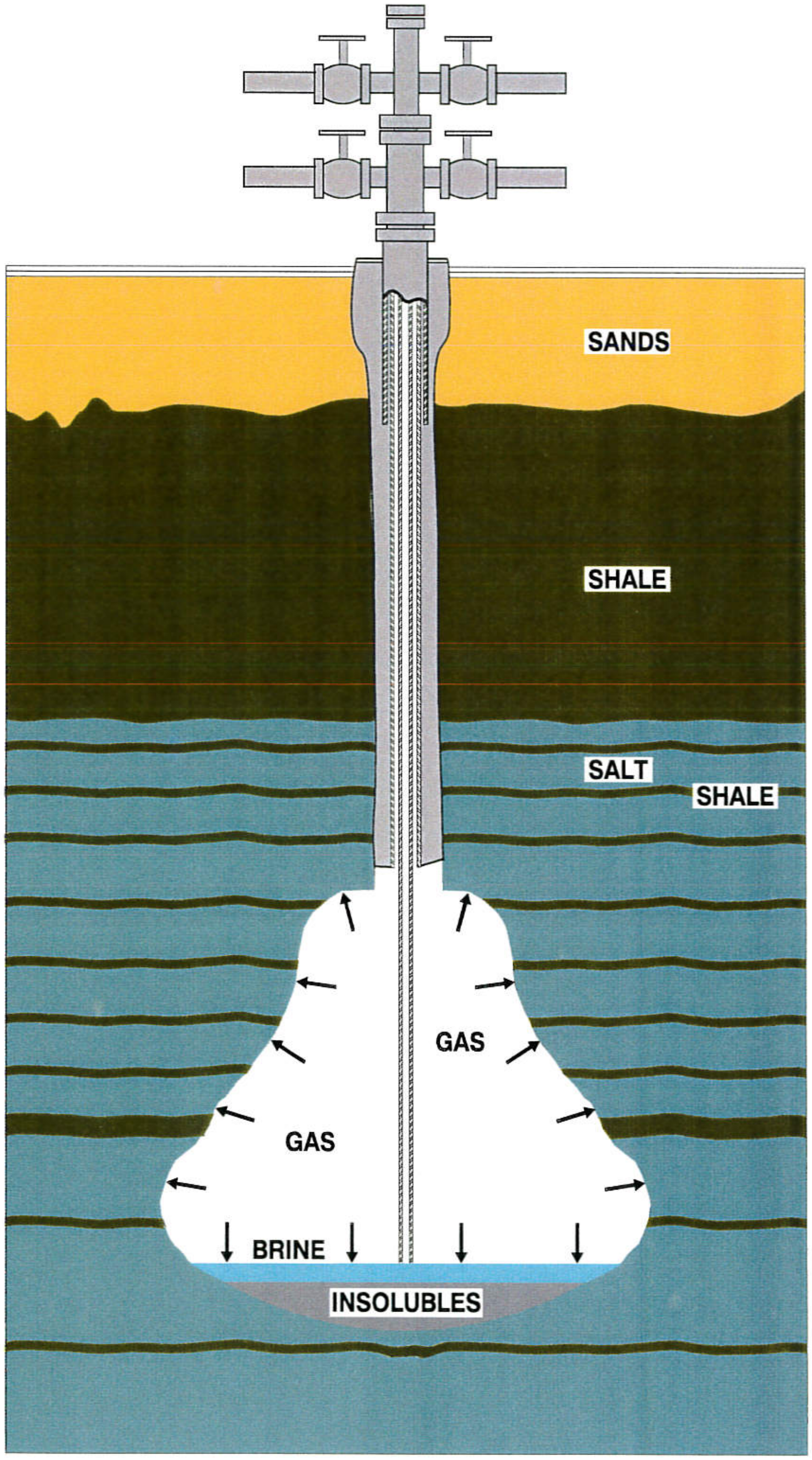

Figure 3. Schematic Illustration of a Compressed Natural Gas Storage Cavern in a Bedded Salt Formation.

dome. The current Texas Regulations (Railroad Commission Rules 95 and 97) were developed following the loss-of-product accident at the LPG storage facility in the Brenham salt dome. Development of the Kansas regulations followed the loss-of-product near Conway.

Table 1. Effective Dates for State Regulations for Hydrocarbons Storage Caverns

State	Rule	Effective Date
Alabama	Alabama State Oil and Gas Board 400-6 (Gas)	May 16, 2000
Kansas	Kansas Administrative Regulation 28-45 (Liquids and Gas (?))	1984
Louisiana	State Wide Order 29-M (Liquids and Gas)	July 20, 1977
Mississippi	Mississippi State Oil & Gas Board Rule 64 (Liquids and Gas)	February 19, 1992
New York	6 NYCRR, Part 559 (Liquids and Gas)	In Draft
Oklahoma	None	NA
Texas	Railroad Commission Rules No. 95 (Liquids) and No. 97 (Gas)	January 1, 1994

There are states that have promulgated rules that are not correlated to accidents within their state boundaries. For example, Mississippi, Alabama, and New York rule development did not follow a specific accident. The Louisiana rule is currently being revised by the Louisiana Department of Natural Resources. Oklahoma, despite having hydrocarbon storage caverns, has no rule specifically regulating this type of storage.

KANSAS REGULATIONS

The KDHE rules for underground storage wells and caverns are contained in Kansas Administrative Regulation 28-45. These rules have been around for some time, and KDHE recognized the need to revisit these rules some time ago. KDHE has been working with industry to revise the rules for several years.

It is important to recognize that these rules were promulgated at a time when there were no natural gas storage caverns in Kansas and thus, the rules can reasonably be expected to be deficient for gas storage caverns.

The significant weaknesses in the KDHE rules have been well documented in the press in recent weeks. For example, the rule does not require a Mechanical Integrity Test nor does it require any sort of casing inspection log. The rule does not address (nor perhaps contemplate) the reentry or drilling out of plugged and abandoned wells.

The Kansas rule does not address how close caverns can be to one another. This is perhaps not a major issue with liquid wells, but is important for gas storage caverns.

The Kansas rule does not require Emergency Shutdown Valves at the wellhead, which is a common requirement in other states. The Kansas rule requires minimal information to be reported to KDHE by operators compared to other states.

When discussing the Kansas rules, it is important to recognize that whereas Kansas has more liquid hydrocarbon wells and caverns and natural gas storage wells and caverns than any other state in the Union, they do not have the largest regulatory and enforcement staff or the largest budget. Clearly, that may be the biggest change required at KDHE.

It is difficult to make direct comparisons of manpower in one state versus manpower in another state merely because the areas of responsibility can be different from a state agency in one state to a seemingly similar state agency in another state. However, it is interesting to note that the Louisiana agency responsible for regulating underground storage wells employs nine professionals in Baton Rouge and regulates about 4,500 wells or about 500 wells per professional. The Texas agency responsible for regulating underground storage caverns employs two professionals in Austin who regulate about 950 wells or slightly less than 500 wells per professional. It is my understanding that KDHE employs two professionals in Topeka who are responsible for regulating more than 6,000 wells. *The number of "wells per professional" regulated in Kansas appears to be six times the number in the comparable Louisiana and Texas regulatory agencies.*

QUESTIONS

Are the Kansas regulations sufficient for regulating underground natural gas storage caverns and wells? When the current regulations were promulgated, natural gas was not stored in salt caverns in Kansas. Clearly, the Kansas regulations need revision. In that regard, the natural questions that arise are twofold:

1. What should be regulated?

2. How should the items in (1) above be regulated?

In response to the first question, at a minimum, the following should be regulated:

- Wells and wellheads
- Caverns

- Operations
- Testing and monitoring.

Wells and Wellheads

Kansas requires two casings in storage wells – one for groundwater protection and one casing at least 105 feet into the salt formation (50 feet in "existing" wells). Many states require one casing for groundwater protection and two casings in the salt, but these are states with caverns developed in salt domes. Salt domes are typically overlain with a "caprock" which is very porous and saturated with sodium chloride brine, which can be very corrosive. The same corrosive environment may or may not exist above or at the top of bedded salt formations. Texas, which has both bedded and domal formations, does not require two casings set into the salt for caverns developed in bedded salt formations.

Some states require pressure testing of the casing during the construction of the well (after cementing). Kansas does not. Some states require cathodic protection for some wells. Kansas does not require cathodic protection.

Questions that KDHE will need to address include:

1. Will Kansas require two cemented casings (or one casing and a protected annulus) into the salt in the future for wells?
2. Will storage wells in Kansas require cathodic protection?
3. Is corrosion a significant problem in well casings in storage wells in Kansas?
4. Will Kansas require pressure testing of cemented casings during construction of new wells in the future?
5. Will KDHE require Emergency Shutdown Valves?

Caverns

In many states, the location of the cavern (within the salt formation) is restricted and the size of the cavern must be periodically checked. In Kansas, performing a "gamma log" in the well periodically checks the "size" of the cavern. The gamma log is able to establish the location of the cavern roof and thus, the location of the cavern within the salt formation. Texas has rules similar to those in Kansas for monitoring the location of the cavern roof in bedded salt caverns. In Kansas, periodic sonar surveys are generally only required in caverns that have reached a volume of 120,000 petroleum barrels. There are, however, other situations for which KDHE may require a sonar survey.

Many other states regulate the distance between caverns (the "web thickness"). Kansas does not (except for brine production wells). It is not necessarily as important to regulate the distance between liquid storage caverns. However, since the pressure difference between adjacent natural gas storage caverns can be significant, the distance between caverns can be important.

Questions that KDHE will need to address include:

1. Has consideration been given to requiring a "minimum" web thickness between caverns?
2. Has consideration been given to requiring a "minimum" gas storage pressure? What does KDHE believe is important in establishing a minimum gas storage pressure?

Operations

All states have some level of regulation of cavern operations. Perhaps the most significant operational characteristic that is regulated is the maximum pressure allowed in a storage cavern. The maximum pressure in a storage cavern is stated as a pressure (in pounds per square inch) divided by a depth (in feet) at the depth of the casing shoe. The casing shoe is the deepest point of the "last" (most "inner") cemented casing. Maximum permissible pressures in many states range from 0.8 psi/foot to a high of 0.9 psi/foot. The higher maximum pressures are generally associated with caverns in salt domes rather than caverns in bedded formations.

Kansas does not specify a maximum pressure in terms of psi/foot. Rather, they ask for "a description of methods to be used to prevent overpressuring of wells to the point of lifting or fracturing overburden."

All states require reporting of maximum pressures and volumes of hydrocarbon injected and withdrawn over a period of time. Most states require reporting on a monthly or quarterly basis. Kansas requires reporting on an annual basis. The operator of a facility in Kansas need only report a maximum pressure for the entire year; whereas, operators in other states must report maximum pressures for every month or quarter of operation.

Most states besides Kansas require continuous monitoring of the pressure on every wellhead. Kansas only requires that the operator maintain records of product injections and withdrawals and maximum pressures during injections or withdrawals. These records need not be provided to the state, but must be available for inspection. Kansas also allows for recording of "each well or well system" pressures. Seemingly, if two or more wells are connected at a common manifold at the surface (as is the case at Yaggy), individual wellhead pressures need not be monitored or recorded. Rather, only the common manifold pressure need be recorded.

Questions that KDHE will need to address include:

1. What maximum pressure criterion will KDHE adopt?
2. Will KDHE have a different criterion for liquid storage than for gas storage?
3. What will KDHE require from an operator as proof that the maximum pressure is safe?

4. Does KDHE intend on increasing the requirements for reporting of wellhead pressures and product movements?
5. Will KDHE require continuous monitoring of wellhead pressures?

Testing and Monitoring

Most states require various types of testing and monitoring. Perhaps the most significant test required by most states (Kansas being an exception) is the Mechanical Integrity Test (MIT). Most states require this test of storage wells on a 5-year frequency. Kansas does not require an MIT for liquid or compressed natural gas wells, but does have an MIT requirement for brine mining wells.

Many states require MITs when the wellhead or cemented casings are modified. Kansas does not.

A few locations in some states require casing inspection logs on storage wells on a regular basis. For example, storage wells in salt domes with single cemented casings into the salt formation in Texas are required to have a casing inspection log on a regular basis. Texas wells in bedded salt formations are not required to have a casing inspection log. Kansas does not require casing inspection logs for any storage wells.

Many states are requiring (through permit conditions rather than rule) subsidence surveys on an annual basis. Kansas requires subsidence surveys every 2 years. Surveys in Kansas are required to be only third-order surveys. This may be inadequate for capturing any subsurface movement.

Questions that KDHE will need to address include:

1. Will KDHE require regular MITs?
2. Will KDHE allow alternative testing to substitute for MITs?
3. Will KDHE revisit their subsidence survey specifications?
4. Has KDHE considered requirements for casing inspection logs, particularly for "reentered" wells?

Again, I appreciate the opportunity to present these views on behalf of the city of Hutchinson. The city justifiably has very serious concerns regarding the aptness of the current Kansas regulations for underground hydrocarbon storage caverns. As a consultant that has committed his career to salt storage cavern technology, I have stated to the city that when properly designed, tested, monitored, operated, and regulated, salt caverns can be extraordinarily safe and effective facilities for storing hydrocarbons.

KANSAS GEOLOGICAL SURVEY
Office of the Director

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GEOLOGY OF NATURAL GAS PATHWAYS AND ACCUMULATIONS UNDER HUTCHINSON, KANSAS

Presented to the Senate Utilities Committee

February 27, 2001

M. Lee Allison, PhD, R.G.
State Geologist and Director
Kansas Geological Survey
University of Kansas

The Kansas Geological Survey is tasked under statute to investigate and report on the natural resources of the state. We are established as a research unit of the University of Kansas to bring unbiased and scientifically sound expertise to bear on resource issues.

Our role in the Hutchinson situation began the day after the trailer park explosions when it became known that geological investigations were needed. We served initially as geologic advisors to KDHE. When many of the early vent wells turned out to be dry holes, it became clear that complex geologic conditions were likely controlling the pathways and accumulations of the gas. Our work consisted of:

- Determining what layers might serve as geologic conduits for gas under the city;
- Compiling subsurface information on the shape and nature of the geologic layers;
- Compiling information on sinkholes and subsidence in the Hutchinson area;
- Examining rock cores from the Yaggy field and surrounding oil and gas fields;
- Examining geophysical wireline logs from wells to identify possible conduits;
- Producing subsurface geologic maps of relevant horizons;
- Developing a geologic model to guide drilling of vent wells and other remediation actions;
- Recommending additional investigative and exploratory steps.

The Kansas Geological Survey has done the following so far:

- Collected, processed, and interpreted a 3.5-mile long seismic reflection line along Wilson Road between Yaggy and Hutchinson, and a 1/4 mile long line at Rice Park; (these data amounted to 60 gigabytes, filling 100 CD ROMs)
- Completed specialized computer processing on the seismic data to identify two possible gas-bearing amplitude anomalies (both were drilled and produced gas);
- Created structure contour maps on a variety of geologic horizons using 3700 oil and gas wells;
- Created a detailed structure contour map on the gas-bearing layer using water and vent well data;
- Identified and correlated the gas-bearing layer on geophysical logs from oil and gas wells and vent wells in the area;
- Compiled reports on the history of subsidence in the Hutchinson area;

- Examined well cores to determine the geologic origin of the gas-bearing layers in order to predict possible pathways, including the Atomic Energy Commission core in Rice County;
- Acquired, digitized, and processed sonic well logs to create a synthetic seismogram to correlate the seismic lines to the wells;
- Calculated that there are geologically reasonable conditions under which high-pressure gas could have traveled 7 miles underground in a few days;
- Examined outcrops in the region that might be equivalent to the gas-bearing layer;
- Advised the Groundwater Management District on a groundwater-monitoring program;
- Analyzed brine samples from the geysers for inorganic materials for source studies;
- Considered the potential for subsidence due to collapse of brine well caverns;
- Produced digital orthophoto quadrangle air photos for plotting data;
- Briefed state and local officials on the geology;
- Worked with KDHE, Kansas Gas Service, and the City of Hutchinson to recommend drilling locations; and
- Responded to scores of inquiries from citizens, consultants, attorneys, and the news media.

We have found that:

- The gas is confined to a relatively thin geologic layer at the top of the Permian-aged (approximately 250 million years old) Wellington Shale, about 200 feet above the Hutchinson Salt Member;
- The regional dip of the deeper rock layers is to the west meaning that, all other factors being equal, gas would move in general to the east (because methane is lighter than water, it will tend to move updip through rock);
- The large number of vent wells that are dry holes suggests that the gas pathways are discrete and cover a relatively small area under the city;
- The seismic amplitude anomalies were drilled and found to contain gas; each is about 150-200 feet across;
- The gas-bearing layer may be composed of siltstones that are locally fractured;
- There are anticlines present (rocks folded into an arch) that could serve to direct gas along their crests; and
- There are deep faults or fractures (many thousands of feet deep) that appear to control the orientation of the Arkansas River channel and may have controlled the location and orientation of ancient channels during the Permian period as well.

What investigations need to be done to return confidence to Hutchinson and ensure that this cannot happen again?

- Determine which of these factors or combination of factors is responsible for the gas moving under Hutchinson: pathways along buried channels or similar sedimentary feature; along anticlines; along fractures and faults; or along some combination of these features;
- Verify that the vent wells have adequately drained all the pockets of gas;
- Monitor water wells for contamination;
- Locate abandoned brine wells drilled from the late 1800s onward;
- Establish base line studies in the event of subsidence;
- Identify other potential pathways.

Information on Hutchinson Gas Incident to Senate President Kerr & Senate Utilities Committee and Affected Area Representatives

Presented by
Karl Mueldener
Kansas Department of Health & Environment
Bureau of Water

February 27, 2001

3-2

Information on
Hutchinson Gas Incident
to
Senate President Kerr & Senate Utilities
Committee and Affected Area
Representatives

Presented by
Karl Mueldener
Kansas Department of Health & Environment
Bureau of Water

February 27, 2001

Describe Kansas Facilities

- Hydrocarbon storage
  - propane,butane,natural gas, gasoline
- Stored in salt formation
  - solution mined caverns, jugs
- 10 active facilities
  - 1 natural gas, 9 LPG
- Companies: Kansas Gas Service, Koch, Ferrellgas, NCRA, Texaco, Williams, Oneok
- 624 active wells, 159 plugged wells, 80 million bbls total Kansas storage
- 7 inactive facilities

KDHE/Bureau of Water
February 2001

3-3

Regulatory Program History

- Natural gas storage and LPG storage from 1950's
- Federal Safe Drinking Water Act, 1974 (UIC)
- KDHE regulations from 1981
- 1986, injection programs divided between KCC and KDHE
- KCC has oil field related waste brine disposal and production zone gas storage
- KDHE has industrial waste disposal, federal underground injection control w/o oil field, salt solution mining wells
- Related program is Underground Injection Control (UIC), from Federal Safe Drinking Water Act

History

- 5 types of injection wells addressed by UIC
  - Class 1, hazardous and non-hazardous waste injection (KDHE)
  - Class 2, oil field brine injection (KCC)
  - Class 3, salt solution mining (KDHE)
  - Class 4, hazardous waste into and above aquifers (illegal)
  - Class 5, others not covered above
- Hydrocarbon storage wells not covered by UIC, but are a state program

3-4

State Regulatory Authority

- KSA 65-171d(a), "protect the soil and waters of the state from pollution resulting from under ground storage reservoirs of hydrocarbons and liquid petroleum gas"
- KAR 28-45-1 through 11
- KCC statutory authority, KSA 74-623, jurisdiction "except refining, treating, or storing of oil or gas after transportation .."

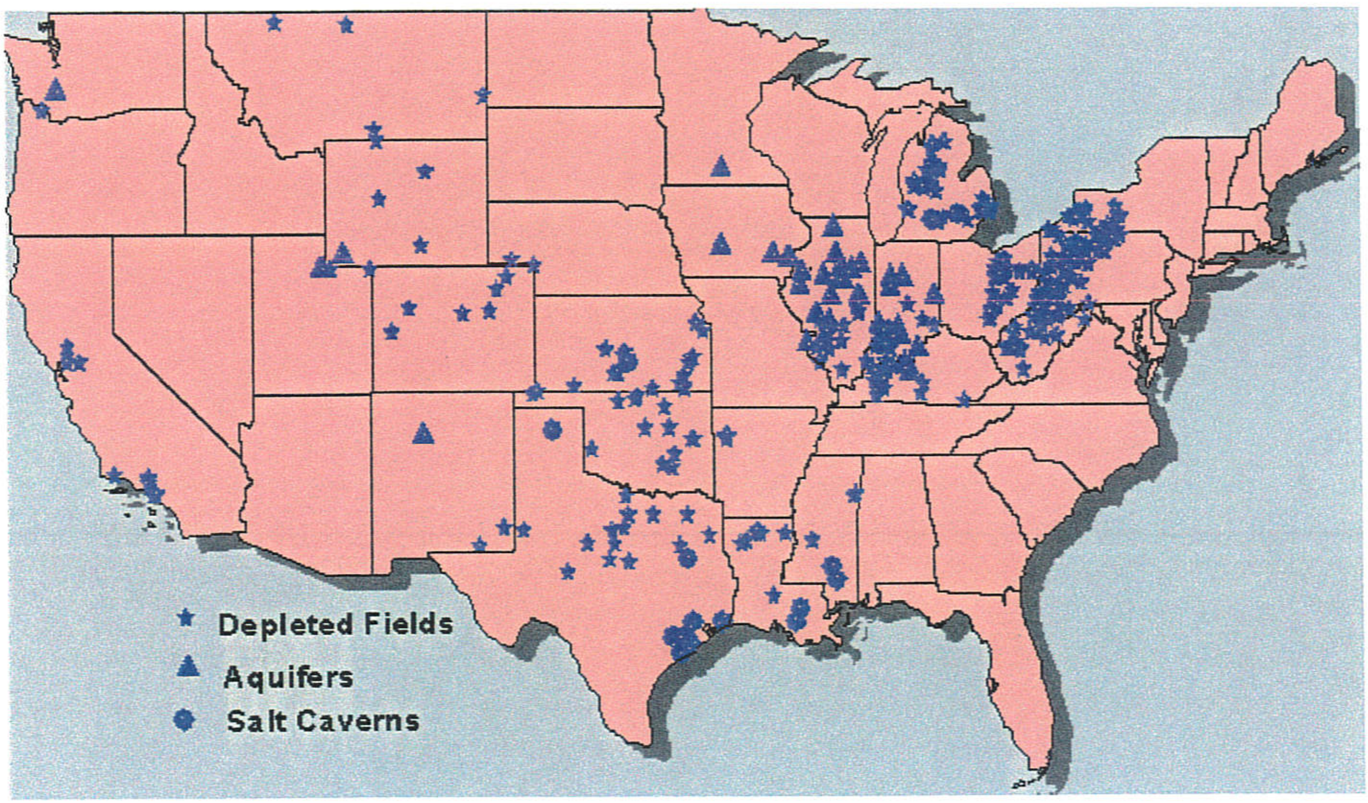
KDHE/Bureau of Water
February 2001

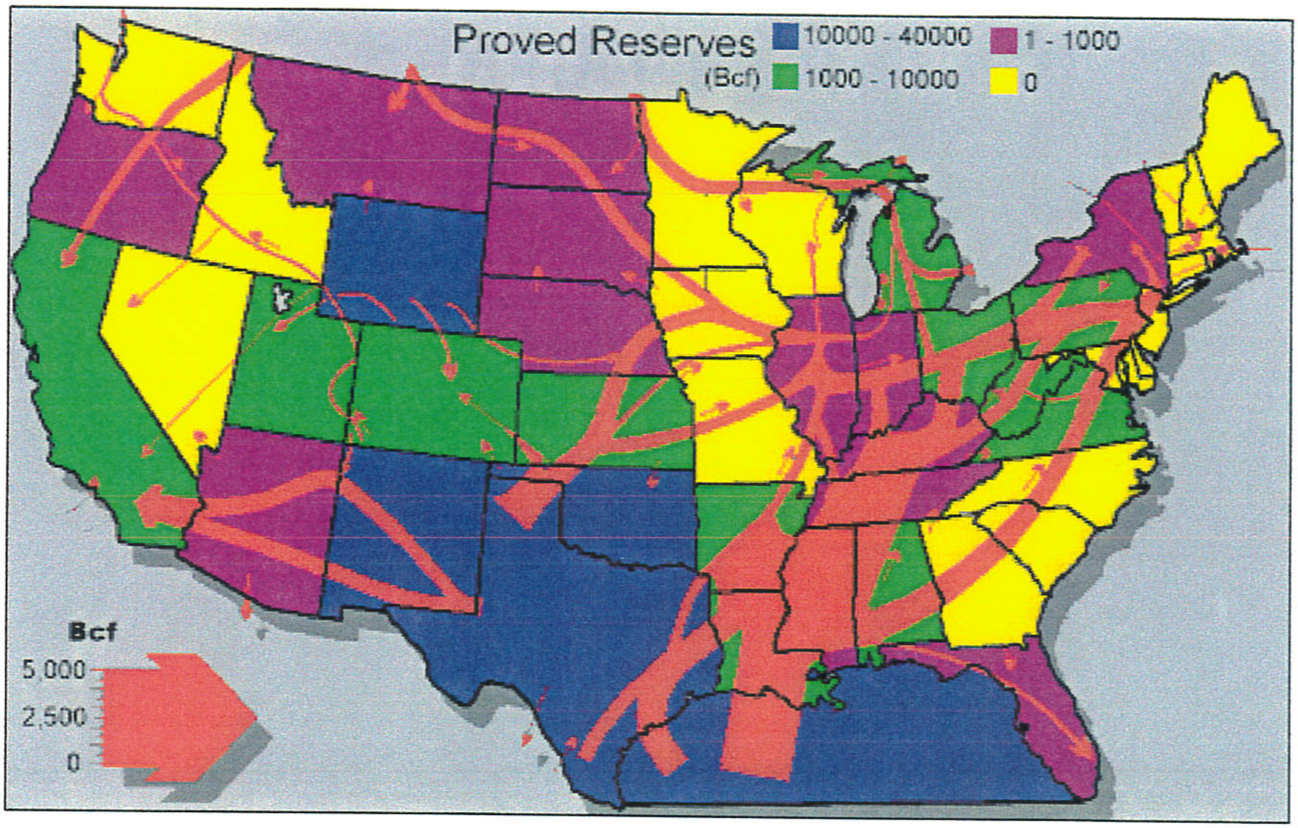
Regulation Plans

- Update started in 1996
- Meetings with industry
- Hutchinson incident gives new priority to regulation update
- Staff temporarily assigned to regulation process

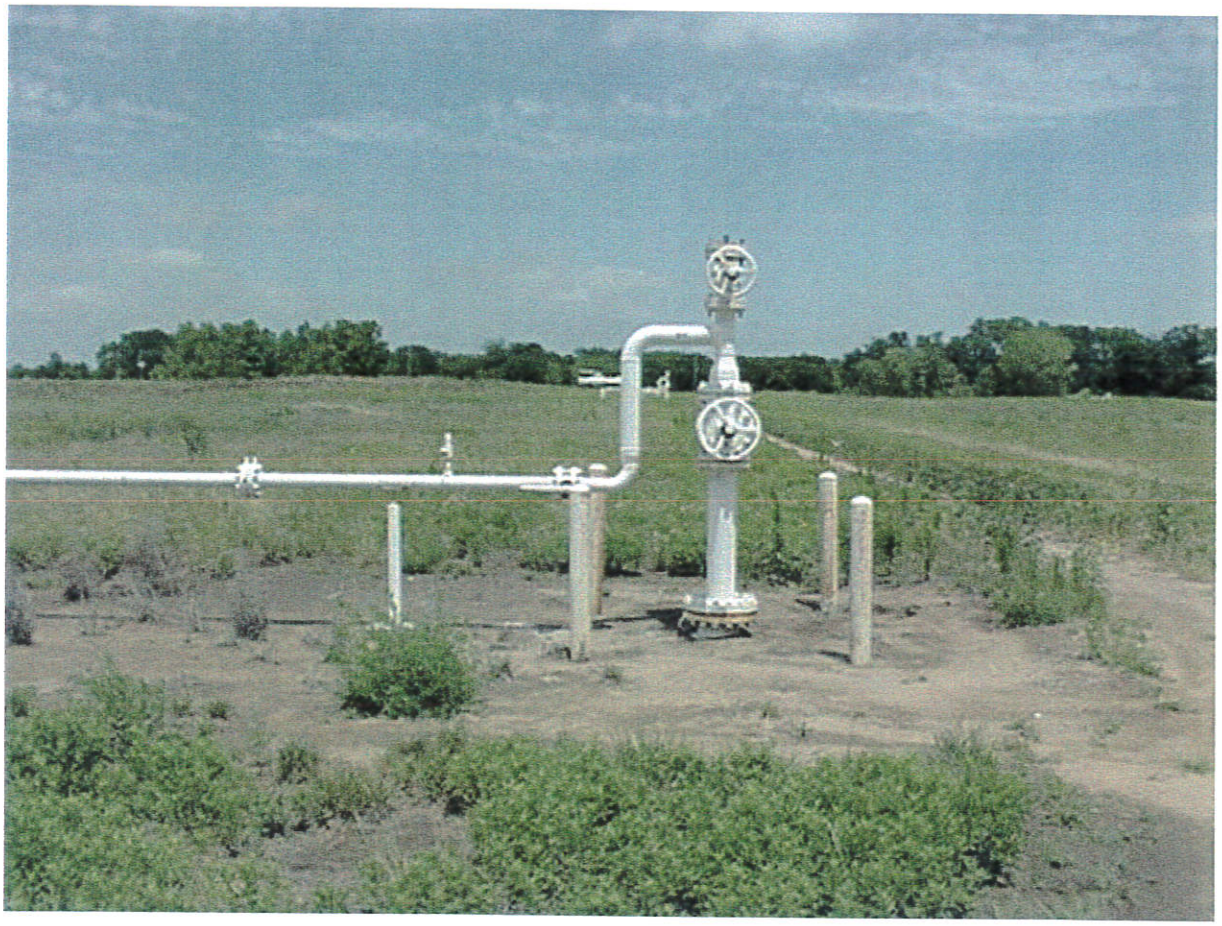
KDHE/Bureau of Water
February 2001

Natural Gas Storage Facilities in the United States

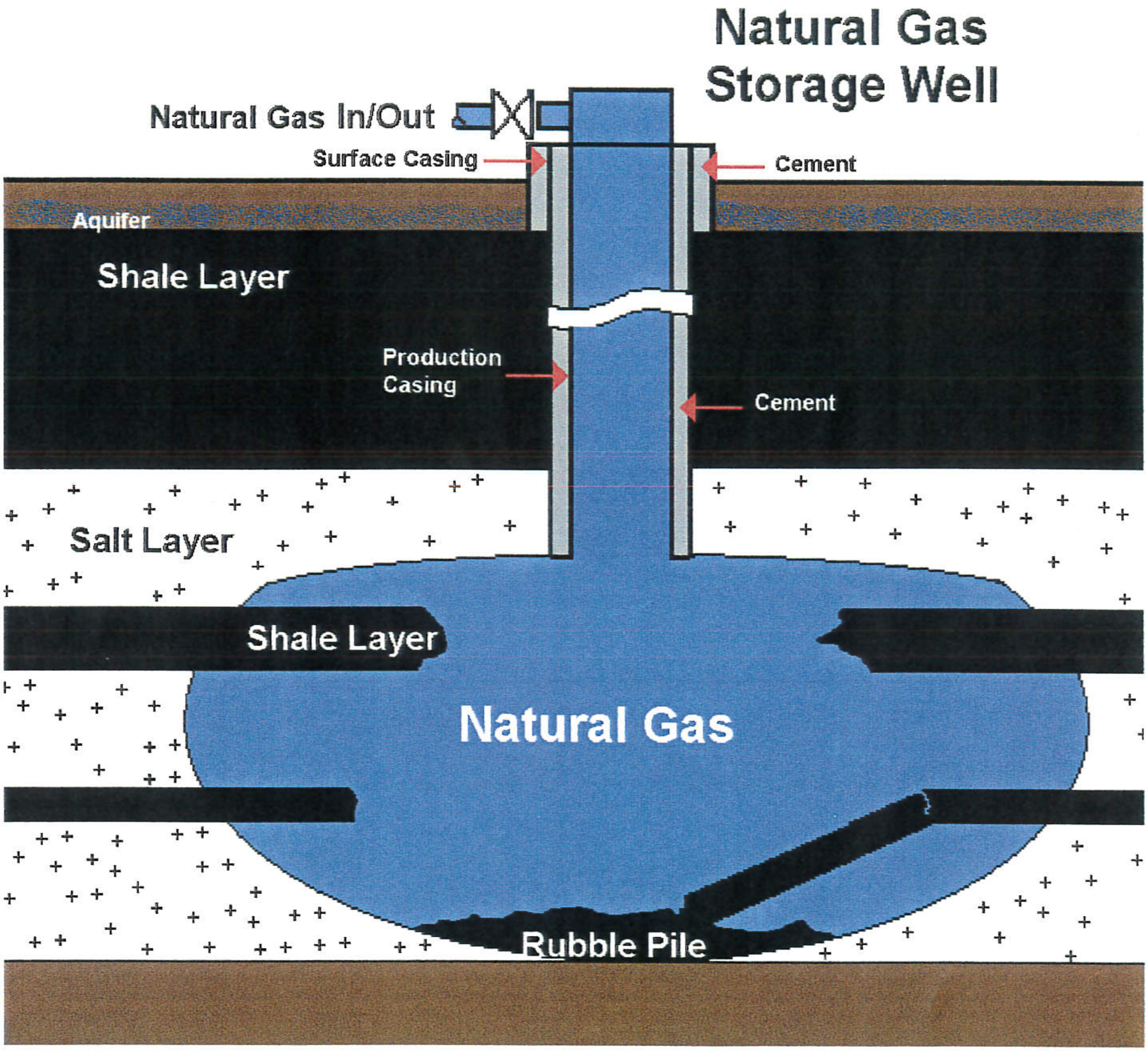


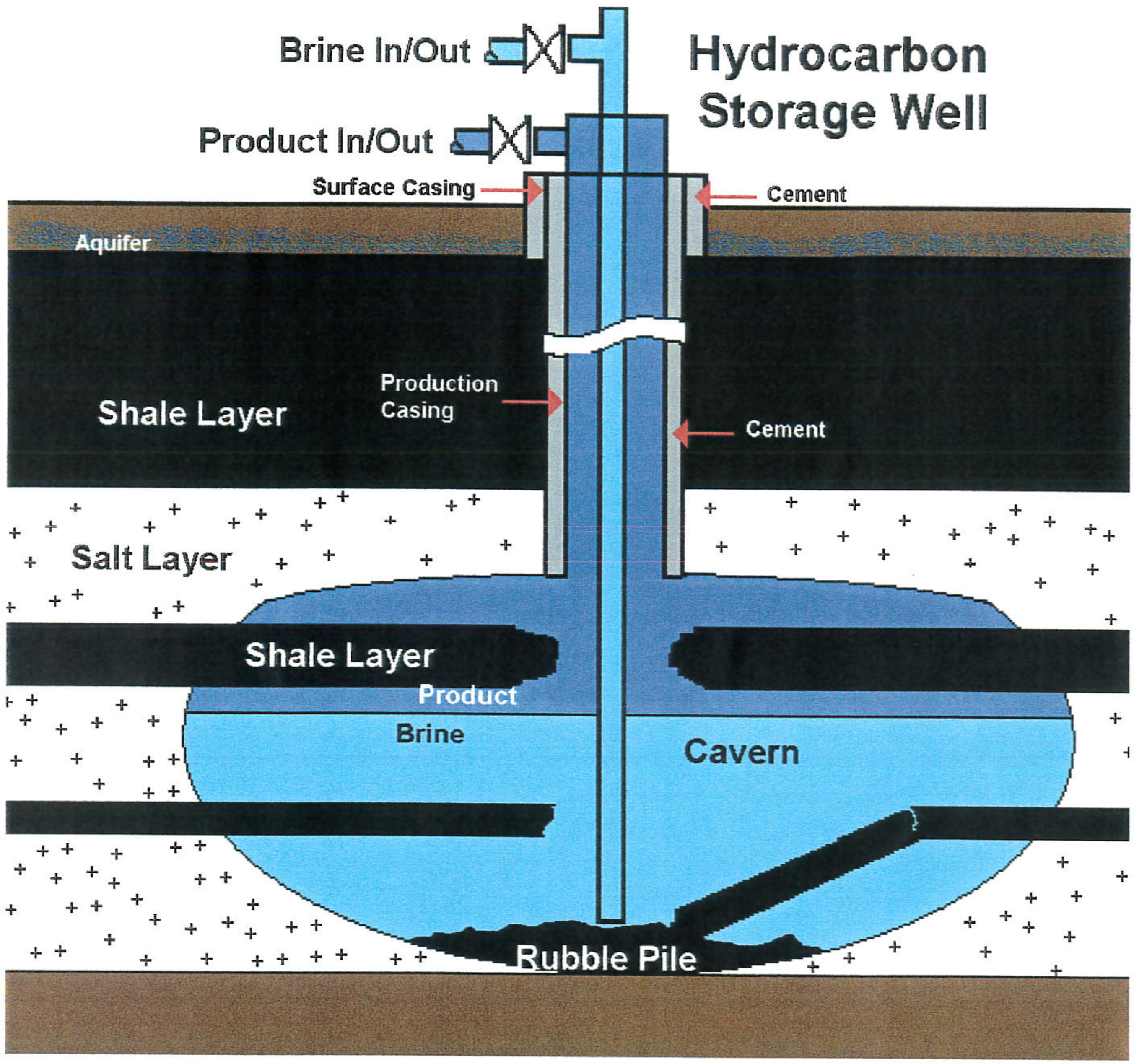


This map shows the principal flow of natural gas in the lower 48 states. It also shows the areas that hold most of the nation's proved reserves. The flow of natural gas from the Gulf region is nearly 5,000 Bcf annually.



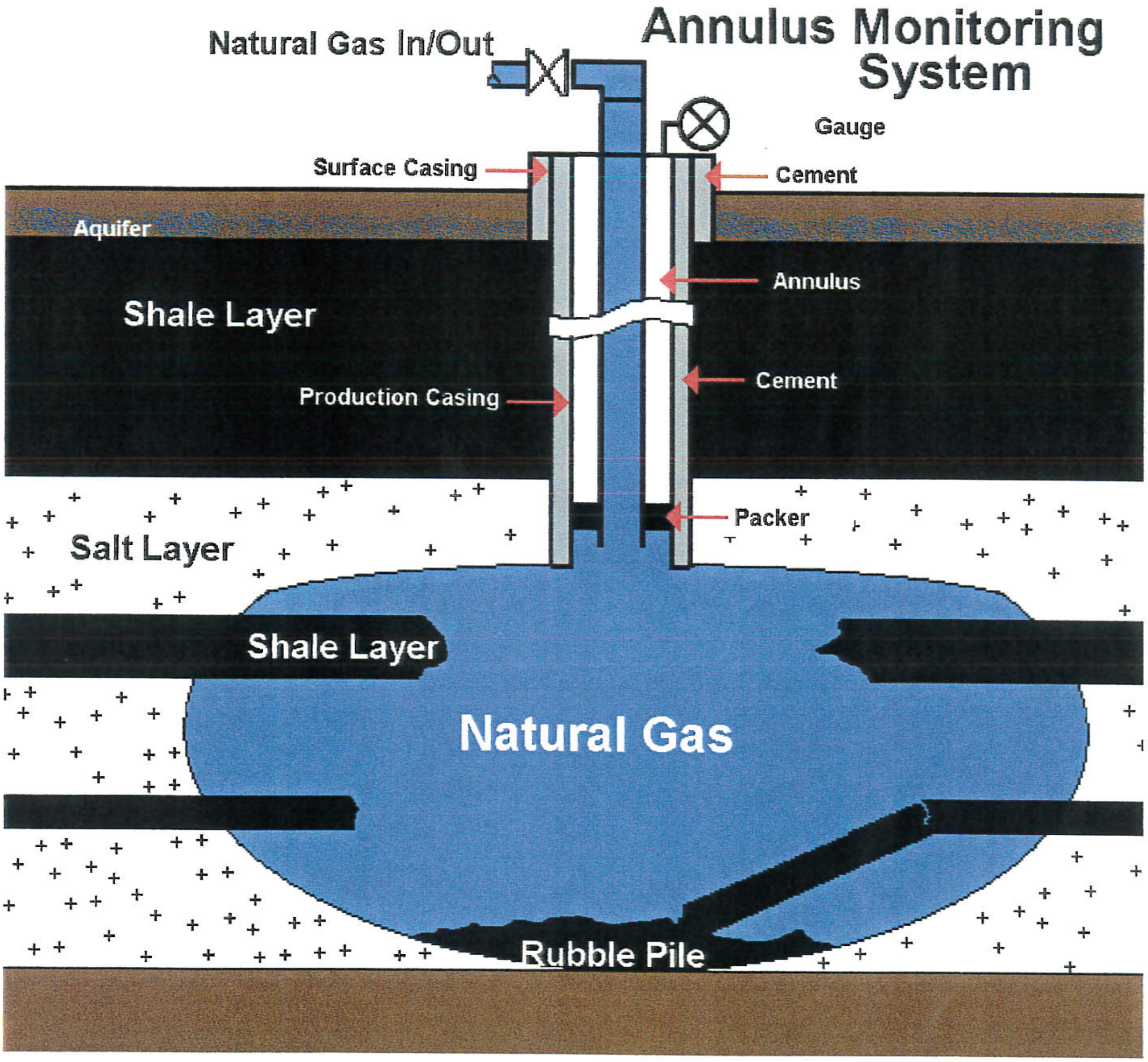
Kansas Gas Service
Yaggy Facility
Storage Well S-1


Natural Gas
Storage Well
Natural Gas In/Out
Surface Casing
Cement
Aquifer
Shale Layer
Production
Casing
Cement
Salt Layer
Shale Layer
Natural Gas
Rubble Pile



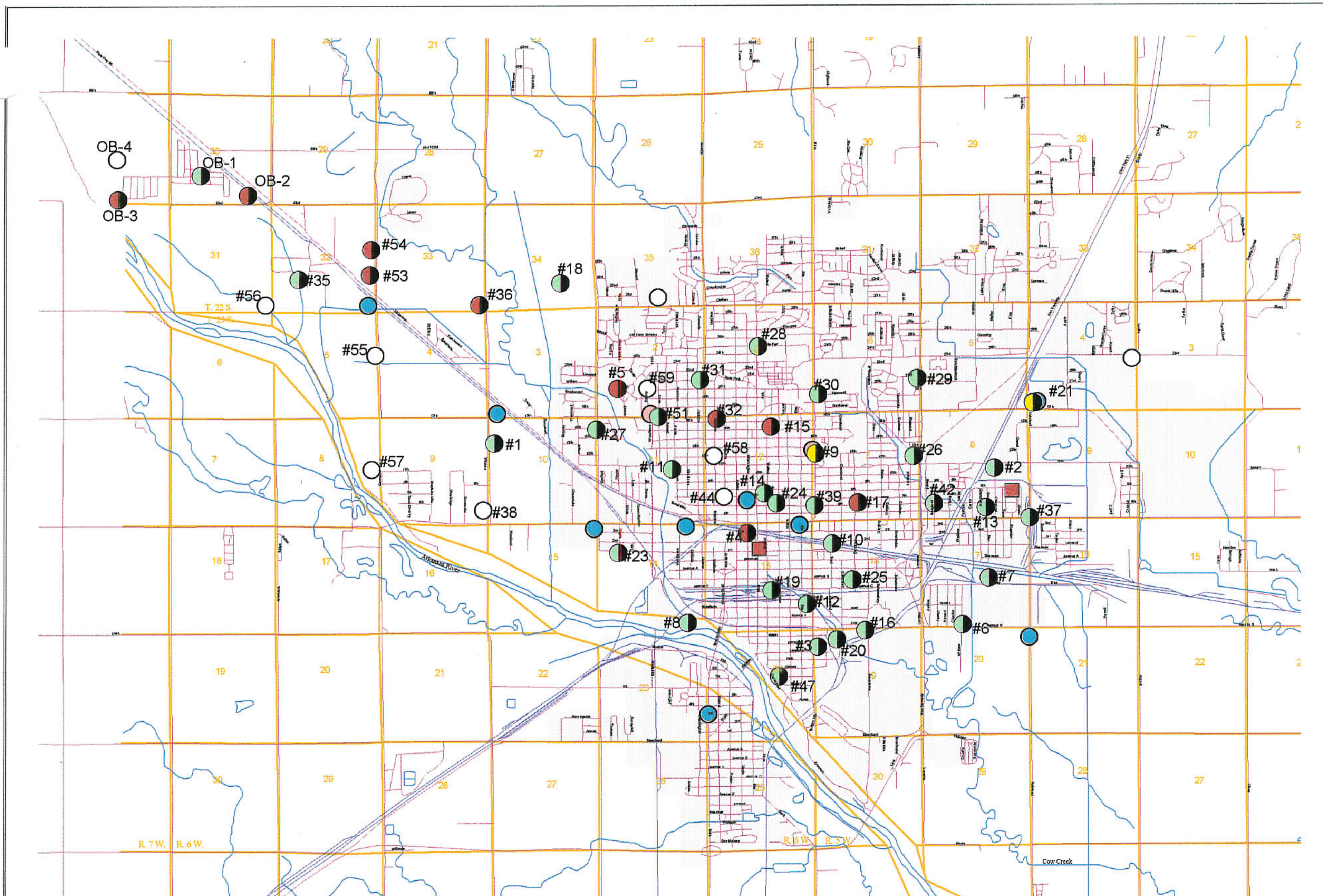
Hydrocarbon Storage Well
Brine In/Out
Product In/Out
Surface Casing
Cement
Aquifer
Production Casing
Cement
Shale Layer
Salt Layer
Shale Layer
Product
Brine
Cavern
Rubble Pile

CONCEPT



Annulus Monitoring System
Natural Gas In/Out
Gauge
Surface Casing
Cement
Aquifer
Shale Layer
Annulus
Cement
Production Casing
Packer
Salt Layer
Shale Layer
Natural Gas
Rubble Pile

3-11



N

LEGEND

Green/black circle	Deep Drilled Vent Well - No Methane Gas Detected
Red/black circle	Deep Drilled Vent Well - Methane Gas Venting
Yellow/black circle	Deep Drilled Vent Well - Methane Gas No Longer Venting
White circle	Deep Drilled Vent Well - Current/Proposed Drilling
Pink circle	Cathodic Protection Well - Venting Gas or No Longer Venting Gas
Blue circle	Cathodic Protection Well
Red square	Explosion Site
Line	Railroad
Shading	Incorporated Areas

LOCATIONS OF METHANE GAS INCIDENTS AND INVESTIGATION AREAS - HUTCHINSON

Printed 2/23/01

Testimony to Kansas State Senate
Utilities Committee Hearing
February 27, 2001
By
Eugene Dubay, President
Kansas Gas Service Company

Chairman Clark, Senators and guests, thank you for this opportunity to talk to you about the role that natural gas storage plays in the timely, cost-effective distribution of natural gas to our customers. Joining me today are Clark Southmayd, Vice President, ONEOK Resources; Larry Fischer, Vice President, Western Region for Kansas Gas Service (KGS); and Steve Johnson, Executive Director of Corporate Relations for KGS.

KGS is a division of Tulsa-based ONEOK, Inc. and distributes natural gas to more than 625,000 Kansas residential, commercial and industrial customers, more than two-thirds of the end-users in the state. While KGS owns no storage facilities, we purchase storage services from two sources, which I'll explain in a moment.

Underground natural gas storage is not a new industry practice – it dates back to 1915. But in today's restructured, highly competitive natural gas market, storage has taken on a much higher profile. Significant expansions and new installations in storage capacity and deliverability were made across the country in the 1990s. Today about 8.2 trillion cubic feet of natural gas is stored in the United States, of which about 300 billion cubic feet is stored in Kansas.

Senate Utilities Committee
February 27, 2001
Attachment 4-1

KGS gets two-thirds of its natural gas for peak-day delivery from storage. Its main suppliers of storage services are:

- Williams Gas Pipeline Central for 13.4 billion cubic feet (bcf)
- Mid Continent Market Center (MCMC) for 2.1 bcf.

Mid Continent Market Center (MCMC) is ONEOK's Kansas gas transmission and storage company. The majority of KGS' purchased storage is at the Brehm Storage Field, a depleted gas reservoir in Pratt County, and at the Yaggy Storage Field, a group of interconnected salt caverns in Reno County. Brehm has a total capacity of about 1.6 bcf, all of which is dedicated to KGS. Yaggy has a total capacity of 3.5 bcf. KGS uses about one bcf of that capacity.

Storage facilities offer various advantages to local distribution companies (LDCs) and consumers:

- LDCs, such as KGS, can provide customers with more reliable service, especially during peak periods such as winter months.
- When production or transportation services are interrupted, supply demands can still be met through storage gas.
- Stored gas offers flexibility. We can buy gas under long-term contracts to secure a reliable supply, and commit to short-term purchases when it's most cost-effective. For example, at the end of December when it appeared that Kansas would continue to experience severe winter weather, we determined that the supplies available to meet customer needs might be insufficient and we purchased additional flowing gas. Some of these incremental purchases were injected into storage when

cold weather did not materialize in early January in order to ensure reliability for the remainder of the winter.

- Storage facilities are especially useful in highly volatile markets, like Kansas, where we have peak winter days and high summer loads due to electric generation needs. We have seen times when our storage is empty at the end of July, yet it usually is full in time for winter needs.

As you are well aware, release of natural gas through abandoned, uncapped and unplugged salt solution wells caused two explosions in Hutchinson on Jan. 17 and 18, resulting in the loss of two lives, the destruction of two businesses and the evacuation of more than 200 homes and businesses in and around the Big Chief mobile home park.

Throughout this crisis, Kansas Gas Service has been committed to three objectives:

- To ensure the community's safety by investigating any potential natural gas leaks and drilling vent wells in the area
- To return the evacuees to their homes as soon as safely possible
- And to determine what caused natural gas to be present in the ground below Hutchinson and to fully understand the chain of events that led to the two explosions.

We brought in up to 180 employees from around the state and experts from our offices in Oklahoma and the Midwest to help us bring the situation under control. As we conducted leak surveys along 23,000 service lines and 252 miles of distribution main, and drilled numerous vent wells, we were able to identify problems unrelated to the underground gas, as well as finding leaks from the surface distribution system.

To date, we have drilled more than 45 deep vent wells including re-entering one abandoned salt solution well. Nine of those wells found gas and were flared. Thirty-six wells produced no gas. At Yaggy Field itself, we have drilled three monitoring wells, two of which found gas and were flared. The third one is currently being drilled.

To identify and plug all abandoned salt solution wells in the area and close off potential avenues for natural gas, the Kansas Geological Survey, KDHE and the City of Hutchinson are mapping the locations of these wells. KGS is helping to identify such wells in the Big Chief Mobile Home Park area.

With the leak surveying, the vent well drilling program and identification of abandoned salt solution wells to be plugged, Hutchinson is much safer than it was when this crisis began.

Because KGS is anticipating that it may not be able to inject gas into Yaggy this summer for next winter's heating season, we are reviewing several options to meet this seasonal need. KGS currently plans to issue a request for proposal to replace approximately 55,000 mmbtu per day of the Yaggy storage for the upcoming year in order to meet peak day requirements.

Salt-dome storage facilities in Kansas are monitored and regulated by the Kansas Department of Health and Environment. ONEOK has always endeavored to meet or exceed all storage safety requirements. The rates charged by Williams for interstate storage services are regulated by the Federal Energy Regulatory Commission and MCMC's intrastate rates are approved by the KCC.

Again, thank you for this opportunity to discuss storage and its role in our industry. We'll now be happy to answer any questions.

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Presentation by John Rose
Enron Transportation Services

Submitted to
Senate Utilities Committee

Tuesday, February 27, 2001
Natural Gas Storage Service

Introduction

Chairman Clark and members of the committee, for the record my name is John Rose. I have 23 years of gas storage experience in Kansas as a Senior Reservoir Engineer for Northern Natural Gas (Northern), a subsidiary of Enron Corp. Northern is Enron's largest interstate pipeline system with approximately 17,000 miles of pipeline and an Upper Midwest market area capacity of 4.2 billion cubic feet per day. Northern operates in 23 Kansas counties and owns two natural gas underground storage facilities in Kansas located near Lyons and Cunningham. My remarks will address the development and operation of these two storage facilities.

Types of Storage

Underground natural gas storage facility sites may be depleted oil and gas fields, aquifer storage or salt cavern storage. The Lyons and Cunningham fields are representative of depleted gas fields that have been converted to provide underground storage service. To be considered for gas storage service, a field must have sufficient volumetric capacity, have sufficient daily deliverability and have an impermeable caprock to hold the gas in place. A very detailed application is then made to the Federal Energy Regulatory Commission and to the Kansas Corporation Commission. This process usually takes one to two years. Upon approval, the old wells are plugged, new wells drilled, pipelines are laid, and separation, dehydration and compression facilities are set. This process takes several years and is very capital intensive. The Cunningham project cost over $100 million to develop, including gas costs.

Lyons

The Lyons gas field was discovered in 1936 and produced 9 billion cubic feet during the period of 1937-48. The field was then plugged and abandoned. Northern began coverting the field to gas storage service in 1973 and the first natural gas injections were in 1975. There are currently 34 injection/withdrawal wells, 22 observation wells and 2 water disposal wells. A typical well completion schematic is attached on the back sheet. The Arbuckle dolomite serves as the storage formation and the Simpson shale is the caprock at a depth of 3300 feet. The reservoir is about about a half a mile wide and three miles long. Approximately 5.3 billion cubic feet of gas is injected in the summer and withdrawn in the winter. The peak withdrawal rate is 80 million cubic feet per day. The Lyons field could on an equivalent basis, provide heat for approximately 80,000 homes on a peak day.

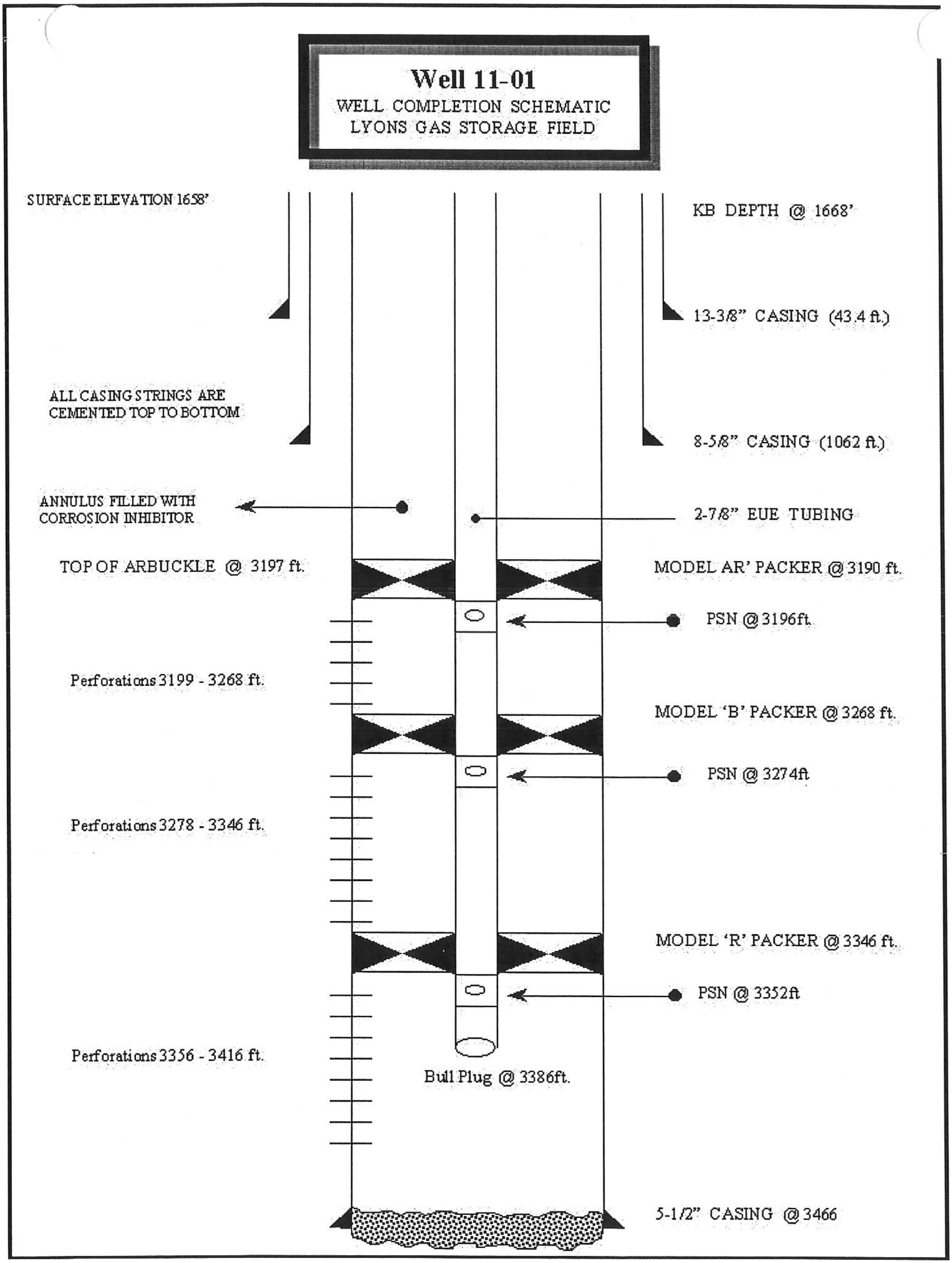
Cunningham

The Cunningham storage field is one of the largest in the state of Kansas. It was discovered in 1932 and produced 71 billion cubic feet through 1970. Northern began converting Cunningham to gas storage service in 1974 and the first gas injections were in 1978. There are currently 53 injection/withdrawal wells, 18 observation wells and 1 water disposal well. The Viola dolomite and Simpson sand formations serve as storage reservoirs and the Kinderhook and Simpson shales serve as caprocks, at depths of 4000 and 4100 feet, respectively. The reservoir is approximately 4 miles wide and 9 miles long. As much as 30 billion cubic feet is injected and withdrawn from the field on an annual basis and the peak withdrawal rate is 650 million cubic feet per day. The Cunningham field could on an equivalent basis provide heat for approximately 650,000 homes on a peak day.

Value of Storage Facilities

Underground storage facilities allow Northern's customers, local distribution companies and marketers to store natural gas and allows Northern to balance its pipeline system and meet operational swings throughout the year. The customer may use storage services to meet demand changes based on unexpected changes in the weather. Storage management is an important piece of a customer's purchasing strategy, along with its supply portfolio and financial management tools. Most importantly, gas storage allows gas to be purchased in the summer rather than in the winter which typically saves consumers money. The Cunningham and Lyons underground storage facilities are very valuable assets for our customers.

This concludes my remarks. I welcome any questions you may have at the conclusion of all of the presentations.


Well 11-01
WELL COMPLETION SCHEMATIC
LYONS GAS STORAGE FIELD
SURFACE ELEVATION 1658'
KB DEPTH @ 1668'
13-3/8" CASING (43.4 ft.)
ALL CASING STRINGS ARE
CEMENTED TOP TO BOTTOM
8-5/8" CASING (1062 ft.)
ANNULUS FILLED WITH
CORROSION INHIBITOR
2-7/8" EUE TUBING
TOP OF ARBUCKLE @ 3197 ft.
MODEL AR' PACKER @ 3190 ft.
PSN @ 3196ft.
Perforations 3199 - 3268 ft.
MODEL 'B' PACKER @ 3268 ft.
PSN @ 3274ft
Perforations 3278 - 3346 ft.
MODEL 'R' PACKER @ 3346 ft.
PSN @ 3352ft
Perforations 3356 - 3416 ft.
Bull Plug @ 3386ft.
5-1/2" CASING @ 3466

Testimony

Before the Kansas Senate Utilities Committee

Topeka, KS

By

Horace W. Diamond
Solution Mining Research Institute, Inc.
Encinitas, CA

February 27, 2001

Good morning. I appreciate the opportunity to testify.

My name is Horace Diamond. I am the Executive Director of the Solution Mining Research Institute, Inc. (SMRI).

SMRI is an international, non-profit organization of solution mining operators, engineering companies, researchers and educators. We have 80 members, half in North American, and half in Europe. Members include such well-known names as Koch Hydrocarbon, Dow Chemical, Phillips Petroleum, IMC Salt, Cargill Salt, Morton Salt, Sandia National Laboratories, and in Europe, ICI, and Gaz de France. SMRI holds semi-annual technical meetings and sponsors research. It does not conduct research itself but contracts with others. SMRI was organized in 1959.

Turning now to the tragedy at Hutchinson, we have to be sure this never happens again. A key step will be updating the Kansas rules for underground storage of hydrocarbons. In order to do this, the exact causes of the incident must be quickly known. Determining all the facts will be difficult because there are so many facets, such as the "mechanical" explanation, the operating conditions, and the rules that were in effect.

It is our opinion that to be sure that all the facts are promptly available, the investigation needs to be conducted by an organization that is able to call witnesses and obtain records. Further, in order to maintain public confidence, we believe the investigation needs to be conducted by an independent organization, rather than one that is directly involved—not Kansas Gas Service or the Kansas Department of Health and Environment.

Dr. Ratigan has testified that the rules need to be revised and we strongly agree. All facts of the Hutchinson tragedy need to be fully known so that nothing is overlooked in the revised rules.

SMRI would be pleased to assist in both the investigation and the rule making.

Thank you.

Solution Mining Research Institute
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Country Code: 1 ◆ Voice: 858-759-7532 ◆ Fax: 858-759-7542
E-mail smri@solutionmining.org ◆ www.solutionmining.org

H. W. Diamond, Executive Director

INTRODUCTION TO THE SOLUTION MINING RESEARCH INSTITUTE

The Solution Mining Research Institute (SMRI) is interested in the production of salt brine and the utilization of the resulting caverns for the storage of oil, gas, chemicals, compressed air and waste; the solution mining of potash and soda ash are also of interest. SMRI is a worldwide organization with more than eighty members in Asia, Europe and North and South America. Participation by operators, researchers, suppliers, consultants, educators and government regulators is encouraged. Activities include:

- Sponsoring and funding research
- Holding technical meetings
- Conducting Classes
- Maintaining a literature file
- Participating in the development of government regulations.

Research

More than one hundred and twenty major research projects have been completed since 1965. The projects cover basic and applied research for all aspects of cavern development and utilization, including computer programs for simulating cavern development and evaluating subsidence over underground openings. SMRI does not conduct any research itself; it funds research by others. Occasionally SMRI shares funding of research with other organizations and governmental agencies. Although research needs are typically determined by SMRI and requests for proposals issued, unsolicited proposals are also welcome.

Technical Meetings and Classes

Technical meetings are held each year in the spring and the fall. Typically, every third meeting is held in Europe, the others in North America. Meetings are open to both members and non-members. Papers and posters are presented on the following topics:

- Geology and mineralogy
- Geochemistry
- Rock mechanics and subsidence
- Cavern and well design, construction and operation
- Environmental protection
- Surface facility design, construction and operation
- Computer modeling
- Storage of oil, gas, other hydrocarbons, and compressed air
- Safety
- Final plugging and abandonment
- Computer modeling
- Salt, potash, soda ash
- Wireline logging
- Surface and underground measurements
- New technologies

Literature

SMRI maintains a literature file consisting of SMRI research reports, SMRI meeting papers, technical books, and outside reports and papers. There are over nine hundred items on file that can be provided. Contact SMRI for a complete listing.

Regulatory Development

SMRI sometimes evaluates proposed governmental regulations and laws affecting the solution mining and storage industries and prepares recommendations.

History

SMRI originated in 1958 when a group of chemical producers, attending a Chlorine Institute meeting, discussed problems related to the production of salt brine. The meeting led to the formation of the Brine Cavity Research Group (BCRG) in 1959 consisting of eleven salt and chemical companies. The initial goal was to investigate ways to determine the size and shape of brine caverns.

By 1965, it became apparent that the interests of the organization included several other aspects of solution mining such as understanding dissolution mechanisms, rock mechanics, and cavern control and prediction. To fund the study of these interests, the BCRG was reorganized as a nonprofit technical association, incorporated and renamed the Solution Mining Research Institute, Incorporated.