Director's Corner - Gregory H. Sovas

Underground gas storage projects continue to consume great amounts of staff time as we deal with a number of expansions as well as new projects. Existing projects are summarized on pages 16 and 17, and two of the new projects are described in the Region 8 Review on page 12. Clearly underground gas storage will continue to be more important to the secure and safe distribution of natural gas in New York and New England.

One of the biggest challenges facing the oil and gas regulatory program is the growing liability of idle and abandoned wells. In most cases financial security, even for operators in compliance with current regulations, does not provide sufficient funding to plug the covered wells. When operators default on their tax bills and counties foreclose on properties that contain unplugged wells, those wells become a liability for local taxpayers. This is not a hypothetical worst-case scenario, but reflect current events already happening in the counties. We need a creative approach to develop new solutions to this problem, and hope to productively work together with all stakeholders in this effort.

Annual well reports are the primary tool used by the Division for tracking compliance. To date, only 76% of operators required to report for 1995 have done so; the statutory deadline for reporting was March 31, 1996. We have strived during recent years to make reporting easier, yet the lack of full compliance forces us to continue to devote resources to enforcement. In our small Division, these resources could be better spent on other projects. I strongly urge all operators to allow us to redeploy these resources by submitting timely, accurate reports for all unplugged active and inactive wells.

An Investigation of Naturally Occurring Radioactive Materials (NORM) in Oil and Gas Wells in NYS - April 1999 (pg 4)

As with natural gas streams, oils may also contain brines, particularly oils generated from secondary production. During secondary production, injected water dissolves salts during its underground movement. During primary production, naturally occurring subsurface brines are brought to the surface as a byproduct of oil flow. The two are separated as a consequence of their different densities - oil tends to float over the brines. The lighter oil fraction, or product, is diverted into stock tanks for pick-up by a crude oil hauler. At newer wells, the brine fraction is diverted to a holding tank for eventual disposal, possibly by being spread on roads for dust control or road compaction. In the past, and at older wells, the separated brines were diverted to a settling pond or brine pit which discharged, or overflowed, into a nearby receiving stream. Many of these are still in use today, with the discharges, at some locations, under regulation via the Department's State Pollutant Discharge Elimination System (SPDES) permit program.

Estimates of brine production in 1987 for New York State oil and gas wells averaged about 8.6 million barrels. The vast majority of this volume (93%) was produced through secondary oil recovery. Of the total volume, 16% was recycled as a secondary production tool (the water flood technique), 63% was discharged under SPDES permit, and 17% was discharged to the surface. About 4% of the total volume was spread on public roads (Fitzpatrick, 1989).

Appendix B contains photos of typical New York State oil and gas wells and related equipment.

- NORM as an Oil and Gas Issue

NORM are an inherent part of many geologic materials. Consequently, NORM are encountered during geologically-related activities. During the 1980's, considerably elevated concentrations of NORM were discovered in oil and gas equipment associated with the North Sea drilling operations of the United Kingdom (Smith, 1987; Waldram, 1988). Subsequently, elevated radiation concentrations were discovered (1986) in some oil and gas equipment of the southern United States (USEPA, 1993). In these cases, the elevated NORM concentrations in the scales and sludges associated with used equipment were of particular concern. NORM contaminated equipment can lead to unnecessary exposures to workers during equipment refurbishing or reuse and/or the need for special handling and disposal procedures.

Fitzpatrick 1989. Fitzpatrick, Kathleen. Water Produced with Oil and Gas in New York State: 1987 Year-End Volumes and Disposal Methods. April 11, 1989

EXECUTIVE SUMMARY

The history of oil and natural gas production in the State of New York dates back to the nineteenth century. Although most of the State's oil wells and many of the natural gas wells are marginal producers, the petroleum industry remains a valuable mineral industry for the State. New York has approximately 15,000 known commercial oil and gas wells. In 2001, more than 3,277 oil wells and 5,916 gas wells were reported to be active and producing, in addition to approximately 960 storage and solution mining wells. The status of the remaining wells was inactive or unknown.

New York's inventory of drilled wells is both a potential asset and a potential liability. The "drilled well resource" allows industry to respond to and benefit from upswings in oil and natural gas prices as occurred during 2000 and 2001. However, the current inventory of aging, inactive and sub-economic wells will need to be plugged and abandoned at some point, and the future cost of well plugging and site restoration will be substantial. Well plugging and abandonment costs in New York can range from $5,000 per well to more than $50,000 per well depending on the well depth, well condition, site access, and site condition. To the extent that New York operators cannot comply with requirements to plug idle wells or to maintain the mechanical integrity of their inactive wells, the growing inventory of long-term idle wells represents a potential future plugging liability to the State and local governments.

Recognizing both the potential value and the potential risks presented by New York's drilled well inventory, the New York State Energy Research and Development Authority, in coordination with the New York State Department of Environmental Conservation, Minerals Division and the New York Independent Oil and Gas Association, undertook a project to characterize New York's oil and gas wells and to review regulatory and technology options for managing the State's marginal and inactive wells. The goal of the well characterization system is to balance the potential viability of a well - the likelihood of producing commercial quantities of oil or gas - against the potential for the well to become a future financial or environmental liability to the State. The objectives of the project are the following:

- Ensure that New York's marginal and shut-in wells do not become environmental or financial liabilities to the State or local governments.
- Ensure that marginal and inactive wells, which represent a "drilled-well resource", are not prematurely abandoned before the wells can be evaluated for by-passed production and alternative uses.
- Identify cost-effective technologies that could reduce the cost to evaluate, rework, or plug and abandon marginal and uneconomic wells.

Brine Disposal

Disposal Wells

New York State has five UIC Class IID Wells Authorized for the disposal of brine associated with oil and gas production.

The 1990 injection volumes for these wells were 109,270 barrels which represents 8.5 percent of their permitted injection volumes.

Other Disposal Methods

Produced water volumes for 1990 are compared to 1989 volumes below. The decline in oil-associated produced water is largely attributable to Pennzoil's shutting down of its waterflood operations in the Chipmunk field of Cattaraugus County. Most produced water associated with the waterflood operations is discharged into streams under the State Pollution Discharge Elimination System program, discharged into holding ponds, or recycled for waterflooding. The number of gas producers reporting water production rose 36.9% in 1990 over 1989, possibly as a result of Division efforts to ensure compliance with reporting requirements. Preliminary indications from reports filed by waster haulers are that 50% of gas-associated brine is hauled to out-of-state treatment plants, 28% is road spread, 18% is injected into New York's disposal wells, 3.5% is hauled to an in-state treatment plant, and 0.5% is injected at a disposal well in Pennsylvania.

Produced Water	1989	1990	Change
Oil-Associated	4,755,893	2,047,243	-57%
Gas-Associated	221,717	298,878	35%
Bass Island	47,075	29,531	-37%
TOTAL	5,024,685	2,375,652	-52%

Leaking Gas Well in Fredonia Successfully Plugged - DEC

http://www.dec.ny.gov/environmentdec/36424.html

Long Abandoned Wells Predate Strict Rules

After the plugged well was filled you would never know it was there

DEC has a strict environmental regulatory program for oil and gas wells drilled in New York. New York has had an active oil and gas industry since the 1880's and DEC estimates that more than 75,000 oil and gas wells have been drilled in the state. Most of these wells existed prior to the establishment of New York's regulatory program in 1963 that ensures the proper plugging of wells. DEC has identified about 4,800 unplugged, abandoned oil and gas wells in New York for which no known owner can be located. It estimates that at least as many more unplugged and abandoned wells exist that are yet to be discovered. Many of the older wells were abandoned by their owners when low production and/or low prices made it unprofitable for them to continue production.

More Information

For more information or to report an abandoned well, see Identifying Existing Wells on DEC's website, and contact DEC's Region 9 Allegany sub-office at 716-372-0645 or the Region 8 Avon office at 585-226-2466.

http://www.dec.ny.gov/docs/materials_minerals_pdf/dgeisv1ch11.pdf

Draft GEIS, Volume 1, Chapter 11

XI. PLUGGING AND ABANDONMENT OF OIL AND GAS WELLS

A. INTRODUCTION

The plugging and abandonment of oil and gas wells is an operation that is critical for the protection of underground and surface waters. Proper plugging procedures must be followed to effectively block the migration of oil, gas, brine and other detrimental substances into freshwater aquifers. The infiltration of water into oil and gas reservoirs must also be prevented to avoid damage to these resources.

State law requires operators of most oil, gas and solution mining wells in New York State to maintain financial security with the Department to ensure that the wells are properly plugged and abandoned after their economic life is over. Financial security requirements were substantially increased in 1985 to more closely match the actual costs of plugging operations.

http://www.dec.ny.gov/energy/1532.html

DEC - What landowners need to know about Oil and Gas Wells

Abandoned Wells

At least 70,000 oil and gas wells have been drilled in New York since the 1800's, but information is available for only about 30,000 of them. Locations for the others are unknown, and wells have been found in such unexpected places as basements, stream banks and under parking lots. Abandoned wells may pose hazards not only to walking on the ground surface if outdoors, but also to ground water resources if not properly plugged. In addition, they provide a potential conduit for leakage of oil, gas or brine to the atmosphere, soil or surface water.

Plugging occurred in 16 counties, however, almost 50% of the plugging jobs were in Allegany County and another 30% were in Cattaraugus County. The vast majority of plugging jobs involved old oil wells, particularly in the Richburg Field.

Some of this plugging activity can be attributed to the recent high prices for oil. During the process of redeveloping an old oilfield, operators may need to plug old or inactive wells.

Abandoned and Orphaned Wells

Old Historic Well Problems

Abandoned wells can leak oil, gas and/or brine; underground leaks may go undiscovered for years. These fluids can contaminate ground and surface water, kill vegetation, and cause public safety and health problems.

Historically, abandoned wells have been discovered in the woods, along roadsides, and in residential yards, playgrounds, and parking lots. They've even been discovered inside buildings, and underwater in wetlands, streams and ponds.

2008 Status Report

Abandoned, unreported and inactive wells continued to be a problem despite high oil and gas prices. In 2008 a total of 284 operators reported 3,071 wells with zero production. Another 133 unreported wells are considered abandoned. This is in addition to over 4,717 orphan wells in the Department's records. Enforcement actions have reduced the number of unreported wells, but their numbers remain significant.

DEC has at least partial records on 39,000 wells, but estimates that over 75,000 oil and gas wells have been drilled in the State since the 1820s. Most of the wells date before New York established a regulatory program. Many of these old wells were never properly plugged or were plugged using older techniques that weren't as reliable and long-lasting as modern methods.

New York State Oil, Gas and Mineral Resources, 2002 Annual Report - part 3, pages 2-4

ABANDONED WELLS

The Division estimates that over 75,000 oil and gas wells have been drilled in New York State since the 1820s. Most of the wells were drilled before New York established a regulatory program and many were never plugged. Every year the Division of Mineral Resources deals with a "new" group of problem abandoned wells in a wide variety of settings. Here is a selection of abandoned wells from 2002.

Residential Area - Pipeline company employees detected natural gas emanating from two residential lawns in the Village of Rushville, Ontario and Yates County. Explosive gas levels were also found inside a garage. Division staff uncovered two natural gas wells in the vicinity. Gas in the soil declined when the wells were vented under DEC direction. Roughly 24 gas wells were drilled in the village in the 1900's and need to be plugged when funds are available. The backhoe is excavating a leaking well next to a building.

School - During construction of a new bus garage at the Bolivar-Richburg High School in Allegany County, several buried abandoned wells were uncovered. Since no well records were available, the school had to bring in a small service rig (red equipment in foreground) to check the condition of the wells. All the wells had to be plugged before construction could resume. This is not the first school well incident that the Division has handled. For example, in nearby Wyoming County DEC plugged a gas well that was leaking brine in the parking lot of Wyoming County Central School in 1991.

Public Lands - Using State Environmental Audit funds, the Department plugged seven problem abandoned wells on a wide range of public lands. DEC plugged three abandoned gas wells on the Three Rivers Wildlife Management Area in Onondaga County. One well had been flowing natural gas and another was discharging brine. In addition, DEC plugged four abandoned wells in Cattaraugus County, three on Cattaraugus Reforestation Area #22 in the Town of Allegany and one on the Zoar Multiple Use Area in the Town of Persia. In a separate incident, another abandoned well was discovered on property that The Nature Conservancy purchased for possible addition to the Deer Creek Wildlife Management Area in Oswego County.

Seneca Lake - Through field and office work, Division staff discovered seven abandoned salt wells at the US Salt facility in the Town of Reading, Schuyler County. The wells had been abandoned for decades. All the wells were less than 50 feet from the shore and adjacent to a steep grade which raised concerns about potential impacts to the lake. Rig access was very difficult, but the responsible party successfully plugged all the wells.

Ongoing Problems - Many abandoned well issues take several years to resolve as the Division pursues legal action against those responsible. The Moore Lease in Allegany County is a good example with more than 200 abandoned wells involved in legal actions. The Moore wells occur in a variety of settings (residential areas, roadside, woodland,

Another enforcement success involved collection of a $100,000 fine for an operator's illegal brine discharges and abandoned wells in Chautauqua and Cattaraugus counties. The case was in litigation for several years and took significant effort from both technical and enforcement staff.

Region 9 staff continued using GPS (global positioning system) equipment to document the location of lost and abandoned wells. New York has thousands of old wells with poor or non-existent records on both their location and condition. Most of the 220 wells surveyed in 2000 were in Allegany County's old oil field and had been left unplugged and abandoned for decades. Such wells have a high potential for polluting groundwater. Staff also discovered abandoned separation tanks; some still contained oil, some had leaks that had never been cleaned up and one was still receiving oil from a flowing well.

Courthouse searches are often needed to determine the responsible party for abandoned wells and tanks like these. The required research can be difficult, but staff identified the owner of several Allegany County wells abandoned for 30 years. The owner was contacted and is now working to bring the wells into compliance.

field etc) and many are leaking oil. Abandoned wells can leak oil, gas and/or brine. They can contaminate groundwater and surface water, kill vegetation and cause safety and health problems. Underground leaks may go undetected for years before their damage is discovered.

Priority Plugging List

Historically, abandoned wells have been discovered at playgrounds and parking lots, inside buildings, in wetlands, underwater in creeks and ponds, in wooded and brushy areas and in residential yards. Every year DEC staff discover additional abandoned wells during scheduled inspections or while investigating complaints. DEC staff evaluate the environmental and public safety threats posed by each well and place the most serious cases on the Priority Plugging List to be plugged whenever funds become available.

Currently, there are 634 wells in 18 counties on the Priority Plugging List. Allegany and Cattaraugus County have a considerable number of abandoned old oilfield wells on the Priority Plugging List, but problem oil and gas wells of all ages are on the list.

To date, only a small percentage of Priority Plugging List wells have ever been removed from the list. Wells removed from the list were plugged and abandoned with monies from the Oil and Gas Account and Environmental Audit Funds.

This Priority Plugging List well in the City of Rome, Oneida County was discharging brine at a rate of five gallons per minute into a wetland adjacent to Brandy Brook and had already killed over an acre of vegetation in 1998.

Abandoned Oil & Gas Wells

Drilling for oil & gas in NYS has occurred since the early periods of exploration in the U.S. During much of that time proper well abandonment was not performed once wells were no longer in use. This has resulted in the improper abandonment of potentially tens of thousands of oil & gas wells from the western most regions of NYS to the eastern areas of Lake Ontario. Concern for groundwater contamination involved the uncontrolled vertical migration of hydrocarbons & other associated contaminants by way of the abandoned bore hole.

- Level of Concern - **High**
- Scope of Concern - Regional

Environmental Audit Process

The Environmental Audit Program requires that each State Agency annually report any environmental problems associated with the lands and facilities they manage. Many agencies such as DEC, Parks, Urban Development, DOT and Mental Health have recently plugged leaking or abandoned wells identified in the Environmental Audit (see page 23 for DEC plugging on State lands). However, many abandoned wells located on State lands are still not being reported, such as those found on DOT right-of-ways. In February Division staff made a presentation at a State Agency Environmental Audit Workshop. Division staff explained the need to report abandoned wells and showed the workshop attendees examples of abandoned wells and the wide variety of settings where they can be found.

New York State Oil, Gas and Mineral Resources, 1996 Annual Report - page19

Brine Tank Inspections

The focus of the brine tank post-site project was on wells which were in producing status for ten years or more. Previous enforcement inspections had discovered a number of faulty tanks for wells in this age group. Some had holes you could literally walk through. Mineral Resources staff identified all wells which were ten or more years old and in production using the minerals database. The wells were then sorted by county and posted on topomaps. Staff were assigned an area to inspect and began the project in late June.

A brine tank in Chautauqua County in need of repair

The summer months results were quite disturbing. Minerals inspectors were able to access remote well locations and initially found approximately 40% of the total number of brine tanks to be leaking or have holes in the sides. The regulations require brine to be stored in watertight tanks or containers. Our inspections found that this was not the case for these wells. We discovered that the probability of finding bad tank increased with its distance from a road. Another fact came to light, bad tanks were common to both large and small operators alike. The field inspections continued into the fall and winter months until its completion in March of 1997.

Letters were sent and in some cases phone calls made to the operators which had leaking or faulty tanks. The letters required the operators to drain the brine from the faulty tank, and then repair or replace all of them. They were informed that the tank must not be used to store brine until it was watertight. Operators were also required to inspect all of their brine storage tanks and to report the result of their inspections to the Department. This was necessary due to the fact that only a very small number of any given operator's wells were inspected by our staff. The reports were to also include the proposed work program the operators planned to undertake to repair or replace the faulty tanks.

Every year while conducting scheduled inspections or investigating complaints, DEC staff discover more abandoned wells. Extensive courthouse research is often required to identify a well's previous owners. Many of these cases take several years to resolve as DEC pursues legal action against the responsible parties.

Oil & Gas Account

New York has an Oil and Gas Account which was created to plug problem abandoned wells. It is funded by a $100 per well permit fee; at the end of 2009 the balance was $208,806. DEC has over 500 wells on its priority plugging list. Since the funds are insufficient to plug all the priority wells, DEC continues to pursue other mechanisms to plug abandoned wells.

DEC-Coordinated Plugging Efforts

In 2009 Division staff completed work on an Oil and Gas Account contract for a major plugging project involving abandoned oil wells. The $190,000 contract to plug 45 wells on the Thornton-Bradley and Warfield leases in the Town of Alma, Allegany County was completed in late 2009.

- Final Report -

DISPOSAL/RECOVERY OPTIONS FOR BRINE WATERS FROM OIL AND GAS PRODUCTION IN NEW YORK

(Energy Authority Agreement No. 1591-ERER-RIER-91)

submitted to

NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY
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October 9, 1992

EXECUTIVE SUMMARY

There are presently approximately 5,500 active gas wells and 3,800 oil wells owned by about 600 operators in New York State. The majority of active oil wells are in Allegheny and Cattaraugus Counties, and the majority of active gas wells are in Chautauqua County. In 1990, 0.42 MMBBL (million barrels) of crude oil and 25,400 MMCF (million cubic feet) of natural gas were produced with an estimated market value of New York State's 1990 oil and gas production of $66.2 million.

During oil and gas production, a highly saline by-product water is generated with total dissolved solids greater than 100 g/L. Once brought to the surface, brine constitutes an environmental threat to fresh surface water and potable ground water supplies if disposed improperly. The latest (1990) annual brine generation rates, estimated by the New York State Division of Mineral Resources (DMN), are about 300,000 BBL (12.6 million gallons) from gas production and about 2.1 MMBBL (88.2 million gallons) from oil production.

In the past (prior to 1984) brine was generally disposed in a brine pit adjacent to the well. Separated brine was placed in the brine pit and allowed to infiltrate into soil and/or evaporate. However, brine pits are no longer environmentally acceptable due to potential groundwater contamination, and are not allowed for disposal. There are currently three brine disposal methods that are acceptable to the New York State Department of Environmental Conservation (DEC): road spreading of brines for deicing and road stabilization, discharge to surface waters through permitted facilities, and underground injection.

Although these methods are currently acceptable, costs for the disposal of brine water add a significant burden to oil and gas producers in New York State. These costs and the relatively low market price of oil and natural gas have contributed to the decline in gas and oil production in New York State during the past 10 years. Thus, there is a need to explore and develop brine disposal alternatives that are more cost effective than those presently available.

In addition, because preparation of a generic environmental impact statement (GEIS) is the key step in developing criteria for recommending changes in existing regulations, it is anticipated that new regulations related to brine disposal may be proposed in the future. Any new proposed regulations may affect the acceptability of the current brine disposal methods.

Therefore, in anticipation of possible future changes in brine disposal regulations and the need for a more cost effective brine disposal enterprise to service the oil and gas producers in New York State, the New York State Energy Research and Development Authority (Energy

Table 2.4
BRINE QUALITY DATA FROM
NEW YORK'S GAS AND OIL PRODUCING ZONES[1]

Parameter (mg/L)	Potsdam/ Theresa	Queenston	Medina	Oriskany	Bass Island	Upper Devonian Oil Zones
Sodium (Na)	76,712	73,500	69,893	45,457	60,750	36,367
Calcium (Ca)	31,256	36,603	37,124	33,684	56,400	16,467
Magnesium (Mg)	4,499	2,887	2,766	5,168	3,160	2,733
Strontium (Sr)	--	0	--	--	--	107
Barium (Ba)	750	0	--	--	--	8
Potassium (K)	3,367	1,124	--	1,307	--	71
Iron (Fe)	17	195	676	215	18	189
Manganese (Mn)	0	--	84	--	0	7
Chloride (Cl)	183,701	187,418	181,298	145,442	203,000	92,167
Bromide (Br)	1,417	1,120	1,721	1,687	--	860
Sulfate (SO_4)	18	--	736	57	180	619
Bicarbonate (HCO_3)	89	--	25	203	50	0
Iodine (I)	9	11	18	10	--	200
Lithium (Li)	54	--	--	--	--	--
Trace Metals	--	--	--	--	--	0.74
Hydrocarbons	--	--	--	--	--	107.5
Measured TDS	300,763	298,358	292,121	231,836	323,500	156,267
Calculated TDS	299,187	302,869	292,727	232,743	323,558	149,582
IONIC RATIOS						
Na/Ca	2.4	2.01	1.89	1.42	1.08	2.24
Ca/Mg	9.75	12.76	15.90	6.93	34.17	6.04
Mg/K	1.07	2.64	--	4.00	--	47.03
Cl/Br	142.84	255.07	102.49	104.86	--	104.60
No. of Analyses	9	2	8	4	2	3

[1]As reported in DEC, 1988a.

High total dissolved solids concentrations interfere with atomic absorption analysis. For metals with high concentrations like sodium, calcium, magnesium, potassium, iron, manganese and strontium, the interferences are eliminated by dilution. However, for metals like zinc, lead, nickel and copper which have low concentrations, matrix interferences cannot be eliminated through dilution. Thus, the method of standard additions was used to determine the metal concentrations.

Results of the TS, VS, and FS solids analyses performed on the brine samples are summarized in Table 2.5. Composite sample results are the average of five analyses. The individual well sample solids concentrations are the average of two analyses. Dissolved solids concentrations (TDS, VDS, FDS) on the composite brine were the average of seven analyses, while those for the individual well brine results were averaged from two analyses.

DEC
PUBLICATION

Division of Mineral Resources

DRAFT
Generic Environmental Impact Statement On the Oil, Gas and Solution Mining Regulatory Program

JANUARY 1988

VOLUME I

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Chapters 1-11

New York State/Department of Environmental Conservation

MARIO M. CUOMO, Governor THOMAS C. JORLING, Commissioner

bedrock has also been known to seep to the surface and/or contaminate water supplies. The highly fractured Devonian shale formation found throughout western New York, is particularly well known for its shallow gas pockets. In his 1966 report on the Jamestown Aquifer, Crain explained that natural gas could occur in any water well in the area "which ends in bedrock or in unconsolidated deposits overlain by fine-grained confining material. Depth is not of primary importance because pockets of gas may occur in the bedrock at nearly any depth." As an example he cited a water well that reportedly produced 9.5 million cubic feet of gas per day when it was first drilled. The gas flow declined rapidly and was unmeasureable after several days. This report concurs with the observations of members of the oil and gas industry who have drilled through minor gas bearing zones in the vicinity of this aquifer. Wetlands and landfills are also possible sources of methane contamination of groundwater. Depending on the amount of organic matter in the wetland or landfill, the depth of burial, time of burial and several other factors, sizeable quantities of gas can be generated. In fact, methane recovery wells have been drilled in at least three landfills in New York State for energy production, and methane has to be vented from many others (Phaneuf, 1987, personal communication #55).

Produced Brine - During gas well production, small quantities of formation water are brought to the surface with the gas. The separator removes the brine from the gas and sends it to a storage tank or brine pit. Operators in the past were allowed to use brine pits in association with gas wells for brine storage and disposal. Brine pits are not environmentally acceptable and are no longer permitted by the DEC or the Federal Environmental Protection Agency which considers them brine disposal wells. All existing brine disposal pits are scheduled for elimination within 3 years from June 1984. When production begins, the well may produce less than one barrel of

brine a day and frequently none. As the well gets older the volume of brine may increase up to five barrels a day. Large quantities of brine that must be disposed of also result from occasional maintenance operations such as swabbing. Most of this brine is disposed of by road spreading. Brine from the production stage poses the same kind of environmental concerns associated with formation water produced during drilling operations.

2. Oil Well Production

The equipment necessary for oil production is different from that for gas production. The production equipment on oil wells typically includes a pump, (Figure 10.2), a separator, and stock tanks.

Paraffin can be a major problem for New York State producers because it exists at a relatively high level in the oil. When the paraffin separates out of the oil it can plug the target formation, reduce production and clog equipment. Paraffin clogs in the small underground plastic flow lines attached to oil wellheads have also been known to cause the lines to rupture and leak. Therefore, paraffin treatment chemicals may have to be injected into the well as part of the production process.

When oil is produced from the reservoir it usually has brine and gas associated with it. Before the oil can be sold it must be treated. Most operators in New York State use a stock tank to separate the produced oil and water. The gas is drawn off the top of the separator and water and oil are drawn off the bottom. The brine and oil mixture is sent to a stock tank where it is separated gravitationally. The brine is then recycled for waterflood injection or stored for later disposal. The oil is periodically pumped out of the stock tank to central storage tanks and to the purchaser's refinery.

a. Potential Environmental Problems of Oil Production - Oil and brine can migrate from wells which do not have integrity. If the problem is