

IV. HISTORY OF OIL, GAS AND SOLUTION SALT PRODUCTION IN NEW YORK STATE

A. INTRODUCTION

Oil, gas and salt have been recovered for a variety of uses in New York State dating back to the seventeenth century. Initial methods used to obtain these resources were very primitive. With the continuing need for these resources, more advanced methods have been developed to produce them and regulations have been adopted to be sure this production is conducted in an environmentally safe manner.

B. OIL AND GAS HISTORY

1. Natural Seeps

Initially oil and gas were obtained from natural springs and seeps. There are natural hydrocarbon seeps in Allegany, Ontario, Cattaraugus and Yates counties (Herrick, 1949). Crude oil from some seeps was used for medicinal purposes and fuel by the Indians and early European settlers (Herrick, 1949). The Seneca Oil Spring in Allegany County is the earliest known oil seep in New York, and was reported in a letter written by a French missionary in 1627 (Herrick, 1949). As early as 1767 Indians traded oil from this spring at Fort Niagara (Herrick, 1949). Oil and gas wells have been drilled in New York State for over a century. In 1821, a shallow well was drilled at another famous seep, the Natural Gas Spring in the bed of the Canadaway Creek in Fredonia, and produced enough gas to light many of the village's main buildings for several years (Herrick, 1949).

2. Early Wells

In 1850's, Colonel Edward Drake from Pennsylvania, and James Miller Williams of Canada proved that a more dependable flow of oil could be obtained by drilling a well into the earth's surface (Herrick, 1949, and Oil and Gas Journal 10/22/84). The first recorded oil well in New York State

was drilled to a total depth of 900 feet in July 1860, in Allegany County, eleven miles north of the Seneca Oil Spring (Dodd, Mead, 1949). The first commercial oil well was drilled by the Hall Farm Petroleum Company near Limestone in Cattaraugus County in 1865 (Herrick, 1949).

3. Oil and Gas Production Trends

Oil production in New York State peaked in 1882 when 6,685,000 barrels of crude oil were produced, although occasional surges in production occurred as new pools were discovered and drilled (See Figure 4.1) (Kreidler, 1953). A series of Oriskany sandstone wells were completed beginning in 1930 which led to record natural gas production approaching 40 billion cubic feet of gas in 1938 (see Figure 4.2) (Kreidler, 1953).

The upward trend in oil and gas prices of the 1970's and early 80's made the State an increasingly attractive area for natural gas development. Only 110 wells were drilled in 1970 compared to the 488 new wells drilled in 1985. Even with the recent depressed market, industry still considered it worthwhile to drill over 300 new wells in 1986.

Production of natural gas in New York State rose to a recent peak of 34.2 billion cubic feet in 1986. This figure approaches the record production level of 1938 and is enough to supply New York consumers in the residential, commercial and industrial sectors with natural gas for about 23 days (NYS Energy Office, 1986). Natural gas produced in New York currently supplies about 5.6 percent of the State's needs and this level could equal 10 percent of the State's consumption within a decade, if economics improve.

New drilling and production is dependent on a number of forces, including the strength of the economy, prevailing interest rates and other factors, particularly natural gas and oil prices. Though current low prices discourage development, when the surplus created by artificially high prices of a few years ago is depleted, there are enough oil and gas reserves in New York State to

FIGURE 4.1

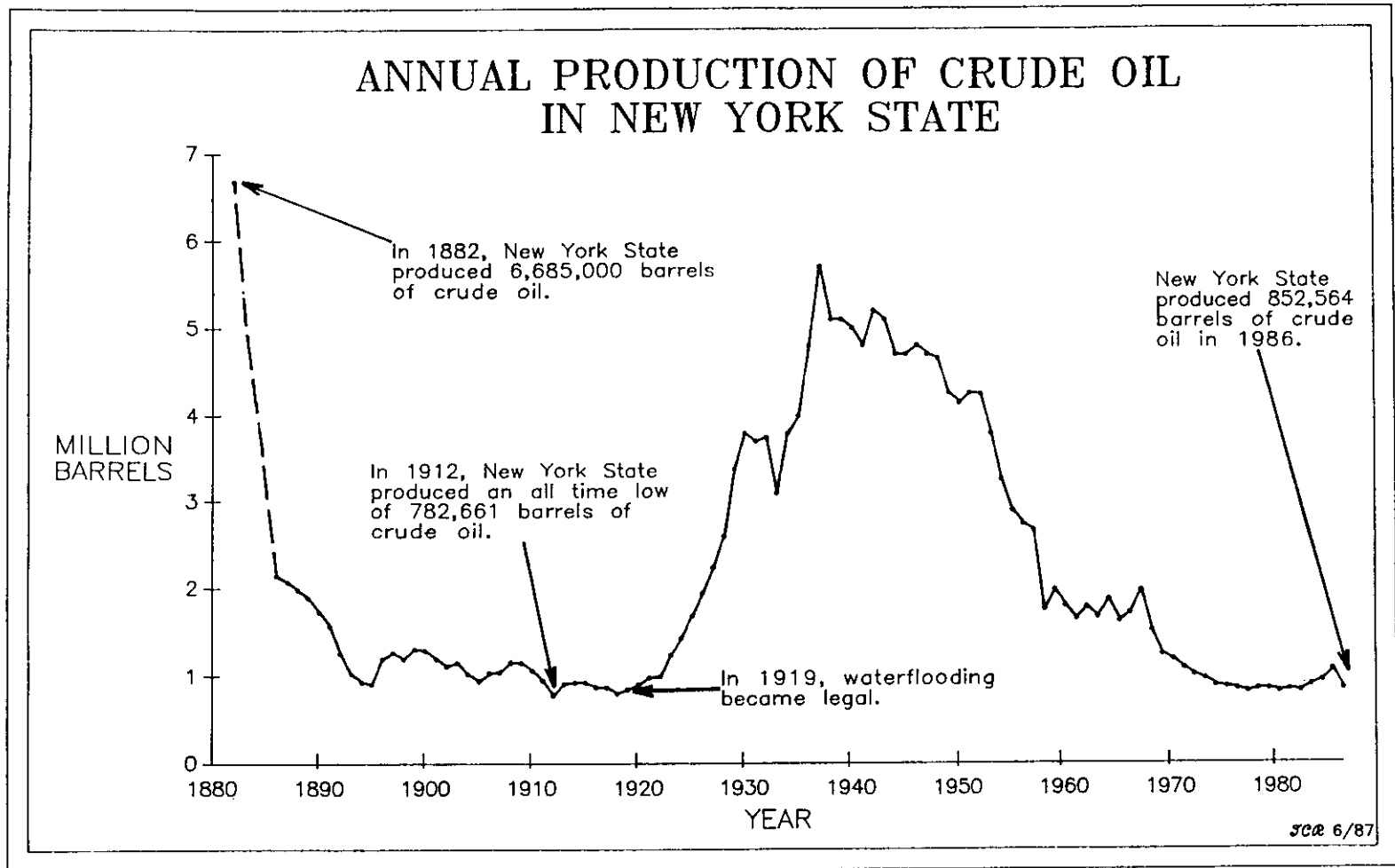


FIGURE 4.1
4-2a

FIGURE 4.2

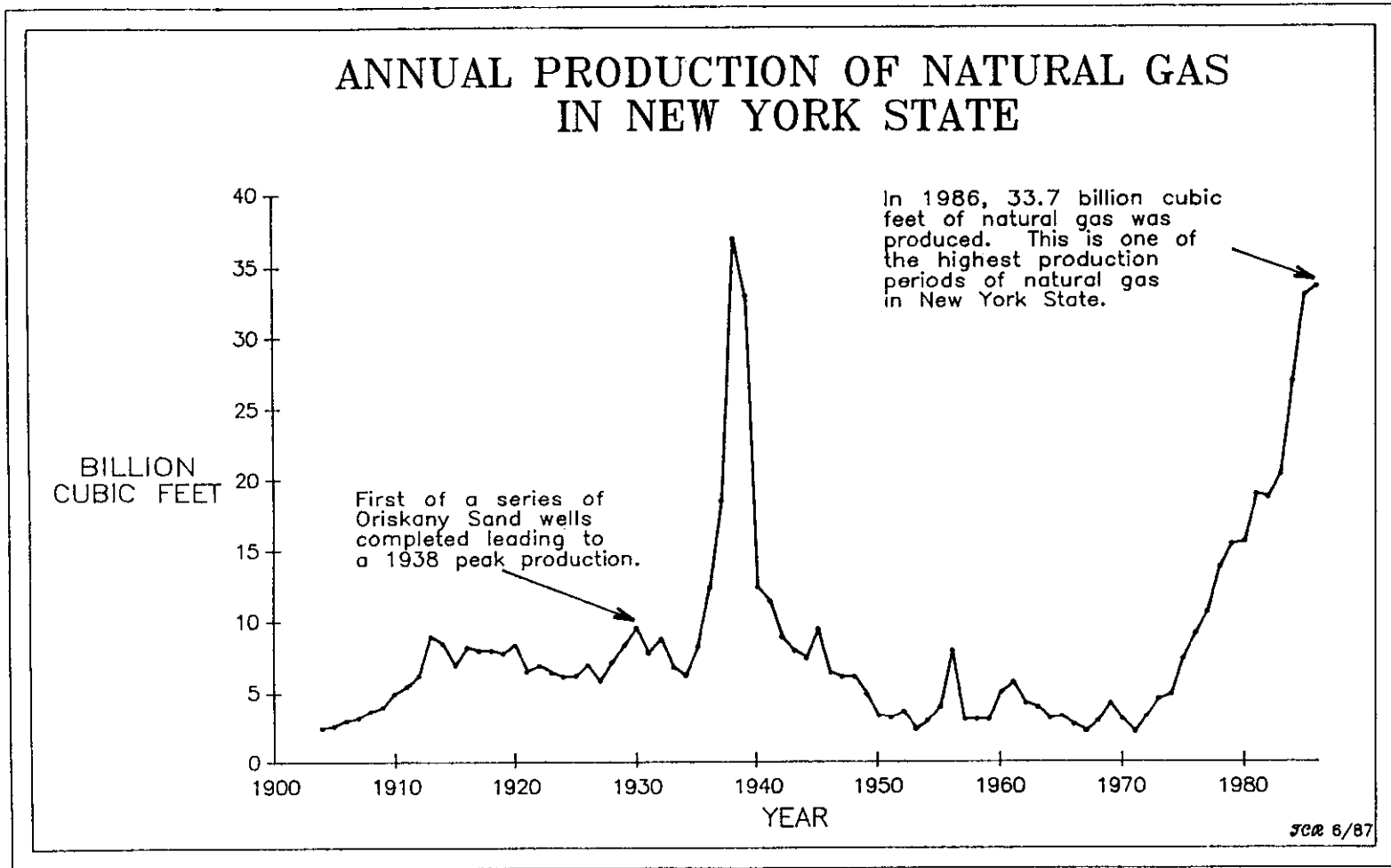


FIGURE 4.2
4-2b

keep this industry active for some time into the future. Currently, Chautauqua County is the State's leading natural gas county while Cattaraugus County leads in oil production.

4. Underground Gas Storage Fields

Underground gas storage fields were developed as a less costly alternative to expanding the pipeline system to meet the peak demand for gas during the winter months. Gas and liquefied petroleum gas (LPG) can be stored in depleted gas or oil reservoirs, aquifers, abandoned salt cavities, and mined underground caverns. Gas is injected into the storage reservoir during summer months when demand is low and supplies are readily available. The first underground gas storage project in New York was established in 1916 at the Zoar Field in Erie County (VanTyne, 1980). As of 1986, there were 21 underground gas storage reservoirs in New York State with a total storage capacity of 177.5 billion cubic feet. As of the end of 1986, 55.4 billion cubic feet of working gas and 85.5 billion cubic feet of cushion gas (required to maintain well pressure so that the working gas can be recovered) were in storage in these reservoirs (NYSDEC, DMN, 1987). Underground storage fields have been created in the Medina, Oriskany, Onondaga and Tully formations.

There are currently three LPG storage facilities in New York State with a total storage capacity of 108.1 million gallons. Only a portion of the total storage capacity, 25.6 million gallons, was in use at year end in 1986 (NYSDEC, DMN, 1987).

C. SOLUTION SALT MINING HISTORY

1. Early Methods of Salt Extraction

Solution salt mining in New York State pre-dates oil and gas activity. In the early 1600's, salt was recovered by evaporating seawater from the Atlantic Ocean (Werner, 1917). Very little salt can be extracted by this

laborious process, and it was soon replaced when other sources were found onshore.

Salt springs were discovered along the shore of Onondaga Lake in the 1640's (Werner, 1917). These springs of strong natural brine were initially transformed into salt by boiling the springwater in large kettles and later by using solar evaporators (Werner, 1917).

As salt production increased, treaties were signed with the Indians to use the land. In 1788, the Onondaga Indians ceded all of their land to the State except for a tract retained for their residence (Werner, 1917). With this action, systematic salt production began and the State came to own all the salt-producing lands.

2. Establishment of Permanent Salt Production Industry in New York State

The Onondaga Salt Springs marked the beginning of a permanent salt production industry and was the main commercial salt operation in the country until 1878 (Werner, 1917). The salt works in Onondaga County were responsible for the settlement and growth of Syracuse and the surrounding area. Cayuga, Genesee, Livingston, Schuyler and Tompkins Counties also had some early salt operations. In addition, the salt industry fostered construction of the Erie Canal to improve transportation to markets in the rest of the country.

The Syracuse salt operation thrived for over a hundred years, but discoveries of rock salt in other counties and states, and improved production processes led to major changes in the Syracuse salt industry. With the discovery of rock salt in Wyoming County in 1878, wells were drilled into these salt deposits (Werner, 1917). Freshwater injected down the wells dissolved the salt and was pumped back to the surface as a concentrated brine. Produced this way, the brines were more concentrated than the naturally occurring salt springs, and marked the beginning of New York's solution mining

industry.

In 1828, over one million bushels of salt were produced and inspected in Geddes and Salina (Werner, 1917). After that time the salt works were continually improved and enlarged, as more and deeper wells were sunk, improved piping was installed, and numerous boiling blocks and solar evaporating vats were constructed. The number of salt production plants reached a peak in 1893 (Werner, 1917).

The National Salt Company of New Jersey was incorporated in 1899 and attempted to control the salt industry east of the Rocky Mountains; many plants in New York were subsequently purchased by this company (Werner, 1917). Today there are five solution salt mining operations in New York (see Figure 4.3). New York has continued to be a major producer of salt and has consistently been in the top three of salt producing states since the 1800's (Werner, 1917, Department of the Interior 1930-1984). In 1984, there were 1,675,000 short tons of salt produced in New York (see Figure 4.4).

D. HISTORIC ENVIRONMENTAL PROBLEMS

In the 1800's, when agricultural development began in New York, early practices of clearing and settlement of the land had caused serious run off problems and siltation of streams in Allegheny County and throughout the Southern Tier. These practices led to an eventual economic and environmental decline and to the local "extinction" of many species of plants and animals.

Early oil and gas practices themselves caused some problems, particularly during the boom years. The problems were overcome in part by the replacement of wood by good steel for pipes and storage tanks. The prosperity from the early oil and gas industry boom also led to an improvement in the quality of life and to the development of municipal water systems and fire departments. Early regulations and programs adopted by New York State in the 1800's had a

FIGURE 4.3 SOLUTION SALT MINING IN NEW YORK STATE

Solution salt operations:

1. Allied Chemical Corporation, Tully
2. Cargill Salt Company, Watkins Glen
3. International Salt Company, Watkins Glen
4. Morton Salt Company, Silver Springs
5. Texas Brine Company, Dale

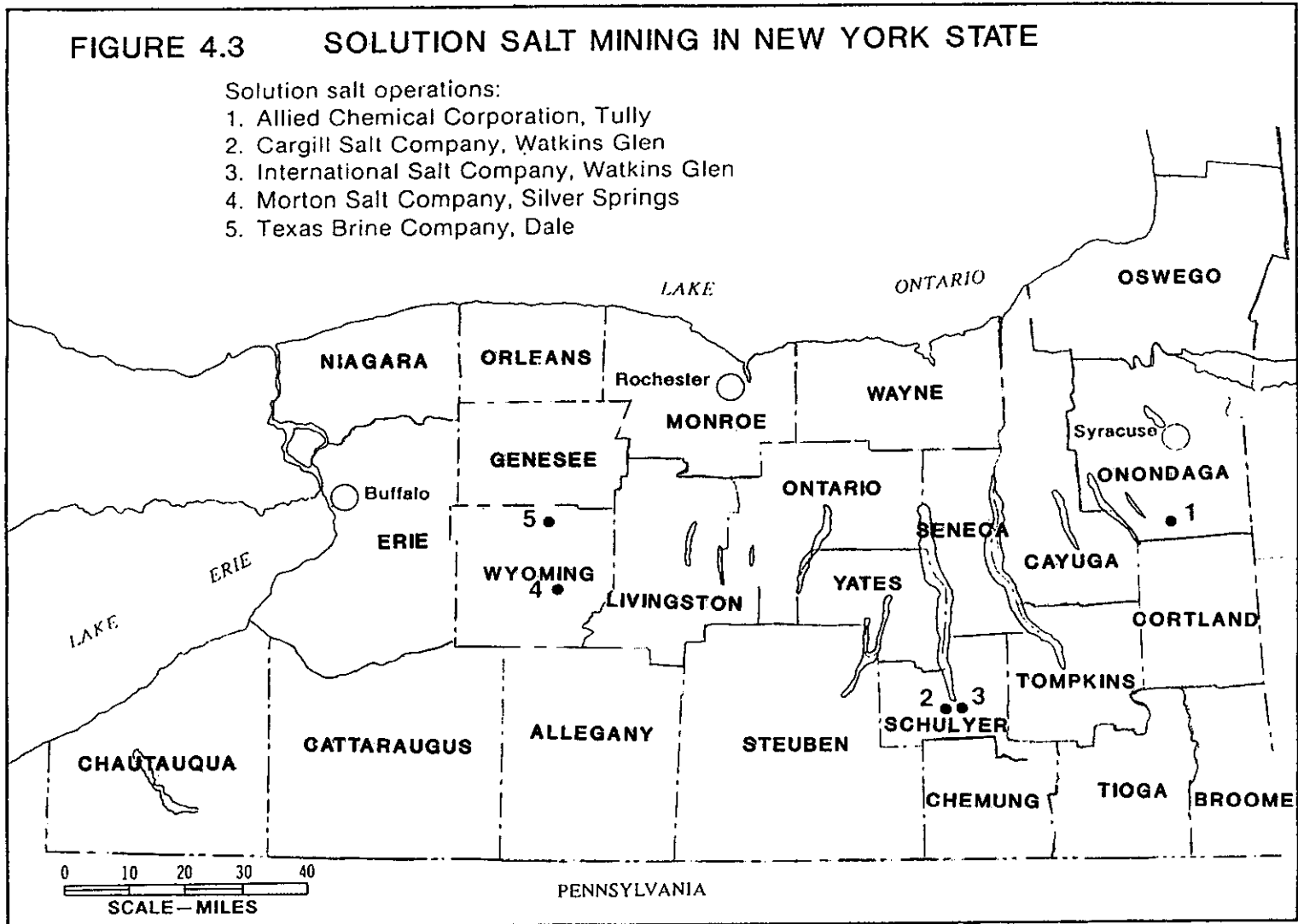
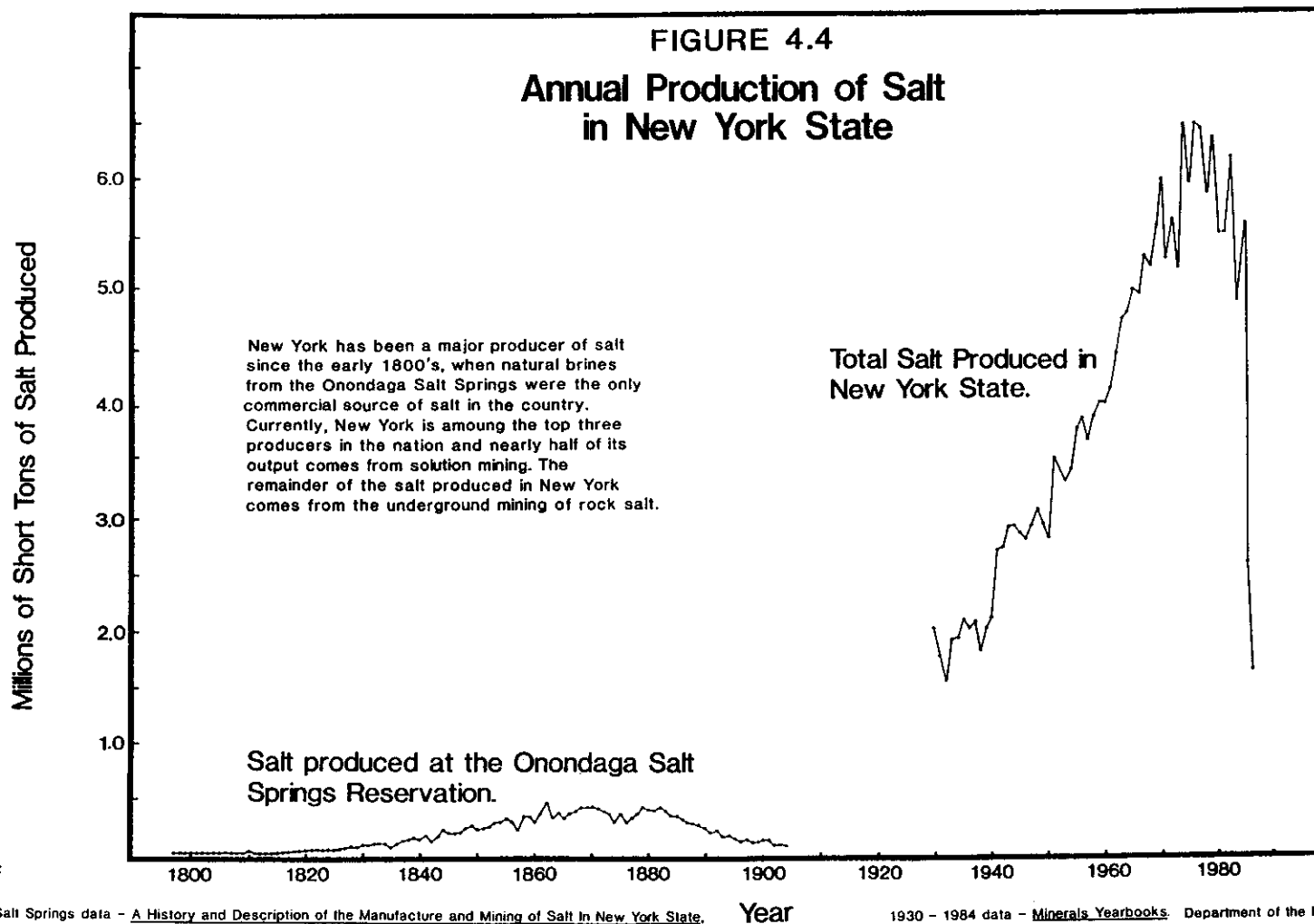


FIGURE 4.3
4-5a

FIGURE 4.4
4-5b



Onondaga Salt Springs data - A History and Description of the Manufacture and Mining of Salt In New York State, by Charles J. Werner, published by the author, Huntington, Long Island, 1917. Salt bushels were converted to short tons by multiplying the number of bushels by .0497. This assumes salt weighs 80 pounds per cubic foot, a cubic foot equals 1 bushel times 1.2445 and a short ton equals 2,000 pounds.

1930 - 1984 data - Minerals Yearbooks, Department of the Interior, Bureau of Mines. These figures represent total salt sold or used by producers in New York State. Approximately half of this production is from solution mining.

limited effect on the oil and gas industry because there was no uniform statewide enforcement. The State has adopted and enforced more comprehensive regulations to protect the environment from potential harm since the 1960's.

There are some examples in the literature of early environmental problems caused by the oil and gas industry. As much as 90 barrels of crude oil a day leaked from early oil tanks and were skimmed from behind a dam on the Little Genesee Creek and shipped to a Buffalo oil works (Herrick, 1949). In 1882, when the Cynthia Oil Works refinery was built in Bolivar Township in Allegany County, there were 10,000 barrels of crude oil in storage that was reported to have been salvaged by dippers from the Little Genesee Creek (Herrick, 1949).

Groundwater supplies in some instances were also contaminated by improperly cased holes, unplugged abandoned wells and other early well drilling practices. Though most of the recorded serious pollution incidences were attributed to early storage practices. In 1922, a pipe was driven 18 feet to obtain drinking water from a layer of buried gravel near a north Olean tank farm. When oil was recovered instead, it was discovered that the local drinking water was contaminated. A pitcher pump oil boom began when dozens of nearby landowners drilled such "water wells", and family members worked the pumps day and night to produce as much as five barrels of oil per day (Herrick, 1949).

In some instances, springs and other sources of water were also polluted by early oil recovery practices. Waterflooding, a technique developed in the early 1900's, was used when production declined in order to obtain additional oil from seemingly depleted wells. The reservoir rocks were filled with water to force out the remaining oil. As water was forced into an injection well, fluids in the reservoir rocks began to flow in the direction of an adjacent production well. When the injection process was not carried out properly, nearby water resources could be contaminated by the diverted oil, which flows

outward or upward in the absence of a confining rock bed, away from the injection well. For example, in 1939 a waterflood contaminated a spring in Peet Hollow which served as the main drinking water supply for the Town of Bolivar. The water supply had to be shut off and an alternate source found (Herrick, 1949).

Another technique introduced in the early 1900's to recover additional oil from wells was well torpedoing. Large amounts of nitroglycerin, a chemical explosive, were dropped into the wells to fracture the rock and theoretically create enlarged pathways through which the oil could flow toward the well (Herrick, 1949 and Watson and Benson, 1984). Environmental contamination resulted when too large an explosive charge was used. Oil would spray up the well and onto the land.

Fortunately, New York has a high average annual rainfall which dilutes small oil and brine spills to such an extent that surface pollution is usually temporary, assuming there are no cumulative impacts from continued spills. The high levels of annual rainfall recharge surface waters and flush-out shallow permeable aquifers at a high rate.

E. NEW YORK STATE'S OIL, GAS AND SOLUTION MINING LEGISLATIVE HISTORY

1. Early History

In order to better organize and control the quality of solution salt production, and because of the increasing oil and gas activity in the 1800's and the need to conserve the oil and gas resources and to prevent unnecessary environmental damage, state legislation to regulate these industries was begun in the late 1800's. Solution salt mining legislation was first introduced to regulate the leasing of salt-producing lands. Beginning in 1797 and lasting for 100 years, the Legislature set up the Onondaga Salt Springs Reservation and leased land in 10-acre lots (Werner, 1917). Under this legislation the

lessee was required to produce ten bushels annually per kettle and to pay a 4 cent tax on each bushel of salt produced. Later legislation increased the tax to help finance the Erie Canal. In the 1820's certain portions of the reservation were sold and the Legislature adopted laws to remove impurities in the salt caused by careless and neglectful producers.

In 1850, the State Legislature passed an act to improve the quality of the salt manufactured in Onondaga County and to protect salt purchasers (Werner, 1917). At that time the salt was often damp and liable to cake. The act required that alum be used instead of quick lime to clear impurities from the brine used in making salt. This process removed magnesium-bearing impurities which adsorbed moisture and created a product which was drier, caked less, and contained less lime.

As early as 1865 legislation was enacted to control the location and amount of crude oil which could be stored, primarily to ensure public safety (Chapter 773 of the Laws of New York, Eighty-eighth session). In 1879, legislation was passed requiring plugging of abandoned wells to prevent freshwater contamination by oil and gas (Chapter 217 of the Laws of New York, 102nd session), but the 1879 legislation required no freshwater plug and had no strong enforcement mechanism. Amendments passed in 1882 did require a wooden freshwater and surface plug in addition to a zone plug. The 1882 amendment also levied a \$200 to \$500 fine and imposed a maximum jail sentence of one year on operators who abandoned a well without plugging it. This legislation had the unique enforcement mechanism of giving half of the fine collected to the informer of any violation (Chapter 64 of the Laws of 1882, 105th session). In 1933 legislation was adopted to allow leasing of state lands for oil and gas drilling (Added L. 1933 C.207, effective April 18, 1933).

In 1963 the State Legislature repealed all previous oil and gas

legislation and amended the Conservation Law to give DEC greater authority over wells drilled in the fields developed after 1963. The purpose of this law was to foster, encourage, and promote the development, production, and utilization of the natural resources of oil and gas in a manner that would prevent waste, increase ultimate recovery, and protect correlative rights of all the interests involved. This bill also reauthorized the leasing of state lands for oil and gas development, and set up procedures specifically designed for the oil and gas business. Although this new law gave New York little legal authority in the older fields, it did enable the State to obtain systematic geologic information and to require records identifying ownership of facilities. Existing fields at the time were largely depleted and were not subjected to many additional regulations. Most of the law's provisions applied to new exploration, development and production, and contained provisions regarding well spacing, wasting oil and gas, flaring gas, and protecting surface and groundwater supplies. The increased plugging requirements pertained only to new wells.

This law was amended in 1969, recodified in 1972, and again amended in 1973, 1974, 1977, 1978, 1981, 1984 and 1987. As amended, it is now titled the Oil, Gas and Solution Salt Mining Law and also provides for the regulation of underground storage of natural gas.

2. 1981, 1984 and 1987 Revisions to the Oil, Gas and Solution Mining Law

In 1981, Governor Hugh Carey proposed a series of reforms to the 1963 law to better manage the development of oil, gas and salt resources of the State. Agreement with legislative leaders on a compromise law was reached and that law became effective on August 26, 1981. The most important change in the law brought an end to the distinction between new and old field areas so that all oil and gas wells in New York State are subject to the same restrictions.

Other provisions of the bill include:

- a. Exemption from spacing requirements for oil fields discovered, developed and operated prior to January 1, 1981. It was recognized that these fields had been developed to such an extent that to apply spacing unit requirements would be unreasonable.
- b. Dramatic increase in the permit fee. A uniform \$100 fee is paid directly into an Oil and Gas Account for plugging abandoned wells and abating dangerous oil and gas related incidents. A variable depth fee of \$125 per 500 feet or portion thereof, to a maximum of \$2,625 is reserved for funding the regulatory program.
- c. Requirement that DEC promulgate new bonding regulations.
- d. Consolidation and strengthening the enforcement provisions. Criminal penalties for violations were added to ensure compliance with the law's provisions.
- e. Creation of an eleven member Oil, Gas and Solution Mining Advisory Board.

Since the new legislation passed in 1981, the Department has made progress in meeting its legislative mandates given the resources available, but thousands of oil and gas wells were drilled in New York State before any comprehensive legislation was enacted to regulate drilling and production. It has been estimated that up to 40,000 wells were drilled prior to 1966 when the State first began keeping records. Approximately 8,400 wells have been drilled from 1966 to 1985. The Division's top priority has been to ensure that any applications for wells to be drilled subsequent to the new law were drilled and completed in an environmentally sound manner. The problems posed by oil and gas drilling in the past represent an enormous backlog of work for the Department.

The 1984 changes to the Oil, Gas and Solution Mining Law increased dramatically the amount of financial security well operators are required to

obtain before drilling their wells. This amount is intended to more closely approximate the costs of well plugging and abandonment.

The 1987 amendments to the Oil, Gas and Solution Mining Law extend its scope to include geothermal, stratigraphic and brine disposal wells deeper than 500'. Neither geothermal or stratigraphic wells have been subject to any regulation or environmental review in the past. The specific inclusion of brine disposal wells clarifies DMN's existing authority to regulate their drilling and plugging. Operation of the disposal wells will continue to be handled under the Division of Water's State Pollutant Discharge Elimination System (SPDES) Permit Program.

3. Regulations Implementing the Oil, Gas and Solution Mining Law

The regulations implementing the Oil, Gas and Solution Mining Law, Parts 550 - 559 of Title 6 of the official compilation of the Rules and Regulations of New York State, address each aspect of the drilling, completion, production and plugging and abandonment of oil and gas wells.

Part 553 of the oil and gas regulations establishes state-wide spacing requirements for oil and gas wells to help protect mineral rights of well owners and to allow for the greatest ultimate recovery of oil and gas. Part 554 regulates drilling practices and reporting requirements. These regulations are designed to prevent pollution and migration of fluids from drilling operations, require notice of commencement of operation, etc. They regulate the testing of surface casing, the use of blowout preventers, the isolation of hydrocarbons encountered above the target depth, hole deviation in well drilling and multiple completions, and they provide for the collection of well completion reports, well logs and samples. Part 555 regulates the plugging and abandonment of wells. Part 556 refers to operating practices and 557 regulates secondary recovery and pressure maintenance. Part 558 restricts

the transport of oil and gas products from owners or operators in violation of the State's Oil, Gas and Solution Mining Regulatory Program. Part 559 regulations were adopted in April 1, 1986 and regulate the production and safety of oil and gas wells operating in the Bass Island trend.

The Department of Environmental Conservation can also add special permit conditions to wells located in areas needing extra environmental protection. Department staff also conduct pre-drilling site inspections as well as drilling, post-drilling and plugging inspections to be sure that wells are in compliance with the well permits. More detail on the regulatory program is provided in Chapters 8 through 14.

The State's oil, gas, solution mining and gas storage regulations have not been updated since 1972 and extensive regulatory revisions are needed. Environmental and safety hazards not addressed by the current regulatory program have been handled by special permit conditions imposed on wells drilled in such critical areas as freshwater aquifers or the relatively high volume, high pressure (high for New York) Bass Island trend. One of the major purposes of this generic environmental impact statement is to present the framework, justification and recommendations for essential regulatory changes to these industries in New York State.