History and Chronology of Manufactured Gas

Manufactured gas was one of the great industrial enterprises of the 19th century. Its active history spanned about 160 years, extending past the half-way mark of the Twentieth century. In this time, an unusual array of invention and economic forces played back and forth across this dynamic industry. Thermal stress and chemical corrosion tore away at the gas machines and their associated production, purification, and storage systems; technological invention promised better methods as well as threats from occasional "opposition" competitors; consumer agitation and economic competition drove gas prices lower and lower; demands for gas-production residuals from the new coal-tar chemical industry showed promises; competing electricity and natural gas pressed hard on all fronts; and coal strikes, financial panics, depressions and war perturbated their operation. The manufactured gas industry was anything but static. Change therefore was the enduring hallmark of the manufactured gas industry.

Manufactured gas must not be confused with natural gas, our great modern-day fuel source. Manufactured (or artificial) gas was made primarily from coal, as well as many other organic feedstocks. During the gas manufacture, tars were created and leaked, spilled or discharged to the environment. These tars are not susceptible to natural degradation and therefore have lives that will extend into geologic time. Manufactured gas plant wastes do not "go away."

The tars are made up of 500 to 3000 different compounds, typically toxic to humans, mammals, and plant life. Sometimes carcinogenic, these tars are more dense than water, thus tending to sink into the groundwater environment where they contaminate passing ground water. Tar is not to be considered equivalent to asphalt, which is a residual of natural petroleum deposits and of oil refineries. Also associated with gas manufacturing were captured impurities such as ammonia, cyanide, sulfur and heavy metals, particularly arsenic.

With Hatheway's estimated 52,000 or more former manufactured gas plants in the United States, the environmental impact becomes obvious. This website is dedicated to informing the public, elected and appointed officials, the media, educators and students about the little known history of manufactured gas and how its wastes impact our environment today.

Birth of Manufactured Gas in the United States (1795)

"The first gas light in the United States occurred in 1796 when the Italian fireworks makers of the M. Amboise Co. made experiments with gas illumination at Philadelphia. Later, illuminating gas was exhibited "... in a sideshow in 1802 by Benjamin Healy at the Haymarket Gardens in Richmond, Va." (Gas Age-Record, 13 Dec, 1924, p. 828), and David Melville, of Newport, RI, experimented with as lights at his home in 1806 and at light houses around 1810. The rich literature of manufactured gas was established with the world looking to Britain and already the health sciences were reporting such connected diseases as scrotal cancer among British chimney sweeps, who had close body contact with coal tars in their work.

Establishment of Manufactured Gas in the United States (1816-1849)

Baltimore, Maryland began the first commercial gas lighting of residences, streets, and businesses in 1816. Commercial gas plants were thereafter built by small groups of local entrepreneurs, employing mainly gas works kits built at New York City and shipped west by freight wagons, canals, rivers and rail. Discharge of gas house residuals, to the atmosphere, the ground and surface waters began to cause reports of death to aquatic life, contamination of drinking water, destruction of crops, and associated health problems.

Growth of Manufactured Gas (1850-1876)
A steady demand for manufactured gas led to expanded street and commercial lighting in America's major eastern cities in the quarter century leading to our Centennial. By 1850 towns along and bordering the west bank of the Mississippi River were sprouting gas works. The clamor for Centennial improvements led to installation of gas works at most towns of 10,000 or more residents. Coincidentally, gas producers were devices developed to provide manufactured gas to power gas engines and to supply fuel for industrial uses. Concurrently, the world chemical industry was established on the basis of coal tar when the 18-year-old Englishman Perkin discovered the first coal-tar dyes in 1854 and his instructor Hoffmann returned to Germany with that basic knowledge. Litigation also began to appear in America over nuisances and damages from open discharge of gashouse wastes.

Expansion of Manufactured Gas (1877-1900)

During this period, America had surpassed the gross general product of Great Britain and "Professor" (an uneducated natural genius) T.S.C. Lowe had made the discovery of carburetted water gas, capable of making fuel gas from water (as steam) and enriched for candlepower by light "oils" recovered from gas-making residual tars and light petroleum oils. Fuel gas was seen by the gas industry as a means of combating the inroads made by electricity on gas lighting. A wave of consolidation of gas works swept the industrialized nations, creating larger gas companies and greater urban use of gas especially after the invention of utility holding companies, at Philadelphia, in 1882, with establishment of the United Gas Improvement Company (U.G.I.). One of the Greenoughs, of Boston, published an entire book (1883) dealing with litigation exposure of gas plants, drawing further speculation over damages due to nuisances and discharge and spillage of gas-house residuals* and wastes. The century closed with passage of the Federal Refuse Act of 1899, empowering the Army Corps of Engineers to defend the nation's navigable waterways from discharge of industrial wastes.

* Note that some of these residuals had value as useful by-products, while others were only waste, some of which was observed or known to be toxic to humans as well as plant and animal life.

Maximization of Manufactured Gas (1901-1919)

Carburetted water gas caused the expansion of manufactured gas to smaller towns, eventually down to those with populations of just a few thousand. The concept of the "central station" was developed at Oakland, California and larger, centrally-located gas plants led to closure and abandonment of smaller, local gas works. Metallurgical engineers developed seamless pipe welding techniques that promoted the use of the necessary transmission pipes for manufactured gas. Coke was at a premium as the smokeless fuel and the motor vehicle began to consume the coal-gas light oils as its fuel. Soon carburetted water gas plants suffered severe shortages and price hikes for their feed stocks, coke and illuminating oil, and the "water gas" tars became emulsifed with water far beyond the contents tolerated (4-6 percent) by the tar distillers. Although it was possible to burn gas tars or to dehydrate such, many gas plant operators were dumping unsalable tar-water emulsions to the environment and the problem only worsened with new wartime coke shortages, during which time carburetted water gas plants continued the substitution of soft coals for coke, aggravating the tar-water emulsion problem. Litigation over damages from leaks, spills and discharges of gashouse wastes expanded and States begin to enact stream anti-pollution laws, some of which specifically name gashouse waste discharge as particular causes of environmental damage and health issues. The Progressive movement also led to establishment of price and tariff regulating commissions in most States.

Decline of Manufactured Gas (1920-1940)

With the termination of the World War, the manufactured gas industry continued to suffer feedstock shortages needed for manufacture of the more affordable carburetted water gas. Concurrently, the world chemical industry began a rapid transition away from coal tar, leaving fluctuations in price and salability of gas works tar residuals. Utility holding companies thrived and discharge and spillage of gas-house residuals* and wastes. The world chemical industry was established on the basis of coal tar when the 18-year-old Englishman Perkin discovered the first coal-tar dyes in 1854 and his instructor Hoffmann returned to Germany with that basic knowledge. Litigation also began to appear in America over nuisances and damages from open discharge of gashouse wastes.

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Demise of Manufactured Gas (1941-1966)

Wartime defense measures led the Federal government to finance huge oil pipelines from the oil fields of Texas to the industrial northeast. At war’s end these pipelines were sold to the natural gas industry and the new commercial supplies led to wide-scale closure of manufactured gas plants in the larger eastern markets. New discoveries of huge and reliable natural gas fields led to pipeline supplies penetrating the remainder of the market areas for manufactured gas. The last manufactured town gas plants terminated operations by 1966, with a few remaining industrial producer gas plants continuing into the 1990s.

Rise of Environmental Concern (1965-Present)

The States were funded by the Federal government, beginning with the Clean Water Act of 1965, to scope and to deal with water pollution control issues. By 1970, the Environmental Protection Agency was signed into existence by Richard Nixon and the first, basic national Air Pollution Control Act was passed in that year. Soon EPA investigators identified the nation’s by-product coke ovens (manufactured gas, chemicals and coke) as a major source of coal-tar emissions (as microscopic airborne particles of Polycyclic Aromatic Hydrocarbons = PAHs) to the environment. The ensuing air pollution regulatory crackdown all but killed the American by-product coke industry by 1990. In the course of this regulatory program, USEPA discovered the existence of manufactured gas plants and made a rudimentary tally of such (1985). The American utility industry, discovered as still owning many of the defunct gas works sites, was enjoined in efforts under the Federal SUPERFUND Act of 1980. Eventually USEPA created 14 National Priority List sites of former manufactured gas works. The latest NPL FMGP was authorized by US EPA in 2002. Today the bulk of responsible cleanup activities at FMGPs are being directed by State environmental agencies, those of Wisconsin, New York, Iowa and Missouri representing the greatest amount of remedial activity, in the experience of the author. Many, many FMGPs however, are escaping any remediation at all through the application of “NIFRAPPING” (No Further Remedial Action Planned) as a result of site and waste characterization that has been so planned and conducted as not to indicate a sufficient degree of risk to humans or the environment, so as to warrant cleanup action under the SUPERFUND Law of 1980. It is the overall opinion of this website author that most FMGP NFRAP sites have not been adequately or competently characterized as to the operational history, their on-site and off-site gas-manufacturing wastes, or the geologic implications of the individual sites.