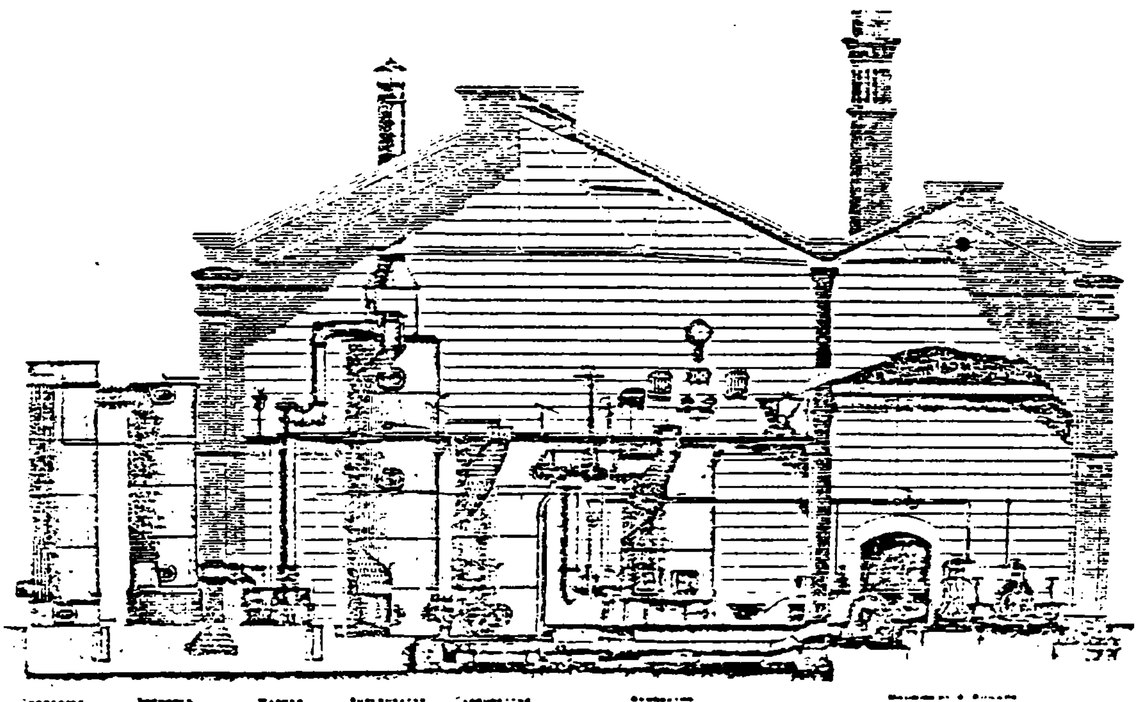
TOWN GAS
AN OVERVIEW



LAWRENCE H. LIEBS

THE BROOKLYN UNION GAS COMPANY

AGA DISTRIBUTION / TRANSMISSION CONFERENCE

BOSTON, MASSACHUSETTS

MAY 1985

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The purpose of this paper is to provide an overview of the town gas issue and a capsule discussion of the various manufactured gas processes and their associated by-products. A general discussion of regulatory issues also shall follow.

PROCESSES

The first manufactured gas plant in North America was opened in Baltimore, Maryland in 1816. Over the next century a variety of processes evolved culminating in the large by-product recovery plants installed during the first-quarter of the twentieth century. Different regions, demography and fuels availability played a significant role in deciding fuel and process type. The majority of the large centralized process recovery plants were located in the dense population centers of the east and midwest, and the smaller cities and towns were served by smaller production units. Oil gas plants were located primarily on the west coast where transportation made use of coal uneconomical. However, oil plants did increase in popularity in other regions of the country towards the end of the gas manufacturing era (Table 1).

A review of the many gas manufacturing "bibles" presents confusing variations of a number of main processes. For example, the term "water gas" was often used to describe varying processes, or any number of processes that entailed "steaming" or spraying steam over the incandescent coal. Carburetion was the injection of naphtha or other hydrocarbon oils into the retorts to be thermally cracked and raise the Btu value. The oil gas processes basically removed the coal or coke

TABLE 1

NATURAL GAS MARKETED, MANUFACTURED GASES

PRODUCED AND PURCHASED BY UTILITIES (a)

Millions of Therms (b)		
Year	Natural Gas	Total Manufactured Gas
1935	21,170	1,853
1940	29,390	1,941
1946	44,640	2,690
1950	67,530	2,659
1954	93,982	1,504
1958	118,575	1,086
1962	145,953	731

Percent of Total Manufactured Gas				
Year	Water Gas	Coke Oil Oven Gas	Retort Coal Gas	Gas & Oil Refinery Gas
1935	47.4	41.8	7.7	3.1
1940	49.6	40.9	4.3	5.2
1946	57.3	34.4	2.7	5.6
1950	60.6	32.4	0.8	6.2
1954	64.4	29.1	(c)	6.5
1958	NR(d)	NR	NR	NR
1962	NR	NR	NR	NR

(a) From Gas Engineering Handbook (1966, p.2/6).

(b) 1 therm = 100,000 Btu.

(c) Included with coke oven gas.

(d) No longer reported.

reference 1

from the process, and depended on the oil alone to generate the gas.

Local or non-specific usage of many of these terms has often made the exact nature of an old plant's process that much more difficult to identify.

Retort Gas

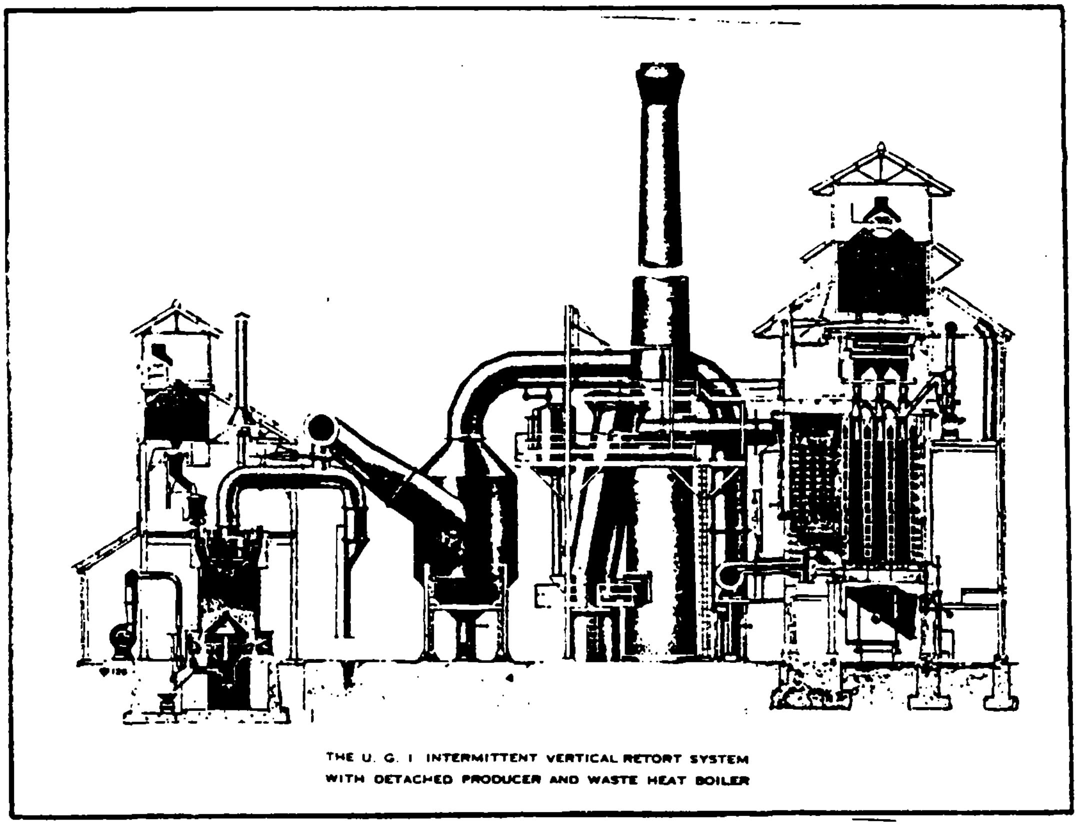
The original method of gas production was by carbonizing coal in horizontal retorts. This was an intermittent process that required cyclic operation for periodic charging and cleaning. Later advancements were vertical retorts that were continuously operated, and intermittent vertical retorts that employed "steaming", or introduction of steam towards the end of the carbonizing process (Figure 1). The steam served to increase the recovery of the remaining coal gas (mostly carbon monoxide and hydrogen), and also increased the quality of the coke produced. The gas produced in this manner was water gas (Table 2).

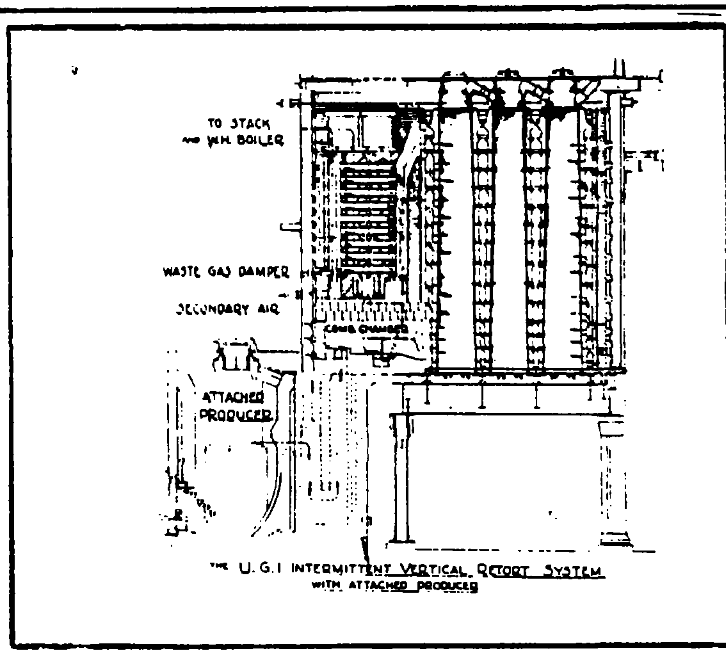
Blue and Water Gas

Usually, the term water gas is used to refer to the blue gas process. While blue gas was of a slightly lower Btu content

FIGURE 1

U. G. I. VERTICAL RETORT SYSTEM





reference 6

TABLE 2

TYPICAL ANALYSIS OF RETORT GAS

	Volume Percent	
	Intermittent	Continuous
Carbon Dioxide	2.1	3.0
Illuminants	3.4	2.8
Oxygen	0.4	0.2
Carbon Monoxide	13.5	10.9
Hydrogen	51.9	54.5
Methane	24.3	24.2
Nitrogen	4.4	4.4
Btu/cu.ft.(HHV)	520.0	532.0
Specific Gravity	0.42	0.42

reference 1

than the water gas produced in the vertical retort, its production was similar though its process employed a series of cycles of air blasts and steam injection. The air blasts were employed to maintain the temperature of the coke bed and the steam was introduced to aid in recovery of hydrogen and other gases by reacting with the carbon. Since the introduction of the steam reduced the temperature of the coke bed, steaming was followed by reintroduction of air to raise the temperature back to the operating level. The steaming and air blast cycles had to be separated to avoid excess production of nitrogen and carbon dioxide. Though the blue gas process was cyclic, automated charging and grate cleaning systems made its operation highly reliable (Table 3).

Carburetted Water Gas

Blue gas was of lower heating value than the "retort gas" previously described. To raise capacity and the Btu content, a carburetion step was added. A spray of oil was added to the blue gas as it passed through a carburetor. The oil was then thermally cracked in a superheater, raising the Btu content of the blue gas. By manipulating the ratio of cracked oil gas to blue gas, the Btu content could be varied greatly. Though this process is correctly referred to as carburetted water gas, (Figure 2) it was often simply referred to as water gas (Table 4).

TABLE 3

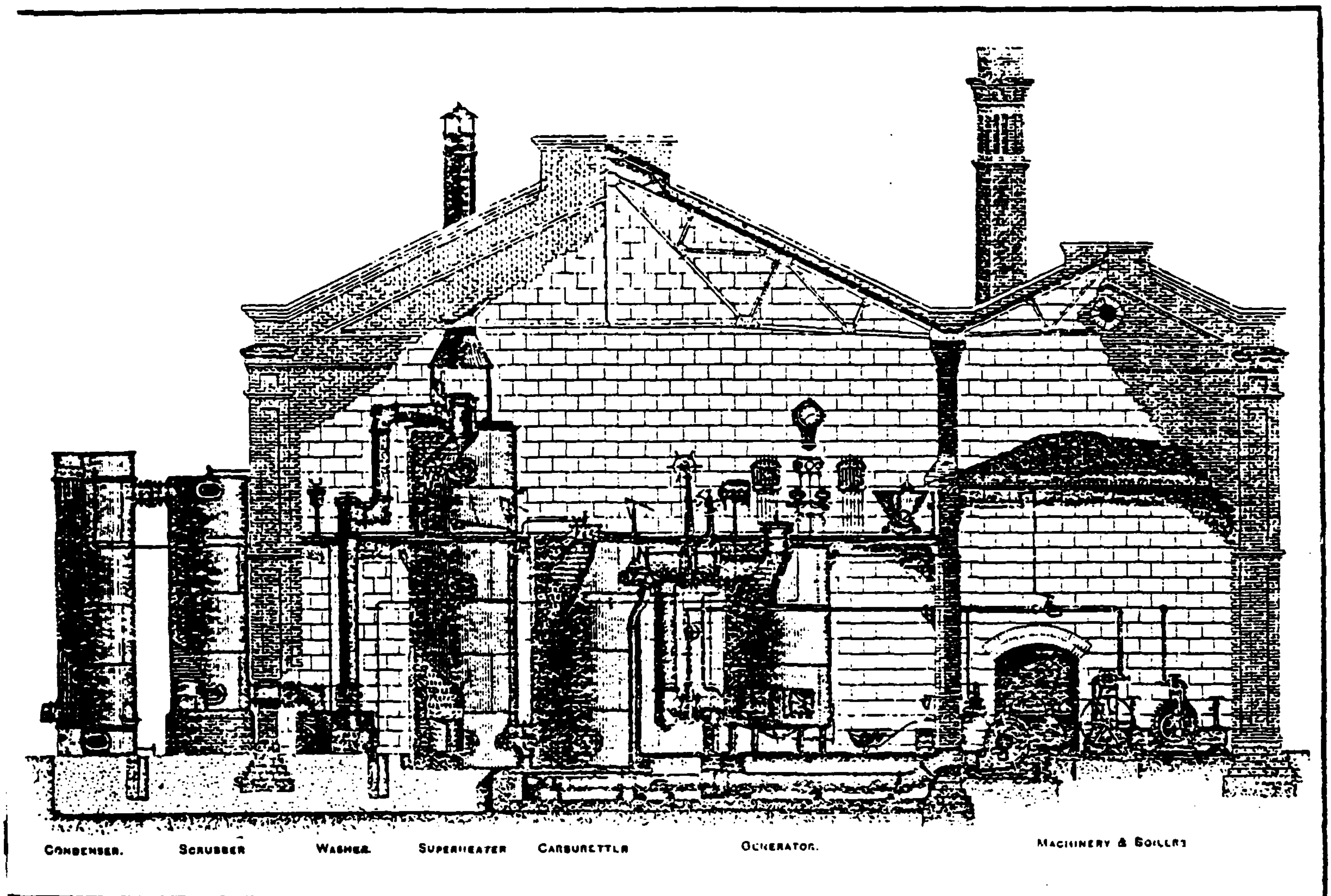
TYPICAL ANALYSIS OF BLUE GAS

	Volume Percent
Carbon Dioxide	5.5
Carbon Monoxide	37.3
Hydrogen	47.6
Methane	1.2
Nitrogen	8.4
Btu/cu.ft. (HHV)	287.0
Specific Gravity	0.57

reference 1

FIGURE 2

CARBURETTED WATER GAS



reference 8

TABLE 4

TYPICAL ANALYSES OF CARBURETTED WATER GASES

	Volume Percent			
Carbon Dioxide	3.4	4.3	1.6	4.4
Illuminants	8.4	12.6	18.9	27.4
Oxygen	1.2	0.7	0.2	1.1
Carbon Monoxide	30.0	30.2	21.3	9.1
Hydrogen	31.7	29.3	28.0	19.9
Methane	12.2	17.8	20.7	21.8
Ethane	0.0	0.0	4.3	5.3
Propane	0.0	0.0	0.0	0.3
Nitrogen	13.1	5.1	5.0	10.7
Btu/cu.ft.	540.0	695.0	850.0	1010.0
Specific Gravity	0.64	0.68	0.69	0.85

reference 1

By-Product Coke Oven Gas

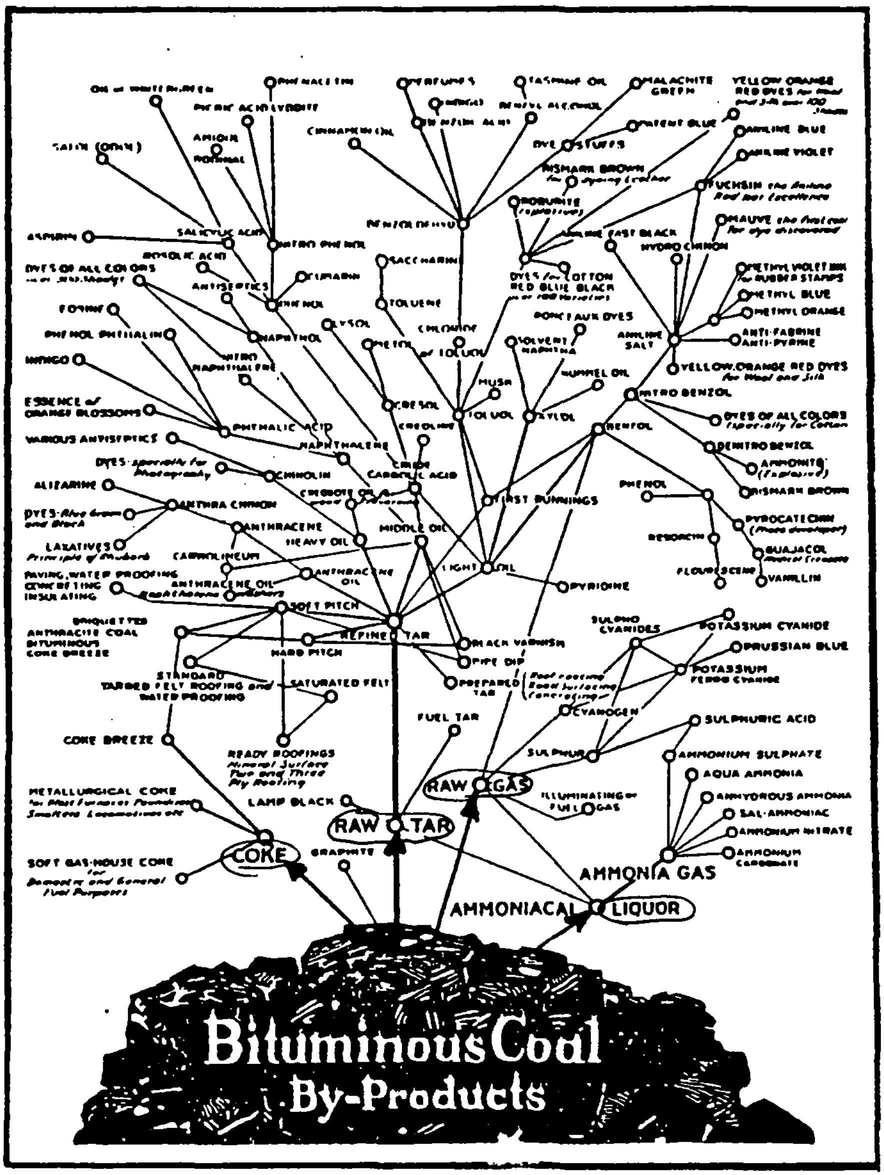
While the described processes did produce coke of various types as by-products, the main purpose of the installations was production of illuminating gas. Tars that were produced by these processes did have economic value for some limited uses, but were not considered a by-product of great economic importance.

As the coal tar based chemical industry began to develop after the Civil War, coal tar began to increase in value as a feedstock. During this period, America's rapidly expanding urban population required a greater production of gas for illumination and industrial purposes. These factors, combined with technological advances in combustion and processing equipment in the highly competitive heavy combustion market led to the development of the large by-product coke oven plants constructed during the end of the nineteenth and first quarter of the twentieth century (Figures 3, 4A & B).

These plants consisted typically of a coke oven battery that produced metallurgical grade coke for resale (Figure 5). The gas produced in the coke ovens was drawn and scrubbed to remove ammonia, light oils, tars, sulfur and other compounds that were economically valuable but not suitable for use in illuminating

FIGURE 3

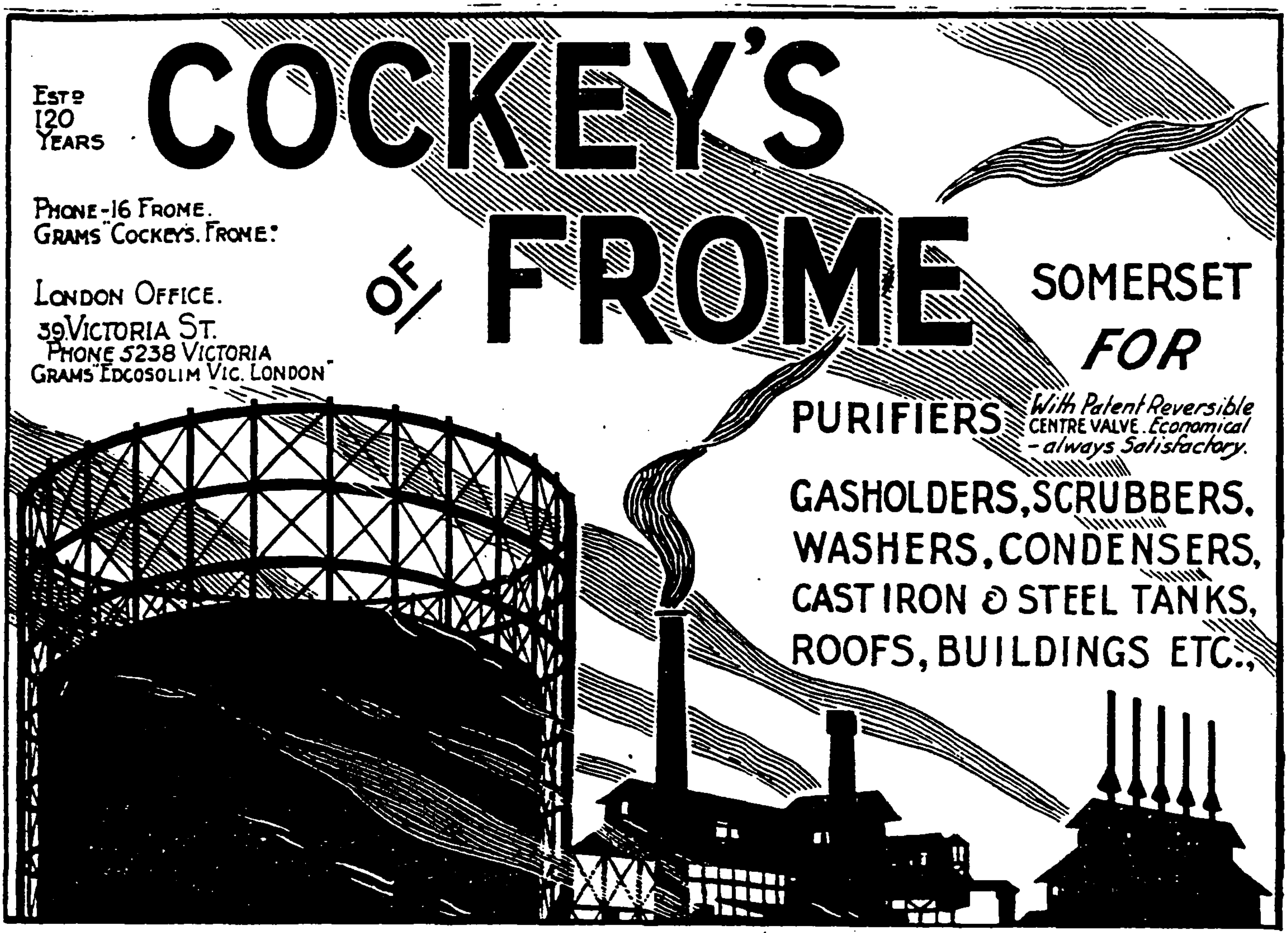
ECONOMIC BY-PRODUCTS



reference 7

FIGURE 4A

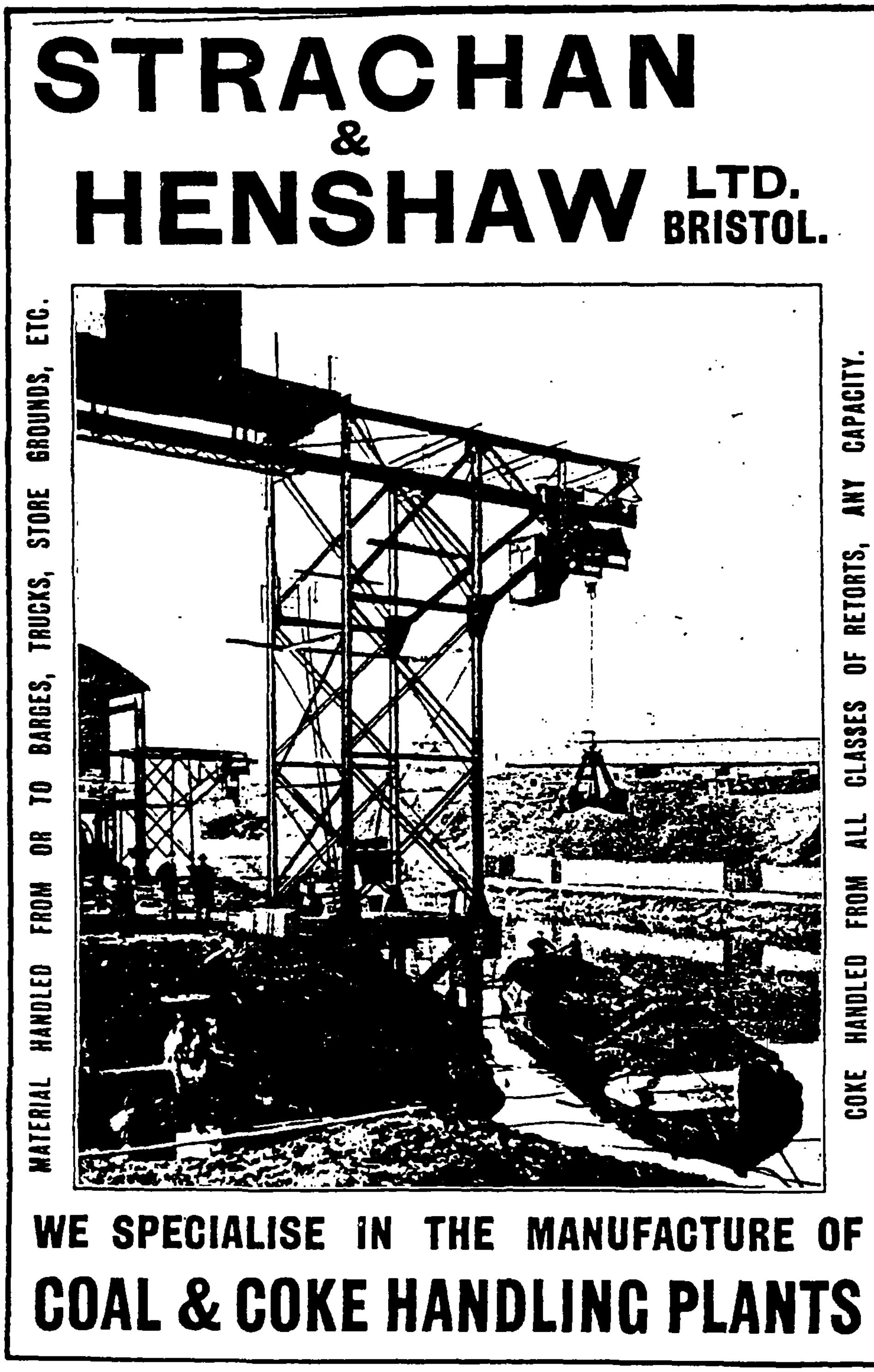
ADVANCES IN TECHNOLOGY



reference 4

FIGURE 4B

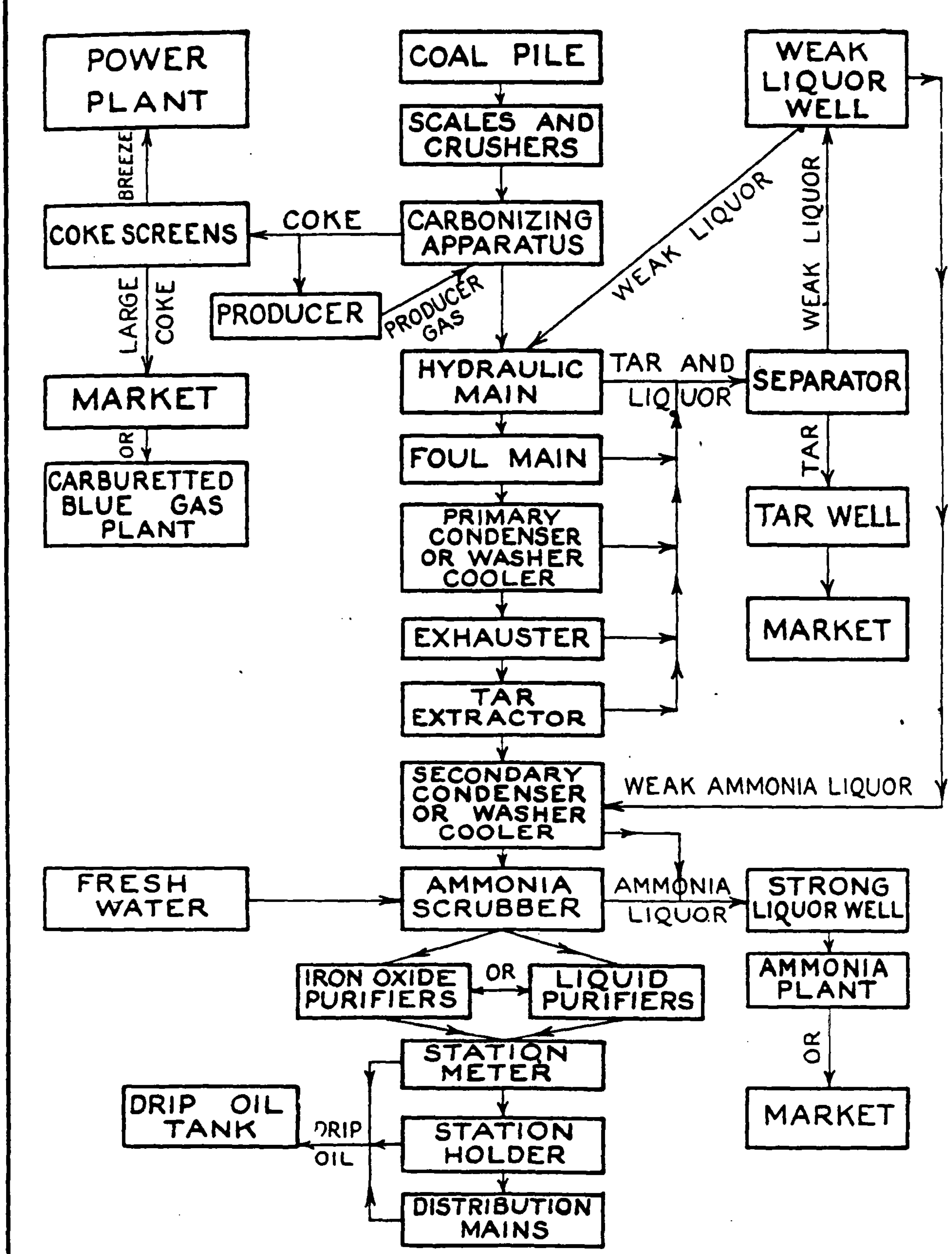
ADVANCES IN TECHNOLOGY



reference 4

FIGURE 5

MATERIAL FLOW SHEET FOR COAL GAS PLANT



reference 6

gas. The scrubbed gas was then distributed by the utility for the usual purposes (Table 5).

Product and Blast Furnace Gas

Coke ovens require a great deal of fuel to provide heat for their operation. Coking facilities not related to gas distribution simply recycled the gas produced during the coking process for fuel. However, since a large percentage of the gases produced are consumed in this way, another means had to be developed to enable the plants to be used for gas distribution. A separate coke or coal based system was developed for this reason and was referred to as producer gas.

Producer gas was of lower Btu content than the other processes mentioned but was sufficient for its intended purpose. In coke plants adjacent to iron and steel plants, blast furnace gas also could be used for underfiring the coke ovens in a similar manner (Table 6).

TABLE 5

TYPICAL ANALYSES OF COKE OVEN GAS

	Volume Percent
Carbon Dioxide	2.0
Illuminants	3.0
Oxygen	0.6
Carbon Monoxide	6.9
Hydrogen	55.0
Methane	27.5
Nitrogen	5.0
Btu/cu.ft. (HHV)	544.0
Specific Gravity	0.38

reference 1

TABLE 6

TYPICAL ANALYSIS OF PRODUCER GAS

	Volume Percent	
	From Coke	From Coal
Carbon Dioxide	5.0	4.0
Illuminants	0.0	0.5
Carbon Monoxide	28.0	28.0
Hydrogen	12.0	14.0
Methane	0.5	3.0
Nitrogen	54.5	50.5
Btu/cu.ft. (HHV)	134.0	178.0
Specific Gravity	0.89	0.86

Reference 1

Oil Gas

A variety of oil gas processes have been developed with their roots in the last quarter of the nineteenth century, and variations are still used in areas isolated from natural gas pipelines (e.g. Hawaii).

While the processes vary, the pyrolosis of an oil feedstock to produce gas is common to all. Modern SNG (Substitute Natural Gas) plants might also be placed in this category, though the modern plants are highly sophisticated, environmentally more compatible, and do not produce tars or the objectionable air pollutants common to the early processes (Table 7).

Oil gas plants were designed to operate on many types of hydrocarbon oils, and produced gases of various Btu content (depending on feedstock). Though oil gas plants were originally confined to the west coast, the process became common in other areas during the early twentieth century when carburetted water gas plants were converted to oil gas for economic and other reasons. Later oil gas processes could produce high Btu gases that were compatable with natural gas. For this reason, oil gas plants continued to operate well into the natural gas era for peak shaving.

TABLE 7

TYPICAL ANALYSES OF OIL GAS

Average quality of gas, (Btu, per cubic foot)	533	537	579
Btu in gas per gallon total oil	62,500	69,245	81,000
	Volume Percent		
Carbon dioxide	1.3	2.8	6.5
Illuminants	4.2	2.7	4.4
Oxygen	0.7	0.1	0.5
Carbon monoxide	8.2	10.6	13.2
Hydrogen	54.0	53.5	45.9
Methane	24.1	27.0	26.2
Nitrogen	7.5	3.3	3.3
Specific Gravity	0.391	0.391	0.533

reference 3

To determine what gas making processes were employed and their location is often not as easy as one would believe.

Many current gas distribution companies are the result of mergers and acquisitions over many decades. Often, records of earlier company purchases have become lost or destroyed. Small manufacturing units may have been razed before a company was purchased, or when larger plants were constructed to consolidate gas manufacture in one location.

While it is often possible to gather general information from company records back to the 1920's or 30's or through the recollections of retirees, information cannot usually be gathered in this manner regarding nineteenth century operations.

Often, the corporate records of property accompanied each company purchase. Also, old business directories list the location of gas plants, as well as other manufacturing concerns. In New York, the Public Service Commission began requiring annual reports during the first decade of the twentieth century. These records clearly list facilities and their output. However, not all states began such reporting requirements at the same time, so the usefulness of these records shall vary by state. Local historical societies often have maps of localities showing land usage, and large facilities were often clearly displayed.

By using business directories and other readily available references, the Radian Corporation was able to assemble a list of manufactured gas plants for USEPA during 1984. Though there were many redundant entries, the information gathered provided a fairly accurate record of the gas plants operated in each state (Reference 2). Even if locations can be established, the type of process, the size of the plant, and other considerations still often must be surmised.

Usually, plants were located along waterways or near railroads due to the large volumes of coal necessary to supply the process. The process used at the plant site can often be deduced by the period, geography and the population density during the time of operation.

BY-PRODUCTS AND WASTES ASSOCIATED WITH GAS MANUFACTURE

(Since the purpose of this paper is to acquaint the reader with an overview of the whole topic of town gas, the substances of environmental concern shall be discussed and identified in very general terms. References are listed at the end of this paper for those who wish more detailed information.)

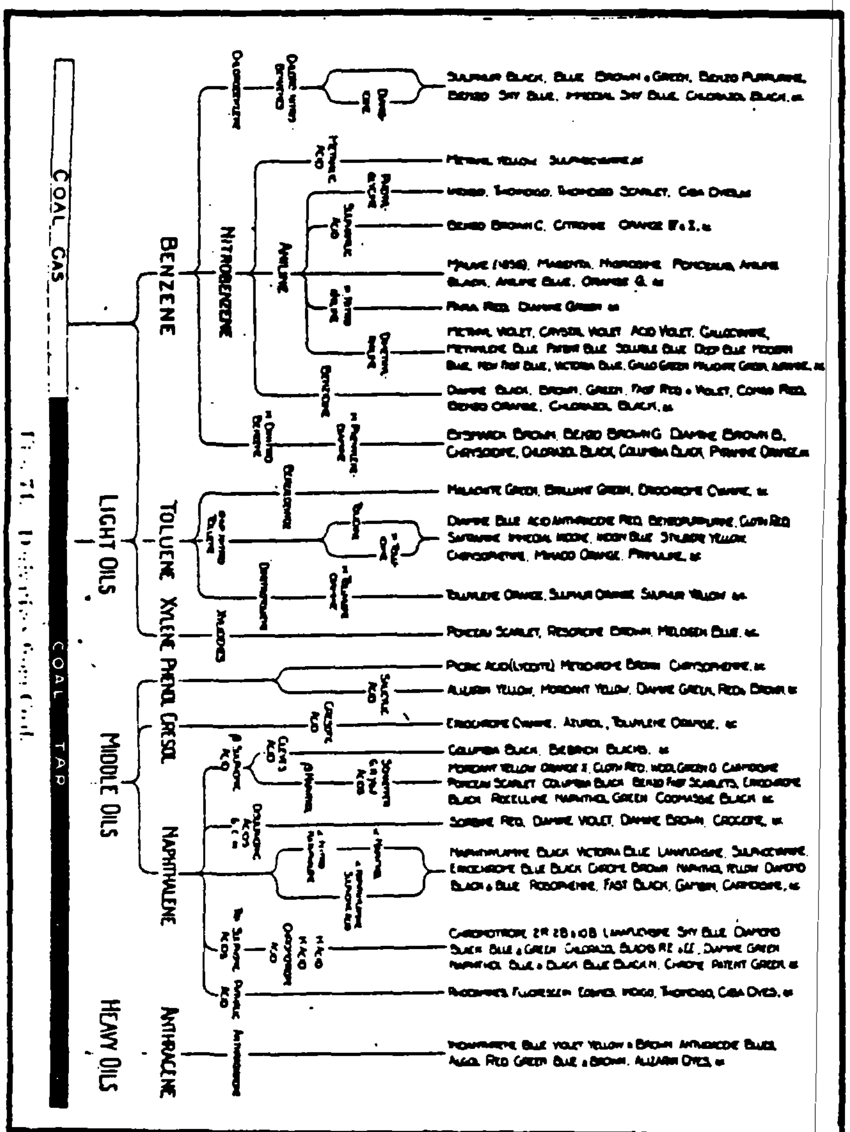
Though one may not know the exact type of plant that was operated, the constituents of the coal tars generated are similar in many ways.

Tars were produced by all processes, though their density varied by process (coke oven tars have a higher specific gravity than those produced by carburetted water gas), as did some of their constituents (carburetted water gas tars contain less phenolics than coke oven tar). Understandably, oil gas tars were more similar to modern petroleum based tars than coal based tars.

Aside from the heavy tars, there was a range of lighter fractions and sludges (Figure 6). Most of these fractions contain Polynuclear Aromatic Hydrocarbons (PAH) and Light Aromatics. PAH's are both naturally occurring and produced by

FIGURE 6

BY-PRODUCTS AND FRACTIONS



reference 3

industrial activity. Some of these substances are suspected of being carcinogenic to humans (Table 8). One light aromatic is also thought to be carcinogenic, and others can be injurious through inhalation or skin contact (Table 9).

Oxide wastes from purifier boxes are a characteristic bluish color. The color is derived from ferrocyanide. Iron oxide was often mixed with wood chips and used to scrub H_2S from the gas (Figure 7). After the oxide was saturated, it was regenerated by contact with air. After a number of cycles, the oxide would be discarded off site, or by surface dumping on location. Other wastes produced were various waste liquors, certain heavy metals, lamp black, clinker, cinders and ash. Years of weathering will have neutralized many of the waste liquors. Most of the heavy metals were the result of corrosion control, caulking of cast iron mains, and other processes not directly related to the combustion of coal and coke (Table 10). Ash and cinders are present for obvious reasons, and would be found in soil layers of any site used for coal based industry.

TABLE 8

SELECTED TYPICAL COAL TAR COMPONENTS

POLYNUCLEAR AROMATIC HYDROCARBONS (PAH)		
COMPONENT	FORMULA	SUSPECTED ANIMAL CARCINOGEN
Fluorene	$C_{13}H_{10}$	-
Anthracene	$C_{14}H_{10}$	-
Phenanthrene	$C_{14}H_{10}$	-
Fluoranthene	$C_{16}H_{10}$	-
Pyrene	$C_{16}H_{10}$	-
Chrysene	$C_{18}H_{12}$	+
Benz (a) anthracene	$C_{18}H_{12}$	+
Benzo (j) fluoranthene	$C_{20}H_{12}$	+
Benzo (a) pyrene	$C_{20}H_{12}$	+
Benzo (g,h,i) perylene	$C_{22}H_{12}$	+
Di benz (a,h) anthracene	$C_{22}H_{14}$	+

reference 1

TABLE 9

SELECTED VOLATILES

(Light Aromatics)

COMPOUND	FORMULA	SUSPECTED ANIMAL CARCINOGEN	EFFECTS ON HUMAN HEALTH
Benzene	C_6H_6	+	Damages blood systems (leukemia, etc.) Headache, nausea
Toluene Xylene	C_7H_8 C_8H_{10}	- -	Above 100-200 ppm in air: Impairs CNS,* Poor coordination, Weakness, Nausea
Ethylbenzene	C_8H_{10}	-	Irritant to Respiratory System & Skin

*Central Nervous System

Reference 1

FIGURE 7

PURIFIER BOX

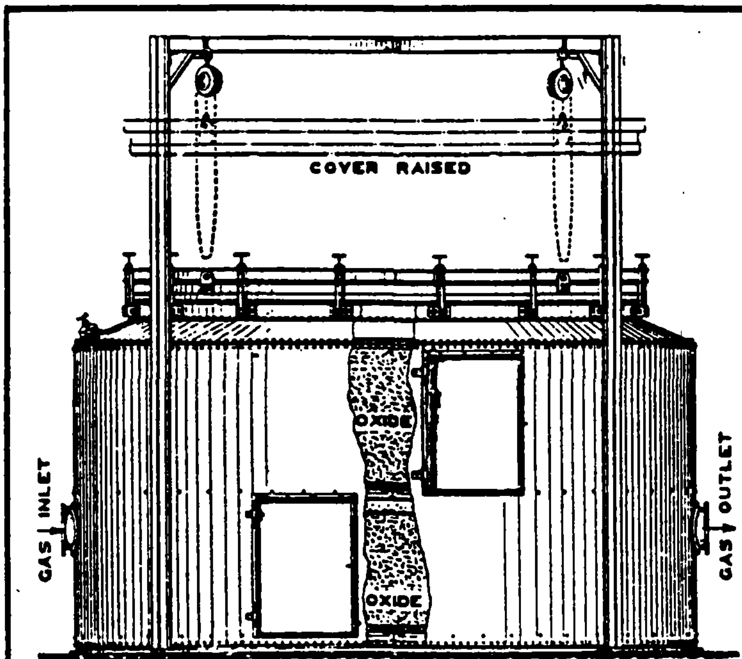


FIG. 69.—Round purifying box.

reference 4

TABLE 10

TRACE METALS

USEPA PRIORITY POLLUTANTS	LIKELY AT TOWN GAS SITES	SELECTED CRITERIA USEPA "RED BOOK" FOR DRINKING WATER (mg/l)
Antimony	-	
Arsenic	X	0.05
Beryllium	-	
Cadmium	-	
Chromium	X	0.05
Copper	X	1.00
Lead	X	0.05
Mercury	-	
Nickel	X	-
Selenium	-	
Silver	-	
Thallium	-	
Zinc	X	5.0

reference 1

ENVIRONMENTAL IMPACTS

Some of the substances associated with town gas are of concern due to potential human contact. Others can impact aquatic species and affect water quality. Some of the concern over old plant sites has centered around those locations that are currently parks. It is believed that PAH or light aromatics such as benzene or xylene in the soil might come into contact with the population through touch or respiration. Concern also exists regarding contamination of ground or surface waters through migration. Media attention has been drawn to old plant sites in a number of locations due to such substances traced back to plant sites after they had been found in streams and rivers. Two such sites (both parks) had been closed for investigation in the last two years, one in New Jersey and one in Washington state. Other companies in various parts of the country have been forced to take remedial action when coal tar based substances have been encountered at or near their old sites during construction.

A number of corporations have developed limited testing programs as a result of the media attention and public concern. Some have found tars or PAH in the soils, but a similar number have found no tar layers and only background levels of PAH and aromatics that could be attributed to any coal based industrial site. Some sites have been found that have the blue ferrocyanide salts on the surface from the oxide purifier boxes, but others had none. This may be due to the use of more advanced liquid scrubbing units employed in later plants, or it may be the result of the thorough removal of all materials at the time of closure.

All these concerns do not automatically relate to each of the 1500 plus plant sites that have been identified. Three factors make each site unique: location (demography and geography) geology (soil characteristics, water table), and closure (how materials were removed, how the plant was razed, etc.).

As mentioned, the greatest concerns regarding old gas plant sites are migration of material, and possible direct contact.

Migration is dependent upon the soil geology, groundwater patterns, and the types of material present on a particular site. Tar residues often form waterproof impermeable barriers and are not likely to migrate. Clayey or impervious soils also greatly reduce migration. Lighter fractions have greater mobility and are more likely to migrate when subjected to groundwater flow. Plant sites near waterways or in areas with high or fluctuating water tables are more likely to affect water quality than other locations.

Sites that are parks or open areas in densely populated locations may attract more attention and a greater possibility of contact with substances present than a site that has been redeveloped or is in an isolated area.

Not all old gas plant sites are considered environmental health threats. Sites that have required mitigation were those that have created a direct impact or revealed materials of concern during construction or other activities.

Whether sites that contain buried non-migrating tars or other materials are an immediate threat to the environment is debated currently. However, information from those sites that have been studied is being evaluated by various researchers to determine what actions are required for gas plant sites in general.

REGULATORY CONCERNS

CERCLA

The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA or Superfund) is the statute of most concern regarding the town gas issue. The purpose of this act was to establish a program to list those abandoned national sites that needed remedial action and establish a mechanism to proceed with mitigation and assign liability. CERCLA requires notice of "release" of "hazardous substances", and authorizes the federal government to respond to those releases. It establishes two funds to pay for the cleanup if no responsible party can be found, or if they are financially unable to pay for the cleanup. CERCLA also establishes joint and several liability for past owners of the site where the release occurs.

Definitions

Release - "...any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment." - CERCLA Section 101 (22) (There are several very specific exemptions to this definition.)

Hazardous Substance - CERCLA cites (Section 101 (14)) the federal statutes that contain listings or criteria for hazardous wastes. CERCLA brings all former statutory listings under one umbrella. Therefore, a substance is hazardous if:

- listed as hazardous or meets the Resource Conservation and Recovery Act (RCRA) hazardous criteria (RCRA Section 3001)

- any toxic pollutant listed under the Clean Water Act (CWA) (Section 307 (a)) or is designated as hazardous (Section 311 (b)(2)(A))

- any hazardous air pollutant listed under Section 112 of the Clean Air Act (CAA)

- A hazardous Substance listed under Section 7 of the Toxic Substances Control Act (TSCA)

CERCLA requires the notification of all releases involving reportable quantities. However, until 40 CFR Parts 117 and 302 (Final Rule) appeared in the Federal Register on April 4, 1985, no time based reportable quantities existed. While the reportable quantity regulations are complex, they attempt to make the reportable quantities more reasonable (e.g. one pound per twenty-four hours vs. one pound with unspecified time period).

While CERCLA does require notification of reportable quantities, such a report does not trigger the liability section of the statute. The purpose of the notification is to alert the government to a particular situation, and the government reserves the right whether to respond or not.

Section 103(C) of Superfund contains the reporting requirement that present or past owners of sites that have (or suspect) hazardous wastes disposed or stored on them had to notify USEPA by June 9, 1981 of the site's location and what materials are (or thought to be) present.

Since coal tars and other gas manufacturing wastes contain materials listed in the statutes and regulations cited above, approximately half of the gas distribution companies notified the USEPA of their old plant sites. The USEPA used the information provided on all 103(c) notifications and other sources to assemble the National Priority list authorized by CERCLA Section 105(g). This list currently contains over 600 sites that USEPA considers to require immediate action. Of those 600 plus sites two are old gas manufactories, one in Vermont, and one in Pennsylvania.

USEPA has begun investigation or actual remediation at approximately 400 of the priority sites. USEPA is authorized to use the monies from the taxes on petroleum and chemical feedstocks and on hazardous waste disposal (the superfund) to pay for these activities if no other means of payment (previous owners or disposers) is available immediately. However, the government intends to eventually recover these costs from the responsible parties.

The liability for the cleanup costs affects all parties involved in a particular site. Those parties may include generators, transporters, owners, or anyone else involved in getting the material to the site, using the materials at the site, or operating the site. The maximum liability for cleanup costs under CERCLA is capped at $50 million in damages over the actual costs of cleanup. This cap shall be removed if the responsible parties willfully caused the situation or fail to cooperate with USEPA's cleanup efforts. If a party is ordered to remediate a particular site and does not comply, punative damages equal to three times the remediation costs can be added plus a daily fine of $5000.

CERCLA also introduces the concept of "joint and several liability." For example, let's assume your company had a waste hauler remove for disposal fifty drums of a material that was not regulated at the time (1956 for example). It is now 1985 and an abandoned landfill has been discovered that contains 10,000 barrels of hazardous substances (including those you disposed in 1956) as defined by the statutes previously discussed. Only fifty of the 10,000 barrels have an identifiable label, and that lable clearly states your company name and address. You are now an identified generator, and if no other responsible parties are found, your company can theoretically be financially liabile for the remediation of the whole site.

The concept of joint and several liability is one of the most hotly debated aspects of CERCLA, and can be devastating to companies that innocently purchase land, other companies, or facilities and inherit associated sites that may come under the CERCLA process.

RCRA

The Resource Conservation and Recovery Act (RCRA) and its regulations (40 CFR 260-265) regulate the generation, storage, and disposal of defined hazardous wastes. While these regulations only cover activities occurring on or after November 19, 1980, certain activities regarding old gas plant sites could come under RCRA.

For example, if Company X decided to test an old plant site, found tars and other substances that were regulated, and decided to clean the site, the excavation, storage, transportation, and disposal of the materials would be regulated by RCRA.

RCRA regulations are complex, and entail separate requirements for generators, transporters, and disposers. All materials have to be handled in compliance with the regulations and all parties must have USEPA identification numbers. All materials have to be transported under uniform manifest by USEPA approved transporters to USEPA approved disposal facilities. Throughout the RCRA process, the generator (or party disposing of the wastes) maintains responsibility for its handling, and has ultimate responsibility for its disposal.

RCRA establishes both civil and criminal penalties for non-compliance. Fines can range up to $50,000 per day for noncompliance and officers of corporations who deliberately fail to comply with the regulations can be subject to separate criminal prosecution.

The Clean Water ACT (CWA)

The spill of oil or "harmful quantities" of hazardous substances into the navigable waterways of the United States is covered by the CWA. Superfund monies can also be used to mitigate a release under CWA. Operators of a facility causing such a spill are liable up to $50 million in cleanup ccsts, and this cap is waived in cases of willful negligence or misconduct. Civil and criminal fines are similar to CERCLA.

In addition to this complex web of federal statutes and regulations, there are similar regulatory instruments on the state level. Many states have their own versions of RCRA and CERCLA. In many cases, the USEPA will defer enforcement of the federal regulations to state agencies whose own regulations have met federal criteria and been approved. State regulations must be considered as equal in importance to the federal, and often have more stringent criteria than the federal.

DISCUSSION AND CONCLUSION

Town gas is obviously a very complex issue. The technical questions regarding what constitutes a release from an old manufacturing plant, what the general environmental impacts involved are, and what health risks to general population exist from these plant sites have not been fully addressed.

Though there have been a number of old plant sites around the country that have required remedial action, USEPA has not considered the sites a primary environmental concern, or added additional plant sites to the two on the National Priority List. Those plants that have required cleanup or mitigation have been handled by the state regulatory authorities. Though media coverage of the individual sites has been extensive, no intensive national coverage has occurred. This may be due to the level of cooperation on the local levels, and the general belief that these plant sites do not offer as great a threat as closed facility sites used for other industrial purposes.

However, it is obvious that interest in this subject is increasing. USEPA has published a listing of all identifiable manufactured gas plant sites and their locations. Some state and city level agencies have begun their own investigation into the town gas issue.

It is in the best interest of each company to have as much information on its old plant sites as possible. It is also in each company's best interest to understand the statutes and regulations associated with the topic. Though each plant site is unique, a full understanding of all legal, technical, and regulatory questions involved is necessary to understand what liabilities, if any, exist.

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