

Geological-remedial observations on the former manufactured gas plants and other coal-tar sites of Australia

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ABSTRACT: Hatheway has tracked the existence and operational history of former manufactured gas plants (FMGPs) around the world, for the past twenty years. His methodology has been to review all manner of historic technical evidence, including the formal and gray literatures, press accounts and historic maps. He attempts to characterize Australian gas history with a focus on what is critical to competent remedial planning and design.

Australia's manufactured gas history presents some expected trends, useful in remedial planning. As with all other worldwide locations, Australian gasworks and other coal-tar sites are best field-characterized by qualified geologists.

Notable features of Australian gas-manufacturing history:

- An early discovery of gas coal (early 1830s), then oil shale (early 1890s), both also exported
- A greater overall affinity to coal-gas generation than to water gas, carbureted water gas or oil gas production
- Australia has had a greater degree of municipal gasworks ownership than in America or in Canada, but far less than was the case in the UK
- Modern FMGP remediation closely parallels the American experience and current mode of actions carried on mainly by State environmental Agencies
- Gasworks cleanups, relatively speaking, are prosecuted at about the same general level of activity as in the United States, which is greater than in Canada and considerably different than in the UK
- Australians are reasonably well informed about FMGP human and environmental threats; about equal to their counterparts in the U.S., but better informed than the average citizen of either the UK or of Canada
- Australian environmental authorities regularly look to the utility industry for funding of FMGP cleanups

The author's tabulation of known Australian gasworks and other coal-tar sites is appended.

1 INTRODUCTION

Former manufactured gas plants (FMGPs) and other coal-tar sites have been the center of environmental remedial attention in the developed world since the arrival of the so-called "environmental era," generally accorded to be 1970. It is a proven fact that the residuals and wastes of gas manufacturing are not only major threats (toxicity and carcinogenicity) to human life, but that their physical and chemical properties are largely environmentally non-degradable and also capable of contaminant transport by ground water and by surface water. As the notion of a "forever" nature of public health and environmental threats spreads, it is paramount to the calling of the professions of the applied geosciences to maintain a prominent voice in the efforts to locate, characterize and remediate these coal-tar sites. There is an overall, worldwide need to codify the particular histories of coal-tar generation, by region

and place, along with lessons learned relative to mitigating coal-tar environmental threats. The author has found that there exists a deplorable worldwide absence of cataloging coal-tar sites, nationally, or by State, Province or Department. In fact, no such effort is known to the author, who has made this matter a personal research and practice endeavor since 1988.

Though the author is by no means an expert on Australian industrial history, this paper is offered as an expression of his interest in furthering a necessary worldwide effort to better understand the general nature of the coal-tar threats, here and there, geographically, so that practitioners and public officials, alike, will better understand the generalities and imperatives that should be recognized about FMGPs and other coal-tar sites. By way of this paper, it is hoped that the applied geosciences will continue to maintain a dominant role in environmental remediation of toxic compounds associated with coal carbonization and with its by-product industries.

The paper has not been written particularly for the Australian audience, rather it is a statement about the desirability of collecting and presenting information useful for the worldwide application of good science and good engineering in the mitigation of the well-known human-health and environmental threats represented by the residuals and wastes of the manufactured gas industry and its allied industries.

2 GAS MANUFACTURING PROCESSES EMPLOYED IN AUSTRALIA

Clearly, Australia, from the beginning of the manufactured gas industry, was blessed with the essential physical ingredients for generation, clarification and purification of manufactured gas and the historic development of the industry closely paralleled that of other developed nations.

2.1 *Coal gas*

The geography of Australia was wholly amenable to the gathering and shipment of its abundant coal resources, and those resources constituted what was necessary to produce suitable illuminating, heating and fuel gas by the traditional coal-gas retorting methods. Australia was receptive to the importation of the various improved methods of coal-gas carbonization, represented chiefly by inclined and vertical retorts, and it would seem that the coal-gas operators never were overwhelmed by the opposing electric power industry, at least during the normal worldwide lifetime of manufactured gas.

2.2 *Gas from wood & other organic material*

Every national experience, in its early years, was subject to the discovery that wood or various other carbon-containing organic material could be carbonized and release illuminating gas. For Australia, it appears that perhaps the earliest such discovery was that of 1849, when Perth pioneer Alfred Carson, lit his home with retorted *Xanthorrhoea* (*grass tree*) wood gas, stored in bullock's bladders. In the next decade, one Henry Courtis is said to have supplied Bath's Hotel at Ballarat (Vic.) with illuminating gas in 1857, shortly before the town's gas works was established. As with other countries, reliance on wood and other organic feedstocks barely survived the first couple of decades of manufactured gas in Australia.

2.3 *Oil-shale and illuminating-oil gas*

The natural outcome of the oil-shale and kerosene rush of 1865–1875 was the discovery, at the beginning of the rush, that the various oil-shale members of the Mt. Kembla fields were rich enough to manufacture of gas with superior candle-power illumination. In fact, where coal was cheaper, on account of transportation costs, Australian gas works often used, as did those of New Zealand and west coast America, the shales for enrichment, to boost candle power of inferior (non-cannel) coals. Australian oil shales were in high demand in California and often sold on the FOB (Freight on Board) spot market as the incoming clipper ship arrived. Throughout

most of Australia's gas manufacturing history, it appears that shale-oil was the early feedstock for oil gas as well as oil-shale gas and enrichment of coal gas. This is an important worldwide anomaly, perhaps separating the Australian experience from the usual trends of the industry.

2.4 *Carburetted Water Gas (CWG)*

Carburetted Water Gas was perfected by the American gas inventor, "Professor" T.S.C. Lowe, from 1873–1875. Lowe's patents were bought by the world's first industrial holding company, the United Gas Improvement Co. (UGI), of Philadelphia, in 1882, and were dramatically marketed in America. UGI penetrated the British market in the early 1890s, just as the Lowe patents were expiring and virtually all the gas equipment makers were offering the "sets." The advantages of CWG were many-fold, but mainly for non-illumination, fuel-gas use and production costs were dramatically reduced on account of lower labor requirements.

It is likely that CWG was adopted in the larger Australian gasworks, beginning about 1900. A clear indication of adoption is believed to be the 1924 reconstruction of one of the gas plants at Geelong. For purposes of remediation, it is well to remember that CWG tar generally was more fluid than that of coal-gas plants, that its mass spectrophotometric fingerprint is diagnostically different from that of coal-gas or, for that matter, other major manufactured gas processes.

Additionally, the unwanted phenomenon of *tar-water emulsions* systematically plagued most CWG plants, worldwide, generally after about 1910, when gas-works light oils became valuable for automobile fuel and after 1914, with the advent of the war in Europe, a time at which coke (the ideal CWG generator feedstock) became dear in price and short in supply. Consequently, Australian gas works that have employed CWG production should be suspect for site and site-area dumping of tar-water emulsions which were quite difficult and expensive to dehydrate, and thus basically unwanted by the tar distillers, and, as well, difficult to burn as retort and boiler fuel at the gas plants.

2.5 *Oil-enriched water gas*

This is the widest category of gas-manufacturing processes, and the various patented processes fought for regional supremacy elsewhere in the world, most intensely for the patent life of T. S.C. Lowe's American Carburetted Water Gas (CWG) process, dating from 1873–1875, and expiring in 1890–1892. Australia seems to have been largely untouched by these promotions.

2.6 *Oil gas*

Gas manufactured from various oils presents another wide variance in time and process. Shortly after (by 1820) the introduction of coal-gas in Great Britain, it was proven, around the world, that all manner of animal and mineral oils can be used as successful illuminating gas feedstock. Thus it would be expected that some evidence of Australian oil-gas plants will eventually appear. Oil gas made a return, on the world stage, toward the end of the 19th century, most prominently in California, where it expanded to the entire Pacific Coast, and led to widespread use after WW II.

Present information discloses that oil gas processes were employed on Australia's railroads, beginning in the 1880s, though it is not apparent to this author yet what named processes were employed. As well, at the end of WW II, the first Australian offshore oil was discovered off Western Australia and this source was employed by the State Electricity Commission to produce heating and cooking gas, at Fremantle.

2.7 *Railway oil gas*

Railway-carriage gas lighting came to Australia in the late 1870s, relatively early, on the worldwide scene, about as early as known in its perfected region of development, Germany. Oil gas, worldwide was dominated by the Pintsch process of Germany, and this may have become dominant in Australia as well. Oil gas was preferred for railway carriage use on account of

the need for portability of the supply and the incidental high illuminating power characteristic of oil gas. According to Longworth (2003), the gas was stored and transported in specialized traveling gas-reservoir tank wagons and, were needed for station and division rail depot use, served as down-sources for stationary gas holders. It is perceived that the gas utilized in carriage lamps was stored under pressure within each of the oil-lit carriages. Remediation concerns for railway oil-gas plants should consider that the manufacture required the usual purification and that the usual tar residuals were created, and often not of particular value as salable by-products. Railway oil-gas manufacturing plants had small footprints, usually less than 0.1 ha.; depot and station gas reservoir sites should not prove to have environmental contamination, as the gas is believed generally to have been dry of light oils and its storage should not have involved the water-seal pit tanks common to pre-1900 gasholders, world-wide.

2.8 *Blaugas; general purpose “bottled” oil gas*

Blaugas was a highly successful, early 20th century German expansion on their Pintsch railway oil-gas technology. So compact and efficient were the Pintsch arrangements, that a broader expansion was made via Blau gas, and the convenience in handling and distribution made for ready acceptance in any rural area with the requisite economy to afford the expensive bottled gas.

2.9 *Acetylene & “gasolene” gas plants*

Both types of plants are distinctly different in technology, but, for environmental threat and remediation purposes, both essentially are benign in terms of wastes produced.

“Gasolene” gas plants are the older of the technologies, relying on use of the volatile light oil residuals of gas-manufacture, as well as those of petroleum refining. Both types of light oils began to appear about as soon as hydrocarbon distillation was developed, in the late 1850s. The technology spread internationally, mainly in the printed media, journals, and books. The origin of the “light oils” was virtually inconsequential, be it gas works or petroleum refining (note, this does not include the hydrocarbon “cracking” technologies that appeared directly following WWI. All that was required was a means of vaporizing the light oil and piping the vapor, as a lighter-than-air gas or under minimal distribution pressure, to the lights supplied by a single generator. The entire system seldom served more than one building, and the generator typically was kept in an underground bunker some 15 m. laterally-clear of the structure to be lit. The only wastes generated were small amounts of carbon powder.

Acetylene gas plants operated from water allowed to drip into a canister of calcium carbide, thus producing the acetylene gas, which had a significantly higher candle power than that of any of the traditional artificial gases (save, of course Pintsch and other specialty oil gases). An acetylene gas plant could be served by one operator, and that on a part-time basis. The plant could be sized to accommodate multiples of gas-lights, generally running at 50, 100, 150, and so forth. The sole residue as the spent calcium carbide, forming a moist, gray, lumpy, non-toxic mass that was disposed by dumping.

Neither Gasolene nor Acetylene gas lighting was affordable for the average common person, and, as such, such plants, though numerous, are to be found in more affluent suburbs and in rural towns and crossroads where the economy was suitable to support a cost of several times that of gas lighting. The author prefers to log and record the presence of these gas plants, for the main purpose that most of them bore innocuous “Gas Plant” names, and non-attention to their discovery and recording leads to future confusion as to a seemingly potential toxic threat associated with the descriptive name.

2.10 *Producer gas*

Producer gas plants came into being in the 1890s, world wide, as offering economical fuel gas for powering producer-gas industrial engines of an near-endless array of applications, from factory work to powering well-field water supply pumps. Producer gas plants produced PAH tars and generally required some degree of purification, so as not to stifle the operation of

the powered engines. Currently, introduction of producer gas plants in Australia is known at various Bendigo (Vic.) gold mines, in 1910. Producer gas plants came in two varieties, *pressure* and *suction*. The first type required installation of a small gas holder (generally less than 10,000 cf, and with above-ground water-seal tank), and the suction type were designed to provide gas manufactured at the rate of sensed demand from the powered gas engines.

2.11 *Non-recovery coke*

Much of Australia's coke has been produced by non-recovery methods, negating production of gas and capture of the tar oils. Whereas elsewhere in the developed world, the economics of the loss of potential by-product residuals has been an important economic consideration, Australia's particular world-regional geography has continued to support the value of this production method. Non-recovery sites, however, in consideration of pre-environmental-era operational technology, present concerns for PAH sequestration in and around the quench areas and at sites where quench water is saved for cooling and re-use. Where discharged directly to the environment, non-recovery sites have potential for sediment capture of fugitive PAH contamination.

2.12 *Coke oven gas*

In general, Australian coal appears historically to have been more favorable for gas production (*cannel* varieties) than routinely appropriate for production of valuable metallurgical and foundry-grade coke. Therefore, as of this writing, it would appear that Australia's potential for development of utility and merchant-type by-product coke ovens was naturally restrained by the nature of Australian coals. Surely, there has been a post-WWII development of coking, but such does not seem to have been driven by the usual economics of coke production for the value-sake of town gas production to cover the basic cost of operation. This may prove to have been an Australian national departure from the worldwide norm, and based, therein on the coking quality of coal produced prior to WWII.

2.13 *Creosote-based wood-preservation plants*

One of the prime by-product uses for the residual tars generated from coal-carbonization plants always has been for creation of wood preservatives generally known as *creosote*. Creosote compounds have no standard formulation chemical identity other than being a basic mixture of PAH tar oils prepared to meet viscosity requirements for use, some of which have been set to general physical-property standards by the wood-preservation chemical industry. The industry still produces the preservative compounds and wood treatment plants yet survive, some of which continue to make use of the creosotes. Generally speaking the handling and application of creosote lead to near-certain environmental contamination of every site so associated with the compounds.

3 GENERAL CHRONOLOGY OF GENERIC GAS DEVELOPMENT IN AUSTRALIA

In dealing with coal-tar sites in general, it is most helpful for key workers and administrators to discover and grasp the significance of what appear to be driving forces that eventually became the greater historic controls over the modern environmental problems. The following is the author's appreciation of the dominant historic Australian conditions (Table 1).

3.1 *c. 1807: Coal discovered at coalcliff, NSW*

This natural resource discover came at just the time that town gas was becoming a true cause of entrepreneurial interest, worldwide. Due to a general lack of local financing for

Table 1. Summary of known and strongly-suspected (2010) Australian coal-tar sites (All States).

Type	Number	Remedial implication
Towne gas plants	147	Expect to encounter another 10–15 percent by number
Coke oven plants (All Types)	16	Counts only the Plant, not individual ovens, generally ranging upward of 50, in increments of 50, to maxima of 200 ovens
Producer gas plants	24	None now listed directly by the State Agencies
Acetylene gas plants	2	None now listed; not generally an environmental concern
Oil-shale distilleries	7	None now listed; probably number at 100–200 sites nationally
Tar distilleries	0	None now listed; probably number at 25–50 sites nationally
Tar by-product plants	0	None now listed; probably number at 50–75 sites nationally
Gas works dumps	3	Known & listed, but not declared yet as “dumps;” this number can be expected to reach more than one per towne gas plant
Total	199	

private-sector gasworks, a half century of inactivity in gas manufacturing ensued, while the Australian coal industry came into being.

3.2 1845–1865: Establishment of the Australian coal industry

Not only was gas coal (cannel) discovered in the newly developed Australian coalfields, but so was keragenous (oil-rich) shale. Together, the coal and the oil-shale meant that illuminating gas of sufficient candle power could be generated wherever the economics of investment and transport could put the gas feedstock on the ground. The final outcome, of course, is that the State of New South Wales now experiences the most profound of the coal-tar remediation challenges.

3.3 1865–1875: Oil-shale & kerosene rush, NSW

This appears to have been a critical time, in which the general populace was given a source of light at a demonstrably affordable price, discounting the heavy burden of ocean freight for the commodity.

3.4 1880: The municipal movement

This is an interesting phenomenon, for it was a variant of the very dominant English trend to corporate ownership, itself facilitated by the UK Gas Act of 1871, in which cities and towns could move toward purchase of the existing gas enterprise without the considerable expense and time then required for a Parliamentary Act. In fact, in Australia, the municipal move virtually cancelled the alternative “Consolidation” movement experienced in at the same time in North America.

3.5 1888: Producer gas plants and gas engines

As a result of German, English and French experimentation, a grand advance was made through development of small-footprint factory gasworks capable of making low-Btu, non-illuminating fuel gas, at the very site of power-application need. With the producer gas plants came the ultimate using devise, the producer gas engine. These engines began to appear in NSW in 1888 (EnergyAustralia, 2004, p. 1) and it would be wide to that eventually thousand or more of these industrial gas plants were operated. Fortunately, though generators of the usual gasworks contaminants, producer gas plants generally prove to have more concentrated hot-spots of toxics. In fact, due to their presently low profile of remediation recognition, their contaminants, leaked, spilled, or dumped, may be overlooked and thus remain threats to public health and the environment.

3.6 1895: Carburetted water gas appears in Australia

The technological theme of separating ordinary water into two fuel gases (hydrogen and carbon monoxide) was a worldwide enticer of bright minds, from about 1860. America's uneducated technical genius, Thaddeus Lowe was able to secure the basic improvements in the theme, with his carburetted water gas process, patented 1873–1875, but the presence of the nominally toxic CO was a major obstacle in exportation of CWG technology overseas. The patent owners (from 1882), the United Gas Improvement Co. (UGI, Philadelphia) made the jump, by sending its convincing agents to Britain, where the process became well accepted, but only after 1900.

3.7 1884–1924: General first phase of Australian coke oven activity

Where coal and industry have come together, worldwide, soon the notion of conversion of coal to its lighter-weight and fuel-superior by-product, coke, soon surfaces. The coalfields of New South Wales and Queensland should be regarded as having hundreds of sites of “beehive” (non-recovery of gas or tars) ovens, which eventually should be investigated for their typical form of contamination, the results of quench-water use and management.

3.8 1915–1930: Second influx of Carburetted Water Gas plant construction

Carburetted water gas appears to have made its most lasting Australian impact as a result of the stringent labor demands and economics of the First World War. CWG had the outstanding advantages of:

1. large generating capacities for footprint;
2. low demand for attending labor;
3. fueled by the coke by-product of coal-gas retorts, and;
4. the ability (unlike coal-gas retorts and gas-capturing by-product coke ovens) of stop-and-start without damage).

In fact, worldwide, CWG plants were so successful that coal-gas slowly receded in its overall contribution, after 1915. There was, however, an ugly environmental detriment associated with CWG plants; the generation of valueless tar-water emulsions, when soft coal was substituted for coke and/or crude or other heavy oil substituted for the essential light tar-oil carbureting fluids. This fact is lost on many FMGP remediation teams.

3.9 1915: Continuous vertical retorts appear in Australia

In their efforts to improve the efficiency of coal carbonization, the Germans took up the notion of moving coal through retorts under the influence of gravity. The main forms are the inclined and vertical “ovens,” and the ultimate varieties were termed “continuous,” as they could release incremental batches of coke and also be recharged with coal, without the usual high activity of attending labor. Furthermore, the ultimate designs also discharged accumulated ash. The highest form of development were British, and we have some evidence of continuous vertical retort installations in Australia.

3.10 WWII: Emergency resurgence of Australian beehive coking

Beehive coking could be carried on without skilled labor, and there was a natural return to these multi-unit plants, as well as to Australia's traditional charcoal industry, as a wartime measure.

3.11 1945–1970: General second phase (by-product recovery) of Australian coking

Information gathered by the author points to a significant, yet poorly characterized, Australian “by-product” coke industry, whereby coal is converted to the always (even today) salable, smokeless metallurgical and foundry fuel, as well as the capture of the volatile content of the coal, as gas, tar, and light tar oils.

3.12 *1961–2002: Arrival of natural gas; in Queensland*

The world woke up to offshore natural gas in the 1960s, and from this time forward, Australia's generation of environmentally detrimental coal-tar and other toxic gas-manufacturing residuals and wastes diminished rapidly, to a near-total obsolescence by year 2002.

4 GENERAL STATUS (2010) OF MEETING COAL-TAR THREATS IN AUSTRALIA

The author has formed an ongoing assessment of the Australian coal-tar environmental remediation situation during his twenty-two years of casually collecting relevant historical and technical information, all of which has been placed in his worldwide "gas works" data base.

4.1 *Author's tally of known and suspected Australian coal-tar sites*

The author has developed and maintains a worldwide database of coal tar remedial facts, including site entries. Table 1 represents the author's rough tally of known and strongly-suspected Australian coal-tar sites is as follows.

4.2 *Author's personal evaluation of the present Australian coal-tar environmental response*

The author maintains a world-wide database of coal tar remedial facts, including site entries. By comparison and contrast, worldwide, the following observations come to mind concerning Australia and its management of the "coal-tar" threat. Basically Australia's "coal tar" threat situation is typical of any developed nation, then and now, but clearly on the highly positive side of achievements to date. This is not the author's indictment, merely a reflection of the current "gas works" remediation problems, worldwide. In nearly all national cases, presumed shortfalls lie with the intent and mechanisms of environmental regulation, whereby responsible parties or land owners often must be forced to undertake meaningful remediation:

- Australia's historic technical and operational literature concerning gas works and other coal-tar sites, appears almost entirely in British gas association proceedings and British trade journals; the literature can be very helpful toward the planning and conduct of meaningful site and waste characterization of individual sites;
- Australia's modern environmental technical literature shows little evidence of open reporting of the lessons learned from characterizing and remediating the subject sites;
- Australia is without visible national, non-regulatory coordination and sharing of essential issues and of lessons learned within the regulatory agencies; this is a common flaw for every nation on earth;
- There is a general absence of a site and waste characterization protocol such as would emphasize the identification and disclosure of how the plant was designed to operate, and where it would be most appropriate to search for the most important (dangerous) "hot spot" sources and pathways of contaminant transport (migration).
- As of this writing, the NSW DEC (Department of Environmental Conservation) was the leading Australian FMGP remedial entity; its overall FMGP assessment guidance was made openly available in 2005, and the Department acknowledges "over" 60 FMGP sites to be located in the State;
- Two cultural conditions have led to a severe obligation of cities and towns to serve as Responsible Parties in funding and managing remediation of many FMGP sites: 1) widespread former municipal ownership, and 2) periods of State ownership of gasworks sites;
- As elsewhere, Australian governmental activities in coal-tar site remediation appear more of the "reaction" type than of proactive searches for coal-tar sites. This paper hopes to be a tiny incentive for movement in the direction of search, record, assess, and evaluate, and,

in doing so, to become more effective in the over-all sense of protection of human health and the environment;

- Nation-wide, there appears to be a minimal level of awareness and environmental sensitivity to the historic presence of the wide variety of derelict coal-tar sites; this includes the associated and subsidiary industries such as institutional gas works, producer gas plants, tar chemicals, coke, and wood preservation, to name a few;
- Australia's coal-tar environmental responders share the usual lack of appreciation that what generally is labeled as "fill" almost universally represents a toxic "dump" of gasworks residuals and/or wastes;
- It can be said that nearly every Australian FMGP, as an historic operating option, will be found with one or more off-site gasworks dump. Historically, the operators knew of the dangerous characteristics and properties of manufactured gas and its residuals and wastes, but often chose direct discharge and open dumping as an expedient. Excellent discovered-examples of gasworks dumps are those of Beechworth and Geelong, both in Victoria, as well as two NSW examples, both at Sydney; the McDonaalstown—Erskineville Gas Works dump and the mammoth Mortlake gasworks dump at Sydney, converted to a reclaimed use for the 2000 Olympic Games;
- The usual basic worldwide confusion over old place names exists in the hugely expansive Australian conurbations; settlements have become towns, towns have grown and coalesced, and the English system of local government has been adopted, through the use of District Councils; all-in-all not a system conducive to gaining and spreading useful environmental remediation information;
- As elsewhere, the scientists and engineers who work most closely with FMGP remediation are not forthcoming with literature useful to the overall problem of coal-tar mitigation. Government workers are over-saddled with work obligations, the consultants are constrained by clients, and the academics are left to themselves.

5 SUMMARY

Australia's response to the human-health and environmental threat of coal tar has been highly commendable, when compared on the world scene. The current programs of the Governments of New South Wales and of Victoria are clearly among the most effective, worldwide. In a general sense, these two States are world leaders, surpassing, in transparency, that of Britain, and in general accomplishments, greater than the situation in all of Canada. When compared with America, the two Australian states are exceeded, in productive coal-tar response, only by the programs of New York State (the unassailable world leader) and California. Readers would do well to visit the websites of those States and to avail themselves of the many freely downloadable (pdf) documentary technical reports of FMGP site and waste characterization and of remedial action decision making and planning.

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History of manufactured gas in Australia; Geological-remedial implications

APPENDICES

These appendices contain three lists of data that pertain mainly to the existence of individual FMGP and related sites of Australia. Even in their abbreviated form, the data may be useful to others, after “digesting” the situational information contained in the body of the paper.

Listed in Table A are those events encountered by the author as seeming to represent various forms of milestones that may have affect the technology or operating manner of the Australia manufactured gas plants.

Table A. Key events in the history of manufactured gas in Australia.

Date	Event	Importance
c. 1800	Discovery of coal measures around Coalcliff, NSW, south of Sydney	Non-recovery coke production became fully developed by Illawarra Coke Co., at Coalcliff, Coledale and Corrimal, beginning in 1917. NSW. Mines closed after WW-II, but site still manufactures coke from rail-supplied coal.
1825	Discovery of coal in Queensland	By Major Edwin Lockyer, on banks of Brisbane River.
1820s	Institutional Gas Machines Introduced to Sydney	Limited to a single establishment each; common to England, and in America as well.
1840s	Institutional Gas Machines Introduced to Melbourne	Limited to a single establishment each; common to England, and in America as well.
1843	First coal production in Queensland	At Goodna
1856	Melbourne receives manufactured gas	Original plan carried out to create several district gas-manufacturing plants, each under private ownership, in various parts of the City, on the general plan in place at London, England.
1857	Ballarrat gold camp	Gas plant established at the most populous place in Victoria.
1865	Benjamin Fawcett erects gas works at Woolongong	Proves value of Mt. Kembla oil shale as gas-making and gas enrichment feedstock; Fawcett's tests show 20 lbs oil shale produce 145 cf gas = 16,210 cf/ton.
1857	Hobart, Tasmania receives manufactured gas	Plant operated 1857–1978; third gas company to go operational in Australia.
1858	Geelong Gas Co., Victoria	Established; operated until 1971, on sale to Gas & Fuel Corp. of Victoria, on introduction of natural gas.
1850s	Export of Newcastle coal to the American Pacific Slope	Supplied the bulk of gas coal to California and to America's west coast until arrival of the transcontinental railroads (1869–1883).
1860s	New manufactured gas plants	Generally constructed on arrival of coal-supplying rail lines, by Parliamentary Act, and about £25,000 of investor capital.

(Continued)

Table A. (Continued)

1865–1875	Oil-shale & Kerosene Rush of New South Wales	Claim-staking, mine development, construction of kerosene retorts and refineries.
1880s	Fertile ground for English gas-manufacturing investments	Continued the cultural-technical cooperation between mother and daughter countries, in the field of gas manufacturing.
1884	First Municipal Gas Works in Australia	Bega, NSW, as Parliamentary-authorized takeover of the existing commercial gas plant. (www.nla.gov.au/nla.cs-pa)
1884	Initial Competition from Electric Lighting	Western Australian Electric Light & Power Co. was present.
1884	New South Wales Government Railways undertakes to manufacture its own rail-carriage and station illuminating gas	Taken over by NSWGR, from private supplier; believed to have had five such plants; <i>A Brief History of NSW Railway Gasworks</i> , by Jim Longworth, Australian Railway Historical Society Bulletin, June, 2003 p. 203–213.
1888	Colonial Gas Association, Ltd.	Formed with offices at Melbourne; a competition company to those existing, especially the Metropolitan Gas Co. of Melbourne.
1888	Metropolitan Gas Co. of Melbourne	Unit of the Colonial Gas Association of Melbourne (English owners); becomes the eventual consolidating gas-manufacturing company at Melbourne.
1890s	Introduction of District Stations	Small increases of compressed gas distribution pressure brought about introduction of subsidiary gas holders, for radial (outward) expansion of residential gas service to some suburban districts.
1900	Likely Appearance of Carburetted Water Gas Process in Australia	At the time, considered as the most affordable gas manufacturing process, worldwide, and capable of shutdown and re-start on a day-to-day basis, without damage to the gas machines (known as <i>sets</i>).
1900	First Natural Gas Discovered in Australia	At Roma, Queensland, in the course of drilling for deep groundwater supplies; captured and fed to street lamps for ten days, then the supply failed. (www.esv.vic.gov.au)
1910	Introduction of Producer Gas Plants	Various gold mines of the Bendigo goldfield.
1914–1918	Development of brown coal fields at Latrobe, Vic.	East of Melbourne; wartime measure to convert lignite to electricity and then to transmit mine-mouth power to Melbourne industries.
1918	State Electricity Commission of Victoria (SECV)	1918: Formed for further exploitation of the Latrobe brown coal field.
1920s–1930s	SECV takes over private electrical generation of Victoria	Municipally (corporate) owned electric plants excepted.
1948	Formation of Western Australia State Electricity Commission	Coal gas continued for a few years, then petroleum discoveries on Barrow Island, off WA coast, near Dampier, were used for oil-gas manufacture.
1951	Formation of Gas & Fuel Corp. of Victoria	To manage manufactured gas supply, Statewide and to construct a Central Station gas works at Morwell.

(Continued)

Table A. (Continued)

Date	Event	Importance
1961	First Sustained Supply of Natural Gas in Australia	Again, at Roma, Queensland, where it was used as commercial fuel for generation of electricity. (www.esv.vic.gov.au)
1960s	Coal carbonization in Australia	Recognized as an obsolete technology; attention turning toward reforming of petroleum refinery by-product gases; coincidental with general trend in America and in England.
1960s	Discovery of offshore natural gas in Bass Straits, Victoria	Essentially coincidental with worldwide discoveries of off-shore natural gas, and, as such, signaled the final demise of manufactured gas in Australia, as elsewhere.
1960s	Construction of Australia's last gas holders	Necessary to meet expanded demand for residential cooking and heating gas fuel; required by advances in high-pressure gas distribution to suburbs; committed just prior to discovery of off-shore natural gas fields.
1969	Natural Gas Delivery Begins	Adelaide, Brisbane and Melbourne. (www.esv.vic.gov.au)
1970s	Emergence of modern natural gas-fired electric power stations	Essentially devoid of traditional environmental threats associated with manufactured gas.
Dec, 1976	Natural Gas Comes to Sydney	(www.esv.vic.gov.au)
1990s	Privatization of Victoria State Gas & Fuel Corp.	Essentially devoid of traditional environmental threats associated with manufactured gas.
1996	National Electricity Market Management Company, Ltd. (NEMMCO)	Supply operator for the Australian National Electricity Market (NEM); together an attempt to secure.
1997	Establishment of VENCORP	Victorian Energy Networks Corp., State-owned monopoly for "efficient" operation of gas and electric generation industries; funded by energy industry participants.
2002	Tasmania supplied with natural gas.	Via sub-sea pipeline from Bass Strait, by the Tasmanian Hydroelectric Commission.
2009	Australian Energy Market Operator	Created as a national energy source and distribution entity; successor to VENCORP, NEM, NEM-MCO, and other entities of eastern and southern Australia.

Table B constitutes the author sum total of years of patient research in identifying and recording separate gas manufacturing and related "coal-tar" sites of Australia. Embedded in the list has been a dedicated attempt to locate and record the founding and existence of all manner of former industrial sites related to the technology of manufactured gas and its volatile (VOC) and semi-volatile (SVOC) toxic wastes. No claims are made as to the completeness of the list, for it seems as soon as one of these lists is established, the author makes more discoveries. This and similar State or national lists compiled by the author have resulted from reading and scanning literature that now constitutes a personal bibliography on the subject, extending to 310 pages of ten-pitch entries. Some of the most useful information in the author's master data base (not shown here) have some from unindexed news items published in the technical journals; items over which the discover is purely fortuitous.

Table B. Known former manufactured gas plants and other coal-tar sites of Australia.

Location	Date Est.	Company Name	Features
Abbotsford, NSW	Unk	Wymston Parade Gas Works Abbotsford Gas Co.	Now City of Canada Bay Known and listed by NSW EPA.
Adelaide, SA	1861	South Australian Gas Co. (SAGASO)	1863: First gas produced
Albany, WA	pre-1899	Albany Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2004: Was under remediation by LandCorp, an agency of the Western Australia Government.
Albury, NSW	pre-1899	Albury Gas Works	Kiewa Street; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Ararat, Vic.	pre-1899	Ararat Gas Works	26–28 Grano St., Ararat West; 2008, was under remediation by SPI Networks (Gas) Pty Ltd.; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Armidale, NSW	c. 1886	Beardy Street Gas Works Municipal Gas Plant	Established, at Beardy St., cor. Allingham St.; 1890, works purchased by the municipality. (<i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) 2003: Known to NSW EPA and under remediation.
Auburn, NSW	Unk	Wilson Park Gas Works Council Gas Plant	Wilson Park, Silverwater District
Ballarat 1, Vic (formerly Ballarrat)	1857	Henry Courtis' Gas Works	Supplied Bath's Hotel with gas made from gum-tree leaves.
Ballarat 2, Vic.	1857	Ballarrat Gas Co.	Cor. Dane St. & Grenville Rd.; 1997, completion of first environmental investigation. Site of the Victorian Gold Rush of 1851, with 10,000 migrants, making it the most populous place in Victoria.
Banyule, Vic	Unk	Imperial Chemical Industries (ICI)	Heidleberg Plant, Northern Rd., Heidelberg Heights.
Barrow Island WA	Unk	Barrow Island Oil-gas Plant	1948: Near Dampier; plant operations taken over by State Electricity Commission.
Barrum 1, Q Howard Township	pre-1887	Torbanlea Colliery & Coke Ovens	1887: Site was operational, within the Barrum Coal Field "There is a range of coke ovens which utilise the slack or waste coal, and the mine is connected with the North Coast line by a private branch about 1–1/4 mile in length, which it joins at the Torbanlea Station, 15 miles north of Maryborough." AWH: he mine had been worked for about twenty years (1867), but there is no written indication of when the coke ovens were built. (p. 180, <i>Annual Report of the Under Secretary for Mines to the Minister for Mines</i> : Queensland Dept. of Mines, for the Year 1897).

(Continued)

Table B. (Continued)

Location	Date Est.	Company Name	Features
Barrum 2, Q Howard Township	pre-1887	Queensland Collieries Mine & Coke Ovens	1887: Site was operational, within the Barrum Coal Field (<i>Annual Report of the Under Secretary for Mines to the Minister for Mines: Queensland Dept. of Mines, for the Year 1897</i>).
Barrum 3, Q Howard Township	pre-1887	Riverbank (formerly Walsh's) Colliery & Coke Ovens	1887: Site was operational, within the Barrum Coal Field (<i>Annual Report of the Under Secretary for Mines to the Minister for Mines: Queensland Dept. of Mines, for the Year 1897</i>).
Bathurst 1, NSW	1872	Bathurst Gas Works At Bathurst RR Station Bathurst Gas Light Co.; City of Bathurst	Established; www.ludicrew.org/wark/republic/chapt03.htm 1880s: Becomes Municipal plant. 1890: Using coal as gas-manufacturing feedstock and oil shale for enrichment; purification by iron oxide; tar selling for 6 cents/gal., no call for ammoniacal liquor (<i>Gas in Foreign Countries, Special Consular Reports, U.S. Dept. State, 1891</i>) 2003: Known to NSW EPA and under remediation.
Bathurst 2, NSW	pre-1884	Railway Gas Works; New South Wales Government Railways	1884: Taken over by NSWGR, from private supplier; believed to have had five such plants; <i>A Brief History of NSW Railway Gasworks</i> , by Jim Longworth, Australian Railway Historical Society Bulletin, June, 2003 p. 203–213.
Bathurst 3, NSW	Unk	Bathurst Gas Works Russell Street Works Bathurst Gas Light Co.	2003: Known to NSW EPA; remedial responsibility of Regional Council.
Bathurst 4, NSW	Unk	Bathurst Gas Works Charlotte Street Works Bathurst Gas Light Co.	2003: Known to NSW EPA; remedial responsibility of Regional Council.
Beechworth 1, Vic.	pre-1899	Beechworth Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Beechworth 2, Vic.	Unk	Beechworth Gas Co. Gas Works Dump	2007: Gas works tars, residuals and wastes discovered below public swimming pool, as a result of excavation for repair of cracked pool liner (www.bordermail.com.au).
Bega, Vic.	1884	Bega Gas Co.; later Bega Municipal Gas Works	Upper Street First municipal gas works in Australia Established; NSW EPA listing; remedial responsibility of Bega Valley Shire Council.
Belfast, Vic.	pre-1899	Belfast Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Benalla, Vic	pre-1899	Benalla Gas Works Colonial Gas Association	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.

(Continued)

Table B. (Continued)

Bendigo, Vic. Now Sandhurst; Greater Melbourne	1860	Bendigo Gas Works	Established at town center, by Alexander Kennedy Smith; mainly with equipment cast in iron at his Carlton foundry. 1860–1973: Operational years; one above-ground historic water-seal gas holder remained in 2009.
Bendigo 2, Vic.	1910	White Hills Mine	1910: Proposed to install suction-type producer gas plant to power gas engines to power the mine.
Bendigo 3, Vic.	1910	New Chum Goldfields Mine	1910: Producer gas plant installed to fuel Crossley (English) suction-type producer gas engines used to drive air compressors providing power to drills producing blast holes.
Bendigo 4, Vic	1910	Nell Gwyne Reef, Diamond Hill Mines	1910: Crossley (English) suction-type producer gas plant installed to drive gas engines powering a 10-head batter of ore stamps, used in crushing gold ore for cyanide extraction of metallic values.
Bendigo 5, Vic	1910	Catherine Reef Workings, Bendigo Amalgamated Goldfields Co.	1910: Crossley (English) suction-type producer gas plant installed to drive gas engines powering a 10-head batter of ore stamps, used in crushing gold ore for cyanide extraction of metallic values.
Bendigo 6, Vic.	1918	Bendigo Amalgamated Goldfields Co.	1918: Installation of a suction-type producer gas plant at Koch's Mill, for fueling producer gas engines involved in ore processing; likely that these plants were installed at the other seven ore mills.
Bentleigh, Vic.	Unk	Bentleigh Gas Works	2007: Site had been subjected to Contaminated Lands Assessment, by Golder Associates.
Birkenhead, SA	Unk	Birkenhead Gas Works	2005: Was known to SA Dept. of Environmental Health.
Birregurra, Vic.	1880s	Birregurra Gas Works	Corner of Srachan St.; presently a public park.
Booktown, Q	pre-1899	Booktown Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Bourke, NSW	pre-1899	Bourke Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Bowen, Q	1940s	Bowen Beehive Coke Ovens	1940s-c. 1967: Records show in 1945 and 1946, Klondyke and Bowen in northern Queensland were the only coke producers in Queensland with Bowen Klondyke turning out approximately 80 percent of Queensland's then-coke production.
Bowden, SA	c. 1871	Bowden Gas Works	North side of rail line near Chief St. underpass; area of the plant had clay pits as source material for brick making; consider filled pits nearest the gas works to possibly contain gas-manufacturing residuals and wastes.

(Continued)

Table B. (Continued)

Location	Date Est.	Company Name	Features
Bowral, NSW	pre-1899	Bowral Gas Works Merrigang Street Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2003: Known to NSW EPA and remediation underway with Wingecarribee Shire Council.
Boxhill, Vic	pre-1899	Boxhill Gas Works Colonial Gas Association	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Brighton, Vic.	pre-1899	Brighton Gas Works	Established; in 1929 had a connection with the UK Institute of Gas Engineers (Proc., v. 78, p. 450).
Brimbank 1, Vic.	c. 1914?	Station Road Plant Albion Explosives Factory	Carinlea, St. Albans District; probable location of producer gas plant; audited by Victoria EPA (1996–2003). www.epa.vic.gov.au
Brimbank 2, Vic.	c. 1914?	Stenson Road Plant Albion Explosives Factory	Kealba, Municipality of Brimbank; probable location of producer gas plant; audited by Victoria EPA (1996–2003). www.epa.vic.gov.au
Brimbank 3, Vic.	c. 1914?	Taylor's Road Plant Albion Explosives Factory	St. Albans, Municipality of Brimbank; probable location of producer gas plant; audited by Victoria EPA (1996–2003). www.epa.vic.gov.au
Brisbane 1, Q	1857	Pigeon Close Gas Works	Established in the West End (AKA West End Gas Works); 1916, installed Glover-West (English) vertical coal-gas retorts; 2006, was under remediation.
Brisbane 2, Q	1865	Newstead Gas Works	1865–1996: Operational life; guide-frame for one of its gasometers left as a cultural monument; 2008; remediation completed by owner ENERGEX for its Brisbane HQ campus.
Brisbane 3, Q	1885	South Brisbane Gas & Light Co.	Established by Parliamentary Bill; John Davis was the Gas Engineer of the works.
Broken Hill, NSW	pre-1899	Mercury Street Gas Works Broken Hill Gas Co. Later, Municipal Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2009: Some remedial work completed; to be replaced by storm water detention basin. (www.abc.net.au)
Brompton, SA	pre-1933	Hindmarsh Gas Works; South Australian Gas Co.	2005: Known to South Australian Department of Environmental Health.
Brunswick 1 Vic.	Unk	Brunswick Gas Works; Municipality of Moreland	21–35 Hope Street; 2005, Victoria EPA had completed two Environmental Audits.
Brunswick 2 Vic.	Unk	Hoffman Brickworks; Municipality of Moreland	72–106 Dawson St.; 2002–2003; completion of two Environmental Audits; likely location of producer gas plant for brick-kiln fuel gas.
Bundaberg, Q	pre-1899	Bundaberg Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.

(Continued)

Table B. (Continued)

Camden, NSW	pre-1899	John Street Gas Works Camden Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Canada Bay, NSW	1883	Mortlake Station Gas Works	See Sydney listings.
Carrington, NSW	pre-1899	Carrington Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Casino, NSW	pre-1899	North Ninth St. Gas Works; later the Municipal Gas Plant	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2003: Known and listed by NSW EPA; Richmond Valley Council is Responsible Party for remediation.
Castlemaine, Vic.	1860	Castlemaine Gas Co.	Established before arrival of railway. 1890: Castlemaine Gas Co. invested to \$121,633; "Storage capacity, one gas holder capable of holding 25,000 cubic feet in an ordinary concrete tank, and one gas holder, capacity 15,000 cubic feet, in course of erection. The pattern or design of this holder is known as a self-contained holder, that is, the tank is of wrought iron and everything is above ground, no excavation being needed." (p.134; <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Cessnock, NSW	Unk	Maitland Rd. Municipal Gas Works	2003: Listed by NSW EPA as an FMGP site.
Clunes, Vic.	pre-1880	Clunes Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Coalcliff, NSW	c. 1916	Illawarra Coke Co.	Merchant plant for production of metallurgical and foundry-grade coke
Coburg, Vic.	Unk	Bradken Foundry; Municipality of Moreland	125–131 Sussex St., and at 98–100 Derby St.; 1997–2002, completion of first of two Environmental Audits; likely site of producer gas production residuals.
Colac, Vic.	pre-1899	Colac Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Concord, NSW	pre-1899	Concord Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Cootamundra, NSW	Unk	Hovell Street Gas Works Municipal Gas Works	2003: Known to NSW EPA and remedial responsibility of the Cootamundra Shire Council.
Corrimal, NSW	c. 1916	Illawarra Coke Co.	Merchant plant for production of metallurgical and foundry-grade coke.
Cowra, NSW	1912	Brougham Street Municipal Gas Works	2003: Known to NSW EPA; remedial responsibility of the Cowra Shire Council.
Cresswick, Vic.	pre-1899	Cresswick Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Dandenong, Vic. SE Suburb of Melbourne	pre-1899	Dandenong Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.

(Continued)

Table B. (Continued)

Location	Date Est.	Company Name	Features
Daylessord, Vic.	pre-1899	Daylessord Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Deniliquin, NSW	pre-1899	George Street Gas Works Deniliquin Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2003: Known to NSW EPA; remedial responsibility rests with Deniliquin Shire Council.
Dubbo, NSW	pre-1890	Gas Lane Gas Works Dubbo Gas Light Co.	1890: Was producing 3,000,000 cf of gas per year. (p. 129; <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) 2003: Known to NSW EPA; remedial responsibility of Dubbo Shire Council.
Espank Station, nr. Lithgow, NSW	pre-1890	Espank Colliery Coke Ovens	Established (p. 142; <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Echuca, Vic.	pre-1899	Echuca Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Esperance, NSW	pre-1898	Esperance Gas Works	No further details at this time.
Everleigh, AKA Macdonaldtown, NSW	pre-1884	Railway Gas Works; New South Wales Government Railways	1884: Taken over by NSWGR, from private supplier; believed to have had five such plants; <i>A Brief History of NSW Railway Gasworks</i> , by Jim Longworth, Australian Railway Historical Society Bulletin, June, 2003 p. 203–213.
Fitzroy, Vic.	pre-1899	Fitzroy Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2007: Had been subjected to Contaminated Land Assessment.
Foot's Cray, Vic.; AKA Footscray, a suburb of Melbourne	pre-1899	Foot's Cray Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Forbes, NSW	Unk	Union Street Gas Works; later Municipal Works	2003: Known to NSW EPA; remedial responsibility of the Forbes Shire Council.
Freemantle 1, WA; suburb of Perth	1884	Rocky Bay Gas Works Freemantle Gas Co.	www.worldofenergy.com.au
Freemantle 2, WA	pre-1916	The State Implement Works	Manufacturer of Producer Gas Plants; therefore it stands to reason that the plant site may have residuals and wastes generated from testing and from factory use of gas producers.
Freemantle 3, WA	1948	Oil Gas Plant State Electricity Commission	Post-1948: Believed to have installed oil-gas machines for use of petroleum oil extracted from oil wells on Barrow Island, near Dampier; at the time the gas works was owned by the State Electricity Commission of Western Australia (1945–1975).

(Continued)

Table B. (Continued)

Geelong 1, Vic.	1858	Geelong Gas Co.	Established, plant at North Geelong; 1924, plant rebuilt, likely with carbureted water gas; 1963, began reforming petroleum refinery gas (Onio Gegi process), and operated until 1971, on sale to Gas & Fuel Corp. of Victoria, on introduction of natural gas; gas plant demolished.
Geelong 2, Vic.	1957	Geelong Gas Co.	Riversdale Rd., Newtown, new gasholder installed; modern design precludes environmental toxics concerns.
Geelong 3, Vic.	Unk	Geelong Gas Works Dump	2007: Off-gasyard dump; had been subjected to Contaminated Land Assessment.
Geraldton, WA	pre-1899	Geraldton Gas Works Colonial Gas Association	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Glen Innes, NSW	Unk	West Avenue Gas Works; later a Municipal Plant	2003: Known to NSW EPA; remedial responsibility lies with Glen Innes Severn Shire Council.
Goulburn, NSW	pre-1890	Black Shaw Road Gas Works Goulburn Gas & Coke Co. Later a Municipal Works	1890: Was producing 30,000,000 cf gas per year. (p. 129, <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) 2003: Known to NSW EPA; remedial responsibility of Goulburn Mulwaree Council.
Grafton, NSW	pre-1890	Pound Street Gas Works Grafton Gas Lighting Co. Later a Municipal Works	Established; producing 3,000,000 cfy (p. 129, <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) 1899: Gas Engineer was Member of IGE of Britain (Proc., v. 78, 1928–1929, p. 472) 3003: Known to NSW EPA; remedial responsibility of Clarence Valley Council.
Grenfel, NSW	Unk	Gooloongong Road Gas Works Later a Municipal Plant	2003: Known to NSW EPA; remedial responsibility of Weddin Shire Council.
Greta, NSW	pre-1890	Kerosene Oil-shale Works	Presumed herein to have been retorting oil shale on-site and leaving PAH residuals. “A sea of kerosene shale is being worked at Greta, not far from Maitland.” cfy (p. 125, <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Gympie, Q	pre-1899	Gympie Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Hamilton, Vic.	pre-1899	Hamilton Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Hartley, NSW	pre-1890	New South Wales Shale & Oil Co.	Established (p. 141, <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) Namesake of geological member name for the Hartley Shale, recognized for its keragenous value for oil retorting and for gas-manufacture or gas-enrichment.

(Continued)

Table B. (Continued)

Location	Date Est.	Company Name	Features
Hay, NSW	pre-1899	Coke Street Gas Works Later a Municipal Plant	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2003: Known to NSW EPA; remedial responsibility of the Hay Shire Council.
Heidleberg, Vic.	pre-1899	Heidleberg Gas Works	Established; 1924, company gas engineers affiliated with the UK Institution of Gas Engineers; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Highett, Vic.	Unk	Highett Gas Works	Pre-2007; had been subjected to a Contaminated Land Assessment by Golder Associates, Pty, Ltd.
Highmoor, Q	1950s	Klondyke Collieries Ltd. Coke Ovens	c. 1952-c. 1967: Operational life of Klyondyke beehive ovens; with Bowen beehive coke ovens, the only coke ovens then operating in Queensland.
Hobart, Tasmania	1854	Hobart Gas Co.	Formed; third gas works in Australia to began producing (1857); consumed coal from Newcastle, NSW; plant operated until 1978; subjected to Contaminated Land Assessment prior to 2007.
Illawarra, NSW	Unk	Illawarra Coke Co.	Post-WWII; known to have been active.
Inverell, NSW	pre-1899	Inverell Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Ipswich 1, Q	1877	North Ipswich Gas Works Ipswich Gas & Coke Co., Ltd.	www.youripswich.com.au 2009: Remediation had been completed, with early 1950s gas holder guide-frame preserved at Riverlink Shopping Center.
Ipswich 2, Q	1880s	Klondyke Coke Ovens	North Ipswich; down hill from cor. W.M. Hughes & Musgrave Sts., N. Bank of Bremer River, fronting The Terrace; non-recovery beehive ovens; operated until early 1950s.
Jerilderie, NSW	pre-1899	Jerilderie Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Joadja Creek, NSW	pre-1890	Oil-shale Refinery Australian Kerosene Oil & Mineral Co.	Established (p. 141, <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Junee 1, NSW	pre-1884	Railway Gas Works; New South Wales Government Railways	1884: Taken over by NSWGR, from private supplier; believed to have had five such plants; <i>A Brief History of NSW Railway Gasworks</i> , by Jim Longworth, Australian Railway Historical Society Bulletin, June, 2003 p. 203–213.
Junee 2, NSW	pre-1899	Lord Street Gas Works Later a Municipal Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2003: Known to NSW EPA; remedial responsibility of the Junee Shire Council.
Junee 3, NSW	pre-1899	Peel Street Gas Works Later a Municipal Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2003: Known to NSW EPA; remedial responsibility of the Junee Shire Council.

(Continued)

Table B. (Continued)

Katoomba, NSW	Unk	Megalong Street Gas Works Later a Municipal Plant	AKA Katoomba-Leura Gasworks 2003: Known to NSW EPA; remedial responsibility of Blue Mountains City Council.
Kiama, NSW	pre-1890	Shoalhaven Street Gas Works Kiama Gas Co.; later a Municipal Gas Plant	Established; was producing (1890) 2,000,000 cf per year (p. 126, <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) 2003: Known to NSW EPA; remedial responsibility of Kiama Municipal Council.
Kingsgrove, NSW	Unk	Kingsgrove Road Gas Works; later a Municipal Gas Plant	2003: Known to NSW EPA; remedial responsibility of the Canterbury City Council.
Kyneton, Vic.	Unk	Kyneton Gas Co.; Municipality of Macedon Ranges	22–26 Mitchell St.; scene of first of two Victoria EPA Environmental Audits (1998–2000).
Lambton, NSW	pre-1899	Lambton Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Latrobe, Tasmania	pre-1899	Latrobe Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Launceston, Tasmania	pre-1899	Launceston Gas Co.	Boland St.; site considered (2008) for remediation and redevelopment.
Lilydale, Vic.	pre-1899	Lilydale Gas Co.	2007: Had been subjected to a Contaminated Land Assessment. www.northernstar.com.au
Lismore 1, NSW	pre-1860	Moleworth Street Gas Works Lismore Gas Co.	
Lismore 2, NSW	pre-1890	Keen Street Gas Works Lismore Municipal Plant	“Coals carbonized in retorts.” “Gas cleaned in tower scrubber (then) passes through oxide of iron purifiers into gas holder.” Producing 3,100,000 cf gas per year (p. 127–129; <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) 2003: Known to NSW EPA; remedial responsibility borne by Lismore City Council.
Lithgow, NSW	Unk	Gasworks Lane Gas Works Municipal Gas Plant	2003: Known to NSW EPA; Lithgow City Council has remedial responsibility.
Lithgow Valley, NSW	pre-1890	Lithgow Valley Coal Co. Coke Ovens	Established (p. 141; <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Liverpool, NSW	pre-1890	Mill Road Gas Works	Producing 30,000,000 cf gas per year 2003: Known to NSW EPA; remedial responsibility borne by Lismore City Council.
Mackay, Q	pre-1899	Mackay Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Maitland 1, NSW	1876	Charles Street Gas Works Maitland West Gas Light Co.	Established (www.newcastle.edu.au/service/archives/pender) 1890: “new plant” ordered from England; may have been carbureted water gas. 2003: Known to NSW EPA; remediation responsibility lies with Maitland City Council.

(Continued)

Table B. (Continued)

Location	Date Est.	Company Name	Features
Maitland 2, NSW	pre-1890	High Street Gas Works Tuck & Sons Gas Co.	West Maitland Established (www.addison.homedns.org).
Maitland 3, NSW	pre-1890	Melbourne Street Gas Works; Maitland East Municipal Gas Works	Established (p. 126; <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) 2003: Known to NSW EPA; remediation responsibility lies with Maitland City Council.
Maitland 4, NSW	1908	Acetylene Gas Plant Mackay Mansion, "Anambah"	Designed and installed by W. H. Pender, the engineer who had entirely serviced the Maitland Gas Light Co. works from its inception in 1876. (http://www.newcastle.edu.au/service/archives/pender/pdf/penderlisting13May2005.pdf).
Maldon 1, Vic.	pre-1899	Mackay Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Maldon 2, Vic.	pre-1899	Colonial Gas Association	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Manly, NSW North Sydney	pre-1890	Stuart Street Gas Works Manly Gas Light Co. Later a Municipal Gas Plant	"The directors of this company, in their report for 1889, stated that the profits for the year were \$8,225, and a dividend was paid at the rate of 10 per cent per annum." "Gas made from coal in the usual way, name, coal put into retorts (fireclay) 4 feet 6 inches lengths, two to make whole retort 9 feet long 22 by 14 inches (cliffs), and passed together through exhauster, condensers, washer, purifiers, and meter into holder. They are at present using oxide of iron for purification, used with sawdust, say two parts of (p. 127) oxide of iron to one of sawdust." Producing 10,000,000 cfy (p. 129) (<i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) 1916: Glover-West Company advertisement proclaims that this gas company, at North Sydney, has vertical retort installation and daily capacity of 2,500,000 cf (<i>Jour. Gas Lighting</i> , 02May, 1916, p. 208) 1916: North Sydney had two CWG sets of Humphreys & Glasgow, Ltd; both @ 500,000 cf per day (<i>Journal of Gas Lighting & Water Supply</i> , 04 Apr, 1916, p. 108) 2003: Known to NSW EPA; remediation responsibility rests with Manly City Council.
Marangaroo, nr. Lithgow, NSW	1867	Marangaroo Oil Shale Retorts	Report on the production of 'Cannelite Oil' from the Marangaroo oil shale deposit near Lithgow. (Bathurst Times; reported in modern times [2005] at http://www.michaelorgan.org.au/oilshale.htm).

(Continued)

Table B. (Continued)

Maryborough, Q	pre-1885	Maryborough Gas Co.	c. 1885: Townsville Gas & Coke Co., Ltd., Flemming also was manager of this gas works. (www.townsville.qld.gov.au/resources) 1898: Report for the Maryborough Gas Works Gas, 10,200 cubic feet per ton of coal; Candle power, 14.73; Coke, 1,460 lb. per ton of coal, or 65 per cent. Tar, 10.5 gallons per ton of coal. Ammoniacal liquor, 16 gallons per ton of coal. (<i>Annual Report of the Under Secretary for Mines to the Minister for Mines: Queensland Dept. of Mines, for the Year 1897</i>) 1899; listed in <i>Gas Engineers Annual Directory</i> , London.
Melbourne 1, Vic.	1840s	Institutional Gas Machines	“Gaslight was first introduced to Sydney in the 1820s and to Melbourne in the 1840s by various individuals who set up small plants which could supply a single establishment.” (<i>Technology in Australia 1788–1988</i> ; likely will show some degree of PAH contamination; sites not yet identified.
Melbourne 2, Vic.	1850	City of Melbourne Gas & Coke Co.	Located on flat land to the west of Spencer Street on the triangle of land later bounded by North Wharf Road, Piggott Street and Blythe Street (or Footscray Road); 1856, first year of gas production, due to complications caused by the Victorian Gold Rush.
Melbourne 3, Vic.	1884	Kew Lunatic Asylum Gas Works	Believed to have been constructed in this year; a known feature of the institution.
Melbourne 4, Vic.	pre-1899	Mount Gambier Gas Co.	One of the district gas companies non-competitively serving the city districts; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Melbourne 5, Vic.	pre-1899	Richmond Gas Co.	One of the district gas companies non-competitively serving the city districts; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Melbourne 6, Vic.	pre-1899	Brunswick Gas Co.	One of the district gas companies non-competitively serving the city districts; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Melbourne 7, Vic.	pre-1899	Williamstown Gas Co.	One of the district gas companies non-competitively serving the city districts; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Melbourne 8, Vic.	pre-1899	St. Kilda Gas Co.	One of the district gas companies non-competitively serving the city districts; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Melbourne 9, Vic.	pre-1899	Zehan, Dundas & Strahan Gas Co.	One of the district gas companies non-competitively serving the city districts; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.

(Continued)

Table B. (Continued)

Location	Date Est.	Company Name	Features
Melbourne 10, Vic.	pre-1899	Bairnsdale Gas Co.	One of the district gas companies non-competitively serving the city districts; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Melbourne 11, Vic.	Unk. 19th c.	Box Hill Gas Works, Eastern Melbourne	One of the district gas companies non-competitively serving the city districts.
Melbourne 12, Vic.	Unk. 19th c.	West Melbourne Gas Works, Wharf Rd., Docklands	One of the district gas companies non-competitively serving the city districts.
Melbourne 13, Vic.	Unk. 19th c.	Port Melbourne Gas Works	1955: plant closed and left dormant 1996: plant site taken over by Melbourne Urban Land Authority, with ensuing environmental remediation investigations and remedial actions.
Melbourne 14, Vic.	Unk. 19th c.	Port Melbourne Gas Meter Shop.	Pickles, Danks, Graham & Foots Sts., likely place of associated mercury contamination; 1999 Victoria EPA first Environmental Audit.
Melbourne 15, Vic.	Unk. 19th c.	Port Melbourne Gas Works Laboratory	1999 Victoria EPA first Environmental Audit.
Melbourne 16, Vic.	Unk. 19th c.	Port Melbourne Gas Works Gas Holder Site 1	Presumed to have the typical 19th c. pit-type water-seal tank, nominally plagued with presence to tar oils and leakage of such through the brick walls/bottom; 1999 Victoria EPA first Environmental Audit.
Melbourne 17, Vic.	Unk. 19th c.	Port Melbourne Gas Works Gas Holder Site 2	Pickles, Graham & Esplanade East Sts.; presumed to have the typical 19th c. pit-type water-seal tank, nominally plagued with presence to tar oils and leakage of such through the brick walls/bottom; 1999 Victoria EPA first Environmental Audit; 2007; Contaminated Land Assessment underway.
Melbourne 18, Vic.	Unk. 20th c.	Longford Gas Plant	Was yet in non-manufacturing service in 1998, as part of the high-pressure gas distribution system.
Melbourne 19, Vic.	Unk	Port Phillip Bay Gas Works	Early 1990s remedial efforts.
Melbourne 20, Vic.	1939–1990s	Carinlea Plant, Albion Explosives (ICI Ltd.)	1999–2005: Redeveloped into housing estates; plant is presumed to have had one or more producer gas plant.
Molong, NSW	1885	Gas Works Lane Plant Molong Gas Co.; later Municipal Gas Plant	1885–1932: Operational life. 2000: PAH contaminants found in site soils; caused NSW State government to create its Environmental Trust to address “orphan” sites. 2003: Site listed by NSW EPA; remediation responsibility assigned to Cabonne Shire Council 2009: Site remediation remains at issue.
Morwell, Vic. About 150 km ESE of Melbourne	c. 1951	Morwell Gas Works	Mine-mouth, Central Gas Manufacturing Station for Greater Melbourne; built and expanded as gas-distribution pressure technology evolved; 2006 had been at least partially remediated.

(Continued)

Table B. (Continued)

Mt. Gambier, SA	pre-1899	Mt. Gambier Gas Works	Established by Colonial Gas Association (London); c. 2000, underwent a Site Contamination Assessment; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Mt. Kembla, NSW	1865	W. J. Hammil Oil-shale Reduction Plant for Kerosene Production.	Hammil was an American, and succeeded in breaking the costly price of imported American kerosene as lamp oil.
Mt. Morgan, Q	pre-1899	Mt. Morgan Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Mudgee, NSW	1885	Mortimer Street Gas Works Mudgee Gas Co.; later Municipal Gas Plant	1885–1932: Operational lifetime 1935: Site sold for residential redevelopment. 2000: Mudgee Shire Council discovers site contamination under homes and child-care center. NSW State government to create its Environmental Trust to address “orphan” sites. 2003: Site listed by NSW EPA; remediation responsibility assigned to Mudgee Shire Council 2005: Removal of 10,000 tons contaminated soil.
Murrumbidgee, NSW	Pre-1890	Northern Shale Co. Retorts, Doughboy Hollow	Established (p. 141; <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Muswellbrook, NSW	pre-1899	Carl Street Gas Works Muswellbrook Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2003: Known to SW EPA; remediation responsibility assigned to Muswellbrook Shire Council.
Newcastle 1, NSW	1867	Remnant Gardens Gas Works Newcastle Gas & Coke Co.	Established at 1 Clatham Rd. 1890: Producing 55,000,000 cy per year. 1916: Installed both Glover-West Vertical Retorts and Humphreys & Glasgow’s UGI CWG (<i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Newcastle 1, NSW	c. 1880	Waratah Gas Works Newcastle Gas & Coke Co., Ltd.	Established at Waratah District of Newcastle, largely the result of endeavors of John Scholey, an English immigrant of 1840, and three-term Mayor from 1883.
Newcastle 2, NSW	pre-1884	Railway Gas Works; New South Wales Government Railways	1884: Taken over by NSWGR, from private supplier; believed to have had five such plants; <i>A Brief History of NSW Railway Gasworks</i> , by Jim Longworth, Australian Railway Historical Society Bulletin, June, 2003 p. 203–213.
Newcastle 3, NSW	1913	Clyde Street Gas Works Newcastle Municipal Gas Plant	Located in Hamilton North 1913–early 1980s: Operational life. 2003: Known by NSW EPA; remediation responsibility assigned to Newcastle City Council.

(Continued)

Table B. (Continued)

Location	Date Est.	Company Name	Features
Newcastle 4, NSW	1914	By-Product Coke Ovens Broken Hill Proprietary	BHP (formed 1885) diversified into steel-making, and adopted the worldwide shift to by-product coke ovens, using Newcastle field coal. Semet-Solvay ovens were utilized and replaced and expanded to two batteries, in 1922 with Wilputte ovens and a new by-products plant. In 1929 the ovens again were expanded, using the largest of the type in the Empire. The plant was under remediation in 2005.
Newcastle 5, NSW	pre-1899	Low Street Gas Works Newcastle Municipal Gas Plant	Located in Wallsend-Plattsburg District; Listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2003: Known by NSW EPA; remediation responsibility assigned to Newcastle City Council.
Newcastle 6, NSW	Unk	Steel Street Gas Works Newcastle Municipal Gas Plant	Located in Newcastle West. 2003: Known by NSW EPA; remediation responsibility assigned to Newcastle City Council.
Newcastle 7, NSW	Unk	Wharf Road Gas Works Newcastle Municipal Gas Plant	2003: Known by NSW EPA; remediation responsibility assigned to Newcastle City Council.
Newcastle 8, NSW	Unk	Koppers By-Product Coke Ovens	2009: Yet operating, with two continuous tar distillation units and a naphthalene still.
Newstead, Q	Unk	Newstead Gas Works	Pre-2007: Had undergone Contaminated Land Assessment.
Nowra, NSW	Unk	Lamonds Lane Gas Works	2003: Known by NSW EPA; remediation responsibility assigned to Shoalhaven City Council.
Oakleigh, Vic.	Unk	Oakleigh Gas Works	Pre-2007: Had undergone Contaminated Land Assessment.
Orange, NSW	pre-1890	Peisley Street Gas Works Orange Gas Co.; later a Municipal Gas Plant	Established. "Four benches of retorts (clay) each carrying 2 cwt. charges, 2 per cent shale charged with coke, 50 per cent of which is saved as coke. Gas per ton, 10,000 cubic feet; tar, 10 gallons. Purified by 135 feet of condensing pipes into tower scrubber, containing 5 tons of coke, passing 2,000 gallons of water in twenty-four hours, then through purifiers charged (1) oxide of iron, (2) with iron and lime. (p. 128) 6,250,000 cfy (p. 129) (<i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Paddington, NSW	Unk	White City Gas Co. Paddington Gas Co.; later a Municipal Gas Plant	2003: Known by NSW EPA; remediation responsibility assigned to Woolhara Municipal Council.

(Continued)

Table B. (Continued)

Parkes 1, NSW	pre-1899	Bogan Street Gas Works Parkes Gas Co.; later a Municipal Gas Plant	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2003: Known by NSW EPA; remediation responsibility assigned to Parkes Shire Council.
Parkes 2, NSW	pre-1899	East Street Gas Works Parkes Gas Co.; later a Municipal Gas Plant	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2003: Known by NSW EPA; remediation responsibility assigned to Parkes Shire Council.
Parramatta, NSW	1872	George Street Gas Works Parramatta Gas Co.	“Parramatta, the oldest city in Australia, did not take advantage of as lighting until August, 1872.” “Coals distilled in clay retorts in ordinary manner; gas washed in scubber; purified with oxide of iron, and no lime used.” (p. 128) Annual production is 26,000,000 cfy (p. 129) (<i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) 2003: Known by NSW EPA; remediation responsibility assigned to Parramatta City Council.
Perth 1, WA	1849	Alfred Carson; a Pioneer	Lit his home with retorted <i>Xanthorrhoea (grass tree)</i> wood gas, stored in bullock’s bladders.
Perth 2, WA	1882	First Towne Gas Plant Laneway Gas Works City of Perth Gas Co.	Established (www.worldofenergy.com.au) AKA Wellington Street Gas Works Bankrupted within the year.
Perth 3, WA	post-1882	Wellington Street Gas Works Perth Gas Co.	Apparently a reorganization and expansion to either side of the footprint of No. 2 AKA Wellington Street Gas Works.
Perth 4, WA	1924	Perth Corporation	1924: Construction of East Perth Gas Works, as a Central Station, serving the entire city; previously the city had been supplied by the Fremantle Gas & Coke Co.; 1928, expansion of gas making capacity; 1948, taken over by Western Australia State Electricity Commission; pre-2007, had been subjected to a Contaminated Land Assessment.
Perth 5, WA	1924	Perth Corporation	1924: Construction of the Victoria Park Gas Holder Station.
Perth 6, WA	1928	Perth Corporation	1928: Construction of the Claremont Gas Holder Station.
Picton, WA	Unk	Koppers Wood Products, Pty Ltd., AKA Australasian Wood Products	Bunbury District; creosote-based wood preservation-treatment plant.
Port Douglas, Q	Unk	Macrossan Street Gas Works	2007: Had been subjected to a Contaminated Land Assessment
Port Phillip, Vic.	1884	Port Phillip Gas Co.	Est. at Queenscliff, west side of entry to the Bay. 2006: Under remediation.
Portland, Vic.	pre-1899	Portland Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.

(Continued)

Table B. (Continued)

Location	Date Est.	Company Name	Features
Rockhampton, Vic.	1874	Rockhampton Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Sale, Vic.	pre-1899	Sale Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Sandgate, Q	pre-1899	Sandgate Gas Works; Colonial Gas Association	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Shepparton, Vic.	pre-1899	Shepparton Gas Works; Colonial Gas Association	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Shoalhaven (AKA Nowra), NSW	Unk	Bridge Street Gas Works	2008: Discovered when Shoalhaven City performed excavations for new skate park.
Singleton, NSW	pre-1890	Gas Street Gas Works Singleton Gas & Coke Co.	Established; “Carbonization in clay retorts through cooling pipes to atmospheric condensers. Thence to scrubbers and on to oxide purifiers.” Producing 6,500,000 cf per year. (p. 129; <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) 2003: Known by NSW EPA; remediation responsibility assigned to Singleton Shire Council.
Stockton, NSW	pre-1899	Stockton Gas Works Stockton Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Sydney 1, NSW	1820s	Various Private Gas Works	“Gaslight was first introduced to Sydney in the 1820s and to Melbourne in the 1840s by various individuals who set up small plants which could supply a single establishment.” (<i>Technology in Australia 1788–1988</i>)
Sydney 2, NSW	1836	Haymarket Station (AKA 21st century as Homebush Bay) Australian Gas Light Co.	“I find that the first gaslight company in these colonies was formed in Sydney in April, 1836, and that Sydney was lighted with coal gas in May, 1841.” (<i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Sydney 3, NSW	1870–1875	Jenkins Street Gas Works Australian Gas Light Co.	Millers Point 2004: Site remediation completed; site replaced with “30 The Bond” high-rise office building.
Sydney 4, NSW	1876	High Street (AKA North Shore) Gas Works North Shore Gas Light Co.	Established at North Sydney. 1890: North Shore: “The coal is charged into the retorts by scoops, the gas passing through hydraulic mains into the foul main, on which a Kortings steam jet exhauster is fixed. The tar is drawn off at a point about 30 feet from the hydraulic main. The gas then enters a Graham condenser, from which it passes to a Livesey’s washer and then to two purifiers filled with oxide of iron;

(Continued)

Table B. (Continued)

			then through the station meter and into the gas holders. To render the cost of purification less expensive, air is admitted to each of the hydraulic mains (there is one hydraulic main to each setting of retorts) to the extent of 1-1/2 per cent of the make of gas. This air coming in contact with the hot tar in the main is carburetted, and consequently it has no deteriorating effect on the illuminating power of the gas." (p. 127) Producing 46,000,000 cf per year (p. 129) (<i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Sydney 5, NSW	1882	Neutral Bay Retort House; Sydney Naval Station Gas Works	Installed as a packaged gas works fabricated for the Crown, in Scotland; operational in place until 1940, then the gas-machinery removed to a second on-station location and continued in service until 2000; original retort house remains as oldest structure on RAN installation.
Sydney 6, NSW; Section formerly Known as Canada Bay	1883	Mortlake Station Gas Works 17 ha., eventually 46 ha., in 1960s. Australian Gas Light Co.	1883: Established at Tennyson Rd. 1921: Had 2nd largest (12,750,000 cf) gas holder in the world in service; early 1930s, beginning of deliberate dumping of non-specification coal tar, CWG tar-water emulsions and other toxic and inert gas manufacturing residuals and wastes, at Lednez site on foreshores of Homebush Bay.
Sydney 7, NSW	Unk	Hickson Rd. Gas Works Australian Gas Light Co.	Located at Millers Point 2003: Known to NSW EPA as former gasworks site; responsibility of Sydney City Council.
Sydney 8, NSW	Unk	Katoomba Leura Gas Works Australian Gas Light Co.	NSW EPA and Blue Mountains District Council arranging Voluntary Remediation Agreement with AGLC and ELGAS.
Sydney 9, NSW	Unk	Wollstonecraft Gas Works Australian Gas Light Co.	Gas Works Rd.; Wollstonecraft a Sydney suburb.
Sydney 10, NSW	Unk	High Street Gas Works Australian Gas Light Co.	High Street (AKA King Street Gas Works), Waverton, North Sydney 2003: Known to NSW EPA; remediation guided by North Sydney District Council.
Sydney 11, NSW	Unk	King Street Gas Works Australian Gas Light Co.	King Street Gas Works, Waverton, North Sydney 2003: Known to NSW EPA; remediation guided by North Sydney District Council.
Sydney 12, NSW	Unk	Breakfast Point Gas Works Australian Gas Light Co.	2006: Known to NSW EPA; remediation guided by Concord District Council.

(Continued)

Table B. (Continued)

Location	Date Est.	Company Name	Features
Sydney 13, NSW	Unk	McDonaldtown—Erskineville Gas Works SRA (State Rail Authority of NSW)	SRA operated only from 1980–2003 2001: Known to NSW EPA (Sydney <i>Morning Herald</i> , 15Oct, 2001); includes gas works dump area off gas plant site.
Talbot, Vic.	1860	Talbot Gas Co.	(<i>Technology in Australia 1788–1988</i>)
Tamworth, NSW	pre-1890	Tamworth Gas & Coke Co.	Peele Street; Tamworth Regional Council. Tamworth Gas & Coke Co. had invested \$49,492 (p. 127); “Ordinary coal-gas process.” (p. 128 4,000,000 cfy (p. 129); (<i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Toowong, Q	pre-1899	Toowong Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Toowoomba, Q	1867	Toowoomba Gas Co.	Established (http://www.thechronicle.com.au/story/2009/06/18/state-coughs-up-6-m-for-polluted-site 2009); under remediation by NSW State; ENERGEX was last owner; some tar contaminated soil on riverbank removed to depth of 16 m.
Townsville 1, Q	pre-1885	Townsville Gas & Coke Co., Ltd.	Established at Flemming Street, Aitkenvale, North Estate; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Townsville 2, Q	pre-1973	Queensland Nickel Co., Ltd., Yabulu Plant	1973–1984: Producer gas plant known to have been present.
Townsville 3, Q	Unk	Bowen Coke Works	2008: Was operating in association with the XSTRATA Copper Refinery.
Traralgon, Vic.	pre-1899	Sewage & Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Vale of Clwyd, Western Dist., NSW	pre-1890	Vale of Clwyd Colliery Coke Ovens	Established (p. 141; <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Wagga-Wagga 1, NSW	1880	Tarcutta Street Gas Works Wark Brothers; Wm. & John	1880: www.wagga.nsw.gov.au 1888: Gas Works taken over by District Council 1890: “Destructive distillation in clay retorts, the gas being then purified by condensing, washing, scrubbing, and sent by passing through purifiers containing red oxide of iron and finished with hydrate of lime.” Producing 14,000,000 cf per year. (p. 128; <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) 2003: 2006: Known to NSW EPA; remediation guided by Wagga-Wagga City Council 2009: Remedial Action Plan finalized.
Wagga-Wagga 2, NSW	1963	Chaston Street Gas Works Municipal Gas Plant	Established by City of Wagga-Wagga 2004: Was the sole NSW EPA listed gas works site for City.

(Continued)

Table B. (Continued)

Wanagul, Vic.	pre-1899	Wanagul Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Wangaratta, Vic.	pre-1899	Ryley Street Gas Works Wangaratta Gas Co. Colonial Gas Association	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2000: Had seen completion of first Environmental Audit, by Victoria EPA.
Warrnambool, Vic.	1874	Warrnambool Gas Works	Established; <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891.
Warragul, Vic.	pre-1899	Warragul Gas Works; Colonial Gas Association	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Warwick, Q	pre-1899	Warwick Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Waterloo, Sydney, NSW	1868	Oil-shale Retort Works	Botany Rd., refining Hartley oil shale to "Comet Oil" as a lubricating oil.
Waterstown, NSW	pre-1897	Waterstown Coal & Coke Co.	1897: Site was operational and making coke (p. 119, <i>Annual Report of the Under Secretary for Mines to the Minister for Mines: Queensland Dept. of Mines</i> , for the Year 1897).
Wellington, NSW	Unk	Gobolion Street Gas Works	2003: Known to NSW EPA as former gasworks site; responsibility of the Wellington City Council.
Werris Creek 1, NSW	pre-1884	Railway Gas Works; New South Wales Government Railways	1884: Taken over by NSWGR, from private supplier; believed to have had five such plants; <i>A Brief History of NSW Railway Gasworks</i> , by Jim Longworth, Australian Railway Historical Society Bulletin, June, 2003 p. 203–213.
Werris Creek 2, NSW	Unk	Single Street Gas Works	2003: Known to NSW EPA as former gasworks site; responsibility of the Liverpool Plains Shire Council.
Whitehorse, Vic.	pre-1890	Box Hill Brick Works Federation Street	Likely location of producer gas plant, providing brick-kiln fuel gas. 2004: Victoria EPA completes Environmental Audit.
Wickham, NSW	pre-1899	Wickham Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Wilcania, NSW	pre-1899	Wilcania Gas Works	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Williamstown 1, NSW	pre-1890	Stevedore Street Gas Works Williamstown Gas Co.	Established; (p. 134; <i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891).
Williamstown 2, NSW	pre-2007	Gas Works Dump Williamstown Gas Co.	Site subjected to Contaminated Land Assessment.
Windsor, NSW	pre-1899	Church Street Gas Works Windsor Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899. 2003: Known to NSW EPA; remediation guided by Hawkesbury City Council.

(Continued)

Table B. (Continued)

Location	Date Est.	Company Name	Features
Woolongong 1, NSW	1865	Gas Works of Benjamin Fawcett	Benjamin Fawcett and Patrick Lahiff open the Mount Pleasant coal mine, to the north of Mount Kembla; Fawcett later erects a gas works in Wollongong and tests the gas producing qualities of the Mount Kembla oil shale shortly after its discovery in 1865.
Woolongong 2, NSW	1865	Corrimal Street Gas Works Wollongong Gas Light Co.	“First gas supply in Wollongong provided from a plant in Corrimal Street.” http://neil2decade.wordpress.com/2010/01/26/wollongong-local-history/
Woolongong 3, NSW	1872	Kerosene Refinery Sun Kerosene & Oil-shale Co.	30 Sep 1872: Prospectus published for ‘The Sun Kerosene and Oil Shale Company, Wollongong’, along with a description of plant. (Illawarra Mercury)
Woolongong 4, NSW	1881	Charlotte Street Gas Works Wollongong Gas Light Co.	1881–1882: Erection of new gas works in Charlotte Street. (http://neil2decade.wordpress.com/2010/01/26/wollongong-local-history)
Woolongong, 5 NSW	1883	Finders Street Gas Works Wollongong Gas Light Co.	“Wollongong was first lighted with coal gas in 1883.” (p. 124) (<i>Gas in Foreign Countries</i> , Special Consular Reports, U.S. Dept. State, 1891) 1883–1977: Plant lifetime. (www-library.uow.edu.au/archives)
Yass, NSW	pre-1899	Dutton Street Gas Works Yarra Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Young, NSW	pre-1899	Young Gas Co.	Established; listed in <i>Gas Engineers Annual Directory</i> , London, 1899.
Yarrabah, Q	c. 1903	Acetylene Gas Light Plant Yarrabah Mission to Aborigines	An innovation, since my last visit, is the installation of an acetylene gas plant by Mr. Field, another of the missionary assistants, as a gift to the station. The result is that 2,000 feet of galvanised iron piping have been laid down, so that the church, schoolhouse, Mr. Reeves’ cottage, and both dormitories are all lighted with gas. (p. 22–23) (<i>Annual Report of the Northern Protector of Aborigines for 1903</i> : Report to the Houses of Parliament).