



BIOMIN, INC.

State of the art water filtration media

We will lower operations costs by 50%, and bring them into compliance with discharge regulations.

P. O. Box 20028 . Ferndale, MI 48220
(248) 544-2552. Fax: (248) 544-3733
E-Mail: biomin@aol.com
Web: www.biomininc.com

Makers of OilSorb™ and Other State-of-the-Art Filtration Media

Technical Advisory #24

Manufactured Gas Processing Sites, Remediation using Organoclay.

By George R. Alther, Biomin, Inc.

Introduction

Manufactured gas plants (MGP) are former coal gasification plants. Coal gasification is a process for converting coal partially or completely to combustible gases (Clark). In turn, after purification, these gases can be used as fuels or as raw materials for other processes (Clark).

Pollution found at FMGP's today:

Commonly associated with former manufactured gas plants (known as "FMGPs" in environmental remediation) are contaminants including:

- [BTEX](#)
 - Diffused out from deposits of coal/gas tars
 - Leaks of carbureting oil/light oil
 - Leaks from drip pots, that collected condensible hydrocarbons from the gas
- [Coal tar](#) waste/sludge
 - Typically found in sumps of gas holders/decanting ponds.
 - Coal tar sludge has no resale value and so was always dumped.
- [Volatile Organic Compounds](#)
- [Semi-volatile Organic Compounds](#)
 - Many heavier coal tar compounds are not very volatile, i.e PAHs
- [Polycyclic aromatic hydrocarbons](#)

- Found in copious quantities in coal tar, gas tar, and pitch.
- [heavy metals](#)
 - Leaded solder for gas mains, lead piping, coal ashes.
- [cyanide](#)
 - Purifier waste has large amounts of complex ferrocyanides in it.
- [Lampblack](#)
 - Only found where crude oil was used as gasification feedstock.
- [Tar emulsions](#)

Below are several case histories describing the successful use of organoclays at MGP sites:

Case History 1: Sediment stabilization.

A large midwestern utility company, which owned property that included a former manufactured gas plant (MGP) site next to a river, had a soil on its site stabilized. This soil was contaminated with coal tar, which includes heavy oils (Bunker C) and pitch. This mixture included benzene, toluene, naphthalene, phentathrine, pyrene and phenolic compounds. The coal tar contaminated the soil below the groundwater table to a depth between 12 to 25 feet. Sediments in the river were contaminated at the sediment/water interface, to a depth of 3 feet

The mixture that was blended with the soil and sediments consisted of fly ash, Portland cement, powdered organoclay and powdered activated carbon. 22 truckloads of organoclay and activated carbon, each, were used.

The mixing mechanism consisted of an in-situ drilling system whereby the mixture was injected into the soil, and soil/mixture columns were constructed. The mixing of the additives was performed with a pug mill (asphalt type) mixer. At the bottom of each column sodium silicate was added to ensure maximum strength. The columns showed consistently more than 50 psi unconfined compression strength and passed the TCLP test.

Case History 2. Wastewater stored in a MGP gas holding tank.

Contents of the tank: Gas, water, coal tar.

Critical contaminants: PNA's, BTEX, Oil, heavy metals.

Discharge limits:

Benzene: 74 ppb

Xylene: 134 ppb

Set up of Filtration system:

Oil/water separator, bag filters, 1 absorber with 9000 lb OILSORB organoclay; 2 absorbers with 6,000 lb granular activated carbon.

Wastewater analysis before and after treatment:

Chemical	Influent concentration Microgram/l	Effluent concentration Microgram/l
Benzene	19,430 or less	9.9
Toluene	8,356 or less	3.9
Ethyl benzene	1,560 or less	ND
Total xylene	7,130 or less	9.2

Cost savings: Organoclay/carbon adsorption vs hauling to a haz waste facility: \$990,000.-

Case History 3.

Case History from cleaning a sump sludge.

A sump sludge contained a wastewater that required cleaning before it could be discharged. The water was passed through 300 lb of organoclay/anthracite and then discharged. The results are:

Contaminant	inlet	outlet	Solubility Mg/l
TOC	29%	65 mg/kg	
Oil	12 mg/kg	1 mg/l	
BOD	429 mg/kg	120 mg/kg	
COD	16,084 mg/l	202 mg/l	
Anthrazene	2,000 mg/kg	<10 mg/l	0.073
Benzo (A) Anthrazene	5,300 “	<10 “	0.014
Fluorene	10,000 “	<10 “	1.98
Indeno (1,2,3,C,D)			

Pyrene	200 “	<25 “	0.62
Naphthalene	29,000 “	< 10 “	34.4
Phenanthrene	40,000 “	< 10 “	1.29
Pyrene	8,000 “	< 10 “	0.14
TPH	172,000 “	< 0.5 mg/l	

The lab results obtained from a mini-column test are (Alther, 2004, 2002):

	Solubility:	percent by organoclay weight removed:
Benzene	1800 mg/l	39
Toluene	535	44
o-Xylene	insoluble	44
Naphthalene	34.4	24.3
PCB 1260	insoluble	52 % by clay weight.

The MGP description below can be obtained at www.google.com.

A newsletter about “Creosote” is found on the web site, www.biomininc.com under “Technical Bulletins”, Oilsorb Guardian”.

A lab study with DNAPL and LNAPL and Biomin's organoclays ability to remove them from water is available from Michael Gefell, BBL, at mjg@bbl-inc.com.

Below is a description of Manufactured Gas Processing, what it is, and its history.

Background

It is reported that London and Westminster Chartered Gas, Light and Coke Company built the first manufactured gas plant in 1812, although the first record of experimental manufactured gas production from coal dates back to seventh century England (Srivastava, 1997). In the United States the first uses of manufactured gas for the purposes of lighting appear to have been in Philadelphia in 1796 and in Richmond in 1803 (Mon, 1995). North America's first manufactured gas plants were built in Baltimore (1816), Boston (1822), and New York (1825) (Srivastava, 1997). During the latter half of the 19th century the manufactured gas industry expanded in the urban industrial areas of the country (Mon, 1995). At the turn of the century almost every good-sized city had its own manufactured gas plant (Mon, 1995). From approximately the 1850s to the early 1950s, MGP sites were the primary source of energy for lighting and heating (Ackerman et al). It is estimated that at the peak of the industry in the 1920s and 1930s, there were more than 10,000 MGPs in operation throughout North America and Europe (Ackerman et al). However, the growing availability of low-cost natural gas delivered by a network of pipelines between the 1940s and 1960s lead to its substitution and replacement of gases derived at MGP sites (Srivastava, 1997; Larsen, 1997; GZA, 1998b).

After plants were closed, they were often demolished, and the property sold (Murarka, 1995). While many former MGPs were demolished long before the advent of environmental regulations, many old plants are still structurally intact today (Ackerman et al). In fact, the majority of properties where larger gas holders were built have been converted to "modern" facilities that are part of the capital assets of the American gas electric utility industry (Neuhauser, 1995). Therefore, the liabilities associated with the former MGP operations are now the responsibility of viable companies. There may be as many as 2,500 such site that, while originally owned by the corporate predecessors of today's gas distribution companies, are now part of modern electric and gas utilities (Murarka, 1995). These sites range from half an acre to over 100 acres in size and could cost between \$25-75 billion of the next thirty years to clean up or contain (Murarka, 1995). Liabilities for individual utility companies vary according to the size of their former MGP operations. For instance, Niagara Mohawk Power Corporation, which represents less than two percent of the total American MGP sites, estimates their environmental liability at more than \$200 million spread over 24 cities and towns in upstate New York (Neuhauser, 1995).

In light of the present environmental awareness, the former MGPs have been gaining attention from regulators as sources of onsite and offsite soil, sediment, surface water and groundwater contamination. In addition, former MGP sites represent a vast amount of unused land. The federal brownfields initiative encourages investigation, remediation, and redevelopment of abandoned, unused or under-developed property. The redevelopment of these sites for reuse can help utilities become more competitive under the current deregulation business climate (Ackerman et al). However, prior to redevelopment of former MGPs, the site must be investigated to delineate onsite and potential offsite environmental impacts. The impacts then must be quantified in order to determine the most advantageous remediation technology on a site-by-site basis. After remediation is completed to appropriate cleanup levels, redevelopment can occur.

Because MGPs are a problem nationwide, there have been extensive investigations to determine what waste materials are typically found at the sites, as well as research performed to decide which remediation technologies can be utilized to cleanup the various contaminated matrices. Although the wastes at MGP sites are generally described, there are a number of factors affecting the volume, characteristics, and toxicity of the wastes generated, such as the type of gas manufacturing process used, the raw materials used in the manufacturing process, the feedstock used in the manufacturing process, and the former disposal practices for the by-products (Larsen, 1997; GZA, 1998b).

Gas Manufacturing Processes

In the United States manufactured gas was produced mainly by three major processes:

Coal Carbonization Process

Carburetted Water Gas Process

Oil Gas Process

Waste Products

By-products of the gas manufacturing process that cannot be recycled, sold, or given away are considered waste products. Many times the wastes were simply covered over with dirt or buried where contaminants could leach into the surrounding sediments, soil, surface water or groundwater. The volume, toxicity, and specific chemical make-up of the waste vary depending upon raw material inputs and processing. In addition to the environmental issues derived from the disposal of wastes generated during processing, historical spills or leaks occurring during gas generation, purification and storage also created environmental concerns. The waste products or spills can cause contaminated soils, sediments, and surface and groundwater at or near the manufacturing facility (GZA, 1998b).

In general the waste products found at former MGPs are tars; oils; inorganic spent oxides (ferrocyanide); benzene, toluene, ethylbenzene, and xylene (BTEX); volatile organic compounds (VOCs); semi-volatile organic compounds (SVOCs); phenolics; polynuclear aromatic hydrocarbons (PAHs); cyanides; thiocyanates; metals (arsenic, chromium, copper, lead, nickel, and zinc); ammoniates; nitrates; sludges;

ash; ammonia; lime wastes; and sulfates/sulfides (Hatheway and Johnson; Larsen, 1997; Srivastava, 1997; GZA, 1998b).

The PAHs and VOCs are found in the coal tar left over from the gasification process (EPA). Coal tar is a by-product of all former MGP sites. Coal tar is a dense, non-aqueous phase liquid (DNAPL) which, when released into an aquifer, can migrate downward until a low-permeability layer is encountered. Therefore, pools of coal tar can be encountered at the bottom of an aquifer, becoming a continuous source of groundwater contamination. The toxicity of MGP coal tars and residues is not well understood as little data exists in the literature (Murarka, 1995). Cyanides are typically found in the cyanide salts left in the iron oxide waste produced when the gas was purified (EPA). The presence of oils, which are light non-aqueous phase liquids (LNAPLs), and tars, which are DNAPLs, creates a dual concern at MGP sites -- the possibility of having a floating product on the water table and a sinking product that can penetrate the entire depth of an aquifer (Larsen, 1997).

The Institute of Gas Technology categorizes wastes from former MGP sites into six major categories (Srivastava, 1997):

- Pumpable liquids (free tars and oils)/source material
- Organic waste or tar/oil-contaminated waters
- Organic waste or tar-contaminated soils and sediments
- Non-pumpable tars and sludges
- Purifier box (or spent oxide) wastes
- Demolition debris

In addition, the contaminants of concern (COC) at MGP sites can be divided into five chemical types: inorganics, metals, volatile aromatics, phenolics, and PAHs. The organic contaminated or PAH containing soils represent the largest waste type at most MGP sites (Srivastava, 1997)

Nature and Extent of Environmental Contamination	<ul style="list-style-type: none">• Asbestos from roofing and pipe lagging; lead paint from gas holder structures; coal tar residuals-NAPLs, PAHs; cyanide composites from purifier waste; structural, chemical, and petroleum products and wastes; mercury-containing equipment. (Asphalt, earth, electrical fixtures, masonry, rubble, metal, and plastics often can be recycled and offset remediation costs. MGP residuals can be used for recycling or co-burning processes.)
--	--

18th International Activated Carbon Conference (IACC-18)

George Alther, President of Biomin, will provide a workshop on organoclays Oct. 18, 2006 before IACC-18. The 6 to 9 PM workshop is titled "Organoclays Extend Activated Carbon Life." Mr. Alther will also provide an oral presentation "Newest data on organoclay sorption capabilities" on Oct. 20, 2006 at IACC-18. You can [register to attend IACC-18](#).

Please visit <http://biomininc.com> for additional technical information.

To obtain samples and to purchase, contact us at Biomin@aol.com

George Alther, President

[Biomin, Inc.](#)

P. O. Box 20028

Ferndale, Michigan 48220

Phone: (810) 544-2552

Fax: (810) 544-3733

E-mail: Biomin@aol.com

Web Site: <http://biomininc.com>