The Commonwealth of Massachusetts

DEPARTMENT OF PUBLIC UTILITIES

May 25, 1990

D.P.U. 89-161

Generic investigation of the facts surrounding and the ratemaking treatment of the costs of investigating and remediating hazardous wastes associated with the manufacture of gas during the period 1822-1978.

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I. INTRODUCTION

A. Procedural Background

In Berkshire Gas Company, D.P.U. 89-112, the Department of Public Utilities ("Department") issued an Interlocutory Order on Environmental Cleanup Issues ("Interlocutory Order"), dated August 18, 1989. The Order was occasioned by a request from Berkshire Gas Company ("Berkshire") in that rate case to include expenses in its cost of service for cleanup of hazardous material at a site owned by Berkshire. Contamination of the site resulted from disposal of coal-tar wastes and other residues from the now-discontinued process of manufacturing illuminating and heating gas from coal and other feedstocks.[1]

The Interlocutory Order directed Berkshire to present evidence and argument on at least ten issues related to cleanup of such sites. In brief, the required information concerned (1) site descriptions, (2) description of gas manufacturing conducted at such MGP sites, (3) industry knowledge, standards, and practice about MGP waste disposal and environmental hazards, (4) legal requirements concerning MGP waste disposal, (5) conformity of MGP waste disposal practices to the gas industry's knowledge and practice and to the law, (6) manner of site

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[1] These processes are referred to collectively as the manufactured gas process or "MGP" for short: hence, hereafter, "MGP plant sites," "MGP era," "MGP wastes," etc. See Section III of this Order for a description of the processes and their by-products and wastes.

acquisition, (7) insurance coverage in place, (8) description of environmental site reviews conducted preparatory to cleanup, (9) detailed cost estimates of cleanup work, and (10) appropriate ratemaking treatment of cleanup costs. Interlocutory Order, pp. 15-16.

B. Petition for a Generic Investigation

On July 18, 1989, Bay State Gas Company ("Bay State") petitioned the Department to initiate a generic investigation into the entire question of gas manufacture and environmental cleanup. The Department allowed that petition and opened the present docket. The Department designated James Connelly, Esq., as hearing officer. Technical staff of the Department's Rates and Research Division assisting in the investigation included Andrew Greene, Director, Paul Osborne, Linda Latham, and José Rotger.

On November 2, 1989, Bay State filed an amended petition ("Joint Petition") for a rulemaking proceeding in which it was joined by the Attorney General of the Commonwealth ("Attorney General"), Berkshire, Boston Gas Company ("Boston Gas"), Colonial Gas Company ("Colonial"), Commonwealth Gas Company ("ComGas"), Essex County Gas Company ("Essex"), and Fitchburg Gas & Electric Light Company ("Fitchburg"). The Joint Petition sought a generic inquiry, leaving apart site-specific investigations, into four of the issues listed in the Interlocutory Order: Issue 3, industry knowledge, standards, and practices; issue 4, legal requirements; issue 7, insurance;

and issue 10, appropriate ratemaking treatment. The Department also allowed the late-filed petitions of North Attleboro Gas Company ("North Attleboro") and Fall River Gas Company ("Fall River") to join in the petition and permitted the Energy Consortium, an association of industrial ratepayers, to intervene. On October 10, 1989, the Department issued an Order of Notice, requiring each gas company petitioner to publish notice, in accordance with the terms of G.L. c. 30A, § 2, and 220 C.M.R. 2.00 et seq., of the first public hearing in the docket on November 3, 1989.

Evidentiary hearings began on February 15, 1990 and ended on April 5, 1990 after seventeen days of testimony. The gas company petitioners jointly sponsored four witnesses to present in their case in chief: Kenneth F. Abraham, Esq., professor, University of Virginia Law School, Charlottesville; Andrew C. Middleton, principal, Remediation Technologies Inc., Pittsburgh, Pennsylvania; and William W. Hogan and A. Lawrence Kolbe, principals, Putnam, Hayes & Bartlett, Inc., Cambridge, Massachusetts. The Attorney General offered the direct testimony of Ronald H. Hill, industrial hygienist, Guilford County Health Department, Greensboro, North Carolina; and Timothy Newhard, financial analyst, utilities division of the Department of the Attorney General. The gas company petitioners also offered two rebuttal witnesses: Mr. Middleton and Barbara D. Beck, principal, Gradient Corporation, Cambridge. In addition to testimony given in the hearings, the evidentiary

record consisted of 59 documentary exhibits sponsored by the gas company petitioners, 236 sponsored by the Attorney General, and 33 by the Department. The petitioners submitted simultaneous initial briefs on May 7, 1990.

C. Joint Motion to Approve a Settlement Agreement

On May 1, attorneys for the petitioner gas companies and the Attorney General ("Settling Parties") filed a Settlement Agreement ("Settlement Agreement") and accompanying Joint Motion for Approval of a Settlement Agreement and Termination of the Proceedings ("Joint Motion"). Ratification of the Settlement Agreement by their principals followed on May 4 and May 7 when executed copies of the agreement were filed with the Department. The Settlement Agreement is described and analyzed at length in Sections IV and V of this Order. In brief, the Settlement Agreement sets forth a detailed cost recovery mechanism to allow recovery over time of cost incurred to clean up MGP waste sites as directed by the cognizant environmental enforcement authorities. No objection to the Settlement Agreement was raised by any party to the investigation.

A second motion filed by the settling parties on May 10 sought extension of the date by which the Department would have to act upon the Joint Motion before the Joint Motion and the Settlement Agreement would expire on their own terms. The Department allowed the extension from May 15 to May 25. On May 18, the Settling Parties filed an amended second version of the Settlement Agreement. The amendments clarified possible

ambiguities regarding the intended inclusion of the calendar year 1978 within the scope of Settlement Agreement. The amendments made no material change in the accord. On May 7, the Energy Consortium filed comments on the Settlement Agreement. The Energy Consortium expressed agreement with "the concept embodied in the Settlement Agreement," but suggested several modifications (Energy Consortium Comments, pp. 4-7).[2]

The remaining sections of this Order outline the legal, historical, and technical background of the production and cleanup of MGP wastes; describe the Settlement Agreement's provisions on recovery of MGP waste cleanup costs; analyze the Settlement Agreement in the context of the record assembled on the four issues that were the subjects of the Joint Petition; evaluate the Settlement Agreement against traditional ratemaking principles; and, finally, rule on the Joint Motion.

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2 Because the Joint Motion requires the Department to consider the Settlement Agreement in its entirety, we do not endeavor to rule on whether the individual modifications suggested by the Energy Consortium are appropriate. Rather, we consider the Energy Consortium's comments in the context of whether the Settlement Agreement, as presented, should be approved.

II. THE LEGAL IMPETUS FOR CLEANUP OF MGP SITES

The investigation in this docket entailed an assessment of acts of the petitioner gas companies (or others for whom they may be responsible) relating to manufacturing gas during the period 1822-1978, which acts may result in future legal liability. The legal impetus behind MGP site cleanup arises from environmental protection and remediation legislation developed over the past twenty years and enacted in both Federal and Massachusetts jurisdictions. This legislation seeks to arrest and reverse actual and potential environmental damage resulting from the disposal of hazardous material on land.

At the Federal level, the key enactments are the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. § 6901 et seq. (1982 & 1987 Supp. V), passed in 1976, and the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), 42 U.S.C. § 9601 et seq. (1982 & 1987 Supp. V), passed in 1980. In order to promote expeditious remediation of contaminated sites, CERCLA imposes joint and several liability, without regard to fault,[3] for investigation and cleanup of any

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[3] Liability without fault under CERCLA and G.L. c. 21E is conceptually similar to, but, in fact, significantly distinguishable from the rule of strict or absolute liability under Rylands v. Fletcher, Law Rep. 3 H. L. 330, as adopted in Ball v. Nye, 99 Mass. 582 (1868). The distinction is important for purposes of our analysis, and so we note it early to emphasize it. Under Rylands and Ball, a plaintiff may recover damages for nuisance injury to his land without proof of (footnote continued)

such site on any person who generated, transported, or disposed of hazardous material there, who owned or operated the "facility" (42 U.S.C. § 9601[9]) where the hazardous material was generated, stored, or disposed, or who simply owned the land. The United States Environmental Protection Agency and Justice Department need make no showing of fault for liability

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negligence where a defendant "collects and keeps on his own land anything likely to do mischief if it escapes" and such escape, in fact, occurs. The defendant, it is said, "must keep it in at his peril[,] . . . is damnified without any fault of his own, and . . . should be held responsible to make good all damages, if he should not succeed in confining it to his own property." Fletcher v. Rylands, Law Rep. 1 Ex. 265 (Blackburn, J.), quoted in Shipley v. Fifty Associates, 106 Mass. 194, 198 (1870). Thus, since Ball was handed down, strict liability has effectively become a branch of nuisance (i.e., tortious interference with another's use of real property). Under CERCLA and G.L. c. 21E, on the other hand, escape of hazardous material from a landower's property onto that of another is not a necessary condition for liability to attach. The presence of such material in that part of the environment comprised by the landowner's property is alone sufficient. But cf. the observation of Mr. Justice Blackburn that the landowner's act of bringing "something on his property not naturally there" may be "harmless so long as it is confined to his own property." Id. Thus CERCLA and G.L. c. 21E extend strict liability well beyond the Rylands rule, which concerns the duty owed by landowners to one another, and establishes, in effect, the duty of each landowner to the sovereign to refrain, at his peril, from certain injuries to his own land as well as the land of others, all to advance the objective of environmental protection. Making a landowner liable to the state for injury to his own land (as distinct from restricting or enjoining uses obnoxious to neighbors or awarding damages for nuisance injury to a neighbor's land) is a great leap for the law and, arguably, a genuine discontinuity in its development (Tr. II, pp. 77-78).

to attach to a person in any of these categories. Dedham Water Co. v. Cumberland Farms, Inc., 689 F. Supp. 1223, 1225 (D. Mass. 1988). CERCLA seeks to protect against any release or threatened release of hazardous material, "release" being defined as "any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment." 42 U.S.C. § 9601(22).

The Massachusetts analogue of CERCLA is the Massachusetts Oil and Hazardous Material Release Prevention Act, G.L. c. 21E (1987), enacted in 1983.[4] Like its Federal counterpart, CERCLA, Section 5 of Chapter 21E establishes categories of person who may be strictly liable for costs or damages from the release or threatened release of hazardous material subject to certain exceptions long familiar in Massachusetts law. See Gorham v. Gross, 125 Mass. 232, 238 (1878); Cork v. Blossom, 162 Mass. 330, 333 (1894). Exceptions include acts of God, acts of war, and unforeseeable acts or omissions of third parties.

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4 The record in D.P.U. 89-161 has benefited from the filing, at the hearing officer's request, of "Comments Regarding M.G.L. c. 21E Liability with Specific Reference to Coal Gas Sites" by Willard R. Pope, General Counsel, Massachusetts Department of Environmental Protection ("DEP") (Exh. DPU-32). Following the lead of G.L. c. 30A, § 14, the Department gives "due weight to the experience, technical competence, and specialized knowledge" of the DEP in setting forth our treatment of G.L. c. 21E in this Order. Bournewood Hospital v. Massachusetts Commission against Discrimination, 371 Mass. 303, 317 (1976).

G.L. c. 21E, § 5(c).

The Chapter 21E enforcement agency is the Massachusetts Department of Environmental Protection ("DEP"). That agency notifies persons who fit the statutory classes of liability known as Potentially Responsible Parties ("PRPs") of their potential liability by issuing a Notice of Responsibility ("NOR"). The DEP acts under what is known as the Massachusetts Contingency Plan ("MCP"), 310 C.M.R. 40.00 et seq., to identify, evaluate, and clean up sites contaminated by hazardous materials. Ideally, the DEP and PRPs work cooperatively to plan a voluntary evaluation and cleanup by the PRPs under DEP oversight. But DEP may also undertake to clean up the site on its own and seek recovery of its costs from the PRP later (Exh. DPU-32).

Cleanup of a site typically occurs in five phases. The first phase is the preliminary assessment to determine whether the property should be classified as a hazardous waste site under G.L. c. 21E and what priority status should be assigned to the site. The second phase systematically assesses the type, amount, and concentration of hazardous material on site and evaluates the threat to people or the environment posed thereby. The final three phases concern developing and effecting a plan for site remediation. If the threat is deemed imminent, short-term measures of may be warranted (id.). The remediation process is generally considered complex and costly (Exh. CO-2, pp. 43-50).

III. HISTORICAL AND TECHNICAL BACKGROUND

To establish the record context against which we have evaluated the Settlement Agreement, we trace the history of the MGP industry's development, identify the processes and feedstocks employed in manufacture, and discuss the process residuals that required disposal during the production years and may require remediation in the 1990s. The details are important to our analysis of the Settlement Agreement set forth in Section V.

A. Development of the Manufactured Gas Industry

The first practical application of gas produced by destructive distillation of coal is generally attributed to William Murdoch in 1792 (Exh. DPU-1, "Gas-Light," Encyclopaedia Britannica, 7th ed. [1842], p. 349, col. a). The first public exhibition of the MGP was made in 1802 by Phillipe Lebon in Paris (id., "Gas," Encyclopaedia Britannica, 11th ed. [1910], p. 483, col. a). In 1812, the Chartered Gas Light and Coke Company was authorized to light the streets of London with gas (id., col. b). In 1822, Boston Gas Light Company, the first gas company in Massachusetts and the second in the United States, was formed by a special act of the General Court (Exh. DPU-15-A, p. 7; Tr. III, p. 20). In the ensuing years, other gas companies were organized to supply gas to other cities and towns throughout Massachusetts through either special acts of the General Court or general corporation statutes (Exh. DPU-15-A).

Initially, the demand for gas was restricted to street lighting (Tr. III, p. 12). As technology developed, gas became available for indoor lighting, cooking, heating, and industrial demand (Exh. CO-2-A, p. 11). By 1900, manufactured gas works existed in many towns. Because the distribution mains of the time were of low pressure, gas works were only able to serve customers within a few miles of the plant (id., p. 14). Therefore, some larger cities had more than one gas works operating in the community (id.). Over the years, technological improvements allowed larger plants to be constructed, and many smaller plants were either consolidated or retired (id., pp. 14-15).

With the development of electricity in the late nineteenth century, the gas industry gradually lost its lighting business and concentrated on other markets, including domestic and commercial heating and cooking (id., p. 11). The development of gas appliances in the early 20th century made gas available for water heating, domestic laundry needs, and refrigeration (id., p. 13). Multiple industrial applications also created their demand during this period (id.).

The introduction of natural gas pipelines throughout the United States, starting in the late 1940s, sounded the death knell for the MGP. Because natural gas was a less costly fuel and had a higher British Thermal Unit ("Btu") content, it quickly supplanted manufactured gas as a base load supply source (Exh. DPU-18, p. 1). With the extension of natural gas

pipelines into Massachusetts by the early 1950s, gas utilities generally converted to natural gas distribution. See Tatten v. Department of Public Utilities, 330 Mass. 360 (1953) (facts surrounding establishment of gas pipeline and eminent domain taking pursuant to St. 1950, c. 462). The gas utilities ceased manufactured gas production, with the exception of some high-BTU oil gas plants which were used for peak-shaving purposes into the 1960s and early 1970s (Exh. CO-2-A, pp. 13-14). The last operational manufactured gas works in Massachusetts, a high-Btu oil gas facility in Lowell, was retired in 1975 (Exh. DPU-6).

To make space available for other purposes, and to reduce property taxes, manufactured gas works were dismantled after their retirement (Exh. CO-2-A, p. 9). Decommissioning consisted of razing the above-ground structures to grade and using demolition rubble to fill in resulting holes (id., pp. 9-10). Below-ground tanks and pipes were purged of gas and left in the ground (Exh. DPU-29; Tr. XVII, pp. 91-93). Cinders and tar liquids were disposed of on-site, and spent oxides were disposed of both on- and off-site (Exh. DPU-29).

In 1985, the Radian Corporation issued a report ("Radian Report") listing 89 former manufactured gas works in Massachusetts (Exh. DPU-17). During the investigation in this docket, the petitioner gas companies reported that they had found an additional seven sites (Exh. DPU-6). This does not exhaust the list of MGP sites in Massachusetts, for the record indicates the existence of other gas utilities and MGP sites

that are not found in the Radian Report and at least one additional MGP site in Brockton (Exhs. DPU-7; DPU-15-A). While many of the former manufactured gas works were operated by the petitioning gas companies or their corporate predecessors, other sites were operated by companies that are no longer in operation and have no relationship to the petitioning gas companies (Exh. DPU-6). A number of sites established by the gas company petitioners or their predecessors are still in use for utility purposes (id.). Other sites had been sold over the years, and are no longer used in the gas industry (id.). At the present time, there are 24 former MGP plant sites on DEP's list of sites to be investigated and 17 sites where manufactured gas wastes were disposed (Exhs. DPU-4; DPU-5).

B. Manufactured Gas Processes

1. Coal Carbonization

The first significant method of manufacturing gas was the coal-carbonization process. Coal carbonization entailed burning a carbon in a closed retort, in the absence of oxygen. This method drove off volatiles (Exh. CO-2-A, pp. 17-18). The resulting gas was rich in hydrogen and methane and had a heat content of about 600 Btu per cubic foot (Exh. DPU-18, p. 25). Coal gas was used throughout the manufactured gas period (Exh. CO-2-A, Sch. 3).

The feedstock for the coal-carbonization process was coal or coke. Coal was extensively used until the 1890s, when the United States steel industry introduced by-product coke ovens

(Exh. DPU-18, p. 17). The development of the by-product coke oven made ample supplies of coke readily available as a feedstock in the coal-carbonization process (id., pp. 17, 19). The first by-product coke oven installed in the United States devoted to manufactured gas production was in Everett, Massachusetts, in 1898 (Tr. III, p. 45). Eventually, coke from by-product coke ovens became the major source of feedstock for manufactured gas operations (Exh. DPU-18, pp. 17-18).

2. Water Gas

Although there were experiments as far back as the 1780s concerning the effect of steam on heated carbon, a process for manufacturing gas by passing steam over a bed of incandescent carbon was first sucessfully developed by T.S.C. Lowe in 1873 (Exh. DPU-1, "Gaseous Fuel," Encyclopaedia Britannica, 10th ed. [1902], p. 602, col. a). In this process, steam reacts with the carbon to produce a fuel gas composed primarily of carbon monoxide and hydrogen (Exhs. AG-72; DPU-18, p. 24). As the resulting gas had a low heat content of about 300 Btu per cubic foot and contained few illuminants, or bright-burning hydrocarbons, water gas was produced primarily for heat rather than for illumination (Exh. DPU-18, p. 24). Because water gas burned with a clear or blue flame, it was commonly referred to as "blue" gas (Tr. III, pp. 108-109).

Shortly thereafter, it was discovered that by spraying a petroleum oil into water gas and running the mixture through a superheater, the molecules of vaporized oil and petroleum would

chemically "crack" and break down into products that would remain in the gas steam, thereby raising the Btu content of the gas (Exhs. AG-73; DPU-18, pp. 110). The resulting gas had a heat content of about 600 Btu per cubic foot and was therefore suitable for illumination (Exh. DPU-18, pp. 109-110). Gas produced by this method was technically called "carbureted water gas," but was widely known as "water gas" (Exh. DPU-13, Tr. of September 10, 1888, pp. 2-3). Because the carbureted water gas process used equipment that had a longer useful life than coal carbonization retorts and because the process initially produced fewer residuals and provided for almost complete conversion of feedstocks to gas, carbureted water gas eventually became the predominant gasification process in the United States (Exh. DPU-1, "Gaseous Fuel," Encyclopaedia Britannica, 10th ed. [1902], p. 602, col. a).

3. Oil Gas

Carbureted water gas required both oil and a form of carbon as feedstocks. Although oil was readily available along the Pacific Coast, it was expensive to transport coke or coal to the region (id., pp. 15-16). This economic disadvantage led to the modification of the carbureted water gas process to eliminate the need for coal or coke (Exh. DPU-18, p. 42). Oil gas was made without coal or coke. The oil gas process involved injecting a mixture of steam and oil into a previously heated generator (Exh. AG-74). Oil gas was initially discovered in England in 1815, and the New York Gas Light Company relied

exclusively on oil gas distilled from retorts until 1829 (Exhs. DPU-18, p. 42; DPU-1, "Gas," Encyclopaedia Britannica, 9th ed. [1879], p. 100, col. a). An oil gas technique using refractory materials was developed in 1889, and the first modern oil gas plant was installed in California in 1902 (Exh. DPU-18, p. 42). Oil gas was eventually used throughout the country (Exh. DPU-17). However, oil gas found only limited use in Massachusetts until after World War II (id., Exh. DPU-18, p. 46).

Because of the availability of natural gas starting in the late 1940s, a number of carbureted water gas plants were converted to high-Btu oil gas facilities to make a product compatible with natural gas (Exh. DPU-18, p. 43). The coke feedstock used in the water gas generator was replaced with a high-temperature refractory brick, and oil sprays and other oil-handling equipment were added (id., p. 51). These plant modifications enabled the production of a high-Btu content oil gas for peak demand at a relatively low cost (id.).

4. Other Processes

Other manufactured gas processes were used throughout the manufactured gas period. Some were variations of the processes just described, and others were distinct on their own terms. Exh. DPU-1, "Gaseous Fuel," Encyclopaedia Britannica, 10th ed. [1902], pp. 603-604) The latter included rosin gas, whale oil gas, acetylene gas, wood gas, peat gas, and petroleum gas (id., "Gas," Encyclopaedia Britannica, 9th ed. [1879], p. 100, col. a;

DPU-18, p. 57). Rosin gas, created by burning pine resin in heated retorts, and whale oil gas, created by burning whale oil in heated retorts, were used to a certain extent during the beginning years of the manufactured gas era, until the development of bituminous coal deposits in the United States around 1840 (Exh. DPU-18, pp. 54, 57). Because gas works using these processes tended to be small-scale operations which produced a mimimal level of wastes, sites that exclusively used these processes are expected to pose minimal hazards (id., p. 54).

Acetylene gas was produced by burning limestone and coal in an electric furnace, producing calcium carbide, which was then reacted with water (Exh. DPU-16, pp. 3-22). A number of small-scale gas works produced acetylene gas in Massachusetts at the turn of the century, but all of these had ceased operations by 1921 (Exh. DPU-15-A). The major waste product associated with acetylene gas was lime sludges, which, according to Mr. Middleton, do not pose an environmental danger (Tr. IV, pp. 111-112).[5]

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5 In addition, Buzzards Bay Gas Company manufactured butane-air gas from 1930 until 1946, when it added propane-air to its supply mix. 1946 Annual Return to the Department.

C. Residual Products From Manufactured Gas Operations

1. Description

The different production methods produced a variety of residuals.[6] The coal-carbonization process produced coke, coal tars, ammoniacal liquor, ash, and "clinkers."[7] (Exh. CO-2-A, Sch. 3). The introduction of by-product coke ovens required additional purification measures that resulted in the production of residuals including ammonium sulfate, naphthalene, light oil, and sludges (id., p. 20).

Besides ash, clinker, and spent oxides, water gas production left a variety of residuals, depending upon the feedstock used. These included water gas tars and water-tar emulsions (Exh. CO-2-A, Sch. 3). The initial use of naphtha as a feedstock in the carbureted gas process produced only traces of tar (Exh. DPU-18, p. 78). With the advent of the internal combustion engine, the increased demand for naphtha to blend with gasoline made naphtha less available for manufactured gas feedstocks (Exh. CO-2-A, p. 22). Light oils, and later, as these became less available, heavy oils, were substituted (id.,

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6 This section (Section III.C) of the Order catalogues MGP residuals and disposal practices. Section III.D discusses the evidence concerning the hazardous properties of MGP residuals and the risks attendant on the disposal practices. See infra, p. 24.

7 "Clinkers" are lumps of congealed ash (Exh. DPU-18, p. 153).

pp. 22-23). These feedstocks, particularly the heavy oils, increased the amount of tar produced and the need to remove sulfur from the manufactured gas (id.).

Major by-products from the oil gas process included lampblack, water-tar emulsions, and light oil (id., Sch. 3). Small amounts of ammonia, cyanides, tar bases, and tar acids were also produced (Exh. DPU-18, p. 46).

2. Composition of Residuals

MGP residuals contain a variety of chemicals, many of which are hazardous materials under CERCLA, 42 U.S.C. § 9601(14) and G.L. c. 21E, § 2. For instance, spent oxides contain sulfur, sulfide, sulfate, and tar (Exh. AG-106). For those spent oxides created by coal carbonization and by-product coke ovens, thiocyanate and cyanide are also present (id.). Polynuclear aromatic hydrocarbons, including benzopyrenes and tetracene, are present in water gas tar, coal tar, oil tar, and lampblack (id.; Exh. DPU-16, sec. 4, p. 30). Volatile aromatics are also found in these same tars and in light oil (Exh. AG-106). Phenolics are present in coal tar; and ammonia, cyanide, sulfide, and thiocyanate are present in ammoniacal liquor (id.).

3. Gas Purification Processes

Depending on the particular process used, various residuals associated with manufactured gas had to be removed prior to gas distribution. Certain components of raw or unpurified gas would condense in distribution mains, corrode pipes, or produce noxious gases at the burner tip (Exh. DPU-18, p. 54). Various

cleaning and purification processes were used to prepare the gas for distribution, depending on the method of gas production and specific raw materials used (id.).

Water vapor and heavier tars were removed from coal gas by driving the raw gas through a hydraulic main, which was cooled to remove the water and heavy tars through condensation (Exh. DPU-18, p. 59; Tr. III, p. 64). In the case of water gas and oil gas, these vapors and tars were removed by passing the raw gas through a washbox. Lighter tars were removed both with direct and indirect condensers (Exh. DPU-18, p. 62). The remaining aerosols of tar were removed with either tar extractors or, after 1924, electrostatic precipitators (Exhs. AG-80; DPU-18, p. 62). At smaller plants, aerosols were removed by shavings scrubbers (Exh. DPU-18, p. 65). Tar from coal-gas works could be resold to industry, but tar produced at carbureted gas and oil gas plants generally contained petroleum derivatives which made them less suitable to industry (Tr. III, p. 102). Tars produced by coal carbonization were often recycled as process fuel where the water component was proportionately small enough not to retard combustion (Exh. DPU-18, p. 133).

Tars with a high water content were referred to as tar-water emulsions (id., p. 136). Emulsions were not generally a problem at coal carbonization plants, for the tar separated cleanly from the condensates and each could be readily recovered (id.). However, tar-water emulsions produced by carbureted water gas

and oil gas facilities often contained too much water either to sell or to burn (id., p. 136). In these cases, the tar-water emulsions were simply disposed of on-site into holding lagoons or pits, or off-site into streams or along railroad tracks (id., p. 134).

Naphthalene was frequently removed from the gas by scrubbing with oil (Exhs. AG-77; DPU-18, p. 69). The naphthalene-enriched oil could then be distilled to recover the naphthalene for resale, if market conditions warranted it, or used in the carbureted water gas or oil gas process (Exh. DPU-18, p. 69).

Initially, light oils were not removed from the gas (id., p. 72). In later years, the demand for benzene and xylene chemicals during World War I spurred the recovery of light oils in the same manner as was used for naphthalene recovery (id., p. 69). Scrubbers were used to recover the oil, which was then either mixed with light oils or carburetion stocks for resale or use as a feedstock, or merely discarded with condensate water (Tr. III, pp. 149-150; Exh. DPU-18, p. 67).

Condensate water was also produced by the tar-extraction process (id.). Because retorted coke could spontaneously combust, it had to be quickly quenched with water to preserve the coke as it left the anoxic environment in the retort (Exh. AG-236). This need provided a use for the condensate water as a coke quencher (Exh. DPU-18, p. 67). Otherwise, the condensate was recycled or disposed of in streams (id.).

Ammonia was removed through several methods, including treatment with sulfuric acid or through ammonia stills (Exhs. AG-78; DPU-18, pp. 78, 81). Phenols were either discharged into city sewers, used as a quenching agent for coke removed from the ovens, or, if recovery was desired, extracted by washing or vapor recirculation (id., pp. 84, 86).

Hydrogen sulfide was initially removed with lime (id., p. 88). Because lime could only be used once, it was an expensive process (id., p. 90). Beginning around 1870, it was discovered that iron oxide could remove hydrogen sulfide, and be reused (id., p. 190; Tr. III, p. 87). Iron oxide could be regenerated either by exposure to air over several months or by blowing air through the purifier box (Tr. III, pp. 152-153). Eventually, the iron oxide became so contaminated with sulfur that it could no longer regenerate and was itself discarded (id., p. 152). During the 1920s, several liquid purification processes were developed for hydrogen sulfide removal (Exh. DPU-18, pp. 92-93, 193).

Cyanide was produced by coal carbonization and removed from coal gas by the same equipment that removed hydrogen sulfide (id., p. 99). Only trace quantities of cyanide were generated by carbureted water gas and oil gas, so its recovery for resale was profitable only at larger plants (id.).

4. Disposition of Residuals

Residuals may be broken down into two categories: by-products and wastes (Tr. III, p. 16). If by-products had the proper chemical constituents and energy content, they could be recycled as a feedstock in the manufactured gas process (Exh. CO-2-A, p. 23). Alternatively, certain residuals, including coke, various tars, and ammonia, could be used in other industries (Exh. DPU-18, p. 132). By selling by-products, gas companies could reduce net production costs, and thereby offer customers a lower-cost product and encourage greater sales (Exhs. CO-2-A, p. 26; DPU-13, Tr. of September 10, 1888, p. 5). Despite the benefits to gas customers and utilities that could be accrued through the sale of by-products, the extent to which by-products could be sold was influenced by available recovery technologies and by whether sufficient by-products could be generated to make resale economically practical (Exh. CO-2-A, p. 26). The prevailing market that existed from time to time for a particular by-products also influenced the decision as to resale or disposal (id.).

Certain residuals, such as ash and clinkers, had little, if any, market value. These wastes were often discarded either on- or off-site as fill material (Exh. DPU-18, p. 153). Even for those residuals with resale value, prevailing market conditions dictated whether the residual could be sold. Although spent oxides were reclaimed in Europe for sulfuric acid, the abundance of brimstone in this country made sulfur readily available and left spent oxides with little, if any, market (id., p. 144).

The use of tar as a by-product in this country was generally limited before World War I, because of the availability of tar-based products, including chemicals and pharmaceuticals, from Germany (Exh. DPU-27, p. 14).

In addition, the physical characteristics of the tars produced by carbureted water gas and oil gas plants limited their value. Unlike tars from coal carbonization plants, tar-water emulsions produced by carbureted water gas and oil gas facilities were of irregular quality and generally contained too much water to burn (Exh. AG-208, p. 1239). These wastes were generally disposed of on- or off-site (Exh. DPU-18, p. 136).

D. State of Scientific and Engineering Knowledge Concerning the Hazards of MGP Wastes

The occupational hazards of coal combustion products were documented as far back as 1775 (Exh. AG-158). At that time, the effect was believed to be caused by mechanical irritation of the skin by soot (Exh. CO-10; Tr. XIII, p. 134). By 1876, a connection between coal tar and cancer, long suspected, was conclusively established (Tr. XII, p. 104). It still remained unclear whether cancer was caused by chemical effects of coal soot on the skin or by mechanical irritiation (Tr. XIII, p. 137; Exh. CO-10, p. 5). Experiments during the early nineteenth century sought to establish what chemical fractions of coal caused cancer; and the link between the chemical properties of coal tar to cancer was established by the late 1920s and early 1930s (Tr. XIII, p. 139; Tr. XII, pp. 109). Benzo(a)pyrene, a

major carcinogen found in coal tar, was first identified in 1933 (Tr. XIII, pp. 146-147). Other carcinogens were identified in 1947 (Exh. AG-154).

Another chemical component of MGP wastes, benzene, was known as a hematological poison since the late nineteenth century (Exh. AG-99, p. 18). Benzene causes aplastic anemia (Exh. AG-178, p. 4; Tr. XIII, p. 109). Though medical science had long seen a linkage between benzene and leukemia, the first clear establishment of benzene as a human leukemogen was made in 1977 (Tr. XIII, p. 109).

Throughout the MGP era, the scientific and medical communities developed the connection of MGP wastes to human health risks. What was lacking was the determination of the level at which public health might be adversely affected by MGP wastes (Tr. XIII, p. 112). While the medical observations of the period may have been precise and based on comprehensive data collection, the relationship between the level of exposure to MGP wastes and the reaction to the exposure was still uncertain (id.). The statistical analyses now used to determine dose-response levels, including multievent modeling, were not developed until 1976 (Exh. CO-42; Tr. XII, pp. 11, 153). The technical ability to detect contaminant levels required under current occupational safety and environmental regulatory standards did not exist until the 1970s (Tr. XII, pp. 11, 153; Exh. CO-41).

The record is replete with scientific inquiry and debate over the causes of recognized health hazards as far back as 1775 (Exh. AG-158). However intense the debate over causation may have been, there seems to have been little dispute over recognition of adverse occupational health effects.

By the late 1800s, the state of knowledge associated with MGP wastes was sufficient to induce passage of environmental regulatory measures with respect to waterways. The disposal of tar and other MGP wastes into waterways was generally restricted or prohibited, by either local or state action (Exhs. AG-193, p. 342; AG-165).

Evidence contemporaneous to the MGP era demonstrates a degree of awareness by the gas industry that MGP plant operators were collecting on their land materials that represented environmental hazards and whose escape could cause injury to others. The gas industry seems generally to have understood that certain properties of MGP wastes were deleterious (Tr. XVII, pp. 79-80). For example, the disposal of spent oxides on land damaged land, leaving the particular parcel unsuitable for agricultural purposes (Exh. AG-128; Tr. VI, pp. 79-80; Tr. XI, pp. 133-134; Tr. XVI, p. 36). The industry was also concerned that the various salts and chlorides contained in ammonia still waste may have had a detrimental effect on vegetation (Tr. XV, pp. 132-133; Exh. AG-168, p. 454). It was also known that the introduction of MGP wastes into a waterway could damage oyster beds and kill fish (Exhs.

AG-167, pp. 349-350; AG-193, p. 342; Tr. XVI, pp. 36-37). Gas liquors were known to be highly toxic to fish, and rendered them unpalatable by the concentration of chemicals in the flesh (Exhs. AG-129, p. 126; Exh. AG-167, pp. 349-350; Tr. XII, pp. 67-68; Tr. XV, pp. 126, 129).

A major concern of the manufactured gas industry during this era was the potential for contamination of water supplies by the escape of MGP wastes from MGP sites. MGP wastes deposited on the ground could seep into wells and streams and render the water unpalatable whether by taste or odor (Exh. AG-128, p. 315; Tr. XII, pp. 51, 71). The disposal of ammonia wastes into the ground was considered to be a hazardous proposition because the waste could percolate into ground water and end up in a stream (Tr. XII, pp. 85-86). It was generally known that tar water waste contained hazardous constituents, including napthalene, benzene, toulene, and xylene (Exh. AG-167, pp. 349-350). Despite the relatively limited state of hydrogeologic science, the MGP industry was aware that the discharge of these substances in concentrated form could produce adverse effects (id., p. 349).

Correspondingly, MGP operators realized the need to avert risk to the property of others from MGP waste nuisances. Concerns at industry meetings revolved around the possibility of successful legal actions against MGP operators on charges of nuisance (Exh. AG-128, pp. 314-315) (see also Section V.B.). Nuisance actions could, and were brought on a number of grounds,

including damage to land, vegetation, and waterways (id.; Exh. AG-100, p. 444; Tr. XI, pp. 130-131). Other causes of legal action cited by industry officials during this period included complaints of tarry wastes carried off by streams and later found adhering to the legs of cattle and injuring soil and crops (Exh. DPU-129, p. 128; Tr. XII, pp. 76-78).

In such circumstances, industry officials were urged to take such measures necessary to prevent any nuisance from being found at their facilities, thereby averting legal actions (Exh. AG-128, pp. 314-315). Measures taken to minimize the possibility of MGP waste's escape included the development of equipment to extract tar from water and to burn tar as boiler fuel (Exhs. AG-194, p. 226; AG-198, p. 158). The trade journals and industry meetings of the MGP era are replete with information concerning the various alternatives available to treat or dispose of MGP wastes (Exhs. AG-167, AG-198; AG-201; AG-202; AG-204; AG-211; AG-218; AG-221). Various recommendations were made as to what specific plant improvements or processes could be used to eliminate or mimimize problems associated with MGP wastes (Exhs. AG-203; AG-205; AG-206, passim). The American Gas Association's various committees were actively considering the most appropriate methods to treat MGP wastes during this period (Exhs. AG-199; AG-206 [Willien]; AG-208; AG-210; AG-213; AG-214). Finally, individual gas utilities reported in the trade journals of the period on the measures they had taken to minimize the problems associated with

the disposal of residuals (Exhs. DPU-12 [Carter]; DPU-26, Sec. 7, pp. 59-81; AG-206 [Klein]; AG-211; AG-217; CO-58; CO-59).

IV. DESCRIPTION OF SETTLEMENT AGREEMENT

On May 1, 1990, the Settling Parties jointly filed a Settlement Agreement. The Energy Consortium refrained from participating in the Settlement Agreement but filed comments in its brief. In the Settlement Agreement, the Settling Parties agreed that, beginning on July 1, 1990 ("the Implementation Date"), each of the gas company petitioners would amortize and recover from their ratepayers over a seven-year period, without carrying charges, the environmental response costs incurred during 1989 (Settlement Agreement, § II). Previously deferred response costs would be treated in the same manner as if they had been incurred during 1989 (id., § VIII). Cleanup costs incurred each year in the future would also be recovered over separate, seven-year amortization periods. The Settling Parties agreed on this compromise for ratemaking purposes without any finding regarding the prudence of the manufactured gas operations and plant decommissioning (id., Preamble).

The Settling Parties propose a definition of recoverable "environmental response costs" to include all investigation, testing, remediation, litigation expenses, and other liabilities relating to manufactured gas facility sites, disposal sites, or other sites onto which material may have migrated, as a result of the operation or decommissioning of Massachusetts gas manufacturing facilities during the period from 1822 through 1978 (id.). The Settling Parties indicate that personal injury settlements or awards relating to manufactured gas waste sites

would be considered recoverable costs within the definition of the term "environmental response costs" (Tr. of May 9, 1990, p. 10 et seq.). The gas company petitioners made a representation that they are not aware of any personal injury suits or claims relating to the pre-1979 manufactured gas operations, waste disposal and decommissioning activities, and are also not aware of any facts that would lead them to believe that any such suits or claims will be filed or asserted (Settlement Agreement, § VII.C; Tr. of May 9, 1990, pp. 12-27). The Settling Parties specifically excluded from recoverable costs any expenses resulting from claims made by the gas company petitioners against insurance companies or third parties,[8] or any expenses resulting from any non-manufactured gas operations, including but not limited to by-product coke oven sites, the Plympton lead site, or PCB sites (id., § VII.A).

Under the Settlement Agreement, the Settling Parties propose that the agreement would preclude any party to the Settlement Agreement (or the Department on its own motion) in a later proceeding before the Department from challenging the propriety of recovery from ratepayers of the environmental response costs on grounds of (a) the prudence of the pre-1979 manufactured gas

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8 Expenses and recoveries resulting from claims against insurers or third parties are addressed separately in the Settlement Agreement, § VI, as described infra, p. 34.

operations, waste disposal, and decommissioning activities that have resulted in the need for incurring the response costs or (b) the appropriateness of allowing rate recovery of such expenses through the recovery mechanism provided for in the Settlement Agreement. In the Settlement Agreement, the Attorney General reserved his right to challenge or contest the prudence of any action taken or not by the gas company petitioners and the amount of any costs or recoveries incurred or obtained through the prosecution of insurance and third party claims (id., § VII.B; Tr. of May 9, 1990, p. 5). The authority of the Department in this regard remains, of course, unimpaired by the terms of the Settlement Agreement.

The Settlement Agreement provides for a recovery mechanism in the form of a separate, additional element in the existing Cost of Gas Adjustment Clause. 220 C.M.R. 6.00 et seq. This element, the Remediation Adjustment Clause, would provide for a per-unit-of-gas charge equal to sum of the charge to be collected under the company's current Cost of Gas Adjustment Clause and the amount given by the environmental response cost formula (Settlement Agreement, § IV.A). This formula would consist of one-seventh of the actual response costs incurred by a company in a calendar year and to be recovered from ratepayers during the upcoming year, less a deferred tax benefit to be returned to ratepayers during the upcoming year. This amount would then be divided by the company's forecast of total firm sales volumes for the upcoming year. The Settling Parties

further agreed that the environmental response cost portion of the Cost of Gas and Remeditation Adjustment Clause would be reconciled annually for each company, with the amount of any over or under collection to be debited or credited to the total annual charge for the following year (id., § IV.C).

The deferred tax benefit would be calculated as follows. For the first year of cost recovery, the deferred tax benefit would be the amount given by the entire actual response costs incurred in a calendar year multiplied by the company's net cost of capital rate (as set in the company's last base rate case and adjusted for income tax effects) and by the effective combined federal and state income tax rate. In the second year, six-sevenths of the actual response costs would be multiplied by the cost of capital and the combined tax rate; in the third year, five-sevenths of the costs would be used, and so forth until the seventh and final year, when one-seventh of the response costs would be used (id., § IV.B).

With regard to filing requirements, the Settlment Agreement requires that each company file with the Department, the Attorney General, and any other interested party all bills and receipts relating to any environmental response costs incurred in the preceding calendar year for which each company seeks to begin recovery in the upcoming year and a schedule depicting the purpose of each expenditure. This filing would occur at least ninety days before each anniversary of the implementation date. In the same filing, each company would include similar material

and information to support any expenses or recoveries from insurance or other third-party claims (id., § IV.D).

The Settlment Agreement accords a different ratemaking treatment to insurance and third-party litigation expenses and recoveries. Insurance and third-party expenses and recoveries would be shared in equal proportions between the gas company petitioners and their ratepayers. In the Settlement Agreement, one half of the expenses incurred by the gas company petitioners in the prior year in prosecuting insurance and third-party claims and one half of any recoveries or other benefits received by the gas company petitioners as a result of a judgment or settlement from insurance or third-party claims, would be credited against all annual amortization amounts that have been or are being collected through the Settlement Agreement's recovery mechanism (id., § VI).

The Settlement Agreement also provides a limitation on the total annual charge to be recovered from ratepayers: the total annual charge to a company's ratepayers would not exceed five percent of a company's total revenues from firm Massachusetts gas sales during the preceding year. If for a particular company, the annual recovery should exceed the five-percent cap, the amount in excess of the cap would be deferred and would accrue carrying charges at the company's net cost of capital (as allowed in the company's last rate case and adjusted for income tax effects) until such sum can be added to the amount to be recovered in a subsequent recovery year without exceeding the five-percent cap (id., § V).

The terms of the Settlement Agreement provided for an option to discontinue the agreed upon ratemaking treatment. Any company whose 1989 firm retail gas revenues were less than $100 million may choose to discontinue the ratemaking treatment of the environmental response costs provided for under the Settlement Agreement in the event that the unrecovered amount of its response costs should exceed the lesser of $2 million or 5.5 percent of its 1989 firm gas distribution revenues (id., § IX). The gas company petitioners for which this provision is applicable are The Berkshire Gas Company, Essex County Gas Company, Fall River Gas Company, Fitchburg Gas & Electric Light Company, and North Attleboro Gas Company.

If a company does provide written notice that it intends to exercise this right, then, as of the first day of the month following the date of notice, the company would no longer be allowed to recover any response costs through the mechanism provided for in the Settlement Agreement (id., § IX.A). Furthermore, any balances remaining in the company's environmental response cost account would be treated for ratemaking purposes as if they had been granted deferral of their recognition and thus not subject to disallowance for the sole reason that they occurred prior to the particular test year used by the company in pursuing rate recovery (id., § IX.B). The company may also seek base rate treatment of the balance remaining in its environmental response cost account and any response costs that it may incur in the future, plus any

expenses or recoveries resulting from insurance or third party claims (id., § IX.C). In addition, the company would bear the burden of proof with regard to the prudence of the environmental response costs for which it seeks or has received recovery from its ratepayers as if the Settlement Agreement had never occurred and it was seeking recovery of these costs for the first time. The Attorney General would then be free to challenge and the Department free to investigate the prudence of the manufactured gas operations and decommissioning activities of the company that resulted in the need to incur the response costs and the propriety of allowing rate recovery of such expenses (id., § IX.D). Finally, if the company initiates a rate proceeding for recovery of response costs, the amounts of any previous recoveries of response costs found to be reasonable by the Department in this proceeding would be credited against the amount of such response costs, if any, found to be recoverable from ratepayers in the Department's decision in that proceeding. Similarly, any amount of previous recoveries of such costs found by the Department to be unreasonable would be credited against the revenue requirement found in that proceeding (id., § IX.E).

The Settling Parties further agreed that in the gas company petitioners' future rate cases environmental response costs would not be considered in determining the level of base rates. The gas company petitioners agreed that they will not make any arguments in a subsequent rate case that the existence of the

Settlement Agreement or the effects resulting from its application justify the allowance of a higher rate of return on common equity (id., § X).

Finally, the Settling Parties agreed on the treatment to be given to gains from future sales of affected properties. In the event a company sells a former manufactured gas operations or dump site and realizes a net gain on the sale, the company would be allowed to calculate its basis in such property (for purposes of the determining the gain to be returned to its ratepayers) by including the carrying costs foregone during the amortization period on those response costs related to said property; provided that such adjustments to the company's basis do not result in the gain becoming a loss (id., § XI).

V. ANALYSIS OF THE SETTLEMENT AGREEMENT ON THE BASIS OF THE GENERIC RECORD

We have reviewed the Settlement Agreement on the basis of the generic investigation record in this docket and generally find it to be in ratepayers' interest. We therefore allow the Joint Motion. In this section, we set forth our reasons for accepting the Settlement Agreement. While refraining from any prudence findings, we describe our conclusions concerning the four issues examined in this docket: industry knowledge and practice, the law of the MGP era, insurance coverage, and appropriate ratemaking treatment, as set forth in the Interlocutory Order and in the Joint Petition. In turn, we assess the Settlement Agreement against our conclusions to indicate the reasons for its acceptability.

A. Industry Knowledge and Practice

Our review of the record in Section III of this Order persuades us that throughout the MGP era, the industry knew either in fact or constructively that the by-products and wastes of the MGP processes were hazardous and, in some cases, were carcinogenic and that the deposition of such materials on land or in ground or surface waters could injure that land or those waters by rendering them unfit for certain purposes. There is evidence, of course, that the ethic of the era sanctioned the use of land for such purposes. And there is further evidence that the economics of marketing MGP by-products were often so adverse as to render disposal of by-products on site or at

authorized dumpsites a more rational alternative than attempted sale, as a matter of short-run economics.

This awareness of the hazardous nature of MGP wastes does not, however, readily translate into imprudence for incurring the kind of liability imposed today by CERCLA and G.L. c. 21E. Even though this awareness may have alerted MGP operators to the risks to others and to neighboring land from MGP wastes, it is difficult, though not impossible, to infer that an MGP operator ought to have known that mere disposal on his own land or at a legal dumpsite, where no escape has subsequently occurred onto neighboring property, would leave him or his successors liable to clean up his own land or the dumpsite as part of a government-ordered remediation some two, ten, or even seventeen decades later. And even if such potential liability should have been foreseen, there would remain the difficult question whether such disposal might fairly be judged imprudent or whether risk of incurring a liability, arguably so remote, should better be viewed as a reasonable cost of doing business. The difficulty of inferring a want of care in MGP disposal practices is heightened by the evidence that the ability to measure the presence and effects of environmental contaminants at the parts-per-billion level of dilution in water was quite unknown to science during the MGP era.

Where, however, the land of others might become implicated by later escape of MGP wastes, the inference of want of care or prudence might more readily be drawn. But even there, as we

point out in our discussion of the law of the MGP era that follows, such an inference, while arguably strong, is not compelled.

It is a virtue of the Settlement Agreement that these difficult judgments are rendered unnecessary. In their place, a reasonable cost-sharing mechanism is established.[9] Therefore, unless and until a company entitled to invoke Section IX of the Settlement Agreement, permitting discontinuance of its ratemaking treatement, acceptance of the Settlement Agreement altogether obviates any need to render prudence judgments on the knowledge and practices of the MGP industry. We confine ourselves to observing that the Settlement Agreement's cost-sharing approach, taken as a whole, is not inconsistent with our reading of the record and of defensible inferences that might be drawn from it on the issue of industry knowledge and practice.

B. The Law of the MGP Era

Understanding MGP-era law is a key to establishing the rights and duties of MGP plant operators and their prudence in the conduct of their business. Interlocutory Order, pp. 15-16. As noted earlier, the Settlement Agreement, § II, would obviate

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9 The cost-sharing mechanism provides for an approximately 50/50 sharing of cost between company stockholders and ratepayers (Tr. of May 9, 1990, pp. 28-29). The mechanism is analyzed in Section V.D of this Order, infra, p. 50.

any need for such prudence inquiries or findings on the part of the Department. Nonetheless, the Department has investigated the MGP-era law as part of this docket and must view the acceptability of the Settlement Agreement against that background, although, as noted, we refrain from any express finding on the prudence question.

Accordingly, we review the Settlement Agreement against pre-CERCLA law concerning (a) rights to use and restrictions imposed on the use of land generally, (b) duty owed by one landowner to another, and (c) defenses and liabilities resulting from use of independent contractors to haul, dispose of, or receive MGP wastes. The law sheds light on rights and duties in the use of MGP plant sites and legal dumpsites and on obligations to neighboring land onto which MGP wastes may have migrated.[10]

The pertinent law is tort law and real property law. We well recognize, of course, the need for caution in "reliance on tort analogies to define a public utility's responsibility in a

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10 Finding the law of the MGP era, before the major change wrought by CERCLA, is akin to the exercise undertaken by Federal courts to determine state law in diversity suits. 28 U.S.C. § 1652. As there may not always be precedent exactly on point, courts look to relevant precedents, analogous decisions, and considered dicta. Nolan v. Transocean Air Lines, 365 U.S. 293, 295-96 (1961); Sproul v. Hemmingway, 31 Mass. [14 Pick.] 1, 5 (1833); Gray v. Boston Gas Light, 114 Mass. 149, 154 (1873). See C. Wright, Law of the Federal Courts, § 58, at 370 (4th ed. 1983).

regulated area." Commonwealth Electric Co. v. Department of Public Utilities, 397 Mass. 361, 367 (1986). But at least until the late 1920s, the MGP era was largely a time of no or of limited regulation of the gas industry (Exh. AG-117, pp. 25-26; Tr. XVII, p. 94). Thus, the best touchstone available is tort and real property law.

During most of the MGP era, land-use regulation was, when compared with late twentieth-century practice, rudimentary. R. Anderson, American Law of Zoning 3d, § 3.03, at 86, § 3.06, at 93 (3d ed. 1986); D. Hagman and J. Juergensmeyer, Urban Planning and Land Development Control Law, § 2.2, at 13, § 2.3, at 14 (2d ed. 1986). In the absence of a legislative or police restriction or of a covenant, a proprietor could "consult his own convenience in his operations above and below the surface of his ground." Greenleaf v. Francis, 35 Mass. [18 Pick.] 117, 121, 123 (1836). See Shipley v. Fifty Associates, 106 Mass. 194, 197 (1870). Ownership was a coelo usque ad centrum ("from heaven to the center of the earth"), and ownership rights could be asserted even at some inconvenience to neighbors. Greenleaf, 35 Mass. [18 Pick.], at 117, 121-22; Gannon v. Hargadon, 92 Mass. [10 Allen] 106, 109-10 (1865). Locale was a major determinant of whether legislative or police restrictions on certain uses were warranted. Commonwealth v. Tewksbury, 52 Mass. [11 Met.] 55, 57 (1846); Commonwealth v. Alger, 61 Mass. [7 Cush.] 53, 87, 95-96 (1851). Even where restriction on the use of private property for trades "useful and beneficial to the

public" was warranted, id., it was to be exercised "only in cases amounting to an obvious public exigency." Tewksbury, 52 Mass. [11 Met.], at 57-58; Alger, 61 Mass. [7 Cush.], at 97, 102-03. Very little indication appears on our record (which is, albeit, generic and not site-specific) regarding legislative or police restrictions of the MGP industry. Indeed, if any inference is warranted, one of a favorable legislative view of the gas industry may perhaps be drawn from the frequent grants of corporate charters by special acts of the General Court (Exh. DPU-15-A).

Although landownership rights were broad during the MGP era, landowners were responsible for certain adverse consequences of use. Private ownership rights were tempered by the common law principle sic utere tuo ut alienum non lædas ("use your own property in such a way that you do not injure that of another"). Public or private nuisance[11] actions might lie for transgression of this maxim. Stowell v. Flagg, 11 Mass. 364, 364-65 (1814); Thurston v. Hancock, 12 Mass. 220, 224 (1815); Tewksbury, 52 Mass. [11 Met.], at 57. Even so, a landowner still retained the right "to use his land to his best advantage." Eames v. New England Worsted Co., 52 Mass. [11 Met.] 570, 572 (1846).

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11 "A public nuisance is an unreasonable interference with a right common to the general public." Restatement, Second, Torts, § 821B. "A private nuisance is a nontrespassory invasion of another's interest in private use and enjoyment of land." Id., § 821D.

But where injury ensued "from an otherwise legitimate use" of his property, the landowner would have to "compensate his neighbor in damages" for the resultant nuisance, Stowell, 11 Mass., at 364-65, even where the damage was modest, Eames, 52 Mass. [11 Met.], at 572, and even where the result might be impossible to control or difficult to predict. Wilson v. New Bedford, 108 Mass. 261, 265 (1871). See also Sherman v. Fall River Iron Works, 84 Mass. [2 Allen] 524, 526 (1861); Sherman v. Fall River Iron Works, 87 Mass. [5 Allen] 213, 214-15 (1862); Shaw v. Cummiskey, 24 Mass. [7 Pick.] 76 (1828); Monson & Brimfield Manufacturing Co. v. Fuller, 32 Mass. [15 Pick.] 554 (1834); Fuller v. Chicopee Manufacturing Co., 82 Mass. [16 Gray] 46 (1860); Shipley, 106 Mass. 194. Nuisance liability might even attach for acts related to land not in the defendant's possession. Gray v. Boston Gas Light, 114 Mass. 149, 154 (1873). Moreover, a landowner was responsible not only for erecting a nuisance of his own, but also for maintaining a nuisance earlier erected on the land by another. Staple v. Spring, 10 Mass. 72, 74 (1813); Eames, 52 Mass. [11 Met.], at 572-73.

Before 1868, violation of duty to refrain from nuisance required a showing of "culpable negligence." Chandler v. Worcester Mutual Fire Insurance Co., 57 Mass. [3 Cush.] 328, 330 (1849). After 1868, a plaintiff no longer had to show negligence for certain kinds of injury to his land, for strict or absolute liability might attach. Ball v. Nye, 99 Mass. 582

(1868), adopting the rule of Rylands v. Fletcher, Law Rep. 3 H.L. 330 (1868). Where a landowner brought or collected "something on his own property not naturally there, harmless so long as it is confined to his property, but . . . mischievous if it should get upon his neighbor's land," he would be held, despite his best efforts to contain what he had collected, "responsible for damages, if he should not succeed in confining it to his own property." Shipley, 106 Mass., at 198. See Fuller, 82 Mass. [16 Gray] 46; Shipley, 106 Mass., at 199; Wilson, 108 Mass., at 265-66; Fitzpatrick v. Welch, 174 Mass. 486 (1899); Devo v. Athol Housing Authority, 335 Mass. 459, 462-63 (1957). The Rylands rule did not enlarge a landowner's duty to refrain from injury to another's property. Rather, Rylands, as adopted in Massachusetts, merely eliminated the need to prove negligence and, in effect, put certain hazardous uses of land "at the sole risk of the user," who henceforth had to provide "safeguards [against escape] whose perfection he guarantees." Ainsworth v. Lakin, 180 Mass. 397, 399 (1902).

Although the Rylands rule was denominated one of strict liability, it was not unqualified. As stated earlier, supra page 8, certain defenses, such as acts of God or unforseeable and wrongful acts of third parties, were available. Cork, 162 Mass., at 333. Moreover, the injury had to be the natural consequence of the breach of duty. Kaufman v. Boston Dye House, Inc., 280 Mass. 161, 169 (1932).

Use of an independent contractor might offer a defense to liability. Brackett v. Lubke, 86 Mass. [4 Allen] 138, 140 (1862). Cf. Foster v. Essex Bank, 17 Mass. 479, 509 (1821). But even that defense could be overcome where an independent contractor "was without proper skill or unsuitable to do the work," Connors v. Hennessey, 112 Mass. 96, 99 (1873), or where improperly done work caused "mischief upon the land of another." Gorham, 125 Mass., at 99. See Connors, 112 Mass., at 99; Sturges v. Society for the Promotion of Theological Education at Cambridge, 130 Mass. 414, 415 (1881); Davis v. John L. Whiting & Son Co., 201 Mass. 91, 93 (1909); Pickett v. Waldorf Systems, Inc., 241 Mass. 569, 570 (1922). Use of an independent contractor by a public utility defendant might also prove an unavailing defense where statute imposed a duty. Boucher v. New York, New Haven, & Hartford Railroad Co., 196 Mass. 355, 359-60 (1907). Cf. Commonwealth Electric, 397 Mass., at 366 n.2. But even apart from statute, common law liability might attach for the wrongful consequences of the acts of an independent contractor performing under a lawful contract. Woodman v. Metropolitan Railroad, 149 Mass. 335, 339-40 (1889), citing Gorham, 125 Mass., at 240.

Having examined the law of the MGP era, we make several observations about applying it to prudence inquiries. Considering the passage of time, the unavailability of percipient witnesses to the events likely to be at issue in prudence inquiries, the general state of company records, and

the condition of MGP plant sites (many of which have been dismantled and redeveloped), we regard applying these principles of law to individual prudence inquiries would likely prove a daunting, though perhaps not impossible task. Although the general picture of the law during the MGP era is clear enough, the law was not static. Attempting to say what legal nuance or subtlety applied when MGP wastes were generated or disposed of or when contaminants may have crossed a site boundary resulting in nuisance injury (assuming such dates could be established) would be difficult, indeed (Tr. XVI, pp. 103-04).

The generic investigation in this docket also persuades us that site-specific information from contemporaneous records is likely to be fragmentary and enigmatic. Mounting a case, whether for prudence or imprudence, would probably prove, at best, extremely difficult in any case. Serious expense would be entailed on the part of the gas companies, the Attorney General, and the Department without significant likelihood of greater benefit to ratepayers in comparison with the outcome under the Settlement Agreement. Because of the inevitable hazards attendant on recordskeeping by corporate predecessors of today's gas companies, inconsistency and unfairness may result in developing a case-by-case body of MGP prudence precedent. Cases might well be decided by the chance survival or perishing of records from decades or even a century and a half ago. In addition, translating an MGP plant operator's incurrence of risk of strict liability into imprudence, while not an impossible

task, requires a nicety of judgment that is certainly open to good faith disagreement.

In contrast to all these uncertainties is the clear-cut sharing of cost and risk set forth in the Settlement Agreement. Applying the law of the MGP era might, in fact, favor recovery where hazardous materials from the MGP industry have not migrated from MGP plant sites or lawful dumpsites. While investigation of Massachusetts MGP sites has not progressed to a state of detailed assessment, the nature of the wastes is such that risk of migration offsite appears to be small or moderate (Tr. XVI, p. 38). For these reasons, we conclude that the Settlement Agreement represents a reasonable allocation of costs between shareholders and ratepayers.

C. Insurance Coverage, Litigation, and Proceeds

Massachusetts law concerning insurance coverage of MGP waste cleanup is presently inchoate at best. Some preliminary steps are being taken, to be sure, that may answer certain questions. For example, the Federal court for the Massachusetts District has certified certain questions of insurance law to the Supreme Judicial Court regarding coverage for the cleanup of New Bedford harbor. In Re Acushnet River & New Bedford Harbor Proceedings, 725 F.Supp. 1264 (D. Mass. 1989). In addition, the Supreme Judicial Court has before it an appeal on kindred issues in Hazen Paper Co. v. United States Fidelity & Guaranty Co., Hampden County Super. Ct., Civil Action No. 86-1679 (January 10, 1989).

Whether and how the Court may pronounce on these issues is not known, and the absoluteness of any resolution it offers is not certain. And, even were the Court to answer all the legal questions now before it, much time and effort would be expended to apply its answers to insurance litigation over the scores of MGP sites across the Commonwealth.[12] Thus, whatever the upshot of the two matters now before the Court, insurers are certain to show their customary energy and adeptness in asserting their defenses and in taking years to do so (Tr. I, p. 69, ll. 19-24). Against this background, we have assessed the insurance provisions of the Settlement Agreement.

Early in hearings, the Department expressed concern lest allowing rate recovery of all or a major part of MGP cleanup costs, as urged by the gas company petitioners on brief, would

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12 Moreover, one of the most contentious issues is not before the Court in either of these cases: namely, the application of the "owned property" exclusion in standard policies on MGP sites owned by the gas company petitioners or their predecessors (Tr. II, p. 120; Attorney General Brief, pp. 141-42). The "owned property" exclusion, a typical feature of general liability insurance policies, states that the policy does not apply to damage to property owned or occupied by the insured, as, for example, an MGP plant site itself (Exh. CO-1, p. 33). Some courts apparently are disposed to construe such clauses against the insurer. Allstate Insurance Co. v. Quinn Construction Co., 713 F. Supp. 35 (D. Mass. 1989); C.K. Smith & Co. v. American Empire Surplus Lines, Inc., Worcester County Super. Ct., Civil Action No. 85-32950 (September 27, 1989). But the Supreme Judicial Court apparently has not yet spoken on point.

eliminate "a powerful incentive on the part of the companies to press their claims against their insurance companies" (Tr. II, p. 122). Section VI of the Settlement Agreement recognizes and accomodates this concern. It provides that half of any recovery against insurers or other PRPs would be retained by the gas company so recovering, while the other half would be returned to ratepayers, with adjustment for expenses for prosecuting the claim. This provision allays the Department's concern that any scheme for rate treatment, put into effect before insurance law is clarified and claims are pursued to a conclusion, must maintain a strong incentive for gas companies to assert their policy rights vigorously.

D. Ratemaking Treatment of MGP Waste Cleanup Under the Settlement Agreement

The terms of the Settlement Agreement are dispositive of the critical ratemaking issues that have been reviewed in this investigation. In particular, the Settlement Agreement would resolve, inter alia, the following matters that have received attention in this case: (1) the class of expenses they represent (e.g., whether extraordinary or nonextraordinary, recurring or nonrecurring); (2) whether the costs are recoverable through base rates or an external, mechanism similar in operation to the CGAC; and (3) the treatment of deferred remediation costs with regard to interest accrual. To establish that the Settlement Agreement, in fact, provides a reasonable outcome in disposing of these issues with the Settling Parties, a brief review of existing Department precedent is useful.

The Department has traditionally broken down utility expenses into four categories: (1) annually recurring expenses; (2) periodically recurring expenses; (3) nonrecurring expenses that are extraordinary in amount or nature; and (4) nonrecurring expenses that are not extraordinary in amount or nature. Fitchburg Gas & Electric Light Company, D.P.U. 1270-1414, pp. 32-33 (1983). The Department typically allows annually recurring expenses and normalized values of periodically recurring expenses to be included in a company's cost of service. The Department also allows recovery of extraordinary nonrecurring expenses through amortization and collection from ratepayers over an appropriate period of time.

Following the decision in Commonwealth Electric Company, D.P.U. 88-135/151 (1988), in which the Department disallowed certain costs associated with hurricane damage because the expenses were incurred before the test year, several gas companies presented the Department with petitions to defer environmental cleanup costs for future ratemaking consideration. In response to these petitions, the Department has granted deferral accounting for cleanup costs for several companies: Colonial, Bay State, Boston Gas, and Berkshire. In granting deferral accounting, the Department noted that the sole ratemaking implication of deferral is to remove, as an impediment to ratemaking consideration, the fact that the expenditures were made before the test year that serves as the basis for a general rate proceeding. Interlocutory Order, p. 18

n. 4; Colonial Gas Company, D.P.U. 89-170 (1989); Boston Gas Company, D.P.U. 89-177 (1989); Bay State Gas Company, D.P.U. 89-81, Interlocutory Order (1989).

The Department noted in Colonial Gas, D.P.U. 89-70, that cleanup expenses relating to manufactured gas wastes can reasonably be predicted to recur over the next several years. Unlike rent, wages, or other periodically recurring expenses, it is not possible to derive a representative level of cost for MGP cleanup activities because the precise amount of the expense and its periodicity are subject to significant uncertainties, largely outside of the direct control of the companies. The Department also noted in Colonial Gas that environmental cleanup activities relating to MGP wastes have attributes of both recurring and nonrecurring expenses. Id., p. 7.

In the present generic investigation, there is little controversy on the record that the level of MGP remediation costs expected for the industry as a whole in the Commonwealth will be extraordinary in nature or amount. However, the Settlement Agreement makes no pronouncement on this issue. In creating a separate accounting mechanism to facilitate recovery of remediation costs as a separate cost item, the Settlement Agreement appears to accommodate and facilitate what in all likelihood become an extraordinary cost over time for the gas distribution industry as a whole.

The seven-year amortization of remediation expenses, without interest, appears to reflect a ratemaking treatment that the Department generally permits for extraordinary, nonrecurring costs. In amortizing extraordinary nonrecurring expenses, the Department has typically found an amortization period of between three and five years, with as long a period of ten years, to be appropriate, depending on the particular circumstances of the case. As a general practice, the Department does not allow carrying charges to accrue on unamortized balances of extraordinary costs. The Department finds that the proposed amortization of remediation expenses in the Settlement is not inconsistent with the body of Department rate case precedent, or with the record in this case. The Settlement Agreement's amortization approach provides a reasonable result for ratepayers and gas companies alike.

At a meeting with the Department on May 2, 1990, the Settling Parties provided the Department with a spreadsheet that depicts the operation of the environmental response cost recovery mechanism and the relationship of nominal costs and "real" costs recovered, given an assumed discount rate (Exh. DPU-33). The spreadsheet indicates that this mechanism would recover between approximately 43 percent and 50 percent of the present value of the remediation expenditures incurred by the gas companies, at discount rates of 15 percent and 11 percent, respectively. While the example is a fairly simple case, the Settling Parties provided it to demonstrate to the Department,

in general terms, the effect it would have on consumers. The spreadsheet exhibit (Exh. DPU-33) reinforces our view that the Settlement Agreement establishes an equitable basis for allowing gas companies to recover MGP remediation costs.

E. Additional Considerations

Several features of the Settlement Agreement add to its value for the Settling Parties and for the Department. One essential benefit of the Settlement Agreement is that for the Companies, even though the real dollar recovery of Environmental Response Costs is significantly discounted, the Settlement Agreement will dispel much of the uncertainty in the financial community about the fiscal consequence of these costs for gas companies (Exh. CO-19, pp. 21-22). From an accounting standpoint, the Settling Parties indicated that adoption of the settlement would provide a more certain basis upon which accountants and financial analysts could evaluate gas company finances in contrast to the presently uncertain climate. It is frequently observed, of course, that financial uncertainty may translate into higher capital and borrowing costs for a utility and that, sooner or later, these costs may be borne by ratepayers (id., pp. 11-12). The clarity that the Settlement Agreement affords should help to assuage the concerns of the financial markets and thereby serve to reduce borrowing costs.

The Settlement Agreement would essentially preclude the Settling Parties from litigating the prudence of pre-1979 manufactured gas operations, and waste disposal and

decommissioning activities that resulted in the need to incur Environmental Response Costs. From an administrative perspective, the Settlement Agreement would greatly reduce the extent of litigation surrounding MGP issues in rate cases or other proceedings. In recent rate case filings that preceded the Settlement Agreement's filing, the MGP issues resolved by the Settlement Agreement required lengthy and exhaustive reviews that and posed further administrative burdens in reviewing rate case filings in the already constrained, six-month statutory time-limit. Thus, the Settlement Agreement not only provides a satisfactory and fair ratemaking outcome for MGP for both gas customers and the gas companies, but it does so in an efficient manner.

The Settlement also provides certain public policy benefits that, while not directly affecting ratepayers, are of general concern to the communities affected by MGP waste issues. It is apparent that the gas company petitioners' full and cooperative participation in complying with the spirit and letter of the law in remediating former MGP sites is enhanced by the certainty of ratemaking treatment established by our approval of the Settlement Agreement. By permitting cost recovery in an agreed-upon manner, the Department fully expects that gas companies will proceed to carry out their environmental responsibilities both in a cost-effective manner for ratepayers and in a cooperative fashion with environmental agencies. Uncertainty over ratemaking treatment is no longer an impediment to meeting the goals of environmental cleanup.

F. Conclusion

The Department finds that the Settlement Agreement establishes a reasonable ratemaking mechanism for dealing with environmental response costs that have been or may be incurred by the gas company petitioners. Accordingly, upon the foregoing considerations and analysis, the Department finds that granting the Joint Motion and approving the Settlement Agreement are in the public interest.

VI. ORDER

Accordingly, after due notice, hearing, and consideration, it is

ORDERED: That the Joint Motion of the Settling Parties be and hereby is allowed; and it is

FURTHER ORDERED: That the Settlement Agreement submitted by the Settling Parties be and hereby is approved as providing a fair and equitable resolution to the matters in controversy in the proceedings docketed as D.P.U. 89-161; and it is

FURTHER ORDERED: That the proceedings docketed as D.P.U. 89-161 be terminated with findings that in light of the terms and conditions of the Settlement Agreement, no further investigations are required and that the Department will not on its own motion in the future institute an investigation concerning the prudence of the conduct that resulted in the need to incur Environmental Response Costs as well as the ratemaking treatment, if any, to be accorded Environmental Response Costs.

By Order of the Department,

/s/ BERNICE K. McINTYRE

Bernice K. McIntyre, Chairman

/s/ ROBERT N. WERLIN

Robert N. Werlin, Commissioner

/s/ SUSAN F. TIERNEY

Susan F. Tierney, Commissioner

A true copy
Attest;

MARY L. COTTRELL
Secretary

Appeal as to matters of law from any final decision, order or ruling of the Commission may be taken to the Supreme Judicial Court by an aggrieved party in interest by the filing of a written petition praying that the Order of the Commission be modified or set aside in whole or in part.

Such petition for appeal shall be filed with the Secretary of the Commission within twenty days after the date of service of the decision, Order or ruling of the Commission, or within such further time as to the Commission may allow upon request filed prior to the expiration of the twenty days after the date of service of said decision, Order or ruling. Within ten days after such petition has been filed, the appealing party shall enter the appeal in the Supreme Judicial Court sitting in Suffolk County by filing a copy thereof with the Clerk of said court. (G.L. Ter. Ed.,c. 25, s. 5, as most recently amended by c. 485 of the Acts of 1971)