Public Works Historical Society

PUBLIC WORKS HISTORY

Summer 2011 • Number 98 • ISSN 1525-7002

The Lesson of San Bruno: History Repeats Itself

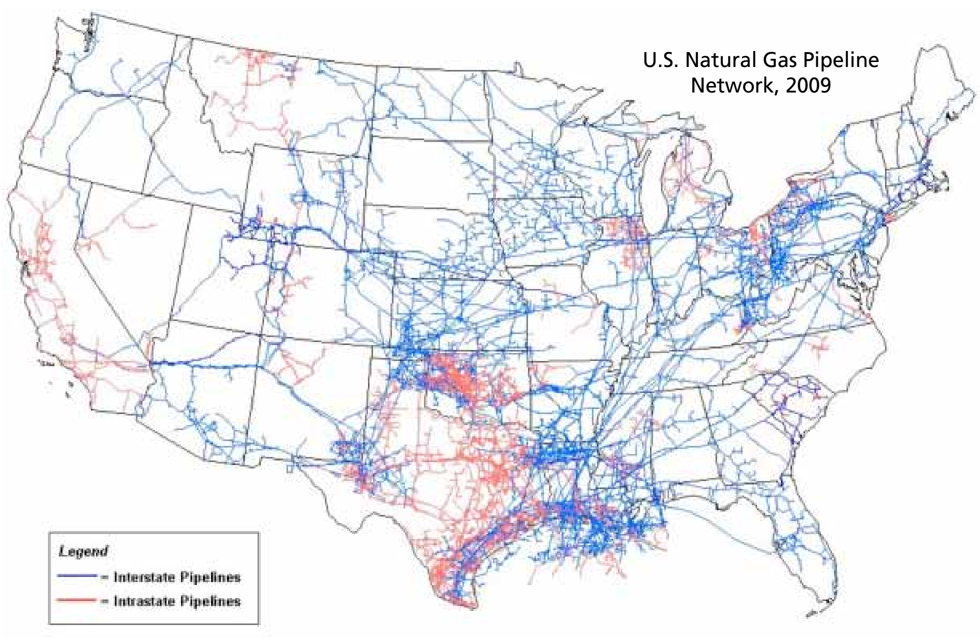
Chris J. Castaneda Ph.D.
Department of History
California State University

At approximately 6:11 p.m. during the evening of September 9, 2010, in San Bruno, California, a 30-inch natural gas pipeline operated by the Pacific Gas & Electric Company (PG&E) ruptured, and the freely escaping gas then exploded. The blast formed a crater measuring 72 feet in length and 26 feet in width. Thirty seven homes were destroyed, 18 were damaged, and most tragically, eight persons were killed and many others were injured. The National Transportation Safety Board is investigating the blast, and an official cause of the blast has not been determined.[1]

The San Bruno explosion is only the most recent episode of a fairly regular and ongoing series of natural gas pipeline-related accidents. The fact that natural gas is an invisible fuel transported underground by pipelines of varying diameter and age means that under most normal circumstances the general public is entirely unaware of the maze of gas lines (not to mention electric and water lines as well) buried underground. What the San Bruno blast has brought to the public's attention, if only momentarily, is what experts know in more detail: the nation's infrastructure of gas lines requires ongoing maintenance, repair and replacement. Indeed, this particular infrastructure is "aging," and corrosion is only part of the story as there is a wide array of causes for natural gas pipeline accidents. According to the American Gas Association, the "leading cause of accidents in both transmission and distribution systems is damage by digging near existing pipelines."[2]

As shown by the map below, the nationwide network of interstate and intrastate gas transmission lines, as well as local distribution lines, is extensive. Long-distance interstate transmission lines are typically 30–48" in diameter, while local distribution lines are considerably smaller, often ½–1½" in diameter. While cast iron and steel pipe were used throughout much of the twentieth century, polyethylene pipe is increasingly being used for both smaller diameter systems as well as some larger diameter lines. With approximately 305,000 miles of gas lines in operation in the United States that serve 62 million residential, 5 million commercial, and 205 thousand industrial customers, regulating and enforcing safety rules is a massive undertaking (see table on page 2).[3]

(continued on page 2)



Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System

1 Preliminary Report. National Transportation Safety Board. Pipeline & Hazardous Material. October 13, 2010.

2 American Gas Association, "What Causes Natural Gas Pipeline Accidents?" http://www.aga.org/Kc/aboutnaturalgas/consumerinfo/Pages/CausesofNGPipelineAccidents.aspx

3 Energy Information Agency, Number of Natural Gas Consumers, http://www.eia.gov/dnav/ng/ng_cons_num_dcu_nus_a.htm

In This Issue…

"Lesson of San Bruno"

(continued from page 1) In 2007, interstate pipelines transported approximately 36 trillion cubic feet (TCF) to industrial, commercial and, ultimately, residential consumers; compressor stations pressurize natural gas in order to propel it through the lines although the gas line pressures are much less in distribution networks than along the trunk lines. The greatest concentration of gas lines is located in the major gas producing areas as well as in densely populated urban areas. Texas and California, respectively, are the top two natural gas consuming states in the nation.

The Pipeline and Hazardous Materials Safety Administration (PHMSA) of the U.S. Department of Transportation establish federal safety regulations. This is not including various state and local regulatory agencies. For new pipeline projects, the Natural Gas Act (1933), particularly Section 7(c), requires issuance of a Certificate of Public Convenience and Necessity by the Federal Energy Regulatory Commission (FERC) when new work is planned. Adding to the regulatory oversight, older lines deemed historic (older than 50 years and meeting the test for historical significance) under the National Historic Preservation Act, 1966 (NHPA) require additional administrative processes. The National Environmental Policy Act, 1969 (NEPA) also provides guidelines for gas pipeline construction projects.

The regulatory framework in which gas pipelines operate is a result of historical and ongoing operational issues and accidents that prompted calls for government oversight. The most tragic natural gas disaster in the 20th century was the New London, Texas, explosion. During the afternoon of March 18, 1937, a huge explosion, caused by accumulated natural gas in the basement, destroyed the Consolidated High School. Initial reports of 500 dead were somewhat overstated, although the final count of 294 killed, mostly students and some teachers, was an astounding loss. Tragically, the school had only recently switched suppliers, from a company that used an odorant in its natural gas to one that did not add the odorant. It was after the New London explosion that the Texas Legislature mandated odorization of natural gas and increased calls for a standardized odorant to be used in natural gas nationwide. While individual states adopted various odorization requirements, and many gas companies also used natural gas odorized with mercaptan for distribution in residential areas, national standards for odorizing natural gas were not implemented until the mid-1970s.[4]

While the New London disaster was monumentally tragic, accidents have continued to occur and, unfortunately, will happen again. More recently, a 36-inch transmission line operated by the Texas Eastern Transmission Corporation ruptured in Edison, New Jersey. *(continued on page 3)*

---

[4] Thanks to Ellie Goldberg and her project on the New London explosion (Oct 4, 10): http://lessonsofthe1937texasschoolexplosion.blogspot.com/. Also see, Christopher J. Castaneda, *Invisible Fuel: Manufactured and Natural Gas in America, 1800-2000* (New York: Twayne Publishers, 1999), pp. 105-6.

Estimated Natural Gas Pipeline Mileage in the Lower 48 States, Close of 2008

Region /State	Pipeline Mileage	Region /State	Pipeline Mileage	Region /State	Pipeline Mileage	Region /State	Pipeline Mileage	Region /State	Pipeline Mileage	Region /State	Pipeline Mileage	Region /State	Pipeline Mileage
Central		Midwest		Northeast		Southeast		Southwest		Western		Gulf Mexico[1]	
Colorado	7,803	Illinois	11,911	Connecticut	928	Alabama	4,818	Arkansas	6,267	Arizona	5,989		9,458
Iowa	5,421	Indiana	4,704	Delaware	280	Florida	4,971	Louisiana	18,900	California	11,770		
Kansas	15,386	Michigan	9,722	Maine	609	Georgia	3,483	New Mexico	6,756	Idaho	1,567		
Missouri	3,944	Minnesota	4,447	Maryland/DC	1,022	Kentucky	6,892	Oklahoma	18,539	Nevada	1,469		
Montana	3,861	Ohio	7,670	Massachusetts	972	Mississippi	9,784	Texas	58,588	Oregon	1,823		
Nebraska	5,697	Wisconsin	3,471	New Hampshire	291	North Carolina	2,484		109,050	Washington	2,072		
North Dakota	1,873		41,925	New Jersey	1,520	South Carolina	2,265				24,690		
South Dakota	1,242			New York	5,018	Tennessee	4,304						
Utah	3,175			Pennsylvania	8,680		39,001						
Wyoming	7,902			Rhode Island	100								
	56,304			Vermont	71								
				Virginia	2,577								
				West Virginia	3,758								
					25,526								

Total US Pipeline Mileage	305,954
Total Interstate[1]	217,306
Total Non-interstate[2]	88,648

[1] In the Gulf of Mexico some large-scale gathering systems are FERC jurisdictional and are therefore counted as interstate.
[2] Includes intrastate transmission and non-FERC jurisdictional large diameter gathering systems or headers. Local distribution company (LDC) mileage excluded.
Note: All mileage is approximate. Includes looped pipeline segments. Approximately 73 percent of Interstate pipeline systems are made up of pipeline diameters exceeding 16 inches while only 34 percent of non-interstate pipeline systems are 16 inches or larger.
Source: Energy Information Administration, Gas Transportation Information System, Pipeline Map Files and Pipeline Projects Database.

"Lesson of San Bruno"

(continued from page 2) Buried seven feet below the surface, the line suffered a rupture, and the leaking gas exploded along an 80-foot section of the pipeline; the line had been damaged by an unrelated work project leading to the explosion. This blast, also in a residential area, created a massive crater measuring 60 feet deep by 120 feet wide. At the nearby apartment complex, 128 apartment units were destroyed but, miraculously, no one was killed (a woman did die of an apparent heart attack during the conflagration). While this accident attracted a great deal of public attention, natural gas-related accidents, typically less severe than these examples, are not uncommon.[5]

During 2004, there were 288 reported "incidents" involving natural gas pipelines. Of these, about one-third were caused by "excavation damage." Of those incidents that occurred within the gas distribution network, 42 percent were the result of excavation work. This does not diminish the need to maintain the integrity of buried lines subject to corrosion, but it clearly suggests that pipeline safety involves much more than the need to maintain pipeline integrity.[6]

Even while preparing this brief essay, I received an e-mail from Pacific Gas and Electric Company (sent to all customers) titled, "Simple safety measures to ensure reliable gas service." The message asks customers to call Underground Service Alert (USA) before digging or trenching, to remain alert to gas smells or sounds of a potential leak, and to note the placement of gas line markers. While we expect our gas provider to ensure safe and reliable service, it is clear that the customer and general public need to be as well informed as possible about the service they are receiving and the technology used to provide it.

5 Castaneda, *Invisible Fuel*, p. 198.

6 American Gas Association, "What Causes Natural Gas Pipeline Accidents?" http://www.aga.org/Kc/aboutnaturalgas/consumerinfo/Pages/CausesofNGPipelineAccidents.aspx

The Curious Case of Combined Sewer Overflows[1]

Martin V. Melosi, Ph.D.
University of Houston

Combined sewers (a single large pipe) were among the earliest sewers constructed in the United States, and they continued to be built into the middle of the twentieth century. Although combined sewers were an efficient way to collect and transport storm water and wastewater, they made treatment more difficult because of the large variation in flows in dry weather and wet weather. But untreated overflows of raw sewage and storm water did not begin to be regarded as major sources of pollution until they were being wholesalely replaced by separate (two-pipe) sewers. The threats to existing wastewater systems, however, were not deteriorating materials, but were tied to design issues. As a result, many were stressed beyond their capacities. Problems with overflows, especially during and after heavy rainfall, introduced a whole new round of debate over the virtues of separate as opposed to combined sewers. As early as the 1950s, combined sewers—or sanitary sewers without adequate storm-sewer complements—were regarded as the prime culprit in the inability of existing systems to operate efficiently.

While nonpoint sources of pollution created serious problems for several decades, combined and separate sewer systems are designed to carry a substantial amount of wastewater and stormwater directly to sewage treatment plants to be treated and then discharged into a water body. During times of heavy rainfall or snowmelt, volume can exceed the capacity of the sewers and/or the treatment plant. Combined systems often are designed to overflow periodically and discharge wastewater directly into watercourses, but these overflows now have come to be regarded as a substantial pollution risk. They have become the major water pollution issue for cities with combined sewers, which numbered 772 in 2002. The Environmental Protection Agency estimated about 40,000 such overflows just this year.

Occasionally unintentional discharges of raw sewage even from municipal sanitary sewers occurred in every system. These sanitary sewer overflows (SSOs) have a variety of causes, including severe weather, blockages, line breaks, power failures, poor design and construction, improper operation and maintenance, and vandalism. In absolute numbers, there are more sanitary sewer systems than combined systems in the United States. Since the mid-twentieth century, local and state governments have not constructed new combined sewers.

As early as 1958, a United States Public Health Service (USPHS) study stated, 8,632 of 11,131 sewered communities employed sanitary sewers (77.5 percent), compared to 1,451 with combined systems (13 percent), and 428 with both (4 percent). However, many of the sanitary systems served small and medium-sized communities, while combined systems were more prevalent in the densely populated Northeast, Great Lakes, and Ohio River regions. A study conducted by the American Public Works Association (APWA) in the early 1960s projected that as many as 54 million people may have been served by combined systems at the time.

By 1964 it was well established that combined sewer overflows (CSOs) represented a substantial pollution source nationwide. At the Federal Water Quality Administration's Symposium on Storm and Combined Sewer Overflows held in Chicago on June 22-23, 1970, one participant noted that "the water pollution problems [including overflows] which have become the target of public opinion and public official concern are the sins of the past being imposed on the present." *(continued on page 4)*

1 A substantial portion of the material detailing issues on CSOs prior to 1990 was drawn from Martin V. Melosi, *The Sanitary City: Urban Infrastructure in America from Colonial Times to the Present* (Balimore: Johns Hopkins University Press, 2000). More recent information came primarily from Environmental Protection Agency documents and American Public Works Association documents.

"Curious Case…"

(continued from page 3)

The discharge of excess water from combined sewers (especially after heavy rains) or discharges of stormwater from separate storm sewers into available outfalls carries an array of pollutants into watercourses. According to a 1999 EPA report, CSOs may contain "high levels of suspended solids, biochemical oxygen demand (BOD), oil and grease, flotables, toxic pollutants, pathogenic microorganisms and other pollutants." CSOs also are a major cause of contamination to shellfish beds and fish kills. The pollutants can exceed water quality standards and pose risks to humans and aquatic species, plus damage waterways. Approximately one-third of cities surveyed in one study indicated that infiltration exceeded their sewers' specifications.

As designed, combined sewers were expected to overflow periodically. Sanitary engineers and public health officials originally believed that these overflows were sufficiently diluted so that they posed no serious water-pollution problems. Estimates suggested that the average overflow from a combined sewer contained 3 to 5 percent raw sewage. As urban growth—particularly the enlargement in impervious areas—caused a major rise in runoff volumes and rates, the overflows increased in frequency and duration and created a greater pollution threat.

Combined sewer overflows (approximately three-quarters of all overflow sources) and other overflow problems often occurred in places where the land was being used for industrial purposes and where discharges took place primarily into flowing water. A study conducted in the early 1960s indicated that 493 of 641 jurisdictions surveyed reported 9,860 CSOs. A large amount of industrial waste was discharged into the sewer systems, representing effluent equal to a 69 percent increase in population in the surveyed areas.

It should be noted that stormwater discharges from separate storm sewers occurred frequently and often for longer durations than from combined sewers (especially if regulator devices in combined sewers, designed to prevent overflows during light rainfalls, operated effectively), and that even "clean" stormwater was polluted. Nevertheless, discharge from combined sewers, which intermingled stormwater and a variety of other wastes, was regarded as the more serious pollution threat. During storm peaks, it was estimated recently that as much as 95 percent of the effluent in the sewer might overflow directly into receiving watercourses.

The solution to overflows most widely advocated in the 1960s was conversion to sanitary sewers. Some states implemented regulations prohibiting the construction of new combined systems or additions. In 1966 the Ohio Department of Health no longer approved plans for combined sewers. In Tacoma, Washington, the sewer began as a separate system but was changed to a combined system. Publicly aired concerns about the need for better pollution control in the mid-1950s led state pollution-control authorities to call for a halt to further construction of combined sewers. Using sewer revenue bonds, which required raising residential sewer service rates 266 percent (from $0.75 to $2.00 per month), Tacoma began its conversion program in 1959. As of January 1966, twenty-three miles of sanitary sewers and fifty-four miles of storm drains were constructed. An additional eight miles of sewer was necessary to complete the program.

Such a financial commitment as Tacoma undertook was regarded as too steep for many cities. Cost estimates for a national separation program ranged from $20 to $48 billion in the late 1960s. In addition, some experts argued that separation was not the panacea for all of the problems associated with combined sewers, particularly if it was carried out on only a portion of the whole sewerage system. In Chicago, city leaders balked at the staggering cost of conversion and argued that the inconvenience and disruption of the streets was "almost beyond description." Chicago authorities considered the development of a deep tunnel, as an alternative, where stormwater flows could be stored in rock stratum 600 feet below the surface. After a storm had passed, the water could be transported to a reservoir.

Other cities searched for other ways to protect watercourses from pollution. The storage concept, as promoted by Chicago officials, gained attention. Until that time, relatively few storage tanks had been installed in the United States, although tank storage had been popular for many years in Great Britain, Germany, and Canada. Although overflows raised serious concern about the effectiveness of existing water-carriage systems and the extent of their pollution, treatment of sewage remained a major focus of anti-pollution efforts.

EPA engineers stated in 1980 that urban stormwater and combined sewer overflows "have been under-researched and often overlooked causes of water pollution until recently…Huge sums of money are spent on secondary plants while major culprits such as urban stormwater and combined sewer overflow go uncontrolled." It was common in past engineering design practices to treat runoff and stormwater as sources of dilution of sewage that replaced or augmented treatment. In addition, many early studies focused on flood control in relation to runoff, but not pollution.

Some local studies were beginning to detect a pattern in the polluting characteristics of urban runoff in the 1970s and 1980s. A Milwaukee project discovered CSO is the major source of fecal coliforms in the Milwaukee River. Urban runoff was determined to be the sole source of degradation in Lake Eola, Florida. Lead concentrations two to three times greater than in nonurban samples were found in urban samples of algae, crawfish, and cattails in some areas.The National Urban Runoff Project, sponsored by the EPA, was conducted in twenty-eight localities between 1978 and 1983, and represented national recognition of the problem.

(continued on page 5)

"Curious Case…"

(continued from page 4) In 1989 EPA published its *National CSO Central Strategy*, which focused attention on CSOs but did not address the site-specific nature of the CSOs, the cost of controls, or a complete range of possible solutions.

By the mid-1990s, combined sewer systems still existed in many communities, especially in New England and the Great Lakes region. Approximately 1,100 cities had combined systems with as many as 15,000 combined sewer overflows that served 43 million people. Cities with CSOs were often those with sewer systems built before wastewater treatment facilities were developed. Three-fourths of the CSO communities are in eight states: Maine, New York, Pennsylvania, West Virginia, Illinois, Indiana, Michigan, and Ohio. In 1993, the EPA estimated that individual CSOs were discharging an average of 50 to 80 times annually, producing about 1.2 trillion gallons of toxic wastes natiowide.

In June 2001, thirty-two states with combined systems held 859 CSO permits. These permits authorized discharges from 9,471 CSO outfalls. Over the years permits varied from less than 900 to 1,500, and outfalls from less than 9,000 to 1,500. Since 1989, however, the number of permits has steadily declined as states better indentified combined systems and attributed some problems to leaking sanitary systems. Many of the 32 states had developed CSO strategies by the EPA 1990 deadline.

Control of CSOs is complex because of site-specific issues of differences in volume, frequency, and waste materials. In 1965, the Federal Water Pollution Control Act recognized the significance of CSOs and authorized funding for research and techniques to control them. Afterwards, the American Public Works Association carried out one of the first national surveys to assess the CSO problem, which found the number of combined sewers in excess of 1,300.

Also, the 1972 Federal Water Pollution Control Act established the regulatory framework for controlling point source pollution, including CSOs. And EPA's 1978 *Report to Congress on Control of Combined Sewer Overflows in the United States* discussed approaches to funding CSO pollution-abatement projects.

Both in 1972 and 1981, Supreme Court cases dealt with CSOs in Milwaukee. However, the landmark case was *Montgomery Environmental Coalition v. Costle* in 1980, which stated that CSOs needed to comply with the technology-based requirements of the Clean Water Act and with federal water quality standards. Some communities advanced controls during the period, and the EPA initiated 13 judicial enforcement actions in the 1980s.

An EPA report on CSOs and SSOs presented to Congress in August 2004 stated that the overflows were "widespread" and contributed adversely to the environment and human health. The 1995 National Water Quality Inventory Report to Congress indicated that the greatest CSO contribution to impairment among sources of pollution was in the oceans (11 percent), estuaries (five percent), and the Great Lakes (three percent), and the least was in rivers and streams (not in the top twenty).

Because of the serious pollution potential from CSOs, the EPA issued the CSO Control Policy in April 1994, which was a national framework through the National Pollution Discharge Elimination System (NPDES). Those with permits for combined sewers, at a minimum, should provide primary treatment and disinfection—as necessary—to 85 percent of the volume annually in the system. The policy also includes nine minimum control requirements to be included in the CSO discharge permit. Communities are in various stages of adopting the program. In 2002 Congress authorized funding ($1.5 billion) to address wet weather discharges, but the funds were not appropriated in that year.

Today CSOs and SSOs remain a serious problem for many cities. The new regulations have helped in monitoring overflows and urging cities to take action, but the risks of overflows and their impacts remain. A deteriorating water and wastewater infrastructure only exacerbates the problem.

Laser Technology Preserves Bridge History

Public Works Historical Society President Bill Kappel shared an interesting article from the April 15, 2010, *Milwaukee Wisconsin Journal Sentinel Online*. The article explains how using a 3-D laser scanner documented how a 134-year old covered bridge was constructed.

The Cedarburg bridge, the last of 40 covered bridges that once stood in the state of Wisconsin, has been closed to vehicle traffic since 1962, but still accommodates pedestrians and bicycle traffic. According to the Ozaukee County web site, this historical monument, originally known as the "Red Bridge," was built with pine logs, fitted and set in place in lattice truss construction. Its 3 in. x 10 in. planks were secured with 2 in. hardwood pins without the use of nails or bolts. The bridge is 120 ft. long.

Using laser technology, the Sight-Line high definition laser scanning company, created 3-D "maps" of every facet of the bridge. The images will be invaluable to engineers should the need ever arise to rehabilitate the bridge or reconstruct it. This project, which is under the auspices of the U.S. Forest Service's Forest Products Laboratory in Madison, Wisconsin, was developed to document several historic covered bridges in the Midwest. To read the JS article about the Cedarburg project, please go to http://www.jsonline.com/news/ozwash/91002129.html.

M. Gordon Wolman 1924-2010

By Martin Reuss

Markley Gordon Wolman, better known as "Reds" Wolman for his carrot-colored hair, died at his home in Baltimore on February 24, 2010. He devoted his career to seeking ways to describe river behavior in a quantitative and rigorous fashion, and his many publications testify to the enduring contribution he made to the subject. Like his father, Abel, who was a renowned sanitary engineer and pioneer in water chlorination, Reds was a beloved member of the Johns Hopkins University community. Indeed, many would argue that his greatest legacy is his many students who went on to distinguished careers in their own right. His Friday afternoon field trips became legendary. They provided the tools Reds used to challenge students on every facet of geomorphology. He constantly asked the fundamental question: how did a landform or river channel end up with its present shape and what processes were involved?

Wolman was born on August 16, 1924, in Baltimore, the only child of Abel and Anna Gordon Wolman. Although his father stimulated his interest in science and engineering, his mother stimulated his interest in cows, sending him to a Connecticut farm at the age of 12 because, according to Wolman, "She wanted me to know that milk didn't come from a bottle." Subsequently, Wolman became a self-described "cow nut," who occasionally dreamed of becoming a dairy farmer. Two summers on the farm also helped generate his life-long interest in erosion and anthropogenic landscape impacts. Wolman went on to Haverford College before being drafted into the Navy during World War II. Subsequently, he returned to Baltimore and completed an undergraduate degree in geology at Johns Hopkins in 1949. At Hopkins, he also became an all-American lacrosse player on the national championship lacrosse teams in 1947 and 1949.

Wolman continued his studies at Harvard, earning a doctorate degree in geology in 1953. His dissertation on Brandywine Creek in Pennsylvania led to his development of what came to be called the "Wolman pebble count," a way to understand stream behavior by categorizing the size and distribution of riverbed rocks. At Harvard he met Luna Leopold, a fellow graduate student in geology and the son of another well-known father, Aldo Leopold, possibly the most influential conservation thinker of the 20th Century. Wolman followed Leopold to the U.S. Geological Survey, where the two men collaborated on investigations of the fluvial geomorphology of various rivers in the American West. Their subsequent studies helped transform geomorphology and hydrology from something primarily descriptive into quantitative, analytical science. Their book, *Fluvial Processes in Geomorphology* (1964), co-written with John Miller, another Harvard fellow student, became a classic in its field, read by every budding fluvial geomorphologist. The book is known not only for its many original contributions, but for its graceful style and literary allusions. Wolman himself contributed Gertrude Stein's quotation describing Niagara Falls.[1]

In 1958, Wolman joined the Johns Hopkins faculty as an associate professor of geography and chairman of the department. Named a full professor in 1962, he played a key role in combining the geography department with the department of sanitary engineering and water resources to create the department of geography and environment engineering, known in the Hopkins community as DOGEE. He chaired this new department from

1970 to 1990 and was named the Griswold Professor in 1975. He taught his last course, Water Resource Development: History and Principles, in the fall of 2009, and continued to work on campus in the weeks before his death. Throughout his career, Wolman was not only known for his sharp mind and innovative thinking, but also for his wit, charm, and modesty.

Wolman was elected to the National Academy of Sciences in 1988. In 2000, the American Geophysical Union awarded him the Robert E. Horton Medal, which recognized his contributions to the geophysical aspects of hydrology. Elected to the National Academy of Engineering in 2002, he was cited for his "outstanding contributions to fluvial processes, water resource management and environmental education." Two years later, the National Council for Science and the Environment honored Wolman with its Lifetime Achievement Award. At that time, he summarized his career by noting, "I went from behavior of natural rivers and how they formed to how they behaved in the environment, which led to water quality and then to a variety of resource policy issues." "All this," he mused, at another time, while going down the Yangtze River, "from counting pebbles."

Wolman is survived by his wife, the former Elaine Mielke, and four children.

[1] First quoted in John Hyde Preston, "A Conversation with Gertrude Stein," Atlantic (1935): 192. "…Niagara has power and it has form and it is beautiful for thirty seconds, but the water at the bottom that has been Niagara is no better and no different from the water at the top that will be Niagara. Something wonderful and terrible has happened to it, but it is the same water and nothing at all would have happened if it had not been for an aberration in one of nature's forms. The river is the water's true form and it is a very satisfactory form for the water and Niagara is altogether wrong."

2010 University of Houston Oil Spill Symposium

The BP-Deep Water Horizon disaster in the Gulf has galvanized the general public and the academic community about our energy choices and our environment. The blowout and oil spill and its potential environmental, energy, and regulatory implications offer an opportunity for scholars and experts to come together to reflect on the myriad challenges we have faced in the past and on the challenges we are certain to face in the near future.

The University of Houston's Center for Public History and the newly formed Center for Energy Management and Policy co-sponsored a one-day oil spill symposium in September 2010, to address some of the historical and ongoing questions about energy production, oil spill response, environmental impact, and government regulation that are key to understanding the recent BP-Deep Water Horizon disaster in the Gulf. This symposium was structured as an interdisciplinary roundtable discussion with three sessions led by a panel of experts with backgrounds in history, resource management, science, policy, law, and industry. Moderators guided a Q&A discussion among the panelist and audience members.

Some of the Oil Spill Roundtable themes were:

- **History** – Cover the history of spills; the responses with regard to industry, government, law, media, public; and the consequences. How industry did or didn't reorganize; new regulatory approaches; ecological effects; public relations. This would include historical interpretations of major catastrophic spills.
- **The current disaster** – Experts from different sectors describing the current status of the spill at time roundtable was held; discussing who has been responsible for what, where and when the real breakthroughs occurred, and what the setbacks have been. This would include assessment of effects on industry, region, and ecology. In addition, there was a discussion on how the disaster is framed for the public.
- **Policy** – With historical perspective and broader context in place, policy issues are addressed in the current situation. This includes the potential long-term effects, likely responses of industry/government/interest groups (environmental, fishing industry, vacation industry) and the general public.

To watch the video please visit http://www.history.uh.edu/oilspillsymposium/.

Announcements

APWA In the News

Mark DeVries Featured in National NPR *On Point* Show

On Wednesday, January 12th, APWA's Winter Maintenance Sub-committee Chair Mark Devries was featured in the NPR *On Point* national news program as a public works expert on winter weather emergencies, and how public works helps communities handle them. Also featured were Dr. Heidi Cullen, climate expert for the Weather Channel (and former research scientist for the National Center for Atmospheric Research), along with APWA members Mike Kennedy, director of winter operations for the Minneapolis Department of Public Works, and Wanda Booker, who is sanitation services manager for the City of Milwaukee, Wisconsin.

The show's commentator, Tom Ashbrook, cited the recent extreme precipitation conditions that have hit North America, and Devries, director/superintendent of public works for the McHenry County Division of Transportation in Illinois, and a 2010 APWA Top Ten Public Works Leader, addressed issues that public works departments deal with on a day-to-day basis.

Devries and the other featured guests brought up the many challenges for public works agencies that occur in handling weather emergencies and large snow precipitation events. Devries also stressed that municipalities have to work to anticipate, and be prepared for, the various winter events that can occur. He went over the various methods that need to be considered for winter weather emergencies, from snow-removal to chemicals needed for pre-treating, and the possibilities of getting back to "bare pavement." Other issues discussed were budget and staff cutbacks with service expectations, civilian help with snow containment, and the data needed to adjust to and prepare for extreme weather situations.

Check local listings of the show with your local/regional NPR station. To listen to the original show, go to NPR's website for the *On Point* show on January 12th called: "Snow Removal Strategy & the Flurry of Winter Weather." You can access it directly when posted to the NPR website at http://onpoint.wbur.org/2011/01/12/snow-removal.

History of Technology

November 3-6, 2011: The Annual Meeting of the History of Technology will be held in Cleveland, Ohio. For further information please visit: http://www.historyoftechnology.org/annual_meeting.html.

The Urban History Association

November 17-20, 2011: Urban History Association: For the Society of American City and Regional Planning Historians' 14th National Conference on Planning History. Baltimore, Maryland. For further information please visit: http://uha.udayton.edu/conf.html.

Public Works for Public Learning

Denis Mulligan, General Manager, Golden Gate Bridge, Highway and Transportation District, San Francisco, California; and Robert Reitherman, Executive Director, Consortium of Universities for Research in Earthquake Engineering, Richmond, California

Everyone knows how to turn the handle on the faucet to make water pour out into the kitchen sink—but where does the water come from and what makes it flow with adequate pressure? People are curious about why the street is being torn up. A simple display board could have cross sections of an old and new pipe attached to it, with an explanation as to the improvement in the water system because of the size and material of the new pipe.

What structural principles and materials hold up the bridges that vehicles pass over? What do all those knobby steel bars do that are embedded in concrete to form columns, beams, walls and floors? Even a short footbridge is an interesting structure, and a small exhibit could explain how it is held up by beams, trusses, arches or cables, as the case may be. Large equipment is inherently interesting to people.

Could a viewing window be installed to let the public see into a recycling yard where materials are sorted and pulverized? Or to look at large machinery at a pumping plant?

A temporary sign explaining pothole repairs could explain why potholes suddenly appear and quickly get worse in wet weather or when it freezes—simple explanations about pavement that a middle school student could understand, or use as a theme in a science project.

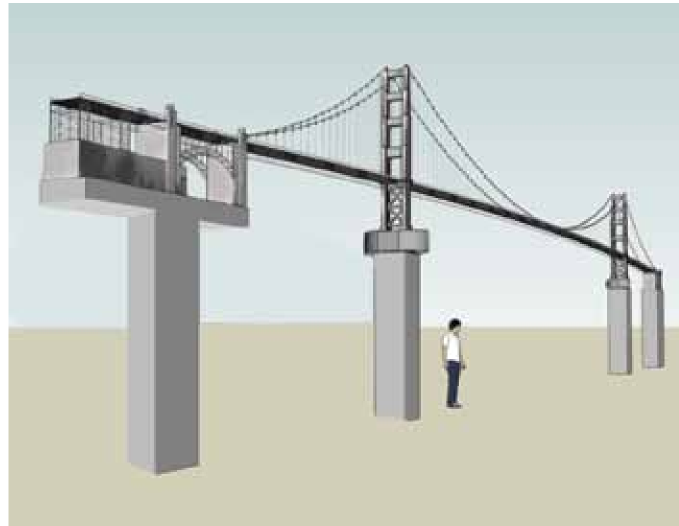


Figure 2: The large (90-foot-long) model of the Golden Gate Bridge, which will function as both the centerpiece of the exhibition area and "table of contents" for surrounding satellite exhibits. (Drawing by EHDD Architecture, model design by Princeton University)

These and many other questions can be explored by the public by capitalizing upon the constructed environment as learning resources. The infrastructure has its essential public works functions to perform, but public works can also be used as public learning resources.

The Golden Gate Bridge Permanent Outdoor Exhibition

The National Science Foundation awarded $3 million to the Golden Gate Bridge, Highway and Transportation District after a nationwide competition for projects on out-of-the-classroom educational projects featuring science and engineering themes. A new Golden Gate Bridge Permanent Outdoor Exhibition is being developed at the San Francisco side of the Golden Gate Bridge (see Figure 1). Approximately 10 million people per year visit the bridge. On a sunny weekend in the summer about 6,000 bicyclists ride to and across the bridge, and tour buses are constantly coming and going. While the visitors will come to be sightseers, the exhibition will surprise them with interesting ways to learn about the bridge.

Figure 1: The Golden Gate Bridge as viewed from the in-progress Permanent Outdoor Exhibition Area at the south end of the bridge.

The centerpiece of the Permanent Outdoor Exhibition is a large, 90-foot-long precise scale model of the bridge, which is the task of Prof. Maria Garlock at Princeton University, recent graduate and practicing engineer Sylvester Black, and students (see Figure 2). The model functions as a three-dimensional structural diagram of the bridge, for example revealing X-trussed horizontal struts that lie hidden beneath architectural cover plates in the towers. For durability in an environment where moist, salt-laden air is common, the model is being made of a special grade of stainless steel, Duplex 2205. Surrounding this centerpiece and "table of contents" model will be two dozen satellite exhibits on particular aspects of the bridge.

Princeton is also producing a tactile ("Braille") model on a bronze plate for blind and sight-impaired visitors. Another model being made by Princeton mounts two similar but structurally quite different models of the bridge deck, one with vertical side trusses as originally constructed in 1937, the other with the addition of truss bracing across the bottom of the bridge, added in a retrofit in

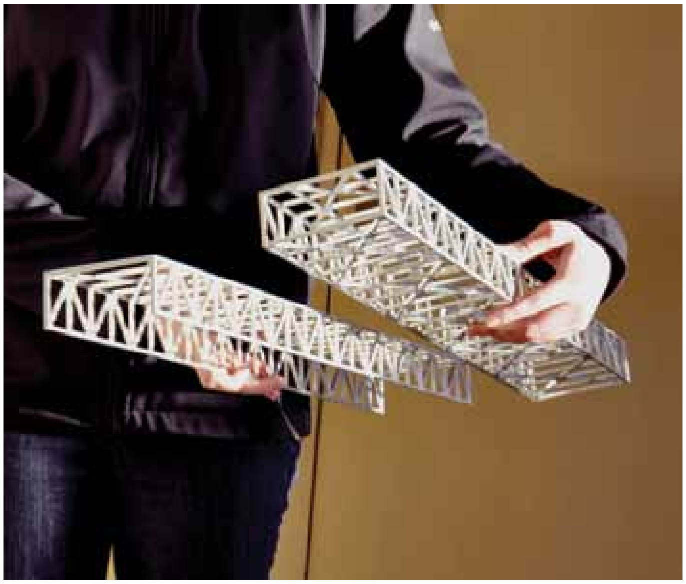


Figure 3: Models of the original deck structure of the Golden Gate Bridge (left) and the retrofitted deck (right) that added lower lateral bracing to increase torsional rigidity and reduce wind response.

1953-1954. The addition of bottom lateral bracing greatly increased the torsional rigidity of the deck, spanning 4,200 feet between the towers, and improving aerodynamic stability under high winds. Visitors can understand that concept, without needing any mathematics, by feeling the difference as they twist the two (see Figure 3). West Wind Laboratories, the District's wind engineering consultant, is producing a companion exhibit with small-scale models of portions of the deck of the ill-fated Tacoma Narrows Bridge, of Washington, which collapsed in 1940, having a blunt profile with deep plate girder deck supports, with the Golden Gate Bridge deck's more stable truss structure. Under ambient wind conditions at the site, one of the models will rock transversely noticeably while the other remains stable.

Figure 4: The chief engineer of the San Francisco Exploratorium science center, Dave Fleming, tries out his "modal model" of the Golden Gate Bridge.

One exhibit is a hands-on 12-foot-long mechanical model of the bridge designed by San Francisco's Exploratorium science center. Visitors can deflect and vibrate the model to excite its modes of vibration (see Figure 4). Other exhibits include a full-size imprint in paving of one leg of one tower (about the size of a footprint of a house). A sample of vertical suspender rope, a little larger than you can put your hand around, will be mounted in one of the District's ferry vessels, explaining that the cable is strong enough to hold up that entire 517-passenger, 497,000-pound vessel—and that there are over 1,000 of those suspender ropes on the bridge. The Consortium of Universities for Research in Earthquake Engineering (CUREE) is designing a large mural 80 feet long depicting the history of the bridge from its conceptual origins to design and construction, and up to the present era of maintenance and modernizing retrofits.

Public Works for Public Learning Conference

As part of the outreach effort of the project, an international conference will be held June 20-22, 2012, shortly after the May 2012, 75th Anniversary of the Golden Gate Bridge, on the theme of "Public Works for Public Learning" (Figure 5). A variety of speakers will explain how their construction and facilities have been featured as a visitor-serving resource. The confirmed "headliner" keynote speaker is Dr. Wayne Clough, a civil engineer and the head of the Smithsonian Institution. APWA's Larry Lux is on the conference planning committee, and exemplary APWA public education projects, such as National Public Works Week activities, will be showcased. Guidance will be offered on how to effectively design (and fund) exhibits and other educational projects. More information on the conference will be available at http://www.curee.org/downloads/PWPL/draft-site/.

A civil engineer, Denis Mulligan has served as the chief engineer of the District; he can be reached at dmulligan@goldengate.org; Robert Reitherman serves as project manager for the Golden Gate Bridge Outdoor Exhibition project; he can be reached at reitherman@curee.org.

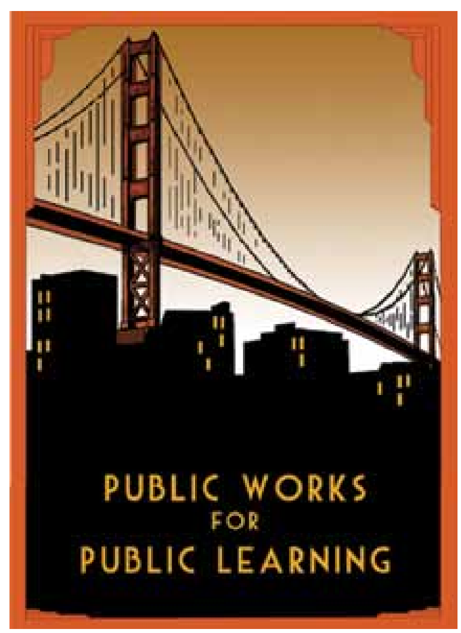


Figure 5: A conference will be held June 20-22, 2012, in San Francisco featuring examples and guidance on designing and funding public exhibits, using public works as public learning resources.

Why You Should Attend Congress

Larry T. Koehle, P.Eng., MPA, Past APWA President
Reprinted from the June 2010 *Reporter*.

If you are considering attending Congress for the first time, you will want the answers to a couple of questions:

Q: Are there technical and professional development sessions relevant to my job in public works?
A: Yes! There are sessions that cover career and professional development, construction management, emergency management, engineering and technology, facilities, fleet services, sustainability, leadership and management, parks and grounds, solid waste, snow and ice, stormwater, and streets/roads and bridges.

Q: Who should attend Congress?
A: Anyone whose responsibilities are public works related. You will see public works directors, superintendents, managers, operations managers and operations personnel, consulting engineers, city and county engineers, construction directors and managers, solid waste managers, public facilities and grounds directors, utility workers and managers including water, sewer, stormwater and flood control, streets/roads/bridge managers, transportation directors, emergency management personnel, city planners, and sustainability specialists.

Now that you've figured out that Congress is for YOU, how do you justify the dollars necessary to those who are paying your way? Let's use the word CONGRESS to explain:

C – Camaraderie is defined as "a spirit of friendly good-fellowship." When you attend Congress, everyone there has experiences that you can relate to. Many have walked in your shoes and sharing those experiences can reinforce, reassure and recharge you.

O – Opportunity: The opportunities you have at Congress are only limited by your own imagination. You have the opportunity to examine the latest technologies, learn about cutting-edge issues, and share those experiences with thousands of professionals like you.

N – Networking is defined as "a supportive system of sharing information and services among individuals and groups having a common interest." One of the greatest benefits of Congress is developing contacts with your counterparts, other public works leaders, vendors and exhibitors. It is almost as if you have a cadre of advisors available to you 24/7. I realized many years ago that I don't have all the answers, but there are those who do. Many of them are in my network, my public works support system, and Congress planted those seeds of long-lasting professional relationships and friendships.

G – Growth in the professional sense is something we must continue to pursue, or we will be left behind. John Maxwell, American author and motivational speaker, says, "If we're growing, we're always going to be out of our comfort zone." Congress sessions and speakers will challenge you professionally and help you discover things that may lead to breakthroughs in your organization. Legendary basketball coach John Wooden once said, "It's what you learn after you know it all that counts."

R – R&D: What do I mean by that? No, it is not research and development. In the public works world, it means "Rip-off & Duplicate." I can guarantee that by attending technical sessions and/or the exposition you will find some process, procedure, leadership lesson, or method that has a direct application to some aspect of your operation. The best part is that someone else has already developed it, tried it, tweaked it, and established lessons learned so you can try it yourself without reinventing the wheel.

E – Exposition: One of the highlights of Congress every year is the exposition.... Hundreds of exhibitors will be there to demonstrate their latest products, and the exhibitor "showcase" 45-minute presentations will present unique learning opportunities designed just for you. Not only will you see the latest in equipment and products, you will find real solutions to the problems and challenges you deal with every day. There will be non-compete time scheduled so you can spend time exclusively on the exhibit floor and not have to worry about missing an education session.

S – Special Events: There are a number of special events that are part of the Congress agenda: Self Assessment Workshop, First-Timers Meeting, Get Acquainted Party, Progressive Women in Public Works Breakfast, Young Professionals Networking Reception, Canadian Public Works Association Luncheon, Public Works Historical Society Luncheon, Awards Recognition Ceremony & Reception, Diversity Brunch, APWA Blood Drive, and the Golf Tournament. There are other workshops scheduled for Wednesday afternoon to see firsthand [local] historic and impressive public works operations and facilities.

S – Service: APWA provides opportunities for service at both the national and chapter levels. At Congress, Technical Committees participate in technical sessions and meet to discuss their plans and opportunities for the upcoming year. Attending Congress will give you opportunities to meet those in positions of leadership and will help you decide how you can best serve your profession at the agency, chapter and/or national levels.
Once you attend Congress, you will understand what a great experience it is for you. Whether you focus on networking, technical sessions, the exposition, special events, or all of the above, you will take something home that you can share and apply in your organization. The cost of admission can pay for itself many times over.
For further information please go to: http://sites.apwa.net/congress/2011/Home/AttendeeHome.aspx.

INTERNATIONAL PUBLIC WORKS CONGRESS & EXPOSITION | September 18-21, 2011 | Colorado Convention Center, Denver, CO

2011 PWHS-Sponsored Congress Programs

Public Works Historical Society Luncheon — Denver Transit: Past, Present, Future

Monday, September 19, 2011
Noon – 1:30 p.m.
(Ticketed Event—separate fee and pre-registration required)

The expansion of the Denver transit services will be one of the largest transportation redevelopment projects in North America. Consider it Denver's Big Dig. Within the next 10 years, nearly 150 miles of commuter rail, light rail and bus rapid transit will extend and connect Denver, intertwining historic Union Station with the future of transportation and urban development. Find out how the project came to fruition, and hear about the new Union Station neighborhood and its transformation of downtown while preserving the building's history.

Speaker: Kevin Flynn
Public Information Manager, FasTracks Eagle P3, Denver, CO

Public Works for Public Learning: National Science Foundation Golden Gate Bridge Project

Tuesday, September 20, 2011
10 a.m. – 10:50 a.m.

Beginning in 2012, visitors to the Golden Gate Bridge will have more to do than just appreciate the extraordinary view. Construction of an interactive science and engineering exhibit is underway. Visitors will learn about the how the bridge was constructed, the special challenges faced, and the engineering feats devised as solutions. Using public works projects as teaching examples for science and engineering concepts is a brilliant way to gain public support for future projects and to encourage interest in the public works and engineering professions. Do you have projects in your community that could be used for this purpose?

Speaker: Denis J. Mulligan
General Manager, Golden Gate Bridge, Highway & Transportation District, San Francisco, CA

The Colorado River Basin: Vital Lifeline of the Southwest

Tuesday, September 20, 2011
3:45 p.m. – 5 p.m.
Sponsored by the Public Works Historical Society

Originating in Colorado and flowing southwest for 1,470 miles to Mexico's Sea of Cortez, the Colorado River system was one of the first drainage basins in which the concept of the multipurpose dam was employed. These projects have brought water and power to many locales in the Southwest, but they've also engendered great controversies over payment for facilities, allocations of supplies, and environmental questions. Join us for this examination of the past and future of these types of projects and impending water rights issues.

Speakers: Michael R. Gabaldon
Director Technical Resources, Bureau of Reclamation, Denver, CO;
Bennett Raley
Trout, Raley, Montano, Witwer & Freeman, P.C., Denver, CO

Request from Chad Blackwell, Architectural Historian

We need your help gathering examples of creative cultural resource/historic preservation mitigation, public outreach, and interpretation projects for a source book. If you have a project that is innovative and successful, please visit www.creativemitigation.com and fill out a brief questionnaire about your project.

Do you know of or have you been involved with:

- An effective project used to creatively mitigate adverse effects on a historic property?
- A cultural resource(s) that has been interpreted in a creatively informative and engaging way to the public—onsite at the cultural resource, or through print publication (booklet/brochure), digital media (podcast, website/page, multi-media, etc.), exhibit, ortour, or by other means?
- An event that was effective in engaging the public in history or preservation of a cultural resource?
- An effective partnership of groups or agencies that have worked together to promote the public's knowledge and appreciation of a cultural resource?

Projects need not fit the above categories so long as they effectively engaged the public in the history or preservation of one or more cultural resources.

Projects with information submitted to us will be described in an informational source book highlighting best examples and practices for creative mitigation efforts, interpretation of cultural resources, and public outreach. The project is undertaken by the U.S. Marine Corps and HDR with support by the Department of Defense Legacy Resource Management Program. Projects do not have to be Department of Defense or military-related projects. All projects are encouraged.

Thank you for your assistance!

Chad Blackwell
Architectural Historian
HDR ONE COMPANY
Many Solutions
9563 S. Kingston Court, Suite 200
Englewood, CO 80112
Phone: 303-754-4213
Fax: 303-721-9202
Email: chad.blackwell@hdrinc.com
www.hdrinc.com

Public Works Historical Society

Public Works History

ISSN 1525-7002

© PWHS, June, 2011

Public Works History, the newsletter of the Public Works Historical Society, is published by the American Public Works Association with support from the Center for Public History at the University of Houston, Texas. Copy and queries should be addressed to the editor:

Dr. Martin V. Melosi
Distinguished University Professor
University of Houston
Department of History
Houston, TX 77204-3003
ph 713-743-3090; fax 713-743-3216
mmelosi@uh.edu

Public Works Historical Society
American Public Works Association
2345 Grand Blvd, Suite 700
Kansas City, MO 64108-2625
ph 816-595-5224; fax 816-595-5324
e-mail pwhs@apwa.net
www.pwhs.net

Editor
Martin Melosi
Department of History
University of Houston, TX

Associate Editor
Carla Curtis
Department of History
University of Houston, TX

Staff Liaison
Teresa Hon
Professional Development Program Manager, APWA

Layout & Design
Cami Travis-Groves
Graphic Designer, APWA

Production Assistance
Connie Hartline
Publications Manager, APWA

As part of our continuing efforts to be more sustainable, the Public Works Historical Society and the American Public Works Association are no longer producing this newsletter in print format.

We encourage you to share this electronic newsletter with your colleagues and to promote membership in the Society. Membership information can be found at www.pwhs.net.