It may be “back to the future” in utilizing a new – but centuries old – technology to help address Pennsylvania’s acid mine drainage sites, which pollute more than 2,500 miles of streams and rivers in Pennsylvania.

According to a recent article in the Pittsburgh Post-Gazette, a technology called “trompe” (old French for trumpet) has been resurrected from where it began in the 16th century and is being used as one of the tools in the toolbox available to remediate acid mine drainage sites at Pennsylvania mines. (See Committee Chronicles on page 7 for a look at a PA trompe site and a trompe technology diagram.)

A trompe is basically a water-powered air compressor with no moving parts that provides the benefits of mechanical aeration without the use of expensive motors and electricity. Water is directed down a vertical pipe or downtube (or several pipes). Because the water falls faster than the air trying to move up the pipe, the air is trapped and compressed. At the bottom of the vertical pipe, the water enters a horizontal separation chamber where the water flows into a discharge pipe and the air escapes into vertical chambers and is piped to mine discharge pools, aerating the acid mine discharge water.

The aeration oxidizes the dissolved iron in the discharge water. As a result, the iron becomes heavier and forms the rust-orange particles often seen at the bottom of acid mine affected waterways. The aerated particles fall out of suspension and collect on the bottom of the ponds where they can be more easily removed.

The idea to use trompe technology for acid mine drainage treatment came from a consulting hydro-geologist and Pennsylvania resident (since 1973) named Bruce Leavitt. During his career, Leavitt was a mining engineer for five years, a hydro-geologist on the staff of CONSOL Energy for 20 years and has been a consulting hydro-geologist for the past 13 years.

He submitted his idea to the 2010 Applied Science Program conducted by the federal Office of Surface Mining (OSM), which had issued requests for proposals for what Leavitt described as ways to implement “off-grid aeration of mine waters”, and in general improve mine water treatment.

Leavitt’s idea to go back to trompe was just one of several competing technologies. He said the other proposals included technologies like water wheels, using wind power or using photo-voltaics.
A House Energy and Commerce subcommittee approved legislation in June 2013 that would add deadlines for states to issue coal ash permits and strengthen the Environmental Protection Agency’s (EPA) authority to assess state coal ash management programs. The bill (H.R. 2218), introduced by Rep. David McKinley (R-W.Va), would require periodic evaluations of the structural integrity of coal ash impoundments.

The Coal Residuals Reuse and Management Act of 2013 would first clarify that EPA still has the authority to investigate and remediate sites under the Comprehensive Environmental Response, Compensation, and Liability Act. The act would further clarify that closure of deficient structures occur as quickly as practicable, and mandate that high-hazard structures prepare an emergency action plan.

This legislation stands a greater chance of passage because it incorporates many of the recommendations made by EPA to clarify timelines and criteria for state programs. According to Rep. McKinley, “This is a legislative remedy that has been years in coming...H.R. 2218 would help eliminate the stigma attached to coal ash and resolve regulatory uncertainty for recyclers that have been in a state of flux as EPA considers a rulemaking on the issue.”

The legislation would settle the debate at EPA on whether to regulate coal ash generated by power plants as either a hazardous waste or a non-hazardous waste. Coal combustion residuals are currently considered an “exempt waste” under the Resource Conservation and Recovery Act. A final rule is not expected until 2014 unless a court orders the agency to issue a ruling sooner.

EPA had expressed concern in April that a draft version of the bill needed further clarification on dead-

lines for the development and implementation of state programs, as well as criteria for determining when state programs are deficient, criteria for determining when a unit is structurally sound, and deadlines for closing unlined or leaking facilities. After follow-up discussions with EPA, language was added to the bill to address the issues.

Coal-fired power plants in 48 states create coal ash every day and the legislation appears to set minimum federal standards and also gives states the flexibility to implement disposal programs that protect the environment and jobs. Legislation on the management of coal ash has been approved multiple times by the House – most recently as part of a broader package called “Stop the War on Coal Act” in September 2012.

Citizens for Recycling First (CRF), which advocates for the recycling of coal ash products, suggests that the legislation combines the input of all interested parties into one bill that fixes the problem. CRF also said that the bill now creates meaningful federal regulatory standards for coal ash disposal while resolving the regulatory uncertainty that has been damaging the coal ash recycling industry.

According to Headwaters Inc., a coal ash recycling company, the legislation is a strong, bipartisan bill that sets permanent federal standards for fly ash disposal with long-term resolutions.

U.S. Must Balance Energy Needs, Water Demands
-- Tony M. Guerrieri, Research Analyst

Water and energy are two inextricably linked resources. Each has the potential to limit the development of the other. The lack of available water can limit energy production, and a shortage of energy can curtail water related services. Understanding how available water resources limit or enable energy production – and how energy costs can potentially limit water services – is key to managing them both in a proactive and integrative fashion.

Since 2009, the U.S. Government Accountability Office (GAO) has issued five research reports on this relationship, which have shown that higher energy consumption in general has required using more water. The energy sector is projected to account for 85 percent of the growth in domestic water consumption between 2005 and 2030. Currently, the energy sector is the second largest water-consuming industry in the U.S. after irrigation. Conversely, huge amounts of energy are required to extract, treat, store and transport water, especially in urban areas.

A capping report by the GAO summarizes the findings of the five previous reports on the interdependence between energy and water. The report, “Energy-Water Nexus: Coordinated Federal Approach Needed to Better Manage Energy and Water Tradeoffs”, highlights key energy-water nexus issues that Congress and federal agencies need to consider when developing and implementing national policies for energy and water resources.

For example, although technologies and approaches exist to reduce the impact of energy development on water resources and reduce the energy needed to move, use, and treat water, their widespread adoption is inhibited by barriers such as economic feasibility and regulatory challenges. In implementing energy and water policies, Congress and federal agencies will also need to be cognizant of the barriers when deciding whether to promote the adoption of these technologies and approaches.

Making effective policy choices will continue to be challenging without more comprehensive data and research. The GAO’s past work has identified the need for more data and research related to the energy-water nexus. For example, such information would help to better understand hydrological processes, including aquifer recharge rates and groundwater movement. In the absence of such data and research, developing and implementing effective policies could continue to be a challenge for Congress and federal agencies.

A new research report emphasizes the linkage between water and energy: The energy sector is expected to account for 85 percent of the growth in domestic water consumption by 2030.

Traditionally, energy and water planning – which involves lawmakers, the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency as well as state and local agencies, industries and environmental groups – has been managed separately, with very little overlap between the two domains, the GAO said. Often water use is not considered in energy research, development programs and initiatives. An example of this is a push toward bio-fuel production. Bio-fuels are an alternative to traditional fossil fuel-based energy production, but also require vast quantities of water.

The report adds that uncertainties affecting energy and water resources, such as population growth, increased competition for energy resources, climate change and shifts in demographics affect energy and
water resources and are expected to exacerbate the challenges associated with managing both the supply and demand of water and energy.

An abundance of water and energy resources and inexpensive pricing has led to a relaxed attitude about water and energy use. New ways of thinking about energy and water will be needed to meet future demands for both. The report calls for the DOE to institute an oversight program to address the energy-water nexus, as described in the federal Energy Policy Act of 2005.

In a response letter, the DOE said the issues raised by the relationship between energy and water reach virtually every energy program. “Because of the variety of roles that water plays across different energy technologies, the DOE can best address the issues by incorporating consideration of water directly into the specific energy programs, rather than creating a separate silo focused on the energy-water nexus,” wrote David B. Sandalow, the DOE’s assistant secretary for policy and international affairs.


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**Infrastructure Financing Best Met By Combining Funding Options**

-- Craig D. Brooks, Executive Director

A Congressional Research Service (CRS) report has laid out a number of options for financing much-needed upgrades for sewage treatment and drinking water infrastructure, but said that no single option is without drawbacks and that a combination of several options would probably work best.

The report, “Legislative Options for Financing Water Infrastructure”, discusses six options for funding water infrastructure projects. According to CRS, the first and simplest option would be to increase funding for existing state revolving loan funds (SRF) under the Clean Water Act and the Safe Drinking Water Act. However, a major concern with that option is that federal capitalization grants for SRFs are entirely subject to annual appropriations, which have generally been flat or declining for more than a decade. The CRS report suggests that securing SRF funding is likely to be more difficult in future years because of the Budget Control Act of 2011.

A second option discussed by CRS is creation of a federal water infrastructure fund. Proponents of such a fund contend that trust fund expenditures would not impact the federal deficit, assuming that revenues are at least as large as program spending, because they would be drawn down from collections that are dedicated by law for specified purposes. The most difficult issue with this option is how to generate revenues. According to the CRS report, clean water lacks a clear basis for charging or taxing a set of users like that which exists for either highway for aviation trust funds.

The new report lists many options but finds it difficult to offer one single solution to water infrastructure financing

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A third option listed by CRS is the creation of a “Water Infrastructure Finance and Innovation Act” (WIFIA) program. The WIFIA program could provide capital at a low cost to the borrower, and it could be flexible on repayment. The WIFIA program is not intended to duplicate existing water infrastructure financing tools. However, enacting a WIFIA program would raise federal budgetary and revenue issues.

Fourth, CRS suggests that a National Infrastructure Bank be created. Such a bank is a government-established entity that provides credit assistance to sponsors of infrastructure projects. Proponents of this form of financing say an infrastructure bank might help facilitate water infrastructure projects by providing large amounts of financing on advantageous terms. This, says the report, might encourage investment that would otherwise not take place, particularly in large, expensive projects where costs are borne locally, but whose benefits are regional or national in scope. The drawback, according to CRS, is financing projects through a national bank might not be the lowest-cost means of achieving a project. A federal bank option would most likely direct financing to projects that are most visible rather than the ones that are the most in need.

Fifth, CRS discussed lifting private bond activity restrictions on water infrastructure projects included in the administration’s fiscal year 2014 budget request. Most qualified private activity bonds are subject to a state volume limit which prevents investment in need-
ed water infrastructure projects. Lifting the current cap will provide the opportunity for private entities to meet requirements for tax-exempt bond financing and induce additional infrastructure investment. It is unclear how much private investment will actually take place if the restrictions were relaxed.

Finally, CRS said that authority could be reinstated for the issuance of Build America Bonds included in the administration’s 2014 budget request. Build America Bonds were established by the American Recovery and Reinvestment Act of 2009. The authority to issue the bonds expired on December 2010. This type of program taps into a broader market for investors without regard to tax liability, such as pension funds, which typically do not invest in tax-exempt bonds, CRS said. The bonds could also be extended to investment in privately owned water infrastructure, the report said.

According to the report, it is unlikely that any of the proposals by CRS would be up and running quickly, meaning that, at least for the near term, communities will continue to rely on the existing SRF programs.


America’s Migratory Birds Threatened by Climate Change  
-- Tony M. Guerrieri, Research Analyst

According to a report by the National Wildlife Federation (NWF), climate change poses a threat to many migratory bird species, including many that live in and visit Pennsylvania.

The NWF report, “Shifting Skies: Migratory Birds in a Warming World”, outlines the challenges that climate change poses for birds. It warns that a warming climate could lead to a decline in some bird populations and even extinctions in others, and it calls on the federal government to curb carbon pollution and adopt what it calls “climate-smart conservation strategies.”

Migratory birds live a complicated and delicate existence, depending on multiple food sources and varied habitats. They cannot survive just anywhere. A migratory bird’s life is a chain of habitats for feeding, breeding and raising young. The slightest change in habitat can have dramatic - even devastating - impacts.

Migratory birds have faced stresses such as commercial hunting, loss of forests, wetlands and other key habitat, the use of DDT and other pesticides, the introduction of invasive species and other impacts of human development. Now, according to the report, they are facing a new threat – climate change – that could dramatically alter their habitat and food supply and push many species toward extinction.

The NWF report offers specific examples all around North America of the dangerous consequences of a warming climate:

- Spring is arriving earlier and winter later, creating a “migration mismatch” in timing for some birds. This mismatch occurs when a temporary food supply shifts away from the migratory cycle of birds. The most notable example is when the peak moment of insect abundance no longer happens when chicks are hatched and need the most food.
- Extreme weather events are becoming more frequent and more intense. Last year’s Superstorm Sandy has already cost the U.S. Fish and Wildlife Service $68 million to restore habitats on 25 refuges.
- Birds’ ranges are shifting and in some cases, contracting. Approximately 177 of 305 species tracked have shifted their centers of abundance during the winter northward by 35 miles on average in the past four decades.
- Some habitats are changing. For example, climate change is exacerbating pests and disease, such as the mountain pine beetle that has devastated many western forests – changes that undermine birds’ survival.
- Ocean birds, such as king rails and piping plovers, are the most at risk because many nest on islands flooded by sea level rise. And as ocean waters become more acidic from carbon pollution, the marine food chain may be impaired.
- Changing precipitation patterns threaten the Midwest’s prairie pothole region, known as “America’s duck factory.” Many ducks such as mallards and pintails face disappearing breeding habitat.

The report stresses that action is important given that wildlife watching contributed $54 billion to the U.S. economy in 2011, with consumers spending $4 billion on bird seed alone and bird hunters dropping another $1.8 billion that same year.

Among the report’s recommendations for curbing climate change and its impacts on migratory birds, such as sea level rise, wildfires, drought and more extreme weather events are:
- Reduce carbon pollution under the Clean Air Act. While the U.S. Environmental Protection Agency’s
authority to regulate industrial carbon pollution has been approved by the Supreme Court and repeatedly upheld by Congress, the administration has not yet set carbon pollution limits.

- Invest in clean energy and reduce dependence on dirty fuels. Properly sited wind, solar, geothermal and sustainable bio-energy will reduce domestic consumption of carbon-polluting fuels like coal, oil, tar sands and natural gas, which are driving climate change.

- Protect and restore natural carbon sinks. Restoring the ability of farms, forests and other natural lands to absorb and store carbon provides increased benefits to birds and other wildlife by providing important habitat, as well as helping to mitigate climate change.

- Use climate-smart conservation strategies to protect sensitive habitats and restore degraded areas. Land and water protection efforts increasingly will need to take future climate projections into account to ensure long-term value to birds and other wildlife. Degraded landscapes need to be restored, and citizens can take action to provide important habitat through backyard and schoolyard habitat programs.


EPA Releases Survey Showing $384 Billion Needed for Drinking Water Infrastructure
-- Craig D. Brooks, Executive Director

The Environmental Protection Agency (EPA) released a report in June 2013 showing that $384 billion in improvements are needed for U.S. drinking water infrastructure through 2030. This total includes the needs of 73,400 drinking water systems across the United States, as well as American Indian and Alaska native village water systems, according to the report. The report is based on a survey of public water systems.

EPA's “Drinking Water Infrastructure Needs Survey and Assessment: Fifth Report to Congress” identifies the investments needed for thousands of miles of pipes and thousands of treatment plants, storage tanks and water distribution systems. The survey shows that the nation’s water systems have entered a rehabilitation and replacement era in which much of the existing infrastructure has reached or is approaching the end of its useful life. The estimate represents projects necessary from January 1, 2011 through December 31, 2030.

EPA allocates drinking water state revolving loan fund grants based on the results of the assessment. The survey must be submitted to Congress every four years under the Safe Drinking Water Act.

EPA’s fourth survey, released in March 2009, estimated needs of $335 billion over a 20 year period starting January 1, 2007. The needs in the most recent survey are comparable to those in the 2009 assessment and the 2005 assessment, as well. Both have been adjusted to 2011 dollars, EPA said.

EPA has issued a new report listing the dollar amount needed for U.S. drinking water infrastructure needs in 73,400 drinking water systems.

EPA has noted a recent assessment by the American Water Works Association (AWWA) that suggests a significantly higher number needed for water infrastructure. The 2012 AWWA report estimates that more than $1.7 trillion would be needed for water projects between 2011 and 2050. The estimate is significantly higher than EPA's because it is based on a different set of assumptions about pipe replacement and investment, and covers a longer period of time.

EPA said its most recent assessment was conducted by a random survey sent to about 3,150 public water systems, representing large, medium and small systems. The assessment shows that improvements are primarily needed in:

- **Distribution and Transmission**: $247 billion to replace or refurbish aging or deteriorating lines;
- **Treatment**: $72 billion to construct, expand or rehabilitate infrastructure to reduce contamination;
- **Storage**: $39 billion to construct, rehabilitate or cover finished water storage reservoirs; and
- **Source**: $20 billion to construct or rehabilitate intake structures, wells and spring collectors.

**On the Horizon . . .**

**A LOOK AT UPCOMING EVENTS**

- **Monday, September 30, 2013, 12 noon - Environmental Issues Forum.** Room G-50, K. Leroy Irvis Bldg., Capitol complex, Harrisburg, PA – Dr. David J. Nowak, Ph.D, project leader for the USDA Forest Service’s Northern Research Station, will discuss the agency’s innovative “i-Tree” program and how communities can get help in planning how best to make trees work for them.

- **Monday, October 21, 2013, 12 noon - Environmental Issues Forum.** Room to be determined, Capitol complex, Harrisburg, PA – Pennsylvania hydro-geologist Bruce Leavitt (see below) will discuss his “back to the future” technology – known as “trompe” technology, dating back to the 16th century - that he has rediscovered and is using to remediate acid mine drainage in an energy saving, cost-efficient and effective way.

Please e-mail Geoff MacLaughlin in the committee office at gmaclaughlin@jcc.leg.state.pa.us or call Geoff at 717-787-7570 if you plan to attend Environmental Issues Forums.

And, check the committee website at http://jcc.legis.state.pa.us for more details and events that may be added to the schedule.

**COMMITTEE CHRONICLES . . .**

As described in this month’s The Chairman’s Corner article, consulting hydro-geologist Bruce Leavitt recently led a large group of government officials, coal industry operators, watershed organizations and others on a walking tour of the trompe technology acid mine drainage remediation demonstration site on the North Fork of Montour Run in Allegheny County.

*Pictured at right is Leavitt (right) describing the technology to some of the large crowd. The photo at lower right shows the trompe technology at work.*

Pictured at left is a diagram of a trompe technology system designed by Biomost, Inc., project designer and consultant on the North Fork site.
One advantage of the trompe technology, is that the energy it provides is constant and not affected by a lack of wind or sun, and it’s low-cost and efficient.

In the *Post-Gazette*, Leavitt was quoted as saying, “Trompe can reduce the size and costs of passive treatment systems for mine drainage. And it can take a treatment system that’s not working, or not working well, and clean the water better.” He added that the technology has a high energy conversion efficiency (in excess of 80 percent), and that it could work at active mine drainage treatment sites as well, where it would reduce the “horsepower requirements” for treatment.

OSM agreed and approved Leavitt’s proposal, one of only two grants approved for off-grid aeration. According to Lois Uranowski, chief of the Ecological Services and Technology Transfer Branch at OSM, as quoted in the *Post-Gazette*, “…And we received this proposal from Bruce Leavitt that is practical, simple and easily installed. We’ve had a lot of interest from Appalachian states and all over.”

Leavitt said that under the OSM project grant, he put together designs for three different size trompes, which others could duplicate. The trompes could use two inch diameter pipe, three inch pipe and four inch pipe. The trompes, he said, are designed to work at low pressure and with minimal operating costs. He noted that systems must be designed to be able to handle increases in mine flow discharges, however, and multiple downtubes which would come on line as the water level increases would do that, again relatively inexpensively.

Leavitt’s trompe technology is already in place in several demonstration projects, including one on the North Fork of Montour Run in Findlay, Allegheny County, at the Manner site in Clearfield County and at the Curley site in Fayette County.

Leavitt said that the technology has caught the attention of Pennsylvania’s Department of Environmental Protection, as well as other states. At a recent walking tour of the North Fork site, Leavitt said state government officials from Maryland, West Virginia and Ohio joined Pennsylvania to see the technology in action. There were more than 80 people on the tour, he added, including a number of industry and watershed association representatives.

As a result of what folks saw, Leavitt said he is working on some quotes for other PA projects, including one with a watershed group and another with a mining operator.

The history of trompe technology is interesting in itself. Leavitt said it was first developed in Italy in the 16th century and moved next to Spain, where it was an integral part of the operation of the Catalan forges for iron production in the 17th century. Eventually, a couple of similar forges were built in California.

Leavitt said the popularity of trompes began to wane in the early 20th century, when the electric motor and electric technology began to take over. On very large projects, electricity may retain its advantages as the depth of the downtubes and the size of the horizontal fields must increase, but otherwise, trompes are a very cost-effective and efficient source of off-grid power, Leavitt said.

He said he was on a bus trip in Canada in 1970 or 1971 when he saw the largest trompe ever built – the Ragged Chute trompe – with a 345-foot vertical fall. Located in Ontario, that trompe was used to run rock drills at a silver mine and provide ventilation to the miners.

Moving from the past to the future, Leavitt hinted that he is working on another possible use for trompe technology outside of mining – using trompes in sewage treatment plants, which also feature continuous flow and have a need for aeration.

Stay tuned.