

**18<sup>th</sup> Annual  
Maryland Ground Water Symposium**



**Session Guidebook  
Wednesday, September 30, 2009**

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ABSTRACTS  
of  
PRESENTATIONS

18<sup>TH</sup> ANNUAL  
MARYLAND GROUND WATER  
SYMPOSIUM

# WEDNESDAY SEPTEMBER 30, 2009

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MORNING SESSION ONE

10:45 – 11:15

**Conducting Inspections**

Chris Carski, Water Supply Program, MDE  
(*Regency Room*)

This presentation will focus on one of the primary responsibilities of MDE's Engineering and Technical Assistance Division, Sanitary Surveys. The Water Supply Program conducts Sanitary Surveys at public water systems throughout the State and this session will provide an overview of what the MDE's engineers look for in the field when conducting a Sanitary Survey. A discussion of operational requirements will be supplemented by photos of some of the problems that have been encountered. Other topics that will be discussed include: handling emergencies and engineering responsibilities in the office.

**Coal Combustion Byproducts: Potential for Groundwater and Other Environmental Impact and MDE's Recent Actions to Address Them**

Ed Dexter, P.G., Solid Waste Program, MDE  
(*Maryland Room*)

This presentation will discuss chemicals that may be present in coal ash and the potential for migration of these chemicals into groundwater. It will also provide an overview of recent and forthcoming regulatory changes to both address potential impacts and to improve the management of coal combustion byproducts in the State of Maryland. Examples from some recent cases will be provided.

The byproducts formed from the combustion of coal for heat and power contain low but still significant concentrations of a variety of inorganic chemicals that have the potential to adversely impact surface and groundwater. This presentation will provide an overview of recent and forthcoming regulatory changes to both address potential impacts and to improve the management of coal combustion byproducts in the State of Maryland. There will be a discussion of chemicals that may be present in coal ash and the potential for migration of these chemicals into groundwater. Examples from some recent cases will be provided.

## MORNING SESSION ONE (continued)

### **Trace Contaminants In Water**

Simin Rezai, Ph.D., Wastewater Permits Program, MDE  
(Wayne Room)

This presentation focuses on the current state of knowledge of trace organics in water through discussions on a variety of research studies, with particular emphasis on what is known and not known regarding the significance of the levels of trace organics found in water.

Although the earliest reports of pharmaceuticals and steroid hormones in water date back nearly four decades, it is only within the past decade that the subject has come to the forefront of scientific and public attention. Today we know definitively that trace levels of pharmaceuticals, potential EDCs, and other emerging contaminants do occur in source water, and to a lesser extent, in finished drinking water.

### **New Jersey Department of Environmental Protection's (NJDEP) Approaches to Ground Water and Surface Water Protection**

John Gray, New Jersey Department of Environmental Protection  
(Embassy Room)

This presentation will discuss and summarize the New Jersey Department of Environmental Protection (NJDEP) management approaches to ground water and surface water protection, including several stormwater control measures (SCMs), for various recycling industries.

Historically, stormwater and wastewater management strategies have competed against the economic viability of recycling activities and have left regulators and the regulated community with less than desirable water quality protection measures. While the recycling industry is a vital service provider contributing to the rise of sustainable development in New Jersey, empirical data and anecdotal evidence demonstrate that mismanaged stormwater discharges from various recycling facilities can cause severe environmental damage, including ground water contamination and degradation to surface water resources and ecosystems.

NJDEP has established working advisory groups with a broad range of stakeholders, including state academic resources, which have developed significant management strategies for water quality protection.

MORNING SESSION TWO  
11:20 – 11:50

**An Overview of Ground Water in Maryland**

Andrew Staley, Maryland Geological Survey, Maryland Department of Natural Resources  
(*Regency Room*)

This talk will introduce the fundamental concepts of ground water, with emphasis on ground-water settings that exist in Maryland. Topics for discussion will include the hydrologic cycle, porosity, permeability, recharge, water table versus confined aquifers, and cones of depression. Methods of investigation including water-level measurement, geophysical well logs, pump tests, and ground-water flow models also will be covered. In addition, challenges to our ground-water supply including drought, drawdown, and saltwater intrusion will be discussed.

The occurrence of ground water in Maryland is largely dependent on the subsurface geology in which it is found. The aquifers consisting of unconsolidated sediments of the Coastal Plain, for example, will store and transmit ground water very differently from the fractured crystalline bedrock of the Piedmont. As a result, aquifers in the varied regions of the State will respond differently to drought and excessive pumping, and will be susceptible to contamination in different ways.

**Groundwater Monitoring at Landfill Sites**

Stephen Roberts/ Jason Baer, Maryland Environmental Service  
(*Maryland Room*)

The presenters will talk about the results of monitoring and remediation activities conducted at more than 20 landfills throughout the State of Maryland. Several landfill-associated phenomena that should be evaluated in order to develop reliable Conceptual Site Models were observed and will be discussed.

When it comes to assessing or remediating environmental conditions at sites, development of a sound Conceptual Site Model is essential. Yet, it appears that this concept is not widely applied at landfill sites, especially older, non-engineered landfill sites. One of the things that make developing a sound Conceptual Site Model difficult is the fact that landfills are inherently complex structures that can have very heterogeneous constructions, contaminants, and effects on the environment. Unlike traditional “spill sites,” older landfills can be thought of as sustained, long-term releases to the environment. The complexity of understanding the landfill release is exacerbated by the fact that landfills are “living” biological reactors that, not only release contaminants into the environment, but actually generate contaminants as a result of waste decomposition.



## MORNING SESSION TWO (continued)

### **Securing Safe Water from the Surficial Aquifer: A Model of Citizen Involvement in Water Resources**

Gayl Fowler, President, SAIF Water Wells, Inc.  
(*Wayne Room*)

The presentation will discuss how SAIF Water Wells has been active in raising public support and funding to support community education through increased awareness of the health hazards that are presented by inadequately constructed and maintained water wells. Results of laboratory testing from several studies and models of communication for community education, as well as highlights of unsanitary drinking water wells, methods used for water well remediation, and design improvements for bored wells will be covered

The surficial aquifer is a renewable resource that provides an enormous supply of water. In order to make the surficial aquifer part of a diverse water supply system, ways must be found to insure the safety of wells and water systems drawing from this aquifer. Many efforts to upgrade existing wells and several methods of chlorination have been tried, but, most frequently, samples still contained coliform bacteria and sometimes fecal coliform. Various innovative techniques for well construction were developed, however the long term follow-up sampling for coliform bacteria suggests that test wells, and possibly every bored well, should be equipped with a water treatment system designed to significantly reduce bacteria levels.

### **Exploring the Storage and Transport of Roadway Salt to Surface Waters in a Second-Order Suburban Watershed**

Robert Flora, Towson University  
Ed Landa, U.S. Geological Survey  
(*Embassy Room*)

This presentation will discuss the effects of road salt entering into the hydrologic system via stormwater retention basins and provides data from a site investigation conducted in Baltimore County, Maryland.

Urbanized watersheds of the mid-Atlantic U.S. are receiving large quantities of road salt entering into the hydrologic system via stormwater retention basins. The Red Run watershed is located within a designated smart growth region in Baltimore County, MD and the number of stormwater basins in the watershed has increased dramatically over the past 15 years. Seventy storm water retention basins in this watershed have been surveyed over the last year and report surface water conductivities directly related to chloride concentrations that range from 70 uS to more than 200 mS. The groundwater beneath many of the stormwater retention ponds remains elevated (> 10mS) for most of the year suggesting a very slow discharge of salt to groundwater in the adjacent flood plain creating a continuing source.

## AFTERNOON SESSION ONE

1:15 – 1:45

### **A Simulation Model of Summertime Aquifer Levels and Stream Baseflow in the Upper Monocacy River Basin**

Cherie Schultz, James Palmer, Interstate Commission on the Potomac River Basin  
(*Regency Room*)

This presentation will discuss a study that was conducted on the summertime aquifer and stream baseflow in the Monocacy River. The study area includes the drainage areas of Rock and Marsh Creek in Adams County, Pennsylvania, and Alloway, Piney, and Toms Creek in Frederick and Carroll Counties, Maryland, and the study period is 1960 through 2002.

A steady-state ground water/stream flow model of the upper portion of the Monocacy River basin has been constructed to simulate summertime (July, August and September) aquifer levels and stream baseflows under a range of hydrologic conditions. The model provides predictions of mean stream baseflow for each of the five summertime hydrologic conditions, as well as predictions of the occurrence of dry stream reaches. Model results are used to compute the percentage of dry stream miles for each of the five summertime hydrologic conditions, under both current water use conditions and potential future water use scenarios.

### **Emerging Technologies for Groundwater Characterization and Remediation for Petroleum Hydrocarbons**

Forest Arnold, Oil Control Program, MDE  
(*Maryland Room*)

This presentation will provide an overview of emerging technologies for groundwater characterization and remediation of petroleum hydrocarbons, including: improved 3-D visualization software; surfactant injection followed by enhanced fluid recovery events; chemical oxidation, oxygen releasing compounds; ozone microspargers; ISOC oxygen diffusers; ISOGEN oxygen generators, ex-situ bioreactors; recirculating wells; permeable reactive barriers; pneumatic fracturing; and phytoremediation.

Conventional well monitoring, sampling, and aquifer testing technologies can result in data gaps. The use of emerging technologies typically requires more detailed site characterization information on contaminant zones, permeability zones, and ease of material injection into contaminant zones than is produced by conventional monitoring wells, sampling, and aquifer testing technologies. Several advancements in remedial technologies have lead to more rapid cleanup of petroleum impacted sites.

AFTERNOON SESSION ONE (continued)

**Drinking Water Regulations for Public Water Systems supplied by Ground Water Sources Under the Direct Influence of Surface Water (GWUDI)**

Barbara Weber, Water Supply Program, MDE

This presentation covers treatment, monitoring and reporting requirements for public water systems supplied by wells or springs that are under the direct influence of surface water. The main focus is small public water systems such as schools and restaurants; however, the same regulations apply to public GWUDI and surface water systems of all sizes. Owners and operators of small GWUDI water systems and county health department transient program staff especially should consider attending this session.

**Stormwater Management and Discharge Prevention**

Susan Allen, B.S., R.S., Montgomery Co. Department of Environmental Protection  
(*Embassy Room*)

This presentation will discuss research, facts and individual Stormwater Management and Discharge Prevention cases. A variety of violations encountered by the Montgomery County Department of Environmental Protection while inspecting the construction industry will be used as examples.

Stormwater issues will include those associated with the Exterior Insulation and Finish System (EIFS) currently used in building, Concrete and Sediment Discharge into streams and outfalls, Groundwater Discharge from Excavation, Geothermal Runoff, Dust and Trash. There will also be a discussion of the new Hilton Garden Inn being erected in Bethesda, MD, where despite MCDEP intervention, no containment procedures were in place in the first three weeks of construction activity. Best Management Practices for the industry and the implementation of new regulations and, in our case, the partnership of Permitting Services in changing construction methods to preserve air and water quality will be described.

AFTERNOON SESSION TWO  
1:50 – 2:20

**Integrating Groundwater Management into Land Use Regulations Town of Hampstead  
Groundwater Conservation Zoning District**

Ken Decker, Town Manager, Town of Hampstead, Maryland  
(*Regency Room*)

The presentation will describe the Town of Hampstead's adoption of a groundwater conservation zoning district model in an attempt to address groundwater issues through zoning regulations. The "district" is a hybrid commercial-industrial zone designed as a "performance" district rather than a traditional Euclidean "building block" zone. Zoning regulations are the principal tool for managing land use. While many jurisdictions have adopted adequate public facilities ordinances, zoning regulations are generally mute on groundwater conservation and management issues.

While the models performance characteristics can be divided into broad categories -- aquifer protection, environmental sensitivity, limited water consumption, maximum groundwater recharge, site specific design and water conserving construction -- the zoning district also creates a direct linkage between future land use and the groundwater recharge rate as determined by the Maryland Department of the Environment.

**Bioremediation Technologies for Groundwater Contaminated  
with Chlorinated Solvents**

Michelle Lohrah, U.S. Geological Survey  
(*Maryland Room*)

This presentation will discuss recent developments in ground water remediation technology. A wetland-derived anaerobic culture was developed by the U.S. Geological Survey to degrade a wide range of chlorinated volatile organic compounds whose use as solvents by private industry and the military has resulted in groundwater contamination.

The "West Branch Consortia" (WBC-2) is capable of degrading 1,1,2,2-tetrachloroethane, tetrachloroethene, trichloroethene, and their anaerobic daughter products to ethene and ethane, and can also degrade carbon tetrachloride and chloroform. In laboratory tests, bioaugmentation with WBC-2 was equally effective in enhancing degradation of the solvents when added to a matrix of wetland sediment, mixtures of commercial compost and peat, and polyurethane foam used in fixed-film bioreactors. Ongoing field tests and *in situ* application of WBC-2 for remediation of groundwater contamination will be covered. The ability of WBC-2 to grow on a broad range of contaminants and matrices provides versatility for groundwater remediation applications.

## AFTERNOON SESSION TWO (continued)

### **The Master Well Owner Network: Educating Private Well Owners Throughout Maryland**

Stephanie Clemens, Coordinator, Maryland Well Owners Network, University of Maryland  
(*Wayne Room*)

This presentation will provide an overview of the how the Master Well Owner Network began and has evolved over the past three years. Program accomplishments and potential research capabilities will also be discussed.

Poorly constructed and unmanaged water wells represent potential risks for vital ground water aquifers and the homeowners, farmers and businesses that access them. Documenting the impact of polluted drinking water on the health of rural residents is difficult because most pollutants require long-term exposure and mimic effects from other air or food-borne pollutants.

Homeowners with private wells typically neglect water supply management unless obvious water quality symptoms occur. Unfortunately, uninformed homeowners may fail to identify dangerous problems or fall victim to scare tactics used by treatment vendors and spend thousands of dollars on unnecessary treatment equipment.

### **Overview of Advance Treatment Technologies for OSDS**

Kevin Koepenick, R.S., Baltimore Co. DEPRM  
(*Embassy Room*)

This presentation will provide an overview of the basic processes and principles common to all denitrification units, and some helpful hints on how to troubleshoot installation and operational problems.

The establishment of the Bay Restoration Fund (BRF) in 2004 has resulted in a dramatic increase in the use of advance treatment units for private on-site sewage disposal systems (OSDS) throughout the state. Currently there are fourteen (14) grant-funding eligible products approved and labeled as "Best Available Technology" by MDE. Each manufacturer may have unique designs and patents for their products, but they all function using one or more of five (5) basic engineering principles.

## AFTERNOON SESSION THREE

2:35 – 3:05

### **The Maryland Fractured Rock- Water Resources Assessment**

Brandon Fleming, U.S. Geological Survey  
(Regency Room)

This presentation will take a look at the multi-year assessment of the water resources in the fractured-rock aquifers in Maryland that got underway in 2009. The U.S. Geological Survey (USGS) and Maryland Geological Survey (MGS) are conducting work on the project in cooperation with Maryland Department of the Environment (MDE).

Re-designing existing water use databases will provide the State a more powerful tool to better understand spatial and temporal patterns in water use, and give improved insight to water-resource decision makers. Additional study approaches have yet to be fully defined. A final report will highlight the need for a better understanding of the hydrology in fractured rock regions and the development of new tools to make more efficient decisions about water resources based on the best data available.

### **Coastal Plain Aquifer Study**

Jeff Raffensperger, U.S. Geological Survey  
(Maryland Room)

This presentation will describe the science plan developed to create an assessment plan on the sustainability of the Atlantic Coastal Plain aquifer in Maryland. Increasing use of groundwater over the past several decades has caused groundwater levels to decline by as much as 2 feet per year in some areas of southern Maryland. Since the Maryland Coastal Plain region is largely dependent upon groundwater for its water supply this has caused concern about the long-term sustainability of groundwater resources in the region.

Using a refined and updated hydrogeologic framework developed by MGS, an Aquifer Information System (AIS) has been created. The AIS consists of spatial data, including the hydrogeologic framework, and point data (information on wells, withdrawals, and hydraulic properties), within a GIS, as well as a suite of tools that operate on that data. The AIS is the major technical goal of Phase I of the assessment. Phase II focuses on additional field studies, including groundwater monitoring and geochemical analyses, as well as development of a regional groundwater flow model. The flow model will take advantage of recent developments in parameter estimation and uncertainty and sensitivity analyses, to improve model fit and gain insight into the simulated system. Once completed, the model can be combined with the USGS Groundwater Management process (GWM), allowing for optimization of different future pumping scenarios, to provide a science-based tool to facilitate sound management of the groundwater resources in the Maryland Coastal Plain.

## AFTERNOON SESSION THREE (continued)

### **Ground Water Rule Implementation**

Travis Sterner, Water Supply Program, MDE  
(*Wayne Room*)

This presentation will focus on new regulations affecting all ground water systems, including ground water transient systems that go into effect December 1, 2009. The session will be run in an impromptu style of question and answer, and presentation.

Public water systems that have ground water sources must meet the new Ground Water Rule Regulations. These new regulations will affect all ground water systems, including ground water transient systems, and the county health department personnel working with these transient water systems.

### **Performance Evaluation of Advanced Onsite Wastewater Treatment Options**

Tamara Vanivort, W. Virginia Water Research Institute  
(*Embassy Room*)

The presentation will discuss the results of a study recently conducted by researchers from the University of West Virginia of onsite wastewater treatment systems installed at residences in Anne Arundel County, Maryland. The purpose of the study was to determine the efficiency of nitrate- and phosphate-reducing onsite system technologies.

Water quality in the Chesapeake Bay is at risk of nitrate contamination from on site wastewater treatment systems installed throughout the region. The soils are highly porous and permeable with no intervening layer to treat the pollutants from such systems. In the past, most onsite systems installed were typically traditional, conventional type systems. During the last few years an effort has been made to install innovative systems that are capable of removing very high levels of nitrates before the effluent is discharged. Monitoring results show that when the systems were working properly, good results in nutrient reduction were achieved. Results indicate that nutrient-reducing technologies exist which are simple and cost-effective, but that the need for regular maintenance is critical to ensure systems are operating properly to keep nutrient reductions at optimum levels.

## AFTERNOON SESSION FOUR

3:10 – 3:40

### **Hydrological Impacts of Groundwater Withdrawals on Headwaters Streams**

Pat Hammond, Water Supply Program, MDE  
(*Regency Room*)

This presentation will discuss the results of groundwater flow models taken from published literature that were used to develop and demonstrate the limitations of the State's water balance methods. Case studies showing observed or measured declines in streamflow, caused by dewatering of a coalmine and a quarry, and large withdrawals in several watersheds for municipal water supplies, along with review of a few limited biological assessments will also be presented.

Most of the groundwater withdrawals in the fractured rock aquifers in central and western Maryland are taken from headwaters basins. This can cause substantial impacts due to reductions in base flow, especially during low flow periods of a drought. It is difficult to demonstrate these impacts and they have gone relatively unnoticed, primarily because there are few streamflow measurement gage stations on headwaters streams.

### **A Pleistocene Erosional Channel Islet, Southern Baltimore**

Chau Nguyen, Land Management Administration, MDE  
(*Maryland Room*)

This presentation discusses the results of an investigation of buried chromium ore processing residues (COPR) at the Dundalk Marine Terminal. The investigation yielded stratigraphic data suggesting the presence of erosional features in the Lower Cretaceous sediments (Barremian-age Patuxent Formation, Aptian-age Arundel Clay and Albian-age Patapsco Formation, 130 to 100 million years ago).

Data obtained from soil borings and shallow groundwater monitoring wells revealed two distinctive patterns. The first pattern is characteristic of the Patapsco formation and comprised of an approximately 30-foot thick lower sand, 40-foot thick middle clay-silt, and 0 to 20-foot thick upper sand (Bennett and Meyer, 1952). The second pattern is characterized by gravelly sand columns with little to no underlying Arundel Clay.

The gravelly-sand column pattern surrounds the Dundalk Marine Terminal study area and appears to define a Pleistocene-age islet (Newell et al., 2004) of Lower Cretaceous sediments. The erosional channels represented by the gravelly-sand columns appear to have scoured both the Patapsco Formation and Arundel Clay to different depths; in some places the scouring appears to have cut through the Arundel Clay and into the underlying Patuxent Formation.



## AFTERNOON SESSION FOUR (continued)

### **Cross-Connection Control**

Barry Walter, Hydro Designs, Inc.  
(*Wayne Room*)

The primary purpose of this presentation is to suggest simple methods and practices by which cross-connections may be eliminated or controlled without interfering with the functions of plumbing or public water supply distribution systems. The probability of contaminating the public drinking water supply through a cross-connection within a single plumbing system may seem remote at times, but considering the multitude of similar systems the probability is much greater than you think.

Cross-Connection Control remains a critical link in protecting public health by maintaining the quality of drinking water. Water quality will be jeopardized without a persistent effort in cross connection control. Plumbing cross-connections which can be defined as either an actual or a potential cross-connection between the public water supply and any other environment that could contain unwanted or unhealthy substances that would allow such substances to enter the public water supply. This problem is a dynamic one as most distribution systems are continually being altered or extended and all municipalities with public water supplies should have a cross-connection control program in place.

### **Update on OSDS Nitrogen Removal**

Jay Prager, Wastewater Permits Program, MDE  
(*Embassy Room*)

This presentation will provide an update on the Bay Restoration Fund (BRF) and discuss the Chesapeake Bay Nitrogen Reduction Act of 2009. The relationship between these two laws will be examined.

The Bay Restoration Fund, signed into law in 2004, requires all properties with a septic system to pay \$30 per year into the fund. Forty percent of this money is used to implement cover crop programs and 60 percent is used to upgrade septic systems to remove nitrogen. The Chesapeake Bay Nitrogen Reduction Act was passed during the 2009 legislative session and signed by the Governor in May 2009. It prohibits installation of septic systems within the Chesapeake and Atlantic Coastal Bays Critical Area unless the system includes nitrogen removal technology.

AFTERNOON SESSION FIVE  
3:45 – 4:15

**Water Embodied in Biofuel**

Simin Rezai, Wastewater Permits Program, MDE  
(Regency Room)

This presentation discusses the manufacture and use of biofuels and whether or not this form of energy is really a green form of energy will be discussed in along with viable energy production alternatives that have the potential for better long-term success.

As governments have committed themselves to the greater use of biofuels, questions are being raised about how green this form of energy really is. A recent study by a nationally recognized laboratory regarding the correlation between energy and fresh water, demonstrated that it requires 600 gallons of fresh water to drive one mile on ethanol. Researchers at the University of Minnesota reported that the production of ethanol fuel stocks may consume as much as three times more water than previously thought. Additionally, doubts continue to be raised about the green house gas emission benefits of burning biofuels in comparison to burning fossil fuels.

**Simulation of Ground-Water Flow and Optimization of Withdrawals from Aquifers at the Naval Air Station Patuxent River, St. Mary 's County, Maryland**

Cheryl Dieter, U.S. Geological Service  
(Maryland Room)

This presentation focuses on a study of the potential effects of continued withdrawals from three of the six principal aquifers tapped for potable water in southern Maryland, i.e., the Piney Point-Nanjemoy, Aquia, and Upper Patapsco.. These are also the three aquifers that supply water to the Naval Air Station Patuxent River.

Potentiometric surfaces in the Piney Point-Nanjemoy, Aquia, and Upper Patapsco aquifers have declined from 1950 through 2009 throughout southern Maryland. In the vicinity of Lexington Park, Maryland, the potentiometric surface in the Aquia aquifer in 2007 was as much as 160 feet below sea level, approximately 120 feet lower than in 1982. At the present rate, it is estimated that the water levels will decline to the regulatory allowable maximum of 80 percent of available drawdown in the Aquia aquifer by 2050. The effect of the withdrawals from these aquifers by the Naval Air Station Patuxent River and surrounding users on the declining potentiometric surface has raised concern for the future availability of groundwater.

As part of an ongoing study funded by the Naval Air Station Patuxent River, the U.S. Geological Survey has developed a three-dimensional finite-difference groundwater-flow model to simulate the groundwater-flow system in the three studied aquifers beneath the Naval Air Station Patuxent River. Transient and steady-state conditions were simulated to give water-resource managers additional tools to manage groundwater resources and solutions producing the least amount of drawdown in the local potentiometric surface.

AFTERNOON SESSION FIVE (continued)

**Exploring the Brine Envelope**

Larry Zinser, Master Water Conditioning Corporation  
(*Wayne Room*)

This session will present, discuss, and analyze the variables of brine regeneration of cation resin, and the results of an ongoing study of brine use efficiency. The speaker will follow a logical pattern of analysis of each variable in the procedure of brine regeneration. The focus will be on the brine elution curve for analysis of the brining process, and the results of recycling the brine waste. Included will be a survey and discussion of various brine control techniques.

**Topic and Presenter To Be Determined**

(*Embassy Room*)