



The **UNIVERSITY of OKLAHOMA**
Environmental Concerns Committee

Minutes

ENVIRONMENTAL CONCERNS COMMITTEE MEETING

Call To Order

A meeting of the Environmental Concerns Committee was held in Gould Hall on December 13th, 2018. It began at 9:02 AM and was presided by Burr Millsap.

Attendees

Voting Members in Attendance: Tammy McCuen and Kolt Vaughn

Ex-Officio Members in Attendance: Sarah Ballew, Dorothy Flowers, Jason Hancock, Brian Holderread, Burr Millsap, Bob Nairn, Randy Pepler, and Jeremi Wright.

Agenda Items

I. Introduction

Our guest presenter this month is Dr. Bob Nairn. Dr. Nairn is a David L. Boren Professor and Viersen Presidential Professor within the School of Civil Engineering and Science as well as the Director of the Center for Restoration of Ecosystems and Watersheds (CREW). A moment was taken to introduce Dr. Nairn as well as all in attendance of the meeting.

II. Guest Presentation – Dr. Nairn: A Decade of Successful Performance: Exotoxic Metal Retention in Ecologically Engineered Passive Treatment System Contributes to Stream Recovery

The Tar Creek Superfund site is located in Ottawa County, Oklahoma. A superfund is a contaminated site that exists due to hazardous waste being dumped, left out in the open, or otherwise improperly managed. The Tar Creek Superfund site is part of the larger Tri-State Lead Zinc Mining district that existed in the areas of northeast Oklahoma, southeast Kansas, and southwest Missouri. Today, the mining district is composed of a total of four Superfund Sites: the Cherokee County Site, Cherokee County, Kansas; the Orongo-Duenweg Site, Jasper County, Missouri; the Newton County Mine Tailings Site, Newton County, Missouri; and the Tar Creek Site, Ottawa County, Oklahoma.

The Tri-State Lead Zinc Mining District produced both lead and zinc in the 19th and 20th centuries. Underground mining and milling of lead and zinc ore resulted in a concentrate of the original mined materials as well as waste mine tailings, referred to as chat.

Chat Piles - Over the many decades of mining, chat was collected in large above ground piles. These chat piles contain lead, cadmium, and zinc. The Oklahoma portion of the mining district area possessed some 300 million tons of chat. The piles contain elevated levels of heavy metals. These piles remained after

mining operations ceased in the 1960's. Today wind, rain and leachate disperses what remains of the chat piles.

Underground Shafts - During mining, underground shafts went as far as 100 – 500 feet deep and then opened up laterally. While mining, pumps ensured water did not enter and fill the underground shafts. After mining ceased, the shafts filled with water and became contaminated with heavy metals. In 1979, artesian upwellings began releasing the metals-contaminated water at a rate of approximately 1 million gallons of water per day, which has continued every day since 1979. For some perspective, the well publicized 2015 Gold King Mine waste water spill in Colorado spilled approximately 3 million gallons of water. It is estimated that 95 million cubic meters of contaminated waters exist in the mine shafts. The contaminated mine water flows into and devastates the water quality of Tar Creek.

The environmental problems at Tar Creek came to attention in 1979 when the contaminated water began flowing to the surface. The surface water flowed to Tar Creek, killed the downstream biota and turned the creek an orange-red color. Elevated levels of iron, zinc, cadmium and lead exist in water, chat and the surrounding biota. In 1980, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund, was passed. CERCLA's purpose is to 1) identify hazardous materials sites that threaten the environment and public health and 2) remediate the site. Tar Creek was designated as a superfund site in 1981. The site has been included on the National Priorities List since 1983. The land belongs to the Quapaw tribe. After studying the site for 5 years, the EPA concluded the damage was due to irreversible man-made problems and was too expensive to fix. A relocation program was initiated to buy out the landowners. The 2000 census found the population of Picher, Oklahoma to be approximately 2,000. Today approximately 6 people live there.

Tar Creek has been a project of Dr. Nairn's for the previous 20 years. Today, Dr. Nairn and the Center for Restoration of Ecosystems and Watersheds (CREW) work at the headwater stream watersheds of the Tar Creek Superfund Site. CREW has been performing comprehensive watershed monitoring since 1997. Monitoring has found that a considerable amount of zinc and iron exists in the streams surrounding the mines.

CREW and Dr. Nairn operate two full-scale mine water treatment systems, the Mayer Ranch and Southeast Commerce passive treatment systems (PTS). PTSs are an ecological solution. The systems promote naturally occurring biogeochemical, microbial, and ecological processes. The PTSs are driven by distributed renewable energy technologies at the site – solar power. These systems use natural, unprocessed materials. The operation and maintenance costs are lower than other treatment technologies, but they require larger land acreage to operate.

PTSs target contaminant removal through oxidation and reduction reactions, meaning air is either added or removed from the water. These processes are performed in separate process units (ponds). In essence these are "big orange farm ponds with aerators and baffle curtains."

Mayer Ranch Passive Treatment System:

- Received funding from the EPA Water Division (Not Superfund) in 2004.
- Designed to capture artesian mine drainage discharge.
- Has been operating continuously since 2008.

- Is composed of 10 process units (ponds). The waste mine water is circulated through 10 process units and oxygen is either removed or added to extract the heavy metals from the contaminated water.
- First PTS in the entire Tri-State Mining District
- The completed system includes 10 distinct process units with a single initial oxidation pond (cell 1) followed by parallel surface-flow aerobic wetlands/ponds (cells 2N and 2S), vertical-flow bioreactors (cells 3N and 3S), re-aeration ponds (Cells 4N and 4S) and horizontal flow limestone beds (Cells 5N and 5S), and a single polishing pond/wetland (Cell 6). Mine water was diverted into the passive treatment system for the first time on December 2, 2008. (Source: <https://itrcweb.org/bcr-1/Content/Appendix%20B%20Case%20Studies/B2%20Mayer%20Ranch%20Commerce%20Site.htm>)



Southeast Commerce Passive Treatment System

- Received OKDEQ funding in 2015.
- 4 Processing units: Oxidation Pond, Surface Flow Wetland, Vertical Flow Bio Reactor, Final Polishing Unit
- 2.5 acres
- Most difficult challenge was developing a system to capture the upwelling mine water and channeling the water into the processing units.
- Second PTS in the Tri-State Mining District

- Photo source: <http://www.aees.org/e3scompetition/2018honor-universityresearch.php>



Water quality in Mayer Ranch and Southeast Commerce are both seeing big changes. The measured levels of heavy metals are significantly lower. Native fish species and beaver have returned to the area.

Conclusions

- Passive treatment is a demonstrated ecological engineering technology to improve mine water quality
- Water quality improvement has direct influence on ecological metrics in stream and riparian areas
- Widespread applicability

III. New Business

Brian Holderread shared that OU's Residential Colleges were recently certified as LEED Silver, making it the sixth LEED certified building on campus but the first building to receive the level of Silver.

Suchi Bhattacharjee presented a hard copy of the 2019 ECC Environmental Stewardship Call for Awards. The portal is live and the call for nominations will be circulated. A more in depth discussion to generate ideas for dispersing the call for nominations will be pursued.

Dot Flowers reports that the Sustainability Fair will take place on April 18th in the courtyard of the student union. Student groups are invited and encouraged to participate.

IV. Future Agenda Items

Our next meeting will take place on January 10th at 9 AM in Gould Hall room 185. Any changes will be communicated via email.

Adjournment

Meeting adjourned 9:57 am