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Champaign, Illinois, USA

2024 Electric Utility Chemistry Workshop Highlights and Press Release

INTRODUCTION

The 2024 Electric Utility Chemistry Workshop again offered a broad range of important topics for steam generation chemists, engineers, and managers. This article offers several highlights from the event. A somewhat overlooked benefit of this conference is its potential value for those employed at co-generation and large industrial plants, where water and steam treatment issues are similar and equally as important as for the power industry. Accordingly, the planning committee is renaming the event the Electric Utility and Co-Generation Chemistry Workshop (EUC²W) to emphasize the workshop's value to diverse industrial personnel.

SOME INTERNATIONAL FLAVOR

For the second year in a row, we were honored to have representation from PPCHEM AG. Michael Rziha gave two presentations, "Typical and Frequent Chemistry Issues in Cycling Plants" and "The Loss of Know-How." The first paper addressed an extremely important issue facing power industry personnel, frequent unit cycling that follows renewable load swings. Load cycling can significantly influence unit chemistry control and analytical monitoring techniques. In the second paper, Michael addressed a concern for many industries, "Baby Boomer" retirements

and the huge amount of accumulated knowledge that leaves with them. This often places an enormous burden on plant management to maintain plant reliability and efficiency. Yet management often does not prepare for the knowledge loss by bringing in younger employees in time to learn from the veterans. Immediately after Michael's paper, Brian Snyder of Northern Indiana Public Service Company provided excellent information on his company's methods to maintain employee knowledge.

THE PRE-WORKSHOP SEMINAR

In 2007, we inaugurated the pre-workshop seminar as a four-hour supplemental training session on the morning before the start of the main conference. Since then, we have rotated through four topics, with a focus on one subject each year.

- Steam generation chemistry
- Cooling water treatment
- Makeup water production
- Wastewater treatment

These seminars have become an excellent platform for providing detailed information on topics beneficial to many industries.

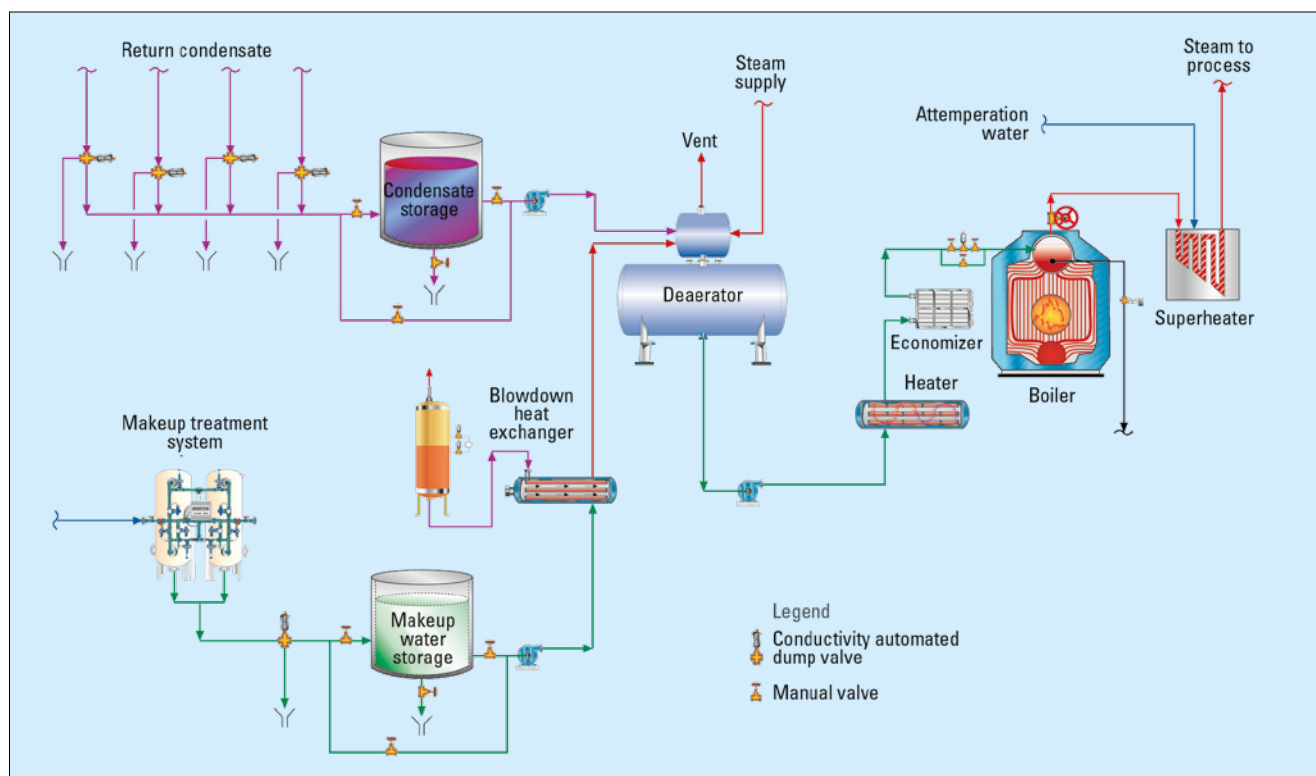


Figure 1: Generic flow diagram of a co-generation water/steam network [1]. The blowdown heat exchanger and feedwater heater may not be present in some configurations. Note the multiple condensate return lines, common for industrial plants.

While this author has served as the technical lead for every seminar so far, each year I have sought the assistance of at least one world-class expert to help prepare and give the presentations. It is my pleasure to announce that Michael Rziha has agreed to be a co-presenter at the 2025 EUC²W, where he can present in greater detail issues related to modern steam generation chemistry control in a load-cycling environment.

This year's topic was makeup water treatment, with the assistance of expert Ed Sylvester of ChemTreat. Some of the major developments that have evolved over the last 10 to 20 years or so include:

- Clarifiers that can operate at much higher flow rates with a much smaller footprint than the large circular units of the last century. (Some designs/processes are available that can assist with heavy metal removal from wastewater streams.)
- The increased popularity of micro- and ultra-filtration (MF and UF, respectively) as a clarifier replacement for suspended solids removal.
- The use of reverse osmosis (RO) for primary demineralization in most high-purity makeup systems. A common makeup treatment arrangement for combined cycle power plants

now is MF or UF followed by RO, with mixed-bed ion exchange polishing of the RO effluent.

- Increased recognition that proper RO pretreatment is critical to maintaining membrane longevity and reliability. This includes suspended solids removal and prevention of microbiological fouling. (Ganesh Kamatkar of Air Liquide offered an informative paper on practical results from the use of chlorine dioxide for RO pretreatment, where ClO₂ does not attack RO membranes like chlorine does.)
- The increasing use of reclaim water sources, most notable is municipal wastewater treatment plant effluent, for the entirety of the industrial plant makeup. Use of such makeup may require installation of a biological treatment system to remove compounds such as ammonia, phosphate, and organic compounds that might otherwise induce severe microbiological fouling in all plant water systems. Modern systems include membrane bioreactors (MBR) and moving-bed bioreactors (MBBR).

Another focus was on the potential influence of co-generation and industrial steam plant condensate return on boiler feedwater purity.

Depending on the intermediate and final products that circulate through process heat exchangers and reaction vessels, a variety of compounds can potentially enter the condensate. These impurities include inorganic ions, acids and bases, suspended solids, and organics. The author once visited a chemical plant at which organic contamination of the condensate return caused foaming in four 550psig (38bar) package boilers. Foam carryover to the steam required frequent and costly superheater replacements.

MAIN CONFERENCE TOPICS

We will now highlight several of the additional topics presented in the main session this year.

Cooling Water

An important subject every year is cooling water, and several papers were part of this year's workshop. Virtually all large industrial plants have multiple cooling water systems. While some large heat exchangers such as power plant steam surface condensers may be on once-through cooling, many cooling systems are of the open-recirculating design that have a cooling tower as the core heat discharge process. A universal feature of cooling towers is that evaporation increases dissolved and suspended solids concentrations in the recirculating water, which requires a combination of blowdown and accurate chemistry control to minimize scale formation and corrosion. Furthermore, cooling systems provide an excellent environment for microbiological fouling.

Issues that have evolved over the years include:

- The very popular acid/chromate scale and corrosion control programs of the middle of the last century have disappeared due to concerns over the toxicity of hexavalent chromium (Cr^{6+}).
- The primary replacement programs relied on inorganic and organic phosphates, with perhaps a small dosage of zinc, for scale and corrosion protection. However, calcium phosphate deposition became a major problem with these programs, requiring development of polymers to control this deposition. In recent years, concerns have grown dramatically about phosphate in cooling tower blowdown and its influence on receiving water bodies such as lakes and rivers. Phosphorus is a primary nutrient for algae growth in surface waters.



- The major water treatment companies have developed non-phosphorus (non-P) programs that rely on specialized organic compounds and additives to establish a direct barrier on metal surfaces to minimize corrosion. The formulations typically include advanced polymeric compounds for scale control.
- Microbiological fouling control continues to be of paramount importance. However, the higher pH (typically near or slightly above 8) of modern scale/corrosion control programs can reduce the efficacy of chlorine (usually fed as bleach) treatment. Alternative oxidizers such as chlorine dioxide and monochloramine may be more effective in these moderately alkaline environments. Periodic treatment with non-oxidizing biocides can also be beneficial. Careful evaluation is necessary for selection of the best treatment method. And changes to a biocide feed program are not allowed without approval of the proper regulatory authorities.

PFAS

Per- and polyfluoroalkyl substances (PFAS) continue to be of growing concern in many countries. Diane Martini of Burns & McDonnell Engineering gave an excellent paper on PFAS, with information on the history of these compounds, the extent to which they have appeared in water supplies, and potential treatment methods. Numerous PFAS compounds exist and exhibit varying degrees of potential toxicity to humans. Intense research is underway regarding capture from the environment and destruction of these compounds. PFAS will continue to be a topic at future workshops.

Carbon Capture & Sequestration (CCS) Water Usage

The leading method for carbon capture continues to be flue gas carbon dioxide absorption in a liquid amine stream. Water balance and parasitic power consumption issues are critical regarding this process. Steve Russell of Kiewit Engineering presented information on water

usage and potential discharge streams within the absorption/regeneration process. Intense research on this technology (and others) continues, with a primary goal being to optimize reaction and regeneration efficiency. CCS is a contentious issue, but many researchers believe it will be part of the solution to reducing CO₂ emissions from a variety of processes, not just power plant combustion.

CONCLUSION

Many industries face common water/steam treatment issues. The EUC²W is a place to hear presentations and participate in valuable discussions about these issues and modern technologies to address them. Next year's event will be June 16–18, 2025, in Champaign, Illinois, USA. It is not too early to mark your calendars for this event. More information on the 2025 EUC²W

can be found on the webpage <https://publish.illinois.edu/electricutilitychemistryworkshop/>. Reminders will appear in the PPCHEM journal.

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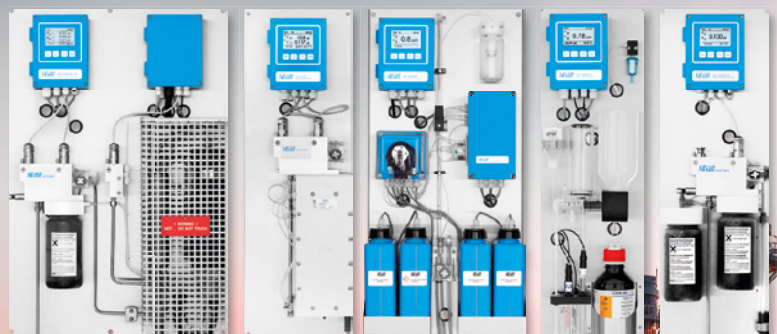
- [1] *Water Essentials Handbook (Tech. Ed.: B. Buecker)*, 2023. ChemTreat, Inc., Glen Allen, VA, USA. Currently being released in digital format at <https://www.chemtreat.com/>.

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