

» IMPORTANCE OF WATER AND STEAM CHEMISTRY IN BOILER SYSTEMS

KEY FACTORS IN STEAM INJECTION OPERATIONS THROUGH THE MEASUREMENT AND CONTROL OF WATER AND STEAM CHEMISTRY IN BOILER SYSTEMS » LESS RISK AND GREATER PROCESS EFFECTIVENESS »

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The role of water and steam chemistry in the performance and lifespan of boiler systems is of paramount importance. Water and steam are not mere carriers of heat in such systems, but active participants in various physical and chemical processes that influence boiler efficiency, safety, and durability. These processes include the formation of deposits, dissolution and redeposition of materials, particularly where water evaporates to form steam or condenses back to water. Understanding and effectively controlling the quality and treatment of water within boiler systems is therefore crucial to their successful operation. This paper will explore the key parameters to be controlled, the necessary treatments to maintain water quality, and the importance of operator training and understanding in managing these complex systems.



Main parameters to control:

The three key parameters to control in any steam supply system are: **pH, Electro-Chemical Potential (ECP), and the presence of specific deleterious species**. These parameters are directly influenced by the quality and treatment of the water used in the boiler and can impact the formation of deposits, the dissolution of materials, the efficiency and lifespan of the boiler itself.

Key factors to be considered:



Water Treatment: water used in boilers must be purified and treated to prevent scale formation, corrosion, and contamination by impurities. This process involves purification of make-up water, condensate polishing, deaeration, blowdown, and the addition of certain chemicals to control pH, ECP, and oxygen concentration. Through these processes, boiler efficiency can be improved, maintenance reduced, and the life of the boiler system extended.

Training and Understanding: Operator training and understanding of boiler water chemistry guidelines is essential to effectively manage these systems. This knowledge extends to how impurities, treatment chemicals, and boiler components interact. Early detection and management of chemistry upsets can be achieved through such understanding, reducing the potential for catastrophic failures and enhancing system performance.



Chemistry-Boiler Interactions and Boiler Types: Understanding the interaction between boiler circuitry and the steam generation process helps to control boiler water chemistry more effectively. Different boiler types - drum boilers and once-through boilers - require unique water chemistry and control strategies. Once-through boilers, for instance, require feedwater of high quality due to their complete conversion of water to steam without recirculation.

Control of Boiler Water Chemistry: Control of boiler water chemistry involves minimizing the introduction of impurities into the boiler, such as sodium hydroxide (NaOH), sodium carbonate (Na₂CO₃), or acid-forming salts like magnesium chloride (MgCl₂) or sulfate (MgSO₄), which can cause corrosion. Additionally, oxygen and carbon dioxide need to be controlled as these gases can also cause corrosion in the boiler system.

Period Boiler Feedwater and Makeup Water: Operator training is particularly important during the initial operating period when adjustments and tests are being made. Experienced operators are valuable during this period.

Water Purification and Condensate Polishing: The purification process, which involves coagulation, filtration, and chlorination, removes dissolved and suspended matter from the source water. When the returned condensate becomes contaminated, mixed-bed ion exchange purification systems, known as condensate polishing, can be used to remove impurities.

Advanced Boiler Types and Treatments: Once-through universal pressure boilers, susceptible to problems like corrosion and deposition of solids, require very high purity feedwater. Flow accelerated corrosion (FAC) can lead to the generation of corrosion products that can cause serious problems. All-volatile treatment (AVT) and oxygen treatment methods are utilized to manage the chemistry of the boiler water, reduce FAC, and enhance boiler operation.



Conclusion:

The efficient and safe operation of boiler systems relies heavily on the effective control of steam and water chemistry. It is crucial for operating personnel to possess a thorough understanding of the measurement and control processes involved. Their expertise plays a vital role in achieving success by maintaining the quality of steam and ensuring optimal heat delivery to the wells and/or reservoirs involved in EOR Processes.

