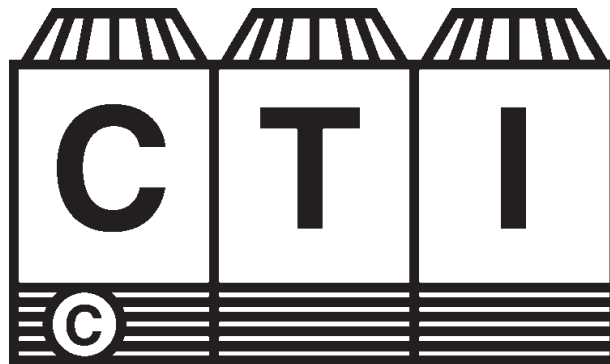


COOLING TOWER INSTITUTE

CTI CODE TOWER

Water Reuse Papers of Interest to Cooling Tower Users



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Water Reuse Papers Of Interest to Cooling Tower Users

Following is a bibliography of published and presented papers on the general subject of water reuse in cooling tower systems. The abstracts have been developed by Water Treating Committee members based on their evaluation of the article. The papers have also been categorized into three groups to clarify the general content of the paper. Additions and deletions may be made from time to time in an attempt to maintain a current list of papers.

Classification

Paper

Bulk Reuse

Water Reuse Within a Refinery; Eble, K. S.; Feathers, J. CTI Journal Vol. 14 No. 2, Summer 1993 Pg. 10-18 (TP93-09).

Abstract: Before Water reuse can be optimized within a refinery, all process water streams and utility water streams must be identified and their contaminants must be characterized. The streams can then be mixed and matched to minimize total refinery water use, water discharge, and water treatment. The cooling system is typically the largest consumer of water within a refinery, and consequently, it is the most likely place to reuse water. This paper identifies many process water streams found in a refinery, compares those characteristics with the level of contaminants which can be successfully treated in the cooling system.

Ten Years of 'Real Life' Operational Experience of a Zero Discharge Power Plant in Florida; Brew, Chris; Blackwell, Chuck; Presented at 4th International Power Generation Exhibition and Conference Part 3 and 4, December 4-6, 1991; Tampa, FL; Published by Power-Gen, Houston, Texas p 479-488.

Abstract: This paper deals primarily with a brine concentrator and its operation over a ten year period beginning in 1981. There is very little recycle in this plant, but rather concentration of waste solids and disposal of solids.

Dairy Wastewater Treatment and Reuse; Hadjivassilis, I.; Proceedings of the First IAWPRC East African Regional Conference on Industrial Wastewaters, Nairobi, Kenya Conference; Oct. 25-28, 1989; p. 87.

Abstract: Dairy waste water is treated by activated sludge with a toxic selector, followed by high rate coagulation, filtration, and disinfection. Treated water is reused for cooling and irrigation. This paper discusses water quality standards for reuse, and describes a layout of the waste water treatment plant with appropriate discussion. The article gives a treatment plant description for dairy wastewater. Performance data for first and second stage activated sludge treatment are given. Problems with filamentous bulking were overcome. Overall performance data for biological treatment and tertiary treatment taken once per month for one year show excellent BOD and suspended solids removal; water quality data for proposed cooling water usage is given. A good case study.

This is an operating plant and associated costs are shown for a three year operation.

True Zero discharge: Water and Wastewater Design Considerations; Webb, Lester C.; Weiss, Kenneth; Power Engineering (Barrington, IL) V. 93 #7, July, 1989 p 36-39.

Abstract: Power plants seek to minimize discharges, and true zero discharge is difficult but achievable. The paper discusses the Orlando Utilities Commission Stanton Station and how it has achieved zero discharge. Selecting the water source, systems design, operating conditions and an integrated environmental plan are discussed.

Several water chemistries are shown and a plant flow sheet is presented including a water balance at full load of 440 MW.

Zero Discharge Water and Wastewater Treatment System for a Combined Cycle Power Plant; Naik, Suresh B., Desai, Mukesh S., Terajewicz, J. Chris, Collins, Neil; Proceedings of the 51st American Power Conference, 1989, Chicago, IL; p 1043-1049.

Abstract: A theoretical discussion is presented about zero discharge design possibilities for a combined cycle power plant based in the Eastern U.S. The characteristics and recycle of various waste waters are discussed. The uses of water and the requirements of each use in this type of plant is given. Various mechanical and chemical treatment options are also discussed.

Minimize Plant Wastewater; Frayne, S. P.; Hydrocarbon Processing V 71 #8, Aug, 1992 p 79-82.

Abstract: This article gives an overview of water recycle and source reduction strategies. Material balances for contaminants found in surveys of typical refinery wastewater are computer modeled using 1) base conditions, 2) wastewater treatment plant recycle to the cooling tower and 3) stormwater and other recoverable water as cooling tower make-up. The amount and quality of the resulting discharges are discussed. No case study data are given.

Zero Water Discharge Systems a Must for Many Waste-To-Energy Plants; Sharma, Vinod K.; Power Engineering (Barrington, IL) V 93 #1 Jan 1989 p 32-35.

Abstract: Most currently planned waste to energy projects specify zero discharge. This paper discusses some of the techniques to minimize water usage. Water sources may vary from well water, municipal or reclaimed waste water. There is a brief discussion of plant boiler operations using American Boiler Manufacturers Association's recommended limits, and typical waste water treatment equipment.

Schematics show process flows, zero discharge waste water systems, and mass balance for systems with water cooled versus air cooled condensers.

Staged Cooling at Signal/Shasta: A high Recycle Evaporative Cooling Technique for Cost Effective Zero Discharge; Lancaster, R. L., Sanderson, W. G.; Journal of the Cooling Tower Institute, Vol. 9 No. 2, Summer, 1988 p 6-13 (TP88-02).

Abstract: The use of hydraulically isolated cooling loops in a primary and a secondary system is presented. Relatively clean water is used in the primary loop (~70% heat rejection), with the blowdown being treated and used as makeup for the secondary loop (~30% heat rejection). This arrangement effectively reduces overall water usage while maintaining cooling objectives. The concept is particularly useful where neither evaporation nor discharge are options for blowdown. High solids-content water is confined to the secondary loop, reducing the exposure of the system as a whole to more deleterious conditions, and treatment requirements. Silica is the usual limiting aspect. System controls are very important, but the cost of these systems are not reviewed. The overall concept is still valid and worthy of consideration where zero discharge is a goal.

Design and Performance of the Zero Liquid Discharge System for Wheelabrator Frackville Energy Company; Mitchell, O. Elmer, Hoehn, H. James; 1992 Annual Conference Proceedings; American Water Works Association; Water Resources; Vancouver, BC, Canada; June 18-22, 1992, p 27-46.

Abstract: A discussion of work done in late 1980's and early 1990's for the design process, startup process and early operating experience of a new co-gen system that employs recycling as part of a zero liquid discharge facility. Make up to the plant consists of water from a mine pit, low in pH, high in iron, manganese and aluminum. This is pretreated by oxidation and lime softening, then combined with waste streams from the site (chiefly boiler blowdown) and treated by RO. The RO reject is used as cooling tower makeup, the RO product used by the boiler. The cooling tower uses side stream lime softening. Cooling tower blowdown is from the softening process and is used for ash conditioning.

Additional Considerations: Work is up-to-date and plant specific. There is some water data but no performance data for the cooling system. Paper discusses how operation changed as experience was gained.