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Recovery and Repassivation after Low pH Excursions in Open Recirculating Cooling Water Systems

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Foreword

This standard practice presents guidelines for preplanning for, recovering from, and repassivation after a low pH excursion in open recirculating water systems, no matter what the cause. The procedures presented in this standard in no way preclude the use of other procedures but are presented as best practices developed over years of experience in a variety of plants. The provisions of this standard should be applied under the direction of qualified water-treatment personnel from water-treatment suppliers and/or consultants and plant personnel.

Low pH excursions in open recirculatory cooling water systems will result in strippage of scales and protective metal oxide films and elevated corrosion rates of 25 to 100 times higher than normal. The accelerated corrosion leads to greater equipment depreciation rates, reduced life expectancy and premature heat exchanger failures. Stripped scales, oxides and subsequent generation of suspended solids lead to fouling of heat exchangers and cooling tower fill, thus reducing water flow, heat extraction and heat rejection rates. If low pH excursion corrective action is not taken quickly, cooling capacity decreases and derating of process side throughput may be expected, with the potential of a forced shutdown outage. This standard provides the sequential corrective actions, chemical alkali selection and applied concentrations that must be adhered to in order to reduce the degree of corrosion and fouling while also avoiding a forced shutdown and minimizing the duration of the derated process side throughput. Secondary benefits of these processes are those associated with reduced prepared water consumption and reduced cost of post-treatment of discharge waters and of achieving environmental compliance.

This standard will assist the following personnel associated with the process;

- Water treatment suppliers and / or consultants to develop the site-specific contingency plan, complete with water and chemical inventory requirements to allow for corrective actions that successfully remediate the upset.
- Managers are ensured success of the application.
- Plant operating personnel are provided with the tools to counteract the upset successfully in a timely manner (hours as opposed to weeks).
- Owners can now reasonably manage the total cost of ownership (TCO) of the excursion.

Scope

The scope of this standard practice is that of pH depression detection, correction, and restoration to safe operating conditions that ensure future avoidance of excessive corrosion and fouling rates as well as process throughput capacity derating. A discussion of the importance of preplanning, the elements that comprise it, in the form of a check list and populated tables containing the types of chemicals, their feed rate and inventory required that are site specific for the cooling system volume and maximum blowdown rate are provided. Auditing and identifying high-risk unit processes that could be a source of low pH ingressor to be completed. Sampling and monitoring the outlets of the high-risk areas with the appropriate on-line sensors or grab sample test apparatus with sufficient reagent inventories are also noted. Knowledge of the site environmental discharge limits and the management of the cooling system discharge during the recovery are addressed. The contingency processes to restore the pH, recover from excursion and completion of repassivation are based upon four degrees of severity associated with excursions. The individual contingencies are defined in the text and illustrated in figure 1.

Rationale

This standard replaces NACE standard RP0392-2001, which was withdrawn in 2011. This standard includes more information on repassivation, approximation of contingency dispersant requirements and demands, heat exchanger clean-up methods and improved directions on how to convert the general concepts and procedures to the site-specific operational hydraulic balances experienced than did RP0392. Appendix A (Nonmandatory) provides such direction which would also provide contingency chemical additives and inventories required, determination when the test result values were representative and to allow for predicting the time to achieve the maximum resultant outcome.

In AMPP standards, the terms *shall* and *must* are used to state requirements and are considered mandatory. The term *should* is used to state something that is recommended, but is not considered mandatory. The term *may* is used to state something considered optional.