Removal of Nitrates from Wastewater at Radford Army Ammunition Plant Using Counter-Current Ion Exchange Technology (Task N.0829)

Statement of Need

Radford Army Ammunition Plant (RFAAP) is historically the largest emitter of Toxic Release Inventory (TRI) chemicals and pollutants in the DoD. In 2010, the TRI wastewater releases from RFAAP were ~12.5M lbs. One-hundred percent of that volume was reported as nitrate compounds discharged to the New River as a result of RFAAP's nitrocellulose (NC) manufacturing. NC is manufactured using a combination of nitric and sulfuric acids to nitrate wood pulp or cotton linters. When processing NC into propellant, the acids must be removed, resulting in millions of gallons of acid and nitrate laden wastewater lost as process waste. This results in significant volumes of acidic wastewater that must be treated before being discharged to the New River. The treatment process uses lime to reduce the acidity of the wastewater; however, nitrates remain soluble and are ultimately discharged to the New River.

EPA regulates the discharge of nitrate in water because nitrates are a biological nutrient that, in high concentrations, can lead to eutrophication of the water body and cause adverse effects on the ecosystem. Nitrates are difficult to remove through filtration and/or precipitation. Also, nitrate-containing industrial water from these operations lack the soluble organics necessary for treatment via many biological denitrification processes. Techniques available for cleaning other contaminants from this industrial water allow marginal amounts of nitrate to remain in the water. These amounts are low enough for reuse back into one or more areas of the manufacturing operations. The data from the material balance and acid loss survey (part of NDCEE Task N.0703) identified potential common opportunities for other propellant manufacturing facilities to treat and reuse the water generated from processing nitrate esters, nitroaromatics and nitroamines, which this follow-on effort seeks to demonstrate at a more robust pilot scale at RFAAP.

Technical Approach

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Status
Ongoing

The NDCEE will assess and determine the most appropriate demonstration location at RFAAP. This assessment will include the review of wastewater constituents and concentrations as well as geographical location, access, and other site-specific characteristics. Once the demonstration site is selected, a continuous counter-current ion exchange (CCIX) technology and associated resin will be determined and the technology configuration will be identified and prepared for the demonstration phase. The demonstration will be performed over a period of six (6) months. The first demonstration trial will occur during the fall of 2014, following the CCIX technology set-up, system validation, and training. The trials will include sampling and analysis of raw wastewater, treated wastewater, and by-product as well as operational analyses and system optimization. At the conclusion of the demonstration period, the pilot CCIX and wastewater collection system will be decommissioned and removed from RFAAP.

Anticipated Results and Benefits

It is expected that the continuous CCIX technology will treat greater than 85% of nitrates from the wastewater and be transitioned to RFAAP to treat wastewater flows in a sustained methodology (i.e., total flow treatment), without buffering for variable acidity levels at a full-scale level.

Technology Transfer and Outreach

It is expected that the continuous CCIX technology will be beneficial to other DoD locations, specifically other Army ammunition plants.