CENTRAL ARIZONA SALINITY STUDY---- PHASE I

Technical Appendix T

LOCAL RESEARCH EFFORTS

Introduction

A substantial amount of research is occurring in the Phoenix Metro area under the umbrella of CASS. Most of this work is being funded by SROG, Reclamation or the City of Phoenix. The research, while applicable to other locations in Arizona or the United States, is focused on specific problems that need to be addressed in the Phoenix Metro area.

Constituents in Evaporation Ponds

In 2002 a study was initiated with Arizona State University to study the Palo Verde Nuclear Generating Station (NGS) evaporation ponds. For the past 20 years, the Palo Verde generating station has purchased reclaimed water from the 91st Avenue WWTP to use for cooling water. The water is treated further on-site for use in the cooling towers adjacent to the nuclear generators. The blowdown from the cooling towers, reflecting a concentration of 30 times the initial concentration, is discharged into two 250-acre storage ponds located on-site where evaporation is the main mechanism for disposal. The study will characterize the concentration and constituents of the brine. If there is a high concentration of brine in the pond, it is possible that natural density stratification has occurred. This would create a solar pond condition in which energy could be recovered from the lower level of the pond.

"Devaporation" Demonstration

The 23rd Avenue WWTP was selected as a test site for an enhanced water recovery membrane pilot project. The project will evaluate a reverse osmosis (RO) treatment facility as a method to improve the quality of treated effluent for reuse. The membrane product water will be blended with effluent from the plant. Quantities and concentrations will be studied to determine the most cost effective mix for reuse. Another potential goal of the study will be to evaluate enhanced water recovery systems. RO systems recover approximately 80 to 85 percent of the effluent resulting in a brine reject of 15 to 20 percent.

The "dewvaporation" system was developed by Dr. James Beckman at Arizona State University as a low cost method of further concentrating brine. The dewvaporation system will further concentrate the brine reject from the RO system by utilizing a continuous contact tower that uses evaporation and dew formation to separate water from brine. The system will be operated in series with the membrane system to increase water recovery. Of the liquids entering the system, 99 percent will be recovered. The ultimate

objective is an efficient large scale facility which generates the brine by-product in a crystallized form. Further potential for industrial and/or commercial applications for the dewvaporation system will also be evaluated.

Cooling Tower Discharge

In February 2003, the City of Phoenix initiated a contract with a consulting company to inventory cooling towers in the valley. Cooling towers concentrate salinity in the feed water and discharge it when the salinity reaches a specified level. It is estimated that industries use upward of 30% of their water for cooling. The purpose of the study is to inventory cooling towers and assess the volume and salt content of discharges sent to the City of Phoenix wastewater treatment plants. The study will focus on all cooling towers greater than 250 tons and then use this data to estimate the impact from the smaller tonnage towers.

Salinity Contributions from Residential Users (AWWARF-sponsored)

The City of Phoenix, along with several other western municipalities, is participating in a study of residential contributions of salinity. The research will use water flow meters and in-line devices to evaluate common household products and practices, and their impact on the sewer system. These devices will monitor both timing and the levels of TDS in wastewater. This will assist in identifying, for example, the role of water softener regeneration in TDS levels at treatment plants. Other participating cities include El Paso, Irvine Ranch, Monterey, and Santa Clara.

Concentrate Disposal

Once salinity is removed, it must be disposed of in an environmentally acceptable and cost-effective manner. Options considered include evaporation ponds, deep well injection and outfall lines to the ocean (where practical). The costs and environmental impacts of these solutions dictate a compelling need for research into creative solutions. These could involve development of solar ponds (which produce energy through varying salinity gradients) and/or means of converting the brine product into a marketable product. Several research efforts are planned or underway to address this compelling need.