

## Environmental assessment of brine discharge and wastewater in the Arabian Gulf

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### ABSTRACT

This study assesses the environmental effects of brine discharge into the Arabian/Persian Gulf and the option of mixing with wastewater to reduce the salt content in the discharge. The Arabian Gulf region occupies about 3.3% of the world area and has 1.0, 2.0 and 2.2% of the total world population in the years 1950, 2008 and 2050 (prognosis) respectively. The study area desalination capacities were obtained as 50, 40 and 45% of total world capacity at the end of 1996, 2008 and 2050 (prognosis) respectively. The trend towards increased recovery ratio in the desalination plants was considered as one important environmental factor. This will significantly increase the brine salt concentration from 1.5 to more than 2 times the seawater. The allocation of wastewater and brine is important for the Arabian Gulf. Straightforward water and salt mass balances were used to calculate residual flow, exchange flow and exchange time in the Arabian Gulf. For example, at zero wastewater discharge from 1996 to 2008, the net volume in the Arabian Gulf decreased by 7.4 million m<sup>3</sup>/d, the exchange volume increased by 69 million m<sup>3</sup>/d, and the mixing time decreased by 22.5 d. Discharging a mix of brine and wastewater in the Arabian Gulf reduces the water and salt exchange between the Gulf and the Indian Ocean. Nutrients in wastewater may cause problems such as eutrophication in the Gulf if the exchange of water is low or if wastewater is discharged to the Gulf with insufficient treatment.

*Keywords:* Arabian Gulf; Desalination; Wastewater; Population; Water–salt balance; Environmental impacts; Salinity

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