A PARAMETRIC STUDY TO DETERMINE THE ELECTRICAL RESISTIVITY OF BURIED REINFORCED CONCRETE TANKS AT THE HANFORD SITE

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The electrical resistivity of liquid underground storage tanks (LUSTs) can affect electrically-based geophysical imaging when determining whether those tanks may have leaked in the past. If the resistivity value of the tank is very low then the sensitivity of the resistivity method to find external leaks emanating from the tanks will also be low, thus making it difficult to precisely determine the extent of a leak. On the Hanford site in eastern Washington, LUSTs are comprised of concrete with steel reinforcing structures such as rebar, remesh, and liner and there has always been a question whether the large amount of steel would make the tanks electrically conductive. Above the tanks but still buried in the ground are large groupings of metallic pipelines that definitely affect surface-based resistivity, and this has been documented in a number of publications. However, one method developed onsite to overcome the surficial pipeline problem has been the long electrode electrical resistivity tomography (LEERT), where steel-cased wells are used as the electrodes. In this work, we conducted a parametric study to indirectly answer the tank conductivity question by developing a set of synthetic, forward LEERT models using a wide range of resistivity values for either the tanks or piping network, ranging from $1x10^{-6}$ to $1x10^{4}$ ohm-m. The patterns and values of the synthetic tomographic models were compared to LEERT field data from the AX tank farm at the Hanford site. This indirect method of assessing the effective resistivity revealed that the reinforced concrete tanks are electrically resistive, and the accompanying piping infrastructure has little influence on the overall resistivity distribution when using electrically based geophysical methods for characterizing or monitoring waste releases. Our findings are consistent with nondestructive testing literature that also shows reinforced concrete to be generally resistive.