The Preparation of Precursors and Models for the Immobilization of Technetium Wastes

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The essential element of the project is to transform Re_2O_7 to covalently bonded perrhenato complexes, $(CO)_3L_2MnOReO_3$ and Tc_2O_7 to pertechnetato complexes, $(CO)_3L_2MnOTcO_3$ from their reactions with manganese hydrides, $(CO)_3L_2MnH$. It is expected that immobilization of $(CO)_3L_2MnOReO_3$ or $(CO)_3L_2MnOTcO_3$ by vitrification in the presence of glass materials (soda ash, silica, and boric oxide) will suffer little volatilization due to the covalent nature of the bonds

The objective of this project is to develop chemical methods for reducing the technetium volatility problem and at the same time improving technetium immobilization by enhancing its incorporation into durable glass and ceramic forms. Since there are no non-radioactive forms of technetium, much of the preliminary work for this project will be focused on the use of non-radioactive surrogates that have strongly similar chemical properties to the technetium oxides. The rhenium heptoxide, Re_2O_7 has similar chemical properties to the technetium heptoxide, Tc_2O_7 and thus should serve as an excellent surrogate for the study of the immobilization of technetium oxide forms. All successful studies involving Re_2O_7 will be duplicated and confirmed by using the radionuclide, ^{99g}Tc.

We believe that the conversion of Re_2O_7/Tc_2O_7 to the covalent ReO_4/TcO_4 complexes by transition metal hydrides and immobilization of technetium nuclear wastes will be easy and inexpensive processes because the starting materials, manganese hydrides, $(CO)_3L_2MnH$ are very easy to synthesize and very stable compounds at room temperature and in air.