
Workshop on Evaluation of Speciation Technology

Florida State University Gregory R. Choppin

All countries which use nuclear power must be capable of handling the spent fuel properly to avoid unacceptable releases of radioactivity to the environment. Since many of these radionuclides have very long half-lives, this requires that we use methods to contain these nuclear wastes for 10-100 thousands of years. In addition countries (particularly, Russia and the USA) which had nuclear weapons programs must now decontaminate the buildings and soils to which, deliberately or accidentally, radioactivity was released during the cold war period.

To design and use efficient separation methods requires an adequate knowledge of the oxidation state of the radioactive metal and its chemical speciation (e.g., degree of hydrolysis, type and extent of complexation, solubility, etc.). Plutonium speciation is particularly challenging as it can exist in several oxidation states simultaneously, each with quite different tendencies to complexation and/or hydrolysis. Moreover, such complexation or hydrolysis can cause changes in the relative population of plutonium in the different oxidation states. The speciation is complicated further in neutral and basic solutions by the formation of Pu-O colloids and by the strong tendency of Pu (IV) to sorb to natural colloids and to surfaces. Another important factor in the choice of methods to use to ascertain the oxidation state and chemical state of plutonium in a particular system is the great uncertainty that these states of plutonium are constant as the concentration changes from tracer (submicromolar) to macro (greater than millimolar) levels.

The major goal of the international NEA-OECD Workshop on Speciation was to review various

methods of speciation of the oxidation and chemical states of radioactive species and to produce a report that discusses such speciation methods in terms of the proper way to use each method, the advantages and the limitations of each method, and information which each method can provide on the chemistry of the radioactive species. An important but minor goal was to give the NEA advice on areas in which future research, workshops, reports, etc. would be useful to advance nuclear technologies.

We hope the report will be a valuable guide to good speciation studies in fuel reprocessing, in decontamination and in environmental migration research.

The lecturers in the Workshop were international (Belgium, Britain, France, Germany, Russia, Japan, USA) experts and covered the background for the need for the use of the proper separation and measurement techniques for speciation at macro and micro concentrations in laboratory, plant and environmental systems. The lectures provided a valuable start for the detailed discussions to prepare the report. These discussions were done by dividing the participants into 5 groups, each with a different subject of speciation. The discussions in the group were lively and explored in depth the methods related to each of the 5 subgroups. The discussions were also helped by the social activities organized by JAERI (lunches and dinners) where the participants could talk about the results of the group discussions.

JAERI (and, in particular, Dr. Z. Yoshida) played a most important role in the organization and conduct of the Workshop and the success of the meeting is largely due to the work of JAERI.