KERR-McGEE CORPORATION
KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73125

ENVIRONMENT AND HEALTH MANAGEMENT DIVISION
EDWIN T. STILL, DVM
VICE PRESIDENT AND DIRECTOR

July 20, 1994

Mr. John H. Austin, Chief
Low-Level Waste Management
and Decommissioning Projects Branch
Office of Nuclear Material Safety
and Safeguards
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Re: Docket No. 70-0925
License No. SNM-928

Dear Mr. Austin:

In accordance with your request of July 18, 1994, the method proposed for collecting the samples and estimating the K_d for soils to be disposed at the Cimarron facility is provided below.

Sample collection: In April 1994, the two existing soil stockpiles containing soil from remediated areas were systematically sampled on a five by five meter grid spacing by coring over a two meter depth and collecting material over each half meter interval. The 634 samples collected are archived at the facility and will be used to prepare six composite samples for distribution coefficient determination.

A random number generator will be used to identify 10% of the samples (20 samples from the north pile and 40 samples from the east pile). Individual composites will consist of aliquots from these samples, again randomly selected, resulting in two composites for the north pile and four composites for these east pile.

K_d Determination: The Kerr-McGee Technical Center will conduct the equilibrium distribution coefficient testing, using the Batch Determination Techniques described in the attached document by B. F. Hajek. The solution used will be groundwater obtained from an on-site monitor well (No. 1325) located adjacent to the proposed disposal area.

Please contact John Stauter (405) 270-2623 or me (405) 270-2934 if you have questions.

Sincerely,

Edwin T. Still

ETS:lld
Attachment

cert # P 918 188 591

NMD

Equilibrium Distribution Coefficients - Batch Determination Techniques

B. F. Hajek

Introduction

The equilibrium distribution coefficient (K_d) is an easily determined equilibrium constant for trace ion adsorption on soils. In using this coefficient the assumption is made that ion exchange extends over a short, nearly linear, section of an adsorption isotherm. This assumption is usually valid since trace ions are present in small concentrations and do not occupy a significant portion of all ion exchange sites (1, 2, 3).

The K_d is calculated from data obtained in batch equilibrium tests by use of the equation,

$$K_d = \frac{Co - C}{C} \quad \frac{\text{ml soln}}{\text{g soil}} ,$$

in which C_o is the initial concentration of radionuclide in solution and C is the equilibrium concentration after solution - soil contact.

Batch Equilibrium Method

Five grams of soil obtained from samples collected by test borings are equilibrated with 20 ml of solution by shaking continuously for 16 hours (overnight). The solution used should simulate, as closely as possible, the solution that will actually flow through the soil. This can be groundwater or seepage water obtained on-site, simulated acid process solution, or ground water-acid process solution mixtures. The solution used is traced with ions of interest such as U, Ra, Th, and As. A higher soil-solution ratio may be required for U adsorption tests since adsorption will probably be low (< 2). A 1:1 ratio may be needed in this case. A lower ratio may be needed for Ra and Th since K_d's may exceed 500 ml/g.

Radionuclide concentration in the equilibrium solution should be such that > 10,000 counts can be accumulated in a reasonable period of time to give a counting error of less than one percent. All K_d tests should be made in duplicate.

The soil sample is usually that fraction that passes a 2 mm sieve. If porous rock or porous gravel are tested for adsorption the solid-solution ratio should be increased and a value for in-place density (bulk density) will be needed to express adsorption on a volume basis.

Solution characteristics required:

1. initial pH
2. final pH
3. concentration of major competing cations and anions

Soil characteristics:

1. grain size distribution
2. qualitative mineralogy
3. approximate bulk density
4. pH of a 1:1, soil:water suspension

References

1. D. W. Bensen. 1960. Review of soil chemistry research at Hanford. HW-67201. General Electric Co., Richland, Washington.

2. W. J. Kaufman. 1963. An appraisal of the distribution coefficient for estimating underground movement of radioisotopes. HNS-1229-21. Hazelton - Nuclear Sci. Corp., Pal Alto, California.

3. W. E. Prout. 1958. Adsorption of radioactive waste by Savannah River Plant Soil. Soil Sci. Vol. 86, pp. 13-17.