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Effect of a bentonite/soil mixture as a barrier for uranium ponds

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Uranium mill tailings need safe management as they contain long-lived uranium and its daughters. Chemical treatment applied on these tailings to neutralize the acid solution and to stabilize the remaining radioactive elements. Then they are stored in ponds. These ponds are used for the accumulation of the solids and evaporation of the liquids. Sometimes the liquid returned to the plant for reuse. These applications are used to isolate the tailings from the environment.

The purpose of this laboratory test is; initially to determine the effectiveness of bentonite/soil mixture as a barrier for uranium ponds. In this study, two experimental ponds equipped; with different two barriers in laboratory. Dimension of this container is; 120 cm in length, 100 cm in width and 100cm in depth. Sampling pipes were placed at different places of the container. First pond includes ordinary soil (Fig. 1A); second pond includes soil/bentonite mixture (Fig.1B). Uranium mill tailing ponds were placed at the surfaces of these two systems. Uranium solution was prepared by using natural uranium ore.

The solution was put into these ponds. These test carried out more than for 10 months. Passed solution was collected by sampling pipes and recorded. Amounts of passed solution were determined according to the location of discharge pipes. At the last stage of these tests, sampling from the different parts o the system has been carried out by small holes, which were opened from the surface by special sampling device. By this way, migration information about the upper parts of the sampling pipes has been received. Behaviour of uranium radionuclides and the effectiveness of the bentonite/soil mixture were experimentally determined.

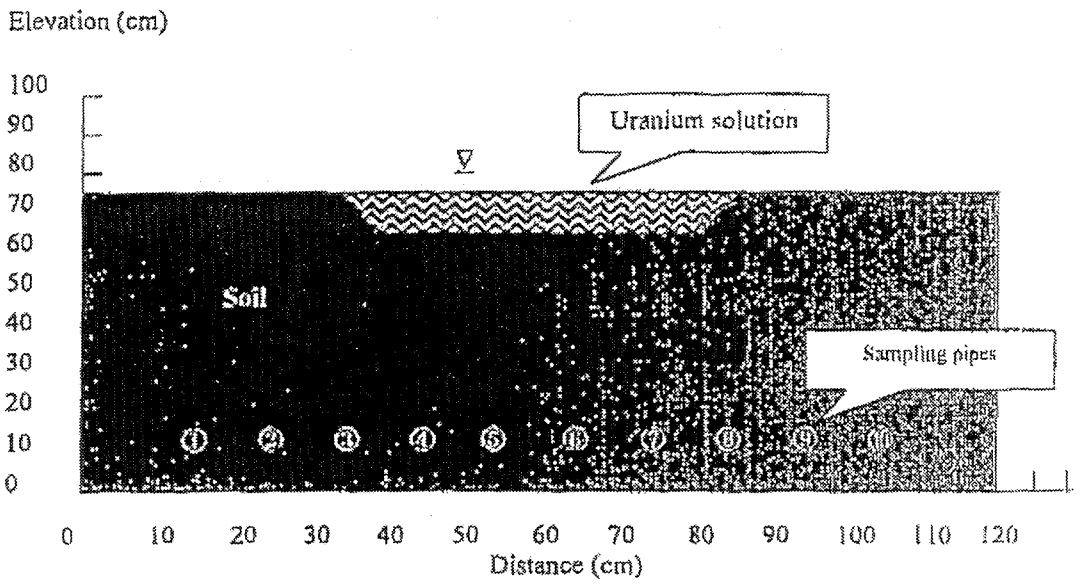

FIG. 1A. Experimental uranium pond equipped with ordinary soil.

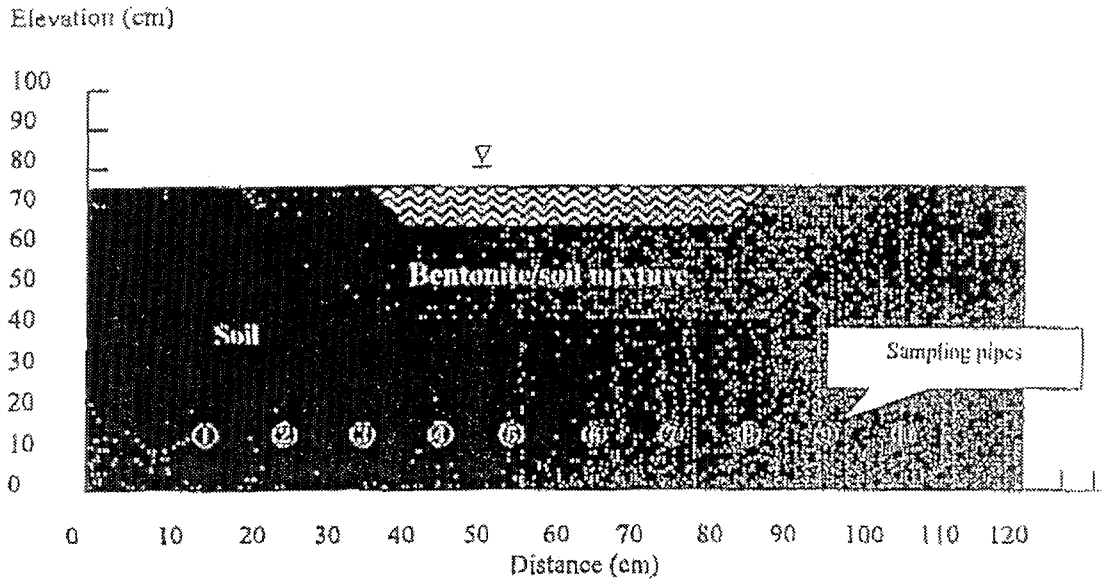

FIG. 1B. Experimental uranium pond equipped with bentonite/soil mixture.

TABLE 1. SPECIFICATION OF THE SOIL AND BENTONITE/SOIL MIXTURE

Specification of the layers	Soil	Bentonite/Soil
Dry density (g/cm^3)	1.86	2.05
Wet density (g/cm^3)	1.48	1.72
Water content (%)	28.4	22.3
Porosity (%)	43.7	32.4

Bentonite/soil mixture layer has better ability to restrain the migration of uranium radionuclides. The performance of the ponds at the natural soil can be improved simply by mixing with bentonite during construction. Bentonite/soil mixture includes 5% bentonite, 95% ordinary soil in weight. This mixture reduced the migration of uranium solution 1/10 when compared with ordinary natural soil.

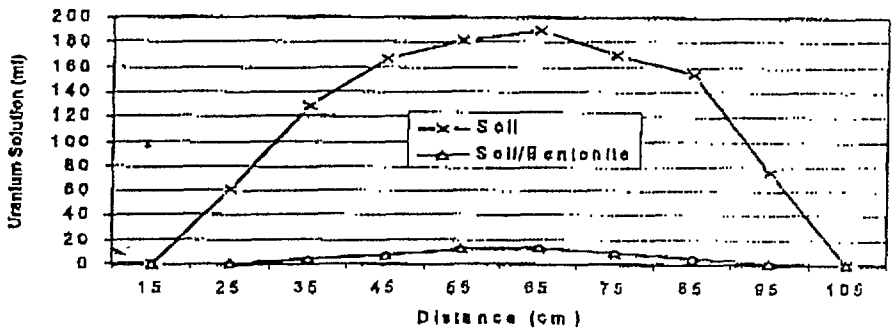

FIG. 2. Discharge amounts of uranium solution for two different layers.

REFERENCES

[1] NEA, "Water Gas and Solute Movement Through Argillaceious Media", NEA/OECD, Paris, France, 1996.

[2] NEA, "Field tracer Experiments-Role in the Prediction of Radionuclide Migration", NEA GEOTRAP Project, OECD Proceedings, NEA/OECD, Paris, France, 1997.