
International Standard



6961

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Long-term leach testing of solidified radioactive waste forms

Essai de lixiviation de longue durée des formes de déchets radioactifs solidifiés

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6961 was developed by Technical Committee ISO/TC 85, *Nuclear energy*, and was circulated to the member bodies in December 1979.

It has been approved by the member bodies of the following countries :

Australia	France	Poland
Austria	Germany, F. R.	South Africa, Rep. of
Belgium	Hungary	Sweden
Brazil	Italy	Switzerland
Canada	Japan	Turkey
Czechoslovakia	Mexico	USSR
Finland	Netherlands	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

United Kingdom
USA

Long-term leach testing of solidified radioactive waste forms

0 Introduction

This International Standard is proposed to establish a testing and evaluation procedure for the resistance of radioactive waste solidification products to leaching under controlled conditions.

This testing procedure is intended to serve as a basis for an inter-laboratory comparison, which will be aimed at examination of the consistency of results obtained in leaching tests carried out in different laboratories, using as objects of the test samples representing various matrix compositions, various waste stream compositions, and various processing and solidification techniques. These samples will be subjected to exposure to leachant solutions of different compositions representing different conditions of salinity and pH, i.e., to deionized water, synthesized sea water, and other aqueous solutions, and leach resistance will be tested at various temperatures as specified in the procedure detailed below.

It should be emphasized that in its present form this test is restricted to evaluation and comparison of the resistance of solidification products to leaching under controlled laboratory conditions, and is not yet suitable for quantitative long-term extrapolations to determine the durability of these products in permanent repositories. The test is therefore not suitable in its present form for long-term hazard evaluation under service conditions.

The test procedure contains no reference to disposal sites or conditions, which may encompass a very wide range of temperatures, pressures and concentrations of solute ions present in the underground water of the disposal site. In particular, the present test procedures does not include tests carried out at high pressures and at correspondingly high liquid temperatures. Considerations concerning the use of the test are further detailed in annex A.

1 Scope and field of application

Processes are developed for the immobilization of radionuclides by solidification of radioactive wastes. The resulting solidification products are characterized by strong resistance to leaching aimed at low release rates of the radionuclides to the environment.

To measure this resistance to leaching of the solidified materials : glass, glass-ceramics, ceramics, bitumen, cement, concrete, plastics, a long-term leach test is presented.

The long-term leach test is aimed at :

- a) the comparison of different kinds or compositions of solidified waste forms;
- b) the intercomparison between leach test results from different laboratories on one product;
- c) the intercomparison between leach test results on products from different processes.

The test temperatures will cover a sufficient range to give an indication of leaching behaviour at temperatures up to 90 °C. The test temperatures are chosen to be 313 K (40 °C), 343 K (70 °C) and 363 K (90 °C).

It is not required to carry out tests in all possible combinations of variables but one set of standard conditions should be met in order to assure interlaboratory comparability of the results. These conditions are :

A. HLW forms (see 3.1.1) and cement or concrete specimens (see 3.1.2); leaching in deionized water at 40 °C and 70 °C, for 1, 3, 7, 10, 14, 21 and 28 days. Three matrix elements and three waste constituents must be analysed.

B. Bitumen and plastic specimens (see 3.1.3); leaching in deionized water at 40 °C for bitumen and 40°C and 70 °C for plastics for 1, 3, 7, 10, 14, 21 and 28 days. At least three important waste constituents must be analysed.

2 Specimens, materials and apparatus

2.1 Specimen

The specimen is either prepared on a laboratory scale or can be taken from actual waste solidification products.

2.1.1 Laboratory scale specimens

The sample from which the test specimen is to be prepared is representative of the process material from the waste solidifying process stream :

- a) the waste mixture can be taken as an average composition of the original waste or an average composition of non-radioactive simulated waste spiked with significant isotopes. Radioactive tracers should be used exclusively together with carriers. The carrier concentration should be given. For the simulation of high level waste the radioactive elements should be simulated according to annex B.