Overview of Current Leaching Approaches

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Countries with batteries of leaching tests:

- France
- The Netherlands
- Germany
- Canada
- The European Union
- Sweden
- Denmark

Programmatic leaching methods other than EPA:

- ASTM
- International Atomic Energy Agency
- US Army
- ANSI/ANS
- ISO

Leaching methods can be divided into two major groups:

- extraction tests - no leachant renewal
- dynamic tests - leachant renewal

Extraction tests include:

- Agitated extraction tests
- Non-agitated extraction tests
- Sequential chemical extraction tests
- Concentration buildup tests

Agitated extraction tests

- performed to reach steady-state conditions as quickly as possible
- measure the chemical properties of a waste-leachant system
  - Examples :
    - TCLP
    - EP TOX
    - CEN 292
    - California WET
    - SPLP

Non-agitated extraction tests

- studies the physical mechanisms that are rate limiting
- physical integrity of the waste matrix affects the amount of contaminants leached
  - Examples:
    - Static Leach Test (MCC-1) (Canada)
    - High Temperature Static Leach Test (MCC-2) (Canada)

Sequential chemical extraction tests

- composed of a battery of agitated extraction tests
- assumes that each successive leachant also extracts the sum of contaminants of all preceding leachants
  - Examples:
    - D5284-93 Sequential Batch Extraction of Waste with Acidic Extraction Fluid
    - Sequential Extraction Tests (research)

Concentration build-up tests

- aliquots of waste are successively contacted with the same leachate
- models an elemental volume of water flowing through a large body of waste
  - Examples:
    - Sequential Chemical Extraction (research)
    - Standard Leach Test, Procedure C (Wisconsin)

Dynamic Tests

- category includes all tests in which the leachant is continuously or intermittently renewed to maintain a driving force for leaching

Dynamic tests can be subdivided into:

- Serial batch tests
- Flow-around tests
- Flow-through tests
- Soxhlet tests

Serial batch tests

- test is conducted using a granular or crushed monolithic waste sample with successive batches of fresh leachant
- data can be used to infer the temporal release of leachable constituents
  - Examples:
    - Multiple Extraction Procedure (MEP) (1320)
    - NEN 7341 Availability Test (The Netherlands)
    - NEN 7349 Serial Batch Test (The Netherlands)
    - Graded Serial Batch (US Army)

Flow-around tests

- a sample of waste is placed in the leaching vessel and the flow of fresh leachant around the waste provides the driving force to maintain leaching
- usually for monolithic samples
  - Examples:
    - ISO Leach Test 6961
    - ANSI/ANS 16-1
    - NEN 7345 Monolithic Diffusion Test (The Netherlands)
    - ASTM C1220-92, Static Leaching of Monolithic Waste Forms for Disposal of Radioactive Wastes

Flow-through tests

- an open container is packed with a porous solid through which leachant is passed
- the effluent is sampled periodically and analyzed for the parameters of interest
  - Examples:
    - Waste Interface Leach Test (WILT) (Canada)
    - NVN 7344 Column Test
    - ASTM D4874-95 Column Test

Soxhlet tests

- used to continuously contact the waste sample with fresh leachant without adding or removing leachant from the apparatus
- used to obtain the maximum amount of a constituent leachable from a waste sample
  - Examples:
    - Soxhlet Test (MCC-5s) (Canada)