Drilling Fluids, Simulated Drill Cuttings, and Earthworm Toxicity

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History

- Drilling Fluids
- Simulated Drill Cuttings
- Earthworm Toxicity



- Onshore Drilling Fluid Technology
- Biological and Chemical Testing Techniques

History

IPEC and SPE



- Laboratory and the Field
- Test Development
- Design Parameters







Identification – ASTM E1676

 ASTM E1676 "Standard Guide for Conducting Soil Toxicity Test with Lumbricid Earthworm *Eisenia foetida*"

"Modifications may be necessary"



Designation: E1676 – 12

Parameter	Conditions
Test Duration	14 Days
Biological Endpoint	Mortality
Temperature	19-25C
Photoperiod	24h/ 400-1080 lx
Test Containers	473-ml Glass Jars

Screening – IPEC 2002

- Drilling Fluid Chemicals and Earthworm Toxicity
 - Karen McCosh, Jonathan Getliff IPEC 2002
- Biomass: Hydrocarbon Base Fluid Toxicity, Internal Brine Phase Chemical Toxicity, Weighting Agent Toxicity



Onshore Drilling Fluid Technology and Impacts



Design Parameters and Objectives

• Modification of ASTM1676 for Drilling Fluids

Parameter	Requirement
Discriminatory Power	Discriminatory power factors are favorable
Practicality	Organisms are easy to culture or are available, tests are easy to implement, adjustments can be easily accomplished
Repeatability	CV of less than 40%
Ecological Relevance	Test conditions and species are acceptable for an indicator test and species for receiving environment
Ranking of known substances in order of environmental impacts	Positive and negative controls are in place, substances are ranked and results follow anticipated ranking

Simulated Drill Cuttings

 Media to incorporate into environmental studies for drilling fluids in the laboratory



- Consistency
- Uncontaminated
- Non toxic
- Support plant growth
- Practical



Simulated Drill Cuttings Spiked with Whole Drilling Fluid



SBM Cuttings



OBM Cuttings



Field Cuttings



Field Cuttings



Spiking Cuttings

Test Environment



Testing Environment



Test Breakdown

• Initial screening study for OBM and SBM



Biological and Chemical Analysis



• ASTM E1676 Modifications for Initial Screening

Parameter	Conditions	Modifications
Test Duration	14 Days	14 Days
Biological Endpoint	Mortality	Mortality
Temperature	19-25C	19-25C
Photoperiod	24h/ 400-1080 lx	Low Light
Test Containers	473-ml Glass Jars	946-ml Glass Jars

- Worms and Plants
- Soil health
- Leachate
 - Chlorides
 - Electrical conductivity
 - Heavy metals



