

1.0 EXECUTIVE SUMMARY

This Standard was developed by Petroleum Technology Alliance Canada (PTAC) and reviewed by the Alberta Energy Regulator (AER). The AER reserves the right to give final approval for the use of any Chemical Cement Alternative in wellbore remediation operations in the Province of Alberta, thus all applications must be submitted to them. PTAC will propose adoption of this Standard to the AER.

This Standard addresses the protocols for testing the properties and their acceptance thresholds of the following Chemical Cement Alternatives prior to use in wellbore remediation applications in the Province of Alberta.

Table 1: Chemical Cement Alternatives [1]

Type	Chemical Cement Alternatives	Examples
A	Modified Cements/ ceramics (non-setting)	Pozzolanic cements, slag, phosphate cements, hardening ceramics, geopolymers
B	Grouts (non-setting)	Sand or clay mixtures, bentonite pellets, barite plugs, calcium carbonate and other inert particle mixtures
C	Thermosetting polymers and composites	Resins, epoxy, polyester, vinylesters, including fibre reinforcements
D	Thermoplastic polymers and composites	Polyethylene, polypropylene, polyamide, PTFE, PEEK, PPS, PVDF and polycarbonate, including fibre reinforcements
E	Elastomeric polymers and composites	Natural rubber, neoprene, nitrile, EPDM, FKM, FFKM, silicone rubber, polyurethane, PUE and swelling rubbers, including fibre reinforcements
F	Formation	Claystone, shale, salt
G	Gels	Polymer gels, polysaccharides, starches, silicate-based gels, clay based gels, diesel/clay mixtures
H	Glass	Solid impermeable silicate glass
I	Metals	Bismuth Alloys
J	Modified in-situ materials	Chemical Cement Alternatives formed from casing and / or formation through thermal or chemical modification

The Chemical Cement Alternative testing protocols addressed are:

- I. Bonding of products to casing, cement and formation
- II. Effects of products on the wellbore (i.e. corrosion, limits wellbore access, etc.)
- III. Longevity of the product in wellbore conditions
- IV. Product integrity under anticipated adverse conditions (example interaction with H₂S or diesel products)
- V. Leaching toxicity
- VI. Groundwater protection
- VII. Safety and Toxicology during storage, handling and transportation
- VIII. Field Pilot
- IX. Field deployment verification

Upon evaluation of various procedures per protocol as practiced in other parts of the global industry, selection of procedures per protocol for the Province of Alberta were based on:

- a) Identifying and mitigating potential handling, transportation, in-situ deployment and environmental risks that may be associated with the Chemical Cement Alternative.
- b) Following the logical steps in determining the key properties and characterization of the Chemical Cement Alternatives.

The critical properties (parameters) of the Alternatives identified in Table 1 above are listed in Appendix I. The values for use in accepting or rejecting Chemical Cement Alternatives is benchmarked against the current property values for Portland Class G cement for the following reasons:

- 1) The AER has established Portland Class G cement as the primary abandonment isolation product. Like Portland cement, all the Chemical Cement Alternatives, with the exception of gels and grouts, produce a solid phase end product.
- 2) Therefore, it is only reasonable to use property values of this product as the benchmark for Chemical Cement Alternatives in order to not subject the Alternatives to a higher or lower standard than currently accepted.
- 3) Although gels and grouts do not produce a solid phase end product with a substantial mechanical strength, for some of its properties (like permeability, fluid interaction, dimensional stability) the values of Portland class G cement are good benchmarks.
- 4) Since gels and grouts do not possess sufficient mechanical strength, for some of its properties (like creep, unconfined compressive strength, hardness and tensile strength, etc.) the values of Portland class G cement are not good benchmarks. However, it is industry practice not to test for these properties in gels and grouts.

The procedure for qualifying laboratories for testing the properties of Chemical Cement Alternatives is presented in this Standard. Also included is the format for reporting the laboratories' Test Results.

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