

Health Monitoring of a Concrete Bulkhead

Areas: Geological Storage, Civil
Client: CNL (formerly AECL)
Location: Manitoba, Canada

ASC ROLE

The performance of a concrete bulkhead in the Tunnel Sealing Experiments (TSX) for AECL was monitored during the complete curing period and after being subject to thermal and pressure loads. The TSX was designed to test seal technology and to measure seal performance.

The seals were monitored as they were subjected to combinations of heat and pressure. The concrete monitoring array consisted of 24 ultrasonic transducers 16 of which were used to continuously monitor AE events whilst the other 8 were used for active velocity surveys.

ASC uses several non-destructive methods to provide the best understanding of the structural changes and changes in material properties occurring in concrete structures during curing or under loading.

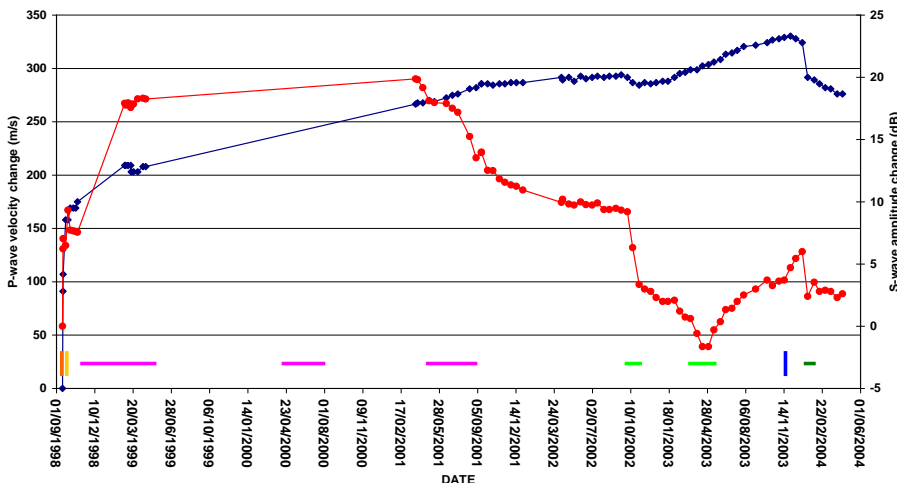
Continuous Acoustic Emission (AE) monitoring is a passive technique that records the acoustic emissions of the structure over an array of sensors. This can provide an image of fracturing through the structure based on the source locations of the AEs recorded.

Ultrasonic velocity surveys are employed at regular intervals to monitor changes in the material properties of the structure more specifically the changes in P and S-wave velocities.



Fracture nucleation Fracture propagation Full fracture growth

Passive monitoring allowed to detect and image the development of a major fracture across one side of the concrete seal during the curing period, allowing for the application of remedial measurements before the phases of pressurisation and heating of the gallery



Changes in the amplitude of the transmitted P and S-waves during the 5-year period of testing revealed the concrete's response to the different thermal and pressure loads. Changes in propagation velocity can be directly correlated to changes in elastic and constitutive properties of brittle materials.