ABSTRACT

Integrating Multiple Seismic Surveys to Interactively Interpret a Salt Dome Flank

H. Roice Nelson, Jr., Walden 3-D, Inc.
Carl L. Brassow, Secured Environmental Management, Inc.

Three seismic surveys were integrated to interactively interpret the northern flank of a salt dome, onshore South Texas. The specific objective was to evaluate if there is a salt overhang that could decease the horizontal extent of salt between the salt-sediment interface and four planned salt caverns proposed as an industrial waste disposal site. The seismic surveys consisted of: (1) SEM, a high-resolution (0.25 ms sample rate) 3-D seismic survey on the crest of the dome; (2) Sheik, a high-resolution (2.0 ms sample rate) 3-D seismic survey off the north flank of the salt dome; and (3) S-2, a 2-D seismic line orthogonal to the salt dome and passing near both the SEM and Sheik surveys.

The seismic data for each of these surveys was loaded on a Landmark Graphics interpretation workstation. Three projects were set up: SEM; Sheik; and Composite. A well-based interpretation of the Top-of-Caprock was gridded and entered into a horizon in the Composite Project. The smoothed travel-time exported version of this horizon was imported to the SEM survey to provide a check for picking the Top-of-Caprock. There is a direct correlation to a strong reflector consistent across the SEM survey. This reflector was interpreted as the Top-of-Caprock. This reflector ties nicely to the salt-sediment-interface interpreted on S-2. The S-2 salt-sediment-interface projects to the top of a no-data-area in the Sheik 3-D seismic survey, which was interpreted as top-of-salt. The proposed salt caverns were converted to seismic travel-time and loaded into the SEM survey as both "faults" and "horizons" to show their spatial relationship to the Top-of-Caprock.

The interpretation process and results were captured in the ESF HyperJournal, a hyperlinked multimedia "living report." Key stages from this report are available on the INTERNET at http://www.hypermedia.com/w3d/geotechnology/W3D95C/index.html using a browser like NetScape or Mosaic. The interpretation results were also transferred to The University of Houston's Virtual Environment Technology Laboratory and the spatial relationships evaluated in their visually immersive CAVE (for those familiar with StarTrek terminology, a computer generated 'holodeck'). This virtual environment has proven to be a very useful means of communicating complex spatial relationships.

One of the more interesting results to be presented is the relationship of seismic amplitudes to calcite distribution in the caprock. Using the interactive system we evaluated the seismic amplitudes ~~from~~ 10 ms intervals (less than 30 feet). We interpret the strong difference between these amplitude maps to mean that the calcite zone is totally within the top 30 feet of the caprock. The map across the entire dome shows this to be a relatively simple dome. The structure of the Top-of-Caprock is simple in the area of the proposed salt caverns. Based on this integrated interpretation, there does not appear to be any salt overhang on the north side of the dome. This means there is virtually no possibility of water reaching the proposed salt caverns and their proposed storage of industrial wastes within the next few thousand years.

• Walden 3-D, Inc. • P.O. Box 382 • Barker, TX 77413-0382 •
• office: (713) 293-0325 • facsimile: (713) 293-9662 • nelson@hypermedia.com •