

Fault Displacement Hazards at Aliso Canyon and Honor Rancho Natural Gas Storage Fields, Southern California, USA

Faults that have a significant potential for future displacement and intersect natural gas storage wells in the subsurface are an underappreciated hazard to well integrity. The American Petroleum Institute's RP 1171 (API, 2015), that is guiding State of California and Federal new rule-making for gas storage fields, states "Depleted hydrocarbon reservoirs are candidates for natural gas storage because the reservoir integrity has been demonstrated over geologic time by hydrocarbon containment at initial pressure conditions." True, but gas wells at storage reservoirs have not existed over geologic time and when wells cross faults capable of future movement there exists a fault displacement hazard to well integrity. If displacement were to occur, then the potential exists for methane leakage to the surface and risks to public safety, the environment, energy supply, and a valuable resource. As with all energy sources, natural gas comes with its own set of challenges: the largest methane leak in US history occurred at the Aliso Canyon Gas Storage Field (ACGSF). Taking almost four months to control, the ACGSF leak demonstrated the difficulty of stopping an underground leak from one well in a pressured gas storage field, and showed the need to evaluate all hazards to gas well integrity and to estimate and mitigate the risks. At the ACGSF and Honor Rancho fields, all of the storage wells cross the Santa Susana (SSF) and Honor Rancho faults, respectively, to reach their storage reservoirs. Both faults have had significant displacement during the last 2-3 ma, and the SSF may have a slip-rate as high as 7.0-9.8 mm/yr during the last ~700 ka. The Southern California Earthquake Data Center estimates the characteristic earthquake magnitude for the SSF to be from M_w 6.6-7.3, and historic records for this range of magnitudes indicate that from 0.3 to 2.8 meters of fault displacement can be expected on the SSF. Small, earthquake-fault movements of up to 0.25 meters severely damaged numerous oil wells in the subsurface at the Wilmington oil field and are significantly smaller than the moderate to large tectonic earthquakes common to southern California that will generate much larger fault displacements. To insure public safety and awareness, new Federal and State regulations should require independent and transparent evaluations of the hazard and risk of capable faults for planned and existing gas storage fields.

Accepted 12/13/2017.

Presentation time and date: 4:20-4:40PM, 5/23/2018, Ballroom H, Salt Palace Convention Center in Salt Lake City, Utah.