Monitoring oil and gas facilities: use of natural reflectors and artificial corners reflectors

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InSAR based ground motion monitoring of oil and gas facilities, including pipelines, plants and LNG terminals, contributes to production planning and the safety of operations. Factors such as seismicity, landslides, coastal erosion or anthropogenic effects such as the oil and gas activities themselves may cause infrastructure to be affected by ground motion, which may in turn pose a threat to the surrounding population and wildlife, or the efficiency of the infrastructure itself. The PSI technique is an efficient tool for assessing and monitoring the effects of the aforementioned on the infrastructure and the surrounding area.

The PSI technique requires the presence of stable reflectors to provide reliable measurements. Infrastructures have the advantage of providing a large number of “natural” measurement points, thus allowing the radar eye to capture information over the zone of maximum interest. For instance to monitor pipelines it is common to use stable points to view the evolution of ground motion over time as the pipeline itself usually provides good persistent scatterer return.

The presence of PSI measurements over infrastructures provides information of interest for the safety of the infrastructures themselves. Additionally, the information gathered on ground by studying infrastructures at oil exploitation sites provides data on reservoir behaviour. Thus, the PSI points provided by the infrastructure are not only used to monitor its own safety, but also as a source of information to better understand the evolution of the reservoir.

Likewise, studying a wider area of interest provides crucial information for the integrity of the infrastructure in question. In many cases, knowledge of the ground deformation in the area surrounding the infrastructure can help to identify and mitigate hazards.

For instance, it is often more important to monitor ground motion over a landslide-prone area near a pipeline rather than just the pipeline itself. In cases where no PSI points are available on this area of interest, Artificial Corner Reflectors (ACR) may be installed to guarantee reliable measurement points.

ACRs consist of a durable and stand-alone metal construction. ACRs can be added to the facilities’ surroundings and to areas of the site where there are no natural reflectors, such as areas that have dense vegetation or snow cover. ACRs are adapted to difficult weather conditions, such as snow, rain and ice storms in order to assure constant measurement points.

Monitoring of oil and gas facilities often requires customized approaches that involve studying motion of the infrastructure itself as well as ground deformation of the surrounding area. The PSI technique applied over natural or artificial reflectors offers a full portfolio of solutions that may also be integrated with other sources of information such as GPS data, to provide an all-weather, long-term, cost efficient solution.