IEAGHG Information Paper: 2016-IP16; the first MRV plan approved by the US EPA for greenhouse gas reporting of CO_2 geological storage is for a CO2-EOR operation.

In December 2015 the US EPA issued an assessment and approval for the first monitoring, reporting and verification (MRV) plan for a project under the US greenhouse gas reporting rule for CO_2 geological storage (known as Subpart RR). As well as being the first MRV plan approved under Subpart RR, this MRV is also notable because the project is a CO2-EOR project and its wells are permitted under UIC Class II (ie for hydrocarbon operations rather than Class VI for CO_2 storage).

The project is the Occidental Permian Ltd's (Oxy) Denver Unit oil production operation in West Texas. The main elements of the MRV include the following aspects.

The Subpart RR regulation requires that potential surface leakage pathways for CO_2 be identified, as well as the likelihood, magnitude, and timing of surface leakage of CO_2 through these pathways. The leakage risk at this site is determined to be well bores. In examining existing well bores as a potential leakage pathway, Oxy provides tabulations of active and inactive wells that are completed in or penetrate the Denver Unit; summarizes regulatory requirements for the wells, and describes operational practices for mitigating potential risks. Oxy examined the probability of leakage through subsurface features such as faults and fractures, and determined that there were no faults or fractures that transect the San Andreas Formation interval (the oil reservoir and sealing layer) in the project area. Oxy therefore argued that there are no leakage pathways at the Denver Unit that are likely to result in significant loss of CO_2 to the atmosphere.

Oxy's strategy for detecting and verifying potential subsurface leakage primarily includes pressure monitoring of injection wells, well maintenance, monitoring of production well performance, and field inspections based on visual inspections and H2S detection by Oxy staff. Based on this detection strategy, if results of the monitoring activities fall outside their normal predicted ranges, Oxy will initiate an investigation to determine if a leak has occurred. Triggers provided in the MRV Plan for leakage investigation include pressure deviation in injection wells, deviations in production levels, triggering of personal H2S monitors, and visual siting of clouds of ice crystals surrounding a leak.

Pressure monitoring of injection wells, along with the historical operational and monitoring data determining the baseline, is used to detect leaks in the injection wells. It may also be able to detect leaks through producing or abandoned wells or faults by comparing the monitoring results to modelled predictions.

Visual sighting of clouds of ice crystals is proposed to detect leaks of pressurized supercritical CO_2, and daily and weekly field inspections will take place. Oxy's strategy to detect surface leakage also relies on the triggering of personal H_2S monitors worn by the staff. Wasson Field oil contains small amounts of H_2S, therefore, it is assumed that any leakage of CO_2 would co-exist with some amount of this gas. The personal H_2S monitors can detect levels of H_2S as low as 0.1 ppm.

Oxy discusses how leaks will be quantified, using a combination of measurements and engineering estimates. Oxy notes that while leakage events may occur, based on its operational experience they are few and typically of small duration and volume. To the extent possible, Oxy will use published emission factors, such as those included in Subpart W of the GHG Reporting Program, to quantify CO_2 volumes.

The MRV Plan describes site-specific variables for the mass balance equation, including as related to calculation of total annual mass injected, calculation of total annual mass produced, and calculation of total annual mass emitted as equipment leakage or vented emissions. The MRV Plan also describes how total annual mass emitted by surface leakage would be calculated.

Another notable aspect is the post-injection period monitoring of 2-3 years based upon predictive modelling and monitoring data, and the experience of field behaviour over the previous decades.

The MRV Plan approval process includes a public review period and there were no appeals lodged against this draft decision.

As the first MRV plan approved under Subpart RR, this MRV plan sets important precedents for the level of information and detail that will be required in the USA for greenhouse gas reporting from CO_2 geological storage projects. To note that this one relies heavily upon existing oil and gas regulations and the monitoring undertaken as part of the oil production operation, and, as we know, monitoring techniques used will be very site specific. This MRV plan will also be of interest for those used to working to the European requirements for greenhouse gas reporting from CO_2 storage, in its use of the existing operational wells as in-effect monitoring wells using pressure and H2S detection, instead of other subsurface monitoring techniques (as provided by the CCS Directive in Europe – required by the EU's ETS Directive).

Joseph Goffman of US EPA describes this approval as "an important milestone for secure CO_2 storage" https://blog.epa.gov/blog/2016/05/an-important-milestone/ .

This MRV plan will be discussed in more detail at the IEAGHG Monitoring Network and Modelling Network meeting in Edinburgh, July 2016.

The MRV and its approval are available at https://www.epa.gov/ghgreporting/denver-unit .

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