Evaluation of GHG Emissions from Crude Oil and Condensate Storage Tanks

David Picard, Clearstone Engineering
GL 913251

The potential for odour and benzene emissions from storage tanks has been a matter of particular concern at recent hearings for pipeline terminals and upgrader developments, and poses a significant challenge for the proponents of these developments in trying to determine the required level of vapour control. As well, regulators are challenged in trying to understand discrepancies between recent Differential Absorption LIDAR (DIAL) and ambient air monitoring results, which suggest that storage losses are being understated using current estimation methods. To adequately assess receptor impacts, it is necessary to be able to predict
both average emissions as well as instantaneous emission rates as a function of meteorological conditions and tank activities. The current US Environmental Protection Agency (EPA) TANKS software program for estimating evaporation losses from storage tanks is limited to estimating only average emissions.

API specifically recommends that its evaporation loss correlations not be used to size vapour control systems. Some of the key issues and limitations concerning the
current API evaporation loss correlations include the following:

- Companies are tending to estimate their emissions based on the assumption that their tanks, and any floating roofs and the seals on the floating roofs, are in good condition. ii Guidelines are needed to help users properly assess the condition of their tank for the purpose of estimating emissions.
- There are questions as to whether the existing algorithms adequately account for all the effects that contribute to evaporation losses from storage tanks. At a minimum, the completeness of the current algorithms and the reasonableness of the assumptions inherent in these algorithms needs to be assessed and verified against appropriate measurement results.
- Vapour analyses for speciation of the estimated emissions are rarely available. Therefore the vapour composition is usually estimated based on Raoulti¦s law and the liquid analysis. While liquid analyses are much more available than vapour analyses, they normally do not provide concentrations of the critical odorants which ultimately occur in the product vapours, namely:

H2S and other reduced sulphur compounds. The sulphur content of the liquid product is a parameter which is usually known; however, assuming the sulphur is all present as H2S greatly overstates actual H2S concentrations. Alternatively, in some Environmental Impact Assessments (EIA¡¦s) the authors have chosen, in the absence of any data, to set H2S concentrations to zero which is equally wrong. A reliable means of estimating H2S and mercaptan concentrations based on the sulphur content of the product and the type of product (e.g., light, medium, or heavy oil) is therefore needed.

Between 2006 and 2030, marketable production of Alberta¡¦s Oil Sands sector is expected to increase 444% from 1.126 million to 5 million barrels per day. This growth will contribute to increased shipments of product to market as well as increased shipments of diluents to heavy oil and crude bitumen production sites. Furthermore, conventional hydrocarbon liquid production is becoming more sour and odorous as companies are exploiting progressively deeper reserves, and
the development of pipeline terminals and upgraders is expanding into more populated and industrially developed areas where air quality issues will be more challenging to manage. The corresponding growth in required delivery and storage infrastructure will result in significantly increased emissions from

liquid storage tanks, which are currently very difficult to monitor and control. In advance of spiking production, it is essential to seek practical solutions for quantifying heavy oil storage tank emissions, which are necessary to affect a range of operational and infrastructure based mitigation strategies. Being able to accurately assess average and instantaneous emissions from storage tanks will assist companies in selecting the right vapour controls and determining the maximum allowable headspace concentrations of pollutants to avoid offsite odours and health risk impacts. The latter information can then be used to develop headspace monitoring programs as a proactive means of tracking the performance of floating roofs and identifying tanks in need of repair in advance of any air quality exceedances.

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