RESEARCH INTO HYDROGEN SULPHIDE GAS (H_2S) EMISSIONS FROM STORED SLURRY WHICH HAS UNDERGONE LOW RATE AERATION

Executive Summary

This document is the final report to the Health and Safety Executive for Northern Ireland and the Health and Safety Authority, Ireland by the Agri-Food and Biosciences Institute and Teagasc Grange Beef Research Centre.

A literature review of the emission of hydrogen sulphide gas (H_2S) from slurry, which has undergone low rate aeration is presented. This review indicates that there has been some work conducted at the laboratory scale but little research utilising full-scale systems.

Atmospheric concentrations of H_2S gas were measured during slurry deposition and storage in one livestock building between December 2005 and March 2006. The livestock building contained six under-slat slurry storage tanks, three of which were fitted with low rate aeration equipment and three, which were normally managed with no aeration. Throughout the period of housing, concentrations of H_2S were measured at slat invert level in all six tanks. The maximum concentration recorded was 7ppm, which would not be considered to pose a risk to personnel or livestock. It is concluded from this experiment that low-rate intermittent slurry aeration systems will not result in emissions of H_2S above the OELV exposure limits during animal housing periods.

Atmospheric concentrations of H_2S gas were measured at slat invert level in the centre of the tanks during mixing of non-aerated slurry and 0.5m above slat level during subsequent pumping of this slurry. Gas concentrations up to a maximum of 257ppm were recorded at slat invert level during the slurry mixing period. Variable concentrations were recorded during pumping of mixed slurry up to a maximum of 107ppm H_2S. Based on these findings it is concluded that current advice from farming organisations and health and safety authorities on safety precautions to take during slurry mixing is correct and should be followed at all times.

Concentrations of H_2S gas were recorded during pumping of slurry, which had undergone low-rate intermittent aeration during the 99 day animal housing period. Concentrations recorded at the time of pumping were generally < 10ppm with some elevated concentrations at the slat invert level immediately after commencement of pumping. Concentrations were generally lower than those recorded during pumping of non aerated and mixed slurry. In this case, mixing of slurry was not required, which reduces the risk of excessive gas exposure to personnel and livestock.

Three farms in Northern Ireland that had low rate aeration systems installed were surveyed. Atmospheric H_2S gas concentrations were measured at slat invert level over an approximate one-week period on three separate occasions for each of the three farms. It is not possible to conclude from the data presented that concentrations and durations of H_2S above slat level during low rate aeration did not pose any health risks. However, above slat level it is likely that concentrations of H_2S would be lowered by dilution with ambient air. Placement

of monitors and recording interval may have resulted in some H_2S concentrations not being recorded. It is suggested that any H_2S produced above slat level during low rate aeration of cattle slurry would be below OELV limits. It is concluded that low rate aeration has potential to aid slurry management in below slat tanks without producing dangerous concentrations of H_2S within the house above slat level.

The purpose of this study was to evaluate low-rate intermittent slurry aeration systems, to assess whether their use would result in excessive hydrogen sulphide gas emissions in a typical slatted floor shed housing beef cattle. H_2S concentrations were also recorded during pumping of the aerated slurry to a reception pit remote from the slatted shed. The results were compared with those obtained when normal slurry management procedures (namely storage, mixing and pumping) were followed. It can be concluded that the use of the low-rate intermittent aeration system did not result in excessive hydrogen sulphide emissions either during the animal housing period or subsequent transfer of the aerated slurry. Indeed, since aerated slurry does not appear to require mixing prior to pumping, the risk of dangerously high concentrations being released over a short period of time is greatly reduced.