Executive Summary

The Effects Subgroup of the CASA Confined Feeding Operations (CFO) Project Team was charged with gathering information for the team on the health effects of ammonia, hydrogen sulphide/TRS, volatile organic compounds, particulate matter, bioaerosols, and odour emissions from CFOs.

The Subgroup reviewed and assembled a great deal of information about the effects of these emissions on human, animal and ecological health. At a high level, the subgroup found health effects information on all the substances, but in a number of cases, there were limitations on the studies that have been done; for example, environmental monitoring and clinical assessments were not performed, and confounding aspects (such as the comparability of the study populations) were not considered or weighed.

The subgroup found it challenging to determine what the association is, if any, between CFO emissions and public health effects. Views differ, even among experts and in the literature, and trying to compare and assess the impacts of different emissions from operations with different kinds and numbers of livestock, and different climate, management practices and other conditions is very challenging. One way to simplify the association between health effects and CFO emissions is to focus on the proximity to CFOs, but even with this approach there are many contextual variables, acting together, that determine whether effects will occur.

The subgroup noted that there is little research on the health effects of animals in CFOs as these effects relate to air quality. Studies included in this report were conducted in both laboratory experiments and in a typical CFO. Findings within a CFO may not be as accurate due to the difficulty of isolating and measuring particular gases. Although little research has been conducted formally, agriculture producers have refined and improved their practices over time based on their knowledge, experience and daily observations. For example, when decreased growth rate is noticeable and may be due to air quality, producers have added technology, such as ventilation and management practices such as removing manure from the barn, to improve air quality. Quality care for the animals is crucial to the sustainability of the livestock industry.

Conclusions and Recommendations

Health Effects from CFO Emissions

Human health studies that look at the effects of emissions from CFOs are more numerous than those on animal health and ecological health.

Conclusion 1: The subgroup considered many studies and agreed by consensus that there are indeed health effects from CFO emissions. More specifically, the subgroup agreed that [The weight of evidence from research studies reviewed by the team demonstrates an association between CFO emissions and public health effects in surrounding communities.][1]

Gathering More Information on Health Effects from CFO Emissions

Although many information gaps exist on health effects from CFO emissions, the Effects Subgroup agreed that the CASA team was not the place to conduct studies on health effects. The Effects Subgroup agreed by consensus that:

[1] Subgroup members agreed to test the statement in square brackets with their stakeholders to determine the level of consensus.

Although there is value in further research on health effects from CFO emissions, neither CASA nor the CASA process should propose or finance scientific health effects research, as such studies are very consumptive of time and money, and such information is being gathered and addressed through other processes (e.g., universities and governments).

Ambient Air Quality Objectives for Emissions from CFOs

All substances considered by the subgroup are covered by ambient air quality objectives[2] except odour (see Odour section below). Alberta has AQOs for 44 substances, most of which do not have specific health effects linked to them; only total suspended particulates, sulphur dioxide, ozone, ethylene, and carbon monoxide are explicitly based on protecting either human or vegetation health.

[The Effects Subgroup concluded that more discussion is needed on if and how ambient air quality objectives apply to CFOs. The CFO team should discuss this and consider whether or not to make a recommendation to clarify this topic for Albertans.]

Ammonia Air Quality Objective

There is currently a 1-hour objective for ammonia in Alberta, and a 24-hour objective for ammonia has been proposed by a multi-stakeholder advisory committee to Alberta Environment, the Alberta Ambient Air Quality Objectives Stakeholder Advisory Committee (AAQOSAC), which wanted advice from the CASA CFO team. The Effects Subgroup believes that the science they reviewed supports a 24-hour ambient air quality objective for ammonia of 200 $\mu g/m^3$ as protective of human and vegetation health and encourages the CFO Project Team to endorse this proposed objective.

> **[Recommendation 1. The Effects Subgroup recommends that the CFO team provide formal endorsement to the Alberta Ambient Air Quality Objectives Stakeholder Advisory Committee to develop a 24-hour Alberta ambient air quality objective for ammonia.]**

Monitoring Air Quality Around CFOs

[The Effects Subgroup concluded that ambient monitoring around CFOs would be beneficial for providing more information on the potential for health effects from emissions, but for providing certainty to industry on the potential costs and benefits of reducing emissions.].

Odour from CFOs

Studies indicate that CFO odours do extend into surrounding areas at levels that may disrupt quality of life. **The subgroup agreed by consensus that odour from CFOs can have health effects**. However, there was no consensus on whether the effects are the result of a psychological conditioned response to the odour or whether there is a physiological basis for the effect. This issue is unclear in the scientific literature. More work would be needed to reach agreement on if and how psychosocial aspects affect thresholds, to determine which variable is being considered in terms of odour response (perception, recognition, complaint, irritant, annoyance). **The subgroup agreed that this area, along with others, represented an information gap.**

The subgroup also agreed by consensus that an ambient air quality objective is not the right mechanism to address odour. An odour management framework was suggested as one possible approach, and the subgroup is recommending that the CFO team consider the options below, as well as any other options that may be suggested. The Alberta Ambient Air Quality Objectives Stakeholder

[2] Although these are not necessarily based on health effects.

Advisory Committee (AAQOSAC) deferred developing an odour management framework for Alberta until the CFO team had had a chance to consider the question.

To address concerns related to odour, the Effects Subgroup proposes the following four options for consideration by the CFO Project Team:

- **a) The CFO Team could develop an odour management framework and agree by consensus to all the components, which could then be used by the AAQOSAC to develop a more comprehensive framework that includes other sectors.**
- **b) The CFO Team could decline to develop an odour management framework, in which case the AAQOSAC has indicated they will develop one for all sectors not just agriculture. If this option were pursued, it has been suggested that the stringency of the H_2S threshold may be negotiated at the CFO team.**
- **c) The CFO Team could recommend that an odour management framework be developed, but only make suggestions about what it should contain, and forward its suggestions to the AAQOSAC to consider in their work.**
- **d) In lieu of an odour management framework, the CFO Team could focus on other emissions that both contribute to odour and have direct health effects. The team may make recommendations on controlling or managing these emissions; e.g., how to achieve a lower H_2S ambient level.**

Specific Ideas on an Odour Management Framework to be considered by the CFO Team

An odour management framework could incorporate both qualitative (FIDOL)[3] and quantitative elements; quantitative elements would be based on Odour Units, a quantitative but subjective measurement of odour and of the concentration of individual odour compounds. Studies also suggest that total VOC concentration may be an excellent surrogate for assessing odour intensity, and is relatively simple and inexpensive to measure in the field.

[3] FIDOL stands for Frequency, Intensity, Duration, Offensiveness and Land use.