



## Water Sulphate Levels and Your Barn Environment

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### SUMMARY

The impact of varying sulphate levels in drinking water on odour and gaseous emissions and on swine manure properties was evaluated. Results showed that drinking water with up to 1,800 ppm sulphate had no adverse effect on pig performance, gas and odour emissions, and manure nutrient levels. This can allow the pork industry to expand into areas previously considered as having unacceptable or undesirable sulphate levels in drinking water sources.

### INTRODUCTION

Odour and gaseous emissions from swine operations is a major environmental concern for the pork industry. Out of the 10 most odorous components of swine odour identified, six are sulphur-containing compounds. No studies have been undertaken to fully assess the extent of the impact of the pig's sulphur intake levels on air quality and on manure characteristics, especially under actual production conditions. The overall goal of this study was to assess the impact of animal drinking water quality on swine manure nutrients and on air emissions.



### RESULTS AND DISCUSSION

The concentrations and emissions of  $\text{NH}_3$  and  $\text{CO}_2$  were not significantly ( $p>0.05$ ) affected by the increasing levels of water sulphate (Table 1). No measurable impact on levels of  $\text{H}_2\text{S}$  gas was observed when manure was undisturbed. However, the average peak  $\text{H}_2\text{S}$  values obtained during plug-pulling from each treatment room was significantly ( $p<0.01$ ) affected by the treatment. During individual replicates, the maximum peak  $\text{H}_2\text{S}$  values measured during pit-plug pulling in the treatment rooms provided with drinking water with 1,200 and 1800 ppm sulphate were 288 and 134 ppm  $\text{H}_2\text{S}$ , respectively; these spikes occurred for only a short period of time and the high levels dissipated to less than 10 ppm in less than 10 min. These observations would appear to indicate that high-sulphate levels in drinking water could contribute to the generation of high  $\text{H}_2\text{S}$  levels during manure clearing operations.

***“Water with up to 1,800 ppm sulphate had no adverse effect on pig performance, gas and odour emissions, and nutrient levels.”***

Odour concentration and emissions from the rooms were not significantly ( $p>0.05$ ) affected by the treatment applied. Wide variability in the measured odour values contributed to the difference being not statistically significant.

In general, the measured manure nutrient levels were consistent with typical reported levels for swine manure. Except for the levels of sulphur, the nutrient properties of fresh manure from the treatment rooms were generally not affected by the amount of sulphate in the drinking water. Fresh manure generally had higher nutrient levels compared to stored manure (Figure 1). Stored manure from pigs given high-sulphate water tended to retain nutrients better compared to stored manure from pigs with low-sulphate water (Figure 2).

**Table 1.** Average weekly gas (NH<sub>3</sub> and CO<sub>2</sub>) concentration and emission levels from the treatment rooms during the replicates.

Treatment	Ammonia Concentration (ppm)			Ammonia Emission Rate (g/hr)			CO <sub>2</sub> Concentration (ppm)			CO <sub>2</sub> Emission Rate (g/hr)		
	Mean <sup>a</sup>	n	SE	Mean <sup>a</sup>	n	SE	Mean <sup>a</sup>	n	SE	Mean <sup>a</sup>	n	SE
Control	9.9	40	0.5	12.1	38	2.0	728.6	40	36.4	1,880.1	39	154.4
600 ppm	10.7	40	0.6	13.4	40	1.5	769.6	40	44.9	2,052.3	40	69.4
1,200 ppm	10.0	40	0.4	12.5	38	1.6	740.8	40	38.0	2,077.7	38	93.3
1,800 ppm	9.7	40	0.4	9.8	37	1.4	735.0	40	36.1	1,896.5	37	108.9

a – Treatment mean values not significantly different (p>0.05)

**Table 2.** Average H<sub>2</sub>S concentrations measured in each room throughout the study

Treatment	Peak H <sub>2</sub> S Concentration (ppm)			Day-long H <sub>2</sub> S Monitoring (ppm)	
	Mean*	n	SE	Mean**	n
Control	22.5a	17	8.4	0.0	11
600 ppm	21.0a	17	7.6	0.0	2
1,200 ppm	54.2b	17	22.4	0.0	2
1,800 ppm	27.9a	17	8.4	0.0	6

\* Treatment mean values followed by the same letter are not significantly different  
 \*\* Below detection limit

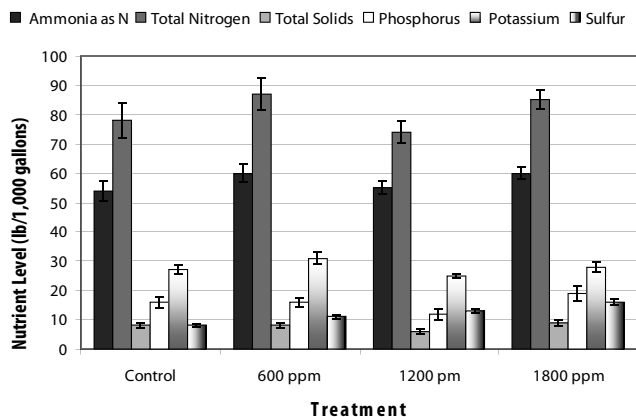
Pig performance was not adversely affected by high levels of sulphate in the pig's drinking water. For all replicates, the average daily gain ranged between 0.86 to 1.12 kg/day. During the study, no notable incidence of scouring or diarrhea was observed.

## IMPLICATIONS

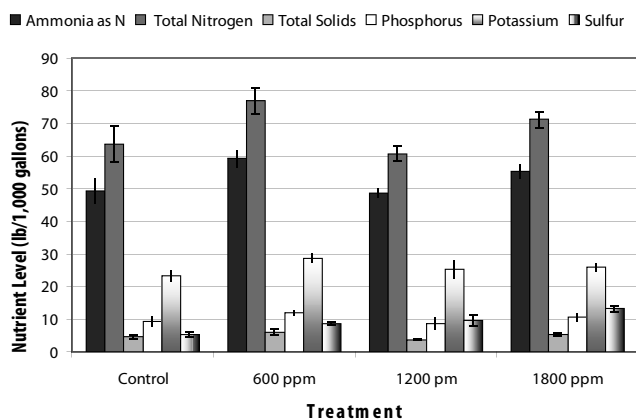
Elevated levels of sulphur intake from water had no adverse impact on manure nutrient composition, odour and gas (NH<sub>3</sub> and CO<sub>2</sub>) emissions or on the performance of grower-finisher pigs. Thus, for water sources with up to about 1600 to 1800 ppm sulphate content, water treatment is not necessary. However, when using high-sulphate drinking water, proper measures should be in place to consider the increased potential for generating high spikes in H<sub>2</sub>S levels during manure handling operations. These results support the possibility of constructing pig barns in locations where the available ground water is high in sulphate (up to 1600 ppm), without concern for adverse impact on growing-finishing pig performance, odour emissions, and manure nutrient value.

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**Figure 1.** Nutrient properties of manure in the pits of the treatment rooms (each bar, n=15).



**Figure 2.** Nutrient properties of manure from the barrels used to simulate long-term storage (n=12).



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