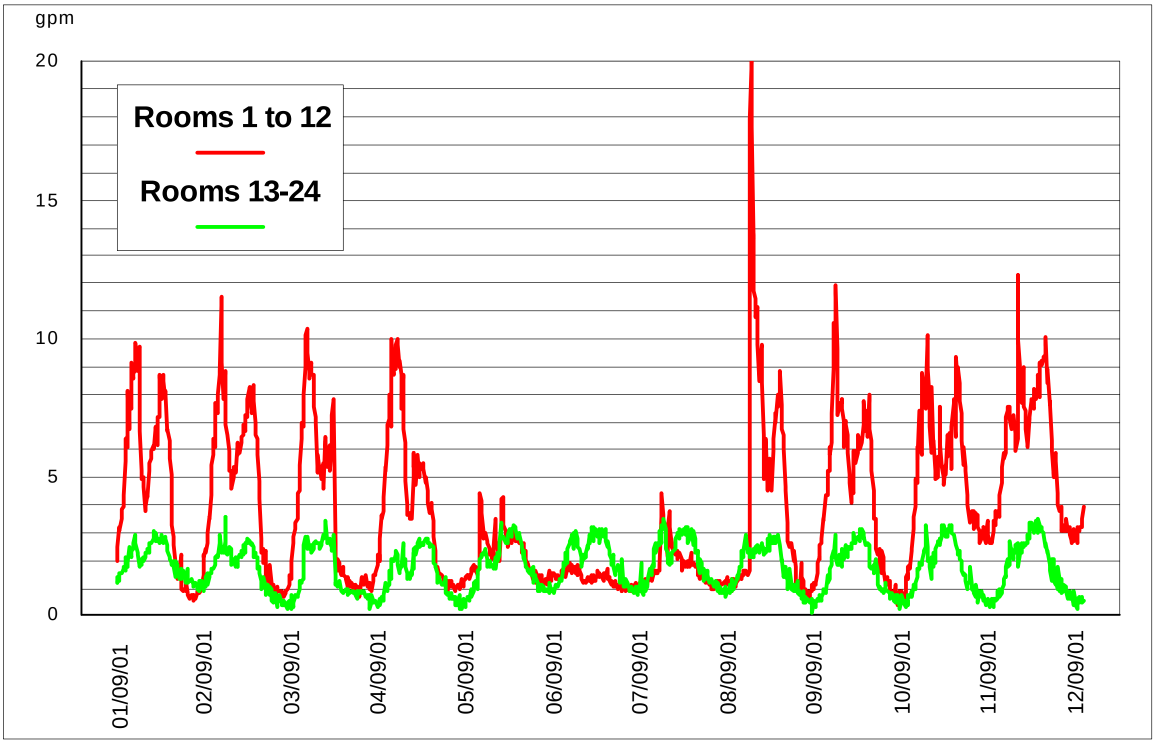
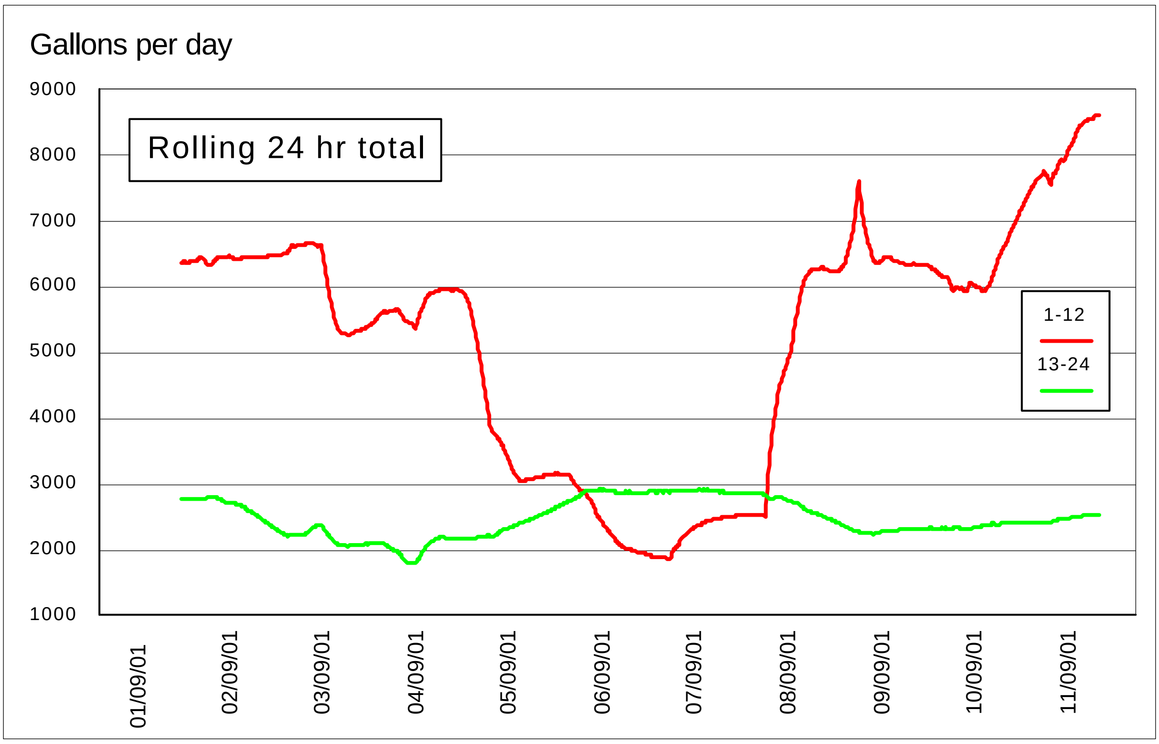
Case Study : Water Shortage Incident





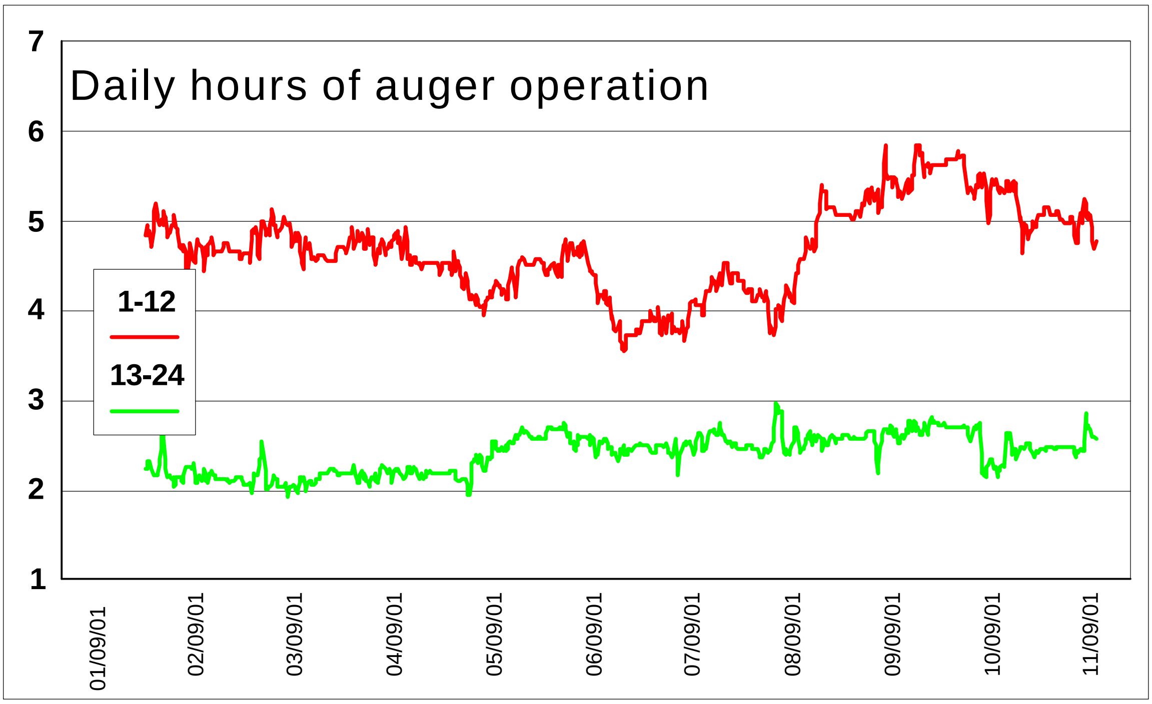
This incident concerns a pig finishing site in Mid West USA, with approximately 9,600 pigs in 24 rooms of 400.
During the period of interest, older pigs were in one half of the site (rooms 1 to 12) and younger pigs in the other half (12-24).
A problem occurred in the supply to one half of the site only (1-12), apparently a filter or pipe partially blocked with sand.
Water remained available, but at lower pressure and flow than normal.

Charts
The top chart shows the total consumption per minute (i.e. rooms 1-12 added together, and 13-24 added together).
The lower chart shows total water use on a 24 hour rolling basis.

Rooms 13-24 remain largely unaffected, whilst 1-12 are severely affected. Total daily volume is down from about 6000 gallons to just around 2 or 3000.

It should be noted that the workers had checked the filters as routine - notice the small peaks during the problem period - but the problem returned almost immediately, several times.

Feed



This chart shows the rolling 24 hour total of auger run times in rooms 1-12 compared to 13-24. Auger operation is, as for most pig finishing sites, triggered by limit switches, so in each room the auger runs only a certain number of times a day, hence the slightly more erratic trace. E.g. at the beginning, all the augers run times in rooms 1-12 added together amount to about 5 hours of auger running time.

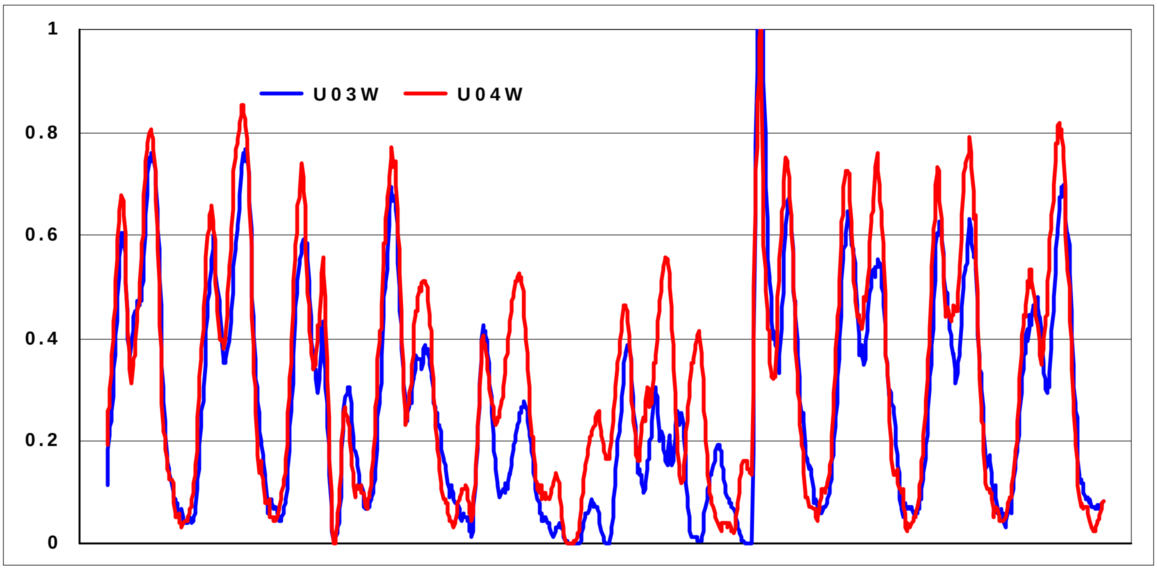
Auger totalised operation is somewhat more erratic than water - it seems that individual augers run only a few times a day, and not necessarily in line with when pigs eat. Therefore, the trace is not so clear and continuous as for water.

Feed use is not quite so depressed as one might expect, but nevertheless shows a significant reduction. It should be noted that even a moderate reduction in feed intake has a significant effect on growth, since most feed is used for maintenance. For example, if pig is normally eating 1.5 times maintenance, this means 2/3rd of intake is used for maintenance. So a 1/3rd reduction of intake means no growth whatever (not a 1/3rd reduction in growth).

Daily pattern and difference between rooms

It might be assumed that, with a lower rate of supply available, pigs would spread their drinking over a greater part of the day.

This appears not to be so. Looking at the data from two adjacent rooms (U03 = Room3 and U04 = Room4), we see that before the incident, the pattern and total daily volume is almost exactly the same - the two rooms contain about the same size and age of pigs. Note also that the two rooms drink at exactly the same time.



We can see that during the incident, U03 was affected to a greater degree than U04. But note that - initially - the pattern and duration of water intake is not greatly changed. The pigs have not substantially changed their drinking habits simply because there is less of water available. They try to do the same, but get less water.

Looking at, say, U03, a peak rate of 0.5 gallons per minute (gpm) was achieved. The pigs could have had as much as they wanted, needed - as much as they had the day before - but they didn't try.

As the incident progresses, peaks remain in each room, but the peaks in different rooms move out of phase with one another. Clearly, pigs within a room still want to drink at the same time as one another, but are - consciously or unconsciously - developing a strategy to drink when water is available.

However, this is clearly at odds with their natural desires. As soon as the water problem is fixed, different rooms move back in phase with one another.

Other information and comments

Part of the reduction during the period concerned was due to some rooms being emptied. The pig numbers data may be questionable in some respects. However, pig movements would not explain why water use recovered so dramatically and instantaneously in all the rooms concerned at 9:40 am on 8th Sept.

Other data from the site suggests there may have been other incidents where water supply was affected (though to a lesser and less prolonged degree).

Some rooms have a much greater reduction in daily volume than others.

One's immediate assumption is that there was some sort of blockage such that water was delivered much more slowly than normal. It is notable that, nevertheless, the usual pattern of drinking remains in the room, in some respects at least.

This chart shows water intake by two adjacent rooms (3 and 4). In the first instance, consumption total and pattern is almost exactly the same, from which one assumes that the number and age of pigs is more or less the same. And afterwards (after 8th) they are the same also.

During the incident, the pattern remains of the same form initially, though at lower volume. This indicates that, even with less water available, the pigs still only try to drink when they normally would. There is, still, about 0.5 gpm available in both rooms shown, but the pigs s don't drink for a significantly greater time. There is still a point of zero consumption when pigs either do not need or do not want to drink.

However, after a day or so, patterns become much more erratic, with peaks and troughs out of phase. One might guess that the pigs are learning to drink when water is available (maybe because other rooms are not drinking then). The pattern is still one of peaks and troughs during each day, and no more time seems to be spent drinking.
As soon as water supply is returned to normal, pigs in these two rooms return to being almost exactly synchronised with one another.

These factors tend to support the general hypotheses that -
- Pigs in a group want to do the same things at the same time
- Pigs have a limit on time spent feeding and drinking

Summary and Conclusions

1 Between 5th and 8th September 2001, a problem occurred with the water supply affecting rooms 1 to 12 on this site (about 4,800 pigs).
2 Delivery capacity was reduced to only 1 to 2 gallons per minute, as compared to the required delivery capacity of around 10 gpm.
3 This severely affected the water intake of the animals and led to a reduction feed intake.
4 Several attempts were made to correct the problem, but it either it was not corrected, or went wrong again almost immediately. The problem was not fully resolved until the 8th Sept at 9:40.
5 Feed intake was affected.
6 Despite the apparent problem with the water supply, water remained available in all the rooms, only at a lower rate. This has directly resulted in a lower daily intake.
7 Other data (not included here) suggests that there may have been a number of previous occurrences of problems associated with delivery of feed and/or water, which have not always been detected at an early stage.
8 Cost of this incident is likely to have been in excess of **$5,000.**
9 Other data (not presented here) suggests this is not an isolated occurrence.
10 Economic costs of such incidents is large and improved failure detection is strongly recommended.

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