Disease treatment and control concepts

Maintenance of healthy pigs through management

Treatment by medication
- Use of medicines on farm
- Use of vaccines through the water supply
- Feed bin management to eliminate medication residues
- Common medication problems

Treatment guidelines
- Use of antibiotics in pigs
- Use of vaccines in pigs
- Control of reproduction
- Withdrawal times
- Examples of treatment programmes
  - Piglets
  - Nursery
  - Grow/finishing
  - Adults
  - Boars
- Using Statistical Process Control to help decision making

Care of the compromised pig
- Design of a hospital area
- Health alarm
- Care of the compromised grower
- Care of the compromised adult

Reduction of pathogens on a farm
- Basic biosecurity
- Managing all-in/all-out ï Pig Flow
- Use of Early Weaning to Reduce Pathogen Load
- Room cleaning protocols
- Partial depopulation
- Depopulation and repopulation

Maintenance of healthy pigs through management

In order to understand and characterise the impact of management factors on health, the ómanagementô can be divided into eight specific areas:

- Medicine control
- Environmental factors:-
  - Water supply
  - Feeding system
  - Floor space and hygiene
  - Air quality and ventilation systems
- Stock movements
- Level of stockmanship

Each of these areas is examined. Respiratory disease in the growing/finishing pig is used to illustrate and provide examples where management/health/clinical diseases interact.

Medicine control

Medicines are used to both prevent and treat pigs with respiratory disease. It is vitally important that all medicines are stored and utilised appropriately. Veterinarians need to be fully versed in all the uses, limitations and requirements of vaccines.

Vaccines ï Vaccines against *Mycoplasma hyopneumoniae*, Swine Influenza, *Escherichia coli*, PCVII and PRRSv are commonly used and if the refrigerator freezes these vaccines will be inactivated. Likewise if the vaccines are stored above 8^{o}C (note the fridge door area may run at 10^{o}C) the effectiveness of the vaccine rapidly reduces.

Management of injections includes both the management of the medicine bottle and the syringes and needles. Poorly stored antimicrobial medical products can become inactivated and if other pathogens are introduced into the bottle, the bottle can act as a medium for transmission. Poor needle hygiene may also infect the pig with pathogens from the skin or inside the body, for instance PRRSv and *Staphylococcus hycius* (Greasy Pig disease).

Fridge set too cold ï ice box cover is missing. Fridge is dirty. Inappropriate items are in the fridge

Feed medication has to be managed well. Note that medicated feed placed on the top of unmedicated feed in a feed bin will not provide expected levels of medication and dilution of the medication will occur. If the feed bin is not completely emptied extended treatment periods will occur. This can result in unexpected feed residues when medicated feed is still present in the bin after the óexpectedô use by date. An added problem is that sick pigs often do not eat.

Water medication also has to be carried out with care ensuring that the water supply is working adequately. Note many pigs which become sick with respiratory diseases, in particular with Actinobacillus pleuropneumonia they may stop or reduce their daily water intake. The medications availability may vary depending on water quality, for example, calcium salts in hard water can deactivate tetracycline products by precipitation. Other products are not necessarily very soluble.

Environmental factors

Water supplies

Any restriction in the water supply not only limits feed intake and increases stress factors on the unit but a restriction can result in a thickening of the mucus lining the upper and middle respiratory tract. This reduces the mucocilary escalatorôs speed and therefore, the ability of the pig to clear its respiratory tract resulting in an increased chance of respiratory disease.

The picture shows a pipe line blocked with lime.

Feed supplies

The respiratory tractôs defence mechanism can be overwhelmed by the presence of dust from the feed supplies. Pigs with atrophic rhinitis for instance will perform very poorly on meal, whereas if they are wet fed, near expected growth rates/feed conversion efficient rates can be realised. The presence of mould and mycotoxins can have significant negative effects on the immune system. If the feeders are not managed well variable feed intakes can occur and if the pig fails to eat properly for 24 hours, stomach/gastric ulceration starts.

Too much food available leading to wastage and dusty feed

The gastric ulcer chronically haemorrhages into the stomach resulting in anaemia and loss of ability to fight disease. Several cases of órespiratory diseaseô have been misdiagnosed as the real cause was gastric ulceration and chronic anaemia with resulting coughing, pulmonary oedema, heart failure and ultimately death.

Large gastric ulcer

Floor

A major factor in the pathogenesis (cause) of respiratory disease in pigs is the stocking rate. Overstocked (hot) and under stocked pigs (cold) place pigs under stress and liable to breakdown with respiratory disease. With overstocking it is important to consider stocking both in terms of square metre of floor space and cubic metre of the house. There are now restrictions on stocking rates within the EU which if kept to will help reduce respiratory disease. However, to meet the EU requirements requires good pig flow and an understanding of current legislation requirements.

The sleeping area is insufficient if pigs have to sleep in the dunging area

Hygiene and floor damage

Hygiene achieved in buildings is often grossly inadequate. It is not generally appreciated that poor quality and dirty floors can have a significant impact on respiratory diseases. If the floor is rough and causes trauma to the feet, disease agents (in particular streptococci) gain access to the pig. They are then transported via the blood straight to the depths of the lung where they can result in pulmonary abscesses.

Hole in the floor resulting in lame pigs

Bedding

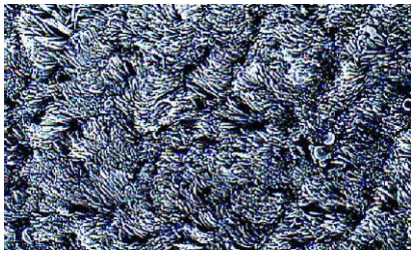
Bedding is being increasingly used to cover and insulate the floor. While some of these materials can provide good environmental control, poor use of bedding contaminated with mould spores can be seriously detrimental to health. The in-proper use of bedding and cleaning routines can result in pigs being forced to sleep on wet bedding which has serious consequences to respiratory health.

Air quality and ventilation systems

Because 10 litres of air is moved in and out of the respiratory tract of the average 60 kg pig per minute, the air quality has a major impact on the respiratory tract. In this section only examples are given but it is essential that all producers who have pigs with respiratory problems maximise air quality. Also note the air is also breathed by the stockpeople working within the house.

Gases

Ammonia has an effect by slowing the mucocilary escalator thus reducing the pigôs ability to clear the lungs. The management of the slurry system can have significant impact on the gases in the room. Many ventilation systems fail by allowing air to move from the slurry pit back into the room. Note the pigôs nose is closer to the floor than the stockpersonsô.



The normal mucocilary escalator

Humidity

Low humidity less than 50% results in a reduction in particle size and therefore more particles enter the lungs and these can carry disease agents. Dry air also causes injury to the mucocillary escalator. Moisture over 75% results in a damp environment which overwhelms the respiratory defenses. Only at 100% humidity is the air actually ócleanedô by the large droplets falling out of the air. However, such systems are illegal throughout the EU.

Dust

There are three aspects to dust; Particles greater than 3.6 µm. are removed before entering the alveolus. Particles less than 1.6 µm will not settle in the alveolus and will move in and out of the respiratory tract. Only particles between 3 and 1.6 µm will enter the lung alveolae tissues. This is important as it means viruses require a piggy back to gain entry into the lung tissues.

Respirable dust in a pig house

Temperature

Pigs require living within their thermoneutral zone and producers need to be aware of the temperature requirements of pigs. On many farms pigs are too hot in the summer time due to lack of an adequate cooling system. This places the pig under severe stress and can affect feed intake. When applied, it is essential to follow agreed temperature curves, in particular in the first stage nursery. Note pigs can be chilled over the night; the younger pig is particularly susceptible.

Draughts

Draughts are possibly the number one environmental factor that affects the pigôs ability to fight respiratory disease. Draughts are a serious stress factor affecting the animalôs ability to sleep properly, it is vital that producers provide pigs with zones and in particular a draught free sleeping area. A draught can be defined as any cold air movement in the sleeping area in excess of 0.2m/second. Note holes in curtains/walls can result in unexpected draughts.

Draught demonstrated by smoke

Air patterns

(a) In the room

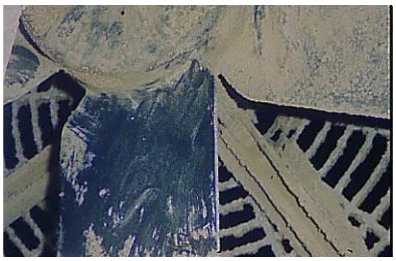
Excessive air is similar to draughts, total air movement is important to understand as this should determine the pigôs behaviour patterns. It is very disappointing that on many farms the air patterns within the room are very poor. Note air patterns can change over the day as the outside temperatures change, particularly when inlet speeds are insufficient.

(b) Between rooms/buildings

Many farms aim to carry out all-in/all-out but fail to realise that this simple concept can be very difficult to achieve and an awareness that poor siting of buildings and inlets/exhausts of ventilation systems can contribute to the spread of disease. Note air movement via slurry channels can destroy all-in/all-out between adjacent rooms.

(c) Fan maintenance

Most farms have very poor fan maintenance programmes. Producers must be aware that a dirty fan can be 40% less efficient than a clean fan. This results in poor air quality and variable air patterns throughout the building (as fans can have different levels of dust on their blades affecting their performance). It also costs more money to run a dirty fan. On one unit a reduction of 25% on the electricity bill to maintain the same environment of the 1st stage nursery was achieved merely by cleaning the fans.



A dirty fan with one blade starting to be cleaned

(d) Curtains

Curtain sided buildings need good management. Used properly they can provide good air pattern through cross flow ventilation. However, it is important to ensure the curtains do not result in draughts. Raise the curtain completely regularly to remove any mice nests. Mice can eat through the curtain and results in a hole which can lead to draughts onto the pigs. Curtain controls also need to be reviewed; several systems move the curtain too many times a day.

Ensure that curtains do not become a breeding ground for mosquitoes. These can transmit pathogens such as PRRSv and JEV around the farm.

Holes in the curtain which were resulting in draughts in the winter months

(e) Building siting

It is very difficult to ideally site a building either due to outside air patterns and the presence of other buildings and ventilation around the building. However, adequate care should be applied before buildings are set up. This is critical in natural cross flow ventilated buildings.

(f) Vegetation between buildings and in ventilation systems

Having vegetation growing up the edge of buildings pose a serious vermin risk for the building as it allows rodents protection prior to entering the buildings. On many farms vegetation even enters the ventilation system disturbing the inlet or outlet. Rubbish/old equipment being discarded along the side of buildings can pose a similar risk and increases the risk of rodent infestation.

This Yorkshire boarding was completely blocked by ivy and the pigs had severe pneumonia

(g) Insulation

Many pigs who live in old buildings suffer severe temperature variation associated with insufficient or damaged insulation panels. Insulation is important both to maintain the temperature in the winter and keep the building cool in the summer.

(h) Ventilation maintenance programme

All farms should have a written and complied with programme to check and maintain the ventilation system on the farm.

Stock movements

Many pigs are exposed to excessive stress because they are placed in buildings unsuitable for them. Many buildings are inadequately prepared for pigs prior to entry. Individual pigs or even whole groups may be too small for the building design and are subjected to environmental variations which are in excess of their ability to cope.

Compromised pigs should be removed to hospital pens and not moved to pens with younger pigs.

Poor pig flow which results from inadequate breeding programmes result in repeated over production and under production. Animals are moved around the farm to stabilise the production and the end result is a failure in all-in/all-out and a breakdown of herd health. It is essential to optimise the efficient production of pig meat which, for example, is not necessarily achieved by breeding all of the gilts who are in oestrus this week. Plan the production system and then farm the plan. Few producers grasp that good control of respiratory disease relies ultimately on the management of the gilt pool which controls breeding output.

Adequate introduction programmes for replacement gilts and boars are an important prerequisite for protecting the unit from new respiratory diseases, in particular the viral diseases. On many farms the unitôs health can be dramatically improved if a 6 week introduction programme is followed together with a well constructed veterinary health plan governing the introduction rules.

Level of stockmanship

Well trained, dedicated, enthusiastic stockpeople are essential to the efficient running of a pig farm. The good stockman must have sufficient time to look after the animals and not spend all their time just running around maintaining the building. Many stockpeople fail to provide sufficient care primarily associated with a lack of organisation and prioritising ability.

Summary

To minimise the economic effects of respiratory disease in pigs involves a whole farm programme. A health maintenance team is required which involves all members of the farm team, from owner, manager, stockperson, veterinarian, nutritionist, geneticists and environmental advisors for example. Irrespective of the disease agent(s) associated with the respiratory disease currently on the farm. To maintain the health of the pigs the farm team must ensure that medicines storage; water supplies; feed supplies; flooring space and hygiene; air quality and ventilation systems; the movement of stock around the farm and the level of stockmanship are all at a standard which will help the pigôs immune system not interfere with its ability to fight any potential disease agent it meets.

ENVIRONMENTAL MEDICINE - SOME USEFUL EQUIPMENT

Basic environmental medicine can be broken down into four major areas: water, food, floor and the air. Each of these areas requires some equipment to allow the clinician to carry out a basic examination. The basic tools in the kit are highlighted in red

Water supply

Note drinker placement, number and position

Look for dirty drinkers

Look for unusual behaviour

Note water appearance, taste and temperature

Note water depth

Tape measure for height

Collapsible 250 ml water cups

Measuring cylinder

Stop watch

Water pressure gauge

Wrench to remove drinker

Tools to take drinker apart ï **Swiss Army knife**

Check stray with a **volt meter**

Food

Note placement of feeders

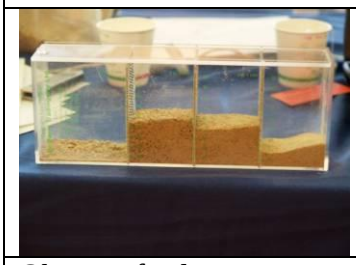
Look at feed usage and wasted feed

Look for unusual behaviour

Measure dimensions of feeder

Presence and age of soiled food

Check **weight** of feed delivered against volume



Observe feed consistency

Note the smell of the feed

Note the taste of the feed

Floor

Note stocking density **measure tape** and **ultrasound** and **calculator**

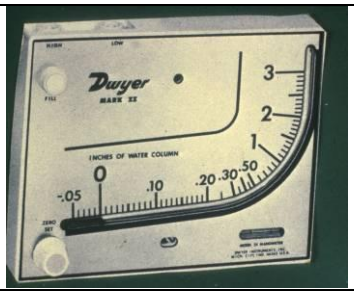
Note defecation pattern

Measure solid/void/step

Note rough edges

Note total floor comfort

		
Presence of mould	Dry and wet areas	Crated area appropriate size
		
Sharp points and projections	Slope of the floor ï **20° measure shown**	Hygiene levels
Air		
		
Cold piglets	Hot finishers	Good lying pattern of group
Note lying pattern and position of group		
		
Smell the air	Note presence of dust	
		
Air **temperature and humidity**	**Infra-red gun**	Remote **temperature recorder**

		
Gas pollutants – NH_3, CO_2, CO, H_2S	**Light levels**	**Air speed** ï easier once air pattern known
		
Small cold smoke to large smoke generators		
Air movement ï **smoke bombs/generators**		**Static pressure**
		
Measure Inlet outlet size	Fan hygiene	Fan Speed ï **tachometer**
		
Drip cooling	Other cooling systems	

Summary List of equipment

Air speed	Calculator	Gas concentrations	Humidity
Light meter	Measuring tape ï 2 metre	Measuring tape - 20 metres	Measuring tape - ultrasound
Pliers	Screwdriver (flat)	Screwdriver (Philips)	Slope meter
Smoke bombs	Static pressure	Stop watch	Swiss Army knife
Tachometer	Temperature	Volt meter	Water measuring bottle
Weight scales	Wrench		

Treatment by medication

Use of medicines on the farm

Medicine storage is the cornerstone of any preventative medicine programme. It is therefore, generally disappointing that medicine storage is relatively poor on many farms and given so little attention to detail.

Medicine storage examination can be broken down into sections:

Cold medicine storage ï using a refrigerator.
Many medicines, for example vaccines, need to be kept between 2-8^{o}C. Freezing most vaccines will render them useless, and the entire preventative medicine programme is negated. Refrigerators which have a freeze thaw cycle must be avoided. Do not rely on the refrigerator dial to monitor the temperature, place a maximum and minimum thermometer in the body of the fridge and monitor the temperature fluctuations at least weekly. The fridge should be kept clean at all times. Check the door seals to ensure the fridge at least attempts to maintain a steady temperature. Know the temperature distribution of your fridge. Ensure that medicines are placed in the body of the fridge. The door and the vegetable tray are generally above 8^{o}C and are therefore, unsuitable areas.


A well managed cold medicine store

A major problem found on farms is the presence of human food in the medicine fridge; this includes soft drinks. Aside from the obvious health and safety issues of storing human food stuffs in a chemical store, there is a potential risk of the spread of some of the most significant swine diseases. Foot and Mouth disease and Classical or African Swine Feverôs are examples where the ingestion of human pork food products by pigs has resulted in the loss of millions of animalôs lives and crippling costs to the local swine industry. Both PRRSv and PCVII have been isolated in fresh pork. If human food is to be brought onto the farm, a) it should not include any pork products and b) it should be stored in a separate area.

Warm medicine storage

This warm medicine storage is appalling and yet never even created a comment by the local veterinarian.

The other medicines used on farms ï antimicrobials for example, should be stored at temperatures generally not exceeding 25^{o}C. It is essential that the medicines are stored clean and dust free. The temperature of 25^{o}C may seem like room temperature, but in many parts of the world, including most of Europe, this temperature will be easily exceeded in the summer months. Therefore, it is not adequate to just store medicines in any office. A proper medicine storage area which is temperature controlled, lockable, and safely away from children and animals should be available on every farm.

Also note that the car is an unsuitable place to store medicines as the boot/trunk can be too hot or too cold depending on the season.

Medicine bottle disposal
A formal protocol should be drawn up detailing the procedures for disposal of used medicine bottles. Just dumping them into the local trash collection is not adequate.

Needles and syringes


Needleless injector

Storage, use and disposal of needles must be adequate to ensure that their use will allow adequate injection techniques without risk of abscessation. A broken needle policy should be in place. On many farms, needles now have to be counted out and returned or accounted for. Alternatively, the newer needless technology should be explored, but there is still a lot of work needed to perfect the system for general use.
Used needles and syringes should be disposed safely. A sharps container should be used for used needles.

In-feed medication
The use of medication via the feed supply is a normal route of administration. While there are advantages to supplying medicines to large number of pigs via the feed, the sick pigs have to eat the feed and in several diseases, such as Actinobacillus pleuropneumonia, they do not eat. In feed medication is ideal for prophylactic use. To treat clinically sick animals the time delay in getting the feed to the farm and even then to the pigs can result in mortality and reduced pig welfare.
Management of the feed bins is essential to ensure that the correct pigs are medicated. For example, have all feed bins numbered. An understanding of how feed moves in the feed bin is required. Medicated feed placed on top of unmedicated feed in a feed bin will not result in the medication being delivered at the required concentration. Once the period of medication has finished it is essential to ensure that the feed system is thoroughly cleaned, including the feed trough in the pens, otherwise medicine residues may inadvertently occur in the pig meat.

Medication through the water supply
The water supply, when working adequately is an ideal route for the mass medication of pigs. However, there are several issues that need to be addressed. The water supply needs to work. When mixing medications to go into the water supply, ensure that medicine is mixed properly otherwise medicine residues may occur. Many medications and vaccines require that the chlorine is removed from the water supply prior to their administration. The water supply is becoming a very useful method of supplying vaccines to large number of pigs without the stress of restraint and injection.

Pig identification
A properly run medication programme relies on accurate pig and pen identification. A review of the medication records is an essential component of the health audit.

Accidental injection protocols
In the unfortunate case of an accidental stick injury, the following 6 rules should be observed:
1 Inform manager (or assistant manager) immediately
2 Obtain relevant data sheet
3 Telephone local medical centre for advice
4 Be taken to the medical centre. Do not drive yourself
5 Go to local medical centre with data sheet and name and telephone of the farm veterinarian
6 Fill in accident book

Injection in the pig

In commercial pig production, it is essential to minimise carcase blemishes. Of particular importance is not to create an abscess through dirty needles.

General Needle use

1	Always use a sharp new disposable needle each day
2	When injecting a group of healthy pigs do not use the same needle for more than 10 - 12 pigs (one litter)
3	Never use a blunt needle
4	Needles must not go from a sick pig to a healthy pig
5	Only use a clean needle to draw out of a vaccine bottle
6	Dispose of used needles (and blades) in a proper sharps bin
7	Return full sharps bin to the veterinarian for safe disposal
8	Do not share needles with another stockperson

Needle length and size

Intramuscular			**kg**		**Subcutaneous injections**		
Piglet	5/8" 21g	16 mm 0.8 mm	**1 - 7**		**Piglet**	5/8" 21g	16 mm 0.8 mm
Weaner	1" 19g	25mm 11mm	**7 - 25**		**Weaner**	5/8" 21g	16 mm 0.8 mm
Grower	1" 19g	25 mm 11 mm	**25 - 60**		**Grower**	1/2" 19g	16 mm 11 mm
Finisher	1" 16g	25 mm 1.3 mm	**60-100**		**Finisher**	1/2" 19g	16 mm 11 mm
Adult	1.5" 16g	40 mm 1.3 mm			**Adult**	1" 19g	25 mm 11 mm

Main Injection sites

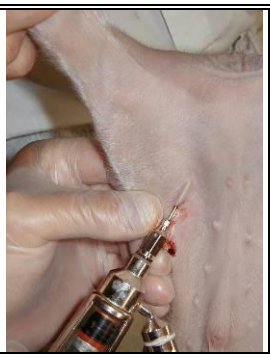
Intramuscular ï behind ear ï note depth of fat in neck

The circle indicates the suitable area

Iron injection in piglet

Intravenous ï ear vein easiest

There are now viable systems for needless systems. These give the dose intradermally and therefore can be given anywhere on the pigôs body.



Subcutaneous ï actually difficult in the pig. Young pig inguinal region. In the adult just behind ear, note angle of needle. Or in the perineal region.

Intravulval injection site.
Many products can be reduced in volume using this technique

Consequences of poor injection technique

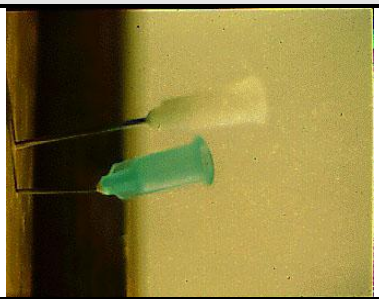
Weaner with an injection abscess

Sow with an injection granuloma

Injection site at slaughter. This pig had received an injection of oxytetracycline 2 days before slaughter.

Causes of injection site abscesses and blemishes

Dirty medicine bottles



Dirty needles

Blunt needle

Dirty syringe

Use of Vaccines through the Water supplies

Today there are several modified live vaccines which are available for administration through the water supply.
These would include:

Ileitis ï *Lawsonia intracellularis*,
Erysipelas ï *Erysipelothrix rhusiopathiae*,
Salmonella choleraesuis
Escherichia coli – E. coli

The following notes describe a method of preparing the water supply so that the vaccine has the best chance of working. However, please follow all advice given with the vaccine.

Vaccine storage	
	Ensure that the vaccine is stored properly on the farm. Some of the vaccines have very specific storage requirements
Preparation of the water supply	
	These vaccines are live. Therefore, the vaccine (organisms) will be killed and will be ineffective if there are any antibiotics or other agents, such as chlorine, in the water supply
	Inactive chlorine with sodium thiosulphate or skimmed milk. Note with skimmed milk do not reconstitute with hot water as this may also kill the vaccine
	Ensure that all antibiotics are removed from the water lines and feed lines for at least 2 days before vaccination. These antibiotics also need to be avoided for at least 5 days post vaccination
The medicator	
	Ensure that the medicator is thoroughly cleaned. This should include the medicator itself, housing and filters used. But note that the medicator cannot have cleaning materials remaining in the medicator or buckets. Soaps can destroy these live vaccines
Measuring the amount of water to be drunk by the pigs – the day before medication, for example around 10-11 am.	
	Fill a new, clean stock solution container with clean water and let the water run through the system
	Record the starting volume of water
	Note the time of day when you start running the water through the system
	After a 4 hour period, measure the amount of water that was used out of the stock solution. This will be the amount of stock solution that will be required
	Pigs have drinking habits that will change with time. Between two individual days the drinking habit does not change much
Flush the water supply	
	Fill the stock solution container with clean water and allow the medicator to run overnight to flush any remaining antimicrobial residues
Day of vaccination (Need the vaccine and sodium thiosulphate)	
	Half an hour before the time yesterday (when the water use consumption over the 4 hour period was calculated) prepare to administer the vaccine
	Stop the medicator temporarily
	Empty the stock solution container.
	Refill with the amount of clean water the pigs will use in 4-5 hours (as determined yesterday).
	Add sodium thiosulphate (which neutralizes chlorine) to clear the water of chlorine. Note some of the trade brands contain a dye which allows you to track the product through the water supply.
	Thaw the vaccine in warm water (not hot) water. This should take 10 minutes
	When the vaccine has thoroughly thawed
	Add the vaccine to the stock solution
	Remove the last drinker from the drinking line
	Start the medicator and allow the sodium thiosulphate to flush through the water line. If a dye is included with the sodium thiosulphate the dye will be seen in the water
	Replace the drinker line to the last drinker
	Allow the medicator to run until all the stock solution has been used.
	Make another 4 litres of stabilizing solution to flush the remaining vaccine out of the water lines
	During administration of vaccine monitor vaccine consumption

After vaccination has finished	
	Ensure that the water supply is fully restored.
	Do not use water or feed medications for at least 5 days after vaccinating through the water lines. This is to prevent killing the vaccine before it adequately stimulates immunity.
Reasons for vaccine failure	
	Vaccine storage
	Vaccines stored at the wrong temperature or variable temperatures. The -70C frozen ileitis vaccine is particularly sensitive if stored for a week in conventional fridge.
	Vaccine mixed with chlorinated water or antibiotics
	Time to deliver vaccine
	Water consumption more than estimated
	Pig Flow changes
	Hot days ï water consumption increases ï variable. If weather very variable delay vaccine
	Medicator problems
	Loss of suction
	Medicator hose come out of bucket
	Vaccine timing
	Vaccine administered too late ï too close to the outbreak

		
Ensure water medicator thoroughly cleaned	Ensure water supplies are thoroughly cleaned	Ensure that the water supply is readily accessible to all the pigs in the house

	Avoid the first week post-weaning as a vaccination time, because the pigs may be learning about drinking water for the first time and they probably have not used this type of drinkers. In addition, the stress of weaning may also interfere with their immune response. Note that maternal immunity may also interfere.

Feed Hygiene To Reduce Contamination

Feed Bulk Bins

Bulk-bin Management is essential to keep feed as fresh as possible

Hygiene		
	Try to run the bin empty between each feed delivery	
Monthly		
	Inspect each bin	
	Check for leaking seams on the bin	
	Check for porous, rusty areas	
	Examine inlet and exit mouths of augers	
Spring and Autumn		
	Run bin empty once a month	
	Dust the bin with a mould inhibitor	
Every 6 months		
	Pressure wash interior	
	Allow to dry thoroughly before refilling	
	Fumigate to ensure eradication of all insects and mites	
	Watch staff health and safety when fumigating and entering feed bins	
Aims		
• **To prevent mould development**		
	Mould causes	Palatability problems
		Loss of nutrients
		Feed wastage
		Performance and health problems
		Loss of profit
• **Reduce mite contamination**		
	Mites cause	Reduced nutrients
		Food wastage
		Loss of profits

• Reduce medicine residues

Augers often leave residual feed in their housing because the screws must have clearance as shown in figure 1, the residual feed is represented in brown

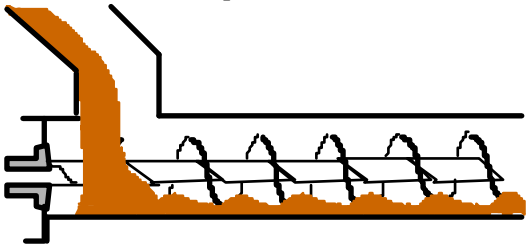


Figure 1

Movement of feed out of a bin occurs directly above the discharge point. The remaining feed then cascades down the slope of the crater that is subsequently formed. Failure to completely empty bins before refilling will result in residual feed retained in the bin

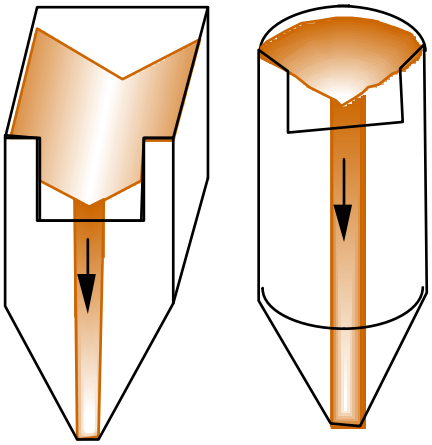


Figure 2

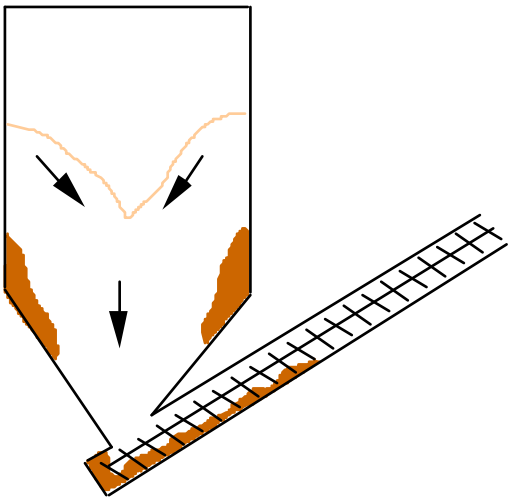


Figure 3

Figure 3 demonstrates the typical feed flow in a feed bin with brown areas illustrating where the feed is most likely to remain and contaminate the next batch

Detection of mites

Mites are not visible to the naked eye
They may be detected as pink/brown "dust" at the base of bins.
If you suspect mites, pinch the "dust" into a peak. If live mites are present the peak will soon collapse
Some mites have a distinctive smell which is often more evident if the "dust" is rubbed between the fingers

Bagged Feed

Storage

Cool and dry, below 18ÅC
On pallets, not on the floor
Away from strong smelling products such as oil or disinfectants
Bags should be stock controlled, always use the oldest deliveries first
Store should be vermin proof. Ensure all feed barrows are covered at all times
Note expiry dates on the products generally 3 months or 9 months with milk products i.e. creep

MEDICINE PROBLEMS

The following montage is to give a flavour of the common mistakes regarding handling of medicines on farms

Refrigerator management - frozen vaccines will not work – you have no preventative medicine programme!

			
Ensure the fridge has a max/min thermometer to record the extremes	Fridge very dirty. Note no ice box cover. Overstocked with medicines	Fridge too cold and frozen. Lower bottle frozen. Too hot is just as bad	Fridge requires defrosting. The products are at a serious risk of freezing
			
The rear of the fridge is frozen and medicines in contact with back plate	The fridge requires to be defrosted before medicines are frozen	Fridge overstocked. This was only a 150 sow unit. Also requires defrosting	The fridge has no management - medicines just thrown in
			
Vaccines in door of fridge and therefore too hot. Note fridge not very clean	Food in fridge especially pork products this is a serious biosecurity risk	A well managed fridge minimal medicines and temp storage check possible	Is the fridge lockable and secure? Is it away from children?

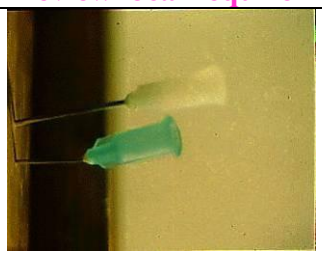
General bottle management

			
Multiple bottles of the same medicine open at the same time.	Bottles stored dirty. This is a serious abscess risk	Keep the tops of bottles clean by covering them or placing them undercover	This degree of bottle contamination is appalling
			
A finishing yardôs simple lockable cupboard	Medicines cannot be óstoredô on convenient walls	Keep all medicines out of the reach of children	Too many medicines. This was only a 200 sow unit

Needle and syringe management

			
Always inject into the neck of pigs	Do not leave bottles and syringes lying around	Do not store needles and syringes in the bottles	Do not leave syringes and needles ŕeadyôon work surfaces
			
This syringe is very dirty and unusable	Do not mix medicines unless specifically advised	Blunt needles cause a lot of trauma when used	Shoulder/neck abscess from dirty injection technique

Disposal of used medicines, needles and syringes – review local requirements

			
Use a sharps tin to dispose of all needles blades etc	Do not carelessly dispose of syringes and needles	Door ways or building supports are not for disposal of needles	Poor medicine bottle disposal

Records and preventing medicine residues

			
Always read and understand the label on the bottle	Complete as soon as possible medicine records	Mark medicated pigs or pens adequately	Residues are not that hard to find in the slaughterhouse

Other medicine administration methods

			
Medication through the water supply - ensure the water supply is adequate. Check for leaks.	Medicating through the feed review feed bin management.	When top dressing, ensure that the medicine is mixed with the feed. Carelessness leads to residues	Ensure that the feeding system is adequate for the pigs and no wastage occurs

Treatment guidelines

The following pages discuss the variety of chemicals and treatments which can be used on modern pigs farms. When dealing with pet pigs it is important to remember that certain products and chemicals may be banned from use within pigs ï without exception. This includes enrofloxacillin within Australia. Check your local regulations.

Pathogen antimicrobial therapy possibilities

Antimicrobial agent		Aminocyclitols	Aminoglycosides		Cephalosporins	Diterpines	Fluroquinolone	Lincosamides	Macrolides				Penicillins		Sulphonamides		Tetracyclines	
Pathogen	**OIE status**	**Spectinomycin**	**Gentamicin**	**Neomycin**	**Ceftiofur**	**Tiamulin**	**Enrofloxacin**	**Lincomycin**	**Tilmicosin**	**Tulathromycin**	**Tylosin tartrate**	**Valnemulin**	**Ampicillin**	**Penicillin**	**Sulphonamides**	**Trimethoprim/ Sulfamethoxazole**	**Florfenicol**	**Tetracycline**
Actinobaculum suis																		
Actinobacillus suis																		
Actinobacillus pleuropneumoniae																		
African Swine Fever	A																	
Arcanobacterium pyogenes																		
Ascaris suum																		
Aujeszkyôs Disease Pseudorabies	B																	
Bordetella bronchiseptica																		
Borrelia spiralis																		
Brachyspira hyodysenteriae																		
Brachyspira pilosicoli																		
Brucella suis	B																	
Classical Swine Fever	A																	
Circovirus I and II																		

Pathogen	OIE status	Spectinomycin	Gentamicin	Neomycin	Ceftiofur	Tiamulin	Enrofloxacin	Lincomycin	Tilmicosin	Tulathromycin	Tylosin tartrate	Valnemulin	Ampicillin	Penicillin	Sulphonamides	Trimethoprim/ Sulfamethoxazole	Florfenicol	Tetracycline
Clostridium difficile																		
Clostridium perfringens																		
Congenital tremor virus?																		
Cytomegalovirus																		
E. coli cystitis																		
E. coli diarrhoea																		
E. coli bowel oedema F18 Ste2x																		
Enterovirus																		
Epidemic diarrhoea virus																		
Erysipelothrix rhusiopathiae																		
Foot and Mouth virus And other vesicular viruses	A																	
Haemophilus parasuis																		
Haematopinus suis																		
Hyostrongylus rubidis																		
*Isospora suis***																		
Lawsonia intracellularis																		
Leptospirosis	B?																	
Metastrongylus apri																		
Mycoplasma haemasuis																		
Mycoplasma hyopneumoniae																		
Mycoplasma hyosynoviae																		
Oesophagostonum dentatum																		
Parvovirus																		
Pasteurella multocida (Toxigenic)	B																	
Pasteurellosis																		

Pathogen	OIE status	Spectinomycin	Gentamicin	Neomycin	Ceftiofur	Tiamulin	Enrofloxacin	Lincomycin	Tilmicosin	Tulathromycin	Tylosin tartrate	Valnemulin	Ampicillin	Penicillin	Sulphonamides	Trimethoprim/ Sulfamethoxazole	Florfenicol	Tetracycline
PMWS																		
PRRSv	B																	
Ringworm																		
Rotavirus																		
Salmonellosis																		
Sarcoptes scabiei																		
Spirochaetal colitis																		
Staphylococcus hycius																		
Stephanurus dentatum																		
Streptococcus abscess																		
Streptococcus arthritis																		
Streptococcus suis joint ill																		
Streptococcus suis meningitis																		
Strongyloides ransomi																		
Swine Influenza virus																		
Swine pox virus																		
TGE	B																	
Toxoplasma gondii																		
Trichonella spiralis																		
Trichuris suis																		

Green ï 70% or more isolates sensitive. **Red** ï Up to 50% isolates resistant

Where the row is white ï antimicrobials are generally not available for therapy. They may still be useful to control secondary pathogens. PRRSv and Tilmicosin is an example of an exception.

Antimicrobials are not generally antiparasiticides ** *Isospora suis* ï use Toltrazuril

The use of Vaccines in Pigs

The following vaccines are commercially available in pigs

Control of:	Comments about use
Aujeszky's Disease	Whole herd twice yearly
Atrophic rhinitis vaccine	To gilts and sows pre-farrowing for piglets via colostrum
Classical Swine Fever	To pigs over 5 weeks of age
Clostridial vaccine ***Clostridium perfringens C*** ***Clostridium novyi***	 To gilts and sows pre-farrowing for piglets via colostrum Twice a year to adults
***E. coli* vaccine** **F4 and F5** **F18**	 To gilts and sows pre-farrowing or at weaning for piglets via colostrum To weaners via water supply
Epidemic Diarrhoea	To sows pre-farrowing for piglets via colostrum
Erysipelas vaccine **Gilt** **Sows** **Boars** **Growing pigs**	Available via injection or water At selection two injections 2-4 weeks apart Sows at weaning and for piglets via colostrum Twice a year After 30 kg
Haemophilus parasuis vaccine	To piglets or weaned pigs. To gilts and sows pre-breeding for piglets via colostrum
Ileitis	To weaner to growing pigs via water
Leptospirosis	To gilts during acclimatization To gilts and sows pre-farrowing
***Mycoplasma hyopneumoniae* vaccine**	To piglets or weaned pigs
Parvovirus vaccine	To gilts during acclimatization
Pleuropneumonia vaccine	To growing pigs
PCVII	To sows pre-farrowing for weaners via colostrum To piglets at weaning
PRRSV vaccine	To weaned pigs To gilts during acclimatization To gilts and sows pre-farrowing for piglets via colostrum
Rotovirus	To gilts and sows pre-farrowing
Salmonella	Via water supply to growing pigs
Swine Influenza	To sows twice a year
TGE	To gilts during acclimatization To gilts and sows pre-farrowing for piglets via colostrum

Note not all of these vaccines are available in all countries.
Timing and requirements may change between different countries.
It is essential to make yourself acquainted with the local legal situation.
In addition there may be a number of Autogenous vaccines available

Synchronisation of Females

1	**Animals not cycling or ovulating**
	Inject with PG600 (a combination of 400 iu eGH and 200 iu hCG - equine and human chorionic gonadotrophin)
	Ovulation will usually occur 100 to 120 hours later when administered at weaning
2	**Cyclic animals**
	12-14 days after last oestrus
	PGF2ŭ (prostaglandins) only work in pigs in mature corpora lutea after 12-14 days after ovulation. The female cycles 4 days after administration
	Other times
	In normal cycling females ovarian activity can be suppressed by administrating oral active progesterone, by the feeding of 15-20 mg of Regumate/Matrix for 14 to 18 days. Cease feeding and oestrus occurs some 2-8 days after last feeding
	Aborting early pregnant animals
	Gilts can be served when the cycle and then the group can be synchronised by aborting the gilts as a group using prostaglandins. The gilts cycle 4 days after the abortion.
3	**Delay after weaning**
	This may be useful to coordinate pig flow. Feed Regumate/Matrix from weaning until 4 days before required heat. Note normal variation in response is same as weaning ie 2-8 days with a peak at 4 to 5 days

To help sows and gilts to come into heat
Combination of PGF2 ŭ and PG600

Group of synchronised animals with poor or no heats:

Day 1 Inject with PGF2 ŭ prostaglandin
Day 3 inject with PG600

Rational:
A group of animals cycling out of sequence will have animals at all stages of the oestrus cycle
Those 12 ï 18 days will cycle 4 days later with PGF2ŭ
Those at 18-21 days will cycle within the next 4 days anyway
Those at 0-12 days may cycle with PG600 in 4-5 days
PG600 to animals at or about ovulation will enhance the ovulation process.

Permitted Medicine List – Example only

Authorised Pharmaceutical List	Q1	+	Q2		2010
	Q3		Q4		

ACTIVE INGREDIENT	PRODUCT NAME	TREATMENT REGIME	WHP
Altrenogest	Regumate	**5 ml** oral dose per day for 18 days to synchronise oestrus is gilts, or for 5 days to weaned sows to hold over for 1 week	**15 days**
Amoxycillin	Betamox	**1 ml/ 20 kg** intramuscularly for 3 ï 5 consecutive days for DIARRHOEA, MENINGITIS, ERYSIPELAS, GREASY PIG, ARTHRITIS, MMA.	**28 days**
Amoxycillin LA	Moxylan LA	**1ml/ 10 kg intramuscularly for** DIARRHOEA, MENINGITIS, ERYSIPELAS, GREASY PIG, ARTHRITIS, MMA.	**28 days**
Amoxycillin	Sol-U-Mox	**20mg/kg** in water. Treat for 3-5 days. Make solution fresh daily. GLASSERS, DIARRHOEA, PNEUMONIA	**14 days**
Apramycin	Aprapharm	**12.5 mg/kg** in water for 5-7 days for DIARRHOEA.	**14 days**
Azaperone	Stresnil	**1 ml/ 20 kg** intramuscularly to all classes of stock requiring sedation	**24 hours**
B- complex	Vitamin B complex	**1ml/ 20 kg** intramuscularly once for POOR CONDITION. Repeat once a week until improve	**NIL Off Label**
Ceftiofur	Excenel	**1 ml/ 15 kg** intramuscularly for 3 -5 days for pigs with PLEUROPNEUMONIA, MENINGITIS, DIARRHOEA	**5 days OFF LABEL**
Citric Acid	Citric Acid	**10mg/litre** of drinking water. To acidify the water DIARRHOEA	**Nil**
Dexamethasone	Dexason	**1 ml/ 20 kg** intramuscularly **once** to reduce inflammation for suckers and weaners with MENINGITIS, and pigs with PLEUROPNEUMONIA.	**10 days**
E. coli, Leptospirosis and Erysipelas vaccine	EcoVacLE	**4 ml** subcutaneously at gilt selection with booster 4-6 weeks later and 3 weeks prior to each farrowing	**NIL**
Enterisol	Enterisol- Ileitis	**2ml** given as an oral drench at weaning	**NIL**
Enzootic pneumonia vaccine	Respisure One Suvaxyn	**2 ml** intramuscularly once at weaning	**NIL**
Erysipelas and Leptospirosis vaccine	Lepto-ery vac	**2.5 ml** intramuscularly	**NIL**
Florfenicol	Nuflor inject	**15mg/kg** intramuscularly once every 2 days. DIARRHOEA and PNEUMONIA	**15 days**
Florfenicol oral	Nuflor oral	**10mg/kg** in the water supply**.** DIARRHOEA and PNEUMONIA	**20 days**
Haemophilus parasuis vaccine	Suvaxyn HPS	**2ml** intramuscularly at 7-10 days of age 2nd injection 2 to 3 weeks later or 3 weeks pre-farrowing for breeding herd.	**NIL**
Immunocastration Vaccine	Improvac	**2 x 2 ml** dose with the second dose administered 4-5 weeks prior to slaughter to prevent boar taint.	**NIL**
Lepto/Erysipelas	Lepto-Eryvac	**2.5ml** subcutaneously every 6 months in sows and boars. **GILTS-** give 2 doses 4-6 weeks apart	**NIL**
Levamisole	Nilverm	Pulse at **1ml/10kg** for 1 day every 3 weeks	**14 days**
LH and PMSG	PG 600	**5 ml** intramuscularly to pubertal gilts to induce heat.	**NIL**
Lincomycin	Lincomix Antibiotic Solution	**1 ml/ 30 kg** intramuscularly for 3 ï 5 consecutive days for ARTHRITIS DIARRHOEA and PNEUMONIA.	**2 days**
Meloxicam	Metacam	**1ml/50kg** intramuscularly once for LAMENESS, MMA. Repeat in 24hours if needed.	**4 days**

Neomycin & Sulfadimidine & Sulfadiazine & Streptomycin	Scourban	**2 ml** orally for piglets that require treatment for DIARRHOEA or as directed by the veterinarian	**14 Days**
Oxytetracycline Short acting	Tetravet Flexidose	**1 ml/ 10 kg** intramuscularly once for MMA, URINARY TRACT INFECTIONS, ARTHRITIS, ABSCESSES, PNEUMONIA, WOUNDS and ILEITIS. Repeat in 48 hours if necessary	**10 days**
Oxytetracycline ï in feed	Tetravet 980	**1 tablespoon/sow/day, 2 tbls/boar/day** for 5 days for ARTHRITIS, ABSCESSES, WOUNDS	**7 days**
Oxytetracycline	Tetravet 980	**20mg/kg** in water **for 3 days** Make solution fresh daily.	**7 days**
Oxytetracycline Long Acting	Oxytet L.A.	**1 ml/ 10 kg** once intramuscularly for ARTHRITIS, ABSCESSES, PE, PNEUMONIA, and WOUNDS. Repeat in 48 hr if necessary	**42 days**
Oxytocin	Syntocin	**½ - 1 ml** intramuscularly to sows that require assistance at farrowing	**NIL**
Parvovirus vaccine	Parvac	**2 ml** subcutaneously at gilt selection with booster 3-4 weeks later	**NIL**
Penicillin ï Short acting	Bomacillin SA ProPen Depocillin	**1 ml/ 10 kg** intramuscularly for 3 ï 5 consecutive days for MENINGITIS, ERYSIPELAS, GREASY PIG, ARTHRITIS, PLEUROPNUEMONIA	**14 days OFF LABEL**
Prostaglandin F2α	Lutalyse Duramate Estrumate	**2 ml i**ntramuscularly to sows on day 111 ï 114 of gestation to induce farrowing and to treat post-farrowing discharge.	**1 day**
Ractapamine	Paylean	**0.25 kg/tonne (5ppm)** commencing in feed **no more than 28 days prior to the last cut**	**12 hours**
Tetracid	Tetracid	**2kg/tonne feed** to acidify the feed. DIARRHOEA	**Nil**
Tiamulin	Tiamupharm liquid	Add **1 litre to 1000 litres** of drinking water. Make fresh daily. For PNEUMONIA	**5 days**
Tilmicosin	Pulmotil 200 Premix	**2kg/tonne** of complete feed for 5 days for 5 days PNEUMONIA, DIARRHOEA	**14 days**
Trimethoprim & sulphamethazine	TMPS 240	**1 ml / 15 kg** intramuscularly to suckers and weaners which require treatment for DIARRHOEA	**28 Days**
Trimethoprim & sulphamethazine	Tribrissen Suspension	One pump orally per 1.5 kg for 3 days. For DIARRHOEA in piglets	**14 days**
Toltrazuril	Baycox Toltracox	**1 ml/ piglet** orally at 4 days of age to control of COCCIDIOSIS	**100 days**
Tulathromycin	Draxxin	**1 ml/40 kg** intramuscularly single injection for PNEUMONIA, PLEUROPNEUMONIA, DIARRHOEA	**26 days**
Tylosin	Tylopharm Tylan 200	**1 ml/ 20 kg** intramuscularly for 3 ï 5 days for pigs with PNEUMONIA, ERYSIPELAS, GREASY PIG and PE.	**3 days**

Examples of treatment programmes

Note not all medications may be available in your country. These sheets are provided as a guideline to discuss with your veterinarians or clients

EXAMPLE - PIGLETS STANDARD THERAPIES

Scour		**Approx cost**
1	If on creep, remove creep	
2a	Orally dose with Tribrissen suspension 1 pump per 1.5 kg bodyweight for 3 days	**$0.11/day**
2b	If piglet sick inject Excenel RTU (0.2 ml per piglet) intramuscularly into the neck with a $^{5}/_{8}$" 21 G needle for 3 days	**$0.16/day**
3	Place water in a bowl drinker	
4	Place electrolytes and cordial in a bowl drinker	
5	If problem occurs in large numbers of piglets consult with the vet	
Joint infections		
1	Inject with Excenel RTU (0.2 ml per piglet) intramuscularly into the neck with a $^{5}/_{8}$" 21 G needle for 3 days	**$0.16/day**
2	Examine teeth clippers and other source of injury	
3	If problem occurs in a number of piglets consult with the vet	
Abscess/wounds		
1	Inject piglet with Excenel RTU (0.2 ml per piglet) intramuscularly into the neck with a $^{5}/_{8}$" 21 G needle for 3 days	**$0.16/day**
2	Check farrowing area for rough floors	
3	Check sow for savaging	

If any treatment fails to show a response consult with the manager immediately

If the pig shows any other condition consult the manager

EXAMPLE - WEANER STANDARD THERAPIES

Scour		Approx Cost 20 kg
1	Remove feed for 24 hours	
2	Provide electrolytes in a cube drinker	
3	Remove visibly sick pigs to hospital pens ï treat with Excenel RTU (1ml per 20 kg bodyweight) intramuscular into the neck (1ò 19 G) needle for 3 days.	**$0.90/day**
4	Medicate via the drinking water using Sol-U-Mox (20mg/kg) for 4 days	**$0.07/pig/day**
Middle ear infection		
1	**Remove pig to hospital pen to prevent bullying**	
2	**Inject with Tetravet Flexi-Dose (4 ml per 20 kg bodyweight) intramuscular into the neck (1" 19 G needle) repeat after 48 hours.**	**$0.64/treatment**
Greasy pig disease		
1	Isolate affected weaners	
2	Inject with Excenel RTU (0.5 ml per 20 kg bodyweight) intramuscularly into the neck (1" 19 G needle) for 4 days	**$0.45/day**
3	Inject pig with Metacam 20 (0.5 ml per 20 kg bodyweight) into the neck (1" 19 G needle) repeat after 24 hours if needed	**$0.90/treatment**
4	Inject with multivitamins (2 ml) intramuscularly into the neck (1" 19 G needle)	
5	Wash with Savlon	
Skin infection/ear biting		
1	Remove to hospital pen	
2	If mild, inject Excenel RTU (0.5 ml per 20 kg bodyweight) intramuscularly into the neck (1" 19 G needle) for 3 days	**$0.45/day**
3	Place toys, chains in affected pen. Check for draughts	
Abscess		
1	Lance with a cross (+) cut	
2	Flush with flowing water	
3	Spray with Chloromide	
4	Inject Excenel RTU (0.5 ml per 20 kg bodyweight) intramuscularly into the neck 1" 19 G needle) for 3 days	**$0.45/day**
5	Flush wound 3 times a day with water	
6	DO NOT lance abscess in a joint	
Meningitis		
1	Inject pig with Excenel RTU (1 ml per 20 kg bodyweight) into the neck (1" 19 G needle) repeat after 48 hours	**$0.90/day**
2	Inject pig with Metacam 20 (0.5 ml per 20 kg bodyweight) into the neck (1" 19 G needle) repeat after 24 hours if needed	**$0.90/treatment**
3	Remove pig to hospital pen. In some cases you may have to be more vigorous with therapy. It is essential they are treated as soon as possible.	
4	Provide water by cube drinker, even possibly by oral dosing. Possibly add Sol-U-Mox in the water drinker	

If any treatment fails to show a response consult with the manager immediately
If the pig shows any other condition consult the manager

EXAMPLE - STANDARD FINISHING THERAPIES

Pneumonia		**Approx cost 50 kg**
1	Inject with Draxxin (1.25 ml per 50 kg bodyweight) intramuscularly into the neck (1" 16 G needle)	**$3.75/treatment**
2	Inject pig with Metacam 20 (1 ml per 50 kg bodyweight) into the neck (1" 16 G needle) repeat after 24 hours if needed	**$1.80/treatment**
3	Remove to hospital pen	
4	If more than 4 pneumonic in one day consult vet	
Infected foot/lame		
1	If one pig, review pig's progress every 12 hours, if no signs of improvement within 36 hours or more pigs start going lame go to point 2	
2	Inject with Excenel RTU (1 ml per 50 kg bodyweight) intramuscularly into the neck (1" 16 g needle) for 3 days	**$0.90/day**
3	Inject pig with Metacam 20 (1 ml per 50 kg bodyweight) into the neck (1" 16 G needle) repeat after 24 hours if needed	**$1.80/treatment**
4	Remove to sick pen if being bullied	
5	If no response in 2 days consult vet	
6	If more than 4 lame in one day consult vet	
Scour		
1	Water medicate group with (Tiamupharm Sol Powder 8.8g/tonne of pig ï 20 pigs at 50 kg liveweight) for 3 days	**$0.30c/pig/day**
2	Remove to sick pen if being bullied	
3	If no response in 2 days consult vet	
4	If more than 4 scouring in one day consult vet	
Bullying		
1	Remove to sick pen	
2	Cool down with water	
3	Keep in dark and quiet until recovered	
Wounds or abscess		
1	Lance with a cross (+) cut	
2	Flush with flowing water	
3	Spray with wound spray dressing	
4	Inject with Excenel RTU (1 ml per 50 kg bodyweight) intramuscularly into the neck (1" 16 G needle) for 3 days	**$0.90/day**
5	Inject pig with Metacam 20 (1 ml per 50 kg bodyweight) into the neck (1" 16 G needle) repeat after 24 hours if needed	**$1.80/treatment**
6	Flush wound 3 times a day with water	
7	DO NOT lance abscess in a joint	
Meningitis		
1	Immediately Inject with Excenel RTU (1 ml per 50 kg bodyweight) intramuscularly into the neck (1" 16 G needle) for 3 days	**$0.90/day**
	Inject pig with Metacam 20 (1 ml per 50 kg bodyweight) into the neck (1" 16 G needle) repeat after 24 hours if needed	**$1.80/treatment**
2	Remove to sick pen	
3	Keep in dark and quiet	
4	Provide water and feed, it may be necessary to drench with water	
5	If more than 2 sick in one day consult vet	

If any treatment fails to show a response consult with the manager immediately
If the pig shows any other condition consult the manager

EXAMPLE - STANDARD SOW TREATMENTS

Lameness		**Approx cost per sow**
1	Inject with Excenel RTU (4 ml per 200 kg bodyweight) intramuscular into the neck (1.5" 16 G needle) for 3 days.	**$3.60/day**
	Inject pig with Metacam 20 (4 ml per 200 kg bodyweight) into the neck (1.5" 16 G needle) repeat after 24 hours if needed	**$7.20/treatment**
2	If persist remove to hospital. Treat with Tetravet Flexi-Dose (20 ml per 200kg bodyweight) into the neck (1.5ò 16G needle). Repeat in 48 hours. If no improvement and severe euthanase	**$3.20/treatment**
Skin infection and wounds		
1	Treat with Tetravet Flexi-Dose (20 ml per 200 kg bodyweight). Repeat after 48hrs if necessary	**$3.20/treatment**
Abscess		
1	If soft and in awkward position (to pig) lance with a clean scalpel cut at lowest/dependant point.	
2	Flush with water or dilute hydrogen peroxide	
3	If no soft point and not causing distress to pig leave alone	
4	Treat with Tetravet Flexi-Dose (20 ml per 200 kg bodyweight). Repeat after 48hrs if necessary	**$3.20/treatment**
5	Keep wound clean	
6	DO NOT lance abscess in a joint	
Assisted Farrowing		
1	Treat with Bomacillin SA (20 ml per 200 kg bodyweight). Repeat after 24 hrs if necessary	**$1.76/treatment**
Mastitis		
1	Treat with Bomacillin SA (20 ml per 200 kg bodyweight). Repeat after 24 hrs if necessary	**$1.76/treatment**
2	Inject pig with Metacam 20 (4 ml per 200 kg bodyweight) into the neck (1.5" 16 G needle) repeat after 24 hours if needed	**$7.20/treatment**
3	Review pre-farrowing feeding levels	
No milk/Agalactia		
1	Treat with 5 IU Oxytocin. This can be repeated every 6-8 hours	**$0.22/treatment**
2	If excitable Stresnil (5 ml per 200 kg bodyweight) into the neck (1.5ò 16G needle).	**$5.00/treatment**

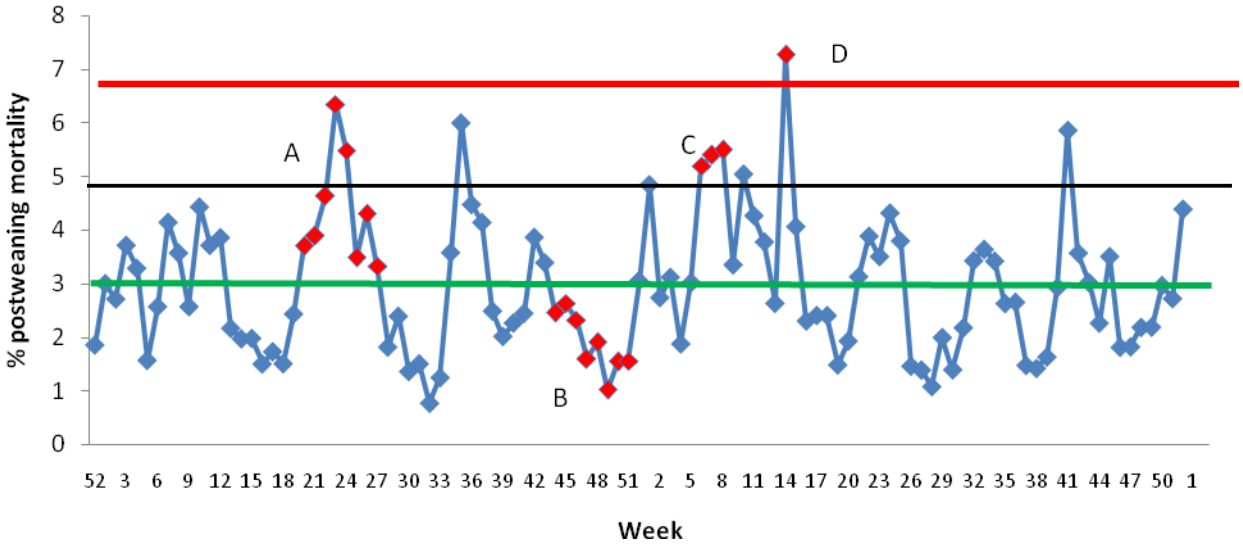
If any treatment fails to show a response consult with the manager immediately
If the pig shows any other condition consult the manager

Example: AI Boar Health, Vaccines and Routine Treatments

Routine Preventative Medicine	
Vaccinations	
Erysipelas	
Boars upon arrival to isolation	2 ml injection of Erysipelas using a 19 gauge 1" needle subcutaneously in the neck
All other boars on the 1 July and 3 January	2 ml injection of Erysipelas using a 19 gauge 1" needle subcutaneously in the neck
Leptospirosis prevention as required by EU directive 90/429/90	
	All boars days and days post-arrival to received 25 mg dihydrostreptomycin per kg body weight given using a 16 gauge 1.5" needle intramuscularly in the neck
	All boars twice yearly
Blood Tests as required by EU directive 90/429/90	
Pre-entry	Brucella CFT; Aujeszky's; Classical Swine Fever; Tuberculosis
At Stud	Brucella SAT, and CFT; Aujeszky's
Exit	Brucella CFT; Aujeszky's; Classical Swine Fever
Boar 1st line treatments	
All boars which are unwell must be reported to the stud manager, Unit Veterinary Surgeon and recorded on the individual boar record cards	
Lameness	
Without swelling	1st day Ketofen 1g in feed. Rest for one week. Continue with Ketofen each day for 3 days. An unlicenced alternative is asprin. Reassess after this time.
With swelling/infection	LincocinÊ injection using 1 ml per 10 kg (approximate dose 20-25 ml) for three days using a 16 gauge 1.5" needle by intramuscular injection into the neck. Reassess at end of treatment period. It is possible to treat with LincocinÊ tablets to avoid the stress of injecting.
Scour	Withdraw feed for 24 hours. Ensure water supply adequate. Reassess the next day
Coughing	Seek advise immediately from Unit Veterinary Surgeon
Blood from penis	Seek advise immediately from Unit Veterinary Surgeon
Pus in semen sample	Keep sample and seek advise immediately from Unit Veterinary Surgeon
Reason for concern	
	A boar with a high temperature can be infertile for 6 weeks

Statistical Process Control on Pig Farms

To make an assessment of events on a farm, it is possible to use statistical process control. For example, post-weaning mortality over time.



Mean/centre line ï green line. Upper control limit ï red line. Midline ï black line.

Method

1. It is important to have 20 points to establish your control lines
2. Determine the mean (centre line)
3. Determine control limits ï 3 standards deviations from the mean ï upper and lower
4. Determine midline between mean and upper control limit

In the example above
Mean calculated to be **3.0**
The standard deviation is 1.3. Therefore **upper control limit** is 3+(3*1.3) = **6.9. Lower** is 3-(3*1.3) = **-0.9**
The **midline** between upper control limit and mean is ((6.9-3)/2)+3 = **4.95**

There are three rules to determine if the system process is "out of control".

1. A single point outside control limits
2. Three out of four consecutive points closer to the control limit than to the centre line
3. Eight or more successive points on one side of the centre line

Using the example above the system was out of control at four incidences
A = Eight or more successive points on one side of the centre line
B = Eight or more successive points on one side of the centre line ï even through below
C = Three out of four consecutive points above the midline
D = A single point outside control limits ï more than 3sd away from the mean
The other fluctuations are within ñnormalò variation.

To explain the pattern

Normal variation is explained by ñCommon causesò ï associated with inherent random variation
Variation outside the control limits is ñSpecial causesò ï sporadic, unstable and unpredictable ï a tornado or absence of personnel for example.

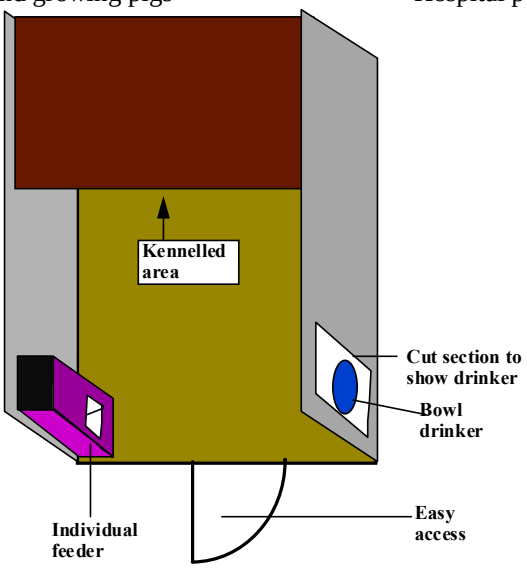
Care of the compromised pig

Design of a Hospital Pen

1	Deep dry straw bedding covering a non-slip, insulated concrete floor
2	Good draught free ventilation. The provision of a kenneled area should be available
3	Provide an individual feeder, which is hand filled twice daily. There should never be a lot of food in the feeders so that in-feed medication is possible
4	Provide a bowl drinker which is set at 30 cm above the ground for 20 kg pigs or more. This drinker should be fed from a separate header tank to enable easy medication if necessary
5	Easy entry and exit points which do not necessitate lifting of the animal over steps
6	Pigs in this pen should be examined a minimum of twice daily and the hospital pen records should be completed
7	All hospital pen pigs should be tagged and treated as individuals on entry
8	Pigs in the sick pen may need a companion
9	Each hospital pen should be of adequate size to hold up to ten pigs

Hospital pen for nursery and growing pigs

Hospital pen for adults

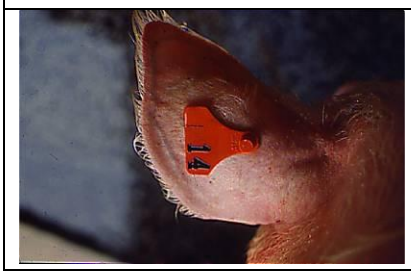


Hospital Pen Records

Date Started	Animal Number	Disease condition	Treatment	Response days after start X = still sick √ = recovered													
				1	2	3	4	5	6	7	8	9	10	11	12	13	14

Compromised pig pen from straw bales

There are times when it is required to provide emergency hospital care.
In many places it is possible to provide hospital accommodation outside. The following gives an illustration of one such accommodation built between two finishing sheds.
Straw based hospital pens will provide adequate protection from 0-40°C.

<table>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>General view of hospital area ï walls constructed from straw bales with a simple gate at one end.
Floor space 1.4 m^2 per pig. One bowl drinker per 20 pigs. Use high quality feed.</td><td>Hiding area
Shade cloth is used to provide a lying area and protection from the sun. Sick and compromised pigs like to hide.</td><td>Good water supply
Ideally in a trough or bowls as shown. Avoid nipples as these are more difficult for weak pigs. Dehydration is a common cause of death in compromised pigs.</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Wallow
If the climate is very hot, even newly weaned pigs will appreciate a shallow wallow.</td><td>Bedding comfort
Sick and compromised pigs like to hide and burrow into straw. In the hot parts of the day, under the straw can be cooling.</td><td>Feeders
Feed little and often. This way the feed is as fresh as possible and rapid changes to the feed can be made</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Pig identity
Do not lose the pig in the system ï record the original pen number and date of entry into the hospital area.</td><td>Good records
Record all pig entry and exit. Pigs should be marketed at the first possible weight. If the pig does not recover adopt a 7 and 14 day review programme. Euthanasia may be the best option for sick pigs which fail to rapidly recover</td><td>Proper care and attention
Ensure that all the animals are checked at least 3 times a day and receive medication where appropriate. The water and feeding system should be capable of being an easy medication route when required.</td></tr>
</table>

Health Alarm List

The vet should be notified as soon as possible if any of the following signs are seen by a member of the unit staff and verified by the manager

This aims to reduce any time delay between an outbreak and effective treatment

Any Age Group	
	The development of lameness in pens or groups of pigs
	Blisters on the snout or excessive salivation in pens or groups of pigs
Sows	
	Four or more sows off their feed with an elevated temperature
	Four or more sows breathing rapidly and with obvious respiratory distress
	Four or more sows aborting within seven days
Suckling herd	
	A noticeable rise in pre-weaning mortality over a two week period
Growing-finishing herd	
	A noticeable rise in post-weaning mortality over a two week period
	Scour spreading through any age of pigs, particularly if containing blood
	A marked rise in the number and severity of pigs coughing or with laboured breathing
	Three or more unexpected deaths in one day

What to do with Compromised Pigs

To send to slaughter all growing/finishing pigs must be over 60 kg in weight and have a body condition score of 3 or greater, if less than condition score 3 treat or destroy
All pigs hospitalised must be identified with a numbered ear tag.
All medication withdrawal periods must be complied with.

Condition	Extent	Immediate action	Action after x days
Lameness	Unable to use back legs	**Destroy**	
	Infected joints with soft pus filled abscess	Treat or **destroy**	**7 days no improvement destroy**
	Multiple joints infected	**Destroy**	
	Single infected joint with non-discharging abscess less than golf ball size and able to walk unassisted	Treat as necessary	Send to slaughter as soon as possible
	Cannot walk with all four feet on ground	Treat or destroy in hospital pen	**7 days no improvement destroy**
	Fractured bone	**Destroy**	
	 Broken leg	 Swollen joint	 Broken back
Hock sores	Less than 3 cm and walking without lameness	Keep on deep straw in hospital pen	If healed <14 days send to slaughter as soon as possible **No improvement destroy**
Bush foot but not lame	One joint only. No discharge and no swelling up leg	Treat as necessary	When the pig goes to slaughter send in separate pen
	 Hock sores	 Bush foot	
Tail bitten	Abscessed	**Destroy**	
	Base of spine exposed	**Destroy**	
	Tail bitten and lame	**Destroy**	
	Infected with no abscesses	Treat in hospital pen	If healed within 14 days retain separate until slaughter
	Fresh with no infection	Treat in hospital pen	Send to slaughter as soon as possible
	 Tail bitten severe	 Tail bitten and lame	 Fresh no infection

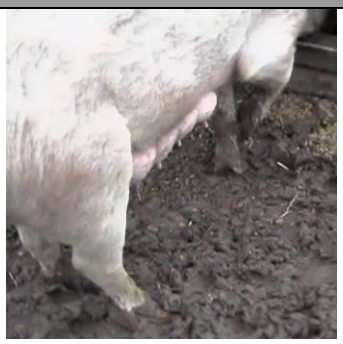
Condition	Extent	Immediate action	Action after x days
Open wounds	Cuts of any type	Treat in hospital pen	When healed send to slaughter as soon as possible
	Grazes less than 6 cm	Treat if necessary	Send to slaughter as soon as possible
Cut = damage through whole skin. Graze = surface skin damage only			
Flank bites	Greater than 6 cm or infected	Treat in hospital pen	Once healed send to slaughter as soon as possible
	Fresh. No infection less than 6 cm and superficial.	Treat if necessary	Send to slaughter as soon as possible
	 Open wounds	 Flank biting	 Beaten up pig
Beaten up pigs	Numerous fight marks	Treat in hospital pen individually	**Sick for more than 3 days destroy**
Ear haematoma	Large and any infection and swelling	Treat in hospital pen	Leave a week, then if necessary lance and when healed send to slaughter as soon as possible
Crumpled ear	Healed and no infection	No treatment necessary	Send on normal load
Middle ear infection	Can walk unaided	Treat as necessary	Send to slaughter as soon as possible
	Cannot walk unaided	**Destroy**	
	 Ear haematoma	 Ear crumpled	 Middle ear
Ruptures Hernias	Belly, scrotal or groin rupture and 9 cm clear of ground with no damage or infection	No effective treatment possible	Send to slaughter as soon as possible
	Pedunculated rupture with no damage or infection	No effective treatment possible	Send to slaughter as soon as possible, separate on the truck
	Rupture in contact with ground, with skin damage or infected	**Destroy**	
		**Any pig with a hernia that is bigger than 30 cm should be destroyed.** Send pigs with large hernias to the cutter market at 70 kg rather than trying to get them to bacon weights	

Condition	Extent	Immediate action	Action after x days
Rectal prolapse	Fresh, no smell, no bigger than 15 cm	Send to slaughter as soon as possible	Or stitch in and send to slaughter as soon as possible
	Larger than 15 cm	**Destroy**	
Rectal stricture	Any type	**Destroy**	
Pneumonia	Walking but off food	Treat in pen	24 hours no improvement move to hospital pen. **No response to treatment for 7 days destroy**
	 Rectal prolapse	 Rectal stricture	 Pneumonic
Thin pig	With or without scour	Treat in hospital pen	If no response clinically within 7 days and **no visible improvement within 14 days destroy**
PMWS		Treat in hospital pen	If no response clinically within 7 days and **no visible improvement within 14 days destroy**
PDNS		Treat in hospital pen	**If no response within 7 days destroy**
Kinky back or other abnormality	Visibly deformed and affects ability to slaughter pig	Mark in the pen	Discuss with veterinarian
	 Thin pig	 PDNS	 Kinky back
All pigs, which present with a condition that makes them unlikely to be slaughtered for human consumption should be destroyed as soon as this decision is reached.			
It is essential that the appropriate therapy is used for each condition and that all pigs are slaughtered after the relevant withdrawal period has elapsed.			

What to do with Compromised Adults

To send to slaughter all adults must have a body condition score of 2 or greater, if less than condition score 2 treat or destroy.
All adults hospitalised must be identified with a numbered ear tag

<table>
<tr><th>Condition</th><th>Extent</th><th>Immediate action</th><th>Action after x days</th></tr>
<tr><td rowspan="6">Prolapses</td><td>Uterine</td><td colspan="2">Immediate treatment or Destroy</td></tr>
<tr><td rowspan="2">Vagina</td><td>Immediate casualty slaughter</td><td></td></tr>
<tr><td>Treat if found fresh</td><td>Sell as soon as possible. If re-prolapses destroy</td></tr>
<tr><td rowspan="2">Rectum</td><td>Immediate casualty slaughter if not excessive</td><td></td></tr>
<tr><td>Treat if found fresh and undamaged</td><td>Sell as soon as possible. If re-prolapses immediate culling</td></tr>
<tr><td colspan="3"> 
Uterine prolapse
 
Rectal prolapse</td></tr>
<tr><td rowspan="4">Open wounds</td><td rowspan="2">Traumatic injuries, cuts and wounds</td><td>Severe - destroy</td><td></td></tr>
<tr><td>Not severe- treat</td><td>Sell when healed. If in doubt ask the vet</td></tr>
<tr><td>Shoulder sores and ulcerated hocks</td><td>Treat and move to bedded area.</td><td>Sell when healed</td></tr>
<tr><td colspan="3"> 
Traumatic injuries
 
Ulcerated granuloma
 
Shoulder sore</td></tr>
</table>

<table>
<tr><td rowspan="8">Lameness</td><td>Off back legs</td><td>Destroy</td><td></td></tr>
<tr><td rowspan="2">Acutely lame</td><td>Severe - destroy</td><td></td></tr>
<tr><td>Not severe - Treat</td><td>If still lame after 7 days destroy</td></tr>
<tr><td rowspan="3">Lame with no obvious cause</td><td>Severe - Destroy or treat</td><td>If still lame after 7 days Destroy</td></tr>
<tr><td>Not severe - treat in bedded area</td><td>If still lame after 7 days Destroy</td></tr>
<tr><td>Casualty slaughter as long as pig can bear weight on all 4 legs and is willing to walk unaided and without being forced</td><td></td></tr>
<tr><td colspan="3">  Off back legs  Acutely lame  Lame sow</td></tr>
<tr><td rowspan="3">Emaciated</td><td rowspan="2">Score 1, ribs visible</td><td>Destroy</td><td></td></tr>
<tr><td>Treat</td><td>Review after 7 and 14 days</td></tr>
<tr><td colspan="3">  Very thin sow</td></tr>
<tr><td rowspan="3">Dystocia</td><td rowspan="3">  </td><td>Treat</td><td>Review when farrowing finished</td></tr>
<tr><td>If live pigs are present</td><td>Use a Doppler pregnancy tester consider destruction and immediate hysterectomy</td></tr>
<tr><td>Destroy</td><td>Note do not send a sow with retained piglets for slaughter as it will be condemned</td></tr>
<tr><td colspan="4">All pigs, which present with a condition that makes them unlikely to be slaughtered for human consumption should be destroyed as soon as this decision is reached.</td></tr>
<tr><td colspan="4">It is essential that the appropriate therapy is used for each condition and that all pigs are slaughtered after the relevant withdrawal period has elapsed.</td></tr>
</table>

Reductions of Pathogens on a farm

Basic biosecurity
Managing all-in/all-out ï Pig Flow
Cleaning the room
Partial depopulation

Biosecurity for Swine Units

Biosecurity is the primary means of protecting the current health status of a farm. It should be clinically investigated at each herd health visit with the same thoroughness as any other part of the farm, for example the farrowing house.

Any breach in biosecurity is serious, but most likely breaches occur with:

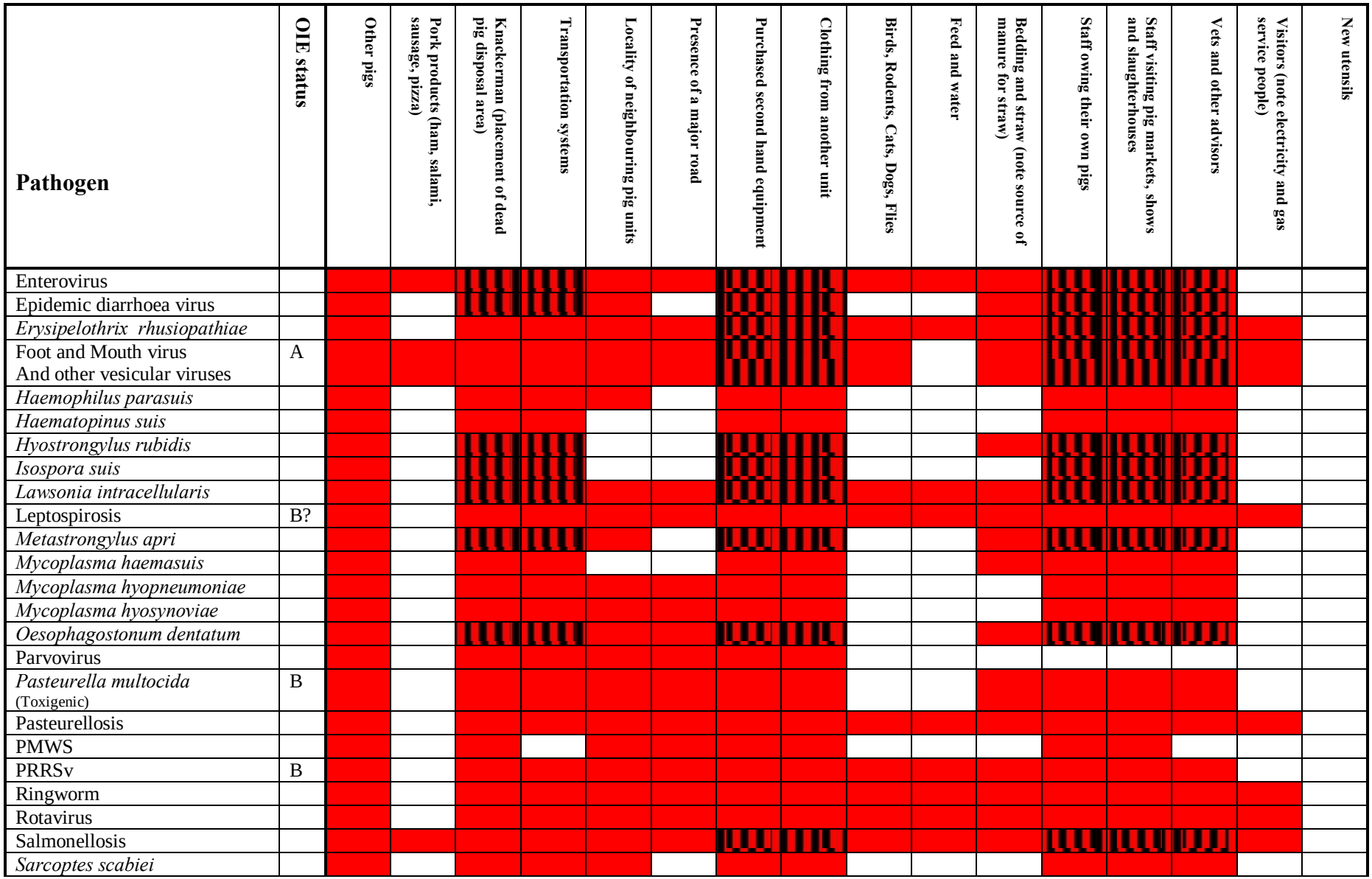
a) Introduction of new pigs ï either through animals (gilts or boars), genetics (AI), contact through feaces from vehicles or clothing, wild animal contact ï note Peccaries (Americas), Wild Boar (Europe and Asia) and Feral pigs (everywhere), or through pig meat products.

b) The location of a farm.

Possible transfer routes of the major Pathogens of the Pig

Where the pathogen movement is primarily through pig faecal movement this is shown by being hatched

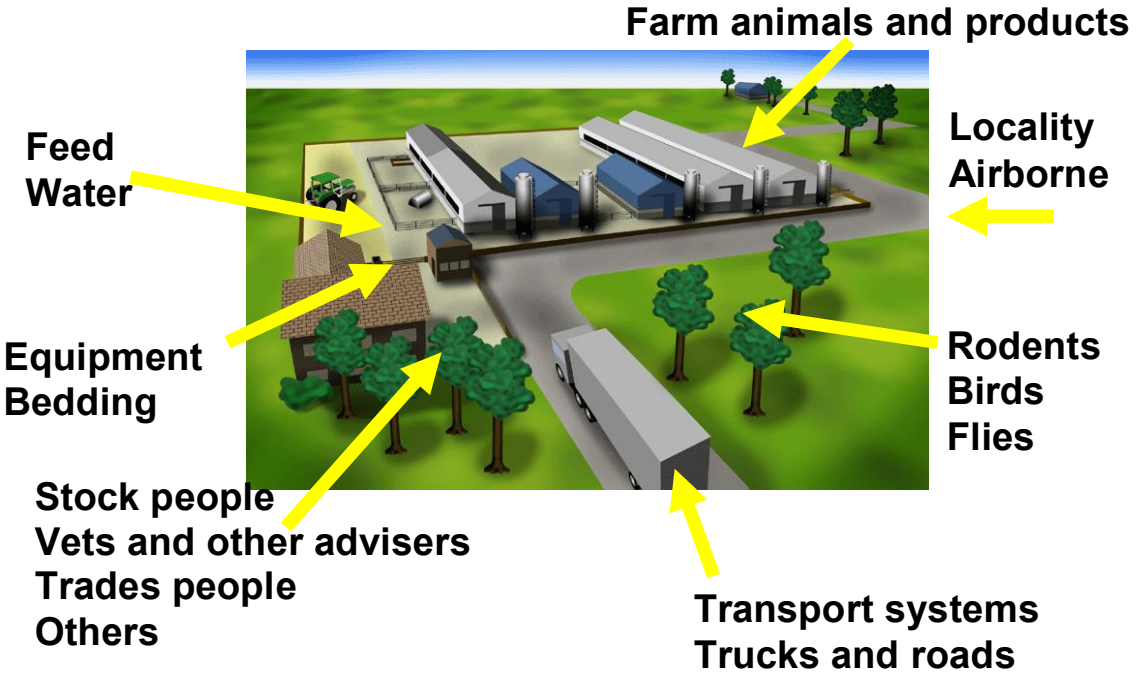
Pathogen	OIE status	Other pigs	Pork products (ham, salami, sausage, pizza)	Knackerman (placement of dead pig disposal area)	Transportation systems	Locality of neighbouring pig units	Presence of a major road	Purchased second hand equipment	Clothing from another unit	Birds, Rodents, Cats, Dogs, Flies	Feed and water	Bedding and straw (note source of manure for straw)	Staff owing their own pigs	Staff visiting pig markets, shows and slaughterhouses	Vets and other advisors	Visitors (note electricity and gas service people)	New utensils
Actinobaculum suis		■		■	■			■	■				■	■	■		
Actinobacillus suis		■			■												
Actinobacillus pleuropneumoniae		■			■												
African Swine Fever	A	■	■	■	■	■		■	■				■	■	■		
Arcanobacterium pyogenes		■		■	■			■	■	■		■	■	■	■	■	
Ascaris suum		■		■	■			■	■			■	■	■	■	■	
Aujeszkyôs Disease Pseudorabies	B	■		■	■	■	■	■	■	■			■	■	■	■	
Bordetella bronchiseptica		■		■	■	■		■	■	■		■	■	■	■	■	
Borrelia spiralis		■															
Brachyspira hyodysenteriae		■		■	■	■	■	■	■	■		■	■	■	■		
Brachyspira pilosicoli		■		■	■	■	■	■	■	■		■	■	■	■		
Brucella suis	B	■		■	■	■			■	■		■	■	■	■		
Classical Swine Fever	A	■	■	■	■			■	■	■		■	■	■	■	■	
Circovirus I and II		■		■		■		■	■								
Clostridium difficile		■		■	■	■		■	■			■	■	■	■		
Clostridium perfringens		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Congenital tremor virus?		■		■	■												
Cytomegalovirus		■		■	■			■	■				■	■	■		
E. coli cystitis		■		■	■			■	■				■	■	■		
E. coli diarrhoea		■	■	■	■	■	■	■	■				■	■	■		
E. coli bowel oedema F18 Ste2x		■		■	■			■	■				■	■	■		


Pathogen
OIE status
Other pigs
Pork products (ham, salami, sausage, pizza)
Knackerman (placement of dead pig disposal area)
Transportation systems
Locality of neighbouring pig units
Presence of a major road
Purchased second hand equipment
Clothing from another unit
Birds, Rodents, Cats, Dogs, Flies
Feed and water
Bedding and straw (note source of manure for straw)
Staff owing their own pigs
Staff visiting pig markets, shows and slaughterhouses
Vets and other advisors
Visitors (note electricity and gas service people)
New utensils
Enterovirus
Epidemic diarrhoea virus
Erysipelothrix rhusiopathiae
Foot and Mouth virus And other vesicular viruses
A
Haemophilus parasuis
Haematopinus suis
Hyostrongylus rubidis
Isospora suis
Lawsonia intracellularis
Leptospirosis
B?
Metastrongylus apri
Mycoplasma haemasuis
Mycoplasma hyopneumoniae
Mycoplasma hyosynoviae
Oesophagostonum dentatum
Parvovirus
Pasteurella multocida (Toxigenic)
B
Pasteurellosis
PMWS
PRRSv
B
Ringworm
Rotavirus
Salmonellosis
Sarcoptes scabiei

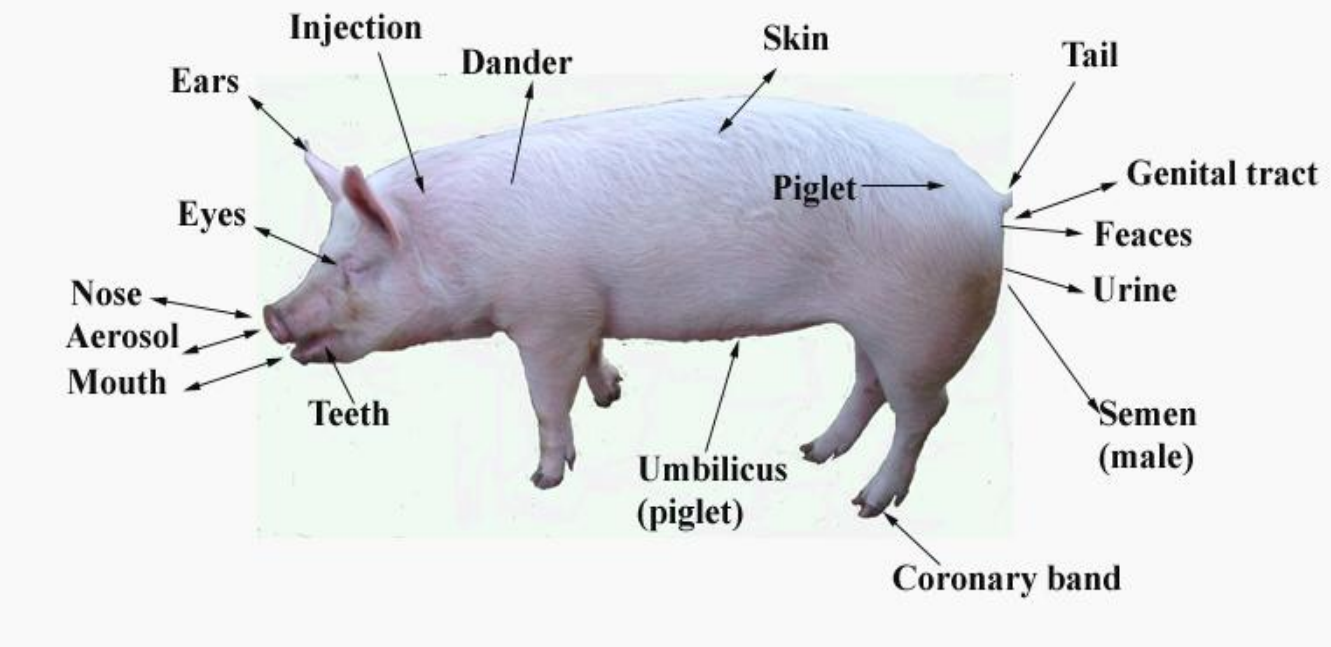
Pathogen	OIE status	Other pigs	Pork products (ham, salami, sausage, pizza)	Knackerman (placement of dead pig disposal area)	Transportation systems	Locality of neighbouring pig units	Presence of a major road	Purchased second hand equipment	Clothing from another unit	Birds, Rodents, Cats, Dogs, Flies	Feed and water	Bedding and straw (note source of manure for straw)	Staff owing their own pigs	Staff visiting pig markets, shows and slaughterhouses	Vets and other advisors	Visitors (note electricity and gas service people)	New utensils
Spirochaetal colitis																	
Staphylococcus hycius																	
Stephanurus dentatum																	
Streptococcus abscess																	
Streptococcus arthritis																	
Streptococcus suis joint ill																	
Streptococcus suis meningitis																	
Strongyloides ransomi																	
Swine Influenza virus																	
Swine pox virus																	
TGE	B																
Toxoplasma gondii																	
Trichonella spiralis																	
Trichuris suis																	

1. Threats to swine unit

How pathogens can enter a farm:



Movement of pathogens into and out of the pig:



The arrows indicate the direction in which organisms can enter and leave a pig

2. Detail of biosecurity to reduce threats to the unit

a. Animal Introduction

The introduction of animals, (gilts, boars, semen, embryos, meat, and wildlife) is the major method of disease spread and has to be given the greatest attention.

An isolation facility is essential on all units. Ideally it would be 50 metres away from other stock. However, with PRRSv control it has been demonstrated that the virus can transmit over 150 metres. A distance of over 150 metres is clearly impossible on several units in high pig dense areas. 500 metres between main unit and isolation is suggested when cleaning units up by segregated weaning.

An introduction program should be written for gilts and boars and strictly implemented. An example program is illustrated below:

Animal Introduction Program

On arrival	
First two weeks	
1	Ensure animals are separate from native pigs for two weeks
2	Ideally separate by 50 meters
3	Attempt to acclimatise the animals to the new environment. Initially attempt to simulate the original environment. Make changes gradually
4	Pay particular attention to: The cooling systems and water supply If possible have bagged feed from original farm or make attempts to match original feed. If pigs come from a straw based system, utilise straw or solid flooring before introducing to slatted systems
5	The animals may require antimicrobial or additional vaccine therapy following introduction. To introduce PRRSv negative gilts/boar into a PRRSv positive farm serious attempts must be made to introduce the gilts/boar to the circulating farm PRRSv viruses ï tonsilar scrapes and serum have been successful.
2nd to 4th week post introduction	
1	Introduce cull adult or grow/finish stock to the new arrivals. PRRSv is not effectively transmitted by cull animals. Ideally on farrow to finish farms, weaners about 25 kg are generally excreting the virus. Introduce faeces from the farrowing house and ideally newly weaned pigs into the gilt/boar pens.
2	Change over the environment to match local conditions
3	It may be necessary to medicate the pigs depending on how they respond to the new diseases
4th to 8th weeks post introduction	
	Remove grow/finish animals to allow the new pigs time to recover from any illness.
Introduce into the herd	

Record all signs of illness over the 8 week period

Artificial insemination is a very effective method of enhancing genetic transfer at minimal risk unfortunately there are still pathogens which can be transmitted through semen. On-farm AI collection is the only way to reduce/control this risk; the farm AI boars go through the same vigorous regime as incoming gilts.

Pathogens believed to be able to be transmitted in Boar Semen in medicated diluent (depending on antibiotic used)
Actinobaculum (Eubacterium) suis
Adenovirus
African Swine Fever virus
Aujeszky's Disease (Pseudorabies) virus
Brucella suis
Circovirus II
Classical Swine Fever virus (Hog Cholera)
Congenital tremor virus (not identified)
Cytomegalovirus
Enterovirus
Foot and Mouth Disease virus
Japanese encephalitis virus
Leptospires spp
Mycoplasma
Porcine Multisystemic Wasting Syndrome virus (pathogen not identified)
Porcine Parvovirus
Porcine Reproductive Respiratory Syndrome virus (PRRSv)
Reovirus
Swine Influenza virus
Swine vesicular disease virus
Transmissible genital papilloma virus
Raw semen contains large numbers of bacteria which include *E. coli*. streptococci, Klebsiella and Staphylococci spp, Citrobacter, Pseudomonas, Proteus, Micrococci, Corynebacterium, Serratia, Bacillus, Enterobacter, Acrobacter and Bordetella.

While many pathogens can be transmitted via boar semen, most of the above conditions are absent from countries or are controlled by units biosecurity or the addition of antibiotics to the diluent. AI remains one of the safest methods of gene transfer. PRRSv negative units should collect on-farm AI.

Considering purchasing an new animal

Before introducing any animal into the herd, it is essential to discuss the health of the source farm with the breeding company veterinarian. Suggested questions to ask would include:

BREEDING SOURCE AUDIT

The following questionnaire may be useful when it is necessary to either de-stock or change source of pigs.

Breed type required	Gilts	
	Boars	
	AI	
Audit Pigs number		
Number of breeding sows	Nucleus	
	Multiplication herd	
Availability		
Price		
Replacement price		
Continuity of source and alternatives with similar health status		
Ability to serve gilts and hold to point of farrowing		
List all vaccines used	Age of pig	Reason
In-feed antibiotics used	Age of pig	Reason

Multiplication Unit Comments

Number of sources for establishment and later added genetics		
Method of establishment of source pigs		
Method of introduction of new genetics	**AI**	
	Hysterectomy	
	Other	
How many years established?		
What new diseases have ever been diagnosed since establishment?		
List all vaccines used in the last 5 years		
Review all in-feed medication used, including growth promoters, in the last 5 years		
Brief review of barrier control		
Name of veterinarian. **Address of practice** **Tel, Fax, E.mail**		
Catalogue known diseases present.		

b. Basic Unit security

A set of rules regarding entry to the unit for animals and people is required. The rules illustrated would be for a high health unit. Your own rules may be more or less than these.

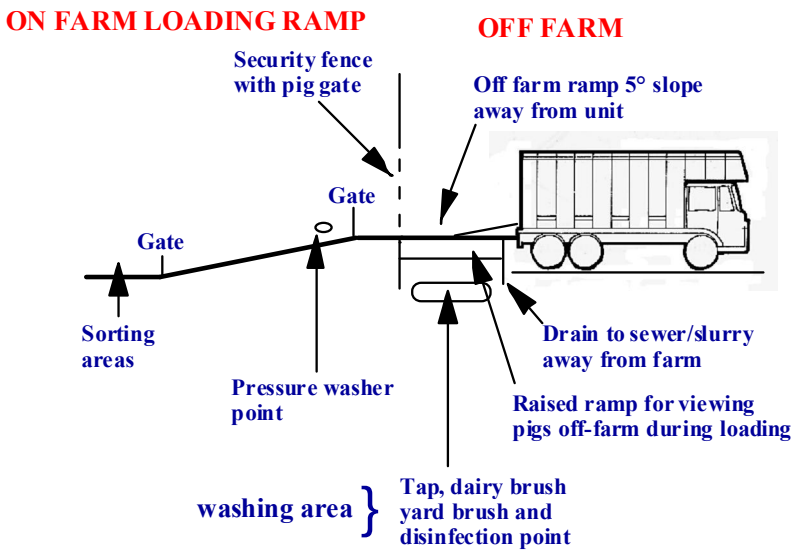
Advanced Unit Security

Basic Design

1	The unit must be surrounded by a complete fence
2	The fence should be 2.5 metres high and 0.5 metres deep to stop pigs and other mammals entering and leaving the unit
3	A car park should be sited away from the unit and appropriately marked
4	All entrances through the fence must be locked
6	All personal items including personal clothing, watches, cigarette lighters etc. must remain outside the entrance area
7	Spectacles, cameras and other visitor equipment must be inspected by a member of staff before being allowed onto the unit
8	All meters (electrical, gas and water) must be situated off-farm and placed in a locked area
9	The farm manager's office should be situated near the entrance
10	A horn switch should be placed by the car park to attract staff attention to visitors.
11	None of the staff should own or come into contact with other pigs
12	No staff should visit animal markets, pig shows or slaughterhouses
13	No unauthorised pigs, pig products or pig faecal material must be allowed onto the farm
14	Unit rules regarding last pig contact must be strictly adhered too
15	All entry and exit points should be well lit, ideally with proximity sensors
The following entrances/exits are permitted	
1	Entrance via a locked door into staff shower facility
2	Entrance via a locked door into a visitor shower facility
3	Connector to the feed bins which pass through the fence
4	Exit via a raised ramp for livestock
5	Exit for dead animal disposal through a locked gate
6	The straw barn has an entrance from off-farm and an entrance on-farm. Both should be kept locked. Staff are not allowed to leave the farm through the straw barn
7	Slurry disposal through underground pipe to slurry store off-farm

Animal Entry and exit rules

Unit security
Entry and Exit Procedures for Livestock



Loading ramp rules

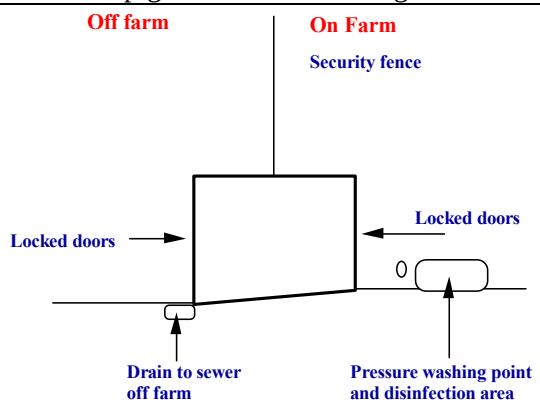
1	Trucks must have no pigs on board, must be clean, washed and disinfected
2	The off-farm disinfectant/washing area (see above) must be prepared prior to each loading by the unit staff, (wearing off-unit clothing) and then they must re-enter the farm
3	The truck driver must inform a member of staff using the horn upon arrival
4	The truck drivers must wash their hands and wear the over-boots provided and dip the boots in the disinfectant provided
5	The truck driver's name and vehicle number should be logged in the animal movement book
6	Farm staff must not cross the security fence line or the loading ramp
7	The loading ramp area must be thoroughly cleaned after loading each batch of pigs
8	The lorry driver must not enter the unit under the security fencing onto the on-farm ramp to assist the loading
9	All entry and exit points should be well lit, ideally with proximity sensors
10	The sorting area and on-farm loading area must be thoroughly cleaned and disinfected once the pigs have arrived or left

Disposal of dead stock

The collection of dead stock by rendering trucks can prove to be a serious risk to a farm, in particular negative farms. Ideally, composting of all dead stock should be encouraged.

To ensure that fallen stock is picked up safely an advice sheet is required. A suggested operating sheet is provided

Disposal of Dead Pigs

1	When a dead animal is identified this should be recorded
2	The farm manager should decide if a post-mortem examination is required
3	The animal should be removed from the house as soon as possible
4	The animal should be moved to the perimeter fence dead area
5	The dead pig area should be designed as below
	 
6	Once the dead pigs are removed by the rendering company the dead box should be pressure washed and disinfected
7	The dead box should be emptied at least once a week, twice in the summer months
8	Cover cuts and abrasions when handling sick or dead pigs
9	Always wash your hands after handling sick or dead pigs
10	The rendering truck must not have any other dead pigs in the truck prior to arrival. Only reputable rendering companies with properly constructed trucks should be utilised
Composting	
	Ideally, a composing system should be designed to cater for any dead animal. Well constructed, sows will totally compost in 3 months.

A dead pit

Composting pile

c. Locality of the pig unit

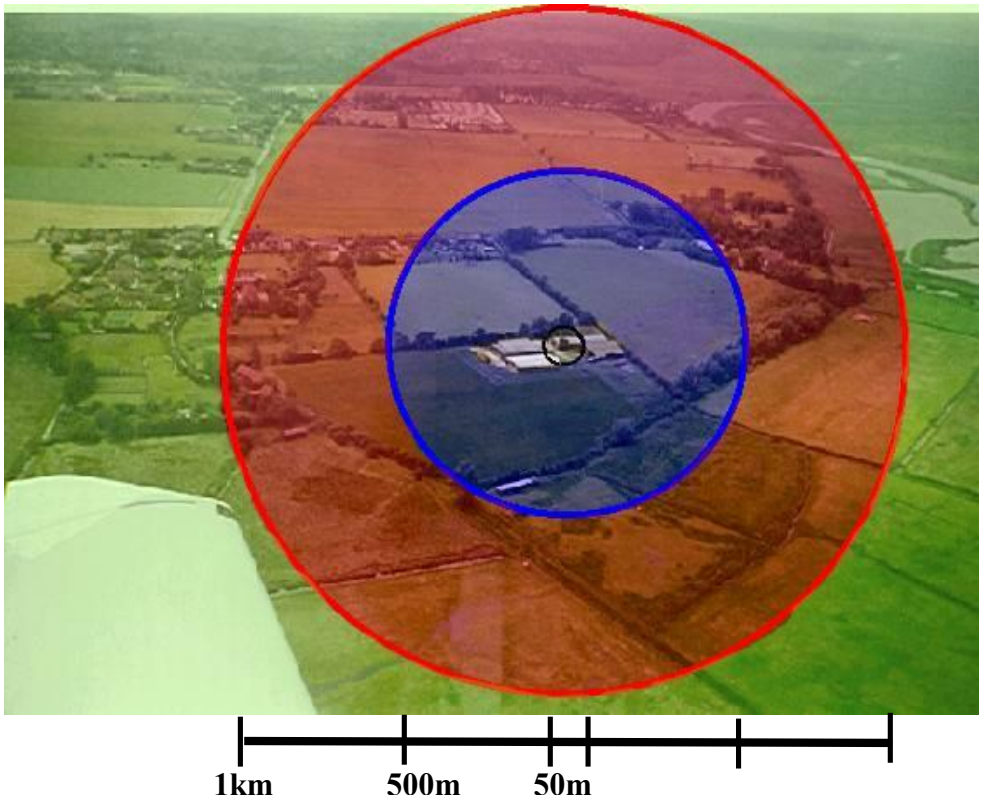
If a pig unit is placed next door to another unit, it is likely to share many of the same diseases. However, the question is "how far is safe?"

In truth there is no specific answer as it depends on the disease. Pleuropneumonia may be difficult to spread more than a few metres, Foot and Mouth Disease on the other hand may spread 100 km or more. Common-sense must prevail in the sitting of your farm and the isolation facility. Even the best placement of the farm can be compromised by the founding of a new farm.

A potential AI stud has its biosecurity review from the air. Google Earth is an excellent resource to assist local and regional biosecurity review

Possible distance spread from acutely infected unit	*Actinobacillus pleuropneumoniae*	Aujeszky's Disease (Pseudorabies)	*Brachyspira hyodysenteriae*	Brucellosis	Classical and African Swine Fever	*Escherichia coli (E. coli)*	Foot and Mouth Disease	*Lawsonia intracellularis*	Leptospirosis	*Mycoplasma hyopneumoniae*	*Pasteurella multocida*	PMWS (cause unknown ï best guess)	Parvovirus	PRRSv	Salmonellosis	*Sarcoptes scabiei* - Mange	Swine Influenza virus	TGE/PED
Less than 10 metres																		
10 to 50 metres																		
50 metres to 1 km																		
1 to 10 km																		
More than 10 km																		

The minimum expected spread from an acutely infected farm is highlighted in red



The movement of smoke from a farm fire.

Estimating distance a pathogen may spread is always difficult. Some pathogens like *Escherichia coli* and Salmonella are ubiquitous (everywhere). Other pathogens may be moved because they exist in wild animals and movement of the pathogen is dependent on these animals, *Lawsonia intracellularis* and Brucella are examples. Note all the pathogens can be spread by pigs, and therefore, the movement of feral pigs will transmit the pathogen over their range. In addition, pathogens that are faecal borne and environmentally resistant (which may be seasonal) can be transmitted over vast distances ï PRRSv for example when winter gets below 0•C, the pathogen will survive in frozen faeces carried on boots or vehicles, potentially over 100ös km. It is interesting, that pathogens like APP do not move far from the pig, and yet is present on almost all pig farms.

d. Equipment purchase

All equipment which is going to come into contact with the animals must be purchased new and without any previous contact with animals.

All equipment must look new on arrival and be clean otherwise entry to the farm must be refused. On no account must equipment be shared between farms.

e. Clothing from other units

Outer clothing from another farm is a serious disease threat and ideally all off-farm clothing should be removed prior to entering the farm. Disposable underwear for visitors greatly helps the practical implementation of these rules. Showering facilities ensure that off-farm clothing is removed prior to entry to the farm. Ensure that the footwear is removed before entering the showering facilities. It is essential that needles, syringes and medicines are not shared between units.

f. Birds, Rodents, Cats, Dogs, Flies

Control programmes must be written and implemented. Rodents are responsible for the transmission of many other pathogens and an example of rodent control is provided.

Rodent Control

1	Rodents do not like exposed situations. Remove all rubbish and overgrown vegetation from outside the buildings. Ideally all buildings should be surrounded by a 1 metre wide concrete walk-way. Keep weeds and grass short	
2	Ensure all bagged feed is stacked tidily on pallets off the floor and away from the walls	
3	Food must be stored in closed containers	
4	All spilt food under feed bins must be swept up and removed	
5	All rubbish must be placed in rodent proof containers	
6	Block all holes wherever possible. Wire mesh on windows must be 6 mm to keep out mice. Seal junctions between walls, floors and ceilings with metal sheeting	
7	Seal water cisterns and header tanks. Seal and remove obsolete plumbing	
8	Depending on the farm health status, cats and dogs are not to be used as rodent control as they are a health risk to the pigs i.e. Aujeszkyôs Disease and Toxoplasma	
9	Prepare a map of the farm and examine for evidence of rats. Examine at least 100 meters around the farm	
10	On the map mark out the position of the permanent baits and where clearance baits are to be placed Ensure all bait boxes are numbered	
11	Clearance baits	Check baits every week and continue baiting for one week after baits have stopped being taken
12	Permanent baits	Check baits every 2 weeks. If signs of feeding are found replenish the bait and re-survey the premises. Place baits in drain pipes placed at the base of straw
13	Burn all dead rodents found and all unused clearance bait boxes	
14	Prevent access to the bait by children and other animals	
15	Wear impervious gloves when handling dead rodents and baits	
16	Wash your hands thoroughly after handling baits or rodents	
17	Operator must be familiar with the safety rules for the rodenticide/baits being used	
18	Empty rodenticide/bait containers must not be re-used for any purpose	
19	In buildings which can be sealed, fumigation may be effective to reduce a serious infestation to controllable levels	

Flies and mosquitoes have been demonstrated to transmit PRRSv at least within a unit and possibly over short distances. However, mosquitoes may also travel more than several miles. They may be significant to the spread of PRRSv during the summer. When moving between units, ensure that your vehicle does not act as a ótransportô system for flies and mosquitoes.
Ensure the ventilation curtain does not create water pockets for mosquitoes to breed

g. Feed and Water

Feed and all feed ingredients must come from known sources and effective control of food borne diseases such as Salmonellosis implemented. Drinking water quality is important and the source should be routinely checked for possible contamination or mains water used. Feed trucks could act as a vehicle of spread particularly.

h. Bedding

Any bedding used on the farm must come from approved sources.

i. Staff

Staff should not have access to other pigs and no pig product including pizza, ham or salami sandwiches for instance, should ever come onto the unit. Showering is not an absolute requirement a minimum should be a change of outer clothing and boots This can be made easier by the use of different coloured boots and overalls.

j. Other Visitors

Various farms impose rules regarding down time from other pigs prior to entry to the unit. Visitors, including vets, and other advisors, are a minimal risk to the farm, especially if they do not bring onto the unit their own clothing and only wear unit clothing. All necessary investigation equipment must be thoroughly cleaned and disinfected. Downtime has not been demonstrated as being significant in the control many pathogens. Contaminated needles and syringes that a vet may move from unit to unit would be a serious risk of spreading diseases such and must be stopped immediately.

Summary

Unit security is a major component of any farm. However, well thought-out practical and common-sense rules will ensure that the risk of disease introduction is minimal and controlled.

Biosecurity Check

Location of farm

General area number of farms

Too close to another farm

Is there a major road near farm?

Perimeter of farm

Fencing needs to be adequate right round the farm

Signs and adequate gating

Communication off farm to limit visitors

Visitor security

Visitor book

Shower and toilet facilities

Unit clothing

Boots

Electricity and gas meters

Internal biosecurity

Feed delivery from of farm ï do not allow feed wagons on farm

Feed storage ï bagged food should not be stored on the floor

Straw storage

Water storage

Manure storage/disposal

Rodent control, too much rubbish

Bird and fly control

Hospital pen location

Cleaning protocols -batching

Dead animal disposal

Knackerman

Isolation facilities and location

Loading facilities

Animal Truck

Animal Contact

Other pigs

Other livestock

Other animals

Medicine use

Disposal

Hygiene

Food products

Staff

Their own pigs

Visit other farms/markets/shows

Visiting Slaughterhouses

Managing all-in/all-out - Pig Flow

Sit with the owner, manager and farm staff to discuss farm records and areas of problems. Discuss the farmôs pig flow and pig flow model and how closely the farm is currently following the model. On new newly visited farms this may be a primary focus. Without an agreed pig flow model the farm will have variable pig production.

When managing the health of pigs there is only one piece of magic that veterinarianôs have in their tool box, that is all-in/all-out. The break provided by removing the animals, their faeces and fixing the building is essential to maximizing the health and well-being of the stock and managing their clinical diseases. All-in/all-out is more difficult than most farmers really realize and is impossible, (without cheating on the pigletôs age or having variability in numbers), without a well designed and implemented pig flow model.

There are two major misconceptions in pig farming, ① that all records are accurate and ② that averages are OK. There are only two records that can be trusted on a pig farm ï

a). The kg of pig meat paid for by the slaughterhouse (customer) and
b). The size of the farm ï either number of farrowing places, sq meters of finishing floor, number of drinkers etc.

Farms should not be compared by global output figures such as pigs per sow per year because they are largely meaningless. The farms producing the most pigs per sow per year are not necessarily the most profitable nor have the best cost structure or perhaps are the most welfare satisfactory. The annual kg of pig meat paid for is a vital number to obtain from the farm, (although generally more difficult than would be expected), as it provides an endpoint to setting targets. For example 100 pigs can be marketed at 114 kg live weight but if 7 are condemned; you will be short of 560 kg of pig meat paid for (assuming 80 kg deadweight carcase) but you still achieved your 26 pigs sold per sow per year.

Likewise the size of the farm is a truth, because as an advisor it is easily measured and verified.

Measuring the size of the farm

Using a tape measure

Using an ultrasound distance measure

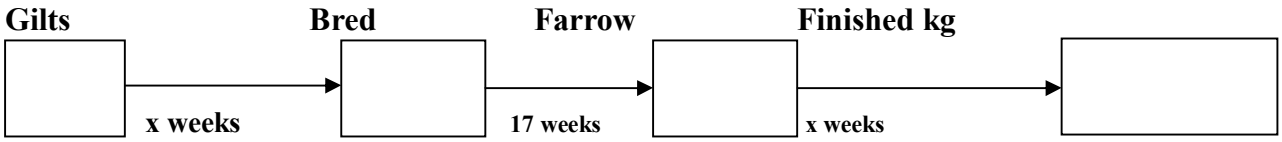
While ópig flowô is discussed by the farming community, the discussion concentrates on maximizing the output, not considering the whole farmôs efficiency. Examination of over 60 farms in the last 5 years would indicate farmers have no real idea how to achieve a consistent flow of pigs through their facilities. Farms generally farm by todayôs events and make do, rather than following any specific farm plan ï ñI mated her because she was in heatò can cause chaos to the pig flow.

The rule of pig flow should be:

Plan your farm and then
Farm you plan

As the basis of any farm health management visit, the veterinarian or advisor should initially discuss the farmôs output plan

In brief a pig flow model considers what would be the likely output target for a unit and is composed of four major areas:

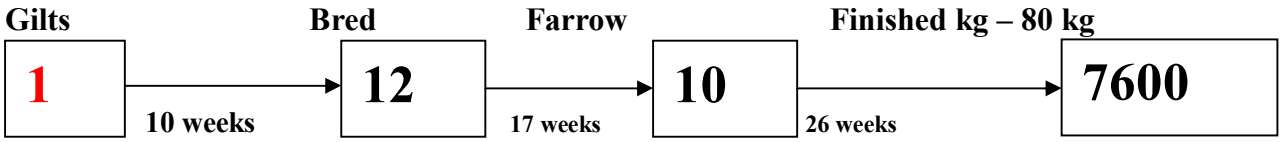


With specific records of:

Gilt pool 95 kg to service
Females a batch to serve
Sows a batch to farrow
kg to wean per batch
kg a batch to sell
kg paid for annually
pigs sold annually

Each of these areas needs to be in balance with each other to allow for the flow to occur. For example a farm farrowing 10 sows a week (about a 250 sow unit) would have an idealized pig flow model as described below

Pig flow model for a 10 sows a batch (week) to farrow farm:



With specific records of:

Gilt pool 95 kg to service	12-15
Females a batch to serve	12
Sows a batch to farrow	10
kg to wean per batch	800
kg a batch to sell	7600
kg paid for annually	395200
pigs sold annually	4940

There are some targets that have to be met:

The farm weans weekly;
The ninety percentile farrowing rate is 82% (the farrowing rate is over 82% ninety percent of the time;
10 piglets weaned per crate with an average weight of 8 kg at 24 days of age;
A 5% post-weaning mortality, therefore 95 pigs at 80 kg dead weight are paid for each week.
The gilts are given 10 weeks introduction to allow for adequate compliance with biosecurity arrangements.
In addition to take finishing pigs to 80 kg dead weight, requires 26-27 weeks.

When planning a pig flow model the basic parameters to use are the unobstructed pig space. It would be most satisfactory to start at the finishing barn; the reality is that the farrowing house is a useful fulcrum from which to build a pig flow discussion.

Setting up a pig flow model

The following questions could be used to start the pig flow investigation:
How many farrowing places are there?
How many rooms are there?
How many farrowing places are there in each room?

A simple example using 24 day weaning – 5 week turn round for the room

A simple example would be:

How many farrowing places are there?	125
How many rooms are there?	9
How many farrowing places are there in each room?	5 rooms of 15, 5 rooms of 10 and one room of 25

Layout of the farrowing rooms:

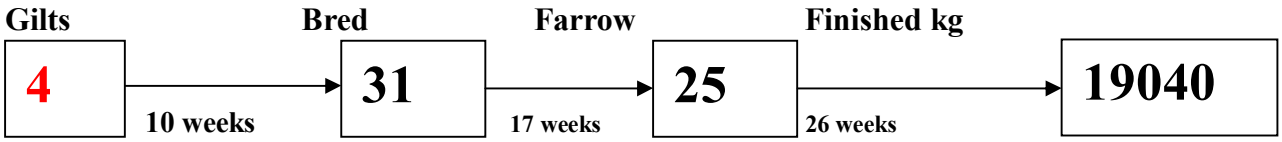
15	15	15	15	15	10	10	10	10	10	25

Normally it is concerning that the number of rooms is not divisible by 5 as this may indicate all-in/all-out is impossible. However, in this case; the pig flow model would easily work with an output of 25 sows farrowing per week. To achieve all-in/all-out and no variability in output per week the rooms are organized into groupings of:

Batching of rooms to achieve all-in/all-out:

15+10	15+10	15+10	15+10	25

The pig flow model would be (taking similar target parameters as before)



With specific records of:

Gilt pool 95 kg to service	35-45
Females a batch to serve	31
Sows a batch to farrow	25
kg to wean per batch	2000 (10 piglets x 8kg x 25 crates)
kg a batch to sell	19040 (95% of 250 x 80kg dead weight)
kg paid for annually	990080
pigs sold annually	12376

A slightly more complex example:
An example using 24 day weaning ï 5 week turn round for the room
A simple example would be:

How many farrowing places are there?	69
How many rooms are there?	7
How many farrowing places are there in each room?	2 rooms of 12, three rooms 6 and rooms of 8 and 9.

This is more typical of a family farm which grows and adds rooms and facilities. Again, there is great concern about the lack of multiples of 5 farrowing rooms for a 5 week rotation (24 days weaning), the distribution is chaotic.

Layout of the rooms:

8 9 12 6 6 6 12

The potential output target for the farrowing area would be 11.75 farrowing places per week, with 10 weaned this is 118 per week? While such figures are presented in various texts, this is clearly nonsense as pigs are whole animals. Eleven farrowing places a week would underutilize the rooms of 12 but be in great excess to the other three rooms.

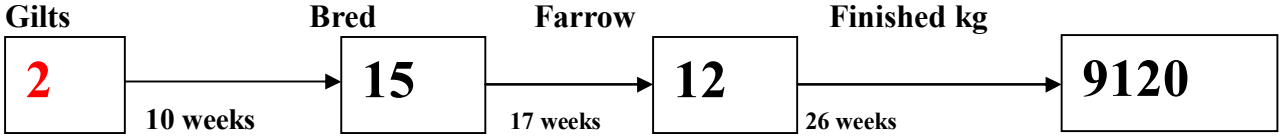
<u>The answer reached by the farm health team was:</u>
To add an extra farrowing place to the room of 9 and divide the room of 8 into a 2 and a 6 using a plywood wall. This allowed 5 rooms of 12.

Batching of rooms to achieve all-in/all-out:

6 + 6 2 + 9 + 1[new] 6+6 12 12

The farm now had all-in/all-out and a consistent flow.

The new pig flow model now looks like:



With specific records of:

Gilt pool 95 kg to service	15-20
Females a batch to serve	15
Sows a batch to farrow	12
kg to wean per batch	960 (10 piglets x 8kg x 12 crates)
kg a batch to sell	9120 (95% of 120 x 80kg dead weight)
kg paid for annually	474240
pigs sold annually	5928

This farm had never weaned over 9.6 and now weans 10-10.2 pigs per farrowing place and weaning weights have improved from 6.5 to 7.5 kg per pig at 24 days of age. Pre-weaning -diarrhoea plagued the farm before the changes and is now a rare event. Pre-weaning diarrhoea now mainly associated with poor door management and chilling.

Managing the pig flow, gilt pool, breeding numbers and the finishing floor

The farrowing house is generally the start of the calculation process; however, the ultimate output is determined by the finishing floor space. Historically this has been strictly true only in the broad sense. In reality the finishing floor has little impact, as farmers have forced whatever the output is onto and out off the finishing floor (eventually).

This can be illustrated using one classic example, 15 sows a week to farrow client phoned the practice concerned with a sharp increase in pneumonia and death in his finishing herd. The farm had recently moved from Large white cross to Meishan cross pigs. The sow output had increased from 9 (LWX) to 11.5 (MeiX) weaned per farrowing place. Therefore, while the farm worked with minimal pneumonic problems at 135 pigs per finishing room per week, the building/pig combination completely failed when 172 pigs (a 30% increase) were crammed into the rooms each week. It was not surprising that mycoplasma pneumonia and death exploded in the rooms. The farmer actually questioned whether the Meishan was more susceptible to pneumonia. The pigs did not get any more pneumonia (actually less) than the Large white cross finishing pigs when appropriately stocked.

With the trend towards recommended stocking rates table 3, the drive towards a controlled pig flow model to comply with slaughterhouse management requirements will be essential.

Table 3

Recommended US and Legal EU Stocking rate regulations

EU Legislation 91/630		Swine Care Manual (NPB 2003)			
Average Weight of pig kg	Minimum Space requirement m^2	Weight of pig		Suggested floor	
		lbs	kg	ft^2	m^2
Ò10 kg	0.15	12-30	5.5-13.6	1.7-2.5	0.16-0.23
Ò20 kg	0.20	30-60	13.6-27	3-4	0.27-0.37
Ò30 kg	0.30	60-100	27-45.5	5	0.46
Ò50 kg	0.40	100-150	45.5-68	6	0.56
Ò85 kg	0.55	150 to market	68 to market	8	0.74
Ò110 kg	0.65				
> 110 kg	1.00				
1 kg = 2.2 lbs	1 m^2 = 10.76sq feet	1lb = 0.454 kg		1 sq foot = 0.0929m^2	

For example, if the total finishing herd space for pigs from 30kg to slaughter (114kg) is 1038.7 m^2 to comply with the EU legislation 91/630 for fan ventilated fully slatted floors 0.65 m^2 should be provided for each pig when the average weight is between 85 and 110 kg, there is only room for 1598 finishing pigs on the farm. To finalize the computation, if there is a 17 week growth requirement from 30 kg to 114 kg (pig flow cannot accommodate summer and winter variations), 94 pigs per week can be marketed, with a 5% loss, 99 pigs a week will be weaned, therefore, a minimum of 10-11 sows a week will be required to farrow.

It is essential to ensure that the pigs are marketed to keep the groupsô average weight of below 110 kg, otherwise a severe space penalty is legally required (from 0.65 to 1 m^2).

The farmôs breeding records are summarized in table 4

Table 4. Summary of sixteen weeks worth of breeding records with results

Week	Number bred	Number farrowed	Number weaned
1	16	14	139
2	12	10	100
3	9	7	69
4	10	9	93
5	11	9	91
6	8	6	59
7	15	13	130
8	12	10	101
9	14	12	118
10	9	7	69
11	16	14	140
12	12	10	102
13	9	8	82
14	8	6	60
15	9	7	69
16	10	6	80
Averages	12 bred per week	83% farrowing rate	10 weaned/ sow

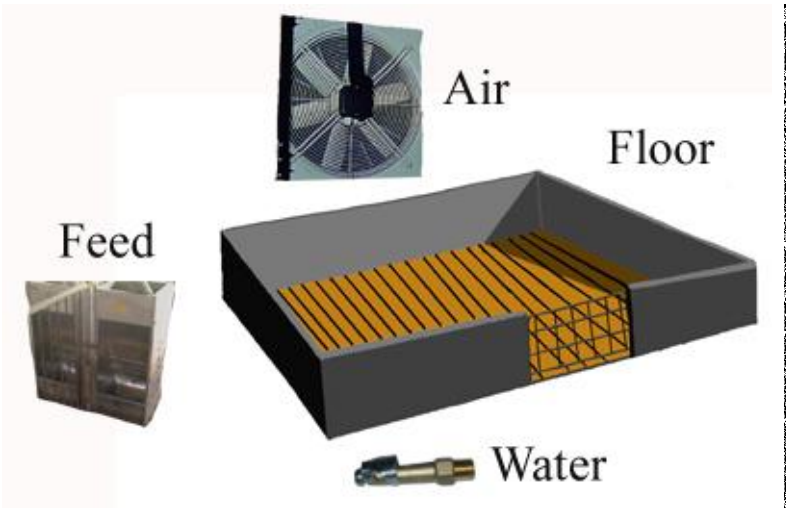
It is clear that the farm overstocked the nursery (let alone the finishing herd) in weeks, 1, 7, 9 and 11 ï 4/16 weeks ï some 25% of the time.
Worse, from a production aspect, and that chilling and more disease occurred in the pigs when the buildings were under-stocked associated with poor insulation, occurred in weeks 3, 4, 5, 6, 10, 13, 14, 15, 16 some 9/16 weeks ï 56% of the time!
The farm only had efficient pig flow for 3 weeks out of 16 - only 19% of the time.
When this farm changed over to a pig flow model (which took 18 months) with an accepted variance of 12-13 breed per week, this stabilized the output to around 100 per week. The farmôs performance changed, with a reduction in post-weaning mortality from 8 to 5% with the relative increase in output, growth improved from 200 days to finish 165 days and significantly, the medicine use in the finishing herd fell by 70%. There was one overriding component in achieving this measure of control on the farm ï the gilt pool - having sufficient gilts available each week.

Other potential flow realities

The current description of utilizing pig flow to manage health has concentrated on flooring space. However, any aspect of the building/pen design could act as the limiting factor to health and therefore, disease expression.

For example if the pigs have 29.6 m^2 of finishing floor, the feeders are 2 meters long, air ventilation is good, but there is only one drinker to provide water to the 40 sixty kg pigs remaining in the group. Either the group size should be reduced or the availability of water (purely for example) should be improved to say 3 drinkers or a different drinker used, to do nothing, will result in serious health issues ï typically respiratory based which will not be resolved by the use of antibiotics.

Many factors can affect the health maintenance of a group of pigs



Entry/exit age of the pig?
How many pigs per drinker?
How much feed space per pig?
How much floor space per pig?
How much air per pig?

All these calculations are needed to determine the maximum flow potential of a pen. Once calculated they are used in the pig flow model.

Pig flow assessments allow for the prescription of the pigôs environment, making it less stressful and easier to manage the pigôs health.

Other records

Once the pig flow model is in place, the other farm records become meaningful. Each key production parameter should have a target, which if not met needs an explanation. This can be a very useful guide to areas that may need more attention during the examination of the stock and buildings.

Use of Early Weaning to Reduce Pathogen Load

It is possible to reduce the number of pathogens and even eliminate some pathogens by the use of early weaning. This programme utilizes the colostral antibodies that are transferred from the mother to her offspring within 6 to 12 hours of birth. This method however, is fraught with potential risks:

A) The piglet may not consume any or sufficient colostrum
B) The colostrum may not contain sufficient or any antibodies to the desired pathogen
C) The sow may be sick and not produce sufficient colostrum

If the groups of piglets do consume sufficient antibodies from the colostrum, the following table provides a guide to the age of weaning required to ôensureô that the piglets can be weaned free of the pathogen. Note, rigorous testing and isolation procedures are also required to ensure that the whole programme is successful. Note the pigs need to be weaned before maternal antibodies have waned.

Week when most antibody lost	Agent
Week 1	*Escherichia coli*
Week 2	Transmissible Gastroenteritis Virus
Week 3	*Actinobacillus pleuropneumoniae.* *Brachyspira hyodysenteriae* *Haemophilus parasuis.* PRRSv
Week 4	*Pasteurella multocida* and *Bordetella bronchiseptica* (PAR)
Week 6-9	Aujeszky's Disease (Pseudorabies) Enterovirus *Mycoplasma hyopneumoniae* PCVII PRCV Respiratory Syncytial Virus Swine Influenza Virus
Week 12	Erysipelas
Week 24	Parvovirus

As a guide 14 days should be the oldest to wean pigs to achieve a segregated weaning programme.

Pressure Washing

Preparation	
1	Remove all the animals from the building
2	Ideally all feed should have been eaten by the previous occupants. Remove all feed by bag and remove from the room
3	Dismantle as many movable objects and remove from the room
4	Isolate all electrics. Ideally all electrics should be encased in a wooden box within the room. Comply with current Health and Safety Recommendations
Pre-cleaning	
1	Turn the water supply off that goes into the header tank
2	Remove end drinker and drain water supply
3	Remove accumulations of dirt from the header tank
4	Re-fit the end drinker. Re-fill the header tank with water and add disinfectant.
5	The dung channels should be drained and emptied. This should include all large faecal accumulations, tanks and gullies
6	All old or blistered paint work on animal housing, ie a crate or stall, should be smoothed down with a wire brush
7	Remove all cobwebs by brushing and all other material either into the slats or pick them up using a shovel
8	Repair any broken pieces of equipment/housing
9	Place a garden sprinkler in the centre of the room attached to an external water supply, close doors and soak room for 1 hour. Note any problem with the electrics etc that may arise. If soaking is not possible move to the next section
Cleaning of all removable objects	
1	All removed drinkers and feed troughs should be cleaned out thoroughly so that all food and faecal material are removed
2	All removed items should be soaked with water for 5 minutes
3	Spray detergent using low pressure washing (300 psi) or the foam gun application at a concentration of 2%
4	Allow detergent contact time of 30 minutes, do not allow surfaces to dry
5	Thoroughly wash down with a pressure washer at 500 psi,
6	All creep light fittings should be thoroughly cleaned. Beware that bulbs may blow if they are hot and water is splashed on them
7	Disinfect all utensils by soaking in disinfectant for 1 hour if possible, otherwise apply disinfectant using a knapsack sprayer or pressure washer at 300 psi
8	Allow all utensils time to thoroughly dry

Cleaning the room	
1	When the room is ready, spray with detergent using a low pressure washer (300 psi) or the foam gun application
2	Allow detergent contact time of 30 minutes, do not allow surfaces to dry
3	Pressure wash the house using a pressure washer set at 500 psi with a 45^{o} angle jet. Pressure washing is a very labour intensive job and particular effort must be made on all surfaces below pig height. However, surfaces above pig height must also be washed. Using steam washing can reduce the time of the operation.
4	Prior to entering the room with a pressure washer, ensure that the operator is properly trained and clothed. Wearing waterproofs, goggles and gloves and any additional equipment as required by health and safety. Electrically operated pressure washers should not be connected in the room to be washed.
5	Start at the apex of the room and work down the walls to the floor paying particular attention to corners and other areas where dirt accumulates. Caked soiling should be brushed if necessary to aid removal
6	If the slats can be easily raised wash the under-surface of the slats to ensure that faecal material does not remain underneath slats within reach of pigs' tongues.
7	Store pressure washer and equipment cleaned. Ensure that the washer is stored so that it is protected from frost during the winter months
Re-building the room	
1	Remove end drinker and drain water supply
2	Re-fit the end drinker. Refill the header tank with water and check that all the drinkers work
3	Allow the house to dry for 2 hours, then disinfect using disinfectant using a knapsack sprayer or a pressure washer at 300 psi with a 45^{o} spray head
4	Spray into the apex of the roof and work down the walls to the floors
5	Open up all the ventilation system and maximise air flow through the building for at least two hours to completely change the air in the building
6	Allow the room to dry completely, using additional heaters if necessary before pigs are placed in the room
7	Make sure that there are no residues of disinfectant around before re-housing pigs
8	Ensure room environment is satisfactory for the pigs before the pigs enter the room
9	Place a disinfectant foot bath outside the house filled with disinfectant

All-in/all-out needs good pig flow and must have even pig numbers between each batch. All-in/all-out is not only about pigs and floors, but also includes air, feed, water and medicine supplies

Partial Depopulation - the Basics

Day	Event
Pre-	Sort out yard accommodation for the finishers
	Purchase cosikennels or make nursery kennels
	Calculate pig flow requirements
0	Weaning day. Wean all pigs older than 21 days into off-site weaner accommodation
	Stockpeople working with adults and farrowing house are not to enter finishing accommodation
	All stockpeople working with adult and farrowing houses are to wear clean overalls and boots
0 - 4	Empty out grow/finish accommodation
1	Clean out fridge and all tops of bottles. Throw out all out of date medicines. Dispose of all used needles and syringes
4 - 24	Clean out buildings starting with weaner accommodation
7	Wean piglets into off-site weaner accommodation
	Move next weekôs farrowing sows into cleaned farrowing room
7 - 28	Repair buildings starting with weaner accommodation
10	Veterinary Check of cleaning programme
24	Wash all overalls and boots used by all personnel
	Start re-populating weaner accommodation
	Stockpeople cleaning finishing accommodation are not allowed into farrowing, adult sow or weaner accommodation
28	All buildings should be functional and ready to accept the pigs

Stockpeople who tend to the grow/finish pigs on the off-site farms are not allowed back onto the farm wearing the same clothes. A complete change of clothing is required to re-enter the farm, ideally after a shower

Pathogen Elimination from farms

Pathogens can become so destructive to the farm that the welfare of the pigs and the farmôs profitability become unviable. It will then be necessary to completely remove the pathogen. For some pathogens this is almost impossible ï *Bordetella bronchiseptica* or *Lawsonia intracellularis* would be examples. These pathogens exist in other common animals and therefore, when eliminated the farm rapidly becomes re-infected.

However, some of the most serious pathogens to pigs can be eliminated from farms, Classical Swine Fever (Hog Cholera), Foot and Mouth Disease and Aujeszkyôs (Pseudorabies) would be examples. This section discusses some techniques which may be used to eliminate various pathogens. The key to pathogen elimination is a thorough understanding of the epidemiology, physical characteristics and diagnostic capabilities of the specific pathogen. In addition, a pathogen is not necessarily eliminated for a farm just because you cannot detect it in the laboratory.

Also note, you cannot eliminate ódiseaseô ï only specific pathogens. This is why a term like óhigh healthô is meaningless.

Possible Elimination methods of the major Pathogens of the Pig

A hatched block indicates it is only sometimes possible

Pathogen	OIE status	Depopulation and repopulation	Hysterectomy and move piglets to a new farm	Direct pathogen exposure	Vaccination	Segregated early weaning	Partial depopulation	Test and remove	Herd closure	Medication programmes
Actinobaculum suis										
Actinobacillus suis										
Actinobacillus pleuropneumoniae		■				■				
African Swine Fever	A	■								
Arcanobacterium pyogenes										
Ascaris suum			■							
Aujeszkyôs Disease Pseudorabies	B	■	▨		■			■		
Bordetella bronchiseptica										
Borrelia spiralis										
Brachyspira hyodysenteriae		■	■							▨
Brachyspira pilosicoli		■	■							
Brucella suis	B	■								
Classical Swine Fever	A	■								
Circovirus I and II										
Clostridium difficile										
Clostridium perfringens										
Congenital tremor virus?									■	
Cytomegalovirus										
E. coli cystitis										
E. coli diarrhoea										
E. coli bowel oedema F18 Ste2x										

Pathogen	OIE status	Depopulation and repopulation	Hysterectomy and move piglets to a new farm	Direct pathogen exposure	Vaccination	Segregated early weaning	Partial depopulation	Test and remove	Herd closure	Medication programmes
Enterovirus										
Epidemic diarrhoea virus										
Erysipelothrix rhusiopathiae										
Foot and Mouth virus And other vesicular viruses	A									
Haemophilus parasuis										
Haematopinus suis										
Hyostrongylus rubidis										
Isospora suis										
Lawsonia intracellularis										
Leptospirosis	B?									
Leptospira pomona										
Metastrongylus apri										
Mycoplasma haemasuis										
Mycoplasma hyopneumoniae										
Mycoplasma hyosynoviae										
Oesophagostonum dentatum										
Parvovirus										
Pasteurella multocida (Toxigenic)	B									
Pasteurellosis										
PMWS										
PRRSv	B									
Ringworm										
Rotavirus										

Pathogen	OIE status	Depopulation and repopulation	Hysterectomy and move piglets to a new farm	Direct pathogen exposure	Vaccination	Segregated early weaning	Partial depopulation	Test and remove	Herd closure	Medication programmes
Salmonellosis										
Sarcoptes scabiei										
Spirochaetal colitis										
Staphylococcus hycius										
Stephanurus dentatum										
Streptococcus abscess										
Streptococcus arthritis										
Streptococcus suis joint ill										
Streptococcus suis meningitis										
Strongyloides ransomi										
Swine Influenza virus										
Swine pox virus										
TGE	B									
Toxoplasma gondii										
Trichonella spiralis										
Trichuris suis										

All elimination programmes hinge on the availability of negative pigs to purchase or that internal replacements will be negative

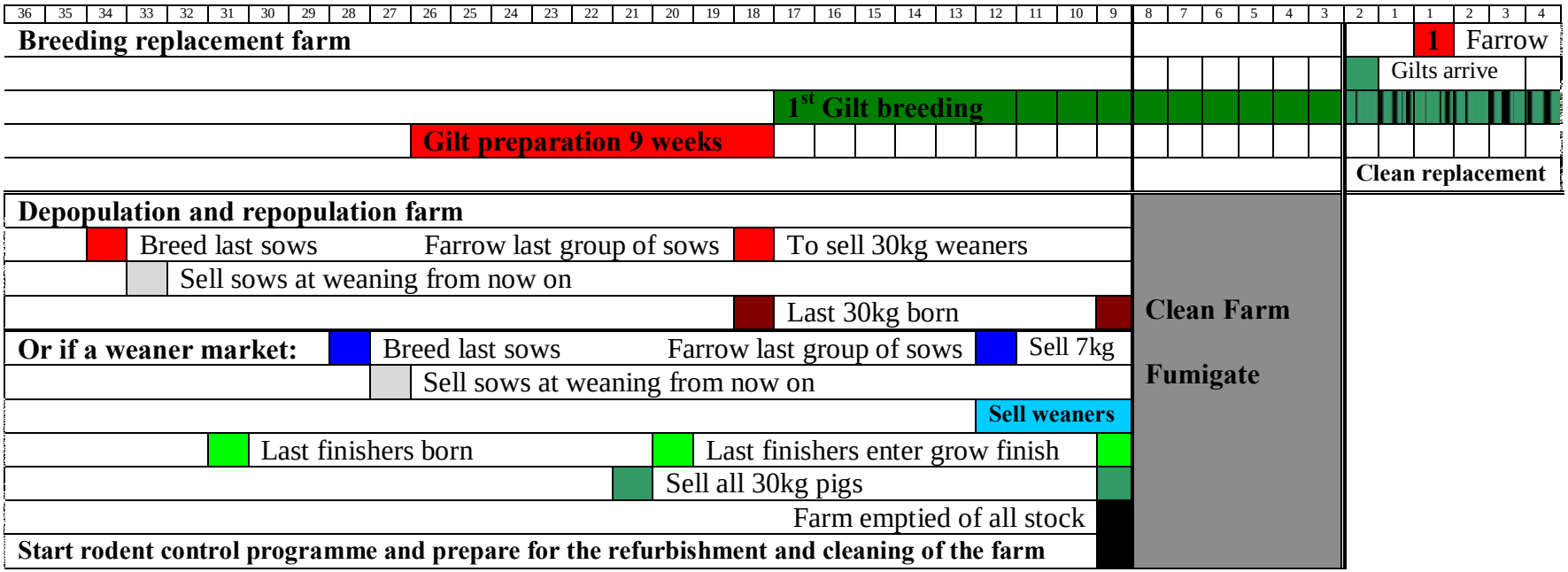
1	**Depopulation and Repopulation**
	Here all pigs, pig products and faecal contaminates must be removed from the farm, followed by fumigation and resting of the farm. The farm is then repopulated with animals negative to the pathogen.
2	**Hysterectomy and move piglets to a new farm**
	A sow at the point of farrowing is euthanased and her uterus removed and placed in disinfectant and carried 50 metres from the euthanasia point. Here the piglets are removed from the uterus and immediately placed in a warm box and taken from the area. None reproductive or systemic diseases can be eliminated – *Actinobacillus pleuropneumoniae*, *Mycoplasma hyopneumoniae* and *Sarcoptes scabiei* for examples.
3	**Direct pathogen exposure**
	All susceptible animals are exposed to the pathogen. The pathogen has no long term carrier status. The pathogen then dies out on the farm. New animals are negative to the pathogen. Enteric viruses ï TGE and PED are classic pathogens that may be controlled. PRRSv has been controlled by the method combined with herd closure.
4	**Vaccination**
	All susceptible animals are vaccinated. The pathogen then dies out on the farm. Generally it is important to identify vaccinated from wild/field pathogen infected animals. Aujeszkyôs (PRV) is controlled by vaccination, combined with test and remove.
5	**Segregated early weaning**
	Segregated early weaning utilising maternal colostrum antibodies possibly combined with medication has proved effective at eliminating several pathogens; *Mycoplasma hyopneumoniae* and PRRSv are examples. Toxigenic *Pasteurella multocida* may be eliminated but will need vaccination control and very early removal of the piglets. APP has been eliminated but requires pre-day 8 weaning of the piglets.
6	**Partial depopulation (Swiss Depop)**
	Partial depopulation is where the susceptible population is removed and the pathogen is removed from the remaining adult stock. *Mycoplasma hyopneumoniae* or PRRSv are examples.
7	**Test and remove**
	All infected animals are identified and removed before they spread the pathogen to remaining susceptible animals. This can be very difficult to achieve. Aujeszkyôs (PRV) combined with vaccination has been successfully eliminated. PRRSv has been eliminated by this method.
8	**Herd Closure**
	The pathogen dies out of the farm over time. Combined with vaccination and direct pathogen exposure, PRRSv and Swine Influenza have been eliminated by this method.
9	**Medication Programmes**
	The pathogen has to be susceptible to medication; viruses for example cannot be eliminated. *Sarcoptes scabiei* (Mange) and *Haematopinus suis* (Lice) can be eliminated by avomectins. Tilmicosin or tulathromycin has eliminated *Mycoplasma hyopneumoniae* especially when combined with segregated weaning and partial depopulation. Tiamulin may be effective in eliminating *Brachyspira hyodysenteriae* when combined with cleaning and partial depopulation.

Pathogen elimination through
Depopulation/Repopulation

Science points -	
	Negative stock is commercially available
	The pathogen does not exist naturally in the environment or locally common wild animals
	The pathogen can be eliminated from the contaminated building easily/quickly by routine cleaning
Standard downtimes	
	This depends on the diseases to be eliminated. For instance *with Brachyspira hyodysenteriae* (Swine Dysentery) it should be a minimum of 8 weeks
	For routine restock 6 weeks would be the suggested minimum
Depopulation	
	Depopulation means total removal of all pigs and their products from the farm for the downtime period
Depopulation procedures	
1	Rodent control should start and be vigorous. Place water near baits to encourage intake
2	Pig Flow ï calculate the required pig flow model to allow the farm to legally maximise its output. Aim where possible to achieve all-in/all-out in all parts of the farm, in particular the finishing area. Consider all possibilities including batch farrowing to achieve all-in/all-out
3	Obviously as animals are sold, buildings become empty and they are to be cleaned and repaired as they become empty
4	Run down all stocks of medicines, feed and disposables
5	It will probably be necessary to arrange stockperson schedules to ensure that ódirtyô stockpeople do not enter ócleaned buildingsô
Cleaning protocols	
1	Ensure Pressure Washing is carried out adequately
2	But also note in addition:
3	Pay particular attention to the removal of all faecal material. The building should be brushed down thoroughly and then dry cleaned using a knife and scrape to remove all visible faeces. The small amounts should be removed with a dustpan and brush. This has to be very thorough and on your hands and knees
4	Remove dust by vacuuming where possible
5	Areas of particular note ï pigs have long tongues
	Under and around gate posts and gates
	Corners at the back of pens
	Around fittings i.e. farrowing crates
	Under drinkers and troughs
	Where cracks and holes exit in the concrete
6	Repair all large cracks and holes in concrete by
	Cleaning out where possible
	Pouring in a suitable disinfectant
	Once dry repair by screeding over with concrete
7	All wooden partitions and removable objects should be soaked in disinfectant for a period of 3 to 5 days using metal baths. Place outside in sunlight to dry
8	Drain and clean the slurry channels and pits. Remove all available faeces. Sometimes this is impractical but it is essential to clean to 30 cm below the removable slats
9	Ideally lime wash all surfaces especially up to 2 metres in height and spray with a disinfectant using a knap sack sprayer into the ceiling and loft areas.
10	Ensure that the water supplies are adequately disinfected
11	Repair all equipment to the necessary standards

Water	Ensure adequate flow is obtainable from all drinkers. This may necessitate replacement of all pipelines. Ensure water pressure adequate around the system
Air	Ensure all ventilation system is thoroughly cleaned. All fans must be checked that they perform as required. Repaint all the blades. Check fan speeds with a tachometer and volt meter
Floor	All floors must be none abrasive. All sharp points are to be removed or covered. Note worn doorways, concrete under water points and around feeders, in particular wet feeding systems. All holes and cracks are to be repaired. Worn rough slats to be repaired or replaced
Feed	Ensure all feeders work as required. All old food needs to be thoroughly removed and sharp edges smoothed. Any holes repaired and if feederôs leak and cannot be repaired they must be thrown away. Feed is the major cost and any waste should be avoided
Vermin	Bird proof all buildings where possible ï future Salmonella controls
Cleaning protocols when farm empty	
	Ensure unit perimeter secure
	Finish cleaning the last building
	Dispose of all medicines, needles and syringes. This should include all medicines
	Remove all disposables from the farm, including all feed. Empty all feed hoppers and feed bins. Ideally all feed should have been eaten
Surfaces	Ensure all surfaces are cleaned. This must include the fridge, chemical store, feed stores, changing rooms and staff room
Midden area	Spread all the midden materials and lagoons and slurry store
	The soil within the proximity of the midden area has faeces still remaining from the old unit. Skin off this area to a depth of 80 cm. Spray the soil with a suitable disinfectant and then rescree over the 80 cm of soil
Straw and other bedding	Old straw remaining from the old unit should be moved and disposed off as this can harbour mice/rats from the old unit
Dogs and cats	Discuss dog and cat protocols. Treatment may be required depending on the diseases to be eradicated
Tractors	Ensure all tractors and equipment, in particular muck spreading and bob cats, are thoroughly cleaned and disinfected
	Burn all straw and used bedding
	Dispose of all brushes, shovels and scrapes
	Dispose of all overalls, boots and protective clothing
	Purchase clothing for the new clean unit
Farm clean protocols	
1	Pressure wash all buildings
2	Lime wash all buildings
3	Fumigate all buildings
4	Seal all buildings as each building becomes clean
5	Dispose of all clothing, boots and purchase new when whole farm finished
Once whole farm fumigated	
1	Restore water supplies and check all drinkers work. Note when water supplies cleaned deposits can block the drinkers
2	Ensure rodent controls are maintained particularly at the perimeter of the farm
New stock introduction and biosecurity protocols	
1	The new stock require isolation procedures
2	Note biosecurity requirements these obviously vary depending on the health of the incoming stock.

Depopulation and Repopulation Calendar of Events – Week (7 day) batch



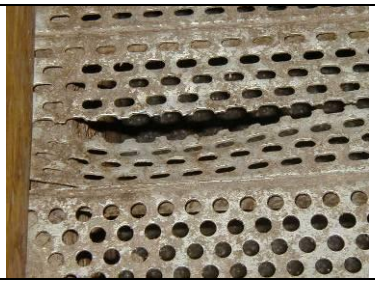
= gilts are bred only over a 7 day period (Friday to Thursday for example). It is essential to get the batches together
The batches of gilts mated in the hatched weeks are mated on the clean farm
Organise gilts using Regumate (Matrix)™ and possibly also use PG600 on the expected day of mating.

= The week of an event

The slaughterweight is assumed to be at 22 weeks of age
Weaners are at max 28 days of age

DEPOPULATION AND REPOPULATION PROBLEMS

The following are some examples how repopulations have encountered problems.

<table>
<tr><th colspan="3">Inadequate planning</th></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Pathogens not recognised ï Brachyspira hyodysenteriae is one example where failure to recognize its presence will result in too short a down-time</td><td>Unrealistic pathogen removal associated with pathogens in the same district too close to the farm. Note the location of the ñisolationò unit</td><td>The presence of wild pigs in the vicinity and poor fencing.</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>New stock are infected with pathogens ï mange can be an example</td><td>In adequate removal of previous stock dead animals</td><td>Inadequate review of surrounding wildlife</td></tr>
<tr><th colspan="3">Inadequate preparation</th></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Pipes and gates may contain feaces on the inside</td><td>Gates require to be fixed before cleaning. Note particularly under the gate</td><td>Inadequate repair of buildings ï holes in the walls and large cracks</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Destroy and remove all broken equipment</td><td>Electrics that are impossible to clean unless fixed</td><td>Poor farm security during and after cleaning</td></tr>
</table>

Greed

Keeping ñoldò medicines on the farm ï even unopened should be suspected

Keeping old equipment ï teething, tail dockers, iron injectors

Slap markers are a classic to remain on the farm

Keeping boots ï the favourite slippers for example.

Attempting to clean overalls

Keeping other equipment which has been in direct contact with the previous pigs

Inadequate cleaning

Examine cleaned area extremely carefully

Water unclean with feaces from previous groups

Examine floor for faeces ï ask the vet to check the building

Even small pieces of faeces need to be manually removed

Under the slatted floor can be extremely difficult to clean

Remember all areas where dirt can hide ï inside curtains for example

Cobwebs - manually clean especially when around electrics

Evidence of the previous pig farm may be clear ï an AI top

Old feed on farm in bags and in feed bins and pipelines.

Poor repair of farm facilities

Down pipes left unfixed are a rodent risk

Waterers which are leaking

Feeders with holes

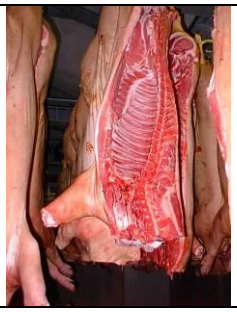
Floors which are worn ï especially under waterer and feeders

Ventilation systems broken ï blocked attic inlets for example

Insulation which requires replacement

Post-repopulation problems

Inadequate rodent and vermin control programmes



Biosecurity rules broken by stockpeople ï slaughterhouse visit

Introduction of pathogens remember pigs are the number on risk

Congenital tremor ï this can be a risk as new gilts are not introduced to ñfarm virusesò which are not removed

Mulberry Heart ï with the increased growth rate increase Vit E to the weaners

Slippery floors ï associated with the extremely good cleaning. Can result in damage to giltôs or weaned sowôs hips

		
In-adequate gilts numbers provided or selected	Poor selection of gilts associated with pressure of the ósaleô ï in particular check backs, legs and teats	Poor feeding control resulting in breeding of overweight or too young gilts
		
Over-optimistic gilt reproduction resulting in empty farrowing crates	Too many gilts bred, again resulting in poor pig flow ï poor weaners	Pre-weaning diarrhoea ï poor gilt immunology
		
Overweight/fat finishing pigs as growth rates are unexpected.	Careless breach of biosecurity - bringing pork products onto the farm	In the long term parity crashes with high stillborn rates etc associated with older sows that were retained with poor culling programmes.

Depopulation and subsequent repopulation can be a great success if the process if fully planned, orchestrated and then implemented.

The major reasons for problems are failing to set formal goals and then setting out to complete these goals. Remember that the repopulation is about gilts and if they are rushed the consequences are far reaching.

Coordinate the gilt growth, introduction, flow and future care with all members of the health team.

Finally, remember, not all ñpathogensò can be eliminated ï *Erysipelothrix rhusiopathiae;* some are brought rapidly back onto the farm ï *Bordetella bronchiseptica* and is some cases perhaps the organism should not be eliminated as its absence makes new stock introduction impossible and movement of the produced stock difficult ï *Haemophilus parasuis* for example.

Pathogen elimination through Hysterectomy and move piglets to a new farm Example - *Actinobacillus pleuropneumoniae* elimination

(It is possible to do with a hysterectomy – carefully prepared caesarean but requires detailed surgical care)

Science assumptions – re *Actinobacillus pleuropneumoniae*	
	The organism is not normally present on the skin
	The organism not normally present in the blood
	The organism is not passed through the placenta to the foetus
Sow Preparation Protocols	
	The sow should be presented at 112-114 days of gestation. The day before the hysterectomy, the sow should be washed without causing stress
Day before hysterectomy	
1	It is better not to try to stop the farrowing time, but sometimes it will necessary. Two compounds may be considered. Check that these compounds are legal.
	Progesterone: 300 mg intramuscular day before
	PlanipartÊ (clenbuterol): 10 ml (300 mg) intramuscular dose every 12 hours
2	Ensure that a foster mother is going to be available on the new farm
Preparation protocol	
1	The sow must not be in labour and giving birth. If any piglets have been born or there is placenta showing, the sow must not be moved off the unit
2	The sow should be gently driven to the site of hysterectomy
3	The truck, driver and support staff must stay at least 25 yards away from the piglet end of the hysterectomy
4	The driver and support staff must wear clean outer clothing on the day of the hysterectomy. Particular areas of concern are the wearing of clean boots and washed hands
5	The truck used to transport the sow should be cleaned and disinfected and not used to move pigs for 12 hours after cleaning and disinfection
6	The breeding company is to ensure all parties know that the hysterectomy is to be carried out the next morning
Hysterectomy site	
1	The hysterectomy site must be secure and discreet
2	The site should be arranged so that the piglet area and dam area are clearly separated by a minimum of 50 metres
3	No staff should move between the two sites at any time
4	After the hysterectomy has been completed all material must be removed and the site disinfected.
5	If the carcase remains at the hysterectomy site, it must be placed in a covered and/or purpose built dog proof building. The carcase must be removed within 24 hours of slaughter. The carcase must have been removed prior to another hysterectomy being carried out
PREPARATION FOR THE HYSTERECTOMY	
DAY PRIOR TO THE HYSTERECTOMY	
Stockpersons Responsibilities	
1	Prepare the bath, ensure that it is thoroughly cleaned and disinfected
2	Ensure the hysterectomy table is thoroughly clean
Within 15 minutes of the start of the hysterectomy	
1	The bath is to be filled to a water depth of 30 cm with hot tap water
2	Add suitable mild disinfectant to the water
3	Move the bath to the clean site of the hysterectomy
4	Have one additional bucket of warm clean water ready to clean post-slaughter
5	If the hysterectomy is not carried out within 25 minutes of filling the bath, then the bath should be refilled with water at the required temperature

Slaughter Procedure	
Three people are required; two stock people (stockperson 1 & 2) and one veterinarian	
1	The piglet area must be ready
2	The sow must be securely snared and restrained by stockperson 1
3	The veterinarian gives stockperson 2 the pithing rod and the knife
4	Both stockpeople must stand behind the veterinarian The veterinarian shots the sow using a captive bolt.
5	Immediately the veterinarian passes the discharged gun to stockperson 2 by the handle, keeping the gun pointing at the floor at all times.
6	The stockperson 2 passes the pithing rod to the veterinarian
7	The veterinarian attempts to insert the pithing rod into the cranial hole. A certain degree of force may be required to fully penetrate the cranium
8	Stockperson 1 must stay behind the veterinarian and continue to restrain the sow on the snare
9	The pithing rod is passed down the spinal cord of the sow and slowly moved in and out until all excessive movement stops
10	Leave the pithing rod in place until after the hysterectomy
The Hysterectomy Procedure	
1	The sow is to be rolled out on her back with stockperson 1 holding one hind leg
2	Stockperson 2 pass to the veterinarian the knife and then places the gun back in its gun box
3	Stockperson 2 prepares to bring the hot water bath to the side of the sow
4	The veterinarian starting at the xyphoid process cuts through the skin and fat, down to between the hind legs. Do not penetrate the abdomen. Cut only through skin and fat
5	Penetrate the abdominal cavity at the xyphoid process. Make a sufficiently large hole to allow the hand to be inserted into the abdominal cavity. Reverse the cutting method and raising the abdominal wall with the hand, cut along the linea alba. Take particular care not to penetrate any internal organs
6	Place the knife blade into the muscles of the fore leg
7	Bring the hot water bath to the side of the sow
8	Pour and pull the uterus into the bath. Pull and tear the ovarian end. In some cases the cervical end can even be torn but in most cases the cervical end will need to be severed by the knife
9	Once the whole uterus is in the water bath both stockpeople must briskly walk with the bath to the piglet area
Possible problems during the hysterectomy	
A	A small hole has been made in the uterus but no piglets are released
	Ignore and continue
B	A larger hole has been made in the uterus and a piglet is released
	A larger hole has been made in the uterus and a piglet is released. Keep pulling the uterus into the water bath and proceed with the hysterectomy. The released piglet is not to be moved to the piglet processing area but is to be dried and returned, whenever possible, to the sow source farm
The piglet site	
DAY BEFORE HYSTERECTOMY	
1	Processing Table
	Ensure the table is cleaned and disinfected thoroughly at least 12 hours before the hysterectomy. The table is designed to have a grill to allow water though but not the uterus and piglets
2	Piglet Transport Box
	Ensure the box is cleaned and disinfected thoroughly at least 12 hours before the hysterectomy. Ensure the box can be warmed effectively. Ensure there is an adequate number of boxes and that they are big enough to take the maximum number of piglets
3	The truck to Transport the Piglets to the new farm
	Ensure the truck is cleaned and disinfected thoroughly at least 12 hours before the hysterectomy

DAY OF THE HYSTERECTOMY	
1	The piglet area should be discretely sited
2	The veterinarian, nurse and stockperson from the destination farm should have clean outer clothing and boots. Plastic outer protectors should be worn
3	Hands should be cleaned prior to arrival and washed with surgical scrub disinfectant. Gloves can be worn by the operators. However, gloves can interfere with the processing time as it can make it more difficult to remove the piglets from the uterus
4	Tools required are: Naval clamps 14 pairs, Sterilised curved blunt ended scissors, Dry towels, 2 bottles RevivonÊ drops
Piglet Processing	
1	The two stockpeople briskly approach the processing table and pour the water and disinfectant onto and through the processing table
2	The two stockpeople briskly walk back to the hysterectomy site
3	All three operators (one vet, nurses and piglet stockperson) open the uterus and remove the piglets. Do not cut into the piglets
4	The veterinarian then moves the blood up the cord towards each pig and placed a navel clamp approximately 5 cm from the umbilicus. The umbilical cord is then cut from the placenta from each piglet.
5	During all this time the nurse and stockperson use dry towels to massage and dry the piglets. The nurse and stockperson must talk to the piglets and encourage the piglets to breath
6	The piglet should squeal and move vigorously before being moved into the transportation box
7	Piglets having problems with breathing, attempt to recover using RevivonÊ dripped on the tongue. Despite the temptation, mouth to mouth resuscitation is not to be attempted as pathogen transmission may occur
8	Once all the piglets are in the transportation box the stockperson, transportation box and transport truck must leave for the new farm
9	Any piglets with any deformity likely to affect production must not enter the piglet transportation box. For example, deformed legs or cleft palate (if noticed)
10	The piglet processing area is now thoroughly cleaned down and all disposable equipment disposed of hygienically (plastic overcoat, gloves etc.,)
At the new farm	
New farm being made – no sow's available	
	The farm facilities must be extremely clean
	Note the new piglets will have received no colostrum and therefore, will have no natural immunity.
	Provide artificial colostrum supplements. Cow colostrum may be a good substitute. Provide 50 ml per piglet at 10 ml per dose by stomach tube.
	Inject each piglet with 3mg ceftiour or 5 mg tulathromycin
New stock being moved to an established farm	
	Induce sows to farrow on the day of the hysterectomy
	Foster pigs of sows as they farrow. If short of sows, box up sowôs natural piglets and give then artificial colostrum and once all pigs are born given them one suckle of the sow
	Hysterectomy piglets must be given priority. When hysterectomy piglets arrive, do not fuss over then. Put shredded paper in the pen and extra lights. Ensure foster sow has not suckled in the last hour, and then just leave the hysterectomy piglets to get on with it.
	Inject each piglet with 3mg ceftiofur or 5 mg tulathromycin

Mycoplasma hyopneumoniae eradication using segregated early weaning

Science Assumptions re *Mycoplasma hyopneumoniae*	
	Sows remain infected all their lives
	Mycoplasma hyopneumoniae colostrum antibodies remain for 14 day post-consumption
	M. hyopneumoniae can be killed with Tilmicosin, Tiamulin, Tulathromycin or Chlortetracycline
	M. hyopneumoniae can be eliminated by cleaning of an offsite nursery
	The absence of *M. hyopneumoniae* antibodies and PCR is an effective diagnostic tool at 10 weeks of age
	Source of *Mycoplasma hyopneumoniae* negative pigs is available.
	Mycoplasma hyopneumoniae only spreads 3 km between farms
Sow preparation programme	
8 weeks pre-farrowing	
	Vaccinate the sows. The success of the programme relies on colostrum antibodies and the key to this is vaccination. Ensure vaccines are stored properly and administered using a 1.5 inch 16 gauge needle.
	Vaccinations that are possible are, APP, Atrophic rhinitis (toxin), Clostridia, *E. coli*, Erysipelas, *Haemophilus parasuis, Lawsonia intracellularis*, *Mycoplasma hyopneumoniae*, PRRSv (dead), SIV.
	Provide the sows with feedback ï using nursery faeces and diarrhoea from the farrowing house.
4 weeks pre-farrowing	
	Repeat the vaccine and feedback programme
2 weeks pre-farrowing	
	Provide in-feed medication of Tilmicosin 400g/tonne and Chlortetracycline 800g/tonne to the sows until the piglets are weaned at 10 days of age.
7-5 days pre farrowing	
All sows must be healthy	
Move into farrowing house	
General bacteria	Tetracycline long acting	30mg/kg injection using a 16G 1.5" needle intramuscularly into the neck

Weaner programme		
Day of life		
1	Iron	200 mg injection by a 21G 5/8" needle intramuscularly into the neck
	Colostrum	Artificial colostrum ï possibly using cow colostrum, 50 ml per piglet at 10 ml doses
2	Avomectin	300 µg/kg by a 21G 5/8" needle subcutaneously into the neck
	Tulathromycin	2.5 mg/kg by a 21G 5/8" needle intramuscularly into the neck
	Enrofloxacin	Oral medicator ï 10mg (not legal in the USA)
4	Toltrazuril	7mg/kg oral dose ï to control coccidiosis
5	Ceftiofur	5 mg/kg by a 21G 5/8" needle intramuscularly into the neck
9	Ceftiofur	5 mg/kg by a 21G 5/8" needle intramuscularly into the neck
10	Weaned move to the off-site nursery - note biosecurity of truck and site	
Post weaning		
	Tiamutin 12.5% solution	180 ppm through the water supply supplied for the first 7 days post weaning
	Chlortetracycline	800 g per tonne of creep feed, to be fed for 21 days post-weaning
	Tilmicosin	400g per tonne of creep feed, to be fed for 21 days post-weaning
	Avomectin	300 µg/kg by a 21G 5/8" needle subcutaneously into the neck
	Tulathromycin	2.5 mg/kg by a 21G 5/8" needle intramuscularly into the neck

Testing the pigs	
Deaths	All deaths should be post-mortemed
Diarrhoea	Investigate all cases of diarrhoea
Coughing	Investigate all cases of coughing and sneezing. Note Post-weaning sneezing may occur
10 weeks of age	The pigs should be tested to ensure that they are negative. Ensure that the testing does not detect maternal colostrum antibodies.
Sentinel	Place known negative gilts into contact with grow/finish pigs and blood test after one month. Note any coughing experienced by these gilts.
Move the pigs to the grow/finish farm	
	Assuming all the pigs are negative, move the pigs to the new grow/finish operation. If there is any question over the health of the pigs, they must not be moved to the new farm.

Pathogen elimination through Partial Depopulation
Example – *Mycoplasma hyopneumoniae*

Science Assumptions re *Mycoplasma hyopneumoniae*	
	Sows remain infected all their lives
	Mycoplasma hyopneumoniae colostrum antibodies remain for 14 day post-consumption
	M. hyopneumoniae can be killed with Tilmicosin, Tiamulin, Tulathromycin or Chlortetracycline
	M. hyopneumoniae survives in the environment for only a couple of days
	The absence of *M. hyopneumoniae* antibodies, PCR and/or IHC are effective diagnostic tools at 12 weeks of age
	Source of *Mycoplasma hyopneumoniae* negative pigs is available.
	Mycoplasma hyopneumoniae only spreads 3 km between farms
Preparation of the programme	
	All animals older than 10 days of days and less than 10 months of age will be removed from the farm
	Farrow to finish farm ï review protocols of partial depopulation with the inclusion of the need to care for piglets from 10 days of age.
	Review the pig flow programme to ensure that sufficient young sows will be available to compensate for the shortfall of gilts that will occur for a 3 month period.
	Cull all sows/boars where necessary to reduce the herd size if appropriate ï with considerations for maintaining pig flow.
	Cull all unhealthy sows and boars.
	The eradication should be programmed for the summer months which will aid environmental removal of the mycoplasma.
	As buildings become empty ensure that a full cleaning, repair and refurbishment programme is instigated.
8 weeks pre-start programme	
	Vaccinate the sows and boars with *Mycoplasma hyopneumoniae*. It is essential to ensure that all piglets get colostrum and are not shedding *Mycoplasma hyopneumoniae* while in the farrowing house. The success of the programme relies on colostrum antibodies and the key to this is vaccination. Ensure vaccines are stored properly and administered using a 1.5 inch 16 gauge needle.
	Provide the sows and boars with feedback ï using nursery faeces and diarrhoea from the farrowing house. It is essential to have all the adults immune to *Mycoplasma hyopneumoniae*.
4 weeks pre-start of the programme	
	Repeat the vaccine and feedback programme

Start of the 6 week eradication programme	
	Ensure that all sows and boars will be provided with 3 kg a day of medicated feed. Boars may require more to ensure adequate medication for their weight or use in combination with injection.
	Boar alternative medication is via injection ï consider using Tulathromycin (2.5 mg/kg) injection once every 7 days. Weigh boars as necessary.
	Provide in-feed medication of Tilmicosin 400g/tonne and Chlortetracycline 800g/tonne to the sows. This will be provided for a period of 6 weeks. Tilmicosin may be very bitter ï provide Talin in the feed to assist palatability of feed.
	In the farrowing house provide 3 kg of medicated feed in the morning feed with unmediated feed in the evening feed.
	Any sick or inappetant sow (in oestrus for example) injection with Tulathromycin (2.5 mg/kg). If a sow is sick for 3 days euthanase. It is essential that *Mycoplasma hyopneumoniae* be not allowed to remain in weakened adults.

Management of piglets in the farrowing house to assist survival of 10 day weaned piglets		
Day of life		
1	Iron	200 mg injection by a 21G 5/8" needle intramuscularly into the neck
	Colostrum	All piglets must receive colostrum from sows. If there is any suspicion that a piglet failed to get adequate colostrum euthanase.
2	Ceftiofur	5 mg/kg by a 21G 5/8" needle intramuscularly into the neck
	Enrofloxacin or Tulathromycin	Oral medicator ï 10mg (not legal in the USA or Australia) Tulathromycin is by injection ï 2.5 mg/kg
4	Toltrazuril	7mg/kg oral dose ï to control coccidiosis
5	Ceftiofur	5 mg/kg by a 21G 5/8" needle intramuscularly into the neck
9	Ceftiofur	5 mg/kg by a 21G 5/8" needle intramuscularly into the neck
10	Weaned move to the off-site nursery - note biosecurity of truck and site	

Management of the early weaned sow	
	Place the early weaned sow onto Regumate a day before weaning. Maintain Regumate until normal expected weaning day. This is essential to maintain pig flow. It is possible to provide Regumate via toasted bread.

Confirming eradication of *Mycoplasma hyopneumoniae*	
Deaths	All deaths should be post-mortemed
Coughing	Investigate all cases of coughing and sneezing. Note Post-weaning sneezing may occur
12 weeks of age	The pigs should be tested to ensure that they are negative. Ensure that the testing does not detect maternal colostrum antibodies.
Sentinel	Place known negative gilts into contact with grow/finish pigs and blood test after one month. Note any coughing experienced by these gilts.
Time	The farm should be examined serially over a period of at least one year. Utilising clinical examination, blood serology and slaughterhouse tests. Immunohistochemisty of any suspect lesions

Pathogen elimination through Vaccination and Test and Remove

Example - Aujeszky's Disease virus eradication programme from a low infected farm

Science assumptions re Aujeszky's Disease Virus	
	Aujeszkyôs Disease Virus is a stable DNA virus
	There is an effective vaccine
	A diagnostic test differentiates between vaccinated and field infected animals
Vaccination	
1	Vaccinate with a gene deleted vaccine all pigs over 10 weeks of age. Continue vaccination for 6 months. This will keep the virus at bay while the herd is cleaned up. Stringent biosecurity measures need to be in operation.
Test and Remove	
2	Blood test all the boars, sows and gilts examine by serology. Blood test 30-50 pigs in the following groups, 30-45 kg, 45-70 kg and 70+ kg range.
	If less than 10% of the sows are positive, remove any positive boars, sows and gilts immediately. Then move to point 3 If more than 10% are positive either depopulate or set up an offsite weaning programme. This would need its own programme
3	30 days later, blood test all the boar, sows and gilts examine by serology. Blood test 30-50 pigs in the following groups, 30-45 kg, 45-70 kg and 70+ kg range.
	Any positive boars/sows or gilts remove from the herd immediately. If some of the finishers are positive, ear tag/notch negative pigs are 30 kg, place then around the grower facility and specifically retest these animals each 6 weeks. These are to act as sentinels.
	If all animals are negative go to point 4.
4	Retest 90 days later a minimum of 120 sows (if the unit is a commercial farm) or all the boars, sows and gilts if a breeding farm. Blood test 30-50 pigs in the following groups, 30-45 kg, 45-70 kg and 70+ kg range.
	Any positive boars/sows or gilts remove from the herd immediately and go back to point 3 If some of the finishers are positive, ear tag/notch negative pigs are 30 kg, place then around the grower facility and specifically retest these animals each 6 weeks. These are to act as sentinels.
	If all animals are negative go to point 5.
5	Retest 6 months later, any positive boars/sows or gilts remove from the herd immediately and go back to point 3
	Any positive boars/sows or gilts remove from the herd immediately and go back to point 3. If some of the finishers are positive, ear tag/notch negative pigs are 30 kg, place then around the grower facility and specifically retest these animals each 6 weeks. These are to act as sentinels.
6	If all animals are negative it is highly likely you now have a negative herd. Vaccination programme can be systematically dismantled over the next 18 months.
7	Declare the farm free of Aujeszkyôs Disease Virus

Pathogen elimination through Herd Closure and Pathogen Exposure

Example - Porcine Reproductive and Respiratory Syndrome

Eradication without Depopulation

Science Assumptions re PRRSv	
	No long term carried status for PRRSv in sows or boars
	PRRSv particles are excreted for less than 100 days following infection (see note at bottom)
	Piglets less than 14 days of age are protected by maternal colostrum deprived antibodies
	Spread of PRRSv is difficult/unlikely over 500 metres
	It is not present in other animals (excluding some ducks)
Difficulties	
	PRRSv is not excreted in many body fluids consistently
	Reproductive problems of PRRSv may be accentuated by the treatment advised
Technique	
	Purchase sufficient young gilts to provide breeding animals for 100 days
	Close the farm to all inputs, excluding PRRSv free semen
Infect all animals on the farm – Pathogen exposure	
	Vaccinate all sows, gilts and boars with a suitable PRRSv vaccine; a live vaccine is acceptable if no previous exposure.
	Obtain tonsilar scrapes from all animals with acute signs. This is made up to vaccinate all sows, gilts, boars and young future breeding stock.
	Practice feedback of faecal materials from acutely ill animals, aborted materials; macerate piglets that die with clinical signs. Feed this material for 14 days.
	At the end of the infection period, throw away all used needles and syringes.
2 weeks later	Vaccinate all sows, gilts and boars with a dead PRRSv vaccine to reduce viral shedding.
	At the end of the infection period, throw away all used needles and syringes.
Herd Closure	
	For 100 days minimum, the farm must be totally closed (excluding PRRSv free semen)
	All piglets over 14 days of age are weaned off the farm for 100 days
	Enhance biosecurity measures
Clean farm	
	At 90 days post-infection, disinfect the entire farm with a suitable disinfectant. Spray the walls, water and air. Wash all clothing and boots. Throw out all used needles and syringes.
Check the effect of the eradication	
1	Purchase 20 PRRSv free gilts.
2	Introduce gilts into the farm and place the animals all around the farm
3	After 21 days, bleed the 20 gilts
4	After 35 days, rebleed the 20 gilts.
5	If the gilts are negative, declare the farm free of PRRSv and allow the weaning age to increase.
6	If any of the gilts are positive, all the gilts are removed. The farm remains closed for another 30 days and the test repeated.
Post-Control	
	All gilts and boars introduced into the farm through an adequate isolation area are PRRSv negative.
	Ideally practice on-farm AI on the farm
	Do not use a live vaccine on the introduced animals
	Consider dead vaccine use if proved to be effective
	Continue enhanced biosecurity measures.

Porcine Reproductive and Respiratory Syndrome virus Elimination
Calendar of Events

Week 1	Infect all sows and boars ï dead vaccine and own material from farm Ensure all staff well aware of biosecurity measures Isolation animals ï infect all with dead vaccine and own materials Stop live vaccines Move materials from the isolation area? Purchase new stock for 100 days and ensure all animals are exposed Close the herd
Week 2	Continue feedback for 14 days
Week 3	Throw away all used needles and syringes Start 100 day countdown All piglets older than 14 days weaned off farm Limit or cease cross-fostering
Week 4-14	All piglets older than 14 days weaned off farm Limit or cease cross-fostering
Week 14	All piglets older than 14 days weaned off farm Limit or cease cross-fostering Disinfect walls, floors, air and water. Vehicles and utensils. Throw away all clothing, boots, etc. Throw away needles and syringes. Order 20 PRRSv negative gilts.
Week 18	Introduce the 20 gilts into the isolation. Order 20 PRRSv negative gilts.
Week 21	Bleed gilts. If negative, go to next week. Move additional 20 PRRSv free gilts into main farm. If gilts are positive ï immediately remove from the isolation area. Close farm for 30 days and re-start checking program.
Week 24	Bleed gilts in isolation and main farm. If negative, go to next week. If any gilt is positive ï immediately remove from the isolation area. Close farm for 30 days and re-start checking program.
Week 25	Start weaning as normal
Week 27	Bleed all 40 gilts again. If negative. Restart gilt introduction program Declare the farm free of PRRSv

Note:
This above programme has successfully eliminated PRRSv from a number of farms. As science progresses, PCR technology has revealed PRRSv virus in tonsilar tissue for 200 days post-exposure. Therefore, in designing the herd closure programme the health team must consider the relative risks. In certain circumstances a 200 day closure programme may be adopted rather than the 100 day programme discussed.

Pathogen elimination through Medication

Example – *Sarcoptes scabiei* var *suis* – farrow to wean unit.

Science points re *Sarcoptes scabiei* var *suis*	
	Avomectin remain active in the pig for 7 days post-treatment
	Sarcoptic eggs are resistant to avomectins
	Sarcoptic eggs hatch in 5 days
	Sarcoptic mites may live off the host for 21 days, but in the summer months this is reduced to 5 days
	Boars are difficult to estimate their weight and are often under dosed ï a major reason for the programme failure
Animal	**Programme**
Suckling pigs	Inject with an avomectin at 300 µg/kg via a 21 gauge $^{5}/_{8}$ " needle, using an insulin syringe by injection in the neck
Gilt pool	In feed medication for 7 days, with an inclusion of avomectin in-feed at 100 µg/kg bodyweight. Ensure all animals eat 2.75 kg per day.
Breeding and pregnant sows	In feed medication for 7 days, with an inclusion of avomectin in-feed at 100 µg/kg bodyweight. Ensure all animals are fed 2.7 kg of feed per day ignore condition score
Lactating sows	Feed 2.7 kg of the dry sow ration, with an inclusion of avomectin in-feed at 100 µg/kg bodyweight in the morning for 7 days. Feed lactator in the evening
Boars	Feed dry sow ration, with an inclusion of avomectin in-feed at 100 µg/kg bodyweight. For large boars increase quantity feed. For instance a 200 kg boar feed 2.7 kg per day for 7 days; 250 kg boar feed 3.3 kg per day for 7 days and for a 300 kg boar feed 4 kg per day. Or inject with Avomectin 300 µg/kg
Hospital pens	Inject all pigs with an avomectin at 300 µg/kg in the neck
All adults off feed for more than 24 hours	Inject with avomectin at 300 µg/kg bodyweight in the neck. Note sows in oestrus
Buildings	At the end of the 7 day animal treatment period spray all houses with amitraz 0.1% at 40 ml per 10 litres of water dilution using a knapsack sprayer
Clothing	Stockpeople attending to the grow/finish herd should not wear the same overalls when attending to the breeding herd
	At the end of the 7 day animal treatment period all overalls and boots should be washed thoroughly, disinfected and re-washed in a amitraz 0.1% solution at 40 ml per 10 litres of water dilution
Repeat medication programme with another injection and 7 day medicated feed	
Feed bin management	All feed lines should be flushed with normal food after the 7 day period to remove any treated feed material.

If this programme is combined with a partial depopulation or a clean pen break system, mange can be eliminated from a farrow to finish farm