Disinfection of farrowing pens

J.M. OWEN *

Summary: The author presents details on the cleaning and disinfection of specialised farrowing accommodation within an intensive pig unit. Procedures are described for use in two quite different sets of circumstances, as follows:

- in the event of the occurrence of one of the major notifiable epizootic diseases
- routine cleaning and disinfection as part of normal management procedures.

In the former case, herd slaughter and the cleaning and disinfection of premises are required by law, in accordance with the protocol adopted by international agreement with reference to the specific disease concerned.

In the latter case, cleaning and disinfection are not governed by statutes, and the protocol is established to suit the requirements of the individual unit, under the supervision of the farmer and the veterinary adviser.


INTRODUCTION

Following the occurrence of a major notifiable epizootic disease, it is of paramount importance that all the disease organisms are eliminated. When such a disease outbreak is detected in a pig unit, all pigs are slaughtered and removed as the first stage of the disease eradication programme. The pig unit will therefore be empty, and the time taken for cleaning and disinfection is less important than the achievement of a satisfactory outcome.

By contrast, routine cleaning and disinfection is performed between batches while the pig unit remains in full production. The objectives are to remove as much as possible of the potential pathogen burden, and to provide a clean, hygienic environment for incoming and newborn stock to enable them to remain healthy and thus achieve their potential for growth and development. The time required to complete routine cleaning and disinfection must be balanced against the real and potential negative effects on performance and welfare in the event of ineffective cleaning and disinfection. The regular throughput of the unit must not be compromised, and sufficient housing should be provided to maintain this throughput.

The farrowing house presents particular problems for cleaning and disinfection, as it contains complex structures which are difficult to clean (e.g. bars, crates and gates), as well as a water supply for individual sows and litters, and structures which are sensitive...
and easily damaged (e.g. complex electrical equipment controlling temperature and ventilation both throughout the house and within the separate environment of the piglet creep area).

A further consideration is that, immediately after routine cleaning and disinfection, the building will house parturient and neo-natal animals. It is therefore necessary to clean and disinfect to a high standard without leaving a residue of gases, liquids or solids which might be harmful to livestock.

In both of the above types of cleaning and disinfection, the dangers to the operators must be constantly borne in mind. These include the physical dangers associated with handling or inhaling the chemicals used, and the dangers presented by electrical equipment during both dismantling and washing. Fumigation procedures constitute a particular hazard, and warning notices should be placed outside rooms where fumigation is being performed. Full protective clothing (including a respirator) should be available to all personnel handling chemicals and disinfectants. All operators should receive training in the handling of chemicals, disinfectants and fumigants, and should be drilled in accident procedures.

CLEANING AND DISINFECTION AFTER AN OUTBREAK OF A NOTIFIABLE DISEASE

General considerations

Following an outbreak of a notifiable disease, the cleaning and disinfection of farrowing houses will form part of an operation involving every section of the pig unit.

Immediate measures must be taken throughout the unit, in view of the risk of disease spread from the infected unit to other premises.

The entire unit must be made secure against the entry of unauthorised people, livestock and stray animals, by placing notices and barriers at all entry points. The prohibition of unauthorised movements onto and off the unit must be strictly enforced; if necessary, the help of the police or the army should be enrolled.

The unit will be empty of pigs, all animals having recently been slaughtered and removed, or removed for slaughter elsewhere.

The organisation of cleaning and disinfection will be under the control and supervision of the State Veterinary Service, although the team of workers actually performing the tasks may be formed of either existing unit staff or general labourers hired specifically for this purpose.

The team should usually consist of three to six individuals, depending on the size of the unit. All team members should be supplied with adequate protective clothing, boots, hats, visors, gloves and respirators. They should be trained in the handling and use of disinfectants and high-pressure washers. The team should preferably consist of existing unit staff (they may have been made temporarily redundant as a result of the outbreak), as they already have a thorough working knowledge of the unit and also have a direct interest in the efficacy of the cleaning and disinfection operation.

Adequate cleaning and disinfection requires a power source (to work the water pumps and provide lighting and heating) and large quantities of clean water.
The mains water supply should be used, if this is of adequate pressure and quality. Otherwise, water can be provided using a hired bowser (mobile tank) of at least 5,000 litre capacity, filled from the nearest available water source.

Vermin should be vigourously controlled throughout the time that the unit is empty. Baits should be laid both within the unit and in surrounding drains and ditches. Flies and other insects will be destroyed by the cleaning and disinfection process.

The procedure required for cleaning and disinfection can be summarised as follows:

a) preliminary disinfection
b) removal of manure, feed and straw for disinfection and stacking outside
c) application of detergent/de-greasing agent
d) thorough cleaning, using clean water applied by high-pressure jet washer
e) final disinfection.

These statutory requirements apply to Office International des Epizooties (OIE) List A diseases, which are defined as 'transmissible diseases which have the potential for very serious and rapid spread, irrespective of national borders, which are of serious socio-economic or public health consequences and which are of major importance in the international trade of animals and animal products' (12).

The following List A diseases affect pigs:
- foot and mouth disease
- swine vesicular disease
- vesicular stomatitis
- African swine fever
- classical swine fever.

The precise measures required to eliminate these diseases differ due to the individual characteristics and degree of stability of each virus, but the general procedures are the same in all cases. The important viral characteristics to be taken into account when considering cleaning and disinfection are listed in Table I.

**Detailed procedures**

As the causal organism of swine vesicular disease (SVD) is the List A virus which is most resistant to destruction, a cleaning and disinfection procedure to eliminate this organism will be described in detail. As soon as each building has been emptied of pigs, the mains power supply should be disconnected to avoid the danger of electrocution and fire, and to enable the dismantling and removal of electrically-powered equipment (e.g. lights, fans, alarms and feed systems). After removal, these should be delicately cleaned by hand before being taken away for storage and/or servicing elsewhere. An electrician will be required to dismantle these items. The removal of this equipment also frees access to the structures behind them (e.g. fan housings and vents) to facilitate adequate cleaning and disinfection. Power and lighting for the cleaning operation should be provided using a portable generator hired for the purpose. Electrical fittings which cannot be easily removed should be brushed by hand and then hand-cleaned with a sponge dipped in disinfectant, before being covered by plastic sheeting for protection during the high-pressure washing process.
### Table I

**Characteristics of causative viruses of Office International des Epizooties List A notifiable diseases of pigs**

(15)

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Causal organism</th>
<th>Survival in faeces or in the environment</th>
<th>pH stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foot and mouth disease</td>
<td>Picornavirus</td>
<td>14 days in dry faeces; 6 months in slurry in winter. Destroyed by sunlight</td>
<td>pH 6-9 (rapidly destroyed below pH 6)</td>
</tr>
<tr>
<td></td>
<td>Aphthovirus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swine vesicular disease</td>
<td>Picornavirus</td>
<td>&gt; 138 days in faeces at 12-17°C (4). Not destroyed by drying</td>
<td>pH 2.8-10.14 (7)</td>
</tr>
<tr>
<td></td>
<td>Enterovirus (11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vesicular stomatitis</td>
<td>Rhabdovirus</td>
<td>Seasonal. Susceptible to light</td>
<td>pH 3−&gt; 13 (14)</td>
</tr>
<tr>
<td></td>
<td>Vesiculovirus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African swine fever</td>
<td>Un-named pox-like</td>
<td>&gt; 11 days in faeces (9). 16 days in putrifying blood</td>
<td>pH 3.9-11.5 (9)</td>
</tr>
<tr>
<td></td>
<td>DNA virus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classical swine fever</td>
<td>Pestivirus</td>
<td>&lt; 4 weeks in manure in winter. Destroyed by light and heat</td>
<td>pH 5-10 (13)</td>
</tr>
<tr>
<td></td>
<td>Flavivirus</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DNA: deoxyribonucleic acid

The first stage of the cleaning and disinfection process can now begin. This consists of a thorough preliminary spray of all surfaces of the building, using a suitable disinfectant, and should be undertaken starting at the roof and working downwards to the floor. It is very important that this preliminary spray is performed immediately after pigs have been removed from the farrowing house, to reduce the risk of virus spread. The disinfectant used for this purpose should be approved for use against the disease concerned (10), and the operator should wear the protective clothing necessary for this operation.

Following the preliminary disinfection, thorough cleaning of the building can begin. Any manure, straw and feed debris should be removed and stacked in a clean area outside. Each layer of the stack should be liberally sprayed with disinfectant. Any thickly contaminated, encrusted or greasy surfaces should be sprayed with a de-greasing agent (detergent) and left to soak overnight. Spraying and soaking should be repeated until all the embedded dirt has softened. Suitable de-greasing agents/detergents are commercially available, and one of these should be used in accordance with the instructions of the manufacturer.

If the farrowing house contains slatted floors, the slats must be lifted and any slurry present in slurry channels should be drained off as well as possible. This enables preliminary spraying of the slurry channels and the ledges supporting the slats. Awkward areas (e.g. farrowing crate bends and corners, troughs and piglet creep areas) should be scrubbed by hand using a suitable disinfectant; this operation should be performed by an operator wearing full protective clothing. Water pipes, header tanks and drinkers should be drained and tied to prevent refilling, and any removable gates, bowls, troughs, etc. can then be carefully dismantled for easier cleaning and stacking outside. Cleaning of this
portable equipment and the building itself, including the slurry channels, should then be performed using a pressurised water jet. All remaining detergent and disinfectant will be flushed away down the slurry channels and drains, which should themselves be pressure-washed to remove any remaining faecal material. As with the preliminary spraying, cleaning should begin with the roof, fan housings and ceiling, and progress downwards; care should be taken to include all inlet and outlet ducts in the spraying operation. Damage of fragile surfaces (e.g. roof insulation) should be kept to a minimum, and whatever cannot be thoroughly disinfected should be destroyed. Food stored in animal buildings should also be destroyed. Water pipes should be flushed using a water steriliser. Sealable rooms should be fumigated. After this thorough cleaning, any damaged areas (e.g. cracks in floors or walls, flaking plaster) should be identified and repaired. These might otherwise provide a reservoir for live virus at a future date. After completion of the repairs, the building should be sprayed to a height of 1.5 m with 1% sodium hydroxide, taking care to avoid plastic piping and sheeting, and galvanised metal. This disinfectant should not be rinsed off. Forty-eight hours later, all non-flammable surfaces should be treated with a flame gun, paying particular attention to the corners of walls and floors, the areas around the posts of farrowing crates, and slurry channels. The building should then be cleaned of all equipment and protective clothing, and closed for fourteen days; at the end of this period, a second sodium hydroxide and flame gun treatment should be applied.

The other List A notifiable disease organisms can be eliminated by adopting less rigorous cleaning and disinfection procedures, as these viruses are less resistant to destruction than SVD virus. The main differences in approach to the elimination of these other disease organisms are described in Table II.

The particular disinfectants recommended for use depend on the characteristics and stability of the virus concerned.

Operator safety should be paramount at all times, and this should be taken into account when selecting the disinfectant. Cost and availability are the other considerations. Recommended disinfectants are listed in Table III.

In some countries, or areas within countries, some OIE List B diseases (e.g. Aujeszky's disease, Teschen disease) are notifiable and are also subject to eradication by slaughter of animals on infected premises. In such cases, a protocol similar to that described above is adopted, with particular consideration of the characteristics and stability of the organism involved.

The same procedures can be applied effectively to any depopulation exercise where it is desirable to eliminate a particular disease organism, even if the disease is not notifiable. However, in such a case, the removal of livestock and the cleaning and disinfection would not be under the control of the State Veterinary Services, but would be performed on a private and individual basis and according to a protocol drawn up by the owner of the premises and the attendant veterinarian.

**ROUTINE CLEANING AND DISINFECTION**

Routine cleaning and disinfection constitute a management measure undertaken on most intensive pig farms as part of the general disease control strategy in the farrowing area.
### Table II

**Procedures for disinfection following an outbreak of an Office International des Epizooties**

**List A notifiable disease of pigs**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Preliminary disinfection</th>
<th>Cleaning</th>
<th>Full disinfection</th>
<th>Further measures</th>
<th>Treatment Manure</th>
<th>Treatment Slurry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foot and mouth disease</td>
<td>Spray immediately.</td>
<td>Wash with high-pressure water jet</td>
<td>Spray with approved disinfectant</td>
<td>Fumigate</td>
<td>Spray with disinfectant. Stack and leave for 3 months</td>
<td>Do not disturb stored slurry for 3 months</td>
</tr>
<tr>
<td></td>
<td>Use approved disinfectant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swine vesicular disease and</td>
<td>Spray everywhere with strong alkaline</td>
<td>De-grease, then wash with high-pressure</td>
<td>Spray with approved disinfectant</td>
<td>Fumigate. Undertake repairs. Apply sodium hydroxide</td>
<td>Spray with disinfectant. Stack and leave for &gt; 5 months</td>
<td>Do not disturb stored slurry for &gt; 5 months</td>
</tr>
<tr>
<td>vesicular stomatitis</td>
<td>disinfectant</td>
<td>water jet</td>
<td></td>
<td>flame gun treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African swine fever</td>
<td>Spray immediately using approved</td>
<td>De-grease, then wash with high-pressure</td>
<td>Repeat spray and de-grease</td>
<td>Final spray and rinse off</td>
<td>Spray with disinfectant. Stack and leave for 42 days</td>
<td>Do not disturb stored slurry for 42 days</td>
</tr>
<tr>
<td></td>
<td>disinfectant</td>
<td>water jet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classical swine fever</td>
<td>Spray the area previously occupied by</td>
<td>De-grease, then wash with high-pressure</td>
<td>Repeat the preliminary</td>
<td>Rinse off</td>
<td>Spray with disinfectant. Stack and leave for 28 days</td>
<td>Do not disturb stored slurry for 28 days</td>
</tr>
<tr>
<td></td>
<td>pigs with an approved disinfectant</td>
<td>water jet</td>
<td>disinfection</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table III

**Characteristics of disinfectants for use against Office International des Epizooties List A disease viruses of pigs**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Disinfectants</th>
<th>Concentration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foot and mouth disease</td>
<td>Sodium carbonate</td>
<td>4%</td>
<td>Contact time of 6 h should be allowed and two applications</td>
</tr>
<tr>
<td></td>
<td>Sodium hydroxide</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Citric acid</td>
<td>0.5%</td>
<td>Contact time of 6 h should be allowed</td>
</tr>
<tr>
<td></td>
<td>Hydrochloric acid</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Formalin</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swine vesicular disease and</td>
<td>Sodium hydroxide</td>
<td>4%</td>
<td>Contact time of 6 h should be allowed</td>
</tr>
<tr>
<td>vesicular stomatitis</td>
<td>Sodium hypochlorite</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Formalin</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African swine fever</td>
<td>o-phenylphenol</td>
<td>1% for 4 h</td>
<td>Sole effective disinfectant when tested in pigs (17)</td>
</tr>
<tr>
<td></td>
<td>Sodium hydroxide</td>
<td>4% for 24 h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Formalin</td>
<td>4% for 24 h</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classical swine fever</td>
<td>Sodium hypochlorite</td>
<td>2%</td>
<td>Contact time of 10 h should be allowed</td>
</tr>
<tr>
<td></td>
<td>Phenolic disinfectants</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sodium hydroxide</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Formalin</td>
<td>3%</td>
<td></td>
</tr>
</tbody>
</table>

Adequate cleaning and disinfection of the farrowing area can only be achieved if the unit operates in modules, each working on an 'all-in/all-out' basis. A farrowing room can only be satisfactorily cleaned and disinfected when empty of stock.

Thorough cleaning and disinfection of the farrowing room are essential, as the immune systems of young pigs in farrowing and nursery units are still developing, and these animals are therefore more susceptible to infectious diseases than any other age group (3). Enteric infection in young piglets is most common in poorly cleaned housing, and housing in which continuous farrowing is practised (18).

In farrowing houses, a wide variety of organisms may be present which are capable of causing reduced growth and performance, or severe disease or death in young piglets if no routine control measures are adopted. These organisms include the pathogens responsible for enteric and respiratory disease, and musculo-skeletal and skin disorders; many can be spread by vermin and flies. In two research projects, piglet losses due to infectious causes (colibacillosis) accounted for 6-25% of pre-weaning pig mortality (5). Indeed, this figure is likely to be a low estimate, as piglets dying from overlaying and starvation in many cases will often have an underlying infection. The most common enteric pathogens of young piglets are susceptible to routine disinfection procedures, and while many of these pathogens occur in the environment, a reduction in the level of organisms in the farrowing house is beneficial to the health and welfare of these young animals.

The aerial environment has the capacity to influence respiratory disease. The two most important constituents influencing respiratory disease are ammonia and dust; they
irritate the respiratory system, and transport gases and pathogens to all parts of the respiratory system (6), while concentrations of bacterial colony-forming units in dust and ammonia in the farrowing house have been found to correlate significantly with the severity of conchal atrophy found at slaughter (16). Respiratory pathogens found frequently in the farrowing house – either present in the environment or causing clinical disease – include bacteria and viruses. Organisms gaining entry through inhalation and via the respiratory route can also be responsible for disease in other systems (e.g. joint infections) and at a later age.

The method of cleaning and disinfection for this purpose should be similar to that adopted for List A disease elimination, with certain limitations due to the need to restock the building within a short time. Each room will probably be cleaned and disinfected at approximately four-week intervals; the disinfectant used should therefore be not only effective in eliminating the pathogens but also non-corrosive to the fixtures. For both reasons, a preliminary disinfection is not usually undertaken.

As described above, the building must be cleaned by removal of manure, bedding, remaining food and encrusted dirt before disinfection can be effective. After removal of the stock, the power supply should be switched off, and power points, sensitive switches and equipment should be cleaned by hand and then protected using plastic sheeting. Light fixtures, etc. should be removed for manual cleaning. Slurry should be drained from slurry channels (if they are present), but it is not always practicable or feasible to lift slats on every occasion to clean this area directly. The floors, walls and fixtures should then be soaked overnight, with detergent if necessary, to soften remaining dirt and debris. The following day, the room should be thoroughly cleaned using water applied through a high-pressure jet washer containing water, or a steam cleaner. Troughs and intricate metalwork should be hand-cleaned, paying particular attention to the corners of the pens, and slats (if lifted) should also be pressure-washed. When clean, the house should be sprayed throughout using a disinfectant approved for general farm use (1, 10). Fumigation may then be undertaken, bearing in mind safety factors both for operators and staff within the unit, and for livestock in nearby houses or rooms. Fumigation is particularly effective against bacteria and is also virucidal, especially at high relative humidity (2). A warning notice should be displayed to alert staff on the unit of the procedures in progress. The water supply should be flushed using a chemical steriliser, as a routine measure each time the house is emptied.

If the unit is experiencing a specific problem, additional procedures may be necessary. For the destruction of ascarid or coccidia ova, a commercially-available compound recommended for these parasites should be used, or alternatively a flame gun treatment can be applied (particularly on floors) at the end of the normal, non-specific disinfection sequence.

It is very important that the room is allowed time to dry before the entry of the next group of animals, particularly in winter. However, this may be incompatible with thorough cleaning and disinfection, as concrete floors and rendered walls are porous and absorb a great deal of water during the procedure. The drying process can be greatly accelerated – without compromising the cleaning and disinfection – if all surfaces are painted with a non-porous, non-toxic resin paint to prevent absorption of water through to the concrete. Such paint is robust enough to withstand frequent pressurised washing, although maintenance is required every few months, particularly on the floor area. This paint should not be applied on the area under the sow, where a very smooth surface would inhibit the movements of the animal.
CONCLUSION

Procedures are described above for use in the following situations:

a) when cleaning and disinfection are required by statutes following the confirmation of an OIE List A notifiable disease. These procedures are designed to completely eliminate the organism, thus preventing further infection on the site or spread to other units. This is a major undertaking and must be conducted thoroughly and effectively, under the supervision of members of the State Veterinary Services. Such measures will have been internationally agreed and will be of proven efficacy. The occurrence of the disease will have had local, national and possibly international implications, and may affect the whole pig-producing industry of the country in terms of movement bans and export embargoes in relation to livestock, meat and meat products.

b) routine cleaning and disinfection. This is of minor significance by comparison, and is a management tool designed to reduce organisms remaining in the environment and in animals housed in other areas of the unit to an acceptable, low level.

The farrowing house is the most difficult area of the unit to clean and disinfect adequately, due to the presence of intricate fittings and equipment, and sophisticated support features for heating, feeding and ventilation, as well as alarms and piglet safety devices.

ACKNOWLEDGEMENT

The author has drawn extensively on unpublished instructions for the staff of the Ministry of Agriculture, Fisheries and Food in the United Kingdom, and also on personal experience of the eradication measures used in the United Kingdom to control swine vesicular disease.

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DÉSINFECTION DES LOGES DE MISE BAS POUR LES TRUIES. – J.M. Owen.

Résumé : L'auteur décrit les procédures de nettoyage et de désinfection des loges spécialement réservées à la mise bas des truies dans une unité d'élevage intensif. Ces procédures diffèrent selon qu'elles s'appliquent à l'une ou l'autre de deux situations très différentes :

- cas d'une maladie épidémique grave à déclaration obligatoire ;

- cas du nettoyage et de la désinfection de routine, dans le cadre de la conduite normale d'un élevage.

Dans le premier cas, la loi fait obligation d'abattre le troupeau et de nettoyer et désinfecter les locaux conformément au protocole adopté en vertu d'un accord international sur la maladie en question.

Dans le second, le nettoyage et la désinfection n'obéissent à aucune règle particulière ; le protocole est choisi en fonction des besoins de chaque élevage et placé sous le contrôle de l'éleveur et du vétérinaire conseil.
DESINFECCIÓN DE LOS PARITORIOS PARA CERDAS. — J.M. Owen.

Resumen: El autor describe los procedimientos de limpieza y de desinfección de los paritorios en una unidad de cría intensiva de porcinos. Los procedimientos descritos obedecen a dos tipos de situaciones, que son muy distintas:

- el caso de aparición de una enfermedad epizoótica grave de declaración obligatoria;
- la limpieza y desinfección de rutina, dentro del proceso normal de manejo.

En el primer caso, la ley obliga a sacrificar el rebaño y a limpiar y desinfectar las instalaciones, siguiendo el protocolo adoptado a nivel internacional sobre la enfermedad de que se trate.

En el segundo caso, la limpieza y la desinfección no son dictadas por ninguna regla en particular, y el protocolo se determina en función de las necesidades de cada producción, bajo el control del productor y del asesor veterinario.

PALABRAS CLAVE: Desinfección — Enfermedades de declaración obligatoria — Limpieza — Paritorios para cerdas — Procedimientos de rutina.

REFERENCES


