



Department
for Environment
Food & Rural Affairs

Nuclear Accidents and the Farmer

Livestock and Crop Management

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Introduction

This guide produced by the Department for Environment, Food and Rural Affairs (Defra) provides technical advice on managing livestock and crops in the period following an accident at a nuclear installation, and where evacuation of the farmer has been necessary. This advice is based around animal welfare and not economic considerations. Whilst it is not possible to account for all eventualities in a publication of this kind, it is hoped the main areas of immediate concern are covered. Much of the following information can be applied to livestock generally meaning beef farmers, smallholders or keepers of exotic species can draw from advice given under the various headings.

In certain accident situations an evacuation may be necessary for more than a day. This advice considers problems which might arise in the unlikely event evacuation of the farmer is necessary for a longer period.

This advice could also be used as part of emergency contingency planning for other types of event.

Exposure to radioactive material

Nuclear sites are designed, built and operated so that the chance of an accidental airborne release of radioactive material is very low, although accidents have occurred. The released radioactive material is carried downwind and can be deposited directly onto the surface of crops or can be absorbed and become incorporated into the plant tissue.

Livestock can become exposed by:

- inhaling radioactive materials
- direct radiation exposure from radioactive materials carried in the air and deposited on the skin and other surfaces, for example buildings or roads
- grazing land, eating feed and drinking water contaminated with radioactive materials

Farm animals are unlikely to suffer as a direct result of radiation exposure. They are generally less sensitive to the effects of radiation and their shorter lifespan makes the risk of cancer much less significant.

Section 1: Livestock farmers

Welfare of animals

Depending on the scale and type of event, there is special provision in emergency plans for re-entry into an evacuated area by farmers or other essential personnel for short periods to carry out jobs such as watering, feeding and milking.

Re-entry will depend upon the levels of radiation found. The timing and length of visits would be specified by the authorities controlling the incident. Since the length of return visits must necessarily be limited, farmers should ensure they are clear as to the priority action for their particular livestock system to get maximum benefit from the time available.

Why not evacuate animals at the outset?

An evacuation is intended to be a precautionary measure to prevent imminent foreseeable danger to people. It will not be possible to arrange for the removal of animals because the effort required to evacuate them in an emergency (which might occur at any hour of the day or night) would complicate and detract from the priority aim of human safety.

The first rule is, therefore, farmers advised to evacuate their holdings should not delay their departure in an attempt to protect their stock from risk.

Is there anything I can do before I leave?

What can be done for stock prior to evacuation will depend very largely on the prevailing circumstances. News of an accident may be broadcast before a need to evacuate is announced. If so, farmers with stock may wish to make preparations to act in accordance with the advice contained in this guide. It may also be possible to take immediate steps to delay the onset of animal welfare problems for as long as possible. For example, turning housed stock out may ensure them a longer-term supply of food and water.

The general rule must be to take what steps you reasonably can if time permits. Keep in touch with news announcements so you can evacuate yourself, your family, staff and visitors immediately the need to do so is announced.

Potential animal welfare problems

It is impossible to generalise about the rate at which welfare problems would develop over time amongst livestock left behind in an evacuated area. This would vary widely from farm to farm depending upon factors such as the provision of necessary ventilation, ready availability of water and feed, ages and classes of stock, production system, type of housing and equipment.

Isolated problems could occur at any time. These might include physical injuries, problems over calving, lambing, and the lack of veterinary attention for stock with ailments.

What are the main welfare problems?

The main requirements for animal welfare, in order of priority, are housing, ventilation, water supply and attention.

Housing

Animals that are housed, and therefore dependent upon human intervention for feed and water provision, are likely to suffer welfare problems faster than animals which are not housed. Free-range poultry return to the house for feed and water provision, and therefore would also be likely to suffer problems quickly. It would not be advisable to house animals which are not normally housed, as this would result in significant stress for the animals.

Ventilation

Inadequate ventilation, and/or the development of excessive heat, can cause stress, suffering and mortality within a few hours. Ensure the backup system is in operation and well maintained.

Water supply

While the majority of production systems are supplied with water automatically, there are one or two calf production and horse / pony systems in which liquids are routinely provided manually. Stock in such systems, particularly when young, could become dehydrated within hours unless special provisions were made.

Feed

Many classes of stock could, under emergency conditions, be provided with some form of improvised feed sufficient to avoid starvation for perhaps 2 to 3 days. Consider welfare implications with sudden feed changes. Stock at grass or animals which could, in an emergency, be turned out, should be safe for longer periods. However, not all stock could be provided for by such simple means. For example, housed ewes in late pregnancy should not be turned out, but on the other hand could develop pregnancy toxemia if attempts were made to provide them with improvised feeding based on concentrates. Calves in individual pens normally fed and watered by bucket would be suffering within 24 hours of their last feed unless transferred to an alternative system. For example, some form of loose housing provided with an automatic water supply and dustbins fitted with teat milk dispensers.

Where ventilation, water and food are provided by means of fully or semi-automatic systems, there is no reason to expect power or water supplies would fail as a direct consequence of an accident at a nearby nuclear power station.

Attention

Some types of stock may suffer from lack of attention and start to notice the absence of people as time passes and stress would begin to develop at varying rates. Milking stock in particular (cows, sheep and goats) would become stressed and agitated by the interruption of milking. Bellowing and bleating would become continuous. Udders would become distended and sore. Teats would dribble and become prone to infection. All milking animals would suffer, with high yielders suffering more severely. Some could develop metabolic disorders. All would begin to dry off and lactation would be curtailed. Apart from milking animals, the most vulnerable groups would be the very young of any species. In particular those in intensive systems, those being artificially reared, and those dependent upon the stockman for their water supply. Free-ranging stock will generally face far less severe problems than housed animals. The following guidance therefore applies particularly to housed animals and poultry. It should be noted that free-range poultry return to the house for food and water provision and would therefore be subject to the same problems as housed animals.

How can I help to avoid widespread problems?

The common aim of the following measures is to delay the onset of widespread welfare problems for as long as possible. Stock would have to be left unattended until the evacuation period has ended or until special arrangements can be made for essential personnel to re-enter an evacuated area for short periods.

Section 2: Dairy farmers

Milkers

During the initial period after evacuation of the farmer, there may be issues arising with animals due to the lack of contact with the farmer. The main priorities, if stock fatalities are to be avoided, are the provision of water and feed. During the period up to 48 hours after evacuation of the farmer, dairy cows should be given adequate food, but not large amounts, to help reduce milk production and moved to a space where they cause least damage to themselves. An adequate water supply should be provided. Careful attention should also be given to time-saving measures.

The highest yielding cows are likely to suffer most stress. They are vulnerable to metabolic disorders and mastitis brought on by the forced extension of milking intervals. If possible, separate high yielders from the rest of the herd and give them priority at milking time. It is

not essential to milk cows out completely. Leaving some milk in the udder will save time and decrease subsequent yield, thus alleviating stress.

Stock at pasture

During the grazing period to reduce the collection time for milking, move the herd to any pasture, hay or silage field with water available situated close to dairy buildings, even if growth is limited on the field in question.

Housed stock

In housed conditions the provision of water is the top priority, even if this involves emergency expedients like leaving a hose pipe running into a gully to which the animals have access. Deprivation of food for periods of up to 36 hours should not prove too serious in the case of adult ruminants.

Where possible, all yarded heifers and other young stock old enough to graze should be turned out. Stock should not normally be turned out into open areas where there are likely to be hazards such as unguarded machinery.

If grazing is impracticable, then turn stock housed in cubicles, boxes or sheds into yards with water available wherever conditions permit. Conditions in cubicles and sheds will rapidly become filthy if stock are left unattended for any length of time. Provide free access to roughages and, if necessary, throw cut bales into the yard area.

Do not feed milk producing concentrates unless this is the only type of feed available or is essential to keep cows quiet during milking, in which case feed smallest amounts possible. Feed a lower protein ration, if available. An immediate drink after milking is an unnecessary luxury which will only serve to stimulate further milk production, thus perpetuating high stress levels. Research indicates up to 40 per cent of the daily water intake can be reduced without welfare implications.

Cows should not be left tethered as animals could cause damage themselves while struggling to get free as hunger and agitation increase over time.

Milk hygiene and disposal

Dispense with milk hygiene measures to save time as the milk will not go for human consumption. If time is limited, or hot water unavailable, clean the plant with cold water only. The sole aim is to prevent milk fat congealing and blocking the system. Add 25 parts per million of hypochlorite (25 millilitres per 1000 litres of water).

Milk disposal options which avoid pollution risks should be discussed with Defra in consultation with the Environment Agency. Options might include drawing milk from bulk tanks into a vacuum slurry tanker, if available or obtainable, for spreading onto land well away from water courses. Milk could be pumped from bulk tanks into slurry lagoons or

onto manure heaps using portable pump taken onto the farm on re-entry. Alternatively, it could be pumped into water tanks carried in by lorry especially for this purpose.

Artificially reared calves

This is the most vulnerable group and the following action is recommended. Release calves from individual pens if they are bucket fed and watered. Move them into a separate area of a yard, fenced off from other stock. Provide them with a continuous water supply. Provide hay or calf pellets on the ground. On your first return visit, if equipment is readily available, quickly provide an improvised cold feed supply using acidified milk powder made up and fed via dustbins with teat feeders. If bucket feeding cannot be avoided, consider feeding electrolyte replacement at first feed on return. Ensure calves which are being artificially reared are not turned loose amongst dairy cows. Their dams would in all probability reject them and they would be in danger of being trampled.

General issues

Manpower

More manpower than usual will be needed during return visits. Stock will be very agitated and stressed as a result of infrequent milking, feeding or watering and will jostle harder than usual to gain access to the milking parlour, feeding or watering facilities. Help will be required to segregate vulnerable groups or individuals and to attend to jobs other than milking which can be done simultaneously.

Freezing conditions

Take in any equipment required to aid defrosting and maintain a frost protected water supply. Such conditions could prevent relief milking within the limited time available on a re-entry visit. If time permits, empty milking pipelines prior to initial evacuation.

Bulls

Bulls may present a particular problem. If a bull can be put with the herd it will normally respond quietly and contentedly. Risks could arise, however, from predictable sources, for example neighbouring cows on heat. Damage to fences, gates, property and even people could ensue. On the other hand, leaving a bull isolated in a loose box for several days within hearing distance of agitated and bellowing stock has its own attendant dangers.

Section 3: Sheep farmers

Dry and lactating ewes, and growing sheep grazing pasture with water available should suffer no more than isolated welfare problems if left to their own devices for a few days. However, problems could arise if sheep are housed. Unless flocks are in the process of lambing, stock may be turned out with access to feed and water.

In indoor early lambing systems (from December to January), ewes with lambs at foot could be turned out before weaning without incurring potentially serious welfare consequences and a heavy mortality rate. The only recourse is to fill all racks and troughs and ensure water is available. If weaning is complete, unshorn ewes may be turned out immediately leaving lambs indoors with fresh food and water.

Housed breeding flocks (from January to April) could be turned out to pasture or areas with feed if they are at least 3 weeks prior to lambing, the weather is not too severe and some supplementary feed could be provided. Some self-help molasses and soft compound feed blocks could be given. Do not over feed concentrates because of the risk this would create of pregnancy toxæmia and/or acidosis occurring. If ewes are lambing, and if time permits, separate ewes with lambs from pregnant ewes.

Housed store lambs (from December to April) being fed on forage and concentrates could be turned out.

High yielding flocks of milking sheep could become subject to metabolic disorders due to disruption of normal milking intervals. Leave housed, reduce feed to reduce milk production and give high yielders priority for milking. However milking sheep, except very high yielding flocks, could be turned out if external weather conditions are not extreme. If turned out, feed no milk producing concentrates and give supplementary roughage where needed. See section on dairy cows for advice on milk disposal and treatment of milking equipment.

Section 4: Poultry farmers

In all indoor and free range poultry units, maintenance of a satisfactory environment, in terms of ventilation and temperature, and provision of food and water is essential.

Broiler breeder, growing bird and laying hens

If the units are fitted with a fail-safe mechanically ventilated system, check this is operating. Overheating and lack of oxygen will cause suffering and can kill birds within hours. If fail safe system is not operating or not fitted, open sufficient windows, if available, and/or ventilation inlets to facilitate adequate natural ventilation dependent on the prevailing weather and stock in question.

Check the header water tank supply. When full, this should last 12 hours even if the water supply fails. Beyond this, birds should survive for 48 hours before mortalities occur. Additional water resources should be placed for any free-range systems using manual water provisions, for example manual bell drinkers. There is little risk of the water supply freezing in well designed and insulated houses.

Where feeding is mechanised, adjust to maximum rate of delivery in case mechanisms fail during the evacuation. If hand fed, fill all hoppers to their limit.

Older ducks and geese, when fully feathered, are more hardy than other species, and able to survive with less stress if heating loss occurs in colder weather. Nevertheless, emergency systems should be sought and provided. Follow guidance on ventilation, heating, water and feed as above.

Chicks, poults and ducklings

Newly hatched chicks and poults have energy and water reserves from the yolk and sac and will be sustained by this for a period of time, so food and water may not be an urgent concern within the first day of an evacuation, but may be if it takes longer for staff to get access to birds.

Deprivation of food is more critical for young birds than for adults. Severe stress could occur within 6 to 12 hours. Provide maximum supply of food whenever possible. Apart from ventilation and water, the principal welfare need is for supplementary heating dependent upon age and species. Check liquid gas supply. If low and no delivery is possible during period of evacuation, take in portable oil, gas, electric space heaters on re-entry. Siting of portable appliances must be planned with care. Note, though, some types may present a fire hazard if used in livestock premises. Avoid any risk of overheating or of the flame generated spreading to litter, straw or the fabric of the building.

Free-range (including organic) commercial systems

Allow birds with access to the range to continue to have outside access, otherwise follow the guidance for broiler breeder, growing bird and laying hens above. Check automatic watering system and top up feed containers. In well-equipped systems feed should last 24 hours.

Section 5: Pig farmers

The requirement for adequate ventilation is essential to all production systems. Heat stress can rapidly cause suffering and mortality. Check the ventilation is adequate before leaving the premises. Excess cold can also cause suffering, especially in the case of young animals. Reduce the danger by the provision of plenty of straw where possible. For outdoor sows, provide feed for 2 to 3 days and make sure water in bore holes is adequate. Place the feed in troughs rather than on the ground where it would become contaminated.

Farrowing sows in crates

This is probably the most vulnerable group. Ensure an automatic water supply is functioning. Give 2 to 3 days of feed in troughs and do not give creep feed if there is no access to water. Sows will begin drying off within 24 hours if denied water, with serious resultant welfare consequences for the piglets. Provide creep feed for piglets, in addition to sow feeding, where possible.

Fire risks

The provision of adequate supplementary heat is clearly critical to the wellbeing of piglets. Where used, leaving heat lamps on in units which may be unattended for 48 hours or more increases the risk of serious fires occurring, which could jeopardise all farm stock. If time permits, turn off lamps and provide plenty of straw in the creep area. If this is not possible, then judgement must be used to balance the relevant risks, taking account of prevailing weather conditions, the state of the equipment and the overall fire risk.

Dry sows

Check automatic water supply system and fill trough and buckets with water. If time permits, fill hoppers and troughs with food aiming to overfeed if possible. This action should avoid widespread welfare problems for 2 to 3 days. If using electronic feeders, consider feeding on the floor in case the feeders should fail.

Weaned pigs (up to 30 kg)

Apart from checking the availability of water, the main priority is to provide feed. Deprivation is rather more time critical for this group than for older pigs. By 24 hours, serious aggression may be developing. Treat this group as second priority for feeding, after farrowing sows. If time permits, environmental enrichment could be provided to assist in lessening any aggression issues.

Pigs (over 30 kg)

Water, followed by feed, are the main needs for this group. Apart from gradually developing stress and aggression, pigs of this weight will manage without undue suffering for longer than weaners if denied food.

Pipeline/wet feeding systems

Provision of water is the top priority. Where there is no separate water supply, fill to capacity all available troughs with water and place dry feed on any solid floor area. If a separate water supply is available, fill troughs with dry feed.

Section 6: Goat farmers

For all goats, there should be adequate feed available for 2 to 3 days preferably as a forage such as hay or silage if housed, and available grazing if outdoors. This should be sufficient for maintenance of metabolic and physiological requirements.

There should be adequate clean water for 2 to 3 days and if not automatic, then sufficient accessible containers should be filled, ensuring containers are not too deep such that inquisitive kids cannot fall in and drown.

Where goats are housed, the buildings must be well ventilated. If goats are to be housed in temporary accommodation, this must be suitable, well ventilated, and free from hazards that may injure goats or in which they may get caught.

Special care must be taken with any goats close to kidding, particularly if there is a risk of dystocia.

Goats should not be left tethered.

Goats are susceptible to enterotoxaemia – particularly when stressed – clostridial disease vaccination should be maintained and regularly boosted to avoid this risk.

Milking goats

High yielding flocks could become subject to metabolic disorders due to disruption of normal milking intervals. Reduce feed to reduce milk production. Give high yielders priority for milking. If time is limited, even relieving the pressure within the udder may suffice without the need to completely milk out the udder. With the exception of a few very high yielding flocks, housed milking goats could be turned out if external weather conditions are not extreme. Feed no milk producing concentrates but provide long fibre such as hay or straw. See section on dairy cows for advice on milk disposal and treatment of milking equipment.

Section 7: Fish farmers

Compared with the management of livestock considered above, the provisions required for the maintenance and care of fish stocks are relatively simple. In flow through aquaculture systems the main factor will be the maintenance of adequate water supplies. In recirculation aquaculture the main requirement will be the maintenance of electricity for life support systems through the provision of aeration and filtration.

Harvested fish

The most that should be attempted at the onset of sheltering or evacuation is to place harvested fish in a cold store until they can be processed or disposed of.

Feeding

Fish can withstand relatively long periods without food and no special provisions are required. However, on farms with automatic food dispensers, storage hoppers should be topped up and the rate of food dispensed reduced to the lowest setting in order to conserve supplies. Such action would be particularly beneficial in the case of fry and small fingerling fish which would suffer first in cases of prolonged starvation.

Water supplies

In flow through fish farms, the greatest threat to fish stocks is likely to be the clogging of screens on water inlets in the absence of regular maintenance but little can be done in this area. Where aeration systems have been installed, these should be left operating to help counteract any oxygen deficiency occurring through a reduction in water supply.

Section 8: Shellfish farmers

As with fish farming, the provisions required for the maintenance and care of shellfish are relatively simple. Shellfish in estuaries, the sea and on the beach can be left unharvested and so no special provisions are required.

There may well be consequential losses if the commencement of an evacuation coincides with some time-critical activity such as harvesting.

Harvested shellfish

The most that should be attempted at the onset of sheltering or evacuation is to store harvested shellfish in refrigeration to extend shelf life and to protect from radiation. No further shellfish should be gathered until advised to do so. Shellfish in depuration will

survive for extended periods of time so long as aeration and water recirculation is maintained.

Section 9: Horse owners

Horses kept outside at pasture should be left out. Horses grazing pasture with water available should suffer no more than isolated welfare problems if left to their own devices for a few days.

Stabled horses should be brought in and left in the stable with a supply of water and sufficient *ad lib* forage for 24 hours. Stabled horses could be left alone if provided with extra water but there would be issues after 24 hours. They may also need supplementary feed.

Horses should not be left tethered.

Section 10: Arable farmers and horticultural holdings

There is very little that should be attempted to safeguard crops at the onset of an evacuation. There may well be consequential losses if the commencement of an evacuation coincides with some time-critical activity such as sowing, spraying and harvesting. All facts should be recorded to form the basis of claims for compensation at a later date.

The most that should be attempted at the time is to stop any field equipment such as that used for irrigation, and turn off any manually controlled equipment in buildings, taking particular care with any which could become a fire risk. The air supply or ventilation to stored products should be shut off where this can be done without the risk of overheating.

Once the evacuation is over, those returning to their holdings may immediately find themselves subject to controls inhibiting the movement of any produce which might have been contaminated until such time as it can be tested. They may also find themselves subject to controls placed on certain types of farming activities. In particular, any which could disturb and re-distribute potentially harmful contaminants which had earlier fallen onto the soil or crops. In practical terms this could prevent activities such as sowing, tilling, ploughing, combining, rotovating and haymaking.

The length of time over which it may be necessary to impose controls on the arable side will depend upon various factors, including the nature of contaminants released from the accident site, the amounts involved, season, stage of crop growth and so on.

In certain accident scenarios the contaminants falling on soil could be taken up by crops. It does not necessarily follow, therefore, that the only crops which would be affected would

be those close to harvesting at the time. Crops at earlier stages of development may also be at risk.

In the case of protected crops, no special precautions are justified. It might be possible at certain times of the year to limit the contamination of crops growing in glasshouses by closing them down and making an adjustment to the heating system if necessary.

However, some exchange of air occurs even when a glasshouse is closed down and so protection is not necessarily complete. In fact, under many atmospheric conditions, such action could, in itself, cause damage to the crop.

Section 11: Your legal position

Farmers are expected to take all practical steps to comply with normal animal and hygiene requirements. However, it is likely the courts would recognise that, in an emergency of this sort, different standards may, for a short time, be unavoidable.

Section 12: Compensation

All sites will have made arrangements for the payment of compensation in the event of an accident occurring which results in injury or damage to third parties. Farmers should therefore maintain records of all facts likely to be of value in support of claims for compensation.