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Heat Stress in Poultry

Solving the Problem

ACTION ON ANIMAL HEALTH AND WELFARE

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Department for Environment Food and Rural Affairs

Department for Environment, Food and Rural Affairs
Nobel House
17 Smith Square
London SW1P 3JR
Telephone 020 7238 6000
Website: www.defra.gov.uk

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Defra Publications
Admail 6000
London
SW1A 2XX
Tel: 08459 556000
Email: defra@iforcegroup.com

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This booklet is intended to describe the main causes of heat stress in poultry. It outlines some of the common sense management measures that will help to prevent it. Whilst it embodies much of the latest advice and the best current husbandry practices, it cannot be exhaustive and is not intended as a substitute for expert advice. If in doubt about a problem, expert advice should be sought.

Introduction

Most poultry production methods in the UK involve large numbers of birds living in controlled environment housing. Under supervision of the farmer, the houses provide everything birds need to maintain their welfare and performance, including protection from the weather. However, a number of aspects of poultry production have changed through the 1990s and beyond 2000. The birds themselves have different genetic characteristics, they are much more productive, and there have been changes to medication and nutrition. Peak summer temperatures outdoors have been recorded as high as 38^{0}C (100^{0}F), and temperatures greater than 30^{0}C (86^{0}F) have been occurring more regularly.

High ambient temperatures can have a major impact on performance of commercial poultry. When they are coupled with high humidity, the combination can become critical. Therefore, there is a need to re-evaluate the management of poultry and equipment used in hot weather so that heat stress is minimised. Heat Stress not only causes suffering and death in the birds, but also results in reduced or lost production that adversely affects the profit from the enterprise.

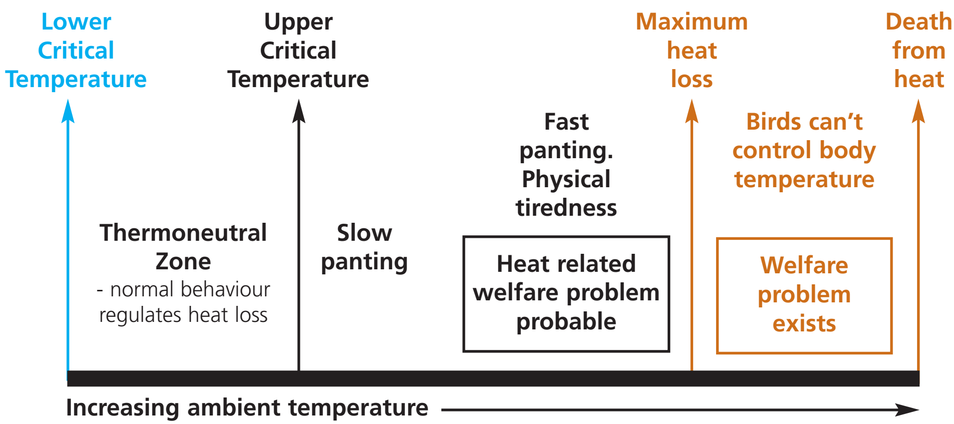
What is heat stress?

Birds are 'heat stressed' if they have difficulty achieving a balance between body heat production and body heat loss. This can occur at all ages and in all types of poultry.

Look at Diagram 1 – in the 'thermoneutral zone', birds can lose heat at a controlled rate using normal behaviour. There is no heat stress and body temperature is held constant. When conditions mean the 'upper critical temperature' is exceeded, birds must lose heat actively by panting. Panting is a normal response to heat and is not initially considered a welfare problem.

But as temperatures increase, the rate of panting increases. If heat production becomes greater than 'maximum heat loss' either in intensity (acute heat stress) or over long periods (chronic heat stress), birds may die. The body temperature of the broiler must remain very close to 41^{0}C (106^{0}F). If body temperature rises more than 4^{0}C above this, the bird will die.

Diagram 1 – Diagram of Thermoneutral Zone



It is important to note that a welfare problem is likely to occur somewhere between the 'upper critical temperature' and 'maximum heat loss', i.e, before bird losses occur. The stock keeper should be aware of bird behaviour and looking for signs of distress. The table at the end of the booklet shows a basic timetable of events during a hot day where heat stress might result in a welfare problem in broilers.

How is body heat produced?

Heat is produced by metabolism within the body, which includes maintenance, growth and egg production. Heat production is affected by body weight, species and breed, level of production, level of feed intake, feed quality and, to a lesser extent, by the amount of activity and exercise.

What are other heat sources within houses?

Excluding temperature of the air ventilating the house, heat is also added from the roof and walls. Much of the heat from working litter is used to evaporate moisture and dry the litter. However, in hot weather, damp litter will make heat stressed birds feel much more uncomfortable than dry litter. In dry litter, birds will attempt to dust bathe more readily to aid cooling.

The heat of electric lights and motors is a very small fraction of that produced by the body metabolism (normally less than 1%). Body heat is the dominant source of heat.

How do birds lose heat?

Heat can be lost in a variety of ways. Three normal methods of heat loss are listed below. Birds modify their behaviour to stay in the 'thermoneutral zone'.

- *Radiation* – Heat will be lost from the body by radiation if the surrounding surfaces are below bird surface temperature. Conversely hot walls and roofs may radiate heat to the bird surfaces.
- *Convection* – heat loss will occur from the natural rise of warm air from around a hot body. Providing moving air can assist convection, but only if the air moves fast enough to break down the boundary layer of still air that surrounds the body.

- *Conduction* – heat will transfer from one surface in contact with another surface, for example, if the birds are seated on litter that is cooler than their bodies. However, the litter immediately under the birds soon assumes a temperature close to that of the body.

After a bird can no longer maintain its body heat balance by one of these three methods (upper critical temperature), it must use "evaporative heat loss", or panting. Evaporative heat loss, whilst essential to the bird, does not contribute to heating the house.

- *Evaporation* – This is very important at high temperatures as poultry do not sweat but depend on panting. *This is only effective if the humidity is not too high. Hot, humid conditions are therefore much more stressful than hot dry conditions.*

How is heat lost from houses?

Heat is lost via ventilated air and by conduction through the roof and walls when not in direct sunlight. In hot weather, the air change is the dominant route.

How do birds respond to increasing temperature?

Birds will try to re-establish their heat balance with the surrounding by changing their normal behaviour. Birds may:

- Try to move away from other birds.
- Move against cooler surfaces, such as the block walls or into moving air streams.
- Lift their wings away from their bodies to reduce insulation and expose any areas of skin that have no feathers.
- Elect to pant slowly.
- Rest to reduce heat generated by activity.
- Reduce feed intake.
- Increase water consumption.
- Divert blood from internal organs to the skin, which darkens skin colour.
- Begin fast panting.

What are the consequences of panting?

- Heat is lost as moisture is evaporated from airways in the birds.
- Panting requires muscle activity, requiring energy use that generates some additional heat. The heat lost by evaporation must be greater than the additional heat generated by panting.
- Slow panting is a normal activity and can be sustained for extended periods of time.
- Respiration rate can increase by as much as 10 times the resting rate. Heavy panting can tire birds, reducing their ability to cope with extended periods of hot weather.
- High relative humidity reduces the effectiveness of evaporative heat loss.
- Increased respiration rate results in loss of carbon dioxide and a rise in blood plasma pH (called respiratory alkalosis). Blood potassium and phosphates are depleted, sodium and chloride levels increase.
- Growth rate or egg production will reduce.

Can hot weather be predicted?

Long-range weather forecasts are becoming far more reliable. Various services provide 5-day forecasts, and they can be obtained via the Internet. A trend can be seen that allows some degree of hot weather planning. *But remember that forecasts give temperature in the shade*. Most poultry houses ventilate with air exposed to direct sunlight that will be hotter than forecast.

Producers also need to be aware of local variations in climate that change the probability heat stress, e.g. off shore breezes, effects of woods, valleys, exposed ground or hot weather that produces thunder storms.

More sophisticated forecasting systems are being developed that will account for more useful temperature and humidity combinations and will have the facility to provide forecasts to within 10km.

Can poultry acclimatise to high temperatures?

Adult birds take about five days to acclimatise to high temperatures. Birds are more susceptible to sudden, large changes in temperature. The first very hot days after a cool spring often result in increased incidence of heat stress. Some of this will be due to poor acclimatisation, but some will be due to managers being less well prepared than later in the summer.

What effect does stocking rate have in hot weather?

If the stocking density is too high for the house and ventilation equipment, temperature may rise dangerously since there will be more metabolic heat being added to the house air than was planned for. Radiant heat transfer from bird to bird is greater and hot, humid air is trapped between the birds. Birds grouped together may be up to 40% less efficient at losing heat.

The long term planning for retail markets means that stock might be ordered months in advance and beyond the abilities of any weather prediction service. Company policy on stocking rates over the summer must realistically reflect the ability of each poultry house to cope with extreme temperature. Retailers should anticipate the possibility of reduced supply in the hottest months on welfare grounds.

Should birds be thinned in anticipation of hot weather?

Thinning is a common practice for optimising market weights and stocking rates, but in itself poses questions about placing additional stress on the birds that remain.

Reducing stocking rate prior to hot weather will reduce heat produced in a house, improve air movement around the birds and allow remaining birds time to recover. However, the stress of thinning in very hot weather, as in any form of intervention, can increase the likelihood of heat stress.

What are the key features of housing that protect birds from hot weather?

The key features are:

- Insulation
- House design and location
- Ventilation

What does insulation do?

Insulation greatly reduces heat transfer through a wall or roof. Even on a normal summer's day, it is surprising how much solar heat can penetrate a roof if the insulation is deficient. On a hot day, the surface of a roof can reach 60^{0}C. Measurements have shown solar gains of up to 30 Watts per square metre (W/m^2) coming through old broiler house roofs. The heat is radiated from the ceiling into the house, increasing the heat load on the birds below.

What is the recommended standard for insulation?

The effectiveness of insulation is described by the 'U value' (the lower the number the better). The modern recommended standard U value is:

- $U = 0.4\ W/m^2 / {}^{0}C$ or better.

In new, clear span buildings, the roof space can accommodate extra insulating material, and the walls are made using composite panels. The U value is typically 0.35.

In a new timber construction house, the typical U Value is about 0.4. It is inevitable in old houses that insulation will have degraded and will be outside recommended standards.

How important is house design?

In the UK, house design and location has traditionally been a function of a temperate climate, planning constraints, stock to be housed and economies of scale. But new house designs are also considering compliance to pollution and environmental control legislation, energy use and improved biosecurity requirements.

The design of the building and its ventilation system, the siting of new buildings and construction materials, will all have an effect. Roof colour, reflectivity, pitch and orientation, and whether the building is in the shade or not, are also factors which will have a small bearing on solar heat gain. Expert advice should be sought at the design stage.

However, extreme summer temperatures must be considered inevitable and some provision to minimise heat stress in extremes must be incorporated within a temperate climate house design. The house and ventilation system must compliment each other to achieve maximum benefit. The result might be a house designed for combined conventional / tunnel ventilation, or being narrower for improved efficiency of air flow, or incorporating some form of air conditioning.

A modern, well insulated, clear-span broiler house. Ridge fans are placed in high-efficiency chimneys. Modular sidewall inlet units can direct air at high speed over the birds.

A modern broiler house using combined conventional / tunnel ventilation. Air is drawn through the tunnel inlets shown and drawn at high speed down the length of the house.

How important is the ventilation system?

Using outside air is the principal method of removing heat from the poultry house. There are two parts to a ventilation system and they must always compliment each other:

- The air change system – fan powered systems are most common, or natural ventilation. Standard UK maximum ventilation rate (MXVR) recommendations (Table 2) are based on the theoretical quantity of air needed to prevent bird heat raising house temperature by more than 3^0C above outside temperature. Different ventilation companies offer specifications between 2.5^0C and 5^0C, depending on the stock, stocking rate and inlet design.
- The inlet system – Whatever the air change capacity available, it is critical to distribute air uniformly and at high speed to all of the birds in hot weather. This is particularly true for birds finishing in the meat sector and where there are high stocking rates.

In naturally ventilated houses, the MXVR to maintain a 3^0C temperature lift dictates the size of the openings in the walls and roof, and these are calculated according to the height of the building. Many naturally ventilated houses are under specified. There is no single rule of thumb for natural ventilation and calculations for each house must be carried out individually. Such calculations may require the services of ventilation consultants.

What are the benefits of high airspeed over birds?

High air speed is essential in heat stress relief. In systems with lower stocking rates, the effects are greater. High air speeds:

- Ensure that air passing over the birds from the inlets is as near to outside temperature and humidity as possible.
- Remove the boundary layer of hot air around the birds, aiding convectional heat loss. This is vital when birds are at, or near, peak stocking rate.
- Remove humid air from around the birds' heads, making panting more efficient.

- Imparts a sense of windchill to the birds. This makes birds feel cooler than the actual temperature. Birds in one house might stop panting when in an identical house, at the same temperature but with slower airspeeds, the birds keep panting.
- Makes the most of evaporative heat loss when, at very high temperatures (> 32^{0}C), the effects of windchill diminish.

What are the recommended air speeds over birds in hot weather?

All meat producers should aim for between 1 m/s and 3 m/s for relief against extreme heat. 1 m/s should be an absolute minimum for commercially stocked houses. 1.0 -1.5 m/s should be within the abilities of most conventional powered ventilation systems, especially after minor upgrades. (1m/s = 200 ft/min)

To achieve 1.5 – 3 m/s, the house would usually need to be operating in a tunnel ventilation format.

Low stocking rate systems, such as breeders, pullets and layers should aim for at least 0.7 m/s. In these systems, high volumes of air can, to some extent, make up for an inlet system that cannot deliver high air speeds over birds. But good air speed and good air change rate is the ideal.

What inlet designs are best suited to creating high air speeds?

Inlets can create two types of air stream within a house:

- Indirect – primary air streams travel along the ceiling and generate secondary air currents over the birds. This air pattern is ideal for rearing, but creates less air speed over birds.
- Direct – primary air streams can be aimed directly over the birds. This is not good for rearing, but is best for heat stress relief.

Many old houses still in use were not designed to create high air speeds over birds for heat stress relief, and only provide indirect air currents; this is typical with old wooden, bay length inlets. To generate over 1 m/s, inlet modification and fan upgrades are invariably required.

Modern houses mostly use inlet systems that offer both air patterns, using indirect air patterns for rearing and direct for hot weather. Tunnel ventilation that draws air down the length of a house, is an alternate example of a direct system.

How is high air speed developed?

High air speed is developed by the negative pressure of fans removing air from the house, or by the stack effect in natural ventilation. With the correct balance between inlet area and recommended air change capacity, a high air speed can be achieved. The correct inlet position creates air movement over the birds.

Where inlet area is very generous in relation to the air change capacity (common in older houses), it is tempting to open inlets too wide in hot weather. The result is low pressure, slow inlet air speed and little or no air speed over the birds. Loss of air movement over the birds can result in severe heat stress.

In some situations, fans are modified to blow air into a house. This does provide substantial air speeds over the birds. Width of the house, effective coverage of the floor and restrictions to the fan, however, need to be considered.

What negative pressure typically generates the recommended air speeds?

This depends on the individual specification of the house, house width, and ventilation system. In broiler houses of 18m width and more, with conventional powered ventilation systems, pressures of -30 to -40 Pascal (Pa) should generate the recommended airspeeds.

Pressure meters are a very useful tool for assessing ventilation performance.

If the system is designed to operate in a tunnel format, with gable inlets and gable fans, then system pressure should be as low as possible to optimise fan performance (typically -15 to -25 Pa).

Can I use internal recirculation fans if air speeds are inadequate?

Internal recirculation fans can play an important role where air speeds over birds are poor. It is important to distinguish between recirculation fans, which do not change air, and the main ventilation fans that do.

However:

- The air movement generated is at house temperature and humidity.
- Air distribution is uneven and birds sometimes huddle into the discharge air plume, increasing stocking rate under the fans.
- Always consider the possibility of modifying the inlets to increase air speed evenly across the house – this might also require an increase in air change capacity.

Hanging recirculation fans have a role to play where air distribution is poor.

What are the recommended maximum ventilation rates?

The recommended MXVR (m^3/hr) are shown in Table 2 (overleaf). They should be applied after accounting for the reduced fan performance due to the pressure required to generate the fast airspeeds recommended in the preceding paragraphs.

Table 2 – Maximum Ventilation Rates (m^3/hr per 1000 birds)

Liveweight (kg)	Broilers (1,000)	Turkeys (1,000)	Laying birds (1,000)
2	9,700	9,700	9,000
2.5	11,500	11,500	10,800
3	13,000	13,000	12,250
5		19,000	
10		32,400	

(1 m^3/hr = 0.588 ft^3/min)

(NB. In tunnel systems, it is air speed that is important as a specification, not air change rate).

What is the simplest way of upgrading to the recommended MXVR?

With the performance equivalent to three to four fans in wooden shafts, the large belt driven fans currently provide the most air change for least cost. They can be placed anywhere in the house that is convenient, and do not interfere with the performance of conventional fans.

Whilst best performance is at low pressure (e.g. in tunnel houses), they will operate up to -40 Pa. Inlet area must be able to accommodate the extra air change capacity, or be increased. The performance of any fan must be known for the anticipated operating pressure.

Always check the electrical supply capacity for the farm and from the generator when increasing fan numbers. Belt driven fans can be used in place of existing fans to save on electricity.

Can the existing ventilation systems be modified?

Placing larger fans in existing wooden shafts yields little increase in performance, and might even be detrimental. Improving back draught shutter design and weather cowl design can improve an existing system. Smooth, round, plastic tubes placed within the existing shafts also improve performance. Fan shafts can, of course, be replaced completely with modern high performance chimneys.

If maximum inlet area is very generous compared to air change capacity, extra fans can be fitted until suitable pressures are achieved. But it is vital to ensure that the extra air is used to generate high air speed *over the birds*. Many old inlet types can be modified into 'summer inlets' that blow air directly over birds.

Some traditional light baffling or weather cowls on inlets can be very restrictive on airflow. Modifying or removing light baffles is often essential to the performance of inlets where the house has been fitted with extra fans. However, the trade off is light ingress.

What is evaporative cooling?

For water to evaporate, energy is required from the air and heat is lost, resulting in cooler air.

Water can be evaporated from cooling pads or from atomising nozzles. Cooling pads are not common in the UK, and are more suited to dedicated tunnel ventilation systems.

Example of a high pressure misting system

What are the advantages of evaporative cooling?

The advantages are:

- The ability to maintain house air temperatures in the bird's 'thermoneutral zone' for extended periods during normal spells of hot weather.
- That panting frequency is reduced or prevented.
- That large changes in temperature can be avoided.
- That windchill from air movement over birds is more effective.
- That high ventilation rates can sometimes be reduced.
- That feed consumption and liveweight gain can be maintained.

What are the disadvantages of evaporative cooling?

The disadvantages are that:

- In extremes of very high temperatures and very high humidities, cooling systems might be ineffective or detrimental.
- There is about a 4.5% RH increase for every 1^{0}C of cooling. A water supply that reduces temperature by 6^{0}C must increase % RH by about 27%. Managers should be aware that it is common for the house humidity probe not to accurately reflect this dramatic humidity increase.
- Should cooling not prevent heavy panting, the resultant increase in % RH can reduce panting efficiency and increase the risk of heat stress.
- A cooling system cannot replace the need for high air speeds from the existing ventilation system.
- Incorrect positioning of nozzles can result in poor cooling and wetting of litter.
- They require frequent maintenance, especially in hard water areas.
- There is limited expertise or cost benefit information available.

Is there a benefit from leaving the ventilation running at maximum all night?

Where a warm evening precedes a hot day, running the ventilation system at or near maximum all night is thought to reduce core body temperature and improve the survival rate during the following day.

Does reducing feed intake or feed removal help in heat stress relief?

Birds in hot environments reduce feed consumption naturally, reducing heat from metabolism. Feed conversion efficiency and growth rate is also reduced. Techniques that increase activity or stimulate food consumption may be counterproductive. Feed removal prior to the hottest part of the day has been shown to be beneficial in reducing mortality. The advantages are reduced metabolic heat output, and where feeds systems can be lifted, increased floor space and improved air distribution over the floor.

Problems can occur, however, on the reintroduction of food – the stimulus to eat again may result in a surge of activity. If the birds have not fully recovered from heat stress during the day, the sudden activity can prove fatal. There is an argument to leave the feed available for broilers, since they do not habitually store food in the crop, and are better able to restrict their own food intake.

Stockmen must be very careful about the timing of reintroducing the food soon after the heat of the day, noting bird behaviour.

Can cool water alleviate heat stress?

Water is lost from the lungs when birds pant and so more water needs to be drunk to prevent dehydration. Cool water stimulates water intake. Reducing the body temperature of the bird is beneficial and has been associated with reduced mortality.

Can dietary adjustments make a difference?

Where feed consumption is decreased due to spells of hot weather, dietary adjustments can help maintain a good supply of nutrients. Protein contributes more metabolic heat than fats and carbohydrates, so a correct energy: protein ratio is important. Dietary vitamins and minerals can be reformulated.

Does flock walking help alleviate heat stress?

The purpose of flock walking is to make birds release heat trapped under the body. If this is carried out before birds show signs of distress, there may be a benefit.

Great care must be taken to observe bird behaviour. If birds are very quiet, will not move away from the walker, or have heads drooping, it is probably best not to disturb them any further.

Is there a danger of heat stress during depopulation?

At times of high ambient temperature or when high humidity poses a threat to the birds, catching, loading and transportation create particular risks of heat stress. It is important that plans are made in advance to reduce the risk. Such plans should include the daily receipt of meteorological forecasts of predicted temperatures for the next few days so that appropriate action can be taken.

What are the basic requirements for catching?

Whatever method is used for catching birds, it is essential that the process takes the minimum time possible which is consistent with ensuring bird welfare. Where possible, catching and loading should be timed for the coolest part of the day. Staff and equipment should be well prepared beforehand.

A team leader with overall authority should be appointed to co-ordinate the operation, and to stop and restart a catch if necessary. The leader should understand bird behaviour in hot weather so that informed decisions can be made.

Ventilation must be provided for uncaught birds until the time they are loaded and, if necessary, additional mobile fans must be provided during the catching operation. Where appropriate in large buildings, shed doors should be closed while crates are loaded onto the vehicle. Water should be given regularly to the uncaught birds by periodically lowering the drinkers, ensuring that sufficient light is available for the purpose.

Should stocking rate in modules and crates be adjusted?

Stocking densities should be adjusted according to:

- The temperature / humidity combination.
- Module or crate design.
- Trailer design, whether curtain-sided or open-sided. If the performance of a trailer in hot weather is not known, under-stock until experience is gained.

- Distance and speed of the journey – if the journey is short and slow, stocking rates should be reduced compared to a longer and faster journey.
- Lairage facilities – the lairage ventilation must be equivalent or superior to the vehicle in motion.

Once birds are loaded, neither the modules nor the vehicle should be left standing in direct sunlight. If a delay in loading occurs, ventilation must be provided for the birds either by unloading the crates into a cool and well-ventilated place (for example, back in the shed) or by driving the vehicle around.

A fully loaded vehicle should never be allowed to stand for any length of time on site at the farm, during the journey, or at the slaughterhouse unless in a suitably and efficiently ventilated lairage.

When is an alarm system required?

Alarms to warn of failure of the ventilation system are mandatory when the birds' welfare depends on powered ventilation. The Welfare of Farmed Animals (England) Regulations 2000 requires an alarm that will give adequate warning of the failure of the system to function properly, and additional equipment that will provide adequate ventilation so as to protect the birds from suffering unnecessary pain or unnecessary distress.

A principal consequence of failure of the primary ventilation system is temperature rise with risk of heat stress and death. Therefore, emergency equipment must be designed to prevent excessive temperature rise. Failsafe systems designed to prevent house temperatures from rising more than 5^0C above the outside temperature by natural ventilation are much less common in modern housing – it is more likely that a self-start generator is the principal failsafe mechanism.

How important is staff training?

It cannot be emphasised too strongly that poultry kept under any system can be prone to heat stress if management and husbandry are not of a high standard.

The Welfare of Farmed Animals (England) Regulations 2000 require that stockmen and others who look after livestock should receive instruction and guidance in, and have access to, any Welfare Codes relevant to the livestock kept on the farm. In this case, staff should be familiar with the relevant Welfare Codes and, in particular, the sections on ventilation and temperature.

How important is communication and contingency planning?

All parts of poultry operations should have detailed written instructions and lines of communications established so that the correct action can be taken when triggered by either high temperature or humidity. If catching and transport is contracted out, close liaison must be maintained with the contractors and a representative of both the farm and the contractor should always be present or available to take any action necessary to safeguard the welfare of the birds.

Poultry producers should ensure that all staff are able to recognise the early signs of heat stress and that senior stockmen and certain other staff are familiar with the ventilation systems built into the poultry house. Written plans should be made in advance to deal with hot weather emergencies. Such plans should include action to be taken and by whom both during normal operations and while the birds are depopulated and transported.

Contingency plans should cover either a partial or complete breakdown of equipment (such as back up systems failing) and designate different roles to members of staff as necessary. Emergency instructions should be clearly displayed for all staff and these should include telephone numbers of veterinary surgeons and equipment engineers. A person should be available or on-call at all times who has authority to take whatever actions are necessary to protect the welfare of the birds.

In Summary:

- Provide adequate ventilation for the number of birds housed.
- Provide fast air speed over birds.
- High humidity increases the likelihood of heat stress in hot weather.
- Where possible, reduce stocking densities during hot weather both in the shed and during transport.
- Regularly maintain and test alarms and emergency ventilation equipment.
- Make contingency plans in advance so all know their respective roles and ensure that someone is available with authority to take actions.

Further advice and information on animal welfare

For advice on all veterinary and welfare matters, contact your private veterinary surgeon.

General advice on welfare matters can be obtained from:

- The State Veterinary Service (Local Animal Heath Office – address and telephone number in your local telephone directory).
- Defra operate a comprehensive web site with links to the animal welfare, publications and Farm Animal Welfare Council pages at www.defra.gov.uk

Publications

Defra produce a number of publications on animal welfare which are free of charge, unless otherwise stated, from Defra Publications, Admail 6000, London, SW1A 2XX, (telephone 0845 955 6000, or via the Defra website – www.defra.gov.uk

Relevant publications include:

- Code of Recommendations for the Welfare of Livestock – Meat Chickens and Breeding Chickens (PB 7275)

- Code of Recommendations for the Welfare of Livestock – Laying Hens (PB 7274)
- Poultry Litter Management (PB 1739)

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Timetable of events during heat stress event

Time of Day	Stockman Actions	Flock Response
Early morning	Ventilation on full to lower core body temperature	Eating and drinking normally – noise and activity normal
	Normal duties – inspections	Eating and drinking normally – noise and activity normal
Mid morning		Birds begin to pant – Eating and drinking normally – noise and activity normal
	Option to withdraw feed and to switch off lights	
Late morning – Noon		Birds panting – feed consumption reduced, drinking against dehydration. Activity reduced – more birds sitting.
Noon – Early afternoon		Birds panting heavily – feed consumption negligible – Some drinking – Limited activity
	Slow flock walking to release heat – up and down a line only, not across.	Birds should readily move away from stockman's feet

Time of Day	Stockman Actions	Flock Response
Early to late afternoon		Birds panting heavily – No activity – drinking stopped – birds sitting, heads up into air stream – Alarm calls may be heard. A welfare problem probably exists about this time.
	Slow flock walking may still be possible – only if birds can still move. Can flick on lights or jump the feed motors for similar response.	Birds should still be able to ripple away from the stockman's feet
Late afternoon to early evening – falling temperature, but elevated humidity	Flock walking not recommended	Birds panting heavily – No activity – drinking stopped – birds sitting – flock quiet and heads can start to drop – mortality often worse at this time.
Evening to dusk	Flock walking not recommended	Birds panting heavily – No activity – drinking stopped – birds sitting and heat and physical exhaustion probable – flock still quiet – mortality still probable.
Dusk – temperatures fall	Watching for all birds to be drinking – Birds may require low light	Birds start to drink again – takes time.
		Birds recover and begin to feed or look for feed if removed
	Ensure birds are fully rested and fill feed lines before reintroducing.	
	Carry out inspection	

Notes

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Nobel House
17 Smith Square
London SW1P 3JR

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