Opinion on Enriched Cages for Laying Hens

November 2007

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OPINION ON ENRICHED CAGES FOR LAYING HENS

Scope

1. To advise the Government of the implications for the welfare of laying hens of the use of enriched cages as an alternative to conventional cages, which are due to be banned within the European Union from 1 January 2012.

Background

Extent and nature of the topic covered in the opinion

2. Council Directive 99/74/EC, prohibits the use of conventional cages within the European Union from 1 January 2012, with production thereafter only allowed in enriched cages or non-cage systems, i.e. either free range or barn systems, including organic systems. There will be significant implications for the welfare of laying hens when this Directive is implemented. The enriched cage system is seen by some as a viable alternative to the free range system, offering improvements in welfare compared with conventional cages.

3. The term "furnished cages" has been coined by some observers to describe cage systems providing additional space or other provisions on the basis that some of the requirements listed as necessary for enriched cages by the Directive more accurately *furnish* the cage, whilst it is a matter of opinion as to whether they actually *enrich* the cage for the hen's benefit. However, for consistency the term "enriched cage" will be used in this Opinion.

Welfare concerns or contentious issues and/or opportunities to improve welfare

4. The main welfare concerns about enriched cages involve the view that such cages still do not satisfy the hens' needs in terms of continuous confinement, restrictions on movement and expression of some behaviours, and a lack of true or meaningful enrichment. Such cages may offer hens more usable space but this may be insufficient to allow expression of the full behavioural repertoire, including foraging, dustbathing and extensive locomotion. These disadvantages may be related more to design, layout, internal features and colony size rather than an inherent or fundamental aspect of enriched cages.

Number of animals involved, duration and extent of poor welfare or suffering

5. In 2005, the UK was the sixth largest producer of table eggs in the EU, having about 29.5 million laying hens producing 8,847 million eggs per year. The 2006 Census identified the UK laying flock as comprising 28.6 million hens. The UK egg market is currently split between about 49% retail (shell eggs), 28% processing and 23% food service. Egg packing station figures for

2006 (Defra) indicate that the split between production systems was as follows:

Conventional cage	62.7%
Free range	27.2%
Barn	5.1%
Organic	5.0%

6. Laying hens are typically kept to about 72 weeks of age, producing approximately 300 eggs per hen. While there are some advantages of conventional cages in terms of health and welfare, these are now generally considered to be outweighed by the disadvantages, principally the barren environment, lack of a separate nesting area and substrate, restrictions on behaviour, and production syndromes such as osteoporosis, leading to poor bone strength and possible fractures.

Legal context, including current and imminent legislation or regulations produced by the GB Governments or the European Union

7. Council Directive 99/74/EC will prohibit the use of conventional cages within the EU from 1 January 2012, with production then only allowed to take place in enriched cages or non-cage systems, i.e. either free range or barn systems including organic systems.

8. The Directive lays down specific provisions that must be supplied by enriched cages, including:

- Space - provision of at least 750 cm^2 of cage area per hen, 600 cm^2 of which shall be at least 45 cm high, and no cage shall have a total area that is less than 2000 cm^2
- A nest
- Litter such that pecking and scratching are possible
- Perches – appropriate perches allowing at least 15 cm length per hen
- Feed trough – supplying at least 12 cm length per hen
- Drinkers – at least two nipple drinkers per cage
- Aisle width – at least 90 cm between tiers of cages
- Claw shortening devices

9. A schematic of an example of the lay out of an enriched cage system as seen by FAWC during its investigations is illustrated in Appendix 1.

National and/or international considerations

10. Up to 40% of the EU free range flock is located in UK. Industry predictions (British Egg Industry Council, 2006) estimate that by 2012 the production systems used by the UK industry will comprise:

Cage	40 to 45%
Free range	45 to 50%
Barn	6%
Organic	4%

11. There are currently about 300 million laying hens producing table eggs in the EU. About 80% of these hens are kept in conventional cages at a stocking density of 550 cm^2 per bird, with 8% of hens kept on free range, 10% in barns and 2% in organic systems.

12. Due to market demands, industry predictions are that across the EU up to half of the 300 million laying hens may switch to enriched cages or non-cage systems by 2012. Therefore, at the time the Laying Hens Directive is due to come into force, there will likely still be at least 150 million hens kept in conventional cages. If the EU ban on conventional cages is enforced in January 2012, industry fears that this will lead to a significant distortion of the trade in eggs within the EU. Under current world trade agreements, it is likely that this would lead to a major influx of eggs from Third Countries with no guarantees as to the welfare of the hens laying those eggs. It would be of great concern to FAWC if those eggs originated from flocks operating to standards significantly below those pertaining in the UK.

Commercial interests and developments

13. In terms of progress on the development of alternatives to conventional cages, Article 10 of Council Directive 99/74/EC required that by no later than 1 January 2005, the Commission was to submit to the European Council:

> *"A report, drawn up on the basis of an opinion from the Scientific Veterinary Committee, on the various systems of rearing laying hens and in particular on those covered by this Directive, taking account of both pathological, zoo-technical, physiological and ethological aspects of the various systems and of their health and environmental impact.*
>
> *The report shall also be drawn up on the basis of a study of the socio-economic implications of the various systems and their effects on the community's economic partners."*

14. At the time of publication of this Opinion, this report had still not been produced. Though it might be argued that the industry has known about the requirements of Directive 1999/74/EC for many years, the absence of this report, a further general review of the Directive now taking place and its possible revision, has meant that the industry has not felt sufficiently confident to make the commercial decisions necessary to invest in alternatives to the conventional cage system.

15. Concern over this indecision and failure to publish the Commission report on husbandry systems for laying hens was expressed most strongly to FAWC during its consultation with industry stakeholders. As a result, the UK industry is seeking an extension for the use of conventional cages from 2012 to 2017. Alternatively, if conventional cages are to be banned from 1 January 2012, then the industry makes the request that there should be an extended phase-in period of five years. The industry suggests that systems allowed during this transitional period would be based on an assessment of welfare in

conventional cages, possibly based on a points system, combined with a reduction in stocking density from 550 to 750 cm^2 per bird. Such moves might also help push investment towards enriched cages, if they are allowed.

16. The Directive also requires a minimum height for enriched cages of 45cm. As a result, most, if not all, current conventional cages could not be converted to enriched cages by the installation of a perch, nest box and a scratching area and hence would be rendered obsolete. Defra-funded research (Defra AW0226, 2004) has suggested that there are no significant welfare benefits demonstrated in terms of the birds' ability to express "normal" behaviours merely by increasing the height of cages above the current legal minimum of 35cm.

Advice by FAWC and/or EFSA relating to the topic, especially within the last two or three years

17. In its advice to Government about enriched cages (December 2002), FAWC reaffirmed its concern, expressed in its 1997 Report on the Welfare of Laying Hens, that conventional cages presented a restricted and barren environment and welcomed a decision that such cages be phased out. Relevant advice in the 1997 report was:

> **Paragraph 103.** *"Opinion differs regarding the value of potential benefits to bird welfare arising from the enrichment of cages. There is a view that whilst non-cage alternatives to battery systems may in the long term be the better way forward from the view point of the birds' welfare, there is an urgent need for substantial effort to be put into improving (enriching) cages."*
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> **Paragraph 104.** *"Another commonly held view is that an enriched battery cage is nonetheless a cage and as such is still unacceptable. It is argued that in this situation enrichment may make little or no difference to public perception. However public perception has not stopped the majority of consumers purchasing eggs from conventional battery systems. These eggs continue to sell perhaps because of their lower cost in comparison with eggs from other systems. For the majority of consumers, the low cost is not perceived as coming at the expense of the birds' welfare."*

18. FAWC made the following recommendation:

> **Paragraph 107.** *"We recommend that applied and carefully targeted research on the space and facilities required for hens in enriched cages should be continued and developed on a commercial scale. Measures must be made of the effect of space and facilities on both behaviour and production. This should take account of the quality of the environment as it may be better for a hen to have less space and an enriched environment than more space in a barren cage where increased injurious pecking behaviour may occur resulting in a need to beak trim."*

19. In spite of FAWC's desire to see the phasing out of conventional cages, the Council did consider that enriched cages might offer the possibility of improved welfare providing that practical, acceptable systems could be introduced. In advising Government in 2002, FAWC was therefore disappointed that since its 1997 Report on the Welfare of Laying Hens, Government research and development had been limited and restricted only to "enriching" cages otherwise similar to conventional cages. Whilst the provision of a perch and rudimentary nesting and scratching areas offered some environmental enrichment, the Defra-funded research carried out at ADAS Gleadthorpe was limited in scope and outcome.

20. In our advice in 2002, FAWC therefore reiterated that what was required was:

> *"Information that relates to the overall welfare outcomes of egg laying systems, both in cage and non-cage environments. Without a framework for assessing the trade-offs between different welfare parameters and the methodology for producing an overall "welfare index", a judgement on the overall acceptability or otherwise of a particular production system cannot be made on a scientific basis".*

21. FAWC was therefore pleased to see the development of the EU LayWel project in which six work packages were designed to focus in detail on the welfare aspects of laying hens in the EU. This culminated in work package 7 which attempted to evaluate welfare in various housing systems by combining the results of the other work packages through a presentation of risk factors and advantages and disadvantages of various housing systems. This project is discussed further in the next section.

Evidence

Scientific knowledge relating to the topic

22. Defra has funded work on production systems (e.g. projects AW0226, AW0231 and AW0235) which have looked at the behaviour of birds in enriched cages, and space utilisation. Project AW0226 examined the welfare of hens in furnished cages with varying stocking densities and cage heights, and examined the suitability of materials and substrates for dust bathing. This work did not suggest any detectable effects on fear or distress responses in the birds, but noted their prioritisation of horizontal space. There seemed good potential for providing dust bathing in furnished cages. Project AW0231 examined the welfare of hens at depopulation in free range, barn, conventional cage and enriched cage systems. It was of interest that this work found that the incidence of total fractures was significantly lower for birds from enriched cages than from other systems. Project AW0235 is yet to be completed and it is hoped will give further useful comparative data (using a multifactoral analysis) on the use of different enriched cage systems, colony size, and possible bird strain effects, throughout a complete laying cycle.

23. LayWel is a research project which was funded by the European Commission under the 6th Framework Programme, supplemented by national funds. The aim of the project was to assess the implications of changes in production systems on the welfare of laying hens. Special emphasis was placed on enriched (also described as furnished) cages. This work is summarised in the Final Activity Report published on 28 March 2006 (www.laywel.eu).

24. Specific objectives of the project were:

a). To produce a consensus definition of laying hen welfare including appropriate indicators.

b). To describe the different categories of housing systems for laying hens:

Description	**Specification**
Conventional cage	All cage systems that are not furnished
Furnished cage (FC)	Cages with furnishment as required by Directive 1999/74/EU; no distinction on group size
Small furnished cage	FC with up to 15 hens per cage
Medium furnished cage	FC with 15-30 hens per cage
Large furnished cage	FC with above 30 hens per cage
Non cage systems	All non-cage systems, e.g. barn, aviary, free range

c). To assess the health of laying hens in enriched cages and alternative housing systems.

d). To determine the needs, preferences, distribution, behaviour and use of facilities and enrichment components by birds housed in various experimental and commercial enriched cages and other egg production systems.

e). To identify physiological measures of stress in laying hens to assist the assessment of welfare.

f). To assess productivity and egg quality traits of laying hens in different production systems in relation to welfare.

g). To integrate the information obtained from all preceding objectives in an overall assessment of the impact of enriched cages and alternative housing systems on the welfare of the laying hen.

25. The principal results of this integrated assessment of the risk for welfare of the laying hen in different systems of egg production are summarised in the following table, adapted from the original in the LayWel final report.

Risk to welfare for key indicators in different hen housing systems
(Adapted from Workpackage 7.1, LayWel, 2006)

Indicator	Cage type				Non cage		Outdoor
	Conventional	Furnished cage			Single level	Multi level	
		Small	Medium	Large			
Mortality (%)	Medium	Medium	High	High	High	High	High
Mortality due to feather pecking and or cannibalism	Low	Medium	Medium	Medium	Medium	Medium	Medium
Red mite	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Bumble Foot	Low	Medium	Medium	Medium	High	High	High
Feather loss	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Use of nest boxes	High	Low	Low	Low	Low	Low	INS
Use of perches	High	Medium	Medium	Medium	Medium	Medium	Medium
Foraging behaviour	High	Medium	Medium	Medium	Low	Low	Low
Dustbathing behaviour	High	Medium	Medium	Medium	Medium	Medium	Medium
Air quality	Low	Medium	Medium	Medium	High	High	Low
Water intake	Low	Low	Low	Low	Low	Low	Medium

26. Indicators labelled Low indicate good or satisfactory welfare or performance since welfare may not necessarily be optimal but there is a low risk of poor welfare. Indicators coloured Medium denote a medium risk of poor welfare. This also indicates factors which were highly variable within systems or between farms. Finally, indicators labelled High indicate a high risk of poor welfare. Often the housing system simply did not provide the facilities required or the characteristics were such that there was a high risk of undesirable outcomes without extreme vigilance. The white box (INS) identifies an “unknown risk to welfare, due to insufficient data”.

27. The primary aim of this classification of the different housing systems was to identify the risk of poor welfare. Therefore, in many cases, it is possible for flocks within housing systems where the risk of poor welfare is medium or high, to actually achieve good welfare. This assessment is not a survey of actual welfare outcomes, which were variable, but an assessment of the risks of problems occurring.

28. The Final Activity Report noted that mortality rates now achieved in larger colony systems may be considerably lower than those recorded during

the project, probably as a result of improved management of these novel systems with experience. Indeed, FAWC was informed by producers during site visits (see Section 3.2) that systems using 60 bird colony versions are now regularly achieving much lower mortality rates of the order of 2%.

29. The main conclusions of the LayWel project included:

- *"The conclusions in the report are that, with the exception of conventional cages, all systems have the potential to provide satisfactory welfare for laying hens. However this potential is not always realised in practice. Among the numerous explanations are management, climate, design, different responses by different genotypes and interacting effects. For example there was different use of nest boxes in furnished cages by different genotypes. The design of small furnished cages also had a significant impact on dust bath use."*
- *"All cage systems tend to provide a more hygienic environment with low risk of parasitic disease."*
- *"Conventional cages do not allow hens to fulfil behaviour priorities, preferences and needs for nesting, perching, foraging and dustbathing in particular. The severe spatial restriction also leads to disuse osteoporosis. We believe these disadvantages outweigh the advantages of reduced parasitism, good hygiene and simpler management. The advantages can be matched by other systems that also enable a much fuller expression of normal behaviour."*

Evidence from farming and allied industries

30. In May 2005, FAWC members visited two farms in East Yorkshire and Lincolnshire to view enriched cages containing 60 hens, which had been installed in conventional closed houses (25,000 hens in one shed on one site and 30,000 hens in each of two sheds on the other).

31. In these systems, the nesting area had 'astroturf' matting flooring (65 x 60 cm), was deliberately darker (around 5 lux) and was surrounded by plastic curtains for seclusion. Over 90% of eggs were laid in the nesting area, and rolled away to egg collection belts on either side of the cage. Litter and scratching areas at the other end of the colony cage consisted of a tray or platform, 65 x 50 cm, and were placed in the brightest light intensity of the cage (up to 100 lux). Perches of at least 15 cm per hen were provided along the cage. There was a feed trough above the egg belt on either side of the cage, providing 12 cm length per bird, and water was supplied via nipples with cups down the centre of each cage. The overall space allowance was 750 cm^2 per bird. All birds were beak trimmed.

32. A brief assessment of bird behaviour and use of the system was made during each visit. In general terms, the hens were well feathered, healthy and able to move around the cage with ease. The large cage size gave the birds the opportunity to perform some normal behaviours (e.g. preening, nesting,

wing flapping), especially if not all birds were attempting the same range of behaviours simultaneously. It was clear that the behavioural repertoire was significantly improved by comparison with that in conventional cages. We were informed by producers using the systems that hens in a colony size of 60 appeared to use the shared space more effectively than those in colonies of either 20 or 40 hens.

33. One critical feature that was essential for the success of the system was the distribution of lighting within the house. There was a need to avoid bright white light in all parts of the cage, with a gradation in light intensity across the cage, brighter in the scratching area and darker in the nest. This promoted the most effective utilisation of the specific areas of the cage without leading to feather loss and mortality through injurious pecking. Provision of perches that could be used effectively by all birds was reported to be associated with improved bone strength.

34. Mortality was reported to be lower than in conventional cages and laying performance was good. A similar result was found in the LayWel project, once experience of the management of enriched cages had been gained

35. The hens were beak trimmed on both farms as a precaution against injurious pecking, because a bright light intensity was needed in some areas of the cage to encourage activity. Anecdotal evidence provided by the managers indicated that the use of hens with intact, untrimmed beaks lead to significant feather pecking and cannibalism.

36. In the larger enriched cages, birds were provided with fresh feed and water, a secluded nesting area (which was well used) and perching space consistent with the requirement of 15 cm per bird. Birds were able to move through the cage with some ease.

37. A number of concerns were raised by FAWC members as a result of these two visits to farms with enriched cages.

38. First, there was doubt about the benefit to the hens of a scratching area. This was provided in the form of a demarcated tray or ledge on which feed or grain was added once or several times during the day. Birds were seen to scratch, forage and even dust bathe in this area, although it was not clear that all birds in the cage were able to perform all these behaviours.

39. Secondly, although a dust bath is not a requirement of the Laying Hens Directive, the ability to dust bathe is considered by many to be an important “normal” behaviour. Incomplete “sham” dust bathing was observed in the scratching area but it was not possible to conclude whether the birds’ motivation to dust bathe was satisfied; deficiencies in the design of the scratching area and the lack of ample amounts of friable substrates may have denied the birds the opportunities to dust bathe.

40. Thirdly, there was concern as to whether an Astroturf mat fulfils all the birds' requirement of a suitable nest substrate. Nevertheless, it was accepted that the birds readily identified the secluded nesting area with 90 to 95% of all eggs being laid in this area.

41. Finally, no data were provided on the incidence and prevalence of bone fractures. However, Defra-funded research at the University of Bristol shows that the incidence of bone fractures over the life of a flock is significantly reduced in enriched cages compared with hens kept in barns or on free range. In addition, the wider openings of enriched cages are less likely to cause injury to spent hens during depletion at the end of lay than conventional cages.

Other pertinent information

42. Food safety issues are having an impact on decisions within the EU relating to the phasing out of conventional cages. More extensive litter or range based systems could give increased contact between eggs and litter/faeces, which is particularly conducive to bacterial proliferation. The urgent need to collect qualitative and quantitative information on contamination of eggs in alternative systems (including enriched cages) has been underlined by the Scientific Panel on Animal Health and Welfare of the European Food Safety Authority (2005).

43. This is especially relevant to EU Regulation 2160/2003 that aims to control salmonella and other zoonotic agents at all relevant stages of production. In this context the European Commission has been funding two European projects, SAFEHOUSE (www.safehouse-project.eu) and RESCAPE (www.rescape-project.eu), since October 2006. Final conclusions and recommendations will not be available until 2009, but the results of these deliberations will need to be considered in any final decisions on production systems deemed appropriate for laying hens at Member State and EU level.

Statement of areas of poor or incomplete evidence, including irresolvable or disputed issues

44. It is apparent that the optimum specifications for the design and management of enriched cages for laying hens are not yet available and have not been promulgated throughout the British egg industry. The results of Government-funded R&D on the welfare and management of laying hens in enriched cages should be published without delay and disseminated widely. Further, the British industry already has substantial experience with the management of hens in enriched cages, but an independent assessment and dissemination of this would greatly aid the industry to adopt best practice.

Critical issues

Statement of the critical issues and questions

45. The characteristics necessary to make a cage environment acceptable in welfare terms deserve very careful consideration, and it cannot be presumed that simply augmenting, or developing modified versions of existing cages would be sufficient. While seeking guidance from welfare science, simply looking at different components of welfare on a piecemeal basis will not provide the answers needed. What is required is information which relates to the overall welfare outcomes of egg laying systems, both in cage and non-cage environments. Without a framework for assessing the trade-offs between different welfare parameters, a judgement on the overall acceptability or otherwise of a particular production system cannot be made on a scientific basis. Conclusions tend to be drawn on the basis of perceptions and subjective assessments, often focussing on specific aspects of the bird's environment. More recently the LayWel Project has led to value judgements on the welfare implications of various housing systems for laying hens. Further details of the full reports can be found on www.laywel.eu and these are discussed more fully in Section 3.1 of this Opinion.

46. The critical concerns remain:

a). Whether an enriched cage can satisfy completely or substantially a hen's motivation to scratch, forage and dust bathe?

b). Whether injurious pecking can be avoided using current husbandry methods, especially since a ban on beak trimming has been proposed?

c). Whether the welfare of hens kept in enriched cages is as satisfactory as that of those kept in barns or free range or whether enriched cages are an acceptable or even only interim compromise?

d). Whether consumers will accept the use of enriched cages, perhaps through education?

47. FAWC believes that these concerns can be overcome or addressed by further development or marketing by the industry, perhaps assisted by the Government.

Ethical analysis

Benefits and costs for animals, farmers and other interested parties

48. In assessing the benefits and costs of any management system or procedure FAWC has always referred to the 'Five Freedoms' when considering animal welfare. These provide the starting point in forming its views on the acceptability of enriched cages for laying hens. It would seem possible to cater for freedom from hunger and thirst, and from pain, injury and

disease, as well as or better in a cage environment than in other commercial production systems. Similarly, in appropriately designed cages the majority of hens might be considered to enjoy more freedom from fear and distress than is the case for many birds in other (particularly free range) systems. The hard wire structures of a cage environment seem to be less good at providing freedom from discomfort, but some aspects of enrichment (e.g. perch provision) may ameliorate this. It is in providing the freedom to express normal behaviour that the cage is so clearly deficient, and research shows that predisposition to some behaviours is so strongly innate that their prevention represents an extremely severe challenge to welfare. This is certainly the case in relation to nesting, an array of movements such as stretching and wing flapping, and – to a lesser extent, it seems – dustbathing. It is the frustration of such behaviours in the confined environment of the cage that underlies the incidence of poor bone strength and the problems of aggression, feather pecking and apparent stress often observed among laying hens.

49. The acceptability of enriched cages has ultimately to be considered in the context of the welfare characteristics of alternative commercial egg production methods, such as the various barn and free range systems; to be dependable such assessments must be rooted as far as possible in valid measurements of welfare.

50. The interests of poultry farmers and others involved in the food chain must also be considered. Given a satisfactory return on their investment then there appear to be no major reasons *a priori* why the use of enriched cages should not be acceptable, provided of course that the same regulations apply throughout the European Union and to imported eggs.

51. A full economic impact assessment is being undertaken by the Government before any introduction of a ban on conventional cages, though the results of this have not been made available to FAWC. However, in terms of the consumer's interests, a ban on conventional cages might be expected to lead to a small rise in the price of eggs at the point of sale, thereby disadvantaging some consumers. We suggest that such an economic assessment is carried out to inform any decision.

Opinion

Advice

52. FAWC considers that all commercial systems of production for laying hens offer some compromise in terms of the hen's welfare. However, well managed enriched cage systems are able to offer the potential for an acceptable balance between the requirements for the hen's health and welfare, and public health, in combination with economic and environmental considerations.

53. On the basis of the scientific and other evidence available to FAWC, including visits to farms using enriched cages, our advice to Government is that the welfare of laying hens kept in enriched cages is acceptable provided that the highest standards of animal husbandry are practiced.

Recommendations:

54. FAWC's recommendations to Government are:

a). The results of R&D on enriched cages undertaken by Government and/or industry should be disseminated widely throughout the poultry industry to ensure the adoption of best practice in the management of laying hens kept in enriched cages.

b). The Code of Recommendations for the Welfare of Laying Hens should be revised to provide the most up-to-date advice to egg producers on enriched cages.

c). The European Commission should be encouraged to publish its report on the development of alternatives to conventional cages for laying hens, as required under Council Directive 1999/74/EC, to remove uncertainty for producers and improve the welfare of laying hens.

References

British Egg Industry Council (2006) – information supplied

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Defra Research Project AW0231 – The welfare effects of different methods of depopulation on laying hens. 2000-2005 (http://randd.defra.gov.uk)

Defra Research Project AW0235 – A study to compare the health and welfare of laying hens in different types of enriched cage. 2005-2008 (http://randd.defra.gov.uk)

Farm Animal Welfare Council (1997). Report on the Welfare of Laying Hens (www.fawc.org.uk)

LayWel project – www.laywel.eu

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Scientific Panel on Animal Health and Welfare of the European Food Safety Authority (2005). Opinion on a request from the Commission related to the welfare aspects of various systems of keeping laying hens. The welfare aspects of various systems of keeping laying hens. European Food Safety Authority Journal 197, 1-23

Appendix 1. Schematic of an enriched cage for 60 laying hens.