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HISTORICAL RESEARCH REPORT

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WORLD HEALTH ORGANISATION
COLLABORATING CENTRE
FOR OCCUPATIONAL HEALTH

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INSTITUTE OF OCCUPATIONAL MEDICINE

RESPIRATORY HAZARDS IN DAIRY AND BEEF FARMING

JOINT IOM/HSE STUDY

by

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SUMMARY

A joint Health and Safety Executive (HSE): Institute of Occupational Medicine (IOM) study of respiratory hazards in dairy and beef farming was conducted in 1993 and 1994 as a preliminary to a proposed HSE Technical Development Project. The study combined the development of exposure assessment methods and the design and validation of a respiratory symptoms questionnaire in the context of dairy and beef farming. Clinical examinations of farm workers were undertaken and blood samples were analysed. Patterns of exposure of farmers and farm workers were observed and some measurements of airborne dust and microorganisms were made. Practical methods of controlling exposure were identified.

The study was undertaken in two phases. In the first phase, a total of 26 dairy and beef farms were visited. A purpose-designed questionnaire on respiratory symptoms, smoking and occupational history was administered to all full time farm workers who had been working on the farm for more than 12 months. The questionnaire was designed to identify, as far as possible, the common respiratory syndromes which may be associated with work on farms. Supplementary questions about the association of symptoms with the time, place, and specific agents were included and found to be informative. Clinical investigations of selected cases with respiratory syndromes and controls were undertaken. These allowed the sensitivity and specificity of the questionnaire to be determined. The study found the questionnaire to have an overall sensitivity, for the identification of defined respiratory syndromes, of 57% and a specificity of 95%. In general, the estimated frequency of respiratory disease amongst dairy and beef farm workers was high. This included a high frequency of occupational rhinitis, asthma and occupational asthma. Chronic bronchitis was relatively infrequent. There was no recent evidence of extrinsic allergic alveolitis or organic dust toxic syndrome, although some cases of the former occurring in earlier years were identified.

The Respiratory Symptoms Questionnaire appeared to be a reasonably adequate tool for the purpose of identifying respiratory syndromes. Its specificity is high, though moderate sensitivity indicates that it provides a fairly secure estimate of a lower limit of frequency and case identification. Further investigation of other combinations of questionnaire answers might enable improvement of sensitivity of the questionnaire without important loss of specificity.

Information was also gathered during the first phase, on which tasks were undertaken at each farm, the nature of the work involved, the substances encountered and the frequency and duration of each task. This was used to develop a Hazard Identification Form which provides a structured basis for recording this information in a suitable format for data collation. Although the main purpose of the form is hazard identification, short descriptions of the tasks can be used to give preliminary estimates of exposure intensities and durations.

The second phase of the study was used to develop further the exposure assessment methodology. A form was developed to enable systematic collection of details about each task to be collected. This information provides the basis for an expert judgement of the intensity of exposure to be made. The Exposure Assessment Form was tested and refined at six of the original farms during the second phase of the study. Total inhalable dust and microorganism concentrations were also measured. The preparation of feed, distribution of feed and bedding of cattle housing generated substantial quantities of dust and bioaerosols. Only tasks performed during the winter months were available for monitoring; some tasks performed only in the summer, for example harvesting and haymaking, are also expected to produce significant dust and bioaerosol concentrations.

The patterns of tasks and exposure in beef and diary farms are complex. Similar tasks were carried out on all of the farms but different methods and materials were used. Task frequency and duration were also variable.

A number of practical methods of controlling exposure were encountered. Most involved modification of working practices or a change of substance, rather than the implementation of engineering controls.

The study has been undertaken in preparation for a larger HSE Technical Development Project. The Hazard Identification and Exposure Assessment Forms and the Respiratory Symptoms Questionnaire will be powerful tools in the Technical Development Project. Care will, however, be necessary to ensure that they are applied and administered consistently throughout the study as inconsistencies could result in spurious findings or in real effects being missed. Comprehensive training and some form of ongoing performance review will be essential. A structured approach to exposure assessment will also help. Exposure measurements are time-consuming and expensive. They should be primarily used to scale and validate the exposure assessments made using the Exposure Assessment Forms. Furthermore, these exposure assessments cannot be made for all tasks at all farms and only the very limited information on exposure intensity collected using the Hazard Identification Forms will be available for many tasks. The value of this information should be assessed by comparison with formal exposure assessments. This type of intercomparison and validation, if undertaken in the early stages of the project, should aid the efficient collection of exposure information.

1. INTRODUCTION

1.1 Background

Respiratory health problems associated with exposure to dusts in farming were first noted by Ramazzini (1713). Today, excess respiratory symptoms in beef, dairy (Cuthbert 1984, Iverson 1988) and pig (Iverson 1990) farm workers are well recognised, though the extent of disease in the UK is unknown. Farmer's lung, a type of extrinsic allergic alveolitis or hypersensitivity pneumonitides, is the archetypal disease associated with farming. Other diseases such as rhinitis, bronchitis, occupational asthma and organic dust toxic syndrome also exist in the industry.

Cattle farm workers are exposed to a multitude of hazardous substances which can cause respiratory ill health. They are exposed to a variety of organic dusts including feed, grain, straw, hay, silage, animal dander, dried faeces and urine, fungal spores and bacteria as well as dust from soils which may contain quartz. The agents are well documented (Donham 1986, Watson 1986, Mutel 1986), although there is little information on exposure patterns and intensity. A variety of chemicals are also used in dairy and beef farming. Respiratory symptoms may result from exposure to pesticides, fertilizers, and fumigants. Farm workers can also come into contact with ammonia, hydrogen sulphide, nitrogen dioxide, welding fume, diesel fume and solvent vapours. Changes in farming practices over the last few decades have increased the concentrations of airborne dusts and chemicals. In general, farms have become larger, production of both animals and crops has intensified and in particular animal confinement houses have been introduced. The dusts, gases and microorganisms associated with livestock farming are concentrated in these buildings and can present significant respiratory hazards (Donham 1977, Donhan 1986, Linnainmaa 1993).

Exposure to respiratory hazards is controlled under current UK legislation. The Control of Substances Hazardous to Health Regulations 1994 (COSHH) (HSE 1995) require workers' exposure to hazardous substances to be prevented or adequately controlled. Some substances found on typical beef or dairy farms have been assigned occupational exposure limits. Grain dust and formaldehyde, for example, have been assigned maximum exposure limits (MEL). Other substances, including ammonia and hydrogen sulphide, have been assigned occupational exposure standards (OES) (HSE 1994). However, the implementation of control measures has been patchy and fragmented, typical of small businesses. It is not helped by the multiplicity of exposures on farms, and the limited resources available for assessing and controlling hazards.

There is a need to know the frequency of occupationally related respiratory disease in beef and dairy farmers and farm workers and the tasks, materials and work practices to which they are related. A cross-sectional study is proposed to address these issues. This will take the form of an HSE Technical Development Project. This current work was undertaken jointly with HSE, as a preliminary study to the main project, to establish which potentially harmful exposures beef and dairy farm workers experience, how these exposures may be quantified and controlled, the likely approximate frequencies of respiratory symptoms in farm workers and the clinical features associated with the symptom complexes identified by questionnaire.

1.2 Aims

The specific research questions addressed by this preliminary study were:

1. What methods of assessment of health and exposure to substances of dairy and beef farmers and farm workers should be used in subsequent studies of dairy and beef farmers and farm workers?

2. What do respiratory symptom complexes identified by questionnaire in farmers and farm workers represent in clinical and immulogical terms?

3. What are the patterns of exposures of farmers and farm workers to hazardous substances, and what are typical exposures in some selected high risk tasks?

4. What kinds of practical methods of control can be identified?

2. STUDY PLAN

This joint IOM/HSE preliminary study has combined the development of exposure assessment methods and the design and validation of a respiratory symptoms questionnaire in the context of dairy and beef farming. The work was planned around surveys of a number of farms in Northern England and Southern Scotland to gather information on tasks and associated respiratory exposures in the beef and dairy farming industry and to administer a medical questionnaire to farm workers. It was designed to include clinical examinations of farm workers and analysis of blood samples.

The study plan is outlined below:

I) Pilot visits to two farms

- to gather basic information on the tasks undertaken in beef and dairy farming; to collect bulk samples and to practice administration of the medical questionnaire.

ii) Phase 1 - Surveys of 26 farms

- to administer questionnaire on respiratory symptoms, smoking and occupational histories;
- to interview farmers or farm managers on the work and tasks carried out on the farm;
- to develop and refine a Hazard Identification Form; and
- to start developing exposure assessment methodology.

iii) Phase 2 - Second surveys of six of the 26 farms

- to test and further refine the Hazard Identification Form;
- to develop and refine an Exposure Assessment Form; and
- to estimate airborne concentrations of total inhalable dust and microorganisms.

iv) Preparation of finalised Hazard Identification and Exposure Assessment Forms, together with associated protocols.

v) Medical examinations of selected cases and controls.

3. METHODS

3.1 Farm Selection and Recruitment

A list of 32 beef, dairy and beef and dairy farms in Southern Scotland and Northern England, together with respective contact names was supplied to the IOM by the Scottish Agricultural College (SAC), Edinburgh. Prior to initial contact by IOM personnel, each of these farms were contacted by SAC personnel and provided with some information about the study and the nature of the work.

Typically in Northern England and Southern Scotland, dairy farming tends to be located in the west of the country, while beef farming tends to be located in the east. To some extent this divide was reflected in the farm list provided by SAC.

Farmers were contacted by telephone by one of two IOM occupational hygienists to describe the study in more detail, find out about the farm and determine willingness to participate. This information was used to decide if the farm was suitable for the study. The main criteria being:

i) Willingness to participate

ii) Type of farm (to ensure a wide range of types were represented)

iii) Work schedules (the farmer/manager could make time available for the visit)

iv) Farm location (to ensure all areas were represented and the farm was convenient for other appointments.)

If the farm was chosen for inclusion in the study, a mutually convenient appointment was made for the occupational hygienist to visit .

A total of twenty six farms were recruited for the first phase of the study. The farm type and location are detailed in the table below:

Farm Location	Farm Type		
	Dairy	Beef	Beef & Dairy
Dumfries and Galloway	3	0	4
Cumbria	7	0	0
Lothian and Fife	0	7	0
Northumberland	0	5	0

A further two farms, one beef and one dairy, were selected for preliminary work prior to the start of the study. Both farms were located in the Lothians. They were selected because of their willingness to participate in this stage of the project and their close proximity to the IOM office. It was anticipated that a number of short visits would be made to both of these farms during the course of the pilot work.

Six of the original twenty six farms were selected for the second phase of the study based on the following criteria:

i) Willingness to participate and the degree of co-operation during the first phase of the study.

ii) Farm type.

iii) Tasks undertaken on the farm.

Farm contacts were always approached in a consistent manner, initially by telephone. The use of the same occupational hygienists at the recruiting stage as during the farm visits enabled a rapport to be established with study participants to ensure maximum co-operation through the study. Subsequent farm visits were also made by the same hygienist to ensure the contacts were maintained.

3.2 Development of Exposure Assessment Methodology

3.2.1 Pilot Studies

A number of visits were made by IOM occupational hygienists to both pilot farms to prepare for the first phase of farm visits. These visits provided the hygienists with detailed information on the work associated with beef and dairy farming. This was used to produce a form which would allow information on the tasks undertaken on the farm and the associated hazards to respiratory health to be collected in a standardised manner. The work also gave the occupational hygienists some experience of administering the respiratory symptoms, smoking and occupational history questionnaire and allowed them to familiarise themselves with the input of questionnaire responses to the Epi Info programme using a portable computer. Samples of a variety of farm materials including feed, bedding, cow dander and urine were collected for the HSE's immunological investigations.

3.2.2 Form Development

The principal aim of the study was to develop an assessment methodology for use by the HSE in their Technical Development Project (TDP). Since it is likely that the TDP will involve visits to a large number of farms by numerous "assessors" and generate a significant quantity of exposure information, a systematic and scientific approach to assessment of occupational exposure was required. For this reason a two tier methodology of hazard identification and exposure assessment was developed, based on systematic information gathering on standard forms. This approach was adopted to maximise consistency between individuals and over time. The forms were designed to permit sufficient data to be recorded so that the potential of tasks to cause inhalation exposure to hazardous substances could be compared. They were also designed to satisfy the multidisciplinary needs of all people collecting, collating and interpreting data and used formats that allowed for recording observations on typical and novel tasks, as they arise.

3.2.3 Hazard Identification Form

Initially a draft form was produced by a working group comprising of occupational hygienists and a data scientist. Its practicality was assessed on both pilot farms.

Information was collected on the form under the following headings:

i) General Farm Details - including farm type, size, etc.

ii) Employees Working on the Farm - including job title and general description of duties.

iii) Tasks Performed on the Farm - including task name, brief description, who carries out the task, when, how often and how long it is carried out for.

iv) Preliminary Respiratory Hazard Identification - including source of hazard.

v) Additional Comments.

The first phase of twenty six farm visits took place between July and September 1993, with one of the two occupational hygienists spending between ½ to 1 day at each farm. During these visits the Hazard Identification Form was completed by informal interview with either the farmer or farm manager. The farm was normally toured to help the information collecting exercise. If possible, on-going tasks were observed, but generally the opportunity to observe tasks during these visits did not arise as often as expected. Each visit was followed by a debriefing session with other members of the project team, with the aim of reviewing the form and making any necessary refinements. A short, structured report was produced for each study farm, the following points were covered:

- General farm description
- Description of ease (or otherwise) of timetabling arrangements
- Assessment of co-operation and willingness of participants
- Who was interviewed during the visit
- What tasks were observed
- What tasks were described
- Identification of any tasks suitable for inclusion in phase 2
- Problems highlighted with the form
- Suggestions for refinement of the form

After 24 farms had been visited the Hazard Identification Form was completely revised. At this stage it was apparent that a more structured approach to collecting task information was required to allow the data to be collated and analysed. Other difficulties including the division of work into discrete tasks and dealing with task variability between farms were also addressed at this stage. A variety of options were considered, a question and answer format was finally selected to allow information to be recorded in a standardised manner.

All tasks commonly occurring on beef and dairy farms were included in the revised form. Using task descriptions from earlier farm visits, tasks were differentiated and methods of performing each task identified. Questions were designed to address variables within tasks which were likely to have an effect on respiratory exposure. Additional questions were designed to take account of who carried out the task, when, how often and for how long.

The final farm visits were used to investigate the suitability of this type of approach in the field. Further refinement of the form took place during the period between the first and second phases of the study.

The Hazard Identification Form was assessed and refined during the farms visits in the second phase of the study. During these, the form was completed by a project team member who had no experience of administering it, to help assess its useability. Further refinements were made after these visits were complete.

A detailed protocol was produced to accompany the form at this stage. This provides general information for users on how and to whom the form should be administered, specific guidance on the type of answer required, explanations of agricultural terms and definitions of answer options.

Both the Hazard Identification Form and its associated protocol were circulated for comment to the HSE members of the project team. During this period HSE agricultural inspectors were given an opportunity to study the form. Comments and suggestions for improvement were incorporated into the final versions of the form and protocol.

3.2.4 Exposure Assessment Form

The Exposure Assessment Form was designed as a tool to gather sufficient information on specific tasks so that systematic assessments of exposure to respiratory hazards could be made. It was developed and refined during the six visits which comprised the second phase of the study. An initial draft was produced prior to the start of the second phase of visits. The process of form development and refinement thereafter followed a similar pattern to that used for the Hazard Identification Form.

Two occupational hygienists visited each of the six farms for one day. Afterwards, a debriefing session enabled the hygienists to review the effectiveness of the form and make any necessary adjustments prior to the next visit. During the visits exposure assessments were carried out on both routine and none routine tasks.

The information collected on the form included the following:

I) Worker identification and job title

ii) Description of task (based on observation)

iii) Respiratory hazards produced

iv) Protective measures in use

v) Training

vi) Results of occupational hygiene measurements and any health surveillance

The assessment of exposure to respiratory hazards is a judgement based on this information.

Much of the information was recorded as free text which is not amenable for data handling. To overcome this problem, components of the form were coded for data processing in a summary section at the front of the form.

When all farm visits were complete a detailed protocol was prepared to accompany the Exposure Assessment Form and provide guidance for assessors undertaking task based respiratory exposure assessments.

Both documents were circulated to HSE members of the project team for comments and suggestions before final versions of the form and protocol were produced.

3.3 Occupational Hygiene Measurements

Occupational hygiene measurements were made at each of the six farms participating in the second phase of the study. Measurements were made to determine airborne concentrations of total inhalable dust and microorganisms. High volume sampling was also undertaken to determine background dust concentrations inside farm buildings.

Air sampling was carried out by IOM occupational hygienists and HSE microbiologists. The project team took time to explain to farmers and farm workers the purpose of the study and the need for sampling of farm tasks. The team attempted to cause the minimal disruption to farm work scheduled for that day and took care to minimise the effect of their presence on worker behaviour.

3.3.1 Sampling strategy

The objectives of the sampling exercise were to obtain some preliminary information on the airborne concentrations of dust and microorganisms, and to investigate how sampling should be used in the Technical Development Project.

Sampling of respiratory hazards was undertaken during the performance of routine and non-routine tasks. Sampling was not necessarily task specific, as working practices on farms meant some tasks were performed simultaneously and sometimes the duration of a single task was too short to sample accurately. In these circumstances groups of tasks or task components were sampled.

The number of samples collected for each task or task group was determined by the following:

i) The number of exposed farm workers for personal monitoring (normally the majority of exposed workers were monitored due to the small numbers working at each farm).

ii) The number of suitable locations for area samples (fixed-point or background samples).

iii) Task performance times (and timing) for duration of samples.

iv) Respiratory hazards to be sampled.

A standard method for documenting samples was adopted. Information recorded for each sample included:

- Date of survey
- Site name
- Task name and description
- Sample identification number
- Identification of wearer
- Sample flow rates
- Equipment failures or other departures from standard practice
- Name of hygienist and recipient of samples

3.3.2 Measurement of total inhalable dust concentrations

Total inhalable dust samples were collected on pre-weighed, 25mm diameter glass fibre filters held in cassettes. Each cassette was fitted into an IOM inhalable dust sampling head (Mark and Vincent, 1986) and attached to a battery operated constant flow sampling pump by flexible tubing. The flow rate was set at $2 l min^{-1}$ at the start of the sampling period, using a calibrated rotameter. This was checked during and after sampling and flow rates were recorded. A note was made of the sampling duration. Personal samples were collected by attaching the sampling head to the farm workers' lapel, within the breathing zone, (ie. within 200mm of the nose and mouth region). The sampling pump was held at the waist with a belt. For quality control purposes field control samples were prepared at each of the six farms. These samples were subject to the same handling procedures as all the other samples, but were not knowingly exposed to any dust.

All the samples were returned to the IOM laboratory, in purpose designed cassette holders, for analysis in accordance with the procedures described in MDHS 14 (Revised) General Methods for the Gravimetric Determination of Respirable and Total Inhalable Dust. (HSE 1993).

3.3.3 Collection and analysis of (high volume) background dust samples

Samples of background dust from inside farm buildings were collected using Staplex (high volume) Samplers, fitted with an SH810 filter holder assembly and glass fibre filter. This instrument operates off mains electricity therefore samples were collected near mains electricity supplies and where there was no opportunity for contact with farm animals. The collection efficiency of these devices is not published.

The flow rate was measured prior to, during and at the end of the sampling period using a calibrated hot bead anemometer. Measurements of air velocity were made at nine points directly in front of the filter, these were used to calculate volume flow rate. A record of sample duration was kept. At the end of the sampling period the filters were carefully folded and transferred into sealable polythene bags for transportation back to the IOM laboratory. For quality control purposes, a field control sample was prepared at three of the farms surveyed.

The samples were analysed in the IOM laboratory following a method adapted from MDHS 14 (Revised) (HSE 1993). The large size of these filters (25 x 20cm) presented some handling problems. The filters had to be folded before initial and final weighings. Trials in the laboratory indicated that this had no measurable effect on filter weight.

After weighing the high volume filters were passed to HSE for immunological analysis.

3.3.4 Collection and analysis of airborne microbiological samples

Microbiologists from the Research and Laboratory Services Division (RLSD) of the HSE conducted microbiological sampling at each of the six farms. Both personal and fixed-point sampling was performed. A number of different techniques were used to give both qualitative and quantitative analysis. Samples were subsequently returned to RLSD. The samples were processed using a range of agar media and incubation temperatures to isolate the different microorganisms present. Details of these procedures are given in Appendix 1.

3.4 Respiratory Symptoms, Smoking and Occupational History Questionnaire

The medical study was conducted in two phases. In the first phase a questionnaire was administered to all subjects who were sixteen and over and who had been in full time farm work for the past 12 months or longer. A second phase comprised clinical assessment of selected subjects.

3.4.1 Questionnaire design

The questionnaire was designed to gather information about respiratory symptoms, smoking history and occupational history from each study subject (Appendix 2).

The questionnaire on cough, phlegm production and breathlessness on exertion were taken from the Medical Research Council Respiratory Symptoms Questionnaire (MRC, 1986). The words "in the Winter" were excluded, since this was considered inappropriate when occupational health effects were of primary interest. This was followed by three further sections of questions enquiring about symptoms of rhinitis, asthma and extrinsic allergic alveolitis (EAA), and organic dust toxic syndrome (ODTS) in the previous 12 months.

The question used to establish symptoms of rhinitis (Q.11) was used in a previous joint IOM/HSE study of respiratory symptoms in wool workers (Love *et al*, 1988). The IUATLD Bronchial Symptoms Questionnaire (Burney and Chinn, 1987) questions on asthmatic symptoms were adapted

by combining the two questions on attacks of shortness of breath into one simplified question (Q.20) and using the other two questions unchanged (Q.19 and 27). This allowed two of the questions (Q.19 and 20) to be linked to supplementary questions.

If positive responses were given to the rhinitis or asthmatic symptoms questions, further questions were asked to determine the relationship of symptoms occurrence to time of day, holiday (vacation) periods of a week or longer and particular activities or places volunteered by subjects. Subjects were also asked in which months in the previous year they had experienced symptoms. These supplementary questions were included to establish work-relatedness and seasonality of symptoms.

The questions to elicit symptoms suggestive of ODTS or EAA were developed specifically for this questionnaire. If subjects had experienced episodes of fever or shivering in the previous 12 months (Q.28) further questions were asked to elicit associated symptoms (Q.29), record which month(s) the symptoms had occurred and record whether subjects attributed the onset of symptoms to being in particular places or carrying out particular activities. This was followed by questions to gauge severity by enquiring about resulting time off work and need to consult a doctor.

Subjects were asked if they had suffered from any of a comprehensive list of respiratory, cardiac and atopic conditions. The questionnaire concluded with questions on smoking history and a full occupational history providing details about all jobs held since leaving full time education: (start date/end date, name of employer, nature of employer's business, job title and description of main job tasks).

A protocol was prepared for use with the questionnaire. Advice on some sections was taken from the Medical Research Council's instructions (MRC, 1986). The protocol provides instruction to administrators on dealing with ambiguous answers to questions, probing further if a suitable answer is not obtained and ensures consistency in the interpretation of answers.

3.4.2 Questionnaire administration

One of two occupational hygienists administered the questionnaire to study subjects at each of the twenty six farms. The Epi Info software package (Dean *et al*, 1990) was used and allowed subjects responses to be entered directly into a portable personal computer. The administrators underwent a training programme which included instruction on the general principles of administering a standardised questionnaire for epidemiological purposes. The importance was emphasised of asking questions using the standardised format, eliminating sources of interviewer bias, dealing with equivocal answers to questions and applying consistency in interpretation and recording of responses.

Mock interviews were conducted with a tutor to give administrators experience in dealing with responses appropriately. This was followed by interviews of non-study farm personnel during visits to the pilot farms. These interviews were tape recorded and reviewed by the tutor to ensure that responses were recorded appropriately and that correct interviewing technique was used. Recording of interviews was repeated during the study to ensure that the correct procedure was still being followed.

3.4.3 Questionnaire Processing

The information collected with the Epi Info package was transferred to the IOM's PRIME 2850 mini-computer. The statistical package Genstat (Genstat 5 Committee, 1987) was used on the PRIME to carry out the analyses of responses.

3.4.4 Definition of Syndromes

The responses to questions on respiratory symptoms were analysed to identify subjects with chronic bronchitis, rhinitis, asthma and ODTS or EAA. The definitions of these conditions, derived from combinations of responses to the questions, are detailed in Appendix 3. The responses to the supplementary questions following the core questions on symptoms of rhinitis, asthma and ODTS/EAA were also evaluated to determine whether these conditions were environment-related or not. Examination of the specific environmental factors (place and activity) enabled obviously occupationally related symptoms to be distinguished from other environmentally related symptoms.

3.5 Clinical Study

The second phase of the medical study involved clinical assessment of selected cases with respiratory syndromes (defined combinations of symptoms) and controls. Ethical approval was obtained from the research ethics committees of the health authority areas in which the study subjects resided.

3.5.1 Selection of subjects

Using the definitions in Appendix 2, a group of cases were identified who complained of symptoms suggesting one or more of the following conditions; chronic bronchitis, occupational rhinitis, occupational asthma and ODTS or EAA. For each case a control subject without these defined syndromes was selected from the remaining study population matching to each case, where possible for sex, ten year age band and geographical location and type of farm. In three cases age matching was poor, and an additional control of opposite sex was chosen. Thus 20 cases and 23 controls were selected.

3.5.2 Clinical assessment

All cases and controls were invited to undergo a clinical assessment, which was conducted at out-patient clinics arranged at a hospital in each geographical area where farms were located. Informed consent to participate was obtained from all clinical study subjects. Subjects were financially compensated for any loss of earnings and for travelling expenses.

Each subject was interviewed and examined by the same occupational physician, after discussion and planning of the examination with an experienced respiratory physician. The examining physician was unaware of the case-control status of the subjects prior to the interview. A full medical history was taken with particular emphasis on respiratory health. Enquiry was made of any symptoms experienced in the previous year, or in the past, which could represent any of the respiratory conditions of interest. If subjects gave a history of such symptoms, then a detailed history was obtained to evaluate any symptoms reported, establish the likely diagnosis and determine the relationship, if any, to farm work activities. Where necessary, this historical information was supplemented by information provided by the subject's general practitioner (with the subject's consent). Clinical examination was performed on each subject including general examination and assessment of cardiovascular and respiratory systems.

3.5.3 Lung function

Lung function testing was conducted using a portable Vitalograph spirometer. The spirometer was checked for volume calibration before each recording session and calibration for temperature was carried out for each subject.

A minimum of three forced expirations were recorded until the highest recorded FVC was less than 5% or 0.12 greater than the next highest recording (Quanjer *et al*, 1983).

The highest FEV_1 and FVC recorded were then compared with predicted values of FEV_1, FVC and FEV_1/FVC ratio adjusted for sex, age and height. If best FEV_1 was more than 1.64 residual standard deviations (RSD) below the predicated FEV_1, or the FEV_1/FVC ratio was more than 1.64 RSD below the predicted value, then the procedure was repeated 20 minutes after inhalation of 400μg salbutamol administered using a 750ml volumatic spacer device, to determine bronchodilator response.

The results of all the above clinical features were interpreted, and diagnoses reached, in consultation with the respiratory physician. Classification into relevant diagnostic categories was conservative, to avoid overstatement of frequencies. For example sneezing in response to farm dusts was not classified as occupational rhinitis unless accompanied by other symptoms, and only obvious clinical occupational asthma was so classified, for example one subject with reversible airflow obstruction, but no symptoms, was classified as "no disease" for the purposes of the study.

3.5.4 Skin prick tests

Skin prick tests were carried out on the volar aspect of forearm skin using Bencard allergen test solutions, after lung function tests were completed. The test solutions used were house dust mite (Dermatophogoides pterronnissinus), cat fur, group B_2 grass pollen, Aspergillus fumigatus, Fusarium, Alternaria alternata, cow hair, hay dust, straw dust and control. The first three were included to provide an index of atopy and the other six allergens were tested as they may additionally be encountered during farm work.

One drop of each test solution was placed on the skin at 3cm intervals. The skin underlying each drop was pricked with a separate sterile disposable prick instrument and then excess solution removed by blotting with a tissue.

After 15 minutes the test sites were inspected and if a weal was present the largest diameter was recorded in millimetres. A weal of 3mm in diameter greater than the control reaction was considered to indicated a positive reaction.

3.5.5 Blood samples

A 30ml venous blood sample was taken for immunological studies. 10mls were placed in a lithium heparin container and posted to the HSE Occupational Medicine and Hygiene Laboratory (OMHL) in Sheffield to arrive next morning. The remaining 20mls were placed in a plain container and stored overnight at 4°C. The sample was centrifuged the next day at 2000rpm for 20 minutes and the plasma was then decanted and frozen at -20°C. All frozen samples were later transported to the OMHL by special carrier. Immunological investigations were performed by the Immunology Section of OMHL.

3.5.6 Confidentiality

All medical information gathered and investigation results were held in confidence.

4. RESULTS

4.1 Exposure Assessment Method

A systematic and scientific approach to assessing respiratory exposure to hazardous substances in the beef and dairy farming industries has been developed. There are two steps in the process, hazard identification and exposure assessment. Both require good liaison with a nominated contact person at each farm, who should be the farmer, farm manager or some other responsible person who has a sound knowledge of the farm.

4.1.1 Hazard Identification Form

The Hazard Identification Form and the associated protocol are given in Appendix 4. Hazard identification is the initial step in the exposure assessment methodology. Information is gathered on the general characteristics of the study farm, farm workers, the division of labour and the type and nature of the tasks performed. The form itself provides a structured basis for recording information in a suitable format for data collation and analysis.

The same form can be used for dairy, beef and mixed farms. Sections specific to dairy or beef tasks are passed over if not relevant to the farm. In Section 1, farm details, information about the farm contact person, location and farm type, etc is recorded. The farm contact person is not necessarily the farmer or someone who lives on the farm, so to avoid confusion the information gathered on the contact person is distinct from the other farm details, eg. address and location.

Information gathered on employees working on the farm is noted in Section 2, which requires details on all persons involved in farm work, including part-time and temporary workers and a generalised job title. Additionally this section enables the assessor to determine which workers meet the criteria for the respiratory symptoms questionnaire.

Sections 3 and 4 allow for a profile of each study farm to be established. This includes the type of cattle farming system in operation, size of herd and other farm work not necessarily related to beef and dairy farming. This information is necessary to assess the relative importance of the cattle herd on the farm and the potential for exposure to other respiratory hazards not related to dairy and beef farming.

Details of the tasks performed on the farm are recorded in Sections 5 to 10. These sections provide an indication of exposure patterns for beef and dairy farm workers. The sections include; beef tasks (section 5) and dairy tasks (section 6), which refer to tasks that are specifically related to dairy and beef farming, respectively. Section 7, other cattle related tasks, includes tasks which are usually associated with cattle farming but not exclusively. Sections 8, 9 and 10, other livestock related tasks; other land related tasks; and maintenance tasks, refer to those tasks performed on the farm but which are not specific to beef and dairy farming.

All the tasks identified in sections 5 to 10 have the potential to expose farm workers to respiratory hazards. For most tasks the associated hazards are self-evident, for example; harvesting, bedding, feeding, etc. Other tasks, for example; assistance with calving, feet paring etc. involve close contact with the animal and may expose farm workers to animal dander, waste and other bioaerosol hazards.

For each routinely performed task identified in Sections 5, 6, and 7 an indication of the likely intensity and duration of exposure is gained from information about how the task is carried out, what materials are used, who performs the task, the time of year and the frequency and duration with which it is performed. The likely frequency and duration of exposure during non-routine tasks is gained by collecting information on whether animals are treated individually, in batches or as a herd.

The majority of questions in these sections allow for only one answer option to be recorded, but a small number of questions allow for two answer options under certain circumstances. This approach has been adopted because most farms use more than one method and/or material to perform some tasks.

Sections 8, 9 and 10 take account of other tasks performed on the farm, not specific to beef and dairy farming, but which could influence exposure patterns for that farm. Limited information is collected to determine if the task is performed, and if so by whom. All regularly encountered tasks are included in these sections, additional space is provided to record atypical tasks that could generate respiratory hazards.

Section 11 is used to record contract work undertaken by farm workers on other farms. A minimum of five days in any year has been set to distinguish between casual work on a neighbouring farm and longer term contract work which is more likely to effect exposure patterns.

Section 12 should be completed if the assessor is given the opportunity to tour the farm buildings. It allows observations to be recorded on housekeeping and the general condition of the farm, particularly in areas where respiratory hazards may be present or generated.

Finally, any additional comments pertinent to the hazard identification process and not covered elsewhere are recorded in Section 13. The information, recorded as free text, should include any hazards not accounted for elsewhere on the form, together with brief details of how exposure occurs.

4.1.2 Exposure Assessment form

Exposure assessment has been developed as the second stage in the two tier methodology. Individual tasks are considered in greater depth through information and observation and the extent of respiratory exposure estimated. The form and protocol are given in Appendix 5. The procedure followed is similar to that applied to COSHH assessments. One assessment is required for each task. The form consists of a front summary sheet with information recorded in a manner amendable to data collation and analysis, and a further two sheets for systematically recording information in the form of free text, not intended for data collation. The assessor makes an informed judgement concerning the level of exposure to each identified respiratory hazard, on the basis of a series of systematic observations of the task.

General farm details are recorded in Sections 1 to 3 of the summary sheet. Sections 7 to 14 are completed next, normally by observation and discussion with the farm workers who perform the task. Information is recorded on the nature of the respiratory hazards, how they are produced and, if applicable, the quantities used and occupational exposure limits. For microbiological hazards, the source is identified to provide some indication of what microorganisms might be present. Further information on factors which modify contact with the hazard, such as control measures and training, is recorded. Additionally, personal exposure measurements, health surveillance and accidental exposure information is collected if available.

This information is used to draw conclusions on the level of assessed exposure under normal working conditions for each identified hazard. This is recorded on the summary sheet. Three options are identified from which conclusions should be drawn. These are:

i) Low exposure: Farm workers are unlikely to experience any or significant inhalation exposure to the specified substance, for example, from work distant from a source of contamination that is well controlled or weak and distance.

ii) Medium exposure: Some inhalation exposure to the specified substance, for example, from work near a weak source or working some distance from a strong source of contamination.

iii) High exposure: Farm workers very likely to experience high inhalation exposures to the specified substance, for example, from work close to a strong source of contamination.

The possibly of incidents or accidents, leading to high exposures is also recorded. Finally, an opportunity is given to record recommendations for improved control of the respiratory hazards. The protocol (Appendix 5) that accompanies the form provides additional details on the information and observations required to complete the assessment, sources of information and advice on drawing conclusions on the level of exposure.

4.1.3 Field trial results

Final draft versions of both the Hazard Identification and Exposure Assessment Forms were tested in the second round of farm visits.

The Hazard Identification Form was found to take approximately 30 to 40 minutes to complete. This was on farms that had either beef or dairy units, but not both. Additional time, say 15 to 20 minutes, would be required to complete both sections for beef and dairy tasks. The level of co-operation from participating farmers was generally good.

The time required to complete the Exposure Assessment Form was dependent on the degree of complexity of the task. Co-operation from farm workers performing the tasks was found to be good, although assessors were aware that working practices may have been altered due to their presence.

4.2 Farm Tasks

During the development of the Hazard Identification Form, information was gathered from the participating study farms concerning beef and/or dairy related tasks performed on the farm. This included a description of the task, time of year and frequency and duration with which it was performed. This information is summarised in Table 1. Table 2 summarises other tasks performed on the study farms that are not directly associated with beef or dairy farming.

A variety of tasks were performed on each of the study farms, most were common to the majority of farms, eg. winter bedding and feeding, some were performed on a small number of farms only, eg. summer feeding. The methods and materials used to perform tasks differed both within and between farms. The prevailing weather conditions had a significant influence on the type of tasks performed, therefore, the farm task profile changed with season.

During the winter months the majority of cattle herds were housed. Important tasks at this time of year were bedding and feeding. Both were performed frequently and were of notable duration. Whilst bedding cattle, farm workers were exposed to dust from bedding materials which included straw, sawdust and shredded paper, also microorganisms from mouldy and soiled bedding. During feeding, farm workers were exposed to dust and bioaerosols from bulk and concentrate feed stuffs, eg. hay, silage and grain, also to preservative chemicals, eg. ammonia from treated straw. Concentrate feed preparation was also important at this time of year, if bruising or milling of grain was undertaken on the farm, workers were likely to be exposed to high concentrations of grain dust and bioaerosols.

During the summer months cattle herds were kept outside and the task profile of the farms changed. In general, the emphasis shifted from cattle to land related tasks, particularly on beef farms. For

example, very few farms fed cattle during the summer when at grass, except for the dairy herds whilst in the milking parlour. Important tasks at this time included silage and hay making, grain harvesting, drying and treatment. These tasks were typically performed between one and three times during the summer. At these times, virtually the whole of the working day was devoted to them, each task taking anything from a few days to more than a week to complete. Farm workers performing these tasks were exposed to dust, bioaerosols and preservative chemicals.

Throughout the year a number of tasks were performed to maintain the health and welfare of the herd. Some of these tasks were performed routinely (eg. worming, debudding, artificial insemination) others were performed as required (eg. assistance with calving) and some fall into both categories (eg. foot paring). For the farm worker these tasks involved close contact with the animal and may have involved exposure to cow dander, animal waste and bioaerosols. Duration and frequency of exposure for most of these tasks depended on how the herd was managed, that is whether animals were dealt with individually or in batches and whether the whole herd or just selected animals were treated.

The nature of the tasks performed on both beef and dairy farms were similar, with the obvious exception of milking and associated tasks. Milking is important because of its frequency and duration, typically being performed twice a day for a total of between 3½ to 7 hours. During milking farm workers were in close contact with the animals in a relatively confined area. Respiratory hazards included bioaerosols, cow dander, animal waste, also chemical cleaning agents and feedstuffs.

A large number of other tasks were described that were not related to beef and/or dairy farming. These were performed as part of the general maintenance of the farm or because of other business interests, some presented additional respiratory hazards to farm workers (eg. cleaning out poultry sheds, crop spraying and welding farm machinery).

4.3 Occupational Hygiene Measurements

4.3.1 Total inhalable dust concentrations

Measurements of total inhalable dust concentrations were made at each of the farms participating in the second phase of the study. Farm workers' exposure was monitored while performing single tasks and groups of tasks typically carried out in succession. Sampling times ranged from less than 10 minutes to over 4 hours. Routinely performed tasks were monitored at more than one farm, for example, bedding and feeding. Less frequent tasks, such as, foot paring and tagging, were monitored once only. The measured concentrations are detailed in Table 3. These ranged from 0.4mgm^{-3}, measured during mucking out of bedding, to 195.3mgm^{-3} measured during the bedding of milkers. The highest concentration was considerably greater than other measured concentrations during bedding. Dust concentrations when bedding with shredded paper appeared likely to be lower than when bedding with other materials, such as straw and there were no obvious strong sources of dust during the sampling period. This may therefore be a spurious result. Elevated concentrations of total inhalable dust were frequently encounted. Concentrations above 10mgm^{-3} were observed during clipping, bagging barley and bedding. Concentrations during feeding were often in excess of 5mgm^{-3}.

4.3.2 High volume samples

The results of the high volume sampling are recorded in Table 4. Samples were collected over several hours inside farm buildings at each of the phase two study farms. The samples were not task specific, although at some time during the sampling period tasks may have been performed in the building where sampling was taking place. The results provide an indication of the background dust concentrations in farm buildings. They range from <0.1mgm^{-3} in the milking parlour of Farm 16 to 0.7mgm^{-3} in the bruiser shed of Farm 17.

These concentrations are much lower than the personal inhalable dust concentrations. The personal samples were collected to give concentrations during specific tasks. The high volume samples give some information about general background concentrations.

4.3.3 Airborne Microorganisms

Total counts of airborne microorganisms in terms of bacteria, fungi and actinomycetes are shown in Table 5. The range of results for both personal and fixed-point samples are detailed for a number of tasks and locations at each farm. Table 6 describes the prevalent fungi isolated at all six farms, while Table 7 describes prevalent bacteria isolated at Farms 17 and 26. A separate HSE report (Stagg S. 1994) has been produced on this work, but a full set of results detailing microorganism concentrations, with reference to sample collection and analytical procedures, are reproduced in Appendix 6.

Airborne bacteria and fungi were detected at concentrations up to 5.67×10^6 and 9.92×10^5 $cfum^{-3}$ of air respectively during this study. To put these values into perspective, background concentrations of airborne microorganisms away from major bioaerosol sources in urban areas may be up to 1.64×10^3 $cfum^{-3}$ and 6.55×10^3 $cfum^{-3}$ for bacteria and fungi respectively (Jones *et al*, 1983), while close to major sources of bioaerosols on farms during grain harvesting they may be up to 6.5×10^{11} $cfum^{-3}$ and 6.5×10^9 respectively (Gould, 1993). Arguably, this puts the typical daily activities at a dairy and beef farms at a mid point between exposure levels indistinguishable from background and those of intense but infrequent exposure for which the need for control measures are likely to be recognised. Recently published guidance in the biological agents ACOP (HSE 1995) suggests that in general there is no dose-response relationship of the kind that exists for many other substances, and risk may be high even at low exposures.

The highest counts of airborne fungi were detected during the milling, mixing and bagging of feed. Here, counts of 8.35×10^4 $cfum^{-3}$ were reached at farm 15 and 9.92×10^5 $cfum^{-3}$ at farm 17. Similar counts were also detected during feeding and bedding. Both tasks involved handling dry, potentially contaminated material in situations where a great deal of dust is likely to be made airborne. Many of the fungi detected in this study were common on most of the farms sampled and included species of Penicillium, Eurotium, Fusarium, Cladosporium, and Aspergillus. Some of these fungi including Aspergillus, Cladosporium, and Penicillium, are potential respiratory sensitisers. Some species of Aspergillus can colonise the lungs of asthmatics or other subjects, and complicate their disease (Stagg 1994).

Airborne bacteria concentrations were greatest during feeding and bedding where counts of up to 5.67×10^6 $cfum^{-3}$ of air were detected. However, exposure was almost as great during the cleaning of cowsheds, tagging and debugging, and debudding of calves. Bacteria were identified from samples taken at farms 17 and 26 and included species of Pseudomonas, Micrococcus, Staphylococcus, Corynebacterium and Rhodococcus (Stagg 1994). Previous studies in the engineering industry have implicated Pseudomonas species as respiratory sensitisers (Mattsby-Baltzer *et al*, 1989).

Airborne actinomycetes concentrations were greatest during feeding and bedding, where counts of up to 3.18×10^5 $cfum^{-3}$ of air were detected. Concentrations in excess of expected background levels were also measured during clipping cows, slurry spreading and mucking out. Actinomycetes isolated in this study were not characterised. (Stagg 1994).

4.4 Medical Study

4.4.1 Respiratory symptoms

Respiratory symptoms questionnaires were administered to personnel at all 26 farms in the main

study. 78 people working full time for at least 12 months were identified and it was possible to interview 66 (85%, 60 male, 6 female) within the constraints of this pilot study. 12 individuals were unable to participate due to annual leave, sickness absence or work commitments. Also at the farms, were 11 part time workers and seven who had worked less than 12 months. These were not studied except for one female part time worker included unintentionally, whose results are nevertheless included (total 67 subjects). The mean age of the respondents was 40 years, ranging from 17 to 70 years.

4.4.2 Individual symptoms

Table 8 illustrates the frequencies with which individual symptoms were reported. An itchy nose with sneezing and stuffiness in the last 12 months was commonly reported. About half these subjects reported that these symptoms were brought on in a particular place, or by a particular activity, or that they were better when on holiday (vacation). About a third reported that these symptoms occurred on most days for at least three months of the last year (chronic rhinitis).

A fifth of the subjects reported wheezing or whistling in the chest at any time in the last 12 months, and 15% an attack of shortness of breath. About half of these subjects reported that these symptoms were brought on by being in a particular place, or by a particular activity, or were better on holiday.

5 subjects reported that feeling feverish or shivery was brought on by carrying out a particular activity (only two from activities at work).

Reported past doctor's diagnoses included 'bronchitis' (8), pneumonia (6), pleurisy (7), pulmonary tuberculosis (2), asthma (9), farmers lung (2), leptospirosis (2), hay fever (12), eczema (6), allergy (14).

Table 9 shows that activities reported to bring on symptoms of rhinitis or asthma included exposure to dust from animal bedding and stored hay, straw, barley and other grain; grass cutting; moving stock. Indoor work in barns was often stated or implied. One subject reported feverishness after shovelling mouldy barley in a tower store (15 years previously), and some other specific agents were reported.

4.4.3 Symptom complexes (syndromes)

Table 10 shows that 24 individuals admitted to complexes of symptoms classified as syndromes; some individuals had more than one. 18 subjects (27%) had environmentally-related rhinitis, in all but three related to work activities or exposures. In seven of these the rhinitis persisted for more than three months in the year (chronic). Six subjects (9%) reported asthma related to work activities or exposures. Five subjects reported feverishness related to place or activity, only two of these related to work activities or exposures. Three subjects (4%) reported symptoms of chronic bronchitis, in each case associated with another syndrome (occupational rhinitis, occupational asthma), or with breathlessness or exertion.

Selected cases for the clinical assessments included all three subjects with chronic bronchitis, all 15 subjects with occupational rhinitis, and all six subjects with occupational asthma (20 subjects). This selection included four subjects who also reported an environmental-related feverish illness, two of them related to work activities or exposures. For clinical assessments 23 subjects without symptoms amounting to syndromes were also selected, as described previously.

4.4.4 Clinical assessments

Sixteen of the 20 subjects with syndromes defined by the questionnaire, and 15 of the 20 selected non-

syndrome subjects attended. Detailed results of the clinical assessments are described in Appendices 7.1 and 7.2.

Extrapolation of the result of the clinical examinations (Appendix 8) enables estimates of the frequency of clinically defined syndromes in the original population to be estimated; and the approximate sensitivity and specificity of the questionnaire to be calculated (Appendix 9). Table 11 shows that the clinical method estimated higher frequencies of occupational rhinitis and asthma, and slightly higher frequency of occupational asthma, than were estimated by the questionnaire. Table 11 shows that the specificities of the questionnaire for the identification of any of the syndromes, and individually for asthma, occupational asthma and occupational rhinitis are high, although the sensitivities of the questionnaire are lower. The possibility of improving the sensitivities by using different combinations of answers has not yet been studied.

4.4.5 Skin prick tests

Appendices 10.1 and 10.2 show the individual results of the skin prick tests for the subjects examined. In summary about 60% of those with respiratory syndromes and about 40% of those without syndromes had one or more positive skin tests. The commonest allergy was to house dust mite (which is related antigenically to grain mites), followed by straw dust; hay dust and in those with syndromes, cat fur (Appendix 10.3).

4.4.6 RAST tests

The results for the RAST tests for IgE antibodies to specific antigens show that about 60% of those with respiratory syndromes, and 27% of those without syndromes had one or more positive RAST tests. The antigens to which antibodies were most commonly found were house dust mite; a mixture of mixed grass pollens, cat fur and house dust mite, intended to identify atopy; and mixed mites (Appendix 11).

A comparison of the two tests did not always identify the same allergen as the cause of sensitisation. The presence of IgG antibodies to the actinomycete M. faeni, was found raised in four farmers compared to a non-agricultural control population. The farmer that had previously suffered with EAA, had significantly increased IgG titre. These findings are described in more detail in the HSE internal report (Allan *et al* 1994).

5. DISCUSSION

5.1 Forms for Hazard Identification and Exposure Assessment

Two forms have been developed for hazard identification and exposure assessment in the context of beef and dairy farming. These are for use by the HSE to record information and observations in a standardised format as part of their Technical Development Project.

The Hazard Identification Form is designed to provide detailed information on the nature of hazards and some preliminary data on the intensity and duration of exposures at each farm in the study. It is a detailed document, to enable descriptions to be recorded of the many tasks performed and the variability in working practices observed between farms. Information is collected in the greatest depth on tasks that are directly related to beef and dairy farming. This includes detail on the nature of the task, the materials that are used and some information on how the task is performed. Data is also collected on the time of year, the frequency, duration and who performs the task. This provides a preliminary indication of the intensity and duration of exposure for each task undertaken on the farm. Tasks not related directly to beef and dairy farming are included to ensure all sources of respiratory exposure on the farm are accounted for.

A detailed protocol exists for use with the form. For ease of use in the field, a summary should be printed either on the form itself or onto summary cards.

The form should be administered in the style of an informal interview with the farmer, farm manager or person who has a sound knowledge of the farm, field trials proved this to be the most appropriate approach. An occupational hygienist, without previous experience of completing the form, interviewed two farmers on separate occasions. The form was found to be manageable and not difficult to administer. Responses were recorded efficiently and accurately. Completion of the form should take up to 60 minutes, but this will vary depending on the type of farm, the size of farm and number of tasks, the tour of the farm buildings, the interviewer's familiarity with the form and the farm and the interviewer/ interviewee relationship.

The Exposure Assessment Form is shorter, but requires some expertise in occupational hygiene assessments to complete. Using this approach, farm workers' exposures are assessed, by task, in some detail. Information is recorded on the respiratory hazards present while performing the task, also the working practices and methods employed to control exposure. If results of air monitoring are available these are also recorded. All information is used to make an assessment of exposure for each of the respiratory hazards identified. Exposures are classified as low, medium or high.

IOM experience of occupational hygiene assessments for research studies indicated that some information is best recorded as free text (Niven *et al* 1993). The form is designed therefore, to allow observations and information to be noted as free text. The information most pertinent to the exposure assessment is then recorded in summary, in a format amenable to data collation and processing. A detailed protocol has also been prepared for this form.

Exposure assessments should be completed by observation of the task and discussions with those who perform it. The time taken to complete the exposure assessment will depend on the complexity of the task and experience of the assessor. Each task assessment is likely to take between 30 and 60 minutes. Assessors will require some expertise and experience of occupational hygiene assessments and understand what causes high and low exposure. A knowledge of beef and dairy farming would also be helpful. Due to the subjective nature of this type of assessment, assessors must be trained.

5.2 Application of Hazard Identification and Exposure Assessment Forms

Successful completion of the Hazard Identification Form relies on effective interviewing, correct recording of responses and co-operation from the interviewee. Care should be taken to ensure that accurate replies to questions are obtained. It is important therefore that the interview is properly set up. The interviewee should be made aware, prior to the interview, how long it is likely to last, so that he/she can set-aside an appropriate amount of time. If sufficient time has not been allowed this may result in a reluctance to provide information and/or inaccurate responses to questions. Interviewer technique is also important. The quality of information obtained will be dependent, to some extent, on the style in which the interview is conducted. Interviewers must be aware, for example, of avoiding leading questions, of putting words into the interviewees' mouth and pushing so hard for an answer that any answer is given. A relaxed approach, combined with a neutral questioning style should be adopted. Finally, the way in which the interviewer is perceived may have some effect on the responses to questions. If Agricultural Inspectors are used to administer the form, care will be needed to ensure they are not seen in their usual role as enforcers, as this may bias the information provided to them.

The Exposure Assessment Form relies on the observation of tasks and discussion with those responsible for performing them. Good co-operation and communication with the farm contact are required so that arrangements for task observation can be made. This is particularly important when tasks are performed infrequently and/or irregularly. Not all tasks will be available for observation at any one time of year, as large numbers are seasonal and some are only performed once a year for a short time period. Others, for example harvesting, are performed under time constraints. The farm contact may have less time and be less willing to co-operate with researchers at these times.

Assessment of exposure requires some skill in observing and communicating with those performing the task. Good co-operation is therefore also required from farm workers. This will again be influenced by the manner in which the assessment is conducted. During observation, presence of assessors may influence the way in which the task is performed, eg. a respirator may be worn when usually it is not. The assessor should be aware of the impact his/her presence may have on the performance of the task.

Finally, exposure assessment is a subjective process and as such there will be inconsistencies between assessors when drawing conclusions. These should be controlled by appropriate training and auditing. Criteria for acceptable performance, for auditing purposes, can only be defined once the Technical Development Project is in progress. Auditing should consider the extent of differences between assessors and the frequency of occurrence.

5.3 Use of the Information Collected using the Hazard Identification and Exposure Assessment Forms

The Hazard Identification Form has been designed for administration at all farms participating in the Technical Development Project. Questions have been devised to determine whether a task is carried out on the farm and also to obtain preliminary information on the nature of the hazards, and how the task is performed. For example, the section addressing winter feeding, refers to concentrate feeds, information is collected on the location of feeding, the type and condition of the feed and the method used to dispense it. This can be drawn upon to provide a subjective estimate of the intensity of exposure. In winter feeding, if bruised grain is fed dry, indoors and by hand, the exposure intensity estimate would be high, whereas if cake pellets are fed outdoors, using an automated dispenser the estimate for exposure intensity would be low. For the task of clipping, the main respiratory hazard is cow dander, the exposure intensity is defined by whether the task is performed indoors or outside and the number of cattle clipped at any one time. Clipping a large number of animals indoors would

be a high intensity exposure, while clipping one or two animals outside would represent a low intensity exposure. All sections referring to specific tasks are designed to provide an estimate of exposure intensity to maximise the value of the information collected on the Hazard Identification Form. In addition, estimates of exposure frequency and duration are gathered for each task to complete the preliminary exposure details.

Exposure assessment is the next stage in the methodology. It is designed to provide an estimate of the level of exposure for individual tasks, and therefore, should be conducted at a smaller number of farms and cover fewer tasks than hazard identification. The procedure allows a detailed assessment of individual tasks to be made, although, like hazard identification, the process relies on subjective judgements. The third stage in the methodology, the measurement of airborne respiratory hazards, provides an objective means of assessing exposure, although monitoring surveys are likely to be undertaken at a small number of farms only. In order to strengthen the Technical Development Project, it is recommended that airborne measurement results are used to validate exposure assessments and train assessors. Exposure assessments should, in turn, be used to inform and validate judgements concerning the hazard identification process and establish a set of guidelines for assigning exposure intensity estimates.

5.4 Linking Individuals to Exposures

This study does not address the categorisation of individuals' exposures to respiratory hazards. Individuals, hazards and exposures need to be linked in the Technical Development Project. To do this, details about the tasks undertaken by all individuals during cattle farming work are required. One way to obtain this information would be to use a checklist of tasks following on from the occupational history section of the Respiratory Symptoms Questionnaire. No matter what approach is selected for obtaining this information, it is essential that the task names used in the Hazard Identification Form are also used to describe individuals' exposures.

5.5 Training for Hazard Identification and Exposure Assessment Form Users

No matter how carefully designed the Hazard Identification and Exposure Assessment Forms are or how well thought out the instructions, problems will arise from unusual circumstances. Personnel given the responsibility for completing Hazard Identification Forms and undertaking exposure assessments must receive information, instruction and training to ensure this work is undertaken competently and consistently. To address these issues and ensure the smooth transition from finalised forms in this project to their use in the Technical Development Project the following recommendations are made:-

1. Handover of the forms and methodology should involve IOM members of the current pilot project team, members of the Technical Development Project team and those personnel responsible for training form administrators and assessors. The aim would be to introduce and describe in some detail both forms and the accompanying protocols, together with the rationale behind them. Data collation and analysis, training requirements for administrators and assessors and auditing of the form systems are the other issues that should also be addressed at this stage.

2. Trainers will need to prepare a suitable programme for administrators and assessors to furnish them with the skills required to complete the forms in the correct manner. This should start with a description of the Technical Development Project and its aims. The hazard identification training should include an introduction form and accompanying protocol, the rationale behind each section of the form and how the data will be used. Information and training should also be provided on approaching farmers, setting up interviews and interview technique. The nature and level of training

for the Exposure Assessment Form will depend on who is selected to undertake this part of the study. Competence in exposure assessment will be necessary and training to provide this will be required for inexperienced personnel. In general, training should include an introduction to the form and accompanying protocol and the rationale behind each section. Training to complete an Exposure Assessment Form should pay particular attention to the respiratory hazards usually encountered on beef and dairy farms. This ought to include typical sources of all respiratory hazards. Assessment techniques including task observation and discussion with farm workers should also be addressed. Experienced personnel would benefit from a refresher course, aimed at ensuring consistency between assessors. An introduction to farm tasks, typical respiratory hazards, in particular microbiological hazards, and agricultural working practices should be included.

3. To maintain a high level of consistency between assessors and to minimise deviations from the methodology that might be expected to develop over time, it is recommended that regular auditing of staff using both the Hazard Identification and Exposure Assessment Forms is undertaken by experienced independent staff.

5.6 Patterns of Exposure in Beef and Dairy Farming

Similar tasks were carried at all 26 study farms, although the methods and materials employed and the frequency and duration with which they were performed varied considerably. This produced notable differences in exposure patterns. Farms were visited in four geographical regions of the UK (South West Scotland, Cumbria, East Central Scotland and Northumberland). Geographical location had some influence on working practices, primarily due to the weather conditions, but substantial differences were also observed within a region.

Usually the duration of the task was determined by size of herd or crop, whether it was performed manually or with mechanised equipment, and the work practice of the farm. Task frequency was determined by the nature of the task, but also individual farm practices. Most tasks were seasonal, others were not carried out during certain weather conditions, while some were only performed when they could be fitted into the farm's schedule of work. Certain tasks were performed simultaneously on some farms.

A variety of respiratory hazards were identified, the most important were dusts from feed and bedding and associated bioaerosols, but others included proprietary chemicals, gases from soiled bedding, fumes from welding and paint vapours. These could be important in some circumstances. Often farm workers were exposed to several respiratory hazards while performing a single task and the same hazards were present during different tasks.

A small number of personal exposure and background concentration measurements were made during the study. They indicated that the preparation of feed, the distribution of feed and the bedding of cattle housing can all generate substantial quantities of airborne dust and bioaerosols. Personal exposure measurements were made between November 1993 and February 1994, therefore only tasks performed during the winter months were available for monitoring. Some tasks performed only in the summer, for example, harvesting, haymaking, are also expected to produce high dust and bioaerosol concentrations.

Patterns of respiratory exposure for beef and dairy farm workers are quite complex. For example, winter feeding and bedding involves frequent exposure of relatively short duration, while harvesting and grain drying involves infrequent exposure of prolonged duration. Exposure patterns can be broadly categorised into the following:

i. Potentially high exposure for most of the working day, for a limited, but usually consecutive number of days within the year. For example, harvesting, haymaking, mucking out main cattle housing areas, etc.

ii. Potentially high exposure for short period(s) of the working day. Typically, exposure is daily although performance of task may be seasonal. For example, feeding, bedding, feed preparation, etc.

iii. Lower level exposure for period(s) of the working day. Exposure is routine and usually daily. For example, milking, artificial insemination, milk tank cleaning, etc.

iv. Variable exposure for differing period(s) of time, usually less than 1 day. Exposure is likely to be infrequent or non-routine. Typically, animal health care tasks for example, clipping, foot paring, etc. Also farm maintenance tasks, for example, welding, painting farm buildings, etc.

These are broadly similar to those described by Watson (1986) for all types of farming.

5.7 Practical Methods of Controlling Respiratory Hazards

During the course of the study a number of practical methods for controlling exposure to respiratory hazards were encountered. Most involved modification of working practices or a change of substance used in the task. These types of control measures appear far more acceptable to farmers than the implementation of engineering controls which often require significant financial investment. Some changes observed in working practices were introduced to improve output or reduce workload, etc. and not necessarily to reduce or control exposure to respiratory hazards. The fact that these changes do help to reduce exposure are an added benefit.

Several farms which used propriety concentrate feedstuffs had substituted the loose type feed with pelleted feed to reduce airborne dust concentrations. A small number of farms had replaced the traditional methods of harvesting and drying grain with new techniques; for example, at one farm barley was undersown with grass. Grain, straw and grass were harvested simultaneously, baled and sealed in polythene. This eliminated the need for grain drying, a typically dusty task. Other techniques have also replaced grain drying. Most common was the treatment of grain with acid although this in itself could present a risk to health if not carefully controlled. Bruising and mixing grain can also produce high levels of dust. One farmer left the area once bruising and mixing were underway and returned to bag the feed only after these processes were complete.

At a small number of farms straw and/or shavings had been replaced as bedding materials with shredded paper because it produced less dust. Rubber mats and slatted floors were also used as alternatives to bedding materials. In addition, a number of farm workers reported that if they detected mouldy bales of straw while bedding cattle they would discontinue the work, leaving the straw to be kicked out by the animals.

In general, farm workers were aware to some extent of respiratory hazards. Most avoided unnecessary exposure. If possible, tasks were usually performed in well ventilated areas. Some respiratory protective devices were noted, but by and large these were in a poor state and not well maintained. There was some room for improvement in hazard awareness. This could be achieved through information leaflets and locally organised instruction and training sessions.

5.8 Medical Study

The respiratory symptoms questionnaire was designed to identify as far as possible the common respiratory syndromes possibly associated with work on farms. These included questionnaire material used and tested elsewhere, particularly for chronic bronchitis (MRC 1986), rhinitis and asthma (Love *et al* 1986). Attempts to recognise extrinsic allergic alveolitis and organic toxic dust syndrome were limited to questions about feverishness or sweating (Love *et al* 1986), with associated symptoms, but nevertheless identified one confirmed case of extrinsic allergic alveolitis (though occurring outside the 12 months time frame of the question).

Supplementary questions about the association of symptoms with time, place and specific agents, particularly place and agent, were informative, and identified many plausible, or known, allergenic agents.

While this pilot study was not designed to measure prevalence of respiratory symptoms reliably, the high estimated frequency of respiratory disease in general is notable (36% or 54%, by the questionnaire, and estimated from the clinical examinations, respectively), as is the high frequency of occupation rhinitis (22%, 36%). Frequencies of asthma in general of 10% or 21% are increased, and the frequency of occupational asthma was estimated to be 9% or 12%. Chronic bronchitis is relatively infrequent in this small population (4%). None had evidence of extrinsic allergic alveolitis or organic dust toxic syndrome in the last 12 months, although one gave a history consistent with the latter five years previously, and one gave a previous history of chronic extrinsic allergic alveolitis treated with steroids.

5.9 Usefulness of "Epi Info"

The work undertaken with the Epi Info package (Dean *et al*, 1990) concentrated on its use in the field rather than the analysis of data or investigation into available facilities. The package was found to be a useful tool with which to administer the medical questionnaire in the field. The programme was configured to aid the input of data in the correct format. Invalid answers were not accepted and inappropriate questions were skipped, based on earlier responses. Interviewees responded well, and with interest, to this method of recording answers.

Data was transferred and analysed using an external package (Genstat 5 Committee, 1987). Constraints of budget and time prevented exploration of the statistical capabilities of Epi Info.

5.10 Training for Medical Questionnaire Administrators

The respiratory symptoms, smoking and occupational history questionnaire is designed to be administered in the style of a formal questionnaire. This requires some skill and expertise. Training of inexperienced personnel will be required to ensure interviewers are competent. Instruction should be provided on the general principles of administering a standardised questionnaire for epidemiological purposes. The importance of asking questions using the standardised format, eliminating sources of interviewer bias, dealing with equivocal answers to questions and applying consistency in interpretation and recording of responses should be emphasized. Mock interviews should be conducted with tutors to give administrators experience of dealing with responses appropriately. Pilot interviews should be arranged with non-study farm personnel to provide further experience of administrating the questionnaire. These interviews should be tape recorded and reviewed by the tutor to ensure that responses are recorded appropriately and that correct interviewing technique is used. Recording of interviews should be repeated during the study as a means of auditing the administration of questionnaires.

6. SUMMARY OF MAIN FINDINGS AND RECOMMENDATIONS FOR FUTURE WORK

6.1 Main Findings

6.1.1 A systematic and scientific approach for identifying hazards and assessing respiratory exposures in the beef and dairy farming industries has been developed. Two forms and associated protocols have been produced for recording information and observations in a format suitable for data collation and analysis. Exposure monitoring could be used to supplement and validate the information collected.

6.1.2 A medical questionnaire has been designed to gather information about respiratory symptoms, smoking history and occupational history. A protocol has been prepared to be used with the questionnaire to provide instructions for the administrators. The study found the questionnaire to have an overall sensitivity of 57% and a specificity of 95%.

6.1.3 During the development of the exposure assessment methodology, a wide range of farm tasks were identified and described. Some were observed. Similar tasks were carried out at all farms but very different methods could be used. Patterns of respiratory exposure on beef and dairy farms are complex. Exposure measurements indicated that the preparation and distribution of feed and bedding cattle housing produced substantial quantities of dust and bioaerosols.

6.1.4 Generally, farm workers were aware to some extent of respiratory hazards. A number of practical methods of controlling exposure were encountered. Most involved modification of working practices or a change of substance rather than the implementation of engineering controls.

6.1.5 The estimated frequency of respiratory disease in general amongst beef and dairy farm workers was high. This included a high frequency of occupational rhinitis, asthma and occupational asthma. Chronic bronchitis was relatively infrequent. There was no recent evidence of extrinsic allergic alveolitis or organic dust toxic syndrome.

6.2 Recommendations for Future Work

6.2.1 In preparation for the Technical Development Project, personnel should be trained in completing the Hazard Identification Form, administering the Respiratory Symptoms Questionnaire and assessing exposures.

6.2.2 To ensure consistency between administrators/assessors is maintained and to minimise deviations from the methodology over time, the exposure assessment procedure and questionnaire administration should be regularly audited throughout the Technical Development Project.

6.2.3 The three point approach to exposure assessment can be designed to maximise the value of data from minimum effort by using air monitoring data to validate the exposure assessment procedure, which in turn can be used to inform and validate judgements made in respect of the hazard identification process. Sampling methods that are well characterised should be used, wherever possible.

6.2.4 To maximise the value of the information collected using the Hazard Identification Form, guidelines for exposure intensity estimates under different conditions of work should be established.

6.2.5 During the Technical Development Project clinical investigations should be performed on a subgroup of individuals to whom the Respiratory Symptoms Questionnaire has been administered for further validation. Some refinement of the criteria for combinations of answers may permit improvements in sensitivity.

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Table 1. Beef, Dairy and Beef and Dairy Farm Tasks described during Site Visits

Task Name	No. of Farms	Time of Year (Range)												Task Carried out by	Comments on frequency and duration of the task	Comments on working practices and respiratory hazard(s)
		J	F	M	A	M	J	J	A	S	O	N	D			
Milking	Beef: N/A Dairy: 9/9 B & D: 4/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Form workers	Typically milking performed twice a day. At one dairy farm it was performed 3 times a day. Total time spent milking ranged from 3 to 7 hours per day depending on herd and parlour size (including parlour cleaning after milking).	Usually parlours were herring bone design with the dairyman in a lower level pit. Concentrate feed dispensed automatically at most farms. Water was used to wash down parlour after use. Chemical cleaning agents used to clean dairy equipment. Respiratory hazards include bioaerosols (cow dander, waste products, feed stuffs). Chemical cleaning agents (sodium hydroxide).
Manual Milk Tank Cleaning	Beef: N/A Dairy: 5/9 B & D: 1/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Farm workers	Frequency of task ranged from once a day to once a month, taking between 5-60 minutes.	Milk tanks cleaned with sterilizing chemicals and brushes, sometimes from inside the tank. Respiratory hazard from the cleaning substance (sodium hypochlorite).

Table 1. Beef, Dairy and Beef and Dairy Farm Tasks described during Site Visits

Task Name	No. of Farms	Time of Year (Range)												Task Carried out by	Comments on frequency and duration of the task	Comments on working practices and respiratory hazard(s)
		J	F	M	A	M	J	J	A	S	O	N	D			
Removal of soiled bedding material (from major cattle housing areas)	Beef: 12/12 Dairy: 9/9 B & D: 3/4	✓	✓	✓	✓	✓				✓	✓	✓	✓	Farm workers	Frequency of task ranged from 1 to 3 times a year, taking between ½ to 9 days each time.	Mechanised equipment used to remove bedding from large areas. (Some small scale manual mucking out). Respiratory hazards include bioaerosols from soiled bedding material, ammonia, hydrogen sulphide.
Washing out of main cattle housing	Beef: 7/12 Dairy: 4/9 B & D: 2/4			✓	✓	✓	✓	✓	✓					Farm workers	Performed once a year only, taking from 1 to 7 days.	At most farms pressure washers and water only used. Two farms used team cleaning systems. Respiratory hazards include bioaerosols from soiled bedding residues.
Winter feeding (not including feeding in the milking parlour	Beef: 12/12 Dairy: 9/9 B & D: 4/4	✓	✓	✓	✓	✓				✓	✓	✓	✓	Farm workers	Task performed either once or twice a day on the same farms, bulk feed given once a day while concentrates given twice a day. Duration ranged from 15 minutes to 5 hours in total each day.	Bulk feed given was either silage or treated straw (usually treated with ammonia) concentrates included bruised barley, cake, brewer's grains also root vegetables and sugar beet pulp. Typically feed distributed mechanically (bulk) and manually (concentrates). Respiratory hazards include dust and bioaerosols form feedstuffs, ammonia from treated straw.

Table 1. Beef, Dairy and Beef and Dairy Farm Tasks described during Site Visits

Task Name	No. of Farms	Time of Year (Range)												Task Carried out by	Comments on frequency and duration of the task	Comments on working practices and respiratory hazard(s)
		J	F	M	A	M	J	J	A	S	O	N	D			
Managing Dairy Footbath	Beef: N/A Dairy: 2/9 B & D: 1/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Farm workers	Frequency of task ranged from once a week to once a year.	At two farms baths were filled by hose and emptied directly into the drain. At the third, bath was emptied through slats in the cubicle shed. Formaldehyde based treatments used, source of main respiratory hazard.
Winter Bedding	Beef: 12/12 Dairy: 9/9 B & D: 4/4	✓	✓	✓	✓	✓				✓	✓	✓	✓	Farm workers	Frequency ranged from everyday to once every third day. Task duration ranged from 15 minutes to 3 hours. For beef farms typically it took 1 hour.	Bedding material included: straw (sometimes chopped), shredded paper, sawdust and rubber mats. Usually the material was rolled or shaken out manually. Three farms used a mechanised system. Respiratory hazards include dust from bedding materials and associated bioaerosols.
Slurry Collection	Beef: 1/12 Dairy: 9/9 B & D: 3/4	✓	✓	✓	✓					✓	✓	✓	✓	Farm workers or no manual input	Where vehicle scrapers used, task performed once or twice a day, taking between 15 and 30 minutes each time. Manual scraping (twice a day, 10 minutes each time) at one farm.	Vehicle driven and fully automated systems used. Some farms operated both. Manual scraping at one farm. Respiratory hazards include bioaerosols from cattle waste.

Table 1. Beef, Dairy and Beef and Dairy Farm Tasks described during Site Visits

Task Name	No. of Farms	Time of Year (Range)												Task Carried out by	Comments on frequency and duration of the task	Comments on working practices and respiratory hazard(s)
		J	F	M	A	M	J	J	A	S	O	N	D			
Summer feeding	Beef: 2/12 Dairy: 5/9 B & D: 2/4				✓	✓	✓	✓	✓	✓				Farm workers	Task performed once a day. Duration of task ranged from 45 minutes to 4 hours (including travelling time to and from fields)	A combination of barley, cake, sugar beet pulp, minerals were fed during summer. Dispensed manually in field. Respiratory hazards include dust and bioaerosols from feedstuffs.
Artificial Insemination	Beef: 2/12 Dairy: 8/9 B & D: 3/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Farm workers or Milk Marketing Board representative or contractors or vet	At beef units synchronised A.I. performed twice a year. One farm estimated total duration for task over a year was 12 hours. At dairy units A.I. performed all year. Estimated that insemination took 10 minutes per cow.	Usually performed indoors. Close contact with animal. Respiratory hazards include bioaerosols from cow dander and cattle waste.
Assistance with calving	Beef: 7/12 Dairy: 9/9 B & D: 4/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Farm workers	Frequency and duration variable within calving periods. Number of cows assisted variable (8-75% of herd). 5-15 minutes spent with each animal.	Calving both indoors and outside. Winter calving usually inside however. Close contact with animal. Respiratory hazards include bioaerosols from cow dander, birth fluids and cattle waste.

Table 1. Beef, Dairy and Beef and Dairy Farm Tasks described during Site Visits

Task Name	No. of Farms	Time of Year (Range) J	F	M	A	M	J	J	A	S	O	N	D	Task Carried out by	Comments on frequency and duration of the task	Comments on working practices and respiratory hazard(s)
Debudding	Beef: 7/12 Dairy: 9/9 B & D: 4/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Farm workers	Debudding was typically performed on batches of calves. Frequency was variable between farms, depending on batch size. Duration of debudding ranged from ½ hour (smallest batches) to one day (largest batches).	Calves restrained manually or in a crush. Typically gas heated debudding irons used, which produce a fume when in contact with the horn. Close contact with the animal during task and while herding. Respiratory hazards include bioaerosols from cow dander, cattle waste, also fume.
Castration	Beef: 4/12 Dairy: 2/9 B & D: 4/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Farm workers or vet	Task usually performed on batches of calves between 2 to 5 times a year, taking on average 1 day each time.	Close contact with animal during task and while herding. Respiratory hazards include bioaerosols from cow dander and cattle waste.
Cattle Identification (tagging)	Beef: 7/12 Dairy: 6/9 B & D: 2/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Farm workers or vet or contractors	Calves tagged just after birth. (All must be tagged). Few minutes for each calf, usually in small batches. Some retagging of mature cattle as required.	Typically tagging performed indoors. Calf manually restrained. (One herd had been freeze branded by contractors). Close contact with calves during tagging and herding. Respiratory hazards include bioaerosols from cow dander and animal waste.

Table 1. Beef, Dairy and Beef and Dairy Farm Tasks described during Site Visits

Task Name	No. of Farms	Time of Year (Range)												Task Carried out by	Comments on frequency and duration of the task	Comments on working practices and respiratory hazard(s)
		J	F	M	A	M	J	J	A	S	O	N	D			
Worming/ Delicing	Beef: 8/12 Dairy: 8/9 B & D: 4/4			✓	✓	✓	✓	✓	✓	✓	✓	✓		Farm workers	Worming during Spring, Summer and Autumn, routinely and as treatment. Duration was between 1 hour to 2 days	Bolus injection, pour-on, drench, intravenous injection used to worm. Close contact with animals during herding and administration of wormer. Respiratory hazards include bioaerosols from cow dander and animal waste.
Feet Paring	Beef: 4/12 Dairy: 8/9 B & D: 4/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Farm workers or vet or contractors	Feet paring performed either routinely or as treatment for lame animal. Routine paring was performed once or twice a year. Duration was 5-60 minutes per animal.	Usually animals restrained in a foot paring crush. Hoof trimmers used. Close contact with animals during foot paring and herding. Respiratory hazards include bioaerosols from cow dander and animal waste.
Clipping	Beef: 5/12 Dairy: 6/9 B & D: 4/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Farm workers and contractors	Typically most of herd clipped once a year when brought in for winter, but animals also clipped for market or showing throughout the year. Duration of Autumn clip ranged from 2-5 days.	Cows usually restrained in a crush, although clipping of udders may be performed in the milking parlour. Areas of the body clipped varied. Close contact with animals during clipping and herding. Respiratory hazards include bioaerosols from cow dander and animal waste.

Table 1. Beef, Dairy and Beef and Dairy Farm Tasks described during Site Visits

Task Name	No. of Farms	Time of Year (Range)												Task Carried out by	Comments on frequency and duration of the task	Comments on working practices and respiratory hazard(s)
		J	F	M	A	M	J	J	A	S	O	N	D			
Slurry spreading	Beef: 1/12 Dairy: 9/9 B & D: 3/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Farm workers or contractors	Frequency of this task ranged from once a week to once a year. Duration ranged from ½ to 5 days each time.	Slurry spread over surface of ground usually by spraying from tractor and spreader. Bioaerosols generated from slurry are the main respiratory hazard.
Muck spreading	Beef: 12/12 Dairy: 9/9 B & D: 4/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Farm workers or contractors	Frequency for task ranged from once a month to once a year. The duration ranged from 3 hours to 7 days.	Muck spread over surface of the ground using automated spreader. Later it may be ploughed in. Respiratory hazard from bioaerosols of decomposing soiled bedding material.
Harvesting cereal crop	Beef: 11/12 Dairy: 2/9 B & D: 2/4							✓	✓	✓				Farm workers or contractors	Harvesting undertaken once a year, between 1½ to 30 days dedicated to this task.	Harvesting was fully mechanised. At one farm barley was undersown with grass. Both were harvested simultaneously and grain straw and grass were bagged together. Respiratory hazards include dust and bioaerosols from soil, grain, straw and grass.

Table 1. Beef, Dairy and Beef and Dairy Farm Tasks described during Site Visits

Task Name	No. of Farms	Time of Year (Range)												Task Carried out by	Comments on frequency and duration of the task	Comments on working practices and respiratory hazard(s)
		J	F	M	A	M	J	J	A	S	O	N	D			
Harvested grain treatment	Beef: 11/12 Dairy: 2/9 B & D: 2/4					✓	✓	✓	✓	✓				Farm workers or contractors	Task performed once a year during harvest, taking one to two days.	Grain drying or preservation with chemical (acid/urea) movement of grain was mostly automated, but some manual shovelling was undertaken. Respiratory hazards include chemical preservation, dust and bioaerosols from grain.
Concentrate feed preparation	Beef: 10/12 Dairy: 2/9 B & D: 2/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Farm workers	Frequency increased during Winter months, ranging from once a fortnight to every day. Duration ranged from ½ to 2 hours.	Feed was bruised, mixed and bagged. Some manual input. Respiratory hazards include dust and bioaerosols from grain, also feed supplements.
Silage making	Beef: 9/12 Dairy: 9/9 B & D: 4/4					✓	✓	✓	✓	✓				Farm workers or contractors	Silage made between one and three times a year. Duration ranged from 2 to 15 days, including collection and storage.	Mechanised process culminating in silage being wrapped or clamped. Some farms used additives to encourage fermentation. Respiratory hazards include bioaerosols from grass pollens and silage additives.

Table 1. Beef, Dairy and Beef and Dairy Farm Tasks described during Site Visits

Task Name	No. of Farms	Time of Year (Range)												Task Carried out by	Comments on frequency and duration of the task	Comments on working practices and respiratory hazard(s)
		J	F	M	A	M	J	J	A	S	O	N	D			
Hay making	Beef: 7/12 Dairy: 7/12 B & D: 3/4						✓	✓	✓					Farm workers	Hay made once a year only, taking between 1 and 20 days including baling and carting.	Mechanised process, one farm used an automated drying process to remove moisture. Respiratory hazards include dust and bioaerosols from grass pollens.

TABLE 2. Other tasks described during site visits not directly associated with beef and/or dairy farming

Task	No. of Farms
Other Livestock Tasks : Sheep	
Feeding	5
Bedding	2
Lambing	11
Worming	9
Vaccination	7
Castration	4
Tail Docking	5
Dipping	9
Pour on Treatment	2
Clipping	8
Disinfecting Pens	1
Feet Paring	1
Other Livestock Tasks : Poultry	
Feeding	1
Egg Collecting	1
Cleaning out Sheds	1
Other Land Related Tasks	
Lime Spreading	13
Ploughing	16
Stone Lifting and Rolling	19
Sowing and Cultivation	4
Fertilizing	16
Spraying	15
Lifting Potatoes	11
Farm Maintenance Tasks	
Hedge Cutting	14
Erection and Repair of Fencing/Stone Walls	11
Building and Maintenance of Ditches and Dykes	4
Welding	14
Painting Farm Buildings	12
Machinery Maintenance and Servicing	8

TABLE 3. Measured concentrations of total inhalable dust during the performance of cattle related tasks at phase two study farms

Farm No.	Sample No.	Individual	Activity	Sample Duration (mins)	Sample Volume (*l*)	Total Dust (mgm^{-3})
03	03/1	Farm worker	Scraping shed	108	201.6	0.9
03	03/2	Farmer	Debudding	55	104.5	2.5
03	03/3	Farmer	Levelling cake in loft	9	17.6	2.3
03	03/4	Farm worker	Clipping udders (helping)	73	142.4	2.9
03	03/5	Farmer	Clipping udders	73	142.4	5.0
03	03/6	Farm worker	Bedding cattle (sawdust, straw)	125	243.8	7.9
03	03/7	Farmer	Milking	137	260.3	1.4
15	15/9	Farm worker	Scraping, bedding with straw, feeding with forage box	109	207.1	1.5
15	15/10	Farmer	Feeding and bedding young stock with straw	42	79.8	6.4
15	15/11	Farmer	Bruising, mixing, bagging grain	48	93.6	15.8
15	15/12	Farmer	Clipping in young stock accommodation	62	114.7	58.9
15	15/13	Farm worker	Helping with clipping in young stock accommodation	60	117.0	3.0
15	15/14	Farm worker	Slurry spreading	75	142.5	2.7
15	15/15	Farmer	Foot paring and clipping (crush)	Void	Void	Void
15	15/16	Farm worker	Bedding milkers with shredded paper	14	28.0	195.3
16	16/1	Farm worker	Scraping sheds and yards	142	274.5	1.0
16	16/2	Farmer	Forking silage, bedding with paper and straw, slurry collection	140	305.5	2.3
16	16/3	Farm worker	Mucking out calf pens	130	240.5	0.5

TABLE 3. Measured concentrations of total inhalable dust during the performance of cattle related tasks at phase two study farms (Cont.)

Farm No.	Sample No.	Individual	Activity	Sample Duration (mins)	Sample Volume (*l*)	Total Dust (mgm^{-3})
16	16/4	Farmer	Tractor work to remove mucked out bedding	123	252.1	0.4
16	16/5	Farmer	Bedding with straw and feeding calves	60	114.0	27.1
16	16/6	Farm worker	Milking	55	115.5	0.9
17	17/9	Farm worker	Loading cattle, bedding and feeding	35	68.3	6.0
17	17/10	Farm worker	Loading cattle, bedding and feeding	35	50.7	4.7
17	17/11	Farm worker	Bagging bruised barley	22	42.9	10.3
17	17/12	Farm worker	Bagging bruised barley	22	42.9	8.4
17	17/13	Farm worker	Loading/moving hay	Void	Void	Void
17	17/14	Farm worker	Loading/moving hay	19	37.1	2.1
24	24/7	Farm worker	Feeding and bedding	120	234.0	2.2
24	24/8	Farm worker	Tagging and worming	127	241.3	8.1
24	24/9	Farmer	Tagging and Worming	Void	Void	Void
24	24/10	Farm worker	Bedding outside yard	66	132.0	5.7
26	26/1	Farm worker	Mucking out feeding and bedding	62	120.9	1.4
26	26/2	Farm worker	Feeding and bedding	40	80.0	2.9
26	26/3	Farmer	Feeding and bedding	40	64.0	2.5
26	26/5	Farm worker	Mucking out with tractor	255	497.2	0.8
26	26/6	Farmer	Mucking out with tractor	138	234.6	0.7
26	26/7	Farm worker	Mucking out and moving straw bales with tractor	258	432.2	0.7
26	26/8	Farm worker	Rolling out new straw	10	20.0	12.5

TABLE 4. Measured dust concentration (High Volume Samplers) inside farm buildings at phase two study farms

Farm No.	Sample No.	Sample Location	Sample Duration (mins)	Sample Volume (*l*)	Dust Conc. (mgm^{-3})
03	5757633	Calf Shed	435	1383300	0.4
	5757637	Cubicle Shed and Milking Parlour	205	492000	0.2
15	5757636	Young Stock Shed	472	1359360	0.2
	5757635	Cubicle Shed	62	178560	0.1
16	5757631	Calf Shed	315	787500	0.1
	5757630	Milking Parlour	367	851440	<0.1
17	5757625	Bruiser Shed	230	533600	0.7
	5757624	Cattle Court	224	501760	0.3
24	5757629	Cattle Court	Void	Void	Void
	5757628	Suckler Shed	348	918720	0.3
26	5757626	Cattle Court	397	952800	0.3
	5757621	Handling Shed/Cattle Court	382	947360	0.1

TABLE 5. Total Counts of Airborne Microorganisms
Counts are in Colony Forming Units per Cubic Metre of Air

Farm 03 (HSE 01)

Site No.	Location/Task	BACTERIA	FUNGI	ACTINOMYCETES
1	Milking parlour (not in use) (fixed-point)	$7.99x10^3$	$1.16x10^3$-$3.21x10^4$	$3.08x10^2$
2	Personal. Driving tractor/Scraping sheds (personal)	$1.57x10^4$-$8.51x10^4$	N.D-$1.72x10^4$	$1.94x10^4$-$4.48x10^3$
3	Calf shed adjacent to sawdust and lime (fixed-point)	$5.38x10^4$-$2.12x10^5$	$6.96x10^2$-$4.12x10^4$	$1.74x10^3$-$4.25x10^3$
4	Calf shed whilst debudding calves (personal and fixed-point)	$1.30x10^4$-$1.29x10^6$	$9.01x10^2$-$3.87x10^4$	N.R
6	Clipping cows (personal and fixed-point)	$5.10x10^3$-$2.74x10^5$	$1.38x10^2$-$1.36x10^4$	$3.00x10^3$-$5.52x10^4$
7	Milking parlour (in use) (personal and fixed-point)	N.D-$5.95x10^4$	N.D-$3.38x10^3$	$4.20x10^2$-$3.75x10^3$

Farm 15 (HSE 02)

Site No.	Location/Task	BACTERIA	FUNGI	ACTINOMYCETES
1	Feed mill preparing feed, grain, protein and vitamin supplements (personal and fixed-point)	$1.31x10^4$-$2.35x10^5$	$1.07x10^2$-$8.35x10^4$	$1.20x10^3$-$3.63x10^3$
2	Clipping calves and cows (personal and fixed-point)	$5.63x10^4$-$2.20x10^5$	N.D-$3.03x10^4$	$3.13x10^3$-$1.29x10^4$
3	Tractor/slurry spreading (fixed-point)	$4.94x10^4$-$2.32x10^5$	N.D-$3.31x10^4$	$8.82x10^4$
4	Cow shed (fixed-point)	$7.58x10^3$-$5.33x10^4$	$1.67x10^2$-$1.73x10^3$	$3.20x10^2$

N.D - Not Detected
N.R - No Result

TABLE 5 (Cont). Total Counts of Airborne Microorganisms
Counts are in Colony Forming Units per Cubic Metre of Air

Farm 16 (HSE 03)

Site No.	Location/Task	BACTERIA	FUNGI	ACTINOMYCETES
1	Personal. Cleaning calf cubicles. Spreading paper and straw for bedding (personal)	$5.07x10^5$-$2.14x10^6$	N.D-$5.25x10^4$	$4.64x10^3$
2	Scraping out sheds and spreading silage (personal)	N.D-$6.34x10^5$	N.D-$1.96x10^4$	$1.47x10^3$-$9.37x10^3$
3	Scraping out cubicle sheds and replacing straw bedding (fixed-point)	$8.00x10^2$-$6.86x10^3$	N.D-$8.46x10^3$	N.D-$2.1x10^3$
4	Mucking out calf shed by hand (personal and fixed-point)	$6.30x10^3$-$5.30x10^5$	N.D-$1.10x10^5$	$7.06x10^2$-$9.23x10^3$
5	Cleaning and mucking out calf shed (personal and fixed-point)	$5.94x10^3$-$1.51x10^6$	N.D-$4.42x10^4$	$3.40x10^2$-$1.11x10^3$
6	Milking parlour during use (personal and fixed-point)	$9.04x10^3$-$7.07x10^4$	N.D-$3.66x10^3$	$3.28x10^3$-$1.34x10^4$

Farm 24 (HSE 04)

Site No.	Location/Task	BACTERIA	FUNGI	ACTINOMYCETES
1	Personal. Feeding and bedding cows. Unrolling straw bales in shed (personal)	$9.14x10^3$-$1.57x10^6$	$9.45x10^2$-$1.51x10^5$	$4.41x10^3$-$3.24x10^4$
2	Whilst feeding and bedding in shed (fixed-point)	$1.38x10^4$-$1.10x10^6$	$6.36x10^3$-$1.15x10^5$	$6.96x10^4$-$3.18x10^5$
3	Tagging and worming in cattle yard (personal)	$8.50x10^4$-$3.70x10^5$	N.D-$1.68x10^4$	N.D
4	Tagging and worming in shed (am) (fixed-point)	$2.27x10^4$-$2.21x10^6$	$1.80x10^3$-$7.33x10^3$	$9.62x10^3$-$1.15x10^4$
5	Tagging and worming in shed (pm) (fixed-point)	$1.06x10^4$-$1.75x10^6$	$2.20x10^2$-$7.24x10^3$	$8.40x10^3$-$1.21x10^4$

N.D - Not Detected
N.R - No Result

TABLE 5 (Cont). Total Counts of Airborne Microorganisms
Counts are in Colony Forming Units per Cubic Metre of Air

Farm 26 (HSE 05)

Site No.	Location/Task	BACTERIA	FUNGI	ACTINOMYCETES
1	Feeding cattle, driving tractor while mucking out and taking muck to heap (personal and fixed-point)	$4.20x10^3$-$2.73x10^5$	$2.73x10^3$-$1.43x10^5$	$1.09x10^4$-$2.31x10^4$
2	Centre of cow shed while mucking out (fixed-point)	$2.64x10^3$-$5.26x10^5$	N.D-$2.02x10^4$	$2.73x10^3$-$2.34x10^4$
3	Tractor whilst mucking out (fixed-point)	$2.54x10^4$-$4.39x10^5$	N.D-$8.77x10^3$	N.D-$8.77x10^3$
4	Centre of cow shed while mucking out (fixed-point)	$1.16x10^4$-$1.52x10^4$	$1.82x10^3$-$1.34x10^4$	$5.70x10^4$
5	Putting out bedding. Unrolling straw bales (personal and fixed-point)	$2.40x10^2$-$4.38x10^6$	N.D-$6.63x10^5$	N.D-$1.25x10^5$

Farm 17 (HSE 06)

Site No.	Location/Task	BACTERIA	FUNGI	ACTINOMYCETES
1	Whilst automated bruising of barley (fixed-point)	N.D-$1.73x10^4$	N.D-$9.12x10^5$	N.D-$9.24x10^3$
2	Bagging feed barley, protein, food pellet (fixed-point)	$1.12x10^4$-$4.41x10^4$	N.D-$7.63x10^4$	N.D-$1.75x10^4$
3	Manual bagging of feed barley, protein, feed pellets (personal)	$5.70x10^4$=$3.84x10^5$	N.D-$9.92x10^5$	$3.38x10^4$
4	Cow barn (fixed-point)	N.D-$1.31x10^6$	N.D-$3.09x10^5$	$1.16x10^3$-$3.84x10^4$
5	Feeding and bedding cows (personal)	$7.67x10^5$-$5.67x10^6$	$3.38x10^3$-$9.02x10^5$	$3.38x10^4$

N.D - None Detected
N.R - No Result
(HSE 06) HSE Farm Code Number

TABLE 6. Prevalent Fungi Isolated

Fungi	Farm 03 (HSE 01)	Farm 15 (HSE 02)	Farm 16 (HSE 03)	Farm 24 (HSE 04)	Farm 26 (HSE 05)	Farm 17 (HSE 06)
Aspergillus spp.	+	+	+	+	+	+
Penicillium spp.	+	+	+	+	+	+
Trichoderma spp.	+					+
Fusarium spp.	+		+	+	+	
Geotrichum spp.	+			+	+	
Eurotium spp.	+	+	+	+	+	+
Mucor spp.	+			+	+	
Cladosporium spp.	+		+	+		
Wallemia spp.		+			+	+
Trichothecium spp.		+				
Scopulariopsis spp.	+	+	+			
Phialophora spp.			+			
Moniliella spp.				+		
Acremonium spp.				+		
Rhizopus spp.					+	

(HSE 06) - HSE Farm Code Number

TABLE 7. Prevalent Bacteria Isolated

Bacteria	Farm 26 (HSE 05)	Farm 17 (HSE 06)	Bacteria	Farm 26 (HSE 05)	Farm 17 (HSE 06)
Ps. nautica	+	+	Pschcrobacter imobilis	+	
Ps paucimobilis	+	+	Zanthomonas oryzae	+	
Ps. luteola	+	+	Weeksella zoohelcum	+	
Ps. vesicularis	+		Micrococcus spp.	+	
Ps. putrefacians	+		Aeromonas salmonicida	+	+
Ps. corrugata		+	Flav. indologenes	+	+
Ps. fluorescens		+	Mic. varians	+	
Staphylococcus xylosus	+	+	Serratia plymuthica	+	
Staphylococcus cohnii	+	+	Pantoea agglomerans	+	
Staphylococcus lentus	+	+	Corynebacterium	+	
Staphylococcus hominis		+	Gram negative rods	+	
Staphylococcus capitis		+	Rhodococcus fascians	+	

(HSE 06) - HSE Farm Code Number

TABLE 8. Frequency of selected individual respiratory symptoms

		Number of individuals answering positively
COUGH		
1.	Do you usually cough first thing in the morning?	2
2.	Do you usually cough during the day or at night?	8
	If YES to 1 or 2:	
3.	Do you cough like this on most days for as much as three months each year?	5
PHLEGM		
4.	Do you usually bring up any phlegm from your chest first thing in the morning?	8
5.	Do you usually bring up any phlegm from your chest during the day or at might?	5
	If YES to 4 or 5:	
6.	Do you bring up phlegm like this on most days for as much as three months each year?	6
BREATHLESSNESS		
	If subject is disabled from walking by any condition other than heart or lung disease, omit questions 7-9 and enter 1 here	0
7.	Are you troubled by shortness of breath when hurrying on level ground or walking up a slight hill?	11
8.	Do you get short of breath walking with other people of your own age on level ground?	2
	If YES to 7 and 8	
9.	Do you have to stop for breath when walking at your own pace on level ground?	0
NASAL SYMPTOMS		
10.	Have you had an itchy nose with sneezing and stuffiness in the last 12 months?	23
	I YES to 10 continue; if NO, go to Q20	
11.	Did these symptoms occur at a particular time of the day or night?	6
12.	At what time?	
	7am - 12 midday	4
	1pm - 6pm	5
	7pm - 12 midnight	0
	1am - 6am	2

TABLE 8. Frequency of selected individual respiratory symptoms (Cont.)

		Number of individuals answering positively
NASAL SYMPTOMS (contd)		
13.	Have these symptoms been brought on by being in a particular place?	13
14.	Have these symptoms been brought on by carrying out a particular activity?	12
	If YES	
15.	What happened to these symptoms when you were on holiday for a week or more?	
	Better 12/no change 7/worse 0/not applicable 4	
16.	Have you had an itchy nose with sneezing and stuffiness on most days for at least three months in the last year?	8
ASTHMA		
17.	Have you had wheezing or whistling in your chest at any time in the last 12 months?	14
18.	Have you had an attack of shortness of breath at any time in the last 12 months?	10
	If YES to 17 and/or 18 continue	
	If NO to both go on to 24	
19.	Did any of these symptoms occur at a particular time of the day or night?	4
	If YES	
20.	At what time?	
	7am - 12 midday	1
	1pm - 6pm	1
	7pm - 12 midnight	2
	1am - 6am	1
21.	Have any of these symptoms been brought on by being in a particular place?	6
22.	Have any of these symptoms been brought on by carrying out a particular activity?	9
23.	What happened to these symptoms when you were on holiday for a week or more?	
	Better 6/no change 8/worse 0/not applicable 2	
24.	Have you woken up with a feeling of tightness in your chest first thing in the morning at any time in the last 12 months	6

TABLE 8. Frequency of selected individual respiratory symptoms (Cont.)

		Number of individuals answering positively
ODTS/EAA		
25.	Have you felt feverish or shivery at any time in the last 12 months?	26
	If YES continue; if NO to end	
26.	When you felt feverish or shivery did you have any of these other symptoms?	23
	Muscle or joint aches	13
	Chest tightness	5
	Cough	12
	Headaches	18
	Shortness of breath	8
27.	Have these symptoms been brought on by being in a particular place?	4
28.	Have these symptoms been brought on by carrying out a particular activity?	5
29.	Did these symptoms cause you to stop work?	6
	If YES	
30.	What was the longest period in the last year that you were off work because of these symptoms?	Range 1-14 (mean 6.5)
31.	Did you consult a doctor about these symptoms?	4

TABLE 9. Reported activities bringing on symptoms of rhinitis and asthma; and specific reported causes of 'allergies'

Nasal symptoms*

- Bedding calves
- Moving hay made earlier
- Bedding with straw
- Feeding cattle, working with hay
- Dusty work
- Milling/mixing grain
- Driving vehicles
- Driving (on) road by rape field
- Grass cutting
- Working in the barn
- Working with hay
- Dressing potatoes

'Occupational asthma'*

- Moving stock
- Spray/moving grain, other indoor hay/grain work
- Preparation and handling of feed and hay
- Running

Feverishness, environment-related*

- Shovelling mouldy barley (in tower store)
- Fishing (stuck on a rock)
- Moving stock
- Running, strenuous activity

'Allergies'*

- Dust
- Cow fly spray
- Schirrosis skin/lambing
- Stress related skin problems
- Dust and mites, grain and stored hay dust
- Dusty hay, wheat straw
- Elastoplast
- Wheat and household dust
- Hay, mites
- Rubber
- Pollen and horse dust

* from the questionnaire

TABLE 10. Subjects with defined combinations of symptoms (syndromes) from questionnaire and classification from clinical study (See Appendix 7)

CB = Chronic bronchitis; E.Rh = environment-related rhinitis (occupational unless otherwise stated); C.E.Rh = chronic E.Rh; Occ.As. = occupational asthma; E.Fever = environmental-related feverish symptom complex; Breath = exercise breathlessness level 2 (walking with other people of same age on level ground).

ID	Questionnaire Diagnosis	CB	E.Rh	C.E.Rh	Occ.As.	E.Fever	Breath
192	E.Rh., Occ.As.	✓	✓	✓		✓†	
204	DNA	✓			✓	✓†	
232	CB, Non-Occ.As.	✓			*		✓
172	Non-Occ.As.				✓		✓
32	E.Rh.		✓	✓			
43	DNA		✓				
71	E.Rh.		✓				
91	DNA		✓	✓		✓	
92	E.Rh.		✓	✓			
102	Non-Occ.As.		✓				
151	Occ.As.		✓				
181	CB		✓				
191	Non-Occ.As.		✓	✓			
201	E.Rh., Occ.As.		✓		✓		
262	E.Rh.		✓				
282	CB		✓				
285	No disease		✓				
291	DNA		✓	✓	✓		
111	No disease				✓	✓	
222	E.Rh., Occ.As.				✓		
94	NS		✓†				
161	NS		✓†				
283	NS		✓†				
93	NS					✓†	
24	20	3	18	7	6	5	2

* did have non-occupational asthma
† not occupational
DNA did not attend
NS not selected for clinical study

TABLE 11. Estimated frequencies of syndromes, by questionnaire and clinically, in 67 farmers and farm workers. The sensitivity and specificity of the questionnaire diagnosis for the clinical result is shown for more numerous syndromes (see Appendix 8 and 9 for methods).

	Questionnaire	Clinical	Sensitivity	Specificity	Predictive Value
Any syndrome	24 (36%)	36 (54%)	55%	90%	88%
Occupational rhinitis	15 (22%)	24 (36%)	31%	82%	50%
Asthma	7 (10%)	14 (21%)	36%	98%	80%
Occupational asthma	6 (9%)	8 (12%)	31%	96%	50%
Chronic bronchitis	3 (4%)	4 (6%)			
EAA/ODTS	2 (3%)	0*			

* 1 subject had ODTS 5 years previously, and another a past history of chronic extensive allergic alveolitis.

APPENDIX 1

Detail of Procedures for Microbiological Sampling and Analysis

1. METHODS

1.1 Sampling for Airborne Microorganisms

Samples of air were taken in the breathing zones of workers where possible, and at selected areas of interest.

1.1.1 Filtration samplers

Air was sampled onto PTFE filters with a pore size of 0.5μm housed in seven hole sample heads (UKAEA). The samplers were attached to battery operated portable vacuum pumps set to a flowrate of 2*l*/min. Sampling duration was recorded.

1.1.2 Midget impingers (SKC)

Midget impingers were used to collect airborne particles into 10ml of ¼ strength Ringers solution with 2% inositol. Air was drawn through the midget impingers by battery operated vacuum pumps at a flow rate of 1*l*/min. Sampling duration was recorded.

1.1.3 AGI - 30 liquid impingers (Hants Glassware LTD)

AGI - 30 liquid impingers were used to collect airborne particles into 20ml of ¼ strength Ringers solution with 2% inositol. These were operated by mains/generator powered vacuum pumps set to a flow rate of 12.5*l*/min. Sampling duration was recorded.

1.1.4 Andersen samplers (Andersen 2000 Inc., Atlanta, GA., USA; Andersen 1958).

Andersen samplers were used to impact airborne particles in six fractions onto agar plates. Duplicate samples were taken at each sampling site. The samplers were operated at a flowrate of 25*l*/min. Sampling duration was recorded.

2. SAMPLE PROCESSING

2.1 Filtration Samples

Microorganisms were recovered from the aerosol monitors by washing in 5ml of peptone/inositol/Tween 80 wash fluid (PIT). The suspension was used to prepare a dilution series which was used as an inoculum.

APPENDIX 1 (Cont.)

2.2 Impingers

Impinger fluids were decanted into pre-weighed sterile universals and the volume readjusted to 10 and 20ml to allow for loss of liquid through evaporation. A dilution series was prepared from the solution to use as an inoculum.

2.3 Andersen Samples

Andersen samples were collected directly onto the range of media described below and incubated at the described temperatures. Colonies were counted and corrected for multiple particle deposition by a "positive hole correction" factor (Andersen, 1958).

3. ISOLATION OF MICROORGANISMS

A range of agar media and incubation temperatures were used to isolate the different microorganisms present:

3.1 Total mesophilic bacteria were isolated on Nutrient Agar incubated at 25°C for 7 days.

3.2 Bacteria capable of growth at human body temperature were isolated on Nutrient Agar (Lab M) incubated at 37°C for 7 days.

3.3 Total thermotolerant fungi were isolated on 2% malt extract agar incubated at 40°C, for up to 10 days.

3.4 Total mesophillic fungi were isolated on 2% malt extract agar and Dichloran glycerol agar (DG 18) incubated at 25°C, for up to 10 days.

3.5 Thermophilic bacteia and actinomycetes were isolated on R8 agar (Amner *et al*, 1989) and incubated at 55°C for 7 days.

4. IDENTIFICATION OF MICROORGANISMS

4.1 Fungi

Fungi were identified by direct observation of colonies growing on isolation plates, and by microscopy. Slide mounts of sporulating and mycelial growth were examined and identified to genus level and species where possible.

4.2 Bacteria

Bacteria from each site were selected and isolated into pure culture by streaking onto nutrient agar. The isolates were identified by Gram staining, morphology and biochemical tests. Biochemical tests included the BIOLOG GN MICROLOG system (Atlas Bioscan Limited, West Sussex) and API Staph, 20E, 20NE (API-bioMerieux, UK Limited, Hampshire). Both are based on a series of biochemical tests with positive results indicated by a colour change or visible growth. The results were analysed with computer programs to give a bacterial species identification.

APPENDIX 2

Respiratory Symptoms, Smoking and Occupational History Questionnaire and Protocol

Respiratory Hazards in Dairy and Beef Farming
Respiratory Symptoms Questionnaire

Personal Details :

Farm code : ☐☐☐☐☐

Subject Code : ☐☐☐☐☐

Surname & Initials of Subject : _____ ☐☐

Sex : M/F ☐

Home Address : _____

_____

_____

_____

_____

Post Code : ☐☐☐☐☐☐☐☐

Date of birth : dd mth yr ☐☐☐☐☐

Daytime Telephone No : ☎: _____

Evening Telephone No : ☎: _____

N.I. No : ☐☐☐☐☐☐☐☐☐

Todays date : dd mth yr ☐☐☐☐☐

Cough

1. Do you usually cough first thing in the morning ? — Y = Yes, N = No ☐
2. Do you usually cough during the day or at night ? — Y = Yes, N = No ☐

If YES to Questions 1 or 2 :

3. Do you cough like this on most days for as much as three months each year ? — Y = Yes, N = No ☐

Phlegm

4. Do you usually bring up any phlegm from your chest first thing in the morning ? — Y = Yes, N = No ☐
5. Do you usually bring up any phlegm from your chest during the day or at night ? — Y = Yes, N = No ☐

If YES to Questions 4 or 5 :

6. Do you bring up phlegm like this on most days for as much as three months each year ? — Y = Yes, N = No ☐

Breathlessness

7. Is the subject disabled from walking by any condition other than heart or lung disease, *If YES,* omit questions 8-9. — Y = Yes, N = No ☐
8. Are you troubled by shortness of breath when hurrying on level ground or walking up a slight hill ? — Y = Yes, N = No ☐
9. Do you get short of breath walking with other people of your own age on level ground ? — Y = Yes, N = No ☐

If YES to Questions 8 and 9 :

10. Do you have to stop for breath when walking at your own pace on level ground ? — Y = Yes, N = No ☐

Nasal Symptoms

11. Have you had an itchy nose with sneezing and stuffiness in the last 12 months ? — Y = Yes, N = No ☐

If YES, to Question 11 continue, If NO, **go to Question 21**

12. Did these symptoms occur at a particular time of the day or night ? — Y = Yes, N = No ☐

If YES, continue; if NO, go to Question 14 :

13. At what times : (please tick √)

Morning	0601-1200	☐
Afternoon	1201-1800	☐
Evening	1801-2400	☐
At night	0001-0600	☐

14. In which months in the last year did you experience these symptoms ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

15. Have these symptoms been brought on by being in a particular place ?

Y = Yes
N = No

If YES, please specify which places :

a.

b.

16. Have these symptoms been brought on by carrying out a particular activity ?

Y = Yes
N = No

If YES, please specify which activities :

a.

b.

17. What happened to these symptoms when you were on holiday for a week or more ?

1. Better
2. No change
3. Worse
4. Not applicable

18. Have you had an itchy nose with sneezing and stuffiness on most days for at least three months in the last year ?

Y = Yes
N = No

Asthma

19. Have you had wheezing or whistling in your chest at any time in the last 12 months ?

Y = Yes
N = No

20. Have you had an attack of shortness of breath at any time in the last 12 months ?

Y = Yes
N = No

If YES, to question 19 or 20, please continue.
If NO to both, please go on to question 29.

21. Did any of these symptoms occur at a particular time of the day or night ?

Y = Yes
N = No

If YES, continue, if NO, go to question 23 :

22. At what times :

Morning	0601-1200	(please tick √)
Afternoon	1201-1800	
Evening	1801-2400	
At night	0001-0600	

23. In which months in the year is the task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

24. Have any of these symptoms been brought on by being in a particular place ?

Y = Yes
N = No

If YES, which places ?

a.

b.

25. Have any of these symptoms been brought on by carrying out a particular activity ?

Y = Yes
N = No

If YES, which activities ?

a.

b.

26. What happened to these symptoms when you were on holiday for a week or more ?

1. Better
2. No change
3. Worse
4. Not applicable

27. Have you woken up with a feeling of tightness in your chest first thing in the morning at any time in the last 12 months ?

Y = Yes
N = No

ODTS/EAA

28. Have you felt feverish or shivery at any time in the last 12 months ?

Y = Yes
N = No

If YES, please continue.
If NO, go to Question 38.

29. When you felt feverish or shivery did you have any of these other symptoms ? (Answer yes or no)

Muscle or joint aches
Chest tightness
Cough
Headaches
Shortness of breath

30. In which months in the last year did you experience these symptoms ? (please tick ✓)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec

31. Have these symptoms been brought on by being in a particular place ?

Y = Yes
N = No

If YES, which places ?

a.

b.

32. Have these symptoms been brought on by carrying out a particular activity ?

Y = Yes
N = No

If YES, which activities ?

a.

b.

33. Did these symptoms cause you to be off work ? Y = Yes N = No ☐

If YES, what was the longest period in the last year that you were off work because of these symptoms ? days ☐☐

34. Did you consult a doctor about these symptoms ? Y = Yes N = No ☐

If YES, what did the doctor say was the cause of these symptoms ?

Past Illnesses

35. Have you ever had, or been told that you have had :

a. An injury or operation affecting your chest ? Y = Yes N = No ☐

b. Heart trouble Y = Yes N = No ☐

c. Bronchitis Y = Yes N = No ☐

d. Pneumonia Y = Yes N = No ☐

e. Pleurisy Y = Yes N = No ☐

f. Pulmonary tuberculosis Y = Yes N = No ☐

g. Asthma Y = Yes N = No ☐

h. Farmers' lung Y = Yes N = No ☐

i. Q Fever Y = Yes N = No ☐

j. Brucellosis Y = Yes N = No ☐

k. Leptospirosis Y = Yes N = No ☐

l. Hay fever Y = Yes N = No ☐

m. Eczema Y = Yes N = No ☐

n. Other chest trouble Y = Yes N = No ☐

If *YES,* please specify :

o. Allergy to something Y = Yes N = No ☐

If *YES,* please specify

Smoking History

These questions ask about smoking regularly by which I mean smoking at least one cigarette a day or one cigar a week or one ounce of tobacco a month, for as much as 1 year.

36. Have you ever smoked regularly ? — Y = Yes, N = No ☐

If NO, go to Occupational History

37. Do you smoke regularly at present ? — Y = Yes, N = No ☐

If YES, when did you start to smoke regularly ? — MM ☐☐ YY ☐☐

38. How much do you smoke at present ?

a. Number of cigarettes day ☐☐☐

b. Number of cigars a week ☐☐

c. Ounces of tobacco a month ☐☐ • ☐

For ex-smokers only :

39. When did you last give up smoking regularly ? — MM ☐☐ YY ☐☐

40. How much did you used to smoke when you smoked regularly ?

a. Number of cigarettes per day : ☐☐☐

b. Number of cigars a week ☐☐

c. Ounces of tobacco a month ☐☐ • ☐

Occupational History

41. **Date full time education ended :** Mth ☐☐ Yr ☐☐

First Job :

Date Started	Name of Employer	Nature of employer's business
Date Ended	Full job title	Main things done in job

Second Job

Date Started	Name of Employer	Nature of employer's business
Date Ended	Full job title	Main things done in job

Third Job

Date Started	Name of Employer	Nature of employer's business
Date Ended	Full job title	Main things done in job

Fourth Job

Date Started	Name of Employer	Nature of employer's business
Date Ended	Full job title	Main things done in job

Fifth Job

Date Started	Name of Employer	Nature of employer's business
Date Ended	Full job title	Main things done in job

Occupational History (Contd.)

Sixth Job :

Date Started	Name of Employer	Nature of employer's business
Date Ended	Full job title	Main things done in job

Seventh Job :

Date Started	Name of Employer	Nature of employer's business
Date Ended	Full job title	Main things done in job

Eighth Job :

Date Started	Name of Employer	Nature of employer's business
Date Ended	Full job title	Main things done in job

Ninth Job :

Date Started	Name of Employer	Nature of employer's business
Date Ended	Full job title	Main things done in job

Tenth Job :

Date Started	Name of Employer	Nature of employer's business
Date Ended	Full job title	Main things done in job

Respiratory Hazards in Dairy and Beef Farming
Joint HSE/IOM Study

Respiratory Symptom, Smoking and Occupational History Questionnaire
Instructions to Interviewers

INTRODUCTION

The diagnosis of respiratory disorders during life is at present largely based on symptoms, together with other features of clinical history, X-rays and/or lung function tests. It is well known, however, that the symptoms to which an individual admits may be influenced to some extent by the exact phrasing of the questions and by the person who asks them. To overcome some of these difficulties, this questionnaire provides a set of standard questions for enquiring about the presence or absence of common respiratory symptoms, smoking and occupational history. The aim in completing it is to elicit the facts and to avoid bias due to different techniques of questioning.

GENERAL INSTRUCTIONS

The subject's personal details should be recorded prior to administering the questionnaire. Farm and subject code as defined by the survey planner should be entered initially. After the personal details have been recorded and before starting to ask questions, an interviewer should instruct the subject that the majority of questions require a simple "yes" or "no" answer. The actual printed wording should be used for each question. In most cases this should lead to a simple "yes" or "no" answer, which should be accepted and recorded. Occasionally the subject will express doubt about the meaning of the question or the appropriate reply. When this happens further probing will be needed. Repetition of the question is usually sufficient. Some guidance for dealing with the more common difficulties is given below. When, after a brief explanation, doubt remains about whether the answer is "yes" or "no", the answer should be recorded as "no".

RECORDING THE REPLIES TO THE QUESTIONS

The questionnaire has been set out to facilitate transfer of data to computer. Most of the questions are of the yes/no type and replies to these questions should be recorded as "y" or "n" in the appropriate box. Where a number of option answers are available a tick should be placed in the box adjacent to the option(s) identified by the subject. Where the answer to a question is a number, eg. the number of cigarettes smoked, the number may be recorded directly in the boxes provided. Where the question is of a more open type, eg. Activity that brings on particular symptoms, the reply should be recorded in full and the coding will be performed later.

COMMENTS ON INDIVIDUAL QUESTIONS

Cough

Question 1 The word **usually** should be emphasized
Count a cough with first smoke or on first going out of doors. Exclude clearing the throat or a single cough.

Question 2 The word **usually** should be emphasized
An occasional cough may be considered normal and therefore recorded "no". Single coughs of a frequency of less than six per day are "occasional".

Question 3 Only asked if answer to Q1 and/or 2 was "yes"
If further probing is required **most days** can be described as **more often than not.**

Note: If a doubtful answer to question 1 or 2 is obtained (eg. "yes, sometimes") question 3 should be asked immediately as a probing question. If the answer to the probing question is "no" the answer to the basic question should be recorded as if it had been "no". If a subsequent question receives a definite "yes" the probing question should be repeated in turn. (See example below).

Q1 -	*Interviewer*	Do you **usually** cough first thing in the morning?
	Subject	Yes, sometimes.
Q3 -	*Interviewer*	Do you cough like this on most days for as much as three months each year?
	Subject	Oh no, not most days.
Q2 -	*Interviewer*	Do you **usually** cough during the day, or at night?
	Subject	Well from time to time.
	Interviewer	Do you cough as much as six times a day?
	Subject	Yes, more than that I'd say.
Q3 -	*Interviewer*	Do you cough like this on most days for as much as three months each year?
	Subject	Well, not every day.
	Interviewer	More often than not?
	Subject	Yes, I'd say so.

The interviewer should record these answers as follows: Question 1 - No, Question 2 - Yes and Question 3 - Yes.

Phlegm

Question 4 The word **usually** should be emphasized
Count phlegm with first smoke or on first going out of doors. Exclude phlegm from the nose, count phlegm swallowed.

Question 5 The word **usually** should be emphasized
"Occasional" phlegm production from the chest may be considered normal and therefore record "no" Phlegm production occurring twice or more a day is not considered to be occasional.

Question 6 Only asked if answer to Q1 and/or 2 were "yes".
If further probing is required **most days** can be described as **more often than not.**

Note: If a doubtful answer to question 4 or 5 is obtained (eg. "yes, sometimes") question 6 should be asked immediately as a probing question. If the answer to the probing question is "no" the answer to the basic question should be recorded as if it had been "no". If a subsequent question receives a definite "yes" the probing question should be repeated in turn. (See example below).

Q1 -	*Interviewer*	Do you **usually** bring up any phlegm from your chest **first thing in the morning?**
	Subject	Yes, sometimes.
Q3 -	*Interviewer*	Do you bring up phlegm like this on most days for as much as three months each year?
	Subject	Oh no, not most days.
Q2 -	*Interviewer*	Do you **usually** bring up any phlegm from your chest **during the day, or at night?**
	Subject	Well from time to time.
	Interviewer	Do you bring up phlegm twice or more a day?
	Subject	Yes, more than that I'd say.
Q3 -	*Interviewer*	Do you bring up phlegm like this on most days for as much as three months each year?
	Subject	Well, not every day.
	Interviewer	More often than not?
	Subject	Yes, I'd say so.

The interviewer should record these answers as follows: Question 1 - No, Question 2 - Yes and Question 3 - Yes.

Breathlessness

Question 7 Refers to a physical disability, but not one brought on as a result of **heart or lung disease.** If answer is "yes" go to question 11.

Question 8 Hurrying implies walking quickly.

Question 9 The words "**own age**" should be emphasized.

Question 10 Only asked if **both** answers to questions 8 and 9 were yes. **The pace at which you would** usually walk is your own walking pace.

Nasal Symptoms

Question 11 All three symptoms should be present, otherwise record "no". If subject cannot remember record "no". If further probing is required an **itchy** nose can be described as a **tickly nose** and a **stuffy nose** can be described as a **blocked** nose.

Question 12 "A particular time of day or night" is a discrete identifiable period.

Question 13 Only asked if answer to question 11 was "yes". Do not give options unless further probing is required. More than one time period can be selected.

Question 14 Select each month once only no matter how many times symptoms occurred in that month.

Question 15 Include occupational and non-occupational locations. Be precise but concise when recording places.

Question 16 Include occupational and non-occupational activities. Be precise but concise when recording activities.

Question 17 Give options after asking the question. A holiday is a break away from farming activities. Record not applicable if there has been no holiday for a week or more during the last 12 months.

Question 18 If further probing is required **most days** can be described as **more often than not.**

Asthma

Question 19 If subject has experienced wheezing or whistling in the chest record "yes". If the question is not understood, vocal demonstration of wheezing by the interviewer may be helpful. Alternatively describe the symptom as a high pitched noise during exhalation. The word asthma should not be used. If subject cannot remember record "no".

Question 20 An "attack of shortness of breath" is an abnormal shortness of breath which is not a result of some physical exertion which would normally cause the subject to breathe more deeply. If subject cannot remember record "no".

Question 21 "A particular time of day or night" is a discrete identifiable period.

Question 22 Only asked if answer to question 22 was "yes". Do not give options unless further probing is required. More than one time period can be selected.

Question 23 Select each month once only, no matter how many times symptoms occurred in that month.

Question 24 Include occupational and non-occupational locations. Be precise but concise when recording places.

Question 25 Include occupational and non-occupational activities. Be precise but concise when recording activities.

Question 26 Give options after asking the question. A holiday is a break from farming activities. Record not applicable if there has been no holiday for a week or more during the last 12 months.

Question 27 If subject cannot remember record "no".

ODTS/EAA

Question 28 If subject has felt feverish or shivery record "yes". If the question is not understood symptoms may be described as periods of feeling hot and cold. If subject cannot remember record "no".

Question 29 The words "when you felt" should be emphasized. Give options on pre-printed card to subject. Read out the options at the same time. Multiple options can be selected.

Question 30 Select each month once only no matter how many times symptoms occurred in that month.

Question 31 Include occupational and non-occupational locations. Be precise but concise when recording places.

Question 32 Include occupational and non-occupational activities. Be precise but concise when recording activities.

Question 33 If further probing is required emphasize the subject should only include the days he was off work because he felt feverish or shivery in the last 12 months. If yes, include any period off work for half a day or more.

Question 34 Record as "yes" any number of consultations with the doctor due to feeling feverish and shivery over the last 12 months, regardless of how many times the symptoms presented themselves. If yes, accurately describe the doctor's opinion of the cause of the symptoms.

Past Illnesses

Questions 35a to 35o Read out the list, record an answer for each illness before moving onto the next illness. If the subject does not recognise or remember a particular illness record as "no".

Questions 35n & 35o These require additional information to be recorded.

Smoking History

Read out the definition of smoking regularly. **Note:** A large cigar is one bigger than a standard cigarette. The word **ever** should be emphasized.

Question 36 If the smoking habit of the subject has ever met the definition of smoking regularly record "yes". If "no" is recorded move on to questions about occupational history.

Question 37 Record "yes" only if the smoking habit **currently** meets the definition of regular smoking.

Question 38 Record figures as precisely as possible. If quantity varies record an average over time. Do not leave boxes blank. For example, record 0 for tobacco and cigars when a subject only smokes cigarettes.

Question 39 If subject cannot remember the month record 01. If subject cannot remember the year record an estimate.

Question 40 Record figures as precisely as possible. If quantity varies record an average over time. Do not leave boxes blank. For example, record 0 for tobacco and cigars when a subject only smoked cigarettes.

Occupational History

The nature of questioning for this section can be less formal than in the previous sections.

Question 41 If subject cannot remember the month record 01.

Occupational History: Explain to the subject you wish to compile a list of all the jobs which he/she has held for at least 4 months since finishing full time education. If subject cannot remember the start or end month record 01. If the subject cannot remember the start or end year record an estimate.

For name of employer, for example, record farmer's name, company name or self employed. For nature of employer's business record, for example, Beef farming, Coal mining, Hairdressing.

Record **separately** different jobs on the same farm or with the same employer.

Space has been provided for 10 jobs. If more space is required continue on a separate sheet and attach securely to the completed questionnaire.

APPENDIX 3

Respiratory Hazards in Dairy and Beef Farming
Joint HSE/IOM Study

Defined Criteria for Respiratory Syndromes from the Questionnaire

1. CHRONIC BRONCHITIS

Cough first thing in the morning OR cough during the day or at night AND cough like this on most days for as much as three months each year AND bring up any phlegm from the chest first thing in the morning OR bring up any phlegm from the chest during the day or at night AND bring up phlegm like this on most days for as much as three months each year.

2. BREATHLESSNESS ON EXERTION

Troubled by shortness of breath when hurrying on level ground or walking up a slight hill AND short of breath when walking with other people of same age on level ground.

3. SERIOUS BREATHLESSNESS ON EXERTION

As above, with the additional criterion: Have to stop for breath when walking at own pace on level ground (no subjects qualified).

4. RHINITIS

An itchy nose with sneezing and stuffiness in the last 12 months. The condition was suspected to be environmental if symptoms were brought on by being in a particular place or were brought on by carrying out a particular activity. Occupational rhinitis was recognised if the specific places or activities were obviously work-related.

5. RHINITIS, CHRONIC

In addition to 4, the subject reported an itchy nose with sneezing and stuffiness on most days for at least three months in the last year.
(Note, those fulfilling the criteria for chronic rhinitis are a subset of those in 4).

6. ASTHMA

A combination of at least two of the following: Wheezing or whistling in the chest at any time in the last 12 months; An attack of shortness of breath at any time in the last 12 months; A feeling of tightness in the chest first thing in the morning at any time in the last 12 months. The condition was suspected to be environmental if symptoms were brought on by being in a particular place or were brought on by carrying out a particular activity. Occupational asthma was recognised if the specific places or activities were obviously work-related.

7. ENVIRONMENT-RELATED FEVERISHNESS, POSSIBLY ORGANIC DUST TOXIC SYNDROME/EXTRINSIC ALLERGIC ALVEOLITIS

Felt feverish or shivery at any time in the last 12 months AND at the same time had any of the following: muscle or joint aches, chest tightness, cough, headaches, shortness of breath: AND the symptoms had been brought on by being in a particular place OR by carrying out a particular activity.

APPENDIX 4

Hazard Identification Form and Protocol

Respiratory Hazards in Dairy and Beef Farming

Inhalation Hazard Identification

Joint IOM/HSE Study

Respiratory Hazards in Dairy and Beef Farming
Inhalation Hazard Identification

Date of visit : Day ☐☐ Month ☐☐ Year ☐☐

Assessor :

Name : ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Initials : ☐☐☐

1. Farm Details

1.1 Contact name (full name) : Forenames : ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Surname : ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

1.2 Status of contact name : 1. Tenant 2. Owner 3. Manager ☐

1.3 Telephone number : ☎: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

1.4 Farm code : ☐☐☐☐☐

1.5 Study classification : 1. Beef 2. Dairy 3. Both ☐

1.6 Farm address : ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

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☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Post Code : ☐☐☐☐☐☐☐☐

1.7 Location : 1. Lowland 2. Upland 3. Both ☐

1.8 Farm type : 1. Livestock 2. Arable and Livestock ☐

2. Employees Working on Farm

Include everyone who is 16 years of age or older who works for at least 2 hours per week. Long term workers are those who have been working on the farm for longer than 12 months.

Forename	Surname	Full time Y/N	Long term Y/N	Job type*

* Job type

1. Farmer 2. General farm worker 3. Stockman/Dairyman 4. Tractor/Machine man 5. Other

3. Cattle Herd Details

3.1 Beef Herd Details

Is there a beef herd on this farm ? Y = Yes N = No ☐

If you answered NO to question 3.1, please skip to question 3.2.
If you answered YES, please continue.

a. Beef system : 1. Breeding 2. Finishing (store cattle) 3. Breeding and finishing ☐

b. Breed ☐

Breeding (Skip to question f. is the farm is a finishing unit only)

c. Number of suckler cows : ☐☐☐

d. Number of bulls for breeding : ☐☐

e. Breeding stock replacements : Homebred : Yes/No ☐

Brought in : Yes/No ☐

Finishing (Skip to Page 5 if the farm is a breeding unit only)

f. Total number of store cattle : ☐☐☐

Page 4

3.2 Dairy Herd Details

Is there a dairy herd on this farm ? Y = Yes N = No ☐

If you answered NO to question 3.2, please skip to Section 4.
If you answered YES, please continue.

a. Breed : ☐

b. Number of milking cows : ☐☐☐

c. Number of young stock and calves (including in calf heifers) : ☐☐☐

d. Number of bulls for breeding : ☐

e. Breeding stock replacements : Homebred : Yes/No ☐
Brought in : Yes/No ☐

4. Non-Cattle Activities

4.1 Are tasks performed with livestock other than cattle on this farm. Y = Yes N = No ☐

If you answered NO to question 4.1, please skip to question 4.3.
If you answered YES, please continue.

4.2 Livestock species other than cattle :

Livestock	Number of animals
Sheep	☐☐☐☐
Pigs	☐☐☐☐
Poultry	☐☐☐☐
Egg production	☐☐☐☐
Goats	☐☐☐☐
Others	☐☐☐☐

If *others*, please specify : ☐

4.3 Are there crops on the farm ? Y = Yes N = No ☐

If you answered NO to question 4.3, please skip to Section 5 if there is a beef herd on the farm, or Section 6 if there is only a dairy herd on the farm. If you answered YES, please continue.

4.4 Land use :

Crop	Acreage
Cereal	☐☐☐☐
Roots	☐☐☐☐
Peas, beans and other vegetables	☐☐☐☐
Horticulture	☐☐☐☐
Silage (all cuts)	☐☐☐☐
Hay (all cuts)	☐☐☐☐
Oil seed rape	☐☐☐☐

The four sections you have just completed were required for all farms. Which sections you go on to complete depends on the activities which you have found taking place on this farm.

Use the table below to guide you to the sections required and return at the end of the form to confirm with the checklist that you have completed all the appropriate sections.

Section	Beef Farm	Dairy Farm	Beef and Dairy Farm	Check List
1. Farm Details	✓	✓	✓	
2. Employees	✓	✓	✓	
3. Cattle Herd	✓	✓	✓	
4. Non-Cattle	✓	✓	✓	
5. Beef Tasks	✓		✓	
6. Dairy Tasks		✓	✓	
7. Cattle Tasks	✓	✓	✓	
8. Other Livestock	✓	✓	✓	
9. Land Related	✓	✓	✓	
10 Maintenance	✓	✓	✓	
11 Control Work	✓	✓	✓	
12 Observations	✓	✓	✓	
13 Comments	✓	✓	✓	

5.0 Beef Tasks

5.1 Winter Bedding

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 5.1, please skip to Task 5.2.
If you answered YES, please continue.

a. Major Housing Methods :
1. Full litter beds
2. Cubicle beds
3. Slatted/hard floors
4. Other

a. ☐ b. ☐

If *other* please specify : ☐

b. Major Litter Types :
1. Straw
2. Sawdust/Shavings
3. Paper
4. Mats
5. None used
6. Other

a. ☐ b. ☐

If *other*, please specify : ☐

c. Major treatment of bedding on the farm :
1. Chopped/Shredded
2. Substances added
3. None

☐ ☐

d. Usual method of bedding :
1. Manual
2. Mechanical
3. Kicked out by cattle

☐

e. Person(s) who carry out this task :
1. Farm worker
2. Contractor
3. Both

☐

f. In which months of the year is the task carried out ? (please tick ✓)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

g. How many times per week (7 days) is this task performed ? ☐☐

h. How long does it take each time ? Hrs ☐.☐

5.2 Slurry Collection

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 5.2, please skip to Task 5.3.
If you answered YES, please continue.

a. Usual method of cleaning slurry from floor of cattle housing :
1. Automated scrapers
2. Vehicle driven scrapers
3. Cattle trodden through slats

☐

b. If applicable, person(s) who carry out this task :
1. Farm worker
2. Contractor
3. Both

☐

c. In which months of the year is the task carried out ? (please tick ✓)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

d. How many time per week (7 days) is this task performed ? ☐☐

e. How long does it take each time ? Hrs ☐.☐

5.3 Removal of Soiled Bedding Material

Is this task carried out on the farm ? Y = Yes, N = No ☐

If you answered NO to Question 5.3, please skip to Task 5.4.

a. Usual method of bedding removal from main cattle housing areas : 1. Manual 2. Mechanised 3. Both ☐

b. Person(s) who carry out removal of bedding material from main cattle housing areas. 1. Farm worker 2. Contractor 3. Both ☐

c. In which months of the year is this task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

d. How many times a year is bedding removed from main cattle housing areas ? ☐☐

e. How long does it take each time (days) ? Days ☐.☐

f. Is manual mucking out ever performed ? Y = Yes, N = No ☐

(Include small scale mucking out here only e.g. calf pens)

g. In which months of the year is manual removal of bedding material carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

h. How many times a year is manual bedding removal carried out ? Days ☐.☐

i. How long does it take each time (hours) ? Hrs ☐.☐

5.4 Washing Out of Main Cattle Housing

Is this task carried out on the farm ? Y = Yes, N = No ☐

If you answered NO to question 5.4, please skip to Task 5.5.
If you answered YES, Please continue.

a. Usual method of washing out : 1. Pressure hose/washer 2. Hose pipe 3. Bucket ☐

b. Are any chemical additives used ? (e.g. detergent, disinfectant) Y = Yes, N = No ☐

c. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

d. In which months of the year is this task carried out ? (please tick)√

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

e. How many times a year are main cattle housing areas washed ? ☐☐

f. How long does it take each time (days) ? Days ☐.☐

5.5 Winter Feeding (Bulk and Concentrate)

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 5.5 please skip to Task 5.6.
If you answered YES, please continue.

a. Usual location of feeding :
1. Indoors
2. Outside
3. Both
☐

b. Major types of concentrate feed given :
1. Milled/Bruised grain
2. Pelleted feed (cake)
3. Loose feed (cake)
4. None given
a. ☐ b. ☐

c. Condition of feed identified above :
1. Dry feed
2. Delivered to farm moist
3. Moistened on farm
4. Not applicable
a. ☐ b. ☐

d. Major types of bulk feed given :
1. Silage
2. Hay
3. Straw
4. None
5. Other
a. ☐ b. ☐

If *other* please specify : ☐

e. Major treatments of bulk feed :
1. None
2. Chemical (eg. ammonia, additive to straw)
3. Artificially dried
4. Not applicable
5. Other
a. ☐ b. ☐

If *other* please specify : ☐

f. Usual method of dispensing concentrate feed :
1. Mechanised
2. Manual
3. Manually loaded into automated dispenser
4. Not applicable
☐

g. Usual method of dispensing bulk feed :
1. Mechanised
2. Manual
3. Manually loaded into automated dispenser
☐

h. Person(s) who carries out this task :
1. Farm workers
2. Contractor
3. Both
☐

i. In which months of the year is the task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

j. How many hours per day during winter is spent feeding ? Hrs ☐.☐

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5.6 Summer Feeding - Other than Grazing (Bulk and Concentrate)

Is this task carried out on the farm ? Y = Yes, N = No ☐

If you answered NO to question 5.6, please skip to Task 5.7.
If you answered YES, please continue.

a. Usual location of feeding : 1. Indoors 2. Outside 3. Both ☐

b. Major types of concentrate feed given : 1. Milled/Bruised grain 2. Pelleted feed (cake) 3. Loose feed (cake) 4. None given — a. ☐ b. ☐

c. Condition of feed identified above : 1. Dry feed 2. Delivered to farm moist 3. Moistened on the farm 4. Not applicable — a. ☐ b. ☐

d. Major types of bulk feed given : 1. Silage 2. Hay 3. Straw 4. None — a. ☐ b. ☐

If *other* please specify : 5. Other ☐

e. Major treatments of bulk feed : 1. None 2. Chemical (e.g. ammonia additive to straw) 3. Artificially dried 4. Not applicable — a. ☐ b. ☐

If *other* please specify : 5. Other ☐

f. Usual method of dispensing concentrate feed : 1. Mechanised 2. Manually 3. Manually loaded into automated dispenser ☐

g. Usual method of dispensing bulk feed : 1. Mechanised 2. Manually 3. Manually loaded into automated dispenser ☐

h. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

i. In which months of the year is the task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

j. How many hrs per day during summer is spent feeding ? Hrs ☐ • ☐

5.7 Artificial insemination

Is this task carried out on the farm ? Y = Yes, N = No ☐

If you answered NO to question 5.7, please skip to Task 5.8.
If you answered YES, please continue.

a. Usual location : 1. Indoors 2. Outside ☐

b. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

c. Usual strategy for inseminations : 1. Individually 2. Batches ☐

5.8 Assistance with calving

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 5.8, please skip to Task 5.9.
If you answered YES, please continue.

a. Usual location for calving : 1. Indoors 2. Outside ☐

b. Average percentage of cows assisted : ☐☐☐

c. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

d In which months of the year is the task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

5.9 Debudding

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 5.9, please skip to Task 5.10.
If you answered YES. please continue.

a. Usual location : 1. Indoors 2. Outside ☐

b. Usual strategy for debudding : 1. Individually 2. Batches ☐

c. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

5.10 Castration

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 5.10, please skip to Task 5.11.
If you answered YES, please continue.

a. Usual location : 1. Indoors 2. Outside ☐

b. Usual strategy for castration : 1. Individually 2. Batches ☐

c. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

5.11 Cattle Identification (Tagging and Freeze Branding)

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 5.11, please skip to Task 5.12.
If you answered YES, please continue.

a. Usual location : 1. Indoors 2. Outside ☐

b. Usual strategy for cattle identification : 1. Individually 2. Batches ☐

c. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

5.12 Worming/Delicing etc.

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to Question 5.12 please skip to Task 5.13.
If you answered YES, please continue.

a. Usual location : 1. Indoors 2. Outside ☐

b. Cattle receiving treatment : 1. Most 2. Selected ☐

c. Major methods used : 1. Drench 2. Subcutaneous injection 3. Bolus 4. Pour on 5. Dust on — a. ☐ b. ☐

d. Usual strategy for treatment : 1. Individually 2. Batches ☐

e. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

5.13 Feet Paring

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to Question 5.13 please skip to Task 5.14.
If you answered YES, please continue.

a. Usual location : 1. Indoors 2. Outside ☐

b. Cattle receiving treatment : 1. Most 2. Selected ☐

c. Usual strategy for treatment : 1. Individually 2. Batches ☐

d. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

5.14 Clipping

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to Question 5.14 please skip to Section 6 if there is a Dairy Herd on the farm or Section 7 if there is only a Beef Herd on the farm.

If you answered YES, please continue.

a. Usual location : 1. Indoors 2. Outside ☐

b. Cattle clipped : 1. Most 2. Selected ☐

c. Usual strategy for clipping : 1. Individually 2. Batches ☐

d. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

6. Dairy Tasks

6.1 Milking

Is this task carried out on the farm ? — Y = Yes, N = No

If you answered NO to question 6.1, please skip to Task 6.2.
If you answered YES, please continue.

a. Capacity of parlour (Number of cows) :

b. Are chemical substances used to treat udders ? — Y = Yes, N = No

c. If yes, is it applied by spray ? — Y = Yes, N = No

d. Concentrate feed given in the parlour ?
1. Milled/bruised grain
2. Pelletised (cake)
3. Non pelletised (cake)
4. None given

e. Condition of concentrate feed given in parlour :
1. Dry feed
2. Delivered to farm moist
3. Moistened on farm
4. Not applicable

f. Is concentrate feeding :
1. Fully automated
2. Semi-automated
3. Manual
4. Not applicable

g. Usual method of cleaning parlour :
1. Pressure hose/water
2. Hose pipe
3. Bucket

h. Are any chemical additives used for cleaning the parlour ? — Y = Yes, N = No

i. Dairy equipment cleaning with chemical additives :
1. Self dosing system
2. Cleaning substances prepared in sink

j. Person(s) who carry out this task :
1. Farm worker
2. Contractor
3. Both

k. Total time spent milking each day (hours) : Hrs

6.2 Manual milk tank cleaning

Is this task carried out on the farm ? — Y = Yes, N = No

If you answered NO to question 6.2, please skip to Task 6.3.
If you answered YES, please continue.

a. Cleaning usually carried out from :
1. Inside tank
2. Outside tank

b. Are chemical cleaning substances used ? — Y = Yes, N = No

c Equipment used :
1. Pressure hose/washer
2. Hose pipe
3. Bucket

d. Person(s) who carry out this task :
1. Farm worker
2. Contractor
3. Both

e. Number of times this tank is cleaned each month ?

f. Time taken to clean tank (minutes) : Mins

6.3 Managing Dairy Foot Bath

Is this task carried out on the farm ? Y = Yes, N = No ☐

If you answered NO to question 6.3, please skip to Task 6.4.
If you answered YES, please continue.

a. Location : 1. Indoors 2. Outside ☐

b. Any preparation/premixing of chemicals ? Y = Yes, N = No ☐

c. Usual method of filling : 1. Hose/Tap 2. Bucket ☐

d. Method of emptying : 1. Direct to drain 2. Bucket 3. Hose 4. Manually scraped ☐

e. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

f. Number of times foot bath used each year : ☐☐

6.4 Winter Bedding

Is this task carried out on the farm ? Y = Yes, N = No ☐

If you answered NO to question 6.4, please skip to Task 6.5.
If you answered YES, please continue.

a. Major Housing Methods : 1. Full litter beds 2. Cubicle beds 3. Slatted/very hard floors 4. Other — a. ☐ b. ☐

If *other* please specify : ☐

b. Major Litter Types : 1. Straw 2. Sawdust/Shavings 3. Paper 4. Mats 5. None used 6. Other — a. ☐ b. ☐

If *other* please specify : ☐

c. Major treatment of bedding on the farm: 1. Chopped/Shredded 2. Substances added 3. None — a. ☐ b. ☐

d. Usual method of bedding : 1. Manual 2. Mechanical 3. Kicked out by cattle ☐

e. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

f. In which months of the year is the task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

g. How many times per week (7 days) is this task performed ? ☐☐

h. How long does it take each time ? ☐ Hrs ☐

6.5 Slurry Collection

Is this task carried out on farm ? Y = Yes N = No ☐

If you answered NO to question 6.5, please skip to Task 6.6.
If you answered YES, please continue.

a. Usual method of cleaning slurry from floor of cattle housing :
1. Automated scrapers
2. Vehicle driven scrapers
3. Cattle trodden through slats
☐

b. If applicable, person(s) who carry out this task :
1. Farm worker
2. Contractor
3. Both
☐

c. In which months of the year is the task carried out ? (please tick ✓)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

d. How many times per week (7 days) is this task performed ? ☐

e. How long does it take each time ? Hrs ☐ • ☐

6.6 Removal of Soiled Bedding Material

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to Question 6.6, please skip to Task 6.7.
If you answered YES, please continue.

a. Usual method of bedding removal from main cattle housing areas :
1. Manual
2. Mechanised
3. Both
☐

b. Person(s) who carry out removal of bedding material from main cattle housing areas.
1. Farm worker
2. Contractor
3. Both
☐

c. In which months of the year is this task carried out ? (please tick ✓)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

d. How many times a year is bedding removed from main cattle housing areas ? ☐☐

e. How long does it take each time (days) ? Days ☐ • ☐

f. Is manual mucking out ever performed ? (Include small scale mucking out here only e.g. calf pens) Y = Yes N = No ☐

g. In which months of the year is manual removal of bedding material carried out ? (please tick ✓)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

h. How many times a year is manual bedding removal carried out ? ☐☐☐

i. How long does it take each time (hours) ? Hrs ☐ • ☐

6.7 Washing Out of Main Cattle Housing

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 6.7, please skip to Task 6.8.
If you answered YES, please continue.

a. Usual method of washing out :
1. Pressure hose/water
2. Hose pipe
3. Bucket ☐

b. Are any chemical additives used ? (eg. detergent, disinfectant) Y = Yes N = No ☐

c. Person(s) who carry out this task :
1. Farm worker
2. Contractor
3. Both ☐

d. In which months of the year is the task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

e. How many times per year are main cattle housing areas washed out ? ☐☐

f. How long does it take each time (Days) ? (Days) ☐☐

6.8 Winter Feeding (Bulk and Concentrate)

(Do not include feeding whilst in Milking Parlour in this section)

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 6.8, please skip to Task 6.9.
If you answered YES, please continue.

a. Usual location of feeding :
1. Indoors
2. Outside
3. Both ☐

b. Major types of concentrate :
1. Milled/Bruised grain
2. Pelleted feed (cake)
3. Loose feed (cake)
4. None given
a. ☐ b. ☐

c. Condition of feed identified above :
1. Dry feed
2. Delivered to farm moist
3. Moistened on farm
4. Not applicable
a. ☐ b. ☐

d. Major types of bulk feed given :
1. Silage
2. Hay
3. Straw
4. None
5. Other
a. ☐ b. ☐

If *other* please specify : ☐

e. Major treatments of bulk feed :
1. None
2. Chemical (eg. ammonia, additive to straw)
3. Artificially dried
4. Not applicable
5. Other
a. ☐ b. ☐

If *other* please specify : ☐

f. Usual method of dispensing concentrate feed :
1. Mechanised
2. Manually
3. Manually loaded into automated dispenser ☐

g. Usual method of dispensing bulk feed :
1. Mechanised
2. Manually
3. Manually loaded into automated dispenser

h. Person(s) who carry out this task :
1. Farm worker
2. Contractor
3. Both

i. In which months of the year is the task carried out ? (please tick ✓)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

j. How many hours per day during winter is spent feeding ? Hrs ☐ • ☐

6.9 Summer Feeding - Other than Grazing (Bulk and Concentrate)

(Do not include feeding while in milking parlour in this section)

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to Question 6.9, please skip to Task 6.10.
If you answered YES, please continue.

a. Usual location of feeding :
1. Indoors
2. Outside
3. Both

b. Major type of concentrate :
1. Milled/Bruised grain
2. Pelleted feed (cake)
3. Loose feed (cake)
4. None given

c. Condition of feed identified above :
1. Dry feed
2. Delivered to farm moist
3. Moistened on farm
4. Not applicable

d. Major types of bulk feed given :
1. Silage
2. Hay
3. Straw
4. None
5. Other

If *other* please specify :

e. Major treatments of bulk feed :
1. None
2. Chemical (eg. ammonia, additive to straw)
3. Artificially dried
4. None
5. Not applicable

If *other* please specify :

f. Usual method of dispensing concentrate feed :
1. Mechanised
2. Manual
3. Manually loaded into automated dispenser

g. Usual method of dispensing bulk feed :
1. Mechanised
2. Manual
3. Manually loaded into automated dispenser

h. Person(s) who carry out this task :
1. Farm worker
2. Contractor
3. Both

i. In which months of the year is the task carried out ? (please tick ✓)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

j. How many hours per day during summer is spent feeding ? ☐

6.10 Artificial insemination

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 6.10, please skip to Task 6.11.
If you answered YES, please continue.

a. Usual location : 1. Indoors 2. Outside ☐

b. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

c. Usual strategy for inseminations : 1. Individually 2. Batches ☐

6.11 Assistance with calving

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 6.11, please skip to Task 6.12.
If you answered YES, please continue.

a. Usual location for calving : 1. Indoors 2. Outside ☐

b. Average percentage of cows assisted : ☐☐☐

c. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

d In which months of the year is the task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

6.12 Debudding

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 6.12, please skip to Task 6.13.
If you answered YES, please continue.

a. Usual location : 1. Inside 2. Outside ☐

b. Usual strategy for debudding : 1. Individually 2. Batches ☐

c. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

6.13 Castration

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 6.13, please skip to Task 6.14.
If you answered YES, please continue.

a. Usual location : 1. Indoors 2. Outside ☐

b. Usual strategy for castration : 1. Individually 2. Batches ☐

c. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

6.14 Cattle Identification (Tagging and Freeze Branding)

Is this task carried out on the farm ? Y = Yes, N = No ☐

If you answered NO to question 6.14, please skip to Task 6.15.
If you answered YES, please continue.

a. Usual location : 1. Indoors 2. Outside ☐

b. Usual strategy for cattle identification : 1. Individually 2. Batches ☐

c. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

6.15 Worming/Delicing etc.

Is this task carried out on the farm ? Y = Yes, N = No ☐

If you answered NO to question 6.15, please skip to Task 6.16.
If you answered YES, please continue.

a. Usual location : 1. Indoors 2. Outside ☐

b. Cattle receiving treatment : 1. Most 2. Selected ☐

c. Major methods used : 1. Drench 2. Subcutaneous injection 3. Bolus 4. Pour on 5. Dust on — a. ☐ b. ☐

d. Usual strategy for treatment : 1. Individually 2. Batches ☐

e. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

6.16 Feet Paring

Is this task carried out on the farm ? Y = Yes, N = No ☐

If you answered NO to Question 6.16 please skip to Task 6.17.
If you answered YES, please continue.

a. Usual location : 1. Indoors 2. Outside ☐

b. Cattle receiving treatment : 1. Most 2. Selected ☐

c. Usual strategy for treatment : 1. Individually 2. Batches ☐

d. Person(s) who carry out this task : 1. Farm worker 2. Contractor 3. Both ☐

6.17 Clipping

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to Question 6.17 please skip to Section 7.
If you answered YES, please continue.

a.	Usual location :	1. Indoors 2. Outside	☐
b.	Cattle clipped :	1. Most 2. Selected	☐
c.	Usual strategy for clipping :	1. Individually 2. Batches	☐
d.	Person(s) who carry out this task :	1. Farm worker 2. Contractor	☐

7. CATTLE RELATED TASKS

7.1 Slurry Spreading

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to Question 7.1, please skip to Task 7.2.
If you answered YES, please continue.

a. Storage of slurry :
1. Tank
2. Lagoon
3. Under floor pit
4. No storage ☐

b. Disposal onto fields :
1. Sprayed
2. Injection ☐

c. Person(s) who carry out this task :
1. Farm worker
2. Contractor
3. Both ☐

d In which months of the year is the task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

e. How many times each year is this task performed ? ☐☐

f. How long does it take each time (hours) ? Hrs ☐☐.☐

7.2 Muck Spreading

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to Question 7.2, please skip to Task 7.3.
If you answered YES, please continue.

a. Muck spreading :
1. Manual
2. Mechanised ☐

b. After spreading :
1. Incorporated into soil
2. Left on surface
3. Both ☐

c. Person(s) who carry out this task ;
1. Farm worker
2. Contractor
3. Both ☐

d In which months of the year is the task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

e. How many times a year is this task performed ? ☐☐

f. How long does it take each time (Days) ? Days ☐☐.☐

7.3 Harvesting Cereal Crop

Is this task carried out on the farm ? Y = Yes, N = No ☐

If you answered No to Question 7.3, please skip to Task 7.4.
If you answered Yes, please continue.

a. Person(s) responsible for this task : (not including grain or straw treatment and storage)
1. Farm worker
2. Contractor
3. Both ☐

b. How long does this take (days) ? Days ☐☐•☐

c. How are bales usually treated ?
1. Chemical injection (eg. ammonia)
2. No treatment
3. Other ☐

If *other* please specify : ☐

d. How are most of bales usually stored ?
1. Outside in field/yard
2. Open barn (roof only)/ outside undercover
3. Inside building ☐

e. Person(s) responsible for treatment and storage of straw :
1. Farm worker
2. Contractor
3. Both ☐

f. How long does the treatment and storage of bales take each year (days) ? Days ☐☐•☐

7.4 Harvested Grain Treatment

Is this task carried out on the farm ? Y = Yes, N = No ☐

If you answered No to Question 7.4, please skip to Task 7.5.
If you answered Yes, please continue.

a. Usual method of treating harvested grain :
1. Dried
2. Chemically treated
3. Crimped and treated
4. Other ☐

If *other* please specify : ☐

b. What quantity of grain is treated (tonnes) ? ☐☐☐☐

c. How is grain usually stored ?
1. Tower
2. Bins (Open/Sealed)
3. Loose (Undercover)
4. Other ☐

If *other* please specify : ☐

d. Person(s) responsible for treating and and storage of grain :
1. Farm worker
2. Contractor
3. Both ☐

e. How many times a year is this task performed ? ☐☐

f. How long does it take each time (days) ? Days ☐☐•☐

7.5 Concentrate feed preparation Page 22

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to Question 7.5, please skip to Task 7.6.
If you answered YES, please continue.

a. Is concentrate feed (on the farm) ?
1. Bruised
2. Hammer milled
3. Other ☐

If *other* please specify : ☐

b. Is concentrate feed mixed with supplements on the farm ? Y = Yes N = No ☐

c. If *yes*, when mixing, is the feed :
1. Dry
2. Moist (ingredients moist prior to mixing)
3. Moistened during mixing ☐

d. Persons(s) who carry out this task :
1. Farm worker
2. Contractors
3. Both ☐

e. In which months of the year is the task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

f. How many times a year is this task performed ? ☐☐☐

g. How long does it take each time ? Hrs ☐☐.☐

7.6 Silage Making

Is this task carried out on the farm ? Y = Yes N = No ☐

If you answered NO to question 7.6, please skip to Task 7.7.
If you answered YES, please continue.

a. Is silage made from ?
1. Grass
2. Maize
3. Grass and other cereal crop sown together
4. Other ☐

If *other* please specify : ☐

b. Substances added to the cut crop whilst harvesting :
1. Chemical\Biological additive
2. Root crops
3. Biological Agents
4. None ☐

c. How is silage usually stored ?
1. Clamp/pit
2. Wrapped bales ☐

d. Other methods of storage :
1. Clamp/pit
2. Wrapped bales
3. None ☐

e. Person(s) responsible for silage making :
1. Farm worker
2. Contractor
3. Both ☐

f. How many times a year is silage made ? ☐☐

g. In which months of the year is the task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

h. How long does this take each time (days) ? Days ☐☐.☐

7.7 Hay Making

Is this task carried out on the farm ? Y = Yes N = No ☐

If the answer to question 7.7 was NO, please skip to Section 8.
If the answer was YES, please continue.

a. Treatment of hay :
1. Artificial drying
2. None
3. Other
☐

If *other* please specify : ☐

b. How are the bales usually stored :
1. Outside in field/yard
2. Open barn (roof only) outside undercover
3. Inside building
☐

c. Person(s) responsible for hay making and treatment :
1. Farm worker
2. Contractor
3. Both
☐

d. How many times a year is hay made : ☐

e. In which months of the year is the task carried out ? (please tick √)

Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

f. How long does it take each time ? ☐☐ • ☐ Days

8. OTHER TASKS : LIVESTOCK (Other than cattle)

Page 24

8.1 Are tasks performed with livestock other than cattle on this farm ? Y = Yes N = No ☐

If you answered NO to question 8.1, please skip to Section 9.
If you answered YES, please continue.

Do not include cattle tasks in this section.

Include tasks for :
a. Sheep
b. Pigs
c. Poultry
d. Egg production
e. Goats
f. Other non-cattle

8.2 Feeding

a. Is this task undertaken ? Y = Yes N = No ☐

b. Livestock types (Refer to the list above) : ☐☐☐☐☐☐

c. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

8.3 Bedding

a. Is this task undertaken ? Y = Yes N = No ☐

b. Livestock types (Refer to list above) : ☐☐☐☐☐☐

c. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

8.4 Aiding birth (eg. lambing)

a. Is this task undertaken ? Y = Yes N = No ☐

b. Livestock types (Refer to list above) : ☐☐☐☐☐☐

c. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

8.5 Worming

a. Is this task undertaken ? Y = Yes N = No ☐

b. Livestock types (Refer to list above) : ☐☐☐☐☐☐

c. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

8.6 Vaccination

a. Is this task undertaken ? Y = Yes N = No ☐

b. Livestock types (Refer to list above) : ☐☐☐☐☐☐

c. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

Do not include cattle tasks in this section. Page 25

Include tasks for :
a. Sheep
b. Pigs
c. Poultry
d. Egg production
e. Goats
f. Other non-cattle

8.7 Castration

a. Is this task undertaken ? Y = Yes, N = No ☐
b. Livestock types (Refer to list above) : ☐☐☐☐☐☐
c. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

8.8 Tail Docking

a. Is this task undertaken ? Y = Yes, N = No ☐
b. Livestock types (Refer to list above) : ☐☐☐☐☐☐
c. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

8.9 Dipping

a. Is this task undertaken ? Y = Yes, N = No ☐
b. Livestock types (Refer to list above) : ☐☐☐☐☐☐
c. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

8.10 Other livestock tasks not covered, which are likely to give rise to a repiratory hazard :

a. Specific task : ☐
b. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

a. Specific task : ☐
b. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

a. Specific task : ☐
b. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

a. Specific task : ☐
b. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

a. Specific task : ☐
b. Who carries out this task ? 1. Farm worker 2. Contractor 3. Both ☐

9. OTHER TASKS : LAND RELATED (To be completed as appropriate

9.1 Are there crops on the farm ? (Include silage, hay etc)
Y = Yes
N = No
☐

If you answered NO to Question 9.1, please skip to Section 10. If you answered YES, please continue.

9.2 Lime spreading

a. Is this task undertaken ?
Y = Yes
N = No
☐

b. Who carries out this task ?
1. Farm worker
2. Contractor
3. Both
☐

9.3 Ploughing

a. Is this task undertaken ?
Y = Yes
N = No
☐

b. Who carried out this task ?
1. Farm worker
2. Contractor
3. Both
☐

9.4 Cultivating and /or Rolling

a. Is this task undertaken ?
Y = Yes
N = No
☐

b. Who carried out this task ?
1. Farm worker
2. Contractor
3. Both
☐

9.5 Sowing

a. Is this task undertaken ?
Y = Yes
N = No
☐

b. Who carried out this task ?
1. Farm worker
2. Contractor
3. Both
☐

9.6 Fertilising

a. Is this task undertaken ?
Y = Yes
N = No
☐

b. Who carried out this task ?
1. Farm worker
2. Contractor
3. Both
☐

9.7 Spraying

a. Is this task undertaken ?
Y = Yes
N = No
☐

b. Who carried out this task ?
1. Farm worker
2. Contractor
3. Both
☐

9.8 Harvesting (other than cereal, silage or hay making)

a. Is this task undertaken ?
Y = Yes
N = No
☐

b. Who carried out this task ?
1. Farm worker
2. Contractor
3. Both
☐

9.9 Other Land Related tasks not covered, which are likely to give rise to respiratory hazard

a. Specific task :

b. Who carries out this task :
1. Farm worker
2. Contractor
3. Both

a. Specific task :

b. Who carries out this task :
1. Farm worker
2. Contractor
3. Both

a. Specific task :

b. Who carries out this task :
1. Farm worker
2. Contractor
3. Both

a. Specific task :

b. Who carries out this task :
1. Farm worker
2. Contractor
3. Both

a. Specific task :

b. Who carries out this task :
1. Farm worker
2. Contractor
3. Both

a. Specific task :

b. Who carries out this task :
1. Farm worker
2. Contractor
3. Both

10. OTHER TASKS : FARM MAINTENANCE

10.1 Hedge Cutting

a. Is this task undertaken ? — Y = Yes, N = No

b. Who carries out this task ? — 1. Farm worker, 2. Contractor, 3. Both

10.2 Erection & repair of fencing/stone walls

a. Is this task undertaken ? — Y = Yes, N = No

b. Who carries out this task ? — 1. Farm worker, 2. Contractor, 3. Both

10.3 Building & maintenance of ditches & dykes

a. Is this task undertaken ? — Y = Yes, N = No

b. Who carries out this task ? — 1. Farm worker, 2. Contractor, 3. Both

10.4 Welding

a. Is this task undertaken ? — Y = Yes, N = No

b. Who carries out this task ? — 1. Farm worker, 2. Contractor, 3. Both

10.5 Painting farm buildings

a. Is this task undertaken ? — Y = Yes, N = No

b. Who carries out this task ? — 1. Farm worker, 2. Contractor, 3. Both

10.6 Machinery maintenance and servicing

a. Is this task undertaken ? — Y = Yes, N = No

b. Who carries out this task ? — 1. Farm worker, 2. Contractor, 3. Both

10.7 Other maintenance tasks not covered, which are likely to give rise to a respiratory hazard :

a. Specify task :

b. Who carries out this task ?
1. Farm worker
2. Contractor
3. Both

a. Specify task :

b. Who carries out this task ?
1. Farm worker
2. Contractor
3. Both

a. Specify task :

b. Who carries out this task ?
1. Farm worker
2. Contractor
3. Both

a. Specify task :

b. Who carries out this task ?
1. Farm worker
2. Contractor
3. Both

a. Specify task :

b. Who carries out this task ?
1. Farm worker
2. Contractor
3. Both

a. Specify task :

b. Who carries out this task ?
1. Farm worker
2. Contractor
3. Both

11. Contract Work :

Farm work on other farms undertaken by farmer/employees of study farm

11.1 Do farm workers undertake work on farms other than the study farm ? (For more than 5 days in any year)

Y = Yes
N = No

☐

If you answered NO to question 11.1, please skip to Section 12.
If you answered YES, please continue.

a. Specify task :

b. How long is spent performing this tasks (days) in year ? ☐☐☐

a. Specify task :

b. How long is spent performing this tasks (days) in year? ☐☐☐

a. Specify task :

b. How long is spent performing this tasks (days) in year? ☐☐☐

a. Specify task :

b. How long is spent performing this tasks (days) in year? ☐☐☐

a. Specify task :

b. How long is spent performing this tasks (days) in year? ☐☐☐

12. OBSERVATIONS MADE DURING WALKTHROUGH OF FARM BUILDINGS

a. State whether cattle were in or out at time of inspection.

1. In (Housed)
2. Out (In field)
3. Both

☐

b. General housekeeping around the farm :

1. Good
2. Adequate
3. Poor

☐

c. Ventilation of the main cattle housing areas :

1. Good air movement - fresh, low odour levels.
2. Adequate air movement.
3. Poor air movement - strong odours, stale stagnant air.

☐

d. Condition of main cattle housing areas :

1. Well kept, feeding passages etc. clean. Any bare floors regularly scraped, cleaned.
2. Adequately kept, reasonable standards of housekeeping maintained.
3. Poorly kept, dirty feeding passages, heavy soiling on bare floors.

☐

Where applicable :

e. Ventilation of grain/concentrate feed treatment and storage areas :

1. Good air movement. Air seems fresh.
2. Adequate air movement.
3. Poor air movement.

☐

f. Levels of dustiness in grain/concentrate feed treatment and or storage areas.

1. Surfaces heavily contaminated with dust.
2. Some surface dust evident.
3. Little or no surface dust apparent.

☐

13. ANY FURTHER COMMENTS

(Include any important additional information about the study farm not covered by the assessment)

Now use the checklist on page 5 to confirm that you have completed all the appropriate sections.

Respiratory Hazards in Dairy and Beef Farming
Joint HSE/IOM Study

Protocol for Completing Inhalation Hazard Identification Proforma

1. INTRODUCTION

The objective of the hazard identification proforma is to provide a standardised farm and task profile for each study farm and an indication of the exposure intensity associated with performing farm tasks. The proforma has been designed to allow all the information collected to be entered onto computer without the need for coding responses after the visit. It is important, therefore, that details are correctly entered into the boxes provided and the entries are clear and legible.

It is not intended that the proforma should be administered in the style of a formal questionnaire rather a structured but informal interview. Indeed it is expected that some further probing and explanation may be required in some areas. Many of the questions provide answer options, (normally these should not be given after asking the question. Where possible, the interviewer should select the most appropriate option based on the interviewee's response. The interview should normally be held with the farmer, farm manager or an employee who has a sound knowledge of the farm.

This protocol provides information on how to complete the proforma. In section 2 a summary is provided describing the different forms of answer required by the proforma. Section 3 provides definitions of common answer options. For quick reference during an interview, section 4 details each question and appropriate answer type.

2. SUMMARY OF ANSWER TYPES

Answers to the questions on the assessment proforma should be recorded in one of several forms.

2.1 Free Text

For this type of question write the answer in full in the box provided.

eg. Question 3.16
Beef Herd Breed?

Galloway Cross

2.2 Date

For this question write the numerical date in the boxes provided.

eg. The 1st of January 1994 should be recorded as:

Day		Month		Year	
0	1	0	1	9	4

2.3 Y or N

This question type requires a 'Y' or 'N' to be written in the box provided depending on whether the answer is Yes or No. Ensure the letters are clear and distinct.

eg. Question 3.1
Is there a beef herd on this farm?

If there is, the answer should be recorded as:

2.4 Number

For this type of question write the number in the box provided. If the number has fewer digits than the boxes provided enter zeros in the left hand box(es).

eg. Question 3.1c
Number of suckler cows?
If there were 84 suckler cows, the answer should be recorded as:

2.5 Single Option

For this type of question one answer is required. Choose the single option that best represents what takes place on the farm. Write the option number in the box provided.

eg. Question 5.1d
Usual method of bedding
1. Manual
2. Mechanical
3. Kicked out by cattle

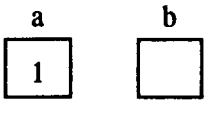
If bedding is usually left to be kicked out by cattle the answer should be recorded as:

2.6 Two Options

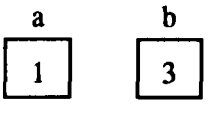
For this type of question up to two answers may be recorded. Choose the option that best represents what takes place on the farm. Write the option number in Box a. However, it may be the case that more than one of the options is used. If this is so write the second most important option number in Box b.

eg. Question 5.1b
Major litter types
1. Straw
2. Sawdust/Shavings
3. Paper
4. Mats
5. Non used
6. Other

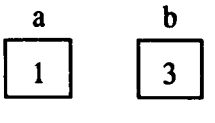
If the farm uses straw only the answer should be recorded as:



If the farm uses mostly straw but also paper the recorded answer should be:



If the farm uses a lost of straw and paper and a smaller amount of shavings the recorded answer should be:



2.7 Tick Months

Place a tick in the box under each month in which the task is carried out.

eg. Question 5.1

In which months of the year is winter bedding carried out?

If winter bedding is carried out from October to March inclusive, the recorded answer should be:

Jan	Feb	Mar	Apr	May	Jun
✓	✓	✓			

Jul	Aug	Sep	Oct	Nov	Dec
			✓	✓	✓

2.8 Livestock Options

In Section 8 letters are used to code each of the livestock types (other than cattle) for which a task could be undertaken. For each task carried out on the farm identify the livestock type(s) involved. Write the code letters, one per box, for each of the types identified.

eg. 8.5 Worming

If sheep and pigs are wormed on the farm the answer should be recorded as:

				a	b

2.9 Specify

Some questions may require specific additional information. Write the answer in full in the box provided.

eg. Question 4.2

Livestock species, other than cattle, on the farm.

If the farm has a herd of 50 deer the answer should be recorded as:

Sheep				
Pigs				
Poultry				
Eggs				
Goats				
Others	0	0	5	0

If others, please specify: Deer

2.10 Definitions of common answer options

The questions listed below appear in a number of sections in the proforma. You should familiarise yourself with the explanations of the available answer options.

Persons who carry out the task

Farm worker - A person working on the study farm either full or part time. Include self employed contractors who have long term, greater than 12 months, full time contracts with the study farm.
Contractor - A person temporarily working for the study farm. Usually brought in to carry out a specific task under contract.

Usual location

Indoors - Inside a building, includes any areas that are both walled and covered.
Outside - In the open, includes fields, yards and partially covered areas.

Usual strategy

Individually - Cattle treated individually as required.
Batches - Cattle treated in groups.

3. INSTRUCTION ON INDIVIDUAL QUESTIONS - Initial Information

Date of Visit: Answer type; Date

Assessor's Name: Answer type; Free text

Initials: Answer type; Free text

1. Farm Details

1.1 *Contact Name: Answer type; Free text*

1.2 *Status of Contact Name: Answer type; Single option*

1.3 *Telephone Number: Answer type; Number*

1.4 *Farm Code: Answer type; Number*

1.5 *Study Classification: Answer type; Number*

1.6 *Farm Address: Answer type; Free text*

1.7 *Location: Answer type; Single option*

1.8 *Farm Type: Answer type; Single option*

Livestock Farming - Commercial production of animals and animal produce only, but may include production of cereals, silage, hay, etc for animal feed used on the farm.
Arable & Livestock - As above and also commercial production of agricultural and/or horticultural crops.

2. Employees Working on the Farm

Enter the names of all those over the age of 16 who currently work for at least 2 hours per week on the farm. Record whether they are full time workers and whether they have been working on the farm for longer than 12 months.

Farmer -	Oversees the running of the farm and undertakes general farming tasks
General Farm Worker -	Undertakes a number of general farming tasks
Stockman/Dairyman -	Usually undertakes tasks associated with stock or dairy farming
Tractor/Machine Man -	Usually undertakes tasks associated with arable farming

3. Cattle Herd Details

3.1 Beef Herd Details: Answer type; Y or N

3.1a Beef System: Answer type; Single Option

Breeding -	Cattle are bred on the farm but sold on before they are ready to go for slaughter
Finishing -	No breeding on the farm, only fattening for slaughter
Breeding & Finishing -	Cattle are bred and fattened for slaughter on the farm

3.1b Breed: Answer type; Free text

3.1c Number of Suckler Cows: Answer type; Number

Suckler Cows - Cows used for breeding, include in calf heifers

3.1d Number of Bulls for Breeding: Answer type; Number

Breeding Bull - Bull used to cover cows naturally or artificially

3.1e Breeding Stock Replacements: Answer type; Y or N

Replacements -	Heifers used to replace suckler cows, but not in calf heifers
Homebred -	Bred on the farm
Brought in -	Young stock not bred on the farm

3.1f Total Number of Store Cattle: Answer type; Y or N

Store Cattle - Cattle being fattened for slaughter

3.2 Dairy Herd Details: Answer type; Y or N

3.2a Breed: Answer type; Free text

3.2b Number of Milking Cows: Answer type; Number

Milking Cows - Record all cows used for milk production, include those that are temporarily dry due to gestation

3.2c Number of Young Stock and Calves: Answer type; Number

Young Stock and Calves - Record all replacements and in calf heifers. Also include heifer and bullock calves

3.2d Number of Bulls for Breeding: Answer type; Number

Breeding Bulls - Bull used to cover cows naturally or artificially

3.2e Breeding Stock Replacements: Answer type; Y or N

Replacements - Heifers used to replace milking cows
Homebred - Bred on the farm
Brought in - Young stock not bred on the farm

4. Non-Cattle Activities

4.1 Other Livestock: Answer type; Y or N

4.2 Livestock Species other than Cattle: Answer type; Number and Specify
Include all mature animals both male and female. Do not include what are considered to be young stock.

4.3 Crops: Answer type; Y or N

4.4 Land Use: Answer type; Number
For silage and hay include all cuts in current or most recent growing season

5. Beef Tasks

5.1 Winter Bedding: Answer type; Y or N

5.1a Major Housing Methods: Answer type; Two Options and Specify

Full Litter Beds - Floor of housing completely covered with bedding material
Cubicle Beds - Housing divided into individual bedded stalls (includes mats) with central aisle not covered with bedding material. Some areas may have slatted floors.
Slatted/Hard Floors - No bedding materials used in housing. Animals lie directly on floor which may be made up of slats to allow excrement to collect below.

5.1b Major Litter Types: Answer type; Two Options and Specify

5.1c Treatment of Bedding on Farm: Answer type; Two Options

Chopped/Shredded - Pieces of bedding material made smaller/shorter by cutting
Substances Added - Include any substances added to the bedding material prior to or whilst it is in the housing

All recorded treatments should be carried out on the farm.

5.1d Usual Method of Bedding: Answer type; Single Option

Manual - Distribution of bedding material inside housing performed without the use of mechanised equipment

Mechanical - mechanised equipment — Distribution of bedding material inside housing performed with the use of eg. mechanical shaker

Kicked Out by Cattle - Bedding material transported to housing but not distributed by farm workers

5.1e *Person(s) Who Carries Out the Task: Answer type; Single Option*

5.1f *Months of the Year: Answer type; Tick Months*

5.1g *How Many Times per Week: Answer type; Number*

5.1h *How Long Each Time: Answer type; Number*
Smallest acceptable unit 0.5 hrs.

5.2 ***Slurry Collection:*** *Answer type; Y or N*

5.2a *Usual Method of Cleaning Slurry: Answer type; Single Option*
Usual method means the way it is mostly done.

Automated scrapers - Mechanically operated, requiring no manual input.
Vehicle driven scrapers - Scrapers attached to farm vehicles which are driven by farm workers
Cattle Trodden Through Slats - Slurry collected by movement of cattle over slatted floor

5.2b *Person(s) Who Carry Out the Task: Answer type; Single Option*

5.2c *Months of the Year: Answer type; Tick Months*

5.2d *How Many Times per Week: Answer type; Number*

5.2e *How Long Each Time: Answer type; Number*
Smallest unit acceptable 0.5hrs

5.3 ***Removal of Soiled Bedding Material:*** *Answer type; Y or N*
Main cattle housing areas are where the majority of the herd are kept.

5.3a *Usual Method of Bedding Removal: Answer type; Single Option*

Manual - Removal of bedding material from inside the housing carried out without the use of mechanised equipment.
Mechanised - Removal of bedding material from inside the housing carried out with the aid of mechanised equipment

5.3b *Person(s) Who Carry Out the Task: Answer type; Single Option*

5.3c *Months of the Year: Answer type; Tick Months*
Place a tick in the appropriate box for the months selected

5.3d *How Many Times per Year: Answer type; Number*

5.3e *How Long Each Time: Answer type; Number*
Smallest unit acceptable 0.5 days

5.3f *Manual Removal of Bedding Material: Answer type; Y or N*

5.3g *Months of the Year: Answer type; Tick Months*

5.3h *How Many Times per Year: Answer type; Number*

5.3i *How Long Each Time: Answer type; Number*

5.4 Washing Out of Main Cattle Housing: *Answer type; Y or N*

5.4a *Usual Method of Washing Out: Answer type; Single Option*

5.4b *Chemical Additives: Answer type; Y or N*

5.4c *Person(s) Who Carry Out the Task: Answer type; Single Option*

5.4d *Months of the Year: Answer type; Tick Months*

5.4e *How Many Times per Year: Answer type; Number*

5.4f *How Long Each Time: Answer type; Number*
Smallest acceptable unit 0.5 days

5.5 Winter Feeding: *Answer type; Y or N*

5.5a *Usual Location of Feeding: Answer type; Single Option*

5.5b *Major Types of Concentrate Feed Given: Answer type; Two Options*

Milled/Bruised Grain - Pressed or crushed grain
Pelleted Cake - Feed mix in pellet form
Loose Cake - Feed mix in loose form

5.5c *Condition of Feed: Answer type; Two Options*

Dry Feed - No moisture is added to feed
Delivered to the Farm Moist - Fed moist, but not moistened on the farm
Moistened on the Farm - Feed arrives on the farm dry and is later moistened

5.5d *Major Types of Bulk Feed Given: Answer type; Two Options and Specify*

5.5e *Major Treatments of Bulk Feed: Answer type; Two Options and Specify*

Chemical - Any substance added to aid preservation, etc
Artificially Dried - Dried by means other than by the local climatic conditions

5.5f *Usual Method of Dispensing Concentrate: Answer type; Single Option*

Mechanised - Dispensing of concentrate feed carried out with the aid of mechanised equipment
Manual - Dispensing of concentrate feed carried out without the use of mechanised equipment
Manually Loaded into Automated Dispenser - Manual loading of dispenser is followed by mechanised dispensing

5.5g *Usual method of Dispensing Bulk Feed: Answer type; Single Option*

Mechanised -	Dispensing of concentrate feed carried out with the aid of mechanised equipment
Manual -	Dispensing of concentrate feed carried out without the use of mechanised equipment
Manually Loaded into Automated Dispenser -	Manual loading of dispenser is followed by mechanised dispensing.

5.5h *Person(s) Who Carry Out the Task: Answer type; Single Option*

5.5i *Months of the Year: Answer Type; Tick Months*

5.5j *How Long Each Time: Answer Type; Number*
Smallest acceptable unit; 0.5 hrs

5.6 Summer Feeding: *Answer Type; Y or N*

5.6a *Usual Location of Feeding: Answer Type; Single Option*

Indoors - Inside a building, includes any areas that are both walled and covered.
Outside - In the open, includes fields, yards or partially covered yards

5.6b *Major Types of Concentrate Feed Given: Answer Type; Two Options*

Milled/Bruised Grain -	Pressed or crushed grain
Pelleted Cake -	Feed mix in pellet form
Loose Cake -	Feed mix in loose form

5.6c *Condition of Feed: Answer Type; Two Options*

Dry Feed -	No moisture is added to feed
Delivered to the Farm Moist -	Fed moist, but not moistened on the farm
Moistened on the Farm -	Feed arrives on the farm dry and is later moistened

5.6d *Major Types of Bulk Feed Given: Answer Type; Two Options and Specify*

5.6e *Major Treatments of Bulk Feed: Answer Type; Two Options and Specify*

Chemical -	Any substance added to aid preservation, etc
Artificially Dried -	Dried by means other than local climatic conditions

5.6f *Usual Method of Dispensing Concentrate: Answer Type; Single Option*

Mechanised -	Dispensing of concentrate feed carried out with the aid of mechanised equipment
Manual -	Dispensing of concentrate feed carried out without the use of mechanised equipment
Manually Loaded into Automated Dispenser -	Manual loading of dispenser is followed by mechanised dispensing

5.6g *Usual method of Dispensing Bulk Feed: Answer Type; Single Option*

Mechanised -	Dispensing of concentrate feed carried out with the aid of mechanised

equipment

Manual - Dispensing of concentrate feed carried out without the use of mechanised equipment

Manually Loaded into Automated Dispenser - Manual loading of dispenser is followed by mechanised dispensing

5.6h *Person(s) Who Carry Out the Task: Answer Type; Single Option*

5.6i *Months of the Year: Answer Type; Tick Months*

5.6j *How Long Each Time: Answer Type; Number*
Smallest acceptable unit; 0.5hrs

5.7 ***Artificial Insemination:*** *Answer Type; Y or N*

5.7a *Usual Location: Answer Type; Single Option*

5.7b *Person(s) Who Carry Out the Task: Answer Type; Single Option*

5.7c *Usual Strategy for Inseminations: Answer Type; Single Option*

5.8 ***Assistance with Calving:*** *Answer type; Y or N*

5.8a *Usual location: Answer Type; Single Option*

5.8b *Percentage Assisted: Answer Type; Number*

5.8c *Person(s) Who Carries Out Task: Answer Type; Single Option*

5.8d *Months of the Year: Answer Type; Tick months*

5.9 ***Debudding:*** *Answer Type; Y or N*

5.9a *Usual Location: Answer Type; Single Option*

5.9b *Usual Strategy for Debudding: Answer Type; Single Option*

5.9c *Person(s) Who Carry Out the Task: Answer Type; Single Option*

5.10 ***Castration:*** *Answer Type; Y or N*

5.10a *Usual Location: Answer Type; Single Option*

5.10b *Usual Strategy for Castration: Answer Type; Single Option*

5.10c *Person(s) Who Carry Out the Task: Answer Type; Single Option*

5.11 ***Cattle Identification:*** *Answer Type; Y or N*

5.11a *Usual Location: Answer Type; Single Option*

5.11b *Usual Strategy for Identification: Answer Type; Single Option*

5.11c *Person(s) Who Carry Out the Task: Answer Type; Single Option*

5.12 Worming/Delicing: *Answer Type; Y or N*

5.12a *Usual Location: Answer Type; Single Option*

5.12b *Cattle Receiving Treatment: Answer Type; Single Option*

Most - Majority of herd treated
Selected - Cows requiring treatment only

5.12c *Major Methods Used: Answer Type; Two Options*

Drench - Oral injection
Subcutaneous Injection - Through skin
Bolus - Introduced by oral injection, remains in the intestinal tract
Pour On - Liquid applied over animal's back
Dust On - Powder applied onto animal's coat

5.12d *Usual Strategy for Treatment: Answer Type; Single Option*

5.12e *Person(s) Who Carry out the Task: Answer Type; Single Option*

5.13 Feet Paring: *Answer Type; Y or N*

5.13a *Usual Location: Answer Type; Single Option*

5.13b *Cattle Receiving Treatment: Answer Type; Single Option*

Most - Majority of herd treated
Selected - Cows requiring treatment only

5.13c *Usual Strategy for Feet Paring: Answer Type; Single Option*

5.13d *Person(s) Who Carry out the Task: Answer Type; Single Option*

5.14 Clipping: *Answer Type; Y or N*

5.14a *Usual Location: Answer Type; Single Option*

5.14b *Cattle Clipped: Answer Type; Single Option*

Most - Majority of herd treated
Selected - Cows requiring treatment only

5.14c *Usual Strategy for Clipping: Answer Type; Single Option*

5.14d *Person(s) Who Carry out the Task: Answer Type; Single Option*

6. Dairy Tasks

6.1 Milking: *Answer Type; Y or N*

6.1a *Capacity of Milking Parlour: Answer Type; Number*
Record the total cow capacity not only number of milking units.

6.1b *Chemical Substances: Answer Type; Y or N*
Include any substances applied to udders other than water.

6.1c *Spray Application: Answer Type; Y or N*

6.1d *Concentrate Feed: Answer Type; Single Option*

6.1e *Condition of Concentrate Feed: Answer Type; Single Option*

6.1f *Concentrate Feeding: Answer Type; Single Option*

6.1g *Usual Method of Cleaning Parlour: Answer Type; Single Option*

6.1h *Chemical Additives: Answer Type; Y or N*

6.1i *Dairy Equipment Cleaning: Answer Type; Single Option*

Self-dosing system - No preparation of cleaning chemicals required other than changing supply containers

Cleaning Substances Prepared in Sink - Cleaning chemicals prepared in sink before being pumped around the system

6.1j *Persons who carry out task: Answer Type; Single Option*

6.1k *Total Time Spent Milking: Answer Type; Single Option*
Smallest acceptable unit 0.5hrs.
Include time spent milking, cleaning the parlour and dairy equipment. Do not include cleaning the milk tank.

6.2 Manual Milk Tank Cleaning: *Answer Type; Y or N*

6.2a *Cleaning Carried out from: Answer Type; Single Option*

Inside tank - Farm worker gets into the tank to clean it
Outside tank - Farm worker cleans the tank from outside

6.2b *Chemical Substances used: Answer Type; Y or N*

6.2c *Equipment Used: Answer Type; Single Option*

6.2d *Person(s) who carry out the task: Answer Type; Single Option*

6.2e *Number of times each month: Answer Type; Number*

6.2f *How long each time: Answer Type; Number*
Smallest acceptable unit 1 minute.

6.3 ***Managing Dairy Footbath:*** *Answer Type; Y or N*

6.3a *Location:* *Answer Type; Single Option*

6.3b *Preparation and mixing of chemicals:* *Answer Type; Y or N*

6.3c *Filling Method:* *Answer Type; Single Option*

6.3d *Emptying Method:* *Answer Type; Single Option*

6.3e *Person(s) who carry out the task:* *Answer Type; Single Option*

6.3f *Foot bath used each year:* *Answer Type: Number*

6.4 ***Winter Bedding:*** *Answer type; Y or N*

6.4a *Major Housing Methods:* *Answer type; Two Options and Specify*

Full Litter Beds - Floor of housing completely covered with bedding material
Cubicle Beds - Housing divided into individual bedded stalls (includes mats) with central aisle not covered with bedding material. Some areas may have slatted floors.
Slatted/Hard Floors - No bedding materials used in housing. Animals lie directly on floor which may be made up of slats to allow excrement to collect below.

6.4b *Major Litter Types:* *Answer type; Two Options and Specify*

6.4c *Treatment of Bedding on Farm:* *Answer type; Two Options*

Chopped/Shredded - Pieces of bedding material made smaller/shorter by cutting
Substances Added - Include any substances added to the bedding material prior to or whilst it is in housing

It is important to ensure the treatments are carried out on the farm.

6.4d *Usual Method of Bedding:* *Answer type; Single Option*

Manual - mechanised equipment Distribution of bedding material inside housing carried out without the use of
Mechanical - equipment Distribution of bedding material inside housing carried with the air of mechanised

eg. mechanical shaker

Kicked Out by Cattle - Bedding material transported to housing but not distributed

6.4e *Person(s) Who Carry Out the Task:* *Answer type; Single Option*

6.4f *Months of the Year:* *Answer type; Tick Months*

6.4g *How Many Times per Week:* *Answer type; Number*

6.4h *How Long Each Time*: *Answer type; Number*
Smallest acceptable unit; 0.5 hrs.

6.5 Slurry Collection: *Answer type; Y or N*

6.5a *Usual Method of Cleaning Slurry: Answer type; Single Option*
Enter the number that corresponds to the option selected in the box provided. Usual method means the way it is mostly done.

Automated scrapers -	Mechanically operated requiring no manual input.
Vehicle driven scrapers -	Scrapers attached to farm vehicles which are driven by farm workers
Cattle Trodden Through Slats -	Slurry collected by movement of cattle over slatted floor

6.5b *Person(s) Who Carry Out the Task: Answer type; Single Option*

6.5c *Months of the Year: Answer type; Tick Months*

6.5d *How Many Times per Week: Answer type; Number*

6.5e *How Long Each Time: Answer type; Number*
Smallest unit acceptable 0.5hrs

6.6 Removal of Soiled Bedding Material: *Answer type; Y or N*
Main cattle housing areas are where the majority of the herd are kept.

6.6a *Usual Method of Bedding Removal: Answer type; Single Option*

Manual - Removal of bedding material from inside the housing carried out without the use of mechanised equipment.
Mechanised - Removal of bedding material from inside the housing carried out with the aid of mechanised equipment

6.6b *Person(s) Who Carry Out the Task: Answer type; Single Option*

6.6c *Months of the Year: Answer type; Tick Months*
Place a tick in the appropriate box for the months selected

6.6d *How Many Times per Year: Answer type; Number*

6.6e *How Long Each Time: Answer type; Number*
Smallest unit acceptable 0.5 days

6.6f *Manual Removal of Bedding Material: Answer type; Y or N*

6.6g *Months of the Year: Answer type; Tick Months*

6.6h *How Many Times per Year: Answer type; Number*

6.6i *How Long Each Time: Answer type; Number*
Smallest unit acceptable 0.5 hours

6.7 Washing Out of Main Cattle Housing: *Answer type; Y or N*

6.7a *Usual Method of Washing Out: Answer type; Single Option*

6.7b *Chemical Additives: Answer type; Y or N*

6.7c *Person(s) Who Carry Out the Task: Answer type; Single Option*

6.7d *Months of the Year: Answer type; Tick months*

6.7e *How Many Times per Year: Answer type; Number*

6.7f *How Long Each Time: Answer type; Number*
Smallest acceptable unit 0.5 days

6.8 ***Winter Feeding:*** *Answer type; Y or N*

6.8a *Usual Location of Feeding: Answer type; Single Option*

6.8b *Major Types of Concentrate Feed Given: Answer type; Two Options*

Milled/Bruised Grain - Pressed or crushed grain
Pelleted Cake - Feed mix in pellet form
Loose Cake - Feed mix in loose form

6.8c *Condition of Feed: Answer type; Two Options*

Dry Feed - No moisture is added to fee
Delivered to the Farm Moist - Fed moist, but not moistened on the farm
Moistened on the Farm - Feed arrives on the farm dry and is later moistened

6.8d *Major Types of Bulk Feed Given: Answer type; Two Options and Specify*

6.8e *Major Treatments of Bulk Feed: Answer type; Two Options and Specify*

Chemical - Any substance added to aid preservation, etc
Artificially Dried - Dried by means other than by the local climatic conditions

6.8f *Usual Method of Dispensing Concentrate: Answer type; Single Option*

Mechanised - Dispensing of concentrate feed carried out with the aid of mechanised equipment
Manual - Dispensing of concentrate feed carried out without the use of mechanised equipment
Manually Loaded into Automated Dispenser - Manual loading of dispenser is followed by mechanised dispensing

6.8g *Usual method of Dispensing Bulk Feed: Answer type; Single Option*

Mechanised - Dispensing of concentrate feed carried out with the aid of mechanised equipment
Manual - Dispensing of concentrate feed carried out without the use of mechanised equipment
Manually Loaded into Automated Dispenser - Manual loading of dispenser is followed by mechanised dispensing.

6.8h *Person(s) Who Carry Out the Task: Answer type; Single Option*

6.8i *Months of the Year: Answer Type; Tick Months*

6.8j *How Long Each Time: Answer Type; Number*
Smallest acceptable unit; 0.5 hrs.

6.9 Summer Feeding: *Answer Type; Y or N*

6.9a *Usual Location of Feeding: Answer Type; Single Option*

Indoors - Inside a building, includes any areas that are both walled and covered.
Outside - In the open, includes fields, yards or partially covered yards

6.9b *Major Types of Concentrate Feed Given: Answer Type; Two Options*

Milled/Bruised Grain - Pressed or crushed grain
Pelleted Cake - Feed mix in pellet form
Loose Cake - Feed mix in loose form

6.9c *Condition of Feed: Answer Type; Two Options*

Dry Feed - No moisture is added to fee
Delivered to the Farm Moist - Fed moist, but not moistened on the farm
Moistened on the Farm - Feed arrives on the farm dry and is later moistened

6.9d *Major Types of Bulk Feed Given: Answer Type; Two Options and Specify*

6.9e *Major Treatments of Bulk Feed: Answer Type; Two Options and Specify*

Chemical - Any substance added to aid preservation, etc
Artificially Dried - Dried by means other than by local climatic conditions

6.9f *Usual Method of Dispensing Concentrate: Answer Type; Single Option*

Mechanised - Dispensing of concentrate feed carried out with the aid of mechanised equipment
Manual - Dispensing of concentrate feed carried out without the use of mechanised equipment
Manually Loaded into Automated Dispenser - Manual loading of dispenser is followed by mechanised dispensing

6.9g *Usual method of Dispensing Bulk Feed: Answer Type; Single Option*

Mechanised - Dispensing of concentrate feed carried out with the aid of mechanised equipment
Manual - Dispensing of concentrate feed carried out without the use of mechanised equipment
Manually Loaded into Automated Dispenser - Manual loading of dispenser is followed by mechanised dispensing

6.9h *Person(s) Who Carry Out the Task: Answer Type; Single Option*

6.9i *Months of the Year: Answer Type; Tick Months*

6.9j *How Long Each Time: Answer Type; Number*
Smallest acceptable unit; 0.5hrs

6.10 ***Artificial Insemination:*** *Answer Type; Y or N*

6.10a *Usual Location*: *Answer Type; Single Option*

6.10b *Person(s) Who Carry Out the Task*: *Answer Type; Single Option*

6.10c *Usual Strategy for Inseminations*: *Answer Type; Single Option*

6.11 ***Assistance with Calving***: *Answer type; Y or N*

6.11a *Usual location*: *Answer Type; Single Option*

6.11b *Percentage Assisted*: *Answer Type; Number*

6.11c *Person(s) Who Carries Out Task*: *Answer Type; Single Option*

6.11d *Months of the Year*: *Answer Type; Tick Months*

6.12 ***Debudding:*** *Answer Type; Y or N*

6.12a *Usual Location*: *Answer Type; Single Option*

6.12b *Usual Strategy for Debudding*: *Answer Type; Single Option*

6.12c *Person(s) Who Carry Out the Task*: *Answer Type; Single Option*

6.13 ***Castration:*** *Answer Type; Y or N*

6.13a *Usual Location*: *Answer Type; Single Option*

6.13b *Usual Strategy for Castration*: *Answer Type; Single Option*

6.13c *Person(s) Who Carry Out the Task*: *Answer Type; Single Option*

6.14 ***Cattle Identification:*** *Answer Type; Y or N*

6.14a *Usual Location*: *Answer Type; Single Option*

6.14b *Usual Strategy for Identification*: *Answer Type; Single Option*

6.14c *Person(s) Who Carry Out the Task*: *Answer Type; Single Option*

6.15 ***Worming/Delicing:*** *Answer Type; Y or N*

6.15a *Usual Location*: *Answer Type; Single Option*

6.15b *Cattle Receiving Treatment*: *Answer Type; Single Option*

Most - Majority of herd treated
Selected - Cows requiring treatment only

6.15c *Major Methods Used: Answer Type; Two Options*

Drench - Oral injection
Subcutaneous Injection - Through skin
Bolus - Introduced by oral injection, remains in the intestinal tract
Pour On - Liquid applied over animal's back
Dust On - Powder applied onto animal's coat

6.15d *Usual Strategy for Treatment: Answer Type; Single Option*

6.15e *Person(s) Who Carry out the Task: Answer Type; Single Option*

6.16 ***Feet Paring:*** *Answer Type; Y or N*

6.16a *Usual Location: Answer Type; Single Option*

6.16b *Cattle Receiving Treatment: Answer Type; Single Option*

Most - Majority of cows
Selected - Cows requiring treatment only

6.16c *Usual Strategy for Feet Paring: Answer Type; Single Option*

6.16d *Person(s) Who Carry out the Task: Answer Type; Single Option*

6.17 ***Clipping:*** *Answer Type; Y or N*

6.17a *Usual Location: Answer Type; Single Option*

6.17b *Cattle Clipped: Answer Type; Single Option*

Most - Majority of herd treated
Selected - Cows requiring treatment only

6.17c *Usual Strategy for Clipping: Answer Type; Single Option*

6.17d *Person(s) Who Carry out the Task: Answer Type; Single Option*

7. Cattle Related Tasks

7.1 *Slurry Spreading: Answer Type; Y or N*

7.1a *Storage of Slurry: Answer Type; Single Option*

Tank - Large storage vessel
Lagoon - Open pond-like storage facility
Underfloor Pit - Below slats in cattle housing area

7.1b *Disposal onto Fields: Answer Type; Single Option*

Sprayed - Ejected from tank to spreader plate and onto surface of fields
Injected - Introduced below the field surface

7.1c ***Person(s) who carry out the task:*** *Answer Type; Single Option*

7.1d *Months of the year: Answer Type; Tick Months*

7.1e *How many times each year: Answer Type; Number*

7.1f *How long each time: Answer Type; Number*
Smallest acceptable unit 0.5hrs

7.2 ***Muck Spreading***

7.2a *Muck Spreading: Answer Type; Single Option*

Manual - Muck is spread without the use of mechanised equipment
Mechanised - Muck is spread with the aid of mechanised equipment

7.2b *After Spreading: Answer Type; Single Option*

7.2c *Person(s) who carry out the task: Answer Type; Single Option*

7.2d *Months of the year: Answer Type; Tick Months*

7.2e *How many times each year: Answer Type; Number*

7.2f *How long each time: Answer Type; Number*
Smallest acceptable unit 0.5 days

7.3 ***Harvesting Cereal Crop:*** *Answer Type; Y or N*

7.3a *Person(s) who carry out the task: Answer Type; Single Option*

7.3b *How long each time: Answer Type; Number*
Smallest acceptable unit; 0.5 hrs.

7.3c *Bale treatment: Answer Type; Single Option*

7.3d *Bale storage: Answer Type; Single Option*

7.3e *Person(s) who carry out the task: Answer Type; Single Option*

7.3f *How long each time: Answer Type; Number*
Smallest acceptable unit; 0.5 hrs.

7.4 ***Harvested Grain Treatment:*** *Answer Type; Y or N*

7.4a *Usual method of grain treatment: Answer Type; Single Option*

Dried - Moisture removed by artificial drying
Chemically Treated - Chemical preservative added to grain
Crimped and Treated - Moist grain preserved by chemical treatment than clamped like silage

7.4b *Quantity of grain treated: Answer Type; Number*

7.4c *Grain Storage: Answer Type; Single Option*

Tower - Purpose built grain storage facility
Bins - Large storage containers open or sealed at top
Loose - Not held in a container but undercover

7.4d *Person(s) who carry out the task: Answer Type; Single Option*

7.4e *How many times a year: Answer Type; Single Option*

7.4f *How long each time: Answer Type; Number*
Smallest acceptable unit 0.5 days

7.5 ***Concentrate Feed Preparation:*** *Answer Type; Y or N*

7.5a *Concentrate Feed: Answer Type; Single Option*

7.5b *Mixing with supplements: Answer Type; Y or N*

7.5c *Mixing supplements: Answer Type; Single Option*

7.5d *Persons(s) who carry out the task: Answer Type; Single Option*

7.5e *Months of the year: Answer Type; Tick Months*

7.5f *How many times a year: Answer Type; Number*

7.5g *How long each time: Answer Type; Number*
Smallest acceptable unit 0.5hrs.

7.6 ***Silage Making*** *Answer Type; Y or N*

7.6a *Silage made from: Answer Type; Single Option*

7.6b *Substances added during harvest: Answer Type; Single Option*

7.6c *Silage storage: Answer Type; Single Option*

Clamp/Pit - Designated area which is sealed usually with polythene to allow fermentation
Wrapped Bales - Bales of silage sealed with polythene

7.6d *Other Storage Methods: Answer Type; Single Option*

7.6e *Person(s) who carry out the task: Answer Type; Single Option*

7.6f *How many times each year: Answer Type; Number*

7.6g *Months of the year: Answer Type; Tick Months*

7.6h *How long each time: Answer Type; Number*
Smallest acceptable unit; 0.5 hrs.

7.7 ***Hay Making:*** *Answer Type; Y or N*

7.7a *Treatment of Hay: Answer Type; Single Option*

7.7b *Storage of Bales: Answer Type; Single Option*

7.7c *Person(s) who carry out the task: Answer Type; Single Option*

7.7d *How many times each year: Answer Type; Number*
Often referred to as number of 'cuts'

7.7e *Months of the year: Answer Type; Tick Months*

7.7f *How long each time: Answer Type; Number*
Smallest acceptable unit 0.5 days

8. Other Tasks: Livestock

8.1 ***Other Livestock tasks:*** *Answer Type; Y or N*

8.2 ***Feeding:*** *Answer Type; Y or N*

8.2a *Task Undertaken: Answer Type; Y or N*

8.2b *Livestock Types: Answer Type; Livestock Options*

8.2c *Person(s) who carry out the task: Answer Type; Single Option*

The following sections should be completed following the guidelines given in Section 8.2.

8.3 ***Bedding:***

8.4 ***Aiding Birth:***

8.5 ***Worming:***

8.6 ***Vaccination:***

8.7 ***Castration:***

8.8 ***Tail Docking:***

8.9 ***Dipping:***

8.10 Other Tasks Not Covered

Complete as necessary.
The tasks identified should have the potential to expose farm workers to a respiratory hazard(s).

9 Other Tasks: Land Related

9.1 Crops on the Farm: Answer Type; Y or N

9.2 Lime Spreading: Answer Type; Y or N

9.2a Person(s) who carry out the task: Answer Type; Y or N

The following sections should be completed following the guidelines given in Section 9.2.

9.3 Ploughing:

9.4 Cultivating or Rolling:

9.5 Sowing:

9.6 Fertilizing:

9.7 Spraying:

9.8 Harvesting:

9.9 Other Tasks not Covered
Complete as necessary.
The tasks identified should have the potential to expose farm workers to a respiratory hazard(s).

10 Other Tasks: Farm Maintenance

10.1 Hedge Cutting

10.1a Task undertaken: Answer Type; Y or N

10.1b Persons(s) who carry out the task: Answer Type; Y or N

The following sections should be completed following the guidelines given in Section 10.1.

10.2 Erection and Repair of Fencing/Stonewalls

10.3 Building and Maintenance of Ditches and Dykes

10.4 Welding

10.5 Painting Farm Buildings

10.6 Machinery Maintenance and Servicing

10.7 Other Tasks Not Covered

Complete as necessary.
The tasks identified should have the potential to expose farm workers to a respiratory hazard(s).

11.1 ***Contract Work:*** *Answer Type; Y or N*
The tasks identified should have the potential to expose farm workers to a respiratory hazard(s). Tasks must be undertaken for more than 5 days by farm workers on farms other than the study farm.

11.1a *Specify task:* *Answer Type; Free Text*

11.1b *How long:* *Answer Type; Number*

12 Observations During Walkthrough

Questions a to f: *Answer Type; Single Option*
Complete this section if an opportunity to tour the farm buildings is given.

13 Any Further Comments
Include any important additional information about the study farm not covered elsewhere.

APPENDIX 5

Exposure Assessment Form and Protocol

Respiratory Hazards in Dairy and Beef Farming

Exposure Assessment

Joint IOM/HSE Study

Summary Sheet

1. Assessment details :

Farm Name : _____	Farm code :
Address : _____	
_____	
Contact name : _____	Task Code :
Task Name : _____	

2. Persons who carry out the task : *Job title codes -* *1. Farmer 2. General farm worker 3. Stockman/Dairyman 4. Tractor/Machine man 5. Other*

Name :	Job Title Code	Frequency and Duration with which task is carried out *(Specify own units)*

Continue on a separate sheet if necessary (attach as an Appendix)

3. General Task Description : *Remember Inhalation Risk Only*

Complete Sections 7 to 15 before completion Sections 4 to 6.

4. Level of assessed exposure :

Hazard Name	1	2	3	4
(a) low				
(b) medium				
(c) high				

5. Are accidents likely to lead to high exposures ? Y/N ☐

If *Yes,* for which hazards : ☐☐☐☐

6. Recommendations for improvements :

7. Name of assessor : _____ Code ☐

_____ Date _____

Page ____ of ____

EXPOSURE ASSESSMENT

8. Substances present or formed whilst carrying out the task *Attach material safety data sheets if they are available.*

Respiratory Hazard Tick box if present	If applicable Quantity used (specify own unit)	How is aerosol produced	Where applicable Occupational Exposure Limit 8hr or 15 min	Status
1. Dust/Fibre ☐ 01				
Specify hazard (s)				
2. Gas/Mist/Vapour ☐ 02				
Specify hazard (s)				
3. Biological ☐ 03				
Indicate source (s)				
4. Fume ☐ 04				
Specify hazard (s)				

EXPOSURE ASSESSMENT

9. **Existing control measures :** *Are they appropriate, adequate, maintained and in use ?. Provide a brief description of controls include substitution, enclosure, ventilation, process changes, systems of work, and personal protection.*

10. **Monitoring of exposure :** *Where monitoring has been carried out, provide summary and attach further details as an appendix. Also comment on whether the monitoring was appropriate and and adequate.*

11. **Health surveillance :** *If health surveillance has been undertaken, summarise the conclusions, and attach as an Appendix if appropriate.*

12. **Information, instruction and training :** *Has any health and safety training been given to workers who are exposed to respiratory hazards whilst carrying out this task.*

13. **Emergency situations :** *Have there been any emergency situations involving an inhalation risk whilst carrying out this task. If so what action was taken.*

14. **Any further comments :**

15. **Conclusions about risks :** *Estimate the duration of exposure and the concentration of hazardous substances in air. Refer also to previous sections on sources, controls and monitoring as appropriate.*

Now complete Section 4 to 6 on Page 1.

Respiratory Hazards in Dairy and Beef Farming
Joint HSE/IOM Study

Exposure Assessment
Protocol for use with the Exposure Assessment Form

1. INTRODUCTION

The proforma is designed to allow an informed judgement to be made concerning the respiratory exposure associated with carrying out a particular identified task. Under normal circumstances most of the assessment form should be completed whilst or just after observing the task.

The form has 15 sections most of which allow for the entry of free text. Sections 4, 5, 6 and 7 should be completed last of all.

2. INFORMATION ON INDIVIDUAL SECTIONS

1. *Assessment details:*

   Enter all relevant details and most importantly farm and task code according to the appropriate code lists.

2. *Persons who carry out the task:*

   Enter the names, initials and surname, of all those on the farm who carry out the task, including the code which best describes their job on the farm. Describe how often the task is carried out on the farm and how long it takes each time. This should reflect the total frequency and duration regardless of number of employees involved.

3. *General task description:*

   Describe how the task is carried out. Careful observation of the task is most important here. If applicable include information on the storage, movement, handling and use, transportation and disposal of hazardous substances that could be inhaled. Consider whether there are dust or fumes visible in the air, is there a smell, signs of spillage, are the surroundings contaminated with dust or liquids from the task?

Now go onto Section 8.

8. *Substances present or formed whilst carrying out the task:*

   Identify all substance types that could be inhaled by workers carrying out the task. Do this by placing a tick inside the appropriate box, then identify the substance in the box below. In the case of biological hazards indicate the likely source of the micro-organism, for example, mouldy hay, soiled bedding. If possible describe the hazard, i.e. is it irritant, harmful or toxic when inhaled. If the substance is bought in, this information should be available on the container in which it is supplied. In this case you should be able to obtain the material safety data sheets from the farmer or product supplier. These will help you complete this section of the assessment. If the substance is a by-product or waste you must rely on standard toxicological information.

   If an identifiable quantity is used note this down. Remember to state your own units and a time period over which this quantity is used. Describe how and why the substance is produced. This

information will be helpful if making recommendations to reduce exposure. Lastly, if the substance has been assigned an occupational exposure limit note this in the final column, remembering to include whether it is a long or short term limit.

You may find you need additional information not available at the time of the visit to complete this section. If this is the case ensure you have sufficient details to collect this information when you return to the office. e.g. Telephone numbers of product suppliers.

9. *Existing control measures:*

This section is most important because the magnitude of exposure is dependent on any existing control measures and the way in which they are used. Consider not only engineering controls, but also methods of working which are equally important. Describe any personal protective equipment. Comment on the appropriateness, adequacy, maintenance and use of these measures.

10. *Monitoring of exposure:*

Describe any measurements of airborne concentrations of substances made while carrying out the task and include the results. You may be able to make some simple measurements using direct reading detector tubes, if you feel this is necessary.

11. *Health surveillance:*

Enquire about any health surveillance carried out. Health surveillance may involve medical personnel, or perhaps just an inspection by a competent person.

12. *Information, instruction, training:*

Describe any health and safety information and training given to workers who carry out this task. Consider whether they are aware of the hazardous nature of the substances. Information and instruction may have been provided by agricultural inspectors, company representatives, local agricultural colleges etc. Training may be as a result of legal duties e.g. for crop spraying.

13. *Emergency situations:*

Note any emergency situations that have arisen involving inhalation of hazardous substances while this task was being performed. What was the outcome? Comment on whether improvements have been made as a result.

Comment on whether, under the present circumstances, there is potential for an emergency situation to arise due to inhalation of a hazardous substance.

14. *Any further comments:*

Include here any information you feel is relevant to the assessment that has not been covered in the earlier sections.

15. *Conclusions about the exposures:*

You should now be in a position to draw some conclusions about the exposure's of workers carrying out this task. It may not be possible to do this during the visit, particularly if you require additional information on hazardous substances, but you should try to complete the assessment as soon after the visit as possible.

In drawing your conclusions consider if the task exposes workers to hazardous substances. Is the nature of the hazard negligible, moderate or severe? If the hazard is severe, your conclusion about the exposure is more likely to be that it is high. Do not forget accidental exposures.

It may help to discuss these issues with a colleague before you reach a decision. Note down your conclusions on these issues.

Now you can return to the front summary sheet.

4. *Level of assessed exposure:*

Record the hazards identified in Section 7 in the boxes provided. Select the option which best describes the conclusions you have drawn about the farm workers' exposures to each of the main respiratory hazards. The following may help you.

Low: Farm workers are unlikely to experience any or significant inhalation exposure to the specified substance, for example, from work distant from a source of contamination that is well controlled or weak and distance.

Medium: Some inhalation exposure to the specified substance, for example, from work near a weak source or working some distance from a strong source of contamination.

High: Farm workers very likely to experience high inhalation exposures to the specified substance, for example, from work close to a strong source of contamination.

5. *Accidental Exposures*

Now consider accidents and emergency situations. Will these result in high exposures to any of the identified substances?

Use a second sheet if the task involves significant exposures to more than four respiratory hazards (Section 7).

6. *Recommendations for improvements:*

Record any practical methods for improving control of exposure you have noted, or discussed with the farm worker.

7. *Name of assessor:*

Sign the assessment and complete the assessor's code box. Record the date.

The exposure assessment is now complete. Check that all codes have been entered, and levels of exposure have been indicated for all identified hazards.

APPENDIX 6

Farm No. 03 (HSE 01)
Total Counts of Airborne Microorganisms
(All counts are in colony forming units per cubic metre of air)

Site No.	Sampler Type	Personal/ Fixed-point	Sample Time/mins	NA 25°C	NA 37°C	MAC 37°C	MALT 25°C	MALT 40°C	DG 18 25°C	R8 55°C
1	AND 1	FP	5	$7.99x10^3$	SW	NR	$3.21x10^4$	$5.29x10^3$	$1.16x10^3$	$3.08x10^2$
2	AM 1	P	94	$3.92x10^4$	$3.41x10^4$	$4.04x10^4$	$8.38x10^3$	$1.54x10^4$	$4.52x10^3$	$1.94x10^4$
	MI 1	P	67	$8.51x10^4$	$3.51x10^4$	$1.57x10^4$	$3.73x10^3$	ND	$1.72x10^4$	$4.48x10^3$
3	AGI 1	FP	69	$2.12x10^5$	$6.56x10^4$	$5.38x10^4$	$6.14x10^3$	$6.96x10^2$	$8.46x10^3$	$1.74x10^3$
	AND 2	FP	1.5	$1.32x10^5$	SW	$1.53x10^5$	$1.02x10^4$	$1.15x10^3$	$4.12x10^4$	$4.25x10^3$
4	AM 2	P	76	$1.35x10^5$	$1.08x10^5$	$1.30x10^4$	$3.54x10^4$	$1.22x10^4$	$3.87x10^4$	SW
	MI 2	FP	111	$1.29x10^6$	$1.53x10^5$	$8.60x10^4$	$1.08x10^4$	$9.01x10^2$	$2.21x10^4$	SW
6	AM 4	P	73	$2.74x10^5$	$1.13x10^5$	$7.71x10^4$	$2.85x10^2$	$8.56x10^2$	$1.71x10^3$	SW
	AGI 2	FP	58	$8.01x10^4$	$2.07x10^4$	$5.10x10^3$	$1.38x10^2$	$2.76x10^2$	$8.28x10^2$	$5.52x10^4$
	AND 3	FP	3	$9.77x10^3$	SW	$2.49x10^4$	$2.96x10^3$	$2.40x10^2$	$1.36x10^4$	$3.00x10^3$
7	MI 3	P	120	$5.00x10^3$	ND	$1.67x10^3$	$8.33x10^2$	ND	$8.33x10^2$	$3.75x10^3$
	AND 4	FP	3	SW	SW	$5.95x10^4$	$3.35x10^3$	$2.47x10^2$	$3.38x10^3$	$4.20x10^2$

NA - Nutrient Agar
MAC - MacConkey Agar
MALT - Malt Extract Agar
DG 18 - Dichloran Clycerol Agar
R8 - R8 Agar

AND - Andersen Sampler
AGI - AGI 30 Liquid Impinger
MI - Midget Impinger
AM - Aerosol Monitor

NR - No Result
ND - None Detected
SW - Swarmed Colony No Result
FP - Fixed-point Sample
P - Personal Sample

APPENDIX 6 (Cont.)

Farm No. 15 (HSE 02)
Total Counts of Airborne Microorganisms
(All counts are in colony forming units per cubic metre of air)

Site No.	Sampler Type	Personal/ Fixed-point	Sample Time/mins	NA 25°C	NA 37°C	MAC 37°C	MALT 25°C	MALT 40°C	DG 18 25°C	R8 55°C
1	AM 1	FP	62	$2.35x10^5$	$1.08x10^5$	$8.47x10^4$	$2.96x10^4$	ND	$2.80x10^4$	$3.63x10^3$
	AGI 1	FP	60	$2.05x10^5$	$7.18x10^4$	$1.31x10^4$	$2.87x10^4$	$3.70x10^2$	$6.03x10^4$	$1.20x10^3$
	AND 1	FP	1.5	$4.81x10^4$	NR	$2.96x10^4$	$8.35x10^4$	$1.07x10^2$	$3.32x10^4$	$1.64x10^3$
2	AM 2	P	60	$5.63x10^4$	$9.19x10^4$	$1.72x10^5$	ND	ND	ND	$3.13x10^3$
	MI 1	FP	40	$2.20x10^5$	$1.51x10^5$	$6.88x10^4$	ND	NR	$3.75x10^3$	SW
	AND 2	FP	3	$1.25x10^5$	NR	$8.04x10^4$	$3.03x10^4$	$1.65x10^3$	$1.34x10^4$	$1.29x10^4$
3	AM 3	FP	68	$4.94x10^4$	SW	$1.01x10^5$	$3.31x10^4$	ND	$2.48x10^4$	$8.82x10^3$
	MI 2	FP	68	$2.32x10^5$	$5.15x10^4$	$2.16x10^5$	ND	NR	$1.47x10^4$	SW
4	AND 3	FP	3	$7.58x10^3$	SW	$5.33x10^4$	$1.73x10^3$	$1.67x10^2$	$1.18x10^3$	$3.20x10^2$

NA - Nutrient Agar
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MALT - Malt Extract Agar
DG 18 - Dichloran Clycerol Agar
R8 - R8 Agar

AND - Andersen Sampler
AGI - AGI 30 Liquid Impinger
MI - Midget Impinger
AM - Aerosol Monitor

NR - No Result
ND - None Detected
SW - Swarmed Colony No Result
FP - Fixed-point Sample
P - Personal Sample

APPENDIX 6 (Cont.)

Farm No. 16 (HSE 03)
Total Counts of Airborne Microorganisms
(All counts are in colony forming units per cubic metre of air)

Site No.	Sampler Type	Personal/ Fixed-point	Sample Time/mins	NA 25°C	NA 37°C	MAC 37°C	MALT 25°C	MALT 40°C	DG 18 25°C	R8 55°C
1	AM 1	P	35	$2.14x10^6$	$1.00x10^6$	$5.07x10^5$	$2.04x10^4$	ND	$5.25x10^4$	$4.64x10^3$
2	AM 2	P	44	$1.85 x10^5$	$6.53x10^4$	$6.34x10^5$	$1.53x10^4$	ND	$1.96x10^4$	$9.37x10^3$
	MI 1	P	34	ND	ND	ND	ND	ND	ND	$1.47x10^3$
3	AGI 1	FP	56	$6.86x10^3$	$4.29x10^3$	$1.43x10^3$	ND	ND	$8.57x10^2$	ND
	AND 1	FP	1	$5.46x10^3$	SW	$8.00x10^2$	$8.46x10^3$	$1.40x10^2$	$2.98x10^3$	$2.16x10^3$
4	AM 3	P	42	$5.30x10^5$	$3.39x10^5$	$2.78x10^5$	$1.10x10^5$	$2.68x10^3$	$7.59x10^4$	$9.23x10^3$
	AGI 2	FP	34	$4.90x10^5$	$1.79x10^5$	$6.49x10^4$	$1.13x10^4$	ND	$2.54x10^4$	$7.06x10^2$
	AND 2	FP	1	$5.48x10^3$	$6.30x10^3$	$9.02x10^3$	$9.80x10^3$	$2.20X10^2$	$2.43X10^4$	$1.42X10^3$
5	MI 2	P	145	$4.76x10^5$	$2.25x10^5$	$5.52x10^4$	$1.17x10^4$	ND	1.90X104	$3.45X10^2$
	AGI 3	FP	180	$1.21x10^6$	$7.06x10^5$	$1.51x10^6$	$4.14x10^4$	ND	$4.42x10^4$	$1.11x10^3$
	AND 3	FP	1	$1.33x10^4$	$6.44x10^3$	$5.94x10^3$	$3.28x10^3$	$1.80x10^2$	$1.26x10^4$	$3.40x10^2$
6	MI 3	P	41	$6.95x10^4$	$7.07x10^4$	$4.88x10^4$	$3.66x10^3$	ND	ND	$1.34x10^4$
	AND 4	FP	1	$2.48x10^4$	$9.04x10^3$	$9.12x10^3$	$3.12x10^3$	$6.00x10^1$	$1.04x10^3$	$3.28x10^3$

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R8 - R8 Agar

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AGI - AGI 30 Liquid Impinger
MI - Midget Impinger
AM - Aerosol Monitor

NR - No Result
ND - None Detected
SW - Swarmed Colony No Result
FP - Fixed-point Sample
P - Personal Sample

APPENDIX 6 (Cont.)

Farm No. 24 (HSE 04)
Total Counts of Airborne Microorganisms
(All counts are in colony forming units per cubic metre of air)

Site No.	Sampler Type	Personal/ Fixed-point	Sample Time/mins	NA 25°C	NA 37°C	MAC 37°C	MALT 25°C	MALT 40°C	DG 18 25°C	R8 55°C
1	AM 1	P	119	$2.32x10^4$	$3.05x10^4$	$9.14x10^3$	$9.45x10^2$	$9.45x10^2$	$6.09x10^3$	$4.41x10^3$
	MI 1	P	119	$8.49x10^5$	$1.57x10^6$	$9.08x10^4$	$1.51x10^5$	$2.69x10^4$	$1.16x10^5$	$3.24x10^4$
2	AGI 1	FP	78	$6.75x10^5$	$1.10x10^6$	$3.59x10^5$	$4.39x10^4$	$6.36x10^3$	$5.25x10^4$	$6.96x10^4$
	AND 1	FP	2	$6.93x10^4$	$1.38x10^4$	$3.14x10^4$	$7.18x10^4$	$1.15x10^5$	$5.46x10^4$	$3.18x10^5$
3	MI 2	P	107	$3.70x10^5$	$3.40x10^5$	$8.50x10^4$	$1.68x10^4$	ND	$8.41x10^3$	ND
4	AM 2	FP	104	$6.17x10^5$	$4.82x10^5$	$2.08x10^5$	$4.33x10^3$	$1.80x10^3$	$5.41x10^3$	$9.62x10^3$
	AM 3	FP	104	$2.21x10^6$	$7.27x10^5$	$2.27x10^4$	$7.33x10^3$	$1.92x10^3$	$7.21x10^3$	$1.15x10^4$
5	AGI 2	FP	45	$1.75x10^6$	$1.16x10^6$	$6.40x10^5$	$2.84x10^3$	$7.11x10^2$	$3.91x10^3$	$1.21x10^4$
	AND 2	FP	1	$2.03x10^5$	$5.43x10^4$	$1.06x10^4$	$2.20x10^2$	$5.40x10^2$	$7.24x10^3$	$8.40x10^3$

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R8 - R8 Agar

AND - Andersen Sampler
AGI - AGI 30 Liquid Impinger
MI - Midget Impinger
AM - Aerosol Monitor

NR - No Result
ND - None Detected
SW - Swarmed Colony No Result
FP - Fixed-point Sample
P - Personal Sample

APPENDIX 6 (Cont.)

Farm No. 26 (HSE 05)
Total Counts of Airborne Microorganisms
(All counts are in colony forming units per cubic metre of air)

Site No.	Sampler Type	Personal / Fixed-point	Sample Time/mins	NA 25°C	NA 37°C	MALT 25°C	MALT 40°C	DG 18 25°C	R8 55°C
1	AM 1	P	184	$1.76x10^5$	$4.15x10^4$	$5.64x10^4$	$1.50x10^4$	$3.88x10^4$	$2.31x10^4$
	MI 1	P	183	$2.73x10^5$	$2.57x10^5$	$1.37x10^4$	$2.73x10^3$	$1.64x10^4$	$1.09x10^4$
	AND 1	FP	1	$4.20x10^3$	$1.03x10^4$	$5.28x10^3$	$1.43x10^5$	$9.31x10^4$	$2.16x10^4$
2	AM 2	FP	229	$4.96x10^4$	$6.27x10^4$	$2.02x10^4$	$1.74x10^4$	$4.36x10^3$	$2.34x10^4$
	MI 2	FP	229	$6.34x10^4$	$5.90x10^4$	$5.46x10^3$	$1.37x10^4$	ND	$2.73x10^3$
	AGI 1	FP	142	$5.26x10^5$	$4.84x10^5$	$1.30x10^4$	ND	$1.47x10^4$	$1.70x10^4$
	AGI 2	FP	124	$1.08x10^5$	$7.06x10^4$	$5.65x10^2$	$1.58x10^4$	ND	$2.83x10^3$
	AND 2	FP	1	$4.16x10^3$	$2.64x10^3$	$2.40x10^2$	$5.32x10^3$	$2.10x10^3$	$1.13x10^4$
3	AM 3	FP	177	$2.54x10^4$	$2.82x10^4$	$2.12x10^3$	ND	$4.94x10^3$	ND
	MI 3	FP	114	$4.39x10^5$	$3.29x10^5$	ND	$8.77x10^3$	ND	$8.77x10^3$
4	AND 3	FP	1	$1.16x10^4$	$1.52x10^4$	$1.34x10^4$	$3.50x10^3$	$1.82x10^3$	$5.70x10^4$
5	AM 4	P	10	$3.04x10^6$	$9.00x10^5$	$6.63x10^5$	$8.75x10^4$	$5.88x10^5$	ND
	MI 4	P	8	$4.38x10^6$	$2.81x10^6$	$6.25x10^4$	ND	ND	$1.25x10^5$
	AND 4	FP	1	$1.29x10^4$	$2.40x10^2$	$7.18x10^4$	$1.27x10^4$	NR	ND

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R8 - R8 Agar

AND - Andersen Sampler
AGI - AGI 30 Liquid Impinger
MI - Midget Impinger
AM - Aerosol Monitor

NR - No Result
ND - None Detected
SW - Swarmed Colony No Result
FP - Fixed-point Sample
P - Personal Sample

APPENDIX 6 (Cont.)

Farm No. 17 (HSE 06)
Total Counts of Airborne Microorganisms
(All counts are in colony forming units per cubic metre of air)

Site No.	Sampler Type	Personal/ Fixed-point	Sample Time/mins	NA 25°C	NA 37°C	MALT 25°C	MALT 40°C	DG 18 25°C	R8 55°C
1	AM 1	FP	65	$9.63x10^3$	$1.73x10^4$	$2.41x10^5$	ND	$1.66x10^5$	ND
	MI 1	FP	65	ND	ND	$7.69x10^4$	ND	$4.62x10^4$	ND
	AGI 1	FP	65	$7.38x10^3$	$2.46x10^3$	$6.89x10^4$	ND	$5.54x10^4$	$1.23x10^3$
	AND 1	FP	1	$2.70x10^3$	$3.46x10^3$	$9.12x10^5$	$2.24x10^3$	$6.85x10^5$	$9.24x10^3$
2	MI 3	FP	34	$4.41x10^4$	$4.41x10^4$	$2.94x10^4$	ND	$1.47x10^4$	ND
	AND 4	FP	1	$2.08x10^4$	$1.12x10^4$	$6.61x10^4$	$3.50x10^3$	$7.63x10^4$	$1.75x10^4$
3	AM 4	P	22	$5.70x10^4$	$3.84x10^5$	$9.92x10^5$	ND	$9.63x10^5$	$3.38x10^4$
4	AM 2	FP	22	$8.09x10^3$	ND	$1.16x10^3$	ND	$1.16x10^3$	$1.16x10^3$
	MI 2	FP	108	$1.31.10^6$	$7.36x10^5$	$8.80x10^4$	ND	$1.81x10^5$	$4.63x10^3$
	AGI 2	FP	108	$5.27x10^5$	$3.53x10^5$	$7.10x10^4$	$1.48x10^3$	$7.40x10^4$	$2.96x10^3$
	AND 2	FP	1	$2.33x10^4$	$1.22x10^4$	$3.09x10^5$	$3.08x10^3$	$1.67x10^5$	$3.84x10^4$
5	AM 3	P	37	$5.67x10^6$	$7.67x10^5$	$9.02x10^5$	$3.38x10^3$	$6.15x10^5$	3.38x104

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R8 - R8 Agar

AND - Andersen Sampler
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MI - Midget Impinger
AM - Aerosol Monitor

NR - No Result
ND - None Detected
SW - Swarmed Colony No Result
FP - Fixed-point Sample
P - Personal Sample

APPENDIX 7.1

Clinical diagnosis and observations for subjects with defined syndromes from the questionnaire (see Table 10 in main text). DNA - did not attend

ID	Case No.	Clinical diagnosis	Classification for purposes of analysis
192	1	Occ. rhinitis from stored hay, straw, barley Occ. asthma from silage, hay	Occ. rhinitis Occ. asthma
204	2	DNA	
232	3	Chronic bronchitis, non-occ. asthma	Chronic bronchitis Non-occ. asthma
172	4	Non-occ. asthma	Non-occ. asthma
32	5	Occ. rhinitis, from straw for bedding	Occ. rhinitis
43	6	DNA	
71	7	Occ. rhinitis, from straw, barley. Possible associated asthma. Leptospirosis previously	Occ. rhinitis
91	8	DNA	
92	9	Occ. rhinitis (hay fever at work) from cutting grass, driving combine harvester. 1989. ODTS and/or late asthma 8 hrs after shovelling mouldy barley in tower store	Occ. rhinitis
102	10	Seasonal, non-occ. rhinitis	Non-occ. rhinitis
151	11	Occ. asthma from bruising barley, barley feed, and in silos	Occ. asthma
181	12	Chronic bronchitis. Infective rhinitis for three months	Chronic bronchitis
191	13	Vasomotor rhinitis (non-occ.)	Non-occ. rhinitis
201	14	Occ. rhinitis from hay dust, bruising barley, and in barns. Occ. asthma from barley, stored hay, mouldy straw dust	Occ. rhinitis Occ. asthma
262	15	Occ. rhinitis from dust from stored hay	Occ. rhinitis
282	16	Chronic bronchitis. Non-specific sneezing from dusts	Chronic bronchitis
285	17	Non-specific sneezing to dusts	No disease
291	18	DNA	
111	19	No symptoms in last year. Previous hyperventilation	No disease
222	20	Occ. rhinitis from hay, straw in winter. Occ. asthma from hay, straw dust, grinding or bruising barley	Occ. rhinitis Occ. asthma

APPENDIX 7.2

Subjects selected for clinical examinations, without syndromes. Symptoms elicited by questionnaire and clinical diagnosis. DNA - did not attend.

ID	Case No.	Symptoms from questionnaire	Clinical diagnosis	Classification
171	21	-	Occ rhinitis from grain dust	Occ rhinitis
202	22	-	DNA	
284	23	-	No disease	No disease
203	24	-	DNA	
211	25	Feverish syndrome, not environmental	No disease	No disease
212	26	-	Non-occ asthma	Non-occ asthma
261	27	-	No disease	No disease
263	28	Feverish syndrome, not environmental	Occ rhinitis from hay and straw	Occ rhinitis
272	29	Feverish syndrome	No disease	No disease
287	30	-	DNA	
31	31	Rhinitis, non-environmental	DNA	
101	32	-	Possible non-occ asthma	No disease
131	33	Rhinitis, non-environmental	DNA	
141	34	-	Occ rhinitis, and occ asthma, from barley, straw	Occ rhinitis Occ asthma
161	35	Chronic rhinitis, asthma, feverish syndrome, all non-environmental	Occ rhinitis from barley. Past history of chronic extrinsic allergic alveolitis	Occ rhinitis
41	36	Feverish syndrome, not occupational	DNA	
62	37	-	No disease	No disease
44	38	Feverish syndrome, not occupational	No disease	No disease
61	39	-	Occ rhinitis from straw dust	Occ rhinitis
63	40	Rhinitis, non-environmental	DNA	
93	41	Feverish syndrome, non-environmental	No disease	No disease
94	42	Rhinitis, non-environmental	No disease	No disease

APPENDIX 8
Estimated frequencies of clinical syndromes in study population (67)

METHOD OF CALCULATION OF ESTIMATED FREQUENCIES

1.	Number of cases (syndromes identified from questionnaire)	24
	Number of cases invited (syndromes except non occupational rhinitis)	20 (16 attended)
	Frequency of clinical syndrome in subjects attending	a
	Estimated frequency in 20 cases	a x 20/16
2.	Subjects without syndromes from questionnaire (may have had some symptoms)	43
	Sample attending clinical examination	15
	Frequency of clinical syndrome in subjects attending	b
	Estimated frequency in population of 43	b 43/15

3. 4 subjects with syndrome of environment but not occupation-related rhinitis, from questionnaire, were not invited for clinical study. Frequency of clinical diagnosis not known. Assume, conservatively, frequency of clinical syndrome is same as in subjects without syndromes, as in (2) above.

4. The overall frequency in population of 67 is

$$a \times \frac{20}{16} + b \times \frac{43}{15} + b \times \frac{4}{15}$$

RESULTS

Estimated overall frequencies of clinical syndromes in farm population (67):

Any syndrome	36	(54%)
Occupational rhinitis	24	(36%)
Asthma (all)	13	(19%)
Occupational asthma	7	(10%)

APPENDIX 9
Estimated Sensitivity and specificity calculations

A9.1 All syndromes including environmental rhinitis, asthma, environmental asthma, chronic bronchitis and EAA/ODTS. Comparison of syndromes identified by questionnaire, with clinical diagnosis.

9.1.1 16 Cases with syndromes (from the questionnaire who attended for examination)

		Clinical diagnosis Yes	No	
Questionnaire Syndromes	Yes	14	2	16
	No	0	0	0
		14	2	16

20 Cases invited, of whom 16 attended, assuming similar distribution

		Clinical diagnosis Yes	No		
Questionnaire Syndromes	Yes	17.50	2.50	20	
	No	0	0	0	
		17.50	2.50	20	(a)

9.1.2 4 Cases with environmental but not occupational rhinitis who were not invited. Assume similar distributions as in (a)

		Clinical diagnosis Yes	No		
Questionnaire Syndromes	Yes	3.50	0.50	4	
	No	0	0	0	
		3.50	0.50	4	(b)

9.1.3 15 Cases without above syndromes (from questionnaire, who attended)

		Clinical diagnosis Yes	No	
Questionnaire Syndromes	Yes	0	0	0
	No	6	9	15
		6	9	15

43 subjects without above syndromes (from the questionnaire), of whom the above 15 cases were a sample (except insofar as selection was influenced by the matching procedure). Assume similar distributions to those above.

APPENDIX 9 (Cont.)

		Clinical diagnosis Yes	No	
Questionnaire	Yes	0	0	0
Syndromes	No	17.2	25.8	43
		17.2	25.8	43 ©

9.1.4 Adding (a), (b), © to estimate distribution in whole population.

		Clinical diagnosis Yes	No	
Questionnaire	Yes	21	3	24
Syndromes	No	17.2	25.8	43
		38.2	28.8	67

$$Estimated\ sensitivity = \frac{21}{38.2} \times 100 = 55\%$$

$$Estimated\ specificity = \frac{25.8}{28.8} \times 100 = 90\%$$

$$Estimated\ positive\ predictive\ value = \frac{21}{24} \times 100 = 88\%$$

APPENDIX 9 (Cont.)

A9.2 Occupational rhinitis

9.2.1 16 Cases with syndromes from the questionnaire who attended for examination

		Clinical diagnosis Yes	No	
Questionnaire Syndromes	Yes	6	6	12
	No	1	3	4
		7	9	16

20 Cases invited, of whom 16 attended, assuming similar distribution

		Clinical diagnosis Yes	No		
Questionnaire Syndromes	Yes	7.5	7.5	15	
	No	1.25	3.75	5	
		8.75	11.25	20	(a)

9.2.2 4 Cases with environmental but not occupational rhinitis who were not invited. Assume similar distribution to cases without syndromes from questionnaire (see below)

		Clinical diagnosis Yes	No		
Questionnaire Syndromes	Yes	0	0	0	
	No	1.33	2.67	4	
		1.33	2.67	4	(b)

9.2.3 15 Cases without syndromes from the questionnaire who attended

		Clinical diagnosis Yes	No	
Questionnaire Syndromes	Yes	0	0	0
	No	5	10	15
		5	10	15

43 Subjects without syndromes by questionnaire, of whom the above 15 cases were a sample (except insofar as selection was influenced by the matching procedure). Assume similar distribution to those 15 subjects

APPENDIX 9 (Cont.)

		Clinical diagnosis Yes	No	
Questionnaire	Yes	0	0	0
Syndromes	No	14.3	28.7	43
		14.3	28.7	43 ©

9.2.4 Adding (a), (b), © to estimate distribution in whole population

		Clinical diagnosis Yes	No	
Questionnaire	Yes	7.5	7.5	15
Syndromes	No	16.88	35.12	52
		24.38	42.62	67

$$Estimated\ sensitivity = \frac{7.5}{24.38} \times 100 = 31\%$$

$$Estimated\ specificity = \frac{35.12}{42.62} \times 100 = 82\%$$

$$Estimated\ positive\ predictive\ value = \frac{7.5}{15} \times 100 = 50\%$$

APPENDIX 9 (Cont.)

A9.3 Asthma

9.3.1 16 Cases with syndromes from the questionnaire who attended for examination

		Clinical diagnosis Yes	No	
Questionnaire Syndromes	Yes	4	1	5
	No	1	10	11
		5	11	16

20 Cases invited, of whom the above 16 attended, assuming similar distribution

		Clinical diagnosis Yes	No		
Questionnaire Syndromes	Yes	5	1.25	6.25	
	No	1.25	12.5	13.75	
		6.25	13.75	20	(a)

9.3.2 4 Cases with environmental but not occupational rhinitis who were not invited. Assume similar distribution to cases without syndromes from questionnaire (see below)

		Clinical diagnosis Yes	No		
Questionnaire Syndromes	Yes	0	0	0	
	No	.53	3.47	4	
		.53	3.47	4	(b)

9.3.3 15 Cases without syndromes from the questionnaire who attended

		Clinical diagnosis Yes	No	
Questionnaire Syndromes	Yes	0	0	0
	No	2	13	15
		2	13	15

43 Subjects without syndromes by questionnaire, of whom the above 15 subjects were examined. Assume same distribution as above

APPENDIX 9 (Cont.)

		Clinical diagnosis Yes	No	
Questionnaire	Yes	0	0	0
Syndromes	No	5.73	37.27	43
		5.73	37.27	43 ©

9.3.4 Adding (a), (b), © to estimate distribution in whole population

		Clinical diagnosis Yes	No	
Questionnaire	Yes	5	1.25	6.25
Syndromes	No	7.51	53.24	60.75
		12.51	54.49	67

$$Estimated\ sensitivity = \frac{5}{12.51} \times 100 = 40\%$$

$$Estimated\ specificity = \frac{53.24}{54.49} \times 100 = 98\%$$

$$Estimated\ Positive\ predictive\ value = \frac{5}{6.25} \times 100 = 80\%$$

APPENDIX 9 (Cont.)

A9.4 Occupational asthma

9.4.1 16 Cases with syndromes from the questionnaire who attended for examination

		Clinical diagnosis Yes	No	
Questionnaire Syndromes	Yes	2	2	4
	No	1	11	12
		3	13	16

20 Cases invited, of whom the above 16 attended, assuming similar distribution

		Clinical diagnosis Yes	No		
Questionnaire Syndromes	Yes	2.50	2.50	5	
	No	1.25	13.75	15	
		3.75	16.25	20	(a)

9.4.2 4 Cases with environmental but not occupational rhinitis who were not invited. Assume similar distribution to cases without syndromes from questionnaire (see below)

		Clinical diagnosis Yes	No		
Questionnaire Syndromes	Yes	0	0	0	
	No	.27	3.73	4	
		.27	3.73	4	(b)

9.4.3 15 Cases without syndromes from the questionnaire who attended

		Clinical diagnosis Yes	No	
Questionnaire Syndromes	Yes	0	0	0
	No	1	14	15
		1	14	15

43 Subjects without syndromes by questionnaire, of whom the above 15 subjects were examined. Assume same distributions as above

APPENDIX 9 (Cont.)

		Clinical diagnosis Yes	No	
Questionnaire Syndromes	Yes	0	0	0
	No	2.87	40.13	43
		2.87	40.13	43 ©

9.4.4 Adding (a), (b), © to estimate distribution in whole population

		Clinical diagnosis Yes	No	
Questionnaire Syndromes	Yes	2.50	2.50	5
	No	4.39	57.61	62
		6.89	60.11	67

$$\textit{Estimated sensitivity} = \frac{2.5}{6.89} \times 100 = 36\%$$

$$\textit{Estimated specificity} = \frac{57.61}{60.11} \times 100 = 96\%$$

$$\textit{Estimated positive predictive value} = \frac{2.5}{5} \times 100 = 50\%$$

APPENDIX 10.1

Skin prick test results (more diameter of weal) in subjects with respiratory syndromes.
HDM = house dust mite (Dermatophagoides pterorrussinus); Cat = cat fur;
Grass = grass pollen; Aspfum = Aspergillus fumigatus; Fus - Fusarium;
Alt = Alternaria Alternata; Cow = cow hair; Hay = hay dust; Straw = straw dust
A weal of 3 mm or greater is considered positive

CASES

ID	Case No.		HDM	Cat	Grass	Asp.F	Fus	Alt.	Cow	Hay	Straw	Control
192	1		8	3	2	-	3	-	1	3	4	-
204	2	DNA										
232	3		5	2	-	4	2	-	4	5	4	-
172	4		-	-	-	-	-	-	-	-	-	-
32	5		4	3	2	-	1	-	-	1	3	-
43	6	DNA										
71	7		13	-	-	-	-	-	-	-	-	-
91	8	DNA										
92	9		-	-	-	-	-	-	-	-	-	-
102	10		-	-	-	-	-	-	-	-	-	-
151	11		7	5	3	-	-	-	1	3	3	-
181	12		-	1	-	-	-	-	-	-	3	-
191	13		1	-	1	-	-	-	2	1	3	-
201	14		10	4	-	2	-	-	1	2	3	-
262	15		6	-	2	-	1	2	2	3	3	-
282	16		-	-	-	-	-	-	-	-	-	-
285	17		-	1	-	-	-	-	-	-	-	-
291	18	DNA										
111	19		-	-	-	-	1	-	-	-	-	-
222	20		9	5	-	-	-	-	-	3	4	-

APPENDIX 10.2

Skin prick test results in subjects without respiratory syndromes
HDM = house dust mite (Dermatophagoides pteronnussinus); Cat = cat fur;
Grass = grass pollen; Asp.fum = Aspergillus fumigatus; Fus - Fusarium;
Alt = Alternaria Alternata; Cow = cow hair; Hay = hay dust; Straw = straw dust
A weal of 3 mm or greater is considered positive

CONTROLS

ID	Case No.		HDM	Cat	Grass	Asp.f	Fus	Alt.	Cow	Hay	Straw	Control
171	21		-	2	-	1	2	-	-	1	1	-
202	22	DNA										
203	23	DNA										
211	24		-	-	-	-	-	-	-	-	-	-
212	25		-	2	1	-	1	-	1	1	-	-
261	26		3	2	-	-	-	-	-	1	1	-
263	27		-	-	-	-	-	-	-	1	1	-
272	28		-	-	-	-	-	-	-	3	-	-
287	29	DNA										
31	30	DNA										
101	31		-	-	-	-	-	-	-	-	2	-
131	32	DNA										
141	33		-	-	4	-	-	-	-	-	-	-
161	34		1	-	-	-	-	-	1	2	3	-
41	35	DNA										
44	36		2	-	1	-	1	-	2	-	1	-
61	37		4	1	-	-	-	-	3	3	3	-
63	38	DNA										
92	39		-	-	-	-	-	-	-	-	-	-
94	40		-	-	-	-	-	-	-	-	-	-
284	41		1	-	-	-	2	-	-	1	-	-
62	42		3	-	-	-	2	-	-	-	-	-
93	43		-	-	-	-	-	-	-	-	-	-

APPENDIX 10.3
Summaries of skin test results

16 subjects with syndromes from the questionnaire

10 had one or more 3 mm response or greater (62%)

8	had a	positive response to	HDM
5	"	"	cat fur
1	"	"	grass pollen
1	"	"	A fumigatus
1	"	"	Fusaria
0	"	"	Alternaria
1	"	"	cow hair
5	"	"	hay
9	"	"	straw

15 subjects without syndromes from the questionnaire (38%)

6 had one or more 3 cm response or greater
3 had a positive response to house dust mite
0 to car fur
1 to grass pollen
1 to Aspergillus fumigatus
0 to Fusaria
0 to Alternaria
1 to cow hair
2 to hay dust
2 to straw dust

APPENDIX 11
RAST % binding greater than 1

Allergen	No of individuals RAST % binding >1 (n = 31)
Cow dander 01/01	1
Cow dander (Pharmacia)	2
Cow dander (Bencard)	0
Cow dander (Allergon)	3
Urine 01/02	0
Urine (conc 01/02)	0
Pellets 01/04	2
Silage 01/05	1
Pellets 02/01	0
Straw 02/02	1
Mineral feed 02/03	0
Silage 02/04	1
Straw 02/05	2
Silage 02/06	0
Barley	1
Mixed mites	9
Atopy	10
House dust mite	12
Mixed grasses	2

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