Institute for Environment and Health

# An objective assessment of systems for the collection and analysis of exposure data in the United Kingdom Armed Services

**Volume I: Main report**

IEH Web Report W8 JANUARY 2002

The Institute for Environment and Health was established by the Medical Research Council at the University of Leicester in 1993. The Institute is principally funded by UK Government Departments and Agencies by way of specific research and consultancy contracts.

This report was prepared by the MRC Institute for Environment and Health for the Defence Evaluation and Research Agency* and issued as a client report in December 2000.

The views expressed here do not necessarily represent those of any Government Department or Agency.

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Volume I of two volumes.
Volume II is: *Reports of Visits to Service Units and Organisations*

Please cite as:
IEH (2002) *An Objective Assessment of Systems for the Collection and Analysis of Exposure Data in the United Kingdom Armed Services*. *Volume I, Main Report* (Web Report W8), Leicester, UK, MRC Institute for Environment and Health, available at http://www.le.ac.uk/ieh/

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ISBN 1 899110 67 4

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# Executive summary

Occupationally related illnesses and accidents are costly to society in both economic and human terms. Records, such as personnel, pay and medical records, collected by industry play a key role in the monitoring of the health of a workforce and in occupational epidemiology. Such records are essential for enumerating groups of workers, for tracing workers and for carrying out exposure assessment.

The aim of this project has been to assess systems currently in use, in the Armed Services and in selected examples in civilian industry, for the collection and retention of data relating to potentially adverse exposures.

In particular the objectives have been to:

- enhance the health surveillance capability of the Defence Medical Services and to relate health outcomes to exposures;
- determine current practice for both collection and retention of exposure data in each of the three Armed Services and to consider how these may be improved;
- identify the linkages and overlaps between health data and information collected in systems such as those covering personnel and pay both within and between Services;
- consider the design and complexity of research for which exposure information might be required and identify the data items necessary for this; and
- provide recommendations for the format in which data should be kept, how long they should be retained and where they should be kept.

The collection and analysis of exposure data is a central element of any occupational health surveillance system since, in addition to the monitoring of patterns of health in a workforce, it enables associations between potential risk factors and health outcomes to be identified and evaluated, and allows the effectiveness of any control measures implemented to be assessed objectively. Exposure data can be collected at a number of levels, ranging from basic, sufficient to demonstrate compliance with statutory requirements and allow a minimal level of exposure data retrieval and interpretation, through to complex, research level, where data are collected in order to perform specific and detailed epidemiological studies. Individuals in the Armed Services may be exposed to a wide range and combination of hazards. These include natural hazards (biological, climatic, geological and geographical), man-made hazards (physical, chemical, biological, ergonomic), psychological hazards and injuries and illness specific to military activities. The collection and analysis of exposure data is essential if the effect of exposures on health is to be evaluated.

Data necessary for exposure assessment can potentially be found in many different sections of an industry. In order to assess the systems within the Armed Services a series of visits to sections with potential involvement in the collection of data relevant to exposure assessment was carried out to:

- establish what systems are used to collect potential exposure information;
- gain a detailed understanding of each system; and

- evaluate the potential use of each system to provide data for exposure assessment.

Visits made included those to policy departments; sections responsible for personnel and pay systems, medical records, occupational and environmental exposure monitoring data, health and safety records, and historical records; and users of Service records.

The data collected from the visits were used to evaluate the systems from the perspective of exposure assessment and to draw up some recommendations as to how the collection of exposure data could be improved. However, there are three major issues that it is important to bear in mind when considering the findings of and recommendations from this study.

The Armed Services have varying histories and traditions. Although their overall remit may be similar to some extent they have different functions; hence their information needs may differ.

The record systems which have been investigated in this project are, in general, designed for specific administrative purposes, and have not been developed to facilitate exposure assessment.

There are a number of important differences between the Armed Services and civilian industry which impact on exposure assessment.

The Services have a large workforce carrying out a large variety of jobs and tasks, involving hazards not commonly experienced by the civilian workforce. Higher mobility than that generally found in civilian life, both geographical and vocational, is also a feature of working in the Services, all of which impact on exposure assessment.

The review of Armed Services records systems made the following observations and conclusions.

There is a well-defined hierarchy for the implementation and interpretation of **health and safety policy** in the Armed Services, which is described in tri-service health and safety policy documents. However, there appears to be a lack of consistency in the application of policy in each Service, since each Service carries out its own interpretation of the health and safety policy document and thus may implement policy in different ways. For example, the reporting of accidents varies considerably between Services, including differing definitions of an accident and uses of computerised and paper record systems.

**Information on personnel administration and pay** within the Services can form a central part of any exposure assessment, from establishing when an individual was employed in the Services, to defining an individual's role at a specific location or time.

In occupational health studies it is necessary to be able to identify uniquely each individual employee. In principle this can be done using Armed Services' records. However, each Service arm has a different structure for Service numbers and uses different Service number formats for officers and ranks/ratings/airmen. Furthermore, additional useful information for uniquely identifying an individual, such as surname and forenames, may, of course, change. Thus there is a possibility that an individual may not be accurately identified, and that duplication of identification details may occur (although this is likely to be a rare occurrence).

The personnel systems record qualifications and training, which are useful indicators of skills and potential exposures; job descriptions also exist. However, specific skills and training may not actually be used by an individual within a particular posting or job; this is also encountered in civilian industry.

The current record systems within the Armed Services record postings, and some systems record movements within postings. However, there appears to be considerable potential for differences, both within and between Services, in the recording of postings and movements. In addition, there appears to be no method of reliably recording detachments from within a post in any of the Services. This may lead to a record indicating a posting to a particular job and location when in fact all of the employment during this period was elsewhere (i.e. during a detachment).

**Medical records** essentially provide a medical history and are not usually a primary source of information relating to exposure assessment. However, they may be potentially useful for confirming the location of individuals at a particular time period, for identification of individuals under health surveillance because of exposure to certain known hazards, and for providing information on particular exposures. There are a large number of forms on which medical information is recorded in the Armed Forces. All Services use the same medical forms, thus ensuring consistency, and all individual medical records are retained indefinitely. However, no computerised system exists at present to identify all people, either within a Service or across the Services, who have had a particular exposure, for example a vaccination, or who have been under health surveillance for a particular substance. Nor is it possible to identify easily groups of people suffering from a similar occupationally related complaint.

**Exposure monitoring**, including personal, fixed location and biological monitoring is carried out to a considerable extent across the three Services, both for regulatory purposes, and on an ad hoc basis. Radiation monitoring appears to be the most well developed system, with a complete record of an individual's lifetime occupational exposure to radiation being maintained, in both paper and computerised formats. Noise exposure assessments are also carried out regularly for particular processes or locations, using a standard form across all Services to record the results. However, they are not readily linkable to any individual audiometry measurements that may be carried out. Results from other monitoring procedures are usually presented in a hard copy report and retained by the Unit carrying out the measurements. Most of these do not record the individuals potentially exposed. These reports are usually retained, but are often filed by date or location, thus increasing the difficulty of identifying measurements for particular substances or processes. Risk assessments are a potentially useful source of data relating to exposures. Standard forms are used across the three Services to record these. However, there is no policy on archiving them and old assessments are usually discarded.

**Historical records** can provide valuable information about specific incidents and non-routine exposures, the location of specific units and their involvement in certain activities or operations. However, there are currently wide variations in the type and completeness of the historical records and the frequency with which they are made.

Three major groups of **users** of information in the Armed Services have been visited. They represented those who use the data to:

- fulfil a legislative duty;
- research potential adverse health or exposure problems; and
- collate data into meaningful and useful statistics.

The ability of users to carry out these functions was found to be limited by difficulties caused by deficiencies in the record systems and in the record retention procedures.

A small sample of **civilian industries** has been visited in order to compare the Armed Service record systems with civilian systems. All of these industries collect personnel, pay, medical and exposure data. Their systems all collect data for ongoing monitoring of health and potentially hazardous exposures that can be used for epidemiological research. They demonstrate that record systems that are both linkable and accessible can be developed for complex industries with large, relatively mobile workforces and a range of hazardous exposures.

This research project has investigated a number of record systems in the Armed Services that provide information relevant for exposure assessment. It has highlighted both general and specific problems that limit the potential usefulness of the records for this purpose and makes recommendations for improvements for the future. Some of the recommendations made below could be implemented in a fairly straightforward way, albeit at some cost and effort. Others address more fundamental issues, which may require a more comprehensive review and changes in policy. In addition to improving the records for use in exposure assessment, implementation of these recommendations would, in many situations, improve and enhance the general functions of the records.

# General recommendations

For each record system:

- Consideration should be given to whether systems should be identical across all three Services, that is whether comprehensive tri-service systems should be developed.
- The primary aims and purpose of each record system should be carefully defined and consideration given to potential secondary uses of the information held.
- There should be a clear retention and archiving policy, and procedures for implementing such a policy.
- The use of computerised record systems with adequate provision of data protection, in addition to, or as an alternative to, paper format should be considered.
- The purpose and nature of each data item should be carefully defined before inclusion.
- Record systems should be developed in such a way that they can be linked to each other.

# Specific recommendations

## All record systems

- When the record system contains data on individuals, there should be a unique way of identifying each individual, which does not change throughout the Service career.
- The same information should be collected for all individuals, regardless of status, and the same retention and archiving policies should be applied to the records, also regardless of the individual's status.
- No information on electronic databases with the potential for use in exposure assessment should be overwritten, and a continuous record of all changes should be maintained.

## Personnel systems

- A minimum data set across all three Services which uses the same definitions and codes should be developed.
- Consideration should be given to the development across the Services of a classification system for jobs and tasks which reflects the work carried out as closely as possible.
- Postings, movements and detachments should be comprehensively and consistently recorded.

## Medical records

- Consideration should be given to developing a clearer distinction between general health service provision and recording, and occupational health service provision and recording in the Services.
- Computerised medical records systems should be linkable to primary personnel databases such as those held by the Armed Forces Personnel Administration Agencies.

## Environmental monitoring

- Tri-service guidance should be developed for the reporting of environmental and occupational monitoring.
- Consideration should be given to developing a comprehensive tri-service computerised database which would provide an index of the reports of monitoring and be searchable by substances measured, location, process, job or task, and date.
- Development of a comprehensive computerised system for recording monitoring data and all associated data could be considered.

## Health and safety

- Health and Safety policy should be implemented in a standardised way across all Services for comparable jobs and tasks.
- There should be a tri-service policy to retain and archive all risk assessments.
- Serious consideration should be given to the linking of risk assessments made under the Control of Substances Hazardous to Health Regulations and other risk assessments to the records of individuals.

## Historical records

- Consideration should be given to the standardisation of the format and content of historical records with an agreed minimum data set, to be implemented across the Armed Services.

# Future research

This project has highlighted several areas which would benefit from further research, including:

- an in-depth analysis of current record systems for use in exposure assessment, including the overlaps and links between systems and across the three Services that includes considering the development of the minimum data sets that are required for different methods of exposure

assessment, the identification of sources of these data in the current Armed Service record systems and developments to improve and link the data systems thus identified;

- an evaluation of the limitations and potential of current record systems in the Armed Services for epidemiological research by carrying out some case studies, for example on malaria in Sierra Leone and on the potential exposures emanating from a waste site in Banja Luka, Bosnia.

- an evaluation of other systems, including civilian and non-UK military systems, for the collection and retention of exposure assessment monitoring data; and

- development of a tri-service database for cataloguing the reports of environmental and occupational monitoring, which would facilitate collation of all measurements carried out on particular substances or processes.

# 1 Introduction

Occupationally related illnesses and accidents are costly to society in both economic and human terms. Records, such as personnel, pay and medical, collected by industry play a key role in the monitoring of the health of a workforce and for conducting occupational epidemiology. Records are essential for enumerating groups of workers, for tracing workers and for carrying out exposure assessment. The retention of records is crucial both for investigation of diseases, such as some cancers that have long latency periods between exposure to the causative agent and disease diagnosis, and for the investigation of previously unrecognised problems.

Collecting data that can be used to evaluate occupational exposures for the Armed Services presents particular challenges. These include:

- the large numbers involved in the Army, the Royal Air Force (RAF) and the Royal Navy (RN);
- the wide range of jobs and tasks which are carried out by service personnel;
- the many health endpoints which may be of concern, ranging from infectious diseases, trauma, cancer and musculoskeletal problems through to psychological problems;
- the variety of potential exposures which may cause an adverse health effect; and
- the mobility of service personnel both geographically and between posts.

The aim of this project was to assess systems currently in use in the Armed Services and in selected examples in civilian industry, for the collection and retention of data relating to potentially adverse exposures.

In particular the objectives were to:

- enhance the health surveillance capability of the Defence Medical Services and the ability to relate health outcomes to exposures;
- determine current practice for both collection and retention of exposure data in each of the three Armed Services and to consider how these may be improved;
- identify the linkages and overlaps between health data and information collected in systems such as those covering personnel and pay both within and between Services;
- consider the design and complexity of research for which exposure information might be required and identify the data items necessary for this; and
- provide recommendations for the format in which data should be kept, how long they should be retained and where they should be kept.

Section 2 gives a brief overview of exposure assessment methodology and the data requirements for different approaches. Exposures that might be experienced in the Armed Services are also described. Section 3 describes the methodology used in the study. The findings concerning the information systems investigated are presented in Section 4. Section 5 evaluates the record systems investigated

with respect to their general strengths and weaknesses and their potential use for exposure assessment. Recommendations are made in Section 6. Section 7 highlights areas that would benefit from further research.

Owing to its restricted duration, this study was limited in the number of data systems that could be investigated and the depth to which each could be evaluated. The information presented in this report represents the practices in use at the time of the investigation, as ascertained by face-to-face interviews at visits by staff of the Institute for Environment and Health (IEH) to each of the Armed Service sections and related non-Service industries. However, the research team are aware that changes to some systems were in progress or may have been completed since visits were made.

# 2 Background

## 2.1 Methods of exposure assessment

### 2.1.1 Introduction

The World Health Organization (WHO, 2000) has defined the term *exposure* as "a contact over space and time between a person and one or more biological, chemical or physical agents", although psychological factors should also be considered, particularly in the military sphere. The collection and analysis of exposure data is a central element of any occupational health surveillance system, since, in addition to the monitoring of patterns of health in a workforce, it enables associations between potential risk factors and health outcomes to be identified and evaluated, and allows the effectiveness of any control measures implemented to be assessed objectively. Indeed, a lack of exposure data is the most commonly cited factor preventing the identification of causal associations between occupational risk factors and adverse health effects (Checkoway, 1991; Stewart & Herrick, 1991).

This chapter briefly reviews methods for assessing occupational exposures, and the types of data necessary for exposure estimation.

### 2.1.2 Approaches to exposure assessment

Exposure assessment involves estimation of both the intensity of an exposure and the duration of contact. Assessment can be prospective or retrospective, with the latter approach being most often used for studies investigating potential adverse health effects. Prospective exposure assessment allows decisions to be made as to the type, volume and quality of exposure data collected and hence enhances its potential usefulness for investigation of health outcomes. Retrospective exposure assessment is frequently necessary in studying health effects that occur many years after an exposure is experienced, and health effects that are unexpected.

Exposure data can be collected at a number of levels, ranging from basic, sufficient to demonstrate compliance with statutory requirements and allow a minimal level of exposure data retrieval and interpretation, through to complex research level, where data are collected in order to perform specific and detailed epidemiological studies (Harris, 1993). Several approaches to exposure assessment have been used in occupational studies. Although there are several possible exposure assessment classification schemes, a particularly useful one is that proposed by Checkoway (Checkoway, 1986; Checkoway *et al.* 1989) (Table 2.1). This scheme classifies assessment methods by increasing levels of complexity, from qualitative through to quantitative dose measurements for individuals.

**Table 2.1** Exposure classification scheme

| Category | Type of exposure data | Examples of data required* |
|---|---|---|
| 1 | Ever versus never | Date starting in an industry |
| 2 | Duration of employment or exposure | Dates starting and leaving an industry |
| 3 | Job categories by process division or task duration | Job title and description |
| 4 | Job categories ranked ordinally by exposure intensity | Job title and description and generic environmental monitoring data for ranking jobs |
| 5 | Quantitative exposure intensity categories | Environmental monitoring data for jobs/tasks, full work history including dates starting and leaving each job/task |
| 6 | Quantitative dose measurements | Personal monitoring data |

* These data are in addition to individual identification details

Categories 1 to 5 can be considered as surrogates for category 6, with the potential for exposure misclassification, that is, misclassification of exposed when actually non-exposed, and vice versa, decreasing from 1 to 6. The effect of exposure misclassification may severely affect risk estimates, particularly if risks are low, since the inclusion of healthy, non-exposed individuals in an exposed group will reduce any differences between the exposed and non-exposed groups. This may obscure any potential excess in health outcomes related to exposure. The effort and cost of obtaining the necessary data, are, however, likely to increase from categories 1 to 6.

Ever or never employed in an industry (category 1) is usually used in initial phases of an epidemiological investigation and allows comparison of the mortality or morbidity rates of workers with control groups to identify potential disease excesses. Although useful in identifying potential health effects of concern, and indicating a need for further investigation, there is a high potential for exposure misclassification, which may result in a decreased estimate of risk or may entirely obscure an increase in risk (Stewart & Herrick, 1991).

Duration of employment (category 2) is another common surrogate of total exposure and is useful when there is one hazardous exposure predominant in the workplace. However, such an exposure marker can only be reliably used when three conditions are met (Checkoway, 1986):

- exposure intensity is relatively constant throughout the work area;
- exposure intensity levels do not vary substantially over time; and
- assignments to jobs involving higher or lower exposed jobs are unrelated to employment duration.

Information such as job title and job descriptions can be used to categorise individuals into subgroups based on similarities in duties or tasks carried out (category 3). This allows identification of subgroups with high excess health risks, and hence may indicate the exposure of concern. This method is most appropriate when workers are assigned to one exclusive job category.

A semi-quantitative approach (category 4) ranks jobs according to relative exposure categories, for example, high, medium or low exposure categories. Categories 3 and 4 may result in misclassification of exposure if frequent movement between job categories occurs.

When actual measurement data exist, but are insufficient to assess exposure for individual workers, quantitative exposures (category 5) can be estimated for specific jobs and tasks or for groups of workers who are thought to be similarly exposed (homogeneous exposure groups).

Exposure measurements for individuals (category 6) are sometimes available from personal monitoring, for example for radiation. More often quantitative exposures are estimated using job- or task-specific exposure concentrations and the amount of time spent in each.

An important consideration in all methods of exposure assessment is the choice of an appropriate exposure measurement, the exposure metric. Cumulative exposure is the most commonly used metric but may not be so appropriate if, for example, the exposure is known to occur intermittently, or if it is peak exposures that result in a health effect. Hence, it is not only the level of detail of the exposure data, but also its relevance to the health outcome of concern, which is important.

### 2.1.3 Data requirements for exposure assessment

The data required for individual exposure assessment increase with category of assessment methodology from ever/never (category 1) to quantitative estimation (category 6). For all categories, it is essential to have a unique way of identifying each individual worker; for example, this could include surname, forenames and date of birth or simply be a unique identity number. Examples of types of additional data which would be required for the different categories are given in Table 2.1. These are likely to include a large number of data items. For example, environmental monitoring data would need to be supplemented with additional information which characterised the situation which was being monitored. This might include details of the location (size of site, processes and activities carried out), sampling and analytical methods, sampling device used, climatic conditions, frequency, duration and patterns of exposure, engineering controls (such as extractor fans or filters), and use of personal protective equipment.

An essential element of any exposure data collection system is also the ability to link exposure assessment information to the group of subjects to whom it corresponds. This may simply mean recording the details of those monitored or linking the data indirectly via, say, information on the location of exposure.

### 2.1.4 Summary

There are many different methods of assessing exposures and the choice depends on the availability of the data and the purpose for which it is required. The need for good quality data with which to estimate exposures is an essential element of any health surveillance system, facilitating the identification of associations between potential risk factors and health outcomes.

## 2.2 Hazardous exposures in the Armed Services

### 2.2.1 Introduction

The Armed Services employ a large workforce for whom good health and fitness for work are both essential. Ill health impacts on operational capability. A study by Thornton and Lubbock (1997) gives

an example of the contribution of occupationally related illness and injury to the burden of primary and secondary care in an operational military setting. Of 2301 consultations over six months at a primary care facility run by 16 Armoured Field Ambulance at Sipivo in Bosnia, 194 (8%) were the direct result of hazards encountered at work (Table 2.2). Those individuals suffering a sports-related injury were classified within the occupational category on the grounds that sport and fitness are a central part of military employment. Non-occupational injuries were defined as those occurring either while not at work or when under the influence of alcohol. In secondary care, 161 (38%) of a total of 428 admissions to a hospital squadron were occupationally related, indicating the more serious nature of occupational disease.

**Table 2.2** Breakdown of occupational illness consultations at primary and secondary care facilities, Sipivo, Bosnia

| Care | | Injury type | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Burn | Eye | RTA[a] | Sport | Training | Other injury | Other condition | Total |
| Primary | Number | 5 | 10 | 8 | 58 | 29 | 79 | 5 | 194 |
| | % | 3 | 5 | 4 | 30 | 15 | 41 | 3 | 101[b] |
| Secondary | Number | 6 | 7 | 13 | 63 | 26 | 42 | 4 | 161 |
| | % | 4 | 4 | 8 | 39 | 16 | 2 | 3 | 100 |

Adapted from Thornton and Lubbock (1997)

[a] RTA, road traffic accident; [b] Percentage greater than 100 due to rounding

The military workforce is generally young and fit with relatively few personnel exposed to the more traditional hazards of industry. However, there are many potentially dangerous materials and processes used in the military workplace, some of which are unique to the military. They are generally well controlled and, compared with other non-military occupations, total exposure is limited by the element of variety in most jobs (Thornton & Lubbock, 1997). Counter to this are the breadth and complex combinations of hazardous exposures that can be encountered in a military setting (see Section 2.2.2). Furthermore, during operational deployments the increased need for speed in carrying out tasks raises the potential for accidents to occur due to poor adherence to accepted procedures (Tharr, 1999). Table 2.3 illustrates the accident rates per 100 000 employees as reported by the Ministry of Defence (MOD) and Health and Safety Executive (HSE) (all sectors). It is clear that fatal accidents are far more frequent in the Services but that major and serious accidents follow the opposite trend.

**Table 2.3** Accident rates per 100 000 employees (1998/1999)

| Sector | Death | Major | Serious |
|---|---|---|---|
| MOD | 5.3 | 59.8 | 428 |
| HSE (all sectors) | 0.8 | 114.9 | 532.1 |

Adapted from MOD (2000)[*]

[*] MOD (2000) *Directorate of Safety, Environment and Fire Policy, 1999/2000 Annual Report*, available [December 2000] at http://www.mod.uk/data/DSEF.pdf

## 2.2.2 Exposure factors

The exposures encountered by civilian workforces tend to be relatively narrow within specific industries. In contrast, individuals in the Armed Services may be exposed to a wide range and combination of hazards. Table 2.4 summarises the natural, man-made and psychological hazards that may be encountered by Service personnel (May *et al.*, 2000). A more detailed list of hazards is given in Annex A. A broad range of potential health hazards that Armed Services personnel may experience is further supported by recent studies (McCauley *et al.*, 1999; Tharr, 1999) of activities in the Gulf conflict. Tharr (1999) looked at the safety and physical hazards in a 'tent city' in southwest Asia (Saudi Arabia). The hazards identified were deficient lighting, tripping hazards, electrical hazards, temperature extremes, hazardous plants and animals (scorpions, black widow spiders, centipedes, wild cats and dogs), hazardous chemicals (jet fuels and other hydrocarbons) and crystalline silica (sand) lifted from the soil surface by weather conditions. Furthermore, it was thought that food and water supplies could potentially be contaminated by terrorist activities thereby presenting another health hazard. The fact that a large number of people were co-located also meant that disease could spread quickly from person to person (Tharr, 1999). McCauley *et al.* (1999) highlighted possible exposures to oil fire emissions, pesticides (both supplied by the Services and those obtained locally), vaccines, prophylactic agents (such as pyridostigmine bromide, the active ingredient in nerve agent pre-treatment sets), and other drugs and exposure to dusts from working in a windy, desert environment (McCauley *et al.*, 1999).

**Table 2.4** Potential hazards in the military setting

| Hazard | Example |
|---|---|
| **Natural hazards** | |
| Biological hazards | Microorganisms: bacteria, viruses, parasites, fungi |
| | Animals: insects and reptiles (bites, poisonous skin secretions and venom), mammals (disease vectors or physical injuries from bites) |
| Climatic hazards | Heat: in hot climates, the main health hazards are heat cramps, heat exhaustion and heat stroke |
| | Cold: injuries include non-freezing cold injury, frostbite and hypothermia |
| Geological hazards | Volcanoes, earthquakes and tsunamis: violent volcanic and earthquake activity is relatively rare and limited to known areas of the globe |
| Geographical hazards | Drought and floods |
| | Altitude: acute mountain sickness, high altitude pulmonary oedema, cerebral oedema |
| | Cold water immersion: the main health hazards include hypothermia and 'cold-shock response' |
| **Man-made hazards** | |
| Physical hazards | Machinery, heat, pressure, noise, vibration, radiation, electricity |
| Chemical hazards | Hazardous chemicals, chemical weapons |
| Biological hazards | Micro-organisms, biological weapons |

| Hazard | Example |
|---|---|
| Ergonomic hazards | Lifting, carrying, work in confined spaces |
| Military activity | Injuries and exposure due to conflict and training |
| **Psychological hazards** | |
| | Stress, post-traumatic stress disorders |

Adapted from May *et al.* (2000)

## 2.2.3 Mobility

The requirement for increased mobility distinguishes the Armed Services from most civilian industries. For reasons of operational capability, the Armed Services must be geographically mobile. In addition, individuals serving in the forces are extremely mobile within their work, both day-to-day and throughout their career. From discussions during visits by IEH Staff to the Services (see Section 4), it has become clear that support for career development is a central ethos. In particular, commissioned officers are encouraged to gain experience in a wide range of duties, being posted to different roles on a regular basis. Units* are also periodically moved in order to allow them to gain experience in other duties or in the use of different equipment, for example, in the Army. Together, geographical and vocational mobility have an important impact on the ability to assess individual exposure to potential hazards.

## 2.2.4 Summary

Fulfilment of the medical requirements of the Armed Services results in a fit workforce with generally good health. However, occupationally related disease and injury can occur. A wide range of potentially hazardous exposures could be experienced. This, together with the increased mobility of the workforce (both geographically and vocationally), impacts on the assessment of individual exposures.

* A discrete subdivision of the Armed Services to which an individual can be posted

# 3 Methodology

Sources of data necessary for exposure assessment can be extensive and, within industry, cover a broad range of areas from pay and personnel systems, to medical data, procurement records and occupational hygiene data. To gain the understanding necessary to assess the data collection systems of any organisation requires opportunities to visit the organisation and learn about the systems directly from those who have developed and use them. In order to assess the systems within the Armed Services, a series of visits to sections with potential involvement in the collection of data relevant to exposure assessment was carried out to:

- establish what systems are used to collect potential exposure information;
- gain a detailed understanding of each system; and
- evaluate the potential use of each system to provide data for exposure assessment.

The Service Units and industries to be visited were identified by a variety of means, based on knowledge of the data necessary for exposure assessment, consultation with staff at the Defence Evaluation and Research Agency (DERA)[*], the internet, recommendations from Units visited and personal contacts. Before a Unit was visited, a project summary, outlining the project's aims and objectives (see Annex B), was sent to the Unit, along with a letter explaining the purpose of the visit. During each visit, a checklist was used (see Annex C) to facilitate consistency and comparability between visits, and to ensure important issues were not omitted. Following each visit, a draft report was made on the visit, describing the systems in use, and initially assessing each system for the purposes of exposure assessment. Each draft report was sent back to the Unit visited, in order that the report's accuracy could be checked. This enabled any necessary amendments or additions to be made, and acted as a quality control measure for each of the visit reports.

Initial familiarisation visits took place between May and June 1999, followed by a series of visits to Service Units and selected examples from industry, taking place between December 1999 and October 2000. A list of the Service Units and industries visited is presented in Table 3.1. The individual visit reports are presented in a separate volume (IEH, 2002). The individual visit reports were then used to gain an overall understanding of the systems in use which, intentionally or incidentally, collect and/or analyse exposure data in the Armed Services. This is presented in Section 4.

[*] Now Defence Science and Technology Laboratory

**Table 3.1** Service Units and civilian industries visited

| Unit | Date of visit |
|---|---|
| **Health, safety and environment policy** | |
| Directorate of Safety, Environment and Fire Policy | May 2000 |
| Chief Environment and Safety Officer (Army) | August 2000 |
| Army Medical Directorate, Medical Intelligence | May 2000 |
| Defence Logistics Organisation, Directorate of Defence Logistics Safety | July 2000 |
| Chief Environment and Safety Officer (RAF) | July 2000 |
| **Personnel and pay administration systems** | |
| Armed Forces Personnel Administration Agency Worthy Down | March 2000 |
| Unit Computing System (UNICOM) | August 2000 |
| Armed Forces Personnel Administration Agency Centurion | April 2000 |
| Armed Forces Personnel Administration Agency Innsworth | March 2000 |
| **Medical records** | |
| Surgeon General's Department | June 1999 |
| Army Medical Directorate | June 1999 |
| Director of Health, HM Naval Base Portsmouth | June 1999 |
| Directorate of Primary Health Care, RAF Innsworth | May 1999 |
| **Occupational exposure and environmental monitoring data** | |
| DERA Radiological Protection Service | June 2000 |
| Medical Operational Planning | May 2000 |
| Defence Logistics Organisation Equipment Support (Land), Hazardous Materials | July 2000 |
| Environmental Monitoring Team, Keogh Barracks | June 2000 |
| Environmental Health Team, Imphal Barracks, York | June 2000 |
| Occupational Health Centre, HM Naval Base Portsmouth | April 2000 |
| Institute of Naval Medicine | June 2000 |
| Flag Office Surface Flotilla Health and Safety Team, HM Naval Base Portsmouth | October 2000 |
| RAF Institute of Health | May 2000 |
| **Historical records** | |
| Army Historical Branch | September 2000 |
| Naval Historical Branch | October 2000 |
| Air Historical Branch | May 2000 |

| | |
|---|---|
| **Users of Armed Services information systems** | |
| War Pensions Agency | July 2000 |
| Gulf Veterans' Illness Unit | June 1999 |
| Defence Analytical Services Agency | June 1999, December 1999 |
| **Examples of data systems in civilian industry** | |
| Rolls–Royce | October 2000 |
| Imperial Chemical Industries | October 2000 |
| Westlakes Scientific Consulting | October 2000 |
| Health and Safety Executive | December 1999 |

# 4 Results

The findings from the visits to Armed Service Units to investigate their record systems are presented in Sections 4.1 to 4.6, which cover, respectively, policy departments, personnel and pay systems, medical records, occupational exposure and environmental monitoring data, historical records, and users of Service records. Section 4.7 describes the systems in use in selected comparable non-Service industries. For each of Sections 4.1 to 4.6 a separate table tabulates the function and purpose of each Unit visited, the data systems examined and their strengths and weaknesses. Annex D lists various forms that may contain potentially useful data for exposure assessment. Every attempt has been made to ensure the data presented here are correct. However, only a limited number of visits could be made during the duration of the project, and hence the following results may not represent the complete systems for each area described. Furthermore, it became clear during the project that changes are occurring or are proposed to some of the systems; the following sections provide information pertaining to the time of the visits by IEH staff.

## 4.1 Health, safety and environment policy

The overall responsibility for health and safety in the Ministry of Defence (MOD) lies with the Secretary of State for Defence. The development of MOD policy on health and safety matters is carried out in the Directorate of Safety, Environment and Fire Policy (D SEF Pol). The Services have a legal, moral and financial responsibility to ensure their personnel are protected (as far as practicable within operational constraints) from injuries and accidents. Table 4.1 gives details of the visits made to Units responsible for policy. Figure 4.1 shows the organisation of responsibility for health and safety.

The main driving forces leading to the collection and retention of exposure data in the MOD are:

- regulatory requirements for health and safety, which may involve collection of exposure data to demonstrate compliance with regulatory limits or processes;
- business efficiency and duty of care to protect the health of Service personnel, in order to maximise the number of individuals available for operational duties; and
- to ensure fair and appropriate compensation and avoid adverse publicity.

### 4.1.1 Safety, Environment and Fire Policy

The D SEF Pol directorate is responsible for health and safety policy for Service personnel and civilians employed by all Services, in the UK and abroad. The responsibility for health and safety may fall to different Top Level Budget (TLB) holders, depending on who is involved and the extent of the situation. Although all relevant UK health and safety policy applies to the Armed Services, derogations and exceptions can be granted. For example, asbestos may still be used in certain nuclear weapons because no suitable alternative exists. Health and safety requirements are codified in document Joint Service Publication (JSP) 375, which, in its current form, focuses on interpreting the legislation as opposed to application of the policies.

There has been a recent initiative to establish Safety, Health, Environment and Fire (SHEF) management audits MOD-wide based on an agreed SHEF Audit Code of Practice. D SEF Pol will act

as the audit authority for MOD as a whole and manage audits at the TLB holder level. The TLB holder will act as the audit authority for their respective area and can nominate a competent organisation to act as the audit authority in their place.

## 4.1.2 Implementation of policy

The responsibility for implementing policy lies with the Chief Environment and Safety Officers (CESOs) of each Service arm (i.e. CESO(Army), CESO(Navy) and CESO(RAF)). Each individual Service implements the policy according to their own arrangements and procedures and produces documentation specific to its situation.

This section outlines findings from meetings with the CESOs for each Service and other policy-related groups. Implementation of policy directives from D SEF Pol is achieved through a broad range of Boards and Committees with either MOD-wide or Service-specific responsibilities with which the CESOs relate. Safety, health, environment and fire safety is managed through an Environment and Safety Board structure headed by a Defence Environment and Safety Board. At the next level, functional boards oversee the development of policy and standards. Each of the Services, the Defence Procurement Agency (DPA), the Defence Logistics Organisation (DLO), the Permanent Joint Headquarters (PJHQ) and the Centre handle SHEF through their main management boards or establish an Environment and Safety Management Board. As outlined above, each CESO acts as the SHEF audit authority. For example, CESO(RAF) will act as the audit authority for the Strike Command and Personnel and Training Command TLB holders.

The Army takes JSP 375 as the authority for health and safety policy but produces Standing Orders for specific activities. The RAF codifies health and safety policy in its own guidance document, Air Publication (AP) 400, based on JSP 375, which is issued to all units who are then responsible for its implementation. The Royal Navy (RN)[a] currently has policy guidance set out in Book of Reference (BR) 9147, *MOD(N) Health and Safety Systems*; however, it is likely that JSP 375 will be used in the future.

The MOD has undertaken a review of JSP 375 and a project has been initiated to rewrite the document and also to make it accessible electronically. The revised document will supply line managers with the instructions and guidance necessary to implement legislative requirements[b].

### *Procurement*

Consideration of the health and safety aspects of equipment and materials begins at procurement. For example, the Land Systems Safety Board sits within the tri-service DPA and sets out the safety case for new equipment for land deployment. For all equipment and materiel, the primary criterion is effectiveness, but ergonomics, health, safety and environment must also be considered. The DLO manages in-service equipment. If health and safety issues arise with equipment and material currently in service, it is the DLO that must formulate and instigate changes to ensure safety. Owing to a shortage of available time, Institute staff were unable to visit DPA to gather more information on the issue of health and safety in the procurement phase.

[a] At the time of the visit, the CESO(N) department had become the Directorate of Defence Logistics Safety (D Def Log Safety) of the DLO. A new, smaller CESO(RN) department is currently being established, which will retain links to D Def Log Safety

[b] MOD (2000) *Directorate of Safety, Environment and Fire Policy, 1999/2000 Annual Report*, available (December 2000) at http://www.mod.uk/data/DSEF.pdf

## *Accidents, incidents and disease reporting*

Accidents are reported using MOD Form 2000; however, this may be difficult to use owing to the large coding book (JSP 442) required to complete it. At Units, a nominated individual (health and safety advisor) is responsible for entering accident information into the Central Health and Safety Project (CHASP) terminal. CHASP is a computer-based data gathering and reporting process, but both access to it and use are variable and it is implemented in different ways across the Services (see Section 4.6.3). For example, the RAF reports all incidents through CHASP whereas the Army only reports incidents resulting in more than one hour off duty. It is thought that diseases reportable under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) are not always reported in CHASP.

At present there is no incident reporting procedure which, if instigated, could help to prevent accidents occurring. There are 24 ways in which accidents can be reported in the Army (e.g. explosives-related accidents are not reported in the same way as road-traffic accidents). Although it is not necessary to standardise the way accidents are reported, CESO(A) is hoping to establish a standard way in which they are notified. This will involve establishing a dedicated focal point with a single telephone number, with subsequent redirection of incident or accident reports to the appropriate department or agency. The notifications would be logged along with the advice and recommendations given. These would be stored electronically and provide an auditable trail to follow-up notifications, reports and follow-up actions. There is a basic aim to establish a RIDDOR-type process.

The Surgeon General sets out policy regarding communicable disease control in the Armed Services. Any occurrence of a communicable disease must be notified to the appropriate reporting authority using the F Med 85 form. There must also be all necessary liaison with the appropriate civilian authorities. It is understood that, although communicable disease reporting is greatly encouraged, it is likely that unreported occurrences far outweigh those reported.

The Army Environment and Safety Board (AESB) uses the CESO(A) for technical advice. The main activity/aim of AESB is to reduce the rate of injury in the Army (i.e. force protection) and it addresses training, in-barracks, transport and radiological protection. Current figures show that the Army loses approximately 200 soldiers per year through fatalities or discharge arising from injuries and accidents while on duty. The target is to reduce this by 10% by 2002.

## *Hazard identification and risk assessment*

In addition to JSP 375 a general risk assessment procedure manual, a Control of Substances Hazardous to Health (COSHH) assessment manual and standard forms on which to record various surveys (on paper, not electronically) are also in use. Health and safety guidance establishes the need to identify hazards and, where necessary, assess the associated risks. Chapter 8 (Volume 3)[*] of JSP 375 describes how risk assessments and risk management should be performed and states that risk assessments should be reviewed periodically. Current practice for the retention of the assessments is that "Risk assessments relating to the work concerned need be held only for as long as they are current…" (JSP 375, para. 0833), and old risk assessments are discarded. However, where injury has occurred the risk assessment is retained, along with the investigation report, for five years. JSP 375 is currently being reviewed and in the future may include revised guidance on the retention of records.

[*] IEH was unable to review JSP 375 during the project

D SEF Pol has audited noise issues and CESO(A) has taken the lead on assessing musicians' exposures. Annual medical checks for those potentially exposed to high noise levels (e.g. musicians and range officers) include an audiometry test. Others at lower risk are tested biennially.

Another facet of force protection involves providing medical intelligence prior to deployment of personnel. For example, the Army Medical Directorate produce medical intelligence assessments. These are advisory rather than prescriptive documents that provide information on environmental conditions, diseases and disease vectors that may be present and an overview of the available medical capabilities. The principle aim is to allow for informed decision making as regards manpower management and the control of disease and non-battle injury.

### *Environmental protection*

Environmental protection issues are addressed in document JSP 445. The responsibility for ensuring compliance with discharge consents lies with the individual Unit. There are plans to establish a register of discharge consents. The MOD currently has a policy for carrying out land quality assessments of all MOD sites; see Section 4.4.2. MOD policy is in accordance with the MOD environmental manual JSP 418.

## 4.1.3 Summary

There is a well-defined hierarchy for the implementation and interpretation of health and safety policy in the Armed Services. However, there appears to be a lack of consistency in the application of policy, since each Service interprets the policy document JSP 375 to suit its specific situation. In the time available for this project it has not been possible to explore the detailed differences in interpretation and implementation between the Services. However, the differences in accident reporting and in the use of CHASP illustrate the potential differences that exist.

**Figure 4.1** Organisation of responsibility for health and safety in the Armed Services

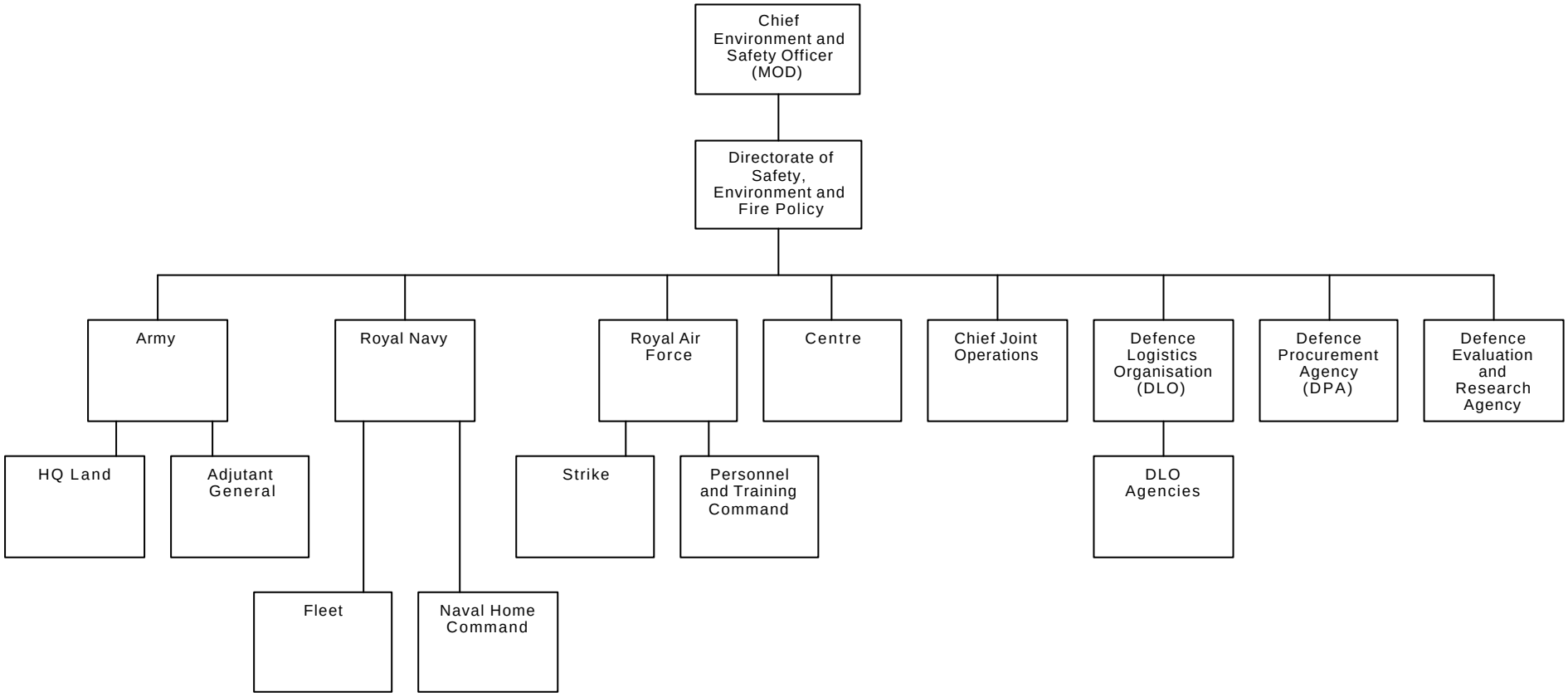


**Table 4.1** Summary of visits to policy units

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| Directorate of Safety, Environment and Fire Policy (D SEF Pol) | Responsible for tri-service health and safety policy | Produces the general MOD health and safety handbook, Joint Service Publication (JSP) 375<br>Also produces a general risk assessment manual, Control of Substances, Hazardous to Health (COSHH) assessment manual and standard forms for these<br>Holds a catalogue of personal protective equipment and its effectiveness | Handbook focuses on legislative requirements<br>Risk assessments should indicate any need for protective equipment | Handbook does not indicate how to implement the health and safety policies; local Service organisations can decide how to do this, resulting in lack of consistency and considerable variation between Units and organisations. Line managers have to indicate what arrangements and procedures have been put in place<br>No MOD policy on retention of risk assessments; old ones are mainly discarded |
| Chief Environment and Safety Officer, Army (CESO(Army)) | Interprets and implements policy directives in Army as set out by D SEF Pol | No collection of exposure data, since mainly policy oriented work | Land Systems Safety Board sets out safety case for new equipment (e.g. assessing potential exposures)<br>Army Environment and Safety Board aims to reduce injury/accident in the Army<br>Trying to unify incident notification in the Army<br>JSP 375 seen as central to health and safety in the Army | No incident (i.e. near miss) reporting system<br>Many ways to report an accident, depending on the situation<br>No historical record of past policy<br>Implementation of policy among top level budget holders (TLBs) may vary |

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| Defence Logistics Organisation, Directorate of Defence Logistics Safety<br>(Formerly CESO(N)) | Interprets and implements safety, health, environment and fire (SHEF) policy throughout the Defence Logistics Organisation | Limited collection of exposure data, since mainly policy orientated work<br>Collates ship pollution reports and reports on occurrences of fires<br>Collection of exposure data driven by regulatory and duty of care requirements, as well as desire to avoid adverse publicity | Well organised system for the implementation of SHEF and other policy<br>Collation of data on ship pollution incidences and all incidences of fires<br>On-going assessment of land quality of all decommissioned MOD sites | No co-ordination of collection and retention of exposure records (although some policy being developed)<br>Almost purely driven by regulatory requirements<br>Policy requires retention only of current risk assessments |
| Chief Environment and Safety Officer, RAF (CESO(RAF)) | Interprets and oversees implementation of SHEF policy within the RAF; assesses implications and influence of new policy | Limited collection of exposure data, since mainly policy orientated work<br>Old risk assessments should be forwarded to CESO(RAF) on decommissioning of an RAF Station/Base | Health and safety policy applies equally in the UK and overseas<br>Defence procurement requires safety case for each new procurement, including considering potential exposures | Implementation of policy among TLBs may vary and result in differences in record keeping<br>Variable compliance with sending risk assessments to CESO(RAF) on decommissioning of Station<br>No historical record of policy with which to interpret old risk assessments |

# 4.2 Personnel and pay administration systems

Personnel and pay record systems are the major source of basic demographic data on individuals in a workforce. They also commonly provide details of work or job histories. As outlined in Section 2.1, such information is central to exposure assessment. Table 4.3 summarises the visits to Units responsible for these systems.

## 4.2.1 Armed Forces Personnel Administration Agency

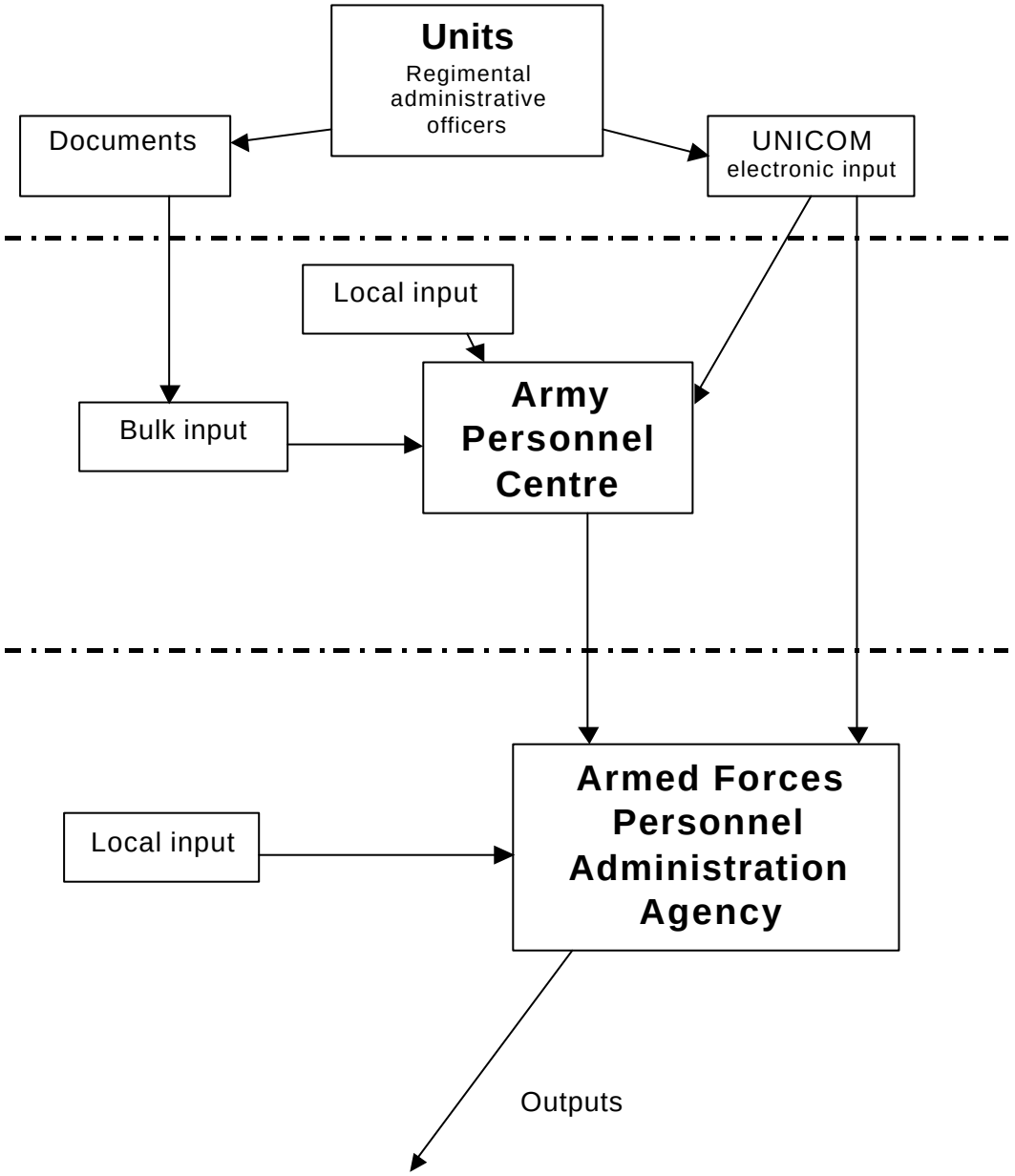
The Armed Forces Personnel Administration Agency (AFPAA) is the main repository for information on personnel, pay and manning in the Services. Each Service has a dedicated AFPAA branch; the Army branch is based at Worthy Down, the RN at HMS Centurion and the RAF at RAF Innsworth, where AFPAA Headquarters (HQ) are also located. Visits were made to each of the three AFPAA branches. The primary aims of AFPAA are to provide data and systems for the payment of military personnel and to support personnel management functions during times of peace (including crisis), transition to war and war. It is understood that AFPAA plans to establish a tri-service facility, rather than the current single Service systems. This Corporate Personnel Data System will aim to ensure that data items have the same definition and are used for the same purpose across the Services. Currently, information is being gathered on the data held on each separate AFPAA system with the aim of establishing a basic dataset common to all Services.

### *Army — AFPAA (Worthy Down)*

Unlike the AFPAA branches for the other Services, data and administration in the Army are split between AFPAA Worthy Down and the Army Personnel Centre (APC) in Glasgow. The APC is responsible for postings and ensuring Units are manned to their required strength. The term 'Unit' can refer to a Battalion, Company or a smaller denomination, depending on the make-up of the Unit. In general, a number of Units comprise a Brigade, and Brigades form a Division. Each Unit has its own 'establishment', that is a defined number of specific personnel. AFPAA Worthy Down is responsible for operating and maintaining the mainframe computer on which resides the pay records, Record of Service (ROS), pension and other records. Data are gathered at the Unit level, using the Unit Computing (UNICOM) system, and sent to APC and AFPAA Worthy Down. At present, therefore, pay and manning issues are separate; however, from 1 April 2001 the two functions will be combined. Pay will then be related more closely to an individual's role and achievements (e.g. training and qualifications).

The data flow from Units may be represented schematically (Figure 4.2).

**Figure 4.2** Flow of personnel, pay and manning data from Army Units



**Personnel**

The primary point of personnel data capture is at the Unit level. In the context of AFPAA Worthy Down, the term Unit refers to the data arriving at the mainframe from a specific UNICOM system. A UNICOM system may administer a single Unit (e.g. a Battalion) or several Units (as at Worthy Down). Individual records are held according to their Unit Identity Number (UIN). The record of each individual in the Army is held on a UNICOM system. The records of staff co-located with another Unit (such as Division HQ staff located at a regimental barracks) are administered by a single UNICOM. Data are generally held on both UNICOM and the AFPAA mainframe for the active service lifetime of the individual. Although pay and personnel information must be kept and maintained by UNICOM, other administrative areas such as stores, training and medical centres either use UNICOM inconsistently or have limited access to it.

Each soldier/officer has a personnel record established from the point at which they officially enlist (i.e. at the recruitment office). The APC establishes the ROS from information gathered by the Training Administration and Financial Management Information System (Recruitment); AFPAA Worthy Down holds the data and is responsible for data input and updating. All the data on the ROS are checked on a monthly basis by comparing field parameters with stored fields in a master file to identify erroneous entries.

The ROS is maintained after an individual has left the Army until their period as a reserve has expired; when an individual leaves the Army, information on their next-of-kin is deleted from their ROS. The ROS is stored electronically in perpetuity. Each individual's hard copy personnel file is kept at APC until they have no reserve value left, after which it is kept at the MOD archive in Hayes. An individuals' reserve value can vary widely depending on their qualifications and experience and can in some cases mean that an individual may be a reserve until retirement age.

Individuals are assigned a Service Number when they enlist; this remains fixed whether they leave and rejoin the Army, or whether they are reserves or in the Territorial Army and subsequently join the regular Army. If a soldier is promoted to officer their Service Number changes and some data, including their previous Service Number are transferred from their old ROS to a new officer ROS; non-transferred data are archived. The officer ROS also records National Health Service (NHS) numbers, whereas the ROS for other ranks does not. Service Numbers for officers and soldiers use different formats as described in Table 4.2.

**Table 4.2** Format of Army Service Numbers

| Status | Format of Service Number | Fictitious example |
|---|---|---|
| Officers (male and female) | Six digits, first five letters of surname | 123456CAPLE |
| Male soldiers | Eight digits, first five letters of surname | 12345678STUTT |
| Female soldiers (regular) | WO, six digits, first five letters of surname | WO123456BOTTR |
| Female soldiers (nurse) | Q, seven digits, first five letters of surname | Q1234567AYLWA |
| Female soldiers (Greenfinches) | F, seven digits, first five letters of surname | F1234567HUGHE |

The ROS holds information on the individual's trade and the post. However, the fact that someone is trained, for example in hazardous materials handling, does not mean they will necessarily perform that role in any posting. The Commanding Officer (CO) decides an individual's tasks in a Unit.

AFPAA Worthy Down was recently given the task of holding information on vaccinations for all individuals. This information is held on UNICOM, which also incorporates a messaging system that issues a reminder when an event (such as a vaccination booster) is due. As with other personnel data, information on vaccinations is sent from UNICOM to AFPAA. Work is also underway to store vaccination information on the ROS.

On discharge from the Army, soldiers are given a broad job description. This is aimed at helping the soldier find employment outside the Army but may be a means to establish, in general terms, an individual's activities while in service. The records of the Units and posts may also give some indication of the tasks and jobs involved in each posting.

#### Movements and location information

Army movements are generally on a Unit basis, but smaller groups or individuals (e.g. replacements) may be posted. The Army differs from the other Services in the diverse way Units can be deployed. The Directorate of Staff and Personnel Support (Army) (DSPS(A)) set Theatre Codes (e.g. Great Britain, 513; Belize, 011); a theatre is an area of the world in which an individual can serve. Headquarters (Land) notifies all those concerned that troops are required to serve in a particular theatre and maintains information on where Units are located through an Arms Plot (a highly classified paper document detailing Unit deployments worldwide). UNICOM and AFPAA Worthy Down use the same UIN and theatre codes.

For officers to move from one location to another, their respective Manning and Career Management Division (MCM Div) must issue a pre-posting order to the new location. This information is sent to AFPAA. On arrival at the new location, the officer is Taken on Strength by the new Unit and an occurrence giving details of this is sent to AFPAA via UNICOM. If the two sets of data match, the ROS of the individual is updated indicating the new location. If the details differ, the UNICOM occurrence is rejected by the AFPAA mainframe computer and the ROS will continue to indicate that the officer is at the old location.

When individuals move from Unit to Unit their UNICOM record is sent to the new Unit and a copy is kept by the old Unit. The receiving Unit should acknowledge receipt of the record. If no acknowledgement is received, the copy held by the old Unit is deleted after one year. When this transfer happens, information on the individual's duties and workplace at their former Unit are deleted from their record. There are remnants of former paper-based systems that still apply to UNICOM. For example, according to the Personnel Administration Manual, detachments from a Unit of less than 21 days duration need not be reported.

On operation or deployment, the maintenance and updating of personnel data may not be a priority. Systems such as UNICOM Out of Barracks (OOB) are being developed to ensure that the UNICOM facility is available when Units are deployed. A means for booking individuals into and out of theatre, known as AP3, with a link to the general personnel data systems is also being considered.

### *RAF — AFPAA Innsworth*

The function of AFPAA Innsworth, like all the AFPAA centres, is to assess the correct pay and pension entitlement for Service personnel and store information to enable identification of who is currently fit for service or deployment.

### Personnel

On enlistment, all RAF personnel are assigned a Service Number, which is unique to that individual and consists of seven digits and a letter. The number does not change, regardless of rank, with only the letter moving to indicate whether someone is an officer or airman; a letter at the beginning indicates an airman and at the end indicates an officer. There are three main personnel records for individuals:

- AFPAA Innsworth computer record — numerous fields and data items;
- Personal Dossier — a paper-based file including correspondence, medical correspondence, records of postings and deployments, etc.; and
- Appraisals — career management information which is held on the mainframe and in the individual's Personal Dossier.

Entries to the computer record either overwrite previous information (such as dental fitness) or are archived within the system (i.e. the system keeps a history of entries). However, for some information there may be a limit to the number of earlier entries that can be stored. Since the 1960s, information has been retained on computer and it is therefore possible for *ad hoc* searches to be made. Paper-based records are stored by name and Service Number, and searches for individuals are therefore possible. Searches for information on all individuals who were at a particular location or Unit, for example, would be more problematical. All computer pay and personnel records are archived when an individual leaves. The paper personnel records for Airmen are retained for seven years after the last entry and are then destroyed. However, a summary sheet is retained indefinitely. For officers, the complete paper personnel records are retained indefinitely.

Links between the AFPAA system, and medical and dental primary health care are being explored through the Station Administration Management Aid system. The AFPAA Innsworth mainframe writes to and receives information from Unit medical systems; basic personnel information is obtained by linking with the systems at AFPAA Innsworth, which also enables limited medical data (e.g. Medical Employment Standard) to be obtained for the personnel record. However, this is currently at a pilot stage. Only officers have their NHS numbers recorded routinely; it is planned to obtain NHS numbers for new recruits in future, but not to store them on the mainframe computer.

### Movements and location information

In general, RAF personnel are posted to fixed locations and the posting is recorded in their mainframe record and Personal Dossier (fixed deployment). If a Squadron is deployed it is usually assumed that everyone in the Squadron is posted, although some individuals may be on detachment or sick leave and hence not deploy. It is also possible to post individuals (non-fixed deployment). Individual postings, are generally recorded, although it is possible for this not to occur. Normally, individuals are provided with a drafting note, which will record where they are being posted. If the individual works on an aircraft, the type of aircraft will be indicated on the drafting note for Airmen who are Corporals or a higher rank. A copy of this note will be filed in the Personal Dossier.

An individual's role during a posting can usually be ascertained from the Posting Identification Code (PIC), which identifies the Unit and job. PICs have only been allocated for airmen since 1997, and how an individual is employed at a station is ultimately the decision of the Station Commander. Specific information on what an individual may have done day-to-day is not recorded.

Currently, deployments are controlled through RAF Innsworth. Requests for deployment are made to RAF Strike Command, which allocates Squadrons to the deployment. The Squadron then decides

which individuals will be deployed and this information is entered on to an Operational Management Information System (OMIS), and the data are simultaneously fed back to the Personnel Management Agency (PMA). This is referred to as a 'Formed Unit Move'. The situation is more complicated when a deployment comprises individuals from different Units. This is called a 'Non-formed Unit Move' and is controlled by the PMA which decides which individuals to deploy and enters the information on to OMIS.

If a Unit is to be deployed the RAF aims to use a Deployed Administration Group (DAG), which has the task of keeping track of individuals on deployment. This is carried out using a Theatre version of the OMIS (TOMIS) terminal, which is linked to the main system at RAF Innsworth.

Generally, the PMA is most concerned about who is deployed in theatre if the operation results in casualties. The location of an individual on a day-to-day basis is only required by the parent Unit, and may therefore not be systematically recorded on TOMIS. The most reliable data held by AFPAA Innsworth are at Unit level. Manual records would be needed to obtain more detail of day-to-day movements. On operation more detailed data may be stored on paper records, but these may be destroyed at the end of the tour.

## *Royal Navy — AFPAA Centurion*

AFPAA Centurion has two main functions: to pay RN and Royal Marine personnel, and to provide a system to underpin the posting of Service personnel (the latter is handled by the Naval Manning Agency (NMA)). Two key computer systems are used: Pay, and the Naval Manpower Management Information System (NMMIS).

### Personnel

As with the other Services, all RN personnel have a unique Service Number. The structure of the Service Number for Officers is different from that of numbers for ratings; if promoted a rating will be assigned a new Service Number, with the structure for an officer.

AFPAA Centurion collects and retains a broad range of personnel data on each individual on both the Pay and NMMIS systems (about 90% of the data are common to the two systems). The information includes demographic data, as well as data necessary for career management, such as qualifications, previous postings, etc. Data are entered on the systems by one of two methods: completion of a Computer Form by a Unit Personnel Office which is sent to AFPAA Centurion for entry into the system; entry into a computerised Personnel Administration System, recently issued to self-accounting Units to allow them to enter data directly, which then automatically updates Pay and NMMIS. The latter method aims to reduce errors in the pay and NMMIS systems as checks will be made at the Unit level. AFPAA (Centurion) also maintains a hard copy Personnel Record File (PRF) for each individual, which will contain copies of certain legal documents, such as their recruitment form.

Like other Services, the Navy operates in Units which, for the purposes of AFPAA Centurion, are discrete entities to which an individual can be posted. Each Unit has a Scheme of Complement (cf. Army establishment), which is a list of every job, specialisation or qualification required for that Unit. This information, along with information in NMMIS, is used by the NMA to identify and fill each post, and may be sufficient to identify the job an individual has been carrying out. However, some aspects of an individual's job may be reflected in their rank, for example Petty Officer Radar.

When an individual is discharged, their Pay record is moved to a discharge computer file and then is archived from Pay 18 months post-discharge. It is retained for seven years for tax purposes, but data

items are gradually deleted, and by ten years post-discharge the record holds only minimal information. This archive record is then held on tape. The NMMIS files, however, are printed out at discharge and are placed into the individual's PRF, which is then sent to Hayes for archiving. The NMMIS files themselves are archived to tape at the point when an individual (rank or officer) has no further reserve liability.

In addition to the computer personnel records, each individual rating has a Service Certificate (SC) and History Sheet. The SC records a rating's postings (but not Movement Occurrence Reports (MOR); see below), Hurt Certificates issued, medals and promotion records, and their History Sheet provides details of the work they undertook during their drafting. Both of these records are paper records and are retained at the individual's Unit. For those ratings on a ship (but not a minesweeper, survey vessel or submarine) these records are held onboard. If a ship is sunk, then both records are lost, although the SC (but not the History Sheet) can generally be reconstructed from data held at AFPAA Centurion. When a rating leaves the RN they are given their SC and History Sheet. A copy of the SC is retained in the individual's PRF and by AFPAA Centurion before being forwarded to the Public Record Office (PRO) after 75 years.

Personnel files are also maintained at a Unit level. However, on discharge, much of the information in the files is destroyed and the remaining papers are sent to AFPAA Centurion for inclusion in the individual's PRF.

Ships and submarines at sea maintain a Souls on Board list, which lists all those currently on board by name, rank and service number. These lists and updates, recording changes, are sent to AFPAA Centurion. However, only the most up to date list is retained, mainly to avoid confusion if a ship or submarine were to be lost.

#### Movements and location information

There are two sources of information on movements and location available from the Pay and NMMIS records. One is the MOR. In the RN, pay is related to the type and location of each Unit. For example, charges are not made for food and accommodation in a sea-going Unit, but are in shore Units. One of the functions of an MOR is, therefore, to alter the main Pay record and update allowances. Movements away from a Unit for more than 24 hours are thus often recorded. MORs are used in both peace and operational situations. An MOR indicating arrival at one location should correspond with another MOR indicating departure from another location, although there is sometimes a mismatch. The movements of ratings are thought likely to be more accurate than those of officers, since the MORs are made on their behalf, whereas officers have to make their own MORs. In addition, a movement not affecting pay may not be recorded, for example moving between minesweepers in a group. The MORs are included in the data items that are deleted from the pay record after an individual leaves the RN.

The other source of movement information is data on the individual's postings, which includes their Unit and posting dates. However, this information will not be very detailed, may cover several years, and may not reflect actual locations and jobs.

Searching of the current records held in the Pay and NMMIS systems is possible by most parameters and is frequently carried out to provide information for various authorities. For example, it is possible to identify who was on a ship on a particular day or to identify all artificers who have served in a particular submarine. This would be particularly useful for epidemiological studies in enumerating any potential cohort.

## 4.2.2 Summary

Information on personnel administration and pay can form a central part of any exposure assessment, from establishing whether or not an individual was employed in the Services, to defining an individual's role at a specific location or time. All levels of exposure assessment require information about the individuals or groups of individuals being studied, such as date of birth, Service Number, training and qualifications, their postings to Units and locations, and the dates of these postings.

The AFPAA systems were designed to administer pay and personnel functions. Although they are able to provide much of the information necessary for exposure assessment this was not part of their original remit. The following discussion thus summarises these systems from the perspective of their use for exposure assessment rather than their primary functions.

### *Service Numbers*

Each Service arm has a different structure for Service Numbers, and within each Service, numbers for officers are different from those of ranks/ratings/airmen. This difference in Service Number between officers and ranks is most pronounced in the Army and Navy where, on commissioning, completely new Service Numbers are issued; in the RAF only the position of the proximal letter moves. This system may have some advantages for exposure assessment in that it is possible to distinguish immediately between officers and ranks, who may by virtue of their roles, experience differing exposures. However, this is outweighed by the danger that the complete change in the number during a career might hamper identification of an individual. Furthermore, the differing structures of the Service Numbers between the Service arms may also hamper across-Service studies.

### *Jobs and tasks*

The systems collect some information on jobs, qualifications and training. It may be possible from job title and posting to define approximately what a job entailed (particularly in the RAF and RN). For all the Services, the fact that an individual is trained for a specific task does not mean he or she will perform that task, either regularly or at all. For example, training in the handling of hazardous materials does not necessarily mean that hazardous materials are handled as part of a particular posting. The decision as to what tasks are performed rests essentially with the CO of the Unit to which an individual is posted.

### *Consistency and validation*

Basic information, such as Service Number, name and date of birth are consistently stored by all Services. However, other information held on an individual may vary both between Services and between ranks and officers. For example, NHS numbers are held on computer file for RAF officers but not airmen. The NHS number could prove useful for an exposure assessment study both as a unique identifier and because it may facilitate the identification of civilian medical records for discharged personnel.

The retention of hard copies of personnel records also varies between and within the Services and is often dependent on seniority. For example, in general, the personnel records retained for officers are usually far more detailed than those for other ranks. In the RAF, all computer records are archived, whereas in the RN the pay record, with many data items deleted (including movement data), is only retained for seven years.

### *Movements and location information*

Each Service may post complete Units or individuals and smaller groups. The RAF and RN focus more on equipment (e.g. ships and aircraft) with the aim of manning that equipment, whereas the deployment of personnel in the Army is more diverse. Tracking the locations of groups, Units and individuals is important both operationally and for the purposes of exposure assessment. The latter has proved a problem, for example, in the investigation of the Gulf conflict (see Section 4.6.2). The systems used by the Services are designed purely for administrative considerations (i.e. knowing where someone is in order to pay them or be able to move them to a new location to fill a task or role).

From discussions with the AFPAA groups, it is clear that, on the whole, information on movement and postings is generated according to defined procedures and differs considerably between Services. However, there can be occasions where movements occur that are not reported or where errors occur, in which case the movement is not correctly recorded. For example, there may be *ad hoc* movements of personnel between RAF stations agreed between Station Commanders. Army officers are pre-posted by their MCM Div but if the information recorded on leaving a post does not concur with information recorded at the new post the record of location may be erroneous. There may be instances where an individual is detached from a Unit but it is not reported because operating procedures are based on paper-based rather than electronic transfer of information. This sort of problem becomes even more acute during operational situations. Furthermore, the movement and location data (e.g. posting) may not correspond to an individual's actual location at any particular point in time.

**Table 4.3** Summary of visits to Units concerned with personnel and pay

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| Armed Forces Personnel Administration Agency (AFPAA) Worthy Down | To pay Army personnel and to provide a system to underpin the posting of Army personnel | Comprehensive demographic, drafting, movement and pay data for all full-time Army personnel<br>AFPAA Worthy Down also responsible for a planned field support system to log individual soldiers/officers in and out of theatre<br>Information flow comes from Unit level (via Unit Computing (UNICOM) system to the Army Personnel Centre and then to AFPAA Worthy Down | Current demographic data on Army personnel<br>Data on postings (by Unit Identity Number)<br>Record of Service (ROS) stored electronically for perpetuity (for both ranks and officers) and searchable by most fields<br>ROS holds information on an individual's qualifications<br>System allows for Service Number of soldiers promoted to officer to be held on ROS<br>All data on ROS are checked on a monthly basis by comparing field parameters with stored fields to identify erroneous entries | Movement data are not always accurate<br>Errors are not addressed at Unit level so may accumulate and continue<br>Army tends to operate in scattered Units<br>Trade or qualification not necessarily representative of day-to-day job<br>Data-sets not identical for officers and soldiers<br>Promoted soldier does not keep same Service Number |

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| Unit Computing (UNICOM) | Provision of Unit-based software and hardware support for pay and personnel, stores, accommodation, rationing, training and operations | UNICOM records pay and personnel information and updates the AFPAA mainframe; information held includes personal information (medical, dental, vaccinations), next-of-kin, clothing supplied, training, qualifications, pay, punishments, pensions, leave | Pay and personnel information must be kept and maintained by UNICOM<br>Records for all serving Army personnel are held on UNICOM<br>Can be used out-of-barracks<br>Uses same Unit Identification Number and Theatre code as AFPAA<br>UNICOM systems held at Units can be queried (e.g. by individuals, location, rank) by central UNICOM<br>Record follows individual when posted to new location; 'losing' system keeps copy of record until acknowledgement from 'gaining' system | Certain areas (e.g. stores, training) do not use UNICOM consistently; not all medical centres have UNICOM<br>Information is not usually held on Unit UNICOM once an individual leaves a Unit<br>Remnants of manual data handling process (e.g. detachment less than 21 days not reported)<br>If no acknowledgement from 'gaining' system, 'losing' system deletes the copy UNICOM record after one year<br>Information on individual's duties and workplace are deleted when they are posted to new Unit |

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| AFPAA Centurion | To pay Naval personnel and to provide a system to underpin the posting of Naval personnel | Comprehensive demographic, drafting, movement and pay data for all full-time Naval personnel in two systems: Pay and the Naval Manpower Management Information System (NMMIS) | Current demographic data on serving Naval personnel<br>Data on movements of all Naval personnel<br>Computer records searchable by most fields (e.g. Units/ships)<br>Same system used in peace and operational situations<br>Identical data-sets and retention policies for officers and ranks | Movement data not always accurate (especially in operational situations)<br>Deleting of data in Pay file and archiving of NMMIS file at Hayes<br>No linkage with other systems<br>Change of Service Number on commissioning |
| AFPAA Innsworth | Pay and manning of the RAF | Comprehensive demographic, posting, movement and pay data for all RAF personnel | Summary personnel record kept indefinitely for each Airman<br>Records stored by Service Number and surname<br>All computer personnel and pay records archived when individual leaves<br>Complete officer records retained indefinitely | Number and types of field differ for Airmen and Officers (e.g. National Health Service (NHS) number currently held for Officers only)<br>Limited number of entries achieved in some fields (e.g. may only hold last five entries in history)<br>Inconsistent retention of hard copy of personnel records: Airmen's records destroyed seven years after last entry; Officers' records kept indefinitely |

# 4.3 Medical records

## 4.3.1 Introduction

Medical records essentially provide a medical history and are not usually a primary source of information relating to exposure assessment (unlike, for example, personnel records and environmental monitoring systems). However, they may be potentially useful for:

- confirming the location of individuals at a particular time period;
- identification of individuals for whom, through regulations such as Control of Substances Hazardous to Health (COSHH), health has to be specially monitored because of exposure to certain known hazards; and
- providing information on exposures experienced.

The medical records systems within the Armed Forces have been investigated in detail concurrently by other research groups during this project. This report will therefore only give a brief overview of the medical records in use and will focus on those of potential relevance to exposure assessment. Table 4.4 summarises visits made to groups dealing with medical records.

## 4.3.2 Overview of Service medical records

The medical service provided to the Armed Forces fulfils both the function of a general health service, that is primary and secondary care, and an occupational health role, ensuring fitness to serve. In the Armed Forces there are essentially three medical record systems. There is a personal medical record which is held in the Unit Medical Centre and follows personnel around on posting. There is the hospital casefile, which, as in civilian practice, is retained by the hospital in which the patient was seen and does not routinely follow the patient. Finally, there is the Field Medical Record system for use on operations and exercises.

There are a large number of forms, many of them in the F Med series, on which patient medical notes and other information is recorded. The Personal Medical Record F Med 4 (a buff coloured envelope) is used to store notes by medical officers, hospital in-patient and outpatient summaries, Medical Board proceedings and results of tests, X-rays and medical examinations, including those carried out under regulatory surveillance schemes. Also recorded (on the outside of the FMed 4) is the individual's grading under the PULHHEEMS (Physical Capacity; Upper Limb; Locomotion; Hearing (left and right); Eyesight (left and right); Mental Capacity; Stability (emotional)) system, which is an assessment of an individual's medical condition or physical limitations relating to their overall health and fitness to deploy. During operational or exercise deployments the Personal Medical Record is held at the Unit's UK base for the Army and RAF, but is held onboard ship for members of a ship's company.

Service personnel from the RAF and Army are also issued with a Personal Medical Summary booklet (B Med 27) which provides basic medical details, including records of immunizations received, summaries of important medical events and allergies, when personnel are in transit or detached from their Units. This forms part of the Field Medical Record system which is used when forces are deployed in the field. This system principally focuses on emergency and hospital care, for example clinical observations, surgical operations and test results, rather than the recording of information relating to minor injuries and illnesses.

Examples of forms held in the Personal Medical Record which may hold useful information relating to exposures are (i) F Med 219C, the Radiation Medical Examination Record, and (ii) COSHH Medical Surveillance and COSHH Health Surveillance Records (F Med 143A and MOD Form 933F, respectively). On the F Med 291C, the type of radiation exposure and duties, the exposure dose since last examination and the cumulative dose are given for the individual. FMed 143A is a medical surveillance record on which details of medical examinations carried out on a regular basis are recorded. The FMed 143A gives details of the Unit/establishment, the location of the process, the nature of the process on which they are employed and the hazardous substance(s) to which they are exposed. The MOD Form 933F records, in addition, location of employment, job title, dates of starting and finishing work, who is carrying out the health surveillance and the results (i.e. fitness for work) and recommendations of the surveillance. This is an example of forms generated by different Service sections which record very similar information.

There are several computerised systems for recording primary health care information, including the Primary Health Care Information System, which uses the Egton Medical Information System software. This holds information such as demographic details, date of last medical, PULHHEEMS grade, vaccination record, past medical history, test results, etc. The information can vary between Units or stations, as can the retention of historical data. In addition, the system is not universally used throughout the Services. The function of the system appears to be to facilitate recording of information from medical appointments, rather than to provide a complete computerised primary health care record.

The current hard copy medical records systems have two main advantages over other systems in the Services:

- all Services use the same medical forms thus ensuring consistency; and
- all individual medical records are retained indefinitely (in a variety of locations depending on the Service).

Although the medical record system appears to operate well in a peace-time situation, problems arise during operational deployments. Some examples of this are given in the description of the problems encountered during the Gulf conflict[*]. For example, although the Personal Medical Records were not generally supposed to be taken out to the Gulf, some Units took them, tried to return them and lost them in transit. The BMed 27 was variably available but was not consistently used by the three Services.

All medical records, both hard copy and computer records, are archived after an individual leaves the Armed Services and are retained indefinitely.

## 4.3.3 Summary

In general, given a Service Number and name it should be possible to retrieve medical records. However, no computerised system exists at present that would facilitate the identification of all people who had had a particular exposure, for example, a vaccination, or were under health surveillance for a particular substance, nor is it possible to identify easily groups of people suffering from a similar complaint. Examples in civilian industry where it is possible to do both of these are given in Section 4.7.

[*] MOD (2000) *Medical Records in the Gulf,* available [December 2000] at http://www.mod.uk/index.php3?page=978

**Table 4.4** Summary of visits to Units concerned with medical records

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| Surgeon General's (SG) Department | Tri-service policy-making directorate for the Defence Medical Services<br>(i) Medical programming and plans<br>(ii) Defence and nursing services<br>(iii) Medical finance and secretariat<br>(iv) Medical training and policy | SG develops the policy for medical records | Medical records fairly complete in peace time situations | Identification of those deployed to a particular operation is likely to be incomplete because the recording of short term attachments is patchy and inconsistent |
| Army Medical Directorate | Provision of medical services | (i) PULHHEEMS, a fitness for work medical classification, and (ii) the J97 primary health care record system — a monthly return of counts of attendances at all medical centres | PULHHEEMS is administratively easy to apply | |

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weakness of data/system |
|---|---|---|---|---|
| Director of Health, HM Naval Base Portsmouth | Provision of medical services | Navy primary care begins with the Joint Service Publication 346 standard medical recruitment form. The same F Med forms as other services are used for all medical matters. Risk assessments are carried out by naval health inspectors. The same Control of Substances Hazardous to Health (COSHH) and risk assessment forms are used as other Services. A Primary Health Care Information System is used in nearly all shore units. On deployment the whole medical record is taken with the Unit | | |

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weakness of data/system |
|---|---|---|---|---|
| Directorate of Primary Health Care, RAF Innsworth | Provision of medical services to the RAF | Routine medical on joining and at various intervals thereafter, depending on health and safety requirements. At each visit data on smoking, alcohol consump tion, exercise, etc. are recorded. Electronic system for medical records (Primary Health Care Information System), and a computerised accident recording system, the latter collated centrally for all three Services (Central Health And Safety Project)<br><br>Each RAF station has a Health and Safety officer, usually a civilian, and a Health and Safety committee. During operations the responsibility is taken on by a military staff member | Computerised medical records system can be linked with the personnel system | |

# 4.4 Occupational exposure and environmental monitoring data

## 4.4.1 Introduction

Measurements of occupational or environmental exposure are particularly useful for exposure assessment since they provide quantitative information on the level of a hazard to which an individual may have been exposed. This can be informative for establishing the levels of exposure at which a health effect occurs and for developing risk reduction strategies. A number of MOD organisations and Units were therefore visited to establish the type and extent of exposure measurement data collected. The establishments visited included: the Royal Navy Occupational Health Centre; the RAF Institute of Health; the Army Environmental Monitoring Team; the Institute of Naval Medicine (INM); the DERA Radiological Protection Service (DRPS) and other establishments, which, in addition to other functions, also collect some occupational or environmental exposure measurement data. Below is a description of the data collected according to the hazard of concern. A summary of the visits to each establishment is presented in Table 4.6.

## 4.4.2 Chemical exposures

### *Occupational chemical exposures*

UK law requires employers, including the Armed Services, to control exposure to hazardous substances to prevent ill health. They have to protect both employees and others who may be exposed by complying with the COSHH Regulations 1999 (HSE, 1999). In the Services, COSHH assessments are usually carried out by a line manager or Unit Health and Safety Advisor, and are made for a specific substance and/or process using MOD Form 911, *COSHH Assessment.* The assessment includes a description of the process and substances involved, a list of the routes by which exposure may occur, conclusions of the risk assessment and the dates at which the assessment should be reviewed. Once completed the current COSHH assessment is retained locally and previous assessments are discarded. Some previous assessments may be retained if there has been a problem with a process or an accident has occurred. However, the practice of retention of assessments varies considerably within the Services.

If a COSHH assessment is particularly complex or there is a need to determine whether exposure to a substance is within statutory limits, it may be necessary to carry out monitoring for the substance of concern. This monitoring is carried out by one of the specialist Units with environmental monitoring expertise, on an *ad hoc* basis, and the results of the monitoring presented in a paper report with copies of the report being provided to the customer and being retained by the Unit. Results of the monitoring are not generally recorded electronically, and whether individuals monitored are identified in the reports varies between Units.

Exposure to some substances may occasionally require routine monitoring under COSHH. However, this is generally only carried out when there is thought to be a continuing exposure problem. When required, MOD Form 933E, *COSHH – Routine Exposure Monitoring*, is completed, which records the name of the individual or location monitored, the method of monitoring and the results. On completion, the form is sent to the line manager or Health and Safety Advisor concerned, who will retain the results along with the COSHH assessment. Furthermore, an individual may require routine health surveillance or routine medicals as a result of their exposure to a particular substance. These are recorded on either MOD Form 933F or F Med 143A, both of which will indicate the substances

involved and be retained in the individual's medical records. However, the medical record will not include a COSHH assessment.

### Biological monitoring

In addition to the monitoring described above, the INM analyses a large number of biological samples for a range of substances including thallium, for individuals involved in the Sting-Ray Advanced Lightweight Torpedo programme; lead, for individuals such as Firing Range Officers; and chrome, nickel, and cadmium, and mercury for RN dental staff. The results of the analyses are reported to the Unit of the individual, and are maintained indefinitely on a database at INM, including details of the individuals exposed (name and Service Number) and the location of the exposure.

### Material Safety Data Sheets

The Material Safety Data Sheets (MSDs) for substances used may provide a useful source of relevant data for exposure assessment, since they include detailed information on the identification of the substance and the manner in which it should be used. Currently, the majority of MSDSs for substances used in the MOD are collated onto a CD-ROM called the Hazardous Stores Information System (HSIS). Records of all previous versions of the MSDSs are maintained on the HSIS. These could provide positive confirmation that a substance was in use in the past and provide details on the advice given at the time on how it should have been used. However, information on where a substance was used, when it ceased to be used or was replaced by another is not recorded.

### Submarine atmosphere monitoring

Submarine atmospheres are monitored on a regular basis for both organic and inorganic constituents. Monitoring of 'permanent gases' (oxygen, carbon monoxide, carbon dioxide, hydrogen, Freons 12, 114 and 1103, benzene, and total aliphatic and aromatics) is carried out on a continuous basis, with readings being taken every four hours and recorded in an Atmosphere Control Log. Copies of the completed log are sent to INM, and stored in paper format, according to submarine and date, and entered on to a computer. All data pertaining to nuclear submarines are held on computer and both the computer and paper records are retained indefinitely. In addition to the monitoring of 'permanent gases', periodic monitoring of the atmosphere using Tenax tubes is also carried out to monitor other organic contaminants that may be present in the atmosphere. Sampling is performed every time a submarine has dived for three days or more, and the resulting tubes returned to INM for analysis. The tubes are analysed for a range of contaminants which may be of toxicological interest or which indicate the effectiveness of the air purification systems. The results of the Tenax tube analyses are presented in paper format, stored by submarine and date, and are retained indefinitely.

### Asbestos

Although there is no routine monitoring of asbestos, if an individual suspects they may have been exposed to asbestos they can choose to complete an Asbestos Personal Record Annotation form (MOD Form 960). This is a self-certification form which provides descriptive details of the nature of the suspected asbestos exposure encountered, and may be signed by a line manager, either confirming that the individual was present at the specified location or concurring with the individual's suspected exposure to asbestos. On completion, one copy of the form is placed in the individual's personnel file, and two copies given to the individual, one of which they may choose to have placed in their medical records. The form is not linked to any monitoring data, which may have been carried out by an environmental health team, nor to any registers of asbestos use, as, for example, kept by the Establishment Works Consultant responsible for maintenance at each site.

### *Environmental chemical exposures*

Data on occurrences of pollution and measurements of chemicals in the environment may provide useful exposure data, where it is suspected individuals may have been exposed incidentally to chemicals in the environment. If a pollution incident occurs a pollution report should be produced (in accordance with the MOD Environmental Manual, JSP 418), and copies forwarded to the relevant CESO. Land-based pollution reports detail the incident and the actions taken to control or remediate the pollution; maritime pollution reports include details of the vessel, location, volume of pollution, nature of pollutant and actions taken to control the pollution. If necessary, Service Environmental Monitoring Units may be requested to carry out monitoring of a pollution incident or situations that incidentally pose a hazard to the health of Service personnel. For example, air monitoring was carried out at a HQ established in Banja Luka, Bosnia, close to a burning municipal waste tip, since there were concerns about potential health effects from the emissions from the tip. Such monitoring is detailed in a scientific report and copies are provided to the requesting Unit and retained by the Environmental Monitoring Unit.

A land quality assessment programme of all MOD properties is currently underway. Each assessment is split into three phases: Phase One is a desk-based assessment of each site; Phase Two is actual sampling and analysis of the environment (not air) for suspected contaminants; and Phase Three is remediation, if necessary. Where an assessment proceeds to Phase Two, the monitoring data collected could prove useful for exposure assessment purposes. Reporting of the Phase One and Two assessments is to the MOD, and copies of the reports are retained by the assessors.

## 4.4.3 Environmental health exposures

Environmental health exposures of concern may include areas such as food hygiene, sanitation, water supplies, pest control and dust. Where environmental health reconnaissance is carried out in an operational situation, it will be reported either as a contribution to a Unit Commander's Exercise report or as a separate report. Although unlikely to contain significant exposure information, the report will be useful in identifying possible confounding factors, and in providing a wider understanding of the range of environmental exposures encountered. However, the inconsistent methods of reporting (i.e. as part of a Commander's report or as a separate report) may make it difficult to locate such information.

An example of routine environmental health monitoring is that carried out on drinking water on ships and submarines. Samples are collected, subject to assistance from the fleet, quarterly for bacteriological analyses and annually for chemical analyses and sent to INM for analysis. However, in reality most of the samples obtained are from ships, with few being received from submarines. The results of the bacteriological and inorganic analyses are maintained on a database at INM, and those of organic chemical analyses reported as hard copy reports, although, in future, these will be included on the database.

## 4.4.4 Noise exposures

Noise exposure monitoring is carried out either as a routine noise assessment or as a specialist noise survey. Routine noise assessments are made by trained noise assessors (usually a Unit Safety Advisor, Army; Health and Safety Advisor, RAF; or a Medical Officer, RN) for a particular process or a specific area. The results of the noise assessment are recorded on a standard tri-service form (MOD Form 945) and include results of the noise measurements made, the location of the assessment, an estimate of the number of employees exposed, the duration of exposure, and any recommendations

made. Because the assessment is for a process or area, the individual employees exposed are not identified. Noise assessments should be reviewed every two years and a repeat assessment carried out every five years. The serial number (consisting of the UIN and a reference number) of a newly completed MOD Form 945 should be recorded on the previous assessment record and vice versa, thus creating a continuous noise assessment record for a location, process or piece of equipment. However, reviews of the assessments may not always be carried out.

On completion of the assessment, the line manager responsible for the area or process retains the form; the retention of the previous assessments varies and it is thought that it is common practice for only the current noise assessment to be retained, with previous assessments being discarded. For example, old noise assessments of ships, which list noise measurements for each area of the ship, are discarded. However, a copy of the assessment form should be forwarded to a Service-specific authority, as indicated on the form, in addition to the line manager. For the RN one of the recipients is the INM, which, on receipt of the form, checks that it has been completed correctly and stores the form indefinitely by the date received. However, not many forms are received by INM, possibly indicating a low compliance with this requirement (other recipients of the form were not interviewed owing to time constraints). Audiometry of individuals exposed above a certain threshold is carried out, but there is little or no linkage between the individual audiometry record and the noise assessment record (although there are several possible linkage data items).

When a noise assessment indicates that noise levels exceed a daily personal exposure level of 105 decibels, or an assessment is required for weaponry (impulsive, pure tone, infra- or ultra-sound), a specialist noise survey is requested. These surveys are usually performed by the relevant Service specialist centre (i.e. INM, the Army Environmental Monitoring Team or the RAF Institute of Health). The results of the survey are presented in a formal paper report, copies of which are provided to the customer and retained by the centre performing the survey. In addition to requests for noise surveys resulting from noise assessments, the specialist centres may also carry out other noise surveys, where there is a general concern about noise levels, in addition to vibration assessments of equipment and environmental noise surveys, all of which are performed on an as requested basis and will be reported in a formal paper report. Although these reports may be indexed electronically, there is (to our knowledge) no coordinated electronic system for retaining any of the noise measurements made.

### 4.4.5 Radiation exposures

Radiation exposures experienced by the Armed Forces can vary and the control of such exposures is regulated by the Ionising Radiation Regulations (IRR) 1999, which give detailed requirements for exposure monitoring and health surveillance. These regulations require provision of a dosimetry service by a Health and Safety Executive (HSE) licensed dosimetry service, which, for the Armed Forces, is provided solely by the DRPS. The IRR 1999 regulations stipulate that the radiation dose of all classified radiation workers, that is those who have the potential to be exposed to 3/10 of the statutory limit, should be monitored and retained for a minimum period of 50 years or until the individual reaches the age of 75. However, it is MOD policy not to differentiate between classified and unclassified radiation workers. All personnel who are identified as being routinely exposed to radiation by their CO (on the basis of advice from a Radiation Protection Advisor), are therefore registered with DRPS and receive routine radiation dose monitoring. If an individual has previously been a classified radiation worker before joining the Service then a Transfer Record, summarising their previous radiation exposure, is requested from the relevant Approved Dosimetry Service (ADS) and entered as part of the individual's dose record.

The most common radiation exposures monitored are those to beta, gamma, X-ray and neutron radiation. However, radiation exposures to radon, tritium (via urine) and whole body internal doses are also determined where required. The majority of radiation exposures are monitored using dosemeters, which are issued to the relevant Units or Establishments on a monthly basis. Each dosemeter has a unique identification code and is issued to a named individual for a period of up to one month, according to a dosemeter issue list provided by DRPS. Once the period of monitoring is complete, the dosemeters are returned to DRPS for analysis, and DRPS will have supplied the Establishment/Unit with another batch of dosemeters for the next month. If a dosemeter is lost, damaged or cannot be read, then the dose received by the individual has to be estimated and submitted to DRPS, along with the rationale for the estimation of the dose. Additionally, if an individual has occasion to undertake work at a facility operated by another employer, then they are issued with a Passbook, summarising their dose to date, and allowing the dose received to be recorded and maintained as part of that individual's record.

Records of radiation monitoring for each individual are maintained at DRPS as paper records (form F Med 291A), on microfiche or microfilm and on optical disk. Records for personnel monitored since 1979 are also retained on an Oracle database. The dose record for an individual includes personnel details (Table 4.5), including details of any changes made, a yearly-apportioned dose breakdown, and results of every dosemeter analysed. These records are retained indefinitely by DRPS and can be searched by any parameter. DRPS therefore maintains a complete record of an individual's lifetime occupational exposure to radiation until the point at which they leave the Service. DRPS does not, however, maintain records of environmental radiation monitoring, for example indoor radon measurements; this is the responsibility of the Establishment or Unit carrying out the monitoring.

**Table 4.5** Personnel data stored in radiation dosimetry records

| | | |
|---|---|---|
| Personal Dosimetry number | Service Number | Regular Issue |
| Establishment Code | NHS Number | Classified Start Date |
| Surname | National Insurance Number | Classified End Date |
| Forename | Ever Classified | Job Code |
| Initials | Leaving Date | Dockyard Number |
| Sex | Category Code | Pregnancy Date |
| Birth place | Occupation Code | In accident |
| Service | Entry Date | Updated Date |
| Rank/Title | BU Date | Medical Date |
| National Registry for Radiation Workers | Employer Number | Central Index for Dose Information Flag |

In addition to the dosimetry, classified radiation workers receive an annual radiation medical, which is recorded on an F Med 291C and assesses their fitness and records their cumulative radiation dose and radiation dose since the last medical. These are retained in the individual's F Med 4 and a copy should be sent to DRPS. However, it is understood that this does not always occur as it is not always agreed that the DRPS should hold medical data.

## 4.4.6 Other occupational and environmental exposure records

### *Risk assessments*

Risk assessments are carried out for a variety of risks such as manual handling, use of display screen equipment, confined spaces and for general areas such as an office or workshop. The assessments are usually made for the hazard rather than for particular individuals. They may provide useful exposure data for identifying the existence of hazards at a particular location and for describing the processes or operations concerned. Risk assessments relating to a specific work activity are held only for as long as they are current, unless they form part of an accident report in which case they are retained for five years after the date of the incident. After that period, they are destroyed.

## 4.4.7 Summary

Occupational and environmental monitoring data make an important contribution to studies of adverse health effects, as they provide quantitative data on the exposures of individuals to potential hazards. A broad range of occupational and environmental monitoring data is collected by the Armed Services for a variety of purposes. The information ranges from the comprehensive dosimetry service provided by DRPS to the production of risk assessments by line managers and safety advisors. There are several factors that impact on the usefulness of the available data for exposure assessment.

### *Information on location and individual employees*

Any exposure data collected need to be linkable to information either identifying the location of the monitoring or the individuals exposed. Generally, some relevant information is recorded with most of the occupational and environmental data collected within the MOD. However, this varies considerably, from a brief description of the location of monitoring or a process, to detailed personnel information (see Table 4.5). This inconsistency limits the usefulness of the exposure data, particularly in linking exposure data to individuals from a location. Ideally, the information collected on individuals should include personnel data, information about their job or the task being performed, the location of monitoring and whether the exposure is considered representative of normal working activities. These data should also be collected in a standardised format consistent with, and validated against, other computer systems, for example personnel systems to facilitate linkage of data between the systems.

### *Retention of data*

Personal monitoring measurements of exposure of individuals to a hazard are generally retained indefinitely, which facilitates the retrospective study of exposures and health effects. However, COSHH and risk assessments, which contain valuable exposure data, are often only retained transitorily, thus limiting retrospective estimation.

### *Accessibility*

The accessibility of the available data is variable. The collection of data on exposures to radiation represents an example of best practice, whereby data are stored in a database and are readily searchable by a range of parameters. Other exposure data collected by the Armed Services, however, are largely collected and retained as paper reports, and it would require a substantial manual effort both to identify the existence of the relevant information and to extract it into a usable format. The accessibility of these data would be improved by greater retention of the data on computerised systems, particularly for data that are collected routinely, for example noise assessments, and better indexing of the reports for data that are collected non-routinely.

### *Linkage*

There is currently little linkage between exposure records and other records, particularly routine medical records such as radiation medicals, audiometry testing or health surveillance. In particular, in situations where the exposure records do not specify the individuals exposed, for example COSHH and noise assessments, there would be great difficulty in linking the health and exposure records retrospectively. This would limit identification of the level of exposure that induces a particular health response. In the case of COSHH assessments, this would be exacerbated by current retention policies.

There is also little linkage with data in other systems, such as personnel and pay records, either directly or indirectly. For example, although most risk assessments include information on the location of the risk, this is not necessarily recorded in a manner that enables it to be linked to location data stored on the personnel systems. Similarly, although the personnel data collected for the purposes of dosimetry are comprehensive, they are not validated against the data held in the AFPAA personnel systems.

**Table 4.6** Summary of visits to units concerned with monitoring of exposures

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| DERA Radiological Protection Service (DRPS) | Provision of a Health and Safety Executive licensed radiological dose monitoring and record keeping service for the whole of the MOD | Collection of radiation dose records and radiation medical examination reports for nearly all exposed Service personnel, covering all types of radiation exposures | All records retained indefinitely on Oracle database and separately on optical disk<br>Maintains a complete working-life dose for all personnel until the point at which they leave the Service<br>Dose record covers previous employment, periods working away from MOD, and overseas and attempts are made to fill in data-gaps from lost or faulty dosemeters | System dependent on Commanding Officer recognising need for an individual to have radiation monitoring<br>Routine radiation medicals not always retained with dose records, due to medical confidentiality issues<br>Some radiation dose records retained by Units rather than DRPS<br>No retention of environmental monitoring data |
| Medical Operational Planning | Surgeon General Medical Operational Planning Section responsible for anticipating the health and environmental hazards which may be encountered on operation. Previously an Environmental Health Officer in Northern Ireland | Computer database developed to record information collected during visits by Environmental Health technicians to audit health and safety practice and recording of the practice | Database based around generic COSHH requirements but can be expanded to include audits for specific substances | |

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| Defence Logistics Organisation, Equipment Support (Land), Hazardous Materials | The Hazardous Materials section is responsible for identifying and classifying all hazardous materials held in the stores inventory of Equipment Support[Land] | Very limited exposure data. The Hazardous Stores Information System holds safety data sheet information on approximately 9000 items | Data are stored and retrievable electronically<br>Set format for each safety data sheet<br>Each substance/material has a unique identifying number (NATO stock number)<br>Records cannot be deleted, only superseded by newer information | |
| Environmental Monitoring Team (EMT), Keogh Barracks | To provide environmental monitoring capability to support Unit-based environmental health personnel | EMT investigates and reports potential exposures. Reports of investigations are stored at EMT<br>Monitoring capabilities include UV spectrometer, atomic adsorption and emission spectrometers, GC-MS and IR spectrometer | Reports provide situation specific information on exposures, sometimes at the individual level<br>Some routine monitoring | Reports are in paper form only and are not stored or retrievable electronically<br>Information on which individual is assessed in a personal exposure assessment is seldom, if ever, held<br>Information is not gathered prospectively; EMT predominantly investigates ongoing problems |

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| Environmental Health Team (EHT), Imphal Barracks | The EHT audits Units' compliance with Army health and safety policy | Very limited collection of exposure data. The audit assesses issues such as training, adequacy of first aid, general health and safety such as trip and fall hazards | The audit provides a means to highlight issues of concern, both from the auditor's viewpoint and for the local Unit Safety Advisor | Lack of continuity in Army postings. This leads to systems set up by one individual being lost or forgotten when their replacement comes into post<br>Health and safety systems are set up based on a full complement. However, when part of a Unit is deployed, the systems are not amended appropriately |
| Occupational Health Centre, HM Naval Base Portsmouth | To provide an occupational hygiene service for Naval bases and COSHH training and advice | Occupational hygiene measurements of exposures to various hazardous substances. COSHH, noise and risk assessments. Also asbestos notation forms | Useful data on exposures to personnel exposed to a variety of hazards<br>Risk assessments provide useful information as to current exposures<br>Retention of asbestos notation forms in personnel or medical records<br>Retention of COSHH health surveillance records in individual's medical records | Monitoring of exposures is purely reactive, hence available data may be biased to worst-case exposures<br>Data only retained as paper reports, therefore only limited retrieval of data possible<br>No linkage to other systems<br>Only current risk assessments retained. No consistent practice on retention of assessments. Assessments are for processes and do not identify people |

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| Institute of Naval Medicine (INM) | To improve operational capability of the Royal Navy by promoting good health and safety and maximising the effectiveness of personnel | Health and hygiene laboratory — carries out range of exposure monitoring of trace metals, organic solvents and water analyses | Large number of thallium and lead exposure results, linked to individuals exposed, retained on searchable database<br>Routine monitoring of water quality on ships. Bacteriological and inorganic results retained on database | Low compliance of water monitoring on submarines |
| | | Acoustics and vibration — provision of advice on noise and vibration issues. Receive Naval noise assessment records | Large number of noise and vibration measurements covering broad range of exposure situations<br>Collation of Naval noise assessment forms | All measurements purely reactive hence may be biased to worst-case exposures<br>Reports retained in hard copy format only<br>Low compliance for sending noise assessments to INM |
| | | Occupational hygiene — toxicological evaluations of all substances used on a submarine, workplace monitoring, specialist advice on COSHH assessments and setting of exposure limits in submarines | Large variety of occupational hygiene measurements on a range of tasks<br>Toxicological and technical detail on all substances used in submarines. All collated in Book of Reference 1326A | Occupational hygiene measurements only retained as reports or on library database<br>Measurements purely reactive, hence may be biased towards worst-case exposures |

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| | | Submarine atmosphere control logs and periodic air monitoring | Continuous air monitoring of selected analyses whole time a submarine is dived | No direct linkage to individual who might be exposed (though possible indirectly) |
| | | | Most data entered into database, and hard copies retained indefinitely | Results of Tenax tube sampling only recorded in reports and not included in database |
| | | | Periodic sampling for organics using Tenax tubes, with results retained indefinitely | |
| | | | Critiques produced regularly on atmosphere control logs | |
| | | Record of Dives forms, used since 1994/95 | Records all dives made within the Services, identifying individuals making the dives, and associated data describing the dive | Differing compliance between Services in making records |
| | | | Retained on computer in ASCII format | |
| Flag Office Surface Flotilla Health and Safety Team | Audit health and safety on ships and assist ships in managing health and safety successfully | No direct collection of exposure data. However, some exposure data collected and maintained on ship | Single, unified system for retention of COSHH records for all ships | Retention of current COSHH and other risk assessments only |
| | | | Maintain general list of hazardous activities and operate permit to work for some activities | No linkage between risk assessments and personnel |
| | | | Noise measurements for all compartments on a ship | Only current noise assessments retained, previous assessments, including measurements discarded |

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| RAF Institute of Health | To provide occupational hygiene, noise and vibration and environmental health support to the RAF | Dangerous Engineering Substances Advisory Team — maintain Hazardous Stores Information System | Material Safety Data Sheets (MSDSs) on nearly all hazardous substances used within the RAF, including guidance on use and safety precautions<br>MSDSs 100% accurate<br>All historical data sheets retained indefinitely<br>Database searchable by almost any parameter | No direct linkage to other systems, e.g. procurement or stores<br>No linkage to data on location or quantity of use, nor identification of Units which make use of substance |
| | | Occupational hygiene, noise and vibration and environmental health divisions | Large numbers of reports, dating back to 1975, of occupational hygiene and noise and vibration measurements covering a broad range of tasks<br>Some environmental health reports from operational situations. | All measurements retained within paper reports. No collation into database, only limited indexing of reports on Excel spreadsheet<br>Not always required to produce a written report for environmental health reconnaissance<br>No linkage with other systems |

# 4.5 Historical records

## 4.5.1 Introduction

The activities of a Unit are recorded in various different ways including in diaries, logs and record books. These records are retained and, with other material, form the basis of a historical archive for each Service. This archive can be used for a variety of purposes, including the production of official histories, as well as helping to answer queries about claims for medals, battle honours and compensation claims. The records may contain information on specific incidents that is pertinent to exposure assessment. For example, they might record involvement in nuclear testing, or a particular chemical incident. Visits were made to the three Service Historical Branches, a summary of which is presented in Table 4.7.

## 4.5.2 Army Commanders' Diaries and Unit historical records

Commanders' Diaries are narrative diaries completed during times of operation. The Diary is based at the Unit level and includes details on major changes within the Unit, summaries of the day's fighting (if applicable) and other activities carried out by the Unit, major orders and instructions, details of any casualties or prisoners and annexes containing as much other information as possible[*]. When completed, the Diaries are retained at the Unit level, until being archived at Hayes.

Unit Historical Records (UHR) are also produced by Units and are non-operational reports covering the period from April to March each financial year. The Unit maintains these UHRs before sending them to Hayes for archiving. The quality of both Commander's Diaries and UHRs varies and they generally only give details of major incidents and significant events.

## 4.5.3 Ship's log

A Ship's Log is a logbook in which a record of a ship's movements and brief details of events are maintained. Each log covers a period of one month, and each page of the log covers one day. On each page is recorded the day, date, approximately where the ship is (e.g. at sea, Malta etc.), and possibly details of the weather, any casualties incurred and three times each day, the ship's longitude and latitude. The bulk of the page is taken up with a number of columns, which are divided into hours, against which comments on events may be recorded. However, these comments will vary enormously and generally only provide the briefest of details as to what occurs. The log is completed in pencil, and on completion sent, through the fleet, to the Admiralty archives at Hayes for 30 years, after which they are transferred to the PRO. Only one copy of the Ship's Log is made, and therefore, should the ship go down, the log may be lost.

## 4.5.4 Reports of proceedings

Reports of Proceedings (ROPs) are similar to the RAF Operations Record Book (ORB) (see Section 4.5.5), but are made for Naval Units by the CO. Usually the ROP will refer to a single Unit, for example a ship, but if a number of ships are acting as a flotilla, then the CO may complete the ROPs for the whole flotilla. The ROPs are purely narrative accounts of what the Unit has been doing over a

[*] MOD (2000) A Review of UK Forces Chemical Warfare Agent Alerts during the 1990/1991 Gulf Conflict July 2000 – A Review of UK Chemical Warfare Agent Alerts from August 1990 to March 1991, available [December 2000] at http://www.mod.uk/index.php3?page=989

period of time or in a particular location, and are usually concerned with the ship itself, rather than individual crew. The ROPs are not completed in a standard format and there is no official guidance as to what should be recorded or over what time period ROPs should be made. Individual ROPs therefore vary considerably in length and detail and can cover periods of anything between a month and a year. ROPs are also made for land-based Naval Units, usually covering a Station or area of command.

On completion the ROPs are sent to the relevant Flag Office, and a copy forwarded to the Naval Historical Branch, where they are stored according to Unit and date. However, no checks are made to ensure ROPs are submitted regularly, nor to ensure a complete set of ROPs are received.

## 4.5.5 RAF Operations Record Book

The ORB is a standard form (RAF Forms 540 and 541), completed by all RAF Units, formations and RAF elements of joint formations, on a monthly basis, to serve as a permanent record of its activities. The ORB is completed by a commissioned officer of the Unit, and is classed as a secondary duty. The type and detail of information recorded in the ORB varies considerably. However, the ORB should record the Unit's location, and the name of the CO and briefly describe the Unit's role. Furthermore, the ORB should record the activities of the Unit for the month, including details of significant events and any casualties. There is likely to be wide variability in the level of detail in which events are recorded, depending on the motivation of the compiling officer, and the perceived importance of the events. In addition, Form 541 is annexed to Form 540 and is used to record significant flights made by the aircraft of the Unit, including the date, type of aircraft, names and initials of crew members, times up and down and details of the flight and its purpose. If the flight was made for combat or raid purposes, a combat or raid report may be annexed to the ORB. Alternatively this may be included in the Form 541. When a Unit or formation is placed on a war footing, the ORB should be completed on a daily basis. However, operational considerations may not always make this possible.

When complete, the ORB is signed by the CO and forwarded to the Air Historical Branch (AHB), and a duplicate copy is retained by the Unit for at least one year. The AHB maintains a record of ORBs received, and follows up failures to submit. The ORBs are checked and retained by the AHB for a period of 25 years, filed according to Unit and date, after which they are reviewed, and security considerations permitting, forwarded to the PRO at 30 years. The ORB is never destroyed.

## 4.5.6 Summary

Historical records do not usually provide information about routine exposures. However, they can provide valuable information about specific incidents and non-routine exposures, the location of specific Units and their involvement in certain activities or operations. A good example of the use of ORBs and Commanders' Diaries for exposure purposes can be found in the accounts of chemical warfare agent alerts produced by the Gulf Veterans' Illness Unit[*]. This relied heavily on the ORBs and Commanders' Diaries to determine whether UK Service personnel had or had not been exposed to chemical warfare agents.

[*] MOD (2000) *A Review of UK Forces Chemical Warfare Agent Alerts During the 1990/91 Gulf Conflict July 2000 — A Review of UK Chemical Warfare Agent Alerts from August 1990 to March 1999,* available [December 2000] at http://www.mod.uk/index.php3? page=989

There are currently wide variations in the historical records of the Services, both in the type and completeness of the records and the frequency at which they are made. The usefulness of the historical records for exposure assessment would be greatly increased if a single system were used for regularly recording historical information across the three Services. This, along with checks to ensure a complete record was obtained and a central index of the records, would facilitate access to the records and data retrieval, both for exposure assessment and historical purposes.

**Table 4.7** Summary of historical branches visited

| Unit | Function/purpose of Unit | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| Army Historical Branch | Provides a corporate memory for the Army and responds to enquiries by other agencies to provide historical information | Commanders' Diaries, made in times of operation by a commanding officer for a Unit<br>Unit Historical Records (UHRs): these are usually produced on an annual basis by each Unit, providing a description of significant events over the year | As with other systems, may provide useful qualitative information concerning specific incidents, non-routine exposures, the location of Units and possible factors confounding exposure | Commander's Diaries only made in times of operation, and not during peacetime<br>UHRs only made annually, therefore limiting the level of detail recorded |
| Naval Historical Branch (NHB) | Collection of Records of Proceedings (ROPs), the production of official histories and responding to official and public queries | Collection of ROPs, which provide narrative descriptions of events occurring to a Unit<br>Ship's Log provides a record of a ship's movements (these are not retained by NHB, but may be consulted by them) | The ROPs provide useful qualitative data on events occurring to a Unit<br>Ship's Logs provide useful accurate information on the location of a ship, three times each day | No guidance or specified time period over which an ROP should be made. No checks are made by the NHB to ensure a complete record is obtained<br>Both the ROPs and Ship's Log are paper records only |
| Air Historical Branch (AHB) | Collection and retention of Operational Record Books (ORBs) and Campaign documents, production of official histories | Collection of ORBs, which provide monthly narrative descriptions of events occurring at each Unit in the RAF | Provides useful qualitative historical information on location, deployments, tasks and flights made by Units<br>Useful source for non-routine and exceptional exposures (e.g. accidents and operational exposures)<br>Checks are made to ensure a complete set of ORBs is obtained and ORBs are retained indefinitely | ORBs stored manually by Unit<br>Qualitative data only<br>ORB not linked with any other records<br>Large variability between ORBs in the type, quality and detail of information recorded<br>Completion of ORB a secondary duty |

# 4.6 Users of Armed Services information systems

Three major groups of users of information in the Armed Services were visited to investigate how they used the information systems available, and what difficulties they encountered. They represented three important different uses of the data potentially available:

- to fulfil a legislative duty (the War Pensions Agency (WPA) administers pensions);
- to research potential adverse health or exposure problems (the Gulf Veterans' Illness Unit (GVIU) facilitates the research into Gulf War Syndrome); and
- to collate the data into meaningful and useful statistics (the Defence Analytical Services Agency (DASA) produces manpower and health statistics).

Table 4.8 summarises visits made to these users.

## 4.6.1 War Pensions Agency

The function of the WPA is to administer the war pensions scheme, which exists to compensate workers for injury or disease encountered during employment. A claimant for a war pension completes a form (WPA1) which includes details of their service, the injury or disease and the circumstances under which this occurred. If a claim is made within seven years of leaving the Armed Services the onus is on the Secretary of State, represented by the WPA staff, to establish beyond reasonable doubt by evidence that the claimed condition is unconnected with service. After seven years it is officially the responsibility of the claimant. However, in practice, confirmation of (i) occupation in the Armed Services at the relevant period, (ii) the medical diagnosis and (iii) the external circumstances is generally carried out by the WPA.

The WPA has developed procedures for requesting the relevant information from a wide range of Armed Service sections and centres. These vary between the three Services, but include centres holding medical and personnel documents, historical branches and hospitals. The WPA encounters many problems obtaining the necessary information due to missing or incomplete records, and inconsistent or ambiguous information.

Examples of difficult issues encountered by the WPA include:

- Verification that a sports injury occurred whilst on active duty or when representing the Services. A decision has to be made as to whether participation in team games is an integral part of training, that is team building, and if the claimant was representing his Unit. At present, there is no indication made on the medical or personnel records as to whether the serviceman was "on" or "off" duty.
- In a similar way road traffic accidents in an operational situation are not always recorded in service documents.
- Claims for psychological problems, such as post-traumatic stress disorder due to witnessing some atrocities, such as a child being shot. The MOD may not be able to provide confirmation of the atrocity.

- Confirmation of exposure to chemicals such as gun oil, hydraulic oil, degreasing agents and cleaning fluids. It is often not possible to confirm that a specific chemical was actually present in a particular oil or fluid, for example trichloroethylene in a degreasing agent.

The annual expenditure on war pensions is about £1.4 billion. Improvements in information collection and retention in many Armed Service sections would have the potential to reduce this and also ensure that compensation is more appropriately awarded.

## 4.6.2 Gulf Veterans' Illness Unit

Approximately 53 000 UK Service personnel from the three Services took part in the Gulf conflict in 1990-91, about half of whom have now left the Armed Forces. Since the conflict, some UK Gulf Conflict veterans have reported a variety of health problems which they have attributed to their service in the Gulf. A number of potential causes have been suggested including multiple routine vaccinations, vaccinations against biological warfare, exposure to pesticides (particularly organophosphates) oil-well fire pollution and exposure to depleted uranium.

The issue has been addressed in several ways by the MOD, and has included the setting up of several independent research programmes and a Gulf Veterans' Medical Assessment Programme. The latter investigates medical complaints from any Service personnel or MOD civilians who served in the Gulf.

To oversee the Government's response to Gulf veterans' illnesses the MOD established the GVIU in March 1997 to provide support for Gulf veterans and the research programmes. The GVIU staff thus have considerable experience of the difficulties of obtaining information retrospectively from Service sections. Difficulties encountered include identification of:

- all those who served in the Gulf conflict and whether these personnel were actively employed in the areas of concern;
- appropriate medical records, including data on immunisations; and
- data on relevant exposures such as to pesticides or depleted uranium.

There have been several reports and papers published in the scientific literature or on the MOD website. Because of the difficulty both in obtaining records and incompleteness or inconsistency of information, the investigations of UK veterans have involved carrying out postal surveys of their health and exposure during the conflict (Unwin *et al.*, 1999; Hotopf *et al.*, 2000). The reliance on self-reporting and the potential for recall bias are important limitations of this type of survey.

The MOD has carried out detailed investigations of several potential exposures of concern in the Gulf conflict. These illustrate the considerable difficulty in carrying out exposure assessment for specific substances and the many different types of record which might have to be examined. The report investigating the use of organophosphate pesticides[*] comments that "…much of the low-level routine paper work would not have been seen as worthy of preservation. Conversely, Departmental files are preserved as a matter of routine, but memories about how one document amongst hundreds was prepared are rarely crisp." The investigators report that the routine documentation generated in theatre that they managed to find was very valuable to their investigation. However, locating potential useful

[*] MOD (1996) *Organophosphate Pesticide Investigation Team (OPPIT) Substantive Report*, available [December 2000] at http://www.mod.uk/index.php3? page=979

files from the various HQ staffs and Units was patchy. One significant obstacle was the amalgamation and abolition of Units in the period since the conflict. The assessment investigated firstly how the provision of health services in the field, including environmental health, and the use of pesticides, should be organised and secondly how this was actually put into practice during the conflict. Records examined included letters and reports on environmental health activity and stocks of pesticide, health and hygiene reports, request forms and records of transactions for local purchase, post-operational reports, and brigade periodic field hygiene reports. Field Hygiene Sections were not required to keep war Diaries and records of daily activity were not retained. No records were located which indicated precisely which pesticides were used, in what quantities and where. No records of stock checks of equipment and pesticides held were retained.

## 4.6.3 Defence Analytical Services Agency

DASA is part of the Government Statistical Service and provides statistical and other analytical services to the MOD. DASA is spread over six sites with the section in Bath producing official statistics on manpower (including for regulars, reservists and civilians) and health. These are published in both hard copy form and on the MOD website. To produce these statistics DASA has to obtain the relevant information from the three Services and manipulate this into an integrated format. Several computerised systems have been developed. These include:

### *Civilian and Service Statistics and Related Analyses*

The Civilian and Service Statistics and Related Analyses (CASSANDRA) is a centralised computer system which is used to collate tri-service personnel data to produce monthly manpower statistics. A user-friendly front end to this system, the Manpower Analysis and Reporting System, has been developed to facilitate easy access to the data held on CASSANDRA. Full computer personnel records from each of the three AFPAAs, and from various sources for civilians and reservists are sent to DASA each month. These records differ with regard to the data held, the format of the data and the codes used, thus requiring considerable manipulation to achieve a common smaller data set from which to produce collated manpower statistics. A sample of the latter, 'proving tables', are sent to the individual manpower branches to check they are correct before the standard monthly tables are produced. CASSANDRA gives monthly cross-sectional overviews of the manpower situation. These are retained for 13 months. Data are retained quarterly for the proceeding four years and only for April for years before this. CASSANDRA is thus not a tri-service continuous computerised personnel system. However, because it contains data on individual personnel, which include unique identification data such as the Service Number, it could be linked to other computerised data systems (see CHASP).

### *Central Health and Safety Project*

The MOD's Central Health and Safety Project (CHASP) is used to collate all reported accidents occurring in the UK involving Service personnel or civilians. When an accident occurs an MOD Accident Reporting Form (MOD Form 2000) is completed by the line manager and sent to a central Health and Safety Unit (HSU). At the central HSU the form is entered into a CHASP terminal (of which there are currently 50 in the UK), and the resulting disk sent to DASA, Birmingham. DASA enters the data into the central CHASP system, and supplements the information from the form with information from CASSANDRA. The resulting system is fully searchable, allowing identification of individuals, and more generic queries to be performed to identify groups with high accident rates or trends. However, this system is only operational in the UK during peacetime, and there may be

differing levels of reporting between Services due to the differing attitudes towards accident reporting. The CHASP system has been running for 3 years, and current policy is to retain the data indefinitely.

### *Computer Aided Retrieval of Medical Documents*

There are a large number of tri-service forms (F Med number) on which medical events and other medical information are recorded (see Section 4.2). A number of these are sent to DASA, transferred to microfiche and catalogued on the Computer Aided Retrieval of Medical Documents database. They include F Med forms 1, 2, 7, 14, 15, 23, 143, 143A, 144, 242, 291C (personal communication, P. Whinney, 14 August, 2000). They can be accessed using the Service Number and name of the individual. The forms are retained back to 1982, with the microfiche being kept indefinitely.

### *Forces Medical Event Database*

The Forces Medical Event Database (FMED) consists of data from FMed forms 14, 23 and 858, which record information on deaths, together with diseases and injuries requiring hospital treatment for more than 48 hours. Causes of death and disease are coded according to the International Classification of Diseases (ICD). The nature of injuries is coded using a NATO coding system. FMED enables collated statistics on deaths and medical discharges to be produced by diagnosis and has been in operation since 1988. The database is searchable by a number of parameters as well as allowing identification of individuals. Difficulties are encountered when treatment or death occurs outside the UK if the entries are made in a language other than English. Forms may also not be sent systematically to DASA. To ensure data quality and completeness when producing the regular reports other sources of information are also used. In conjunction with medical events documents, pay and personnel records are used, with signals and information from casualty branches also being used for deaths.

## 4.6.4 Summary

The three user groups described in Sections 4.6.1 to 4.6.3 all make heavy use of a variety of record systems within the MOD. The functioning of all these groups is limited or made more difficult by deficiencies either in the record systems themselves or in the record retention procedures. In general they would all benefit from development of:

- standardisation across the three Services of data recorded, format, coding and storage, particularly for personnel and pay systems;
- a policy on archiving for all data collection systems;
- standardisation of information recorded in less formal systems such as war diaries, daily reports, etc; and
- a minimum set of essential data items which would facilitate retrospective assessment, at an individual level, of health events, work history and exposures.

**Table 4.8** Summary of visits to users of Armed Service information systems

| Unit | Function/purpose of Unit | Data system | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| War Pensions Agency (WPA) | To administer the war pensions scheme | A form is completed by the claimant giving details of the injury or disease and the circumstances under which this occurred. The WPA then sends various different forms to the MOD to obtain evidence about the claim | Usually MOD medical records are used. The WPA may also contact personnel sections, hospitals and historical branches | WPA encounters many problems in establishing whether the claimant was employed in the forces at the relevant time, whether the 'exposure' took place on duty or while representing the Services and obtaining confirmation of the actual exposure |
| Gulf Veterans' Illness Unit | Facilitation of investigations of health problems of service personnel involved in the Gulf conflict | No actual data but wide experience of sources of data and problems with access and completeness | | |
| Defence Analytical Services Agency | The collection and processing of personnel, medical and accident report data | Personnel data for all three forces on the Civilian and Service Statistics and Related Analyses database. Used to provide statistical information on the strength of Units, and movements between Units and in and out of the Service | Comprehensive demographic data at individual level of Service personnel<br>Searchable by most fields down to individual level, using Manpower Analysis and Report System<br>Linkage to other systems, e.g. Central Health and Safety Project (CHASP) | Not a continuous personnel and pay record; monthly cross-sectional summary<br>Data progressively deleted until only yearly snapshots remain<br>Information held for each force and between Officers and Ranks not standardised (but similarities) |

| Unit | Function/purpose of Unit | Data system | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| | | Reports of accidents and near-misses for all three Services on single CHASP | Comprehensive tri-service accident reporting system<br>Indefinite retention of data<br>Fully searchable system allowing identification of individuals | Limited collection of exposure data, more event data<br>Different levels of reporting between forces<br>Only operational in UK |
| | | Collation of selected F Med forms for inclusion on microfiche, and indexing database (Computer Aided Retrieval of Medical Events Database) | Collates COSHH Medical Surveillance, Audiogram and Radiation Medical Records, thereby indicating exposures to selected hazards<br>Standard forms for all three Services | No linkage with other systems<br>Limited collection of exposure data beyond statutory requirements<br>Forms indexed by individual name and Service Number only, hence cannot search by individual forms, demographic variables, or diagnosis |
| | | Forces Medical Event Database collates information relating to deaths, diseases and injuries resulting in hospitalisation for > 48 hours | Can be queried by all fields down to individual level<br>Validated against death and medical discharge data from pay systems | Data only reflect injury and location of treatment, not necessarily cause or location of injury<br>Forms not always completed in non-UK areas or may be completed in languages other than English |

# 4.7 Examples of data systems in civilian industry

Three non-Service industries and one Government organisation were visited to investigate their health surveillance record systems, and in particular those which would facilitate exposure assessment. These organisations were selected because their processes and activities parallel particular areas of the Armed Services. Rolls–Royce (RR) manufactures and services aircraft engines, which involves heavy engineering processes. Imperial Chemical Industries (ICI) is a major UK chemical manufacturer and Westlakes Scientific Consulting manages all the occupational health and exposure data for British Nuclear Fuels plc (BNFL). The Health and Safety Executive (HSE) has addressed the issue of systematically collecting and recording exposure monitoring data. Table 4.9 summarises visits made to these civilian industries.

## 4.7.1 Rolls–Royce

Rolls–Royce is a complex company with past mergers and acquisitions making it difficult to set up unified systems across the company because of differences in the systems of the previously separate companies (see below for examples).

The breadth of hazards to which RR workers may be exposed is similar to that in the Armed Services and changes as the company expands. Of the physical hazards, noise and vibration are the most significant. Mobility may be less of an issue than in the Services, but some groups within the RR workforce do travel widely as part of their work (e.g. sales and service representatives).

### *Personnel information*

The RR Human Resources department maintains personnel records that track an employee's occupation and where they worked. These records are maintained on a mainframe computer system and in hard copy. Personnel records include information on departments worked in together with dates, a unique Check Number, supervisor and occupation. When carrying out retrospective studies using data for RR employees, it has been found that some codes, for example, department codes have changed over time. This presents difficulties in assigning individuals to a work location. The individual's name is used to identify them, although the Check Number that appears on their personnel record can also be used. Because individuals can leave and rejoin RR on a number of occasions, it is possible for one individual to have more than one Check Number.

### *Medical records*

Hard copy records in RR go back to the late 1950s. These records cover pre-employment health screening and health surveillance medical examinations. This includes medical data gathered for COSHH or internal RR purposes (e.g. audiometry). All medical data are kept (80 000 records) and are now being scanned to establish an electronic copy. This will be searchable by name and any other free text such as location, Check Number or department number; original documents will also be retained.

Certain activities with associated hazards require specific health monitoring and individuals involved in these activities are listed in what is termed a 'nominal roll'. The activity should be the driving force behind defining nominal rolls, but occasionally individuals with lesser exposures are unnecessarily

classified in a nominal roll. The main hazards for which nominal rolls have been established are noise and vibration, although the lung function of individuals working with isocyanates is also monitored.

### *Exposure information*

The collection of exposure information is not a routine occurrence. There is a referral system whereby the Occupational Health or Safety Department highlights an issue (for example, at the instigation of a Union safety representative or local manager) that requires assessment. Individuals are identified who are representative of the particular issue under consideration and who form the focus for personal monitoring. A report is produced that identifies relevant risks and sets out what improvements or actions are required to ensure safety. These recommendations are subsequently audited by an occupational health practitioner to check that they have been implemented. Electronic, microfiche and hard paper copies of these risk assessments are kept and records of previous assessments go back to the 1970s. Individuals who are deemed representative of a group's exposure are identified in the report, as is the department number. The focus is on the activity, not the person. These data could potentially facilitate development of job exposure matrices.

A particular problem with such a broad-based company as RR is that tasks in one place may not be called the same thing in all locations. For example, a turbine blade polisher in Derby may be called a fettler in Bristol. Also, because such risk assessments are valid for a specific point in time, changes to the process may require a reassessment of the activity. For example, the task duration may change if a different method is used.

The aim is to ensure that if workers are exposed to agents their exposure is less than 50% of the occupational exposure standard. The need for a COSHH risk assessment for a specific activity is reviewed annually. The COSHH assessment is re-appraised every five years, and the outdated version is discarded.

### *Rolls–Royce mortality studies*

Rolls–Royce has been studying worker mortality, linking the cause of death provided on the individual's death certificate to their work history. The death certificate has to be sent to RR for pension purposes. They first focused on respiratory diseases and more recently have started a study examining bladder cancers. By comparing a person's work history with their cause of death, RR aims to explore whether there are links between the two (for example, bladder cancer related to working with mineral oils).

### *Software Application Programme*

Rolls–Royce is introducing a mainframe software system for gathering and storing information, primarily on personnel and pay. It is hoped that health and safety issues will also link into this Software Application Programme (SAP). Building on previous work, it is hoped that a coding system will be incorporated into SAP in order to monitor and manage work absence. SAP is not yet in place throughout RR. Once established, it will incorporate data on individuals currently employed; previous employees' information will not be incorporated.

## 4.7.2 Imperial Chemical Industries

Imperial Chemical Industries has had a system for the collection of occupational health information for more than 15 years. The current system, called the Replacement Occupational Health System (ROHSy) was established approximately two years ago with the aim of incorporating management of occupational risks in addition to storage of occupational health information. The previous system was uncoordinated, with information available but poorly accessible. ROHSy takes its lead from ICI Safety, Health and Environment policy.

The starting point on ROHSy is the *area* (comparable to the concept of the COSHH assessment area). The process employed under ROHSy involves identifying the hazards in each area, the affected/exposed groups and the occupational health actions required. For example, in a certain area, hazards could include noise and mercury exposure; the exposed group might be process operators and the occupational health action would be medical surveillance (audiometry and mercury-in-urine analysis). Performance measures are established for each area, rather than across ICI. This makes it possible to set performance measures more tightly to the needs and aspects of each area. By using individuals whose exposure is representative of a group of individuals it is possible to establish exposure groups. Each individual who is identified as being exposed to a particular hazard is assigned to an exposure group. The exposure group can then be subjected to particular occupational health activities. ROHSy established a tighter link between medical and occupational hygiene information. In the past, the links between these data were looser because they had different aims and used different terminologies.

### *Personnel information (demographics)*

Each individual's National Insurance number is held on ROHSy, as is a unique employee identity number (first three letters of surname, initial, month and year of birth, i.e. similar to driver's licence). The demographics module holds information downloaded from the central ICI Human Resources database on a monthly basis. This gives start and cease dates when an individual worked in a specific location/area.

### *Daybook*

The daybook is an attempt to provide an electronic version of the occupational health nurse's daybook in which treatments, immunisations, etc. are recorded. For example, information on immunisations, accidents and treatments are automatically forwarded to the daybook. The system holds data on individuals' previous entries in the daybook.

### *Accidents*

The accidents module is designed to classify injuries as 'minor', 'ICI classified', or 'HSE notifiable' (i.e. according to RIDDOR). The module gathers information on the employee, the date, time and classification of an injury (as classified by a computer algorithm using data entered into the system; e.g. a slip on stairs causing abrasions and requiring no treatment would be classed as minor; a fractured skull would be covered by RIDDOR), date and time of treatment, and details of the accident. There is also a mandatory section for a statement from the injured person; even if none is taken, 'None' must be entered into the field. Individuals' historical information is held in the accidents module.

### *Assessments module*

The assessments module focuses on the groups of employees who may have medical surveillance, biological monitoring, hygiene monitoring and immunisations. By identifying a physical location (area), it is possible to identify which hazards and risks are present, what actions are needed to control those risks and what monitoring is needed to ensure compliance. Controlling and monitoring hazards and risks can be achieved though medical surveillance, biological monitoring, hygiene monitoring and immunisations. The module records where the assessment group is located, and where it sits within the organisation. There should only be one record for an assessment area. A recommendation has been made to use site abbreviations in the area names to ensure conflicts/duplications do not occur. If occupational health actions are required, it is necessary to define who will be affected by the action (i.e. the exposure group). Individuals' details within each exposure group are stored (i.e. under the exposure group 'tanker loaders' will be a list of all individual tanker loaders working in that assessment area and their name, date of birth (DOB), employee number, start date, end date). Each exposure group has a defined contact person.

The module can be used to say whether training is required, and can identify critical equipment and procedures, and the need for personal protective equipment (PPE), respiratory protective equipment (RPE), and occupational health action required. Some sites, though not all, gather information on the amounts of specific chemicals on their site (date first used, date use ceased, amount on plant, annual usage).

### *Medical programme results module*

Results from health surveillance or biological monitoring are entered in this module. Medical programmes consist of a number of tests with a number of parameters. For each identified individual in the medical programme, their exposure group(s) will be identified. An individual can be assigned to more than one exposure group. Only the exposure groups to which the individual has been assigned will be available in the medical programme module. Each exposure group may have more than one medical programme relating to it. Results can only be entered once all 'header' information has been entered (i.e. employees, DOB, exposure group, date, programme, programme type, programme outcome, recall date).

On a monthly basis a medical programme recall is sent to notify all individuals in exposure groups who have appointments in the next month (e.g. for audiometry or other health surveillance).

The system holds information on data already input under each programme. Historical audiometry data from the original occupational health system have also been entered into ROHSy.

### *Immunisation module*

Immunisations are needed because some ICI employees work with human by-products or travel to tropical countries. Again, an individual must be a member of an exposure group identified as requiring immunisation through the assessment module before their information can be entered in this module. One-off immunisations (e.g. tetanus following an accident) are not entered in this module. The module holds information on which immunisation protocols each individual requires; an individual may be in more than one exposure group requiring immunisation. Once all 'header' information has been added, information on the immunisation itself can be added (immunisation, employee, date, time, stage, dose, batch, manufacturer, administered by).

### *Hygiene module*

Hygiene programmes are specified in the assessments module. Only data relating to a specified hygiene programme can be entered in the hygiene module. Individuals who wear a sampler must be a member of an exposure group identified in the assessments module and subject to this hygiene monitoring. Multiple agents can be sampled in the same hygiene programme. No data on results of monitoring can be entered until all information on the individual and sample are input.

### *Reports*

A broad range of reports can be produced by interrogating the system. For example, it would be possible to look at the percentage of smokers at a particular site or within a particular group. To ensure the exposure group information remains valid, a Population Audit is performed periodically which checks that individuals in exposure groups are still working in those exposure groups. Another check is the Population Amendment form which tracks staff movements (joining/leaving/moving). Such reports are sent to line or process managers for them to complete and amend and return to a specified occupational health practitioner.

## 4.7.3 Westlakes Scientific Consulting Ltd

Westlakes Scientific Consulting was set up in 1990 and works in five main areas:

- Occupational Health and Medical Statistics
- Policy Sciences
- Environmental Sciences
- Biotechnology
- Genetics

The Occupational Health and Medical Statistics Group provides a support service to BNFL to manage, monitor, report on and study the effects of occupational exposures on employees. This is partly achieved through the maintenance of Epidemiology, Occupational Health and Dosimetry Databases and in using these databases to conduct epidemiological studies.

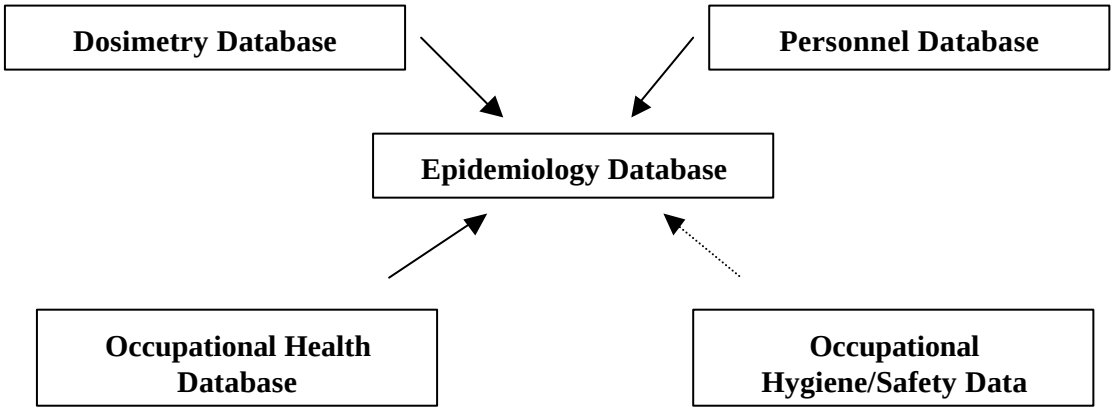
### *Epidemiology Database*

The Epidemiology Database includes approximately 18 000 individuals who have been employed at one or more of the BNFL facilities at any time between 1940 and the present day (with <1% untraced). The database includes personnel data, medical data, dosimetry records, retrospective exposure data on asbestos, and data on smoking and sickness absence. Each individual on the database is flagged on NHS records and hence, through the Office of National Statistics (ONS) or the General Register Office in Scotland, data on cancer registrations and the site and morphology of cancers are obtained and included in the database[*]. Mortality data are also obtained from death certificates and coded using the revision of the ICD code in use at the time. The ICD coding system is also used for recording morbidity and sickness absence data and the capability exists to code from between the fifth and tenth revisions of the ICD code.

[*] It should be noted that cancer registrations are not mandatory, and hence not all cancers may be reported

Data for the Epidemiology Database are currently collected prospectively and come from three main sources: Dosimetry, Occupational Health, and Personnel (Figure 4.3). In the future it is hoped to include occupational hygiene and safety data (including risk assessments), which are currently absent from the database. The aim would eventually be to be able to study the relationship between risk assessments and sickness absence, and, in particular, to establish whether there are associations with specific risks.

**Figure 4.3** Data sources for the Epidemiology Database




Selected data from each of the three main sources are updated to the Epidemiology Database at regular intervals. The data updated are largely dependent on what are needed and what have previously been collected, so as to prevent collecting and storing unnecessary data. Quality control and quality assurance procedures relating to the database include double data entry, accreditation to ISO 9001 for all data collection, continual checking and following-up of data, and audits of the database every five years.

## *Occupational Health Database*

Each BNFL facility has an occupational health service that provides for the occupational health needs of the facility (Figure 4.4). Before employment each employee receives a medical and data are collected on their previous exposures. The employee is then assigned one set of medical records that remain with that employee for life (both computer and paper records). If the individual leaves and later returns to work for BNFL, the medical records are archived and re-assigned. Similarly, if the individual moves to another BNFL facility, their records move with them. On termination of employment the records are archived indefinitely.

The Occupational Health Database was developed as a system to manage the occupational health data for each facility and as a database for epidemiological purposes. The database itself consists of a number of areas, each of which record specific types of personnel, medical, dosimetry and exposure data (Figure 4.4). The personnel data are updated weekly from the Human Resources computer system, thus ensuring they are correct. All medical consultations and results are recorded in the database (this includes those relating to visitors and contractors), and dosimetry data obtained from the Approved Dosimetry Service (ADS) at each facility.

The database has been in use since about 1980 and all data are retained indefinitely. The data can be queried by any number of parameters, either using a built-in report generator or, for more complex queries, by writing specific query programs. There is also a fully auditable trail, including details on who has changed what, when and why changes were made.

## *Dosimetry Database*

The Dosimetry Database holds dosimetry data in the form of annual dose and individual film badge data as well as internal dose data from urine samples, which are used for back-fit modelling exercises. The dosimetry data are held by the ADS as long as the regulatory requirements specify, and by

Westlakes indefinitely. Dosimetry data are available on the database since 1980, prior to which dosimetry measurements are stored on paper records.

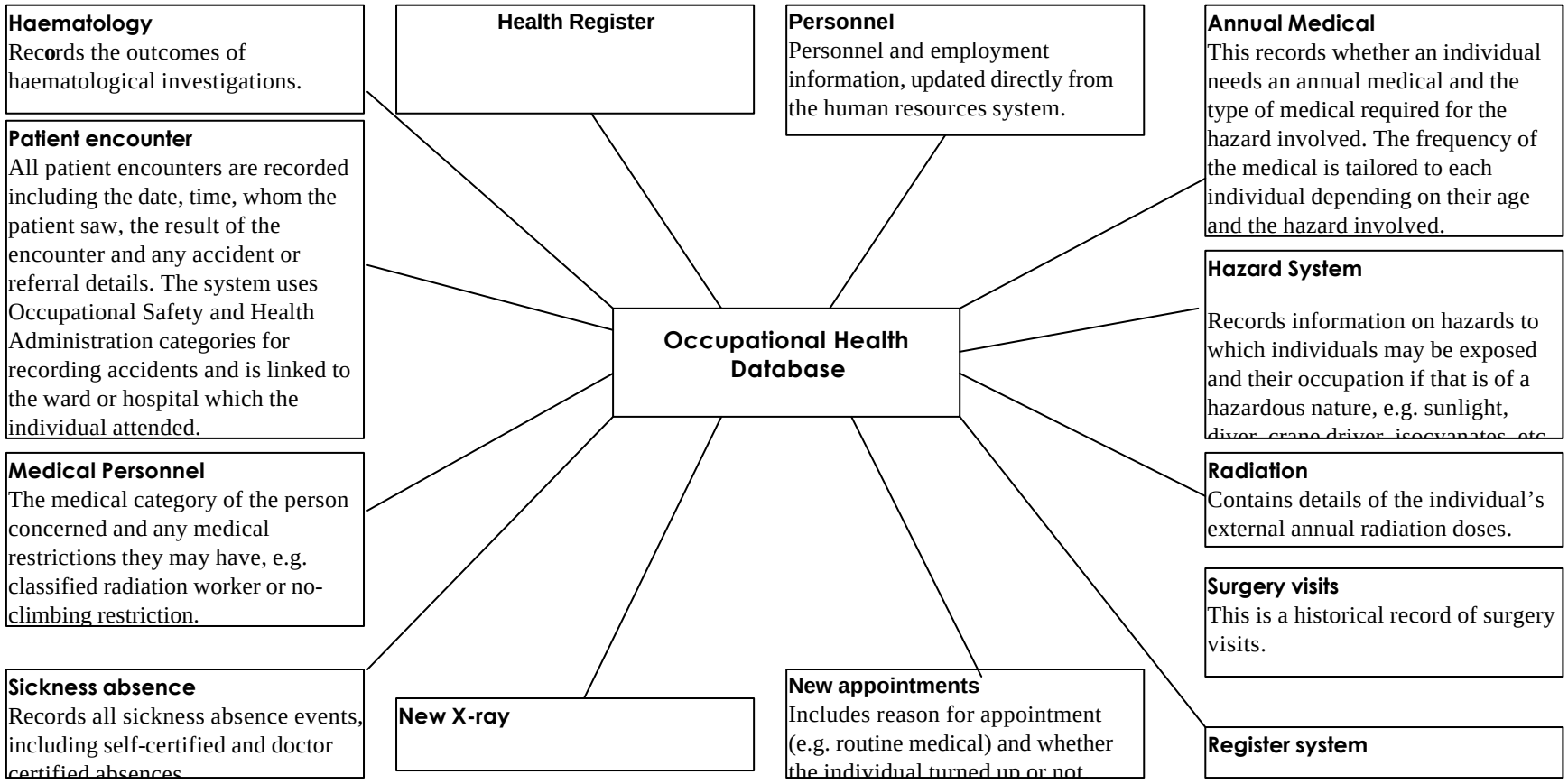
The Dosimetry Database obtains dosimetry data and links it to personnel data from the Occupational Health or Epidemiology Database. It cannot be assumed that the identification numbers used by the ADSs are the same as those used in the occupational health or epidemiology systems and so it is necessary to match individuals to their dosimetry records by other means. This is usually done by using a scoring algorithm which uses the individual's name, site number, National Insurance number, NHS number, initials, DOB and sex to match them with the data on their dosimetry records. Each matching data item is assigned a score and when the total score for a particular match reaches a predefined level (i.e. when most of the data items match), the records are then accepted as being matched to the correct person. The system also searches for and highlights duplicate records both within and across sites so an individual is not estimated to have a higher dose than actually was the case.

## *Epidemiology studies*

The dosimetry and occupational health data tend to drive the epidemiological analysis, which usually takes the form of a cohort or case-control study. When carrying out a study a chronological list of events is created for each individual, for example DOB, date commenced work and site, date dose acquisition began, etc., resulting in a list of about 250 events per person. The list of events is then converted to purely numerical data according to categorical data groupings for a particular aspect of an individual's life, for example for age, sex, calendar year, employer, industrial status, length of service, length of status, radiation status (i.e. plutonium or uranium), etc. Additionally, each individual is assigned to a disease group (each group consisting of a range of diseases according to ICD codes). These data are then used to compute standard mortality ratios for the exposed population as a whole, and for specific groups of individuals (e.g. according to age, sex, disease, etc.). This is compared with disease rates in the general population, calculated from ONS and General Registry data for England and Wales, and Scotland, respectively, to identify any potential disease excesses.

Each study is performed to an epidemiological protocol that is developed specifically for each study. Recently studies have been published on the mortality experience at the Springfields and Capenhurst facilities and on the cancer morbidity experience at the Springfields facility. Studies have also been carried out on the effect of shift patterns on ischaemic heart disease, and on exposure to asbestos.

**Figure 4.4** Westlake Scientific Consulting Ltd. Occupational Health Database



## 4.7.4 Health and Safety Executive National Exposure Database

The National Exposure Database (NEDB) is an integrated database of industrial exposures to over 400 chemical and physical agents in the UK. The database consists of approximately 100 000 measurements collected by HSE staff, mainly at the request of local factory inspectors (about 90% of measurements) who have identified potential problems and a need for monitoring. The remaining measurements (about 10%) are samples that have been collected more routinely. As a result the database may not be representative of normal working conditions, but may be skewed towards worst-case exposures.

Of the 100 000 measurements, about 20% are for asbestos and were made during routine asbestos surveys until 1983. These historical measurements and related information are stored separately from the other exposure data, as different codes are used. However, the data stored are quite comprehensive and include the following fields:

- factory code
- job
- date
- asbestos fibre dimensions (five categories)
- peak exposure
- respirator used (Y/N)
- industry
- employee number
- start and finish time (of sampling)
- type of asbestos monitored
- gravimetric sample

Asbestos data collected since about 1985/6 are not included with the historical data, but are included in the main part of the database, together with data on other chemical and physical exposures.

The remaining 80 000 measurements are stored in the main part of the database and are mainly taken from completed HSE/British Occupational Hygiene Society Environmental Monitoring Data forms. The information held on these measurements dates back to 1985/6, although the Occupational Hygiene Visit Reports (OHVR) have been retained since 1982. The information held on this database is much more detailed than that on the asbestos survey data, and includes abstracts of the visit reports and a

reference to the full visit report, which is accessible by HSE staff. Furthermore, all data are checked before being entered into the database, thereby ensuring quality and reliability of the data. The fields on the main part of the database include:

- form number
- occupier (name and address)
- visit date (from/to)
- substances (exposed to)
- job
- females exposed
- sample type
- sampling duration (minutes)
- biological monitoring
- personal protective equipment (PPE) (Y/N)
- OHVR Reference
- industry (classified according to Standard Industrial Classification codes)
- number of people on site
- visit type
- process
- males exposed
- monitoring procedure (e.g. Methods for the Determination of Hazardous Substances method)
- sampling period (from/to)
- dermal monitoring (Y/N)
- local exhaust ventilation (Y/N)
- visit report abstract

The information held on the individual samples includes:

- sample type
- sampling duration

- job
- exposure type (e.g. normal)
- sampling period (from/to)
- process
- respiratory protective equipment (RPE) (Y/N)
- result

Individuals exposed cannot be identified from the database (for confidentiality reasons), nor does it have any additional information on local environmental conditions or supporting data for the sampling measurements owing to the cost of obtaining such information. However, there may be important additional information contained in the visit report abstract, which is a searchable free text field. Of the 400 substances on the database α-quartz is the most common, with approximately 6000 samples, followed by samples for total dust, toluene, styrene, xylene, lead, cobalt, respirable dust, chrysotile and cristobalite; the database also has some noise exposure measurements.

It is possible to search the database on any field, although sub-searches on selected data are not possible. Searches by visit report make it possible to identify whether multiple substances and/or exposures were sampled. The data from the main part of the database and the asbestos surveys can be imported into a spreadsheet or statistical package for analysis. Data on the occupier of the premises are not provided to external enquirers (usually Government or industry) for confidentiality reasons.

Over the past few years the rate of addition of samples to the database has slowed down, owing to a shift in emphasis to the employer to monitor substances in the workplace. HSE is hoping to encourage employers to send monitoring data for inclusion in the NEDB.

The database has a number of important uses. It holds a substantial number of measurements for several compounds, enabling the distribution of exposures to be derived, and giving an assessment of the range of exposures that are being experienced. It should be noted that these may represent worst case scenarios and thus may overestimate typical exposures. However, the database is potentially useful for informing the setting of standards and exposure limits and for the prescription of diseases for industrial injuries benefit. The database receives requests from industry and researchers who need information on typical ranges of exposure.

## 4.7.5 Summary

Only a small sample of civilian industries were visited but these were chosen for their comparability with the Armed Services. All of them have some form of collection of personnel, pay, medical and exposure data. Some of these are very effective both for ongoing monitoring of health and potentially hazardous exposures and for use in epidemiological research. They demonstrate that record systems which are both linkable and accessible can be developed for complex industries with large, relatively mobile workforces and a range of hazardous exposures. The effectiveness of these systems may partly be due to their focus on occupational health rather than on general health.

**Table 4.9** Summary of visits to comparable civilian industries

| Industry | Function/purpose of industry | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| Rolls–Royce (RR), Derby | System for the collection and management of personnel, medical and exposure-related information | Personnel, medical, exposure information | Personnel records track an individual's occupation and where within RR they worked<br>Individual's name is used as unique identifier and in some locations a check number is also used<br>Hard copies of medical records maintained from 1950s<br>Individuals exposed to hazards (i.e. noise, vibration, isocyanates) requiring health monitoring are assigned to 'nominal rolls'<br>Electronic, paper and microfiche copies of risk assessments are maintained<br>Individuals used as representative of exposure group are identified in risk assessment reports<br>RR using their records to study worker mortality in relation to work history (e.g. respiratory diseases and bladder cancers) | Department numbers may change due to company restructuring<br>Check numbers are not used across the company; RR have acquired various companies over the years with slightly different occupational health systems<br>Occasionally individuals who are not exposed to specific hazards are inadvertently assigned to 'nominal rolls'<br>Job titles are inconsistent across the company (e.g. turbine blade polisher and fettler are the same occupation) |

| Industry | Function/purpose of industry | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| Imperial Chemical Industries (ICI), Runcorn | Comprehensive occupational health management system based on ICI safety health and environment policy | Personnel, medical, accident, risk assessment and exposure information | Individuals exposed to a particular hazard are assigned to an exposure group and are thereby subject to particular occupational health activities<br>Exposure groups have a defined contact person<br>Only individuals in an exposure group can be subject to health surveillance/biological monitoring<br>Individuals are identified by their National Insurance number and a unique ID based on the driver's licence format<br>System can be interrogated and produce a broad range of reports and outputs, both *ad hoc* and routine<br>System automatically sends reminders to individuals in exposure groups who have health surveillance appointments in the next month | Archived data from previous system cannot be interrogated by the system (some data on audiometry has been 'shoehorned' into the system by filling data gaps with default values) |

| Industry | Function/purpose of industry | Exposure data collected/system used | Strengths of data/system | Weaknesses of data/system |
|---|---|---|---|---|
| Occupational Health and Medical Statistics Group, Westlakes Scientific Consulting, Cumbria | Provides support service to British Nuclear Fuels plc to manage, monitor, report on and study the effects of occupational exposures on employees | Collects comprehensive personnel, exposure (both radiological and other) and health data for all employees, and has traced data retrospectively back to 1940s | Comprehensive and integrated exposure and health surveillance system<br>Occupational health database designed both to manage data and for epidemiological purposes<br>Links between occupational health database, epidemiology database and personnel system<br>NHS records of employees flagged<br>Future plans to link risk assessments to sickness/absence data | Some data gaps in retrospective data for some facilities<br>Data on exposures to hazards other than radiation not as comprehensive as radiological data |
| Health and Safety Executive, Bootle – National Exposure Database | Maintain National Exposure Database | Database of industrial exposures to over 400 chemicals and physical agents in the UK, collected at request of HSE Inspectors | Standardised collection of data<br>Linked to original reports<br>Over 100 000 measurements<br>Good search capabilities<br>Good supporting data on location of sampling and nature of tasks being sampled | Probably biased towards worst-case exposures, since mostly sampled for compliance purposes<br>Use of collected data not immediately foreseeable i.e. not routinely used for specified purpose<br>Difficult to identify occurrences of exposures to multiple substances |

# 5 Evaluation

This project has assessed some of the record systems in current use in the Armed Services that have the greatest potential for use in exposure assessment. The one year duration of the study limited both the number of record systems that could be investigated and the depth to which each system could be evaluated. Although every effort has been made to ensure that the information discussed in this report is as accurate as possible, there may be minor omissions and inaccuracies and changes may have taken place since visits were made. To guard against errors, draft reports were sent to each group that was visited asking for their comment and corrections. Most groups returned these draft reports but where no reply was received it was assumed that the interpretation in the report was correct. The Service personnel interviewed were aware of some of the problem areas and issues that have been highlighted through this project, and in some cases these were being addressed or actively discussed.

There are three major issues which it is important to bear in mind when considering the findings of this study.

- The Armed Services have varying histories and traditions. Although their overall remit may be similar, to some extent they have different functions; hence their information needs may differ. This may contribute to variations in approaches to the collection of information and to the development of different database structures and data items. However, there is now an increasing move towards greater coordination in general within the three Services both during peacetime and in operational situations. There is thus perhaps a greater need for the development of harmonised information systems across the three Services. This has been recognised, for example, in projects such as the Corporate Personnel Data System, which aims to develop a tri-service personnel and pay system, with common data items, definitions and codes, as described in Section 4.2.1.

- The record systems which have been investigated in this project are, in general, designed for specific administrative purposes, and have not been developed to facilitate exposure assessment. However, it is anticipated that implementation of many of the recommendations in this report would improve the usefulness of record systems, both for the purpose for which they were originally intended and for health surveillance, including exposure assessment.

- There are a number of important differences between the Armed Services and civilian industry which impact on exposure assessment. The Services have a relatively large workforce carrying out a very large variety of jobs and tasks. Although probably most tasks carried out in civilian industry are also undertaken in the Services, the defence role of the Services inevitably involves additional hazards not commonly experienced by the civilian workforce. Higher mobility than that generally found in civilian life, both geographical and vocational, is also a feature of working in the Services.

There is general recognition within the three Services of the need to monitor both the health of the workforce and the exposures and hazards to which people might be exposed. The collection and retention of exposure data facilitates the ability of the Services to demonstrate compliance with regulatory processes and carry out the duty of care to protect the health of Service personnel. In addition, the problems encountered in attempting to investigate health and exposure issues arising from

the Gulf conflict, in particular, have highlighted the need to be able to carry out epidemiological research.

Section 2.1 outlined different methods of exposure assessment used in occupational health and epidemiological studies; methods range from a simple ever/never classification to quantitative exposure estimates for individuals. From the research reported in Section 4 an evaluation can be made of the potential to use Armed Services' records to carry out exposure assessment by the various methods.

For an ever/never assessment it is necessary to be able to identify uniquely each individual and determine whether they were employed in the Armed Services. In the vast majority of cases this should be possible. However, as described in Section 4.2, the use of a unique Service Number throughout a career in the Armed Services is not universal in the three Services; numbers change in some cases when promotion occurs. Additional useful information for uniquely identifying an individual, such as surname and forenames, may, of course, also change. Thus there is a possibility that an individual may not be accurately identified, and that duplication of identification details may occur (although this is likely to be a rare occurrence).

Duration of employment is a surrogate measure of exposure commonly used in occupational health studies; it requires dates of entry and exit from employment. Once an individual is identified this information should be readily available from Service personnel records. However, Service personnel may have highly variable exposure intensity in both work area and over time. This variability will hamper efforts to use employment duration as an exposure surrogate.

Exposure assessment is greatly enhanced by information on jobs and tasks carried out during employment, together with dates and locations of employment. In civilian industries, such as those described in Section 4.7, this information is usually in the form of a work history recorded as part of the personnel system. The different job titles or groups of titles and locations facilitate the identification of subgroups of individuals with varying exposures and potential health risks. As noted in Section 4.2, a characteristic of employment in the Armed Services is relatively high mobility, both within and between postings. The current record systems within the Armed Services record postings, and some systems, for example, those of the Royal Navy (RN), record movements within postings. However, there appears to be considerable potential for differences, both within and between Services, in the recording of postings and movements. In addition, there appears to be no method of reliably recording detachments from within a post in any of the Services. This may lead to a record indicating a posting to a particular job and location when in fact all of the employment during this period was elsewhere (i.e. during a detachment). Furthermore, Service personnel are seldom assigned to one exclusive job category and often move between jobs as and when required for operational or career development purposes.

In civilian industry, in the past, there was a tendency for job titles to reflect all (or at least some) of the tasks carried out. With the increasing need for flexibility within jobs, many industries have moved towards the use of more generic job titles, such as 'process operator'. In the Armed Services, personnel records tend to reflect the rank or position within the Service hierarchy, rather than specific jobs or tasks, and in some positions the need for flexibility and a wide range of skills is extremely important. The personnel systems record qualifications and training, which are useful indicators of skills and potential exposures; generic job descriptions may also exist. (It is interesting to note that at least one of the computerised systems does not have a field for university degrees for the ranks, but

does for officers.) However, specific skills and training may not actually be used by an individual within a particular posting or job; this is also encountered in civilian industry.

Quantitative exposure measurement can be carried out using fixed site monitors for a particular location or personal monitors attached to individuals. Quantitative estimates for particular jobs, tasks and locations can be used with individual work history information to provide a quantitative estimate of individual exposure. Section 4.4 reported on occupational and environmental monitoring data collected in the Armed Services, and procedures for carrying out risk assessments. A considerable amount of monitoring, including personal, fixed location and biological monitoring, is carried out across the three Services, both for regulatory purposes, such as under the Control of Substances Hazardous to Health (COSHH) regulations, and on an *ad hoc* basis. Radiation monitoring appears to be the most well-developed system. A complete record of an individual's lifetime occupational exposure to radiation is maintained, in both paper and computerised formats. An annual radiation medical is carried out but is not consistently linked, in computerised form, to the exposure data.

Noise exposure assessments are also carried out regularly for particular processes or locations. A standard form is used by all three Services to record the results. The noise assessments record the Unit Identification Number; however, they do not record the employees at risk in a particular location. They are thus not readily linkable to any individual audiometry measurements that may be carried out.

Results from other monitoring procedures are usually presented in a hard copy report and retained by the Unit carrying out the measurements. Most of these, with the exception of some routine monitoring carried out under COSHH, do not record the individuals potentially exposed. These reports are usually retained, but are often filed by date or location, thus increasing the difficulty of identifying measurements for particular substances or processes. Apart from the radiation data, there appear to be relatively few accessible and comprehensive electronic databases either of the exposure data and other data relating to the measurements or of indexes of the paper reports. Few or no links are made between exposure monitoring data and other relevant data, such as those available in health or personnel records. Occupational exposure databases are the subject of much research and discussion in the occupational health field, both in Europe and the United States.

Risk assessments, including COSHH assessments, are carried out where appropriate within the Armed Services, and updated when necessary. Standard forms for risk assessments are used across the three Services. These are potentially a useful source of data relating to exposures. However, there is no policy on archiving these paper records, and the tendency appears to be to discard old assessments whenever a new one is carried out. No electronic database of these assessments appears to exist. It is important to note however, that the Ministry of Defence (MOD) are complying with the COSHH regulations which do not require the retention of out-of-date assessments, although the capability of the Ministry of Defence (MOD) to carry out exposure assessment would be greatly enhanced if all assessments were retained.

Other potentially useful information for exposure assessment might be available from Material Safety Data Sheets (MSDSs), procurement records and logistics Units but the full detail of these records and how they may be used with the other records for exposure assessment needs further evaluation.

The follow-up of issues arising from the Gulf conflict has emphasised the necessity for retention of records that identify the individuals concerned, give details of jobs, task and locations during

employment, and enable an assessment to be made of the potentially hazardous exposures that might have been encountered.

Medical records are retained in perpetuity by all three Services. However, policies on the retention of other records vary both within and between the Services. For example, policy on the length of time personnel records are kept and the degree of detail kept (i.e. full or summary record) varies between the Services and according to status (rank or officer); there is currently no policy for the retention of health and safety records. This research project has drawn attention to many examples of the lack of retention of records, including the selection of specific data items to be discarded from both electronic and paper records, the overwriting of electronically held information when it is updated, and the discarding of complete records. Differences in practice across the Services, and between different types of record (e.g. for ranks and officers) were found to be common. Within the remit of the respective systems these procedures are not problematic and fit within the needs of the system. However, for exposure assessment purposes, the overwriting or discarding of information can preclude adequate exposure assessment.

Many of the issues raised about the record systems in the Armed Services are also experienced in civilian industry. The civilian industries visited were chosen for their comparability with some of the important areas of exposure in the Armed Services. Although only a small sample, they provide useful examples of accessible and linkable record systems for a large workforce and a range of jobs, tasks and exposures. They also demonstrate how personnel, medical and exposure records can be integrated for both health surveillance and epidemiological studies. Although their systems are designed to function for an occupational health service, some of these companies also undertake provision of primary health care for their overseas workforce. Their record systems are thus flexible enough to accommodate this.

# 6 Recommendations

This research project has investigated a number of record systems in the Armed Services that provide information relevant for exposure assessment. It has highlighted both general and specific problems which limit the potential usefulness of the records for this purpose. Some of the recommendations made below could be implemented in a fairly straightforward way, albeit at some cost and effort. Others address more fundamental issues, which may require a more comprehensive review and changes in policy. In addition to improving the records for use in exposure assessment, implementation of these recommendations would, in many situations, improve and enhance the general functions of the records. We acknowledge that some of these recommendations may already be under consideration as part of other Ministry of Defence (MOD) or individual Service activities.

## 6.1 General recommendations

For each record system:

- **Consideration should be given to whether systems should be identical across all three Services, that is whether comprehensive tri-service systems should be developed.** This is a fundamental issue and would require commitment and compromise for change to be achieved successfully. Joint operation is an increasing feature of Service work. Common record systems would enhance administrative functions, in addition to facilitating health surveillance and other health studies.

- **The primary aims and purpose of each record system should be carefully defined and consideration given to potential secondary uses of the information held.** An important secondary use of personnel, medical and exposure information is to provide data for exposure assessment for use in health surveillance and epidemiological research. The importance of being able to investigate potential adverse health effects and exposures associated with work has been widely recognised in civilian industry, particularly in companies employing a large workforce who may be exposed to known hazards.

- **There should be a clear retention and archiving policy, and procedures for implementing such a policy.** The potential uses of records after their initial function is completed should be carefully considered in developing a policy for retention and archiving. Benefits include the capability to respond to issues of litigation, to ensure fair and appropriate compensation and to carry out health related research.

- **The use of computerised record systems with adequate provision of data protection, in addition to, or as an alternative to, paper format should be considered.** Compared with paper based systems, carefully designed computerised record systems offer increased flexibility for change, accessibility to multiple users, ease of storage and archiving and the potential for linkage to other systems.

- **The purpose and nature of each data item should be carefully defined before inclusion.** There needs to be a compromise between collecting the minimum amount of data and thus limiting the usefulness of a system and collecting information which will never be used. The exact form of

each data item also needs to be carefully defined. For example, a tri-service personnel system would require reconciliation of the format of Service Numbers.

- **Record systems should be developed in such a way that they can be linked to each other.** Key data items with unique entries for each separate record, such as an identity number for the record of an individual, should be defined to facilitate linkage between record systems.

## 6.2 Specific recommendations

All record systems:

- **When the record system contains data on individuals there should be a unique way of identifying each individual, which does not change throughout the Service career.** Adherence to the general principal of uniqueness is more important than the actual method of implementation chosen. Methods could include: the use by all Services and all ranks of the same structure for Service numbers; the use of full name, date of birth together with identity number; creation or use of another unique number, for example the National Health Service (NHS) number.

- **The same information should be collected for all individuals, regardless of status.** The backgrounds, roles and exposures of individuals in the Services in all positions are now more similar than in the past, increasing the need for standardisation of information collected. Current differentiation between ranks and officers means that valuable information is not collected for some individuals.

- **The same retention and archiving policies should be applied to the records of all individuals, regardless of status.** Exposure assessment may be required for individuals in a variety of positions in the Armed Services. The current practice of differential retention of data between ranks and officers hinders this.

- **No information on electronic databases with the potential for use in exposure assessment, should be overwritten, and a continuous record of all changes should be maintained.** This should ensure that potentially valuable historical information is not lost. Although a large amount of information is already collected, modern computerised systems should be able to cope with any increase.

### *Personnel systems*

- **A minimum data set across all three Services which uses the same definitions and codes should be developed.** This should include demographic data, work history information and data on movements. There should also be scope to include additional Service specific data items. Secondary uses of the data should be taken into account when defining a minimum data set.

- **Consideration should be given to the development across the Services of a classification system for jobs and tasks which reflects the work carried out as closely as possible.** This could involve developing a system which combines information on rank, postings or movements and jobs or tasks. In addition, job descriptions should be developed which closely describe the tasks actively carried out.

- **Postings, movements and detachments should be comprehensively and consistently recorded.** The same system should be used for all Services and the data retained on each individual's record. Special consideration should be given to how this can be implemented equally effectively in both peacetime and operational situations.

### *Medical records*

- **Consideration should be given to developing a clearer distinction between general health service provision and recording, and occupational health service provision and recording in the Services.** Successful record systems in civilian industry benefit from having implementation of an occupational health service as their primary purpose, although it should be noted that those companies that have a large non-UK workforce often fulfil the function of a primary health service to employees and their families working abroad. A minimum data set might also be considered for medical records focusing on occupational health.

- **Computerised medical records systems should be linkable to primary personnel databases such as those held by AFPAA.** This would enable demographic information and movement and job data to be transferred, facilitating health surveillance, exposure assessment and epidemiological research.

### *Environmental monitoring*

- **Tri-service guidance should be developed for the reporting of environmental and occupational monitoring.** This would facilitate standardisation across the Armed Services of the data collected when monitoring measurements are made.

- **Consideration should be given to developing a comprehensive tri-service computerised database, which would provide an index of the reports of monitoring and be searchable by substances measured, location, process, job or task, and date.** This would greatly benefit the process of exposure assessment, particularly retrospectively, by facilitating the collation of all measurements carried out on particular processes and substances.

- **Development of a comprehensive computerised system for recording monitoring data and all associated data could be considered.** This type of database has been successfully developed and implemented in many civilian industries and UK government organisations, and this issue is being addressed in other non-UK Armed Services.

### *Health and safety*

- **Health and safety policy should be implemented in a standardised way across all Services for comparable jobs and tasks.** A tri-service document detailing how health and safety policy should be implemented would aid this process. Standardisation should include consideration of priorities for health and safety, assignment of responsibility for health and safety and the training of those for whom health and safety is a major part of their work.

- **There should be a tri-service policy to retain and archive all risk and other assessments, including COSHH assessments.** This would give a historical record of known hazards and changes relating to these.

- **Serious consideration should be given to the linking of COSHH and other risk assessments to the records of individuals.** This would facilitate exposure assessment for individuals.

### *Historical records*

- **Consideration should be given to the standardisation of the format and content of historical records with an agreed minimum data set, to be implemented across the Armed Services.** Decisions would be needed for the timing of these reports, for example monthly, the standardisation of the recording method, and the location, preferably centrally, to which the report can be sent for storage. This would ensure a consistent history of Service proceedings and be in line with increased joint operations.

# 7 Future Research

This project has highlighted several areas which would benefit from further research. These include:

- **an in-depth analysis of current record systems for use in exposure assessment, including the overlaps and links between systems and across the three Services.** A full evaluation of the record systems investigated and an assessment of others identified has been limited by the short time-scale of the current project. Further work could include development of a minimum data set required for different methods of exposure assessment, identification of sources of these data in the current Armed Service record systems and developments to improve and link the data systems thus identified both within and between the Services.

- **an evaluation of the limitations and potential of current record systems in the Armed Services for epidemiological research by carrying out some case studies of particular concern.** An example of a health issue and an exposure issue, respectively, is provided by the recent cases of malaria in Sierra Leone, and the potential exposures emanating from a waste site in Banja Luka, Bosnia. Both these situations involved staff from more than one Service and follow-up of these to investigate the exposures and health events would provide valuable insight into the limitations and potential of current systems.

- **an evaluation of other systems, including civilian and non-UK military systems, for the collection and retention of exposure assessment monitoring data.** Data collection for exposure assessment is also of concern to non-UK armed services. This current project has examined a small selection of systems in civilian industry. However, many other industries have also developed their own systems and there is considerable interest in harmonisation of databases for this purpose in both Europe and the USA.

- **development of a tri-service database for cataloguing the reports of environmental and occupational monitoring.** This would provide an index of all the reports of monitoring which could be searched by substances measured, location, process, job or task monitored and date. This would facilitate collation of all measurements carried out on particular substances or processes.

# Acknowledgements

We would like to thank Mr Bob Ferguson and Mr Dean Payne from DERA for identifying relevant Units and individuals and facilitating our visits, and the members of the Health Surveillance Steering Group for their helpful comments at the regular progress meetings. We are grateful to all those people we visited in the Armed Services for giving up their time to assist us in this project and the trouble many of them took in providing us with additional help and documentation. Thanks go to Mrs Elaine Bottrill for providing the secretarial and administrative support for this project, and for setting up and maintaining the filing system required.

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# Abbreviations

| | |
|---|---|
| ADS | Approved Dosimetry Service |
| AESB | Army Environment and Safety Board |
| AFPAA | Armed Forces Personnel Administration Agency |
| AHB | Air Historical Branch |
| AP | Air Publication |
| APC | Army Personnel Centre |
| BNFL | British Nuclear Fuels plc |
| CARMED | Computer Aided Retrieval of Medical Documents |
| CASSANDRA | Civilian and Service Statistics and Related Analyses |
| CESO | Chief Environment and Safety Officer |
| CHASP | Central Health and Safety Project |
| CO | Commanding Officer |
| COSHH | Control of Substances Hazardous to Health |
| DAG | Deployed Administration Group |
| DASA | Defence Analytical Services Agency |
| DERA | Defence Evaluation and Research Agency (now Defence Science and Technology Laboratory) |
| DESB | Defence Environment and Safety Board |
| DLO | Defence Logistic Organisation |
| DOB | Date of Birth |
| DOSB | Defence Ordnance Safety Board |
| DRPS | DERA Radiological Protection Service |
| DSEF Pol | Directorate Safety, Environment and Fire Policy |
| DSPS | Directorate of Staff and Personnel Support |
| EHT | Environmental Health Team |
| EMT | Environmental Monitoring Team |
| FMED | Forces Medical Event Database |
| GVIU | Gulf Veterans' Illness Unit |
| HMS | Her Majesty's Ship |
| HQ | Headquarters |
| HSE | Health and Safety Executive |
| HSU | Health and Safety Unit |
| ICD | International Classification of Diseases |
| ICI | Imperia l Chemical Industries |
| IEH | Institute for Environment and Health |
| INM | Institute of Naval Medicine |
| IRR | Ionising Radiation Regulations |
| JSP | Joint Service Publication |
| MCM Div | Manning and Career Management Division |
| MSDS | Material Safety Data Sheet |
| MOD | Ministry of Defence |
| MOR | Movement Occurrence Report |
| NATO | North Atlantic Treaty Organisation |
| NEDB | National Exposure Database |

| | |
|---|---|
| NHS | National Health Service |
| NMA | Naval Manning Agency |
| NMMIS | Naval Manpower Management Information System |
| OMIS | Operational Management Information System |
| ONS | Office of National Statistics |
| OOB | Out of Barracks |
| ORB | Operations Record Book |
| PIC | Posting Identification Code |
| PMA | Personnel Management Agency |
| PRF | Personnel Record File |
| PRO | Public Record Office |
| PULHHEEMS | Physical Capacity; Upper Limb; Locomotion; Hearing (left and right); Eyesight (left and right); Mental Capacity; Stability (emotional) |
| RAF | Royal Air Force |
| RIDDOR | Reporting of Injuries, Diseases and Dangerous Occurrences Regulations |
| RN | Royal Navy |
| ROS | Record of Service |
| ROHSy | Replacement Occupational Health System |
| ROP | Report of Proceedings |
| RR | Rolls–Royce |
| SAP | Software Application Programme |
| SC | Service Certificate |
| SG | Surgeon General |
| TLB | Top Level Budget |
| TOMIS | Theatre Operational Management Informative System |
| UHR | Unit Historical Record |
| UIN | Unit Identity Number |
| UNICOM | Unit Computing System |
| WD | Worthy Down |
| WPA | War Pensions Agency |

# Annex A

## Potential hazards in the military setting

| Hazard | Example | Notes and exposure considerations |
|---|---|---|
| **Natural hazards** | | |
| Biological hazards | Microorganisms: bacteria, viruses, parasites, fungi | Although bacteria are most frequently associated with disease, viruses, parasites and fungi can also be responsible. From a disease prevention and exposure assessment viewpoint, it is important to consider how pathogenic microorganisms can infect individuals. For instance, exposure may be via food, water, inhalation or through damaged regions of the body (cuts and other wounds) |
| | Animals: insects and reptiles (bites, poisonous skin secretions and venom), mammals (disease vectors or physical injuries from bites) | Insects pose a hazard either directly due to bites and stings or through the diseases they carry (e.g. malaria). A wide range of diseases can be transmitted to humans through casual contact with infected animals or their by-products (skins, pelts), leading to diseases such as anthrax. Infection may also occur through eating infected meat or other animal products or by attacks and bites (e.g. rabies) |
| Climatic hazards | Heat: in hot climates, the main health hazards are heat cramps, heat exhaustion and heat stroke | Although worsened in hot climates, heat-related health hazards can occur in temperate and even cold climate areas. Similarly, cold-related hazards are not confined to cold climate areas |
| | Cold: injuries include non-freezing cold injury, frostbite and hypothermia | |
| Geological hazards | Volcanoes, earthquakes and tsunamis: violent volcanic and earthquake activity is relatively rare and limited to known areas of the globe | Although unpredictable, certain areas are more prone to these hazards than others. The UK experiences only minor earthquake activity with occasional structural damage whereas Japan is more often affected owing to its location |
| | | These hazards may cause other environmental problems such as contaminated drinking water and disruption to other utilities and food supplies |

| Hazard | Example | Notes and exposure considerations |
|---|---|---|
| Geographical hazards | Drought and floods | Drought and flood affect large areas of the world's land mass every year and there is a reasonable chance of deployment to affected areas. In drought affected areas, lack of water is the most obvious hazard. The changing role of the Armed Services means deployments for humanitarian aid, such as to drought or flood affected areas, are becoming more frequent |
| | | Health hazards in flooded areas, other than drowning, include food and drinking water contamination, destruction of equipment and the spread of water borne diseases such as cholera and dysentery |
| | Altitude: acute mountain sickness, high altitude pulmonary oedema, cerebral oedema | These health hazards are caused by a combination of lack of oxygen and the effects of reduced air pressure |
| | Cold water immersion: the main health hazards include hypothermia and 'cold-shock response' | For healthy individuals, the cold-shock response (increased heart rate, an initial inspiratory gasp and uncontrollable hyperventilation resulting in reduced breath hold time) poses the greatest hazard. The reduced breath hold time increases the risk of aspirating water and makes swimming difficult |
| **Man-made hazards** | | |
| Physical hazards | Machinery, heat, pressure, noise, vibration, radiation, electrical | Hazards from machinery and equipment include impact injuries, entanglement in moving parts, crush injuries and amputation of body extremities; tripping hazards may also be present |
| | | Heat hazards are associated with people such as welders and cooks who work in high temperature conditions |
| | | Pressure hazards are associated with people who are subjected to changes in pressure such as divers and aviators. Individuals working at altitude may also experience pressure related health impacts (see altitude above) |
| | | Noise hazards include operating machinery, gunfire, musicians and vehicles. The effects of noise are cumulative and irreparable |
| | | Radiation hazards exist both in barracks and on operation. Both ionising and non-ionising radiation may be encountered |
| | | Electrical hazards are associated with working with electrical machinery, both in barracks and on operation |

| Hazard | Example | Notes and exposure considerations |
|---|---|---|
| Chemical hazards | Hazardous chemicals, chemical weapons | Exposure to hazardous chemicals either as a gas, liquid, vapour, solid, mist or dust that is somehow inhaled or absorbed into the body. In war, chemical weapons may be a concern although exposure to hazardous chemicals may also occur if individuals are deployed into disused industrial sites, either as living or working accommodation. Work activities may also expose people to hazardous chemicals, whether accidentally or as part of normal work practice |
| Biological hazards | Microorganisms, biological weapons | In addition to the hazards outlined above (the living environment microorganisms), medical personnel may be exposed to pathogens such as hepatitis B; engineers may be exposed to pathogens in contaminated water supplies. Biological agents may also be used by an enemy in wartime |
| Ergonomic hazards | Lifting, carrying, confined work spaces | How an individual interacts with their environment can lead to hazardous situations. Equipment must be designed to accommodate people of different physiques to ensure no physical and mental strain in its use. For instance, lower back injuries may occur if the correct lifting equipment or training is not available |
| Military activity | Injuries and exposure to other hazards as a result of military activity | Military activity (training, operations, exercises) provides many opportunities for injuries and exposure to other hazards. For example, lower limb injuries such as sprained ankles, broken bones, exposure to flora and fauna, road traffic accidents, firearms accidents, unexploded ordnance, unsafe buildings |
| **Psychological hazards** | | |
| | Stress, post-traumatic stress syndrome | Exposure to traumatic situations or highly stressful situations in times of crisis or war |

Adapted from May *et al.* (1999)

# Annex B

# Information sheet sent before each visit

## An Objective Assessment of Systems for the Collection and Analysis of Exposure Information

### *PROJECT SUMMARY*

#### Background

Protecting the health of Service Personnel not only involves providing high quality medical services, but also health surveillance (to identify adverse health trends), and collecting information on the exposure of individuals to potential health hazards, so the causes of ill health can be identified and preventative action taken. Although it is relatively easy to identify adverse health trends, it is often much more difficult to identify the cause of the health problem. This is often because there is a lack of information on the exposure of individuals to potential health hazards. This exposure information is important, since without it the cause of health problems cannot be identified and effective preventative action cannot be taken.

#### Aims and objectives

As part of a wider project to enhance its' health surveillance capability, the Defence Medical Services (DMS) has commissioned the Institute for Environment and Health (IEH) to carry out an assessment of the systems in use in the Armed Services (and some examples in industry) for the collection and analysis of exposure information. Specifically the objectives of the project are:

- to determine current practice for exposure information collection and retention;
- to identify the linkages and overlaps with health and exposure information in other systems;
- to consider the future uses for which the information might be needed and identify essential data items;
- to make recommendations for improving information collection and retention for future use

#### Purpose of our visit

Often it is the case that much exposure information is collected already within an organisation, it is just that it is not often readily recognised as such. It is obviously more efficient to make use of the existing systems and information, rather than to collect identical information elsewhere and as a result we are visiting a range of MOD establishments to:

- establish what systems exist which collect exposure information;
- gain a detailed understanding of each system; and
- evaluate each system for the purposes of exposure estimation

An explanation of what we mean by exposure information and the types of data we are interested in is provided overleaf. However, quite simply we are interested in any data system (electronic, paper or other) which collects and stores information on the interaction of Service personnel with any potential health hazard. At a basic level, this might simply be an individual's employment record giving details on the individual, their postings and their job tasks. At a more complex level, it could include measurements of an individual's exposure to a specific chemical agent or radiation. Whatever the level of information, it should be borne in mind that data from many sources can be used for exposure purposes and it is not limited solely to scientific measurements.

In addition to exposure information we are also interested in how the information is managed. Particularly issues relating to the retention, access and linkage of the data. For example, how is the data stored? How can it be accessed? Is it linked to any other records? How long is it stored for, and when might it be archived?

### How will the results be used?

The information collected from our visits will be put together with information from other sources and used to develop recommendations for:

- a basic framework for the collection and retention of exposure information; and
- linkages with other health information systems

This will enable the DMS to monitor exposures to potential health hazards more accurately, improve the effectiveness of health surveillance and enable them to provide better health protection to Service personnel.

### What is exposure information?

Exposure information is any information that provides details of the exposure of an individual or groups of individuals to any potential health hazard. Often specific data is not collected on each individual type of exposure and so it is often necessary to look at alternative sources of data, from which an estimate of likely exposures may be made. The data required can be summarised under six broad question headings:

| | |
|---|---|
| Who? | the ability to uniquely identify individuals who were exposed; |
| What? | a description of the agents to which the individuals were exposed; |
| How much? | the intensity/level of exposure; |
| How long? | the frequency and duration of exposure; |
| Where? | the location of exposure; and |
| When? | the date and time of exposure |

This information may include a work history, start and finish dates of each position/deployment, tasks carried out, personal protective equipment used and documentation of any actual exposure measurements. Indeed, the data collected in a particular system may not be immediately obvious as exposure information, but alongside additional information may be vital in establishing an individuals exposure to a health hazard.

### Examples of exposure information

Below is a list of information and potential exposures we may be interested in. The list is not exhaustive and data collected on other exposures will also be of interest.

| | |
|---|---|
| **Identifier and demographic information** | Name, age, sex, service number |
| **Occupational information** | Job title, job description, location, duration of employment, career history |
| **Exposure modifiers** | Smoking, alcohol consumption, use/issue of personal protective equipment |
| **Medical exposures** | Vaccines, immunisations, medications etc. |
| **Psychological** | Stress, trauma, violence |
| **Muscoskeletal** | Performing tasks repetitively or which involve high muscoskeletal stress |
| **Food and diet** | Food consumption and quality, water consumption and quality |
| **Biological exposures** | Infectious diseases, allergens, biological warfare agents |
| **Chemical exposures** | Exposure to chemical warfare agents, solvents, fuels, insect repellents, pollutants… |
| | Use of chemicals: location, purpose and method of application, quantity used etc. |
| **Physical exposures** | Radiation — ionising, electro-magnetic |
| | Climatic — temperature, humidity, UV radiation, pressure, gravity forces |
| | Noise — sonar, weapon use |

## Further Information

If you require further information about the project or our visit, then please contact either Dr. Lesley Rushton or Mr. Alex Capleton on (0116) 223 1600. Alternatively, if you wish to know more about IEH, then you can visit our web-site at www.le.ac.uk/ieh/

# Annex C

## Interview checklist

1. What is the main function and work of the group being visited?

   (What are their aims and what are their main areas of work?)

2. How many people work there, who do they report to and link with and who reports to them?

3. For which population in the Armed Services do they handle information?

- Tri-service
- Army
- Navy
- RAF
- Reservist
- Civilian
- Other

4 What range of data do they collect?

5 Are any of the data of potential relevance to exposure assessment?

- Identifying individuals
- Job work history and location
- Hygiene measurements

  chemicals in air, water, soil etc

  biological

  noise

  radiation

  ergonomic

- Environmental, e.g. climate

- Hazard data such as risk assessment, e.g. COSHH
- Medical data e.g. vaccinations, hazard surveillance records
- Personal Protective Equipment
- Diet

6 Why do they collect this information? i.e. what is used for?

- Legislation
- Control evaluation
- Routine surveillance
- Performance indicators
- Research
- Risk assessment

7 What media are used to collect the data?

- Paper

ad hoc

forms

- Computer

8 Can they provide examples of the forms or database fields used?

9 Who is required to collect the data ie who fills in the forms, enters the data into the computer database?

10 Is there any documentation on how to collect the information and record it?

11 Are the data used to make routine reports and who does this? Can we have examples?

12 Where is the information kept? How it is stored and accessed? (E.g. physical location, method of storage and filing, accessibility by name/site/date etc.)

13 How long is it kept and what happens to it when it is not of current use or interest?

14 What influences decisions to retain the information?

- Legislation
- Space

- Research uses

15 Is information collected for:

- Individuals
- Particular ranks/occupations/service sections
- Particular tasks
- Particular locations
- Particular hazards

16 When taking actual measurements what other data are collected?

- Location details (name, address, size of site, activities)
- Sample identification details (unique sample no, date, q.a., type of sample)
- Work area information (area description, climate conditions)
- Employee information (name, occupation, job title, tasks)
- Process and operation data (process, frequency)
- Agent (substance identifier, laboratory analytical method)
- Exposure modifier information (sampling strategy, exposure pattern, duration)
- Sampling device information
- Control information (engineering controls, PPE)
- Results (concentrations, average)

17 Who else should we talk to?

# Annex D

## List of forms

| Form | Description |
|---|---|
| B Med 27 | Personal Medical Summary Booklet |
| F Med 1 | Medical Examination Report |
| F Med 2 | Medical Examination Record |
| F Med 4 | Personal Medical Record Folder |
| F Med 7 | Out Patient Record |
| F Med 14 | In-Patient Record |
| F Med 15 | In/Out Patient Record (Continuation Sheet) |
| F Med 23 | Medical Board Record |
| F Med 85 | |
| F Med 143 | Periodic and Special Medical Examination Record |
| F Med 143A | Control of Substances Hazardous to Health (COSHH) – Medical Surveillance Record |
| F Med 144 | Medical Board To Assess Fitness for Commission of Aircrew Duties |
| F Med 242 | Audiogram |
| F Med 291A | Radiation History Envelope |
| F Med 291C | Radiation Medical Examination Record |
| MOD Form 911 | COSHH Assessment |
| MOD Form 933E | COSHH – Routine Exposure Monitoring |
| MOD Form 933F | Control of Substances Hazardous to Health (COSHH) Regulations – Personal Exposure and Health Surveillance Record |
| MOD Form 945 | Noise Assessment Record |
| MOD Form 960 | Asbestos – Personal Record Annotation |
| MOD Form 2000 | MOD Accident Reporting Form |
| RAF Form 540 | Operations Record Book |
| RAF Form 541 | Details of Flights (Annex to Operations Record Book) |