Collections Trust

Larger & Working Objects: a guide to standards in their preservation and care

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Collections Trust

The Collections Trust is the UK's independent organisation for collections. It sets professional Collections Management standards, and provides advice, support and training to help people meet them. Its aim is to connect people and collections, making collections accessible to everyone, now and in the future.

The Collections Trust manages the award-winning Collections Link advisory service and publishes *SPECTRUM*, the UK and international standard for Collections Management.

www.collectionstrust.org.uk

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1.1 Foreword & Acknowledgements

In 1987 the Conservation of Industrial Collections Forum was set up by the Science Museum. This led to the survey carried out by J. D. Storer, and the subsequent report *The Conservation of Industrial Collections*, published in 1989 as a joint venture by the Science Museum and the Conservation Unit of the Museums & Galleries Commission (MGC).

In 1994 the Museums & Galleries Commission published *Standards in the Museum Care of Larger & Working Objects: A guide to standards in their preservation and care*, edited by Crispin Paine.

In 1997, the first edition of *Larger & Working Objects: A guide to standards in their preservation and care*, was issued, written by Stephen Ball and edited by Peter Winsor. This has now been revised and adapted for e-publication by Patricia Andrew and Peter Winsor, 2009.

1.2 Introduction & how to use this publication

In 1994 the Museums & Galleries Commission (MGC) published *Standards in the Museum Care of Larger and Working Objects*, an authoritative source of care standards to which all museums should aspire.

However, many people caring for collections have few resources. Indeed, many larger and working objects (eg textile machinery, vehicles, boats and aircraft) are often privately owned, or in the care of enthusiastic volunteers. So the resource problem can be especially acute for this class of object.

Given these resource limitations, is there a set of practical and realistic standards that preservation groups and small independent museums may follow? The answer is yes! You will find here the standards that all museums, societies and individuals involved in the care of larger or working objects should try to achieve. They apply whether you are working within a museum or preservation society, or responsible for a private collection – or even the owner of just one large or working object.

This publication is organized into sections that each deal with one aspect of care from two main perspectives:

Management
`Management' is used here in a very wide sense: even a single object must be managed.

How do you:

- Build up and add to your collection?
- How should you look after it?
- Who will see your collection or object?
- How will you control their access to it?
- Are you going to lend objects to - or borrow objects from - other individuals or organisations?

And whatever you do, appropriate and adequate documentation is absolutely essential.

Protection
Protection is a large subject. Some sources of risk and potential damage are obvious eg weather, corrosion and fire. But others may be more subtle. For example, have you considered:

- Deterioration, even in a light, airy, centrally heated room?
- Theft and vandalism of collections?
- Theft and vandalism of paperwork, records and archives?

And you will need to consider how you might need to protect the public **from** your objects too.

Section 13 provides useful references and a glossary. If the detail here is not sufficient, please look at other relevant pages of the Collections Link website (www.collectionslink.org.uk), or ask a museum development officer.

Conventions used in this book

The standards are at the heart of the information presented in this book, so they are singled out from the text using boxes like this:

- Every object is acquired in accordance with the organisation's acquisition and disposal policy.
- When acquiring an object, the museum makes the greatest effort to obtain all available information and associated objects, particularly where an object is removed from its context.

Throughout this e-document, **bold** type is used for words and expressions that may be found in the Glossary (to prevent too many **bold** terms appearing in the text, these words are only printed in bold on their first appearance in each section.

The word ‘staff’ occurs frequently throughout the text. This does not mean only the paid, permanent employees of an organization, but refers to all core workers, paid or voluntary.

2. Acquiring and Building the Collection

- Every object is acquired in accordance with the organisation's acquisition and disposal policy.
- When acquiring an object, the greatest effort is made to obtain all available information and associated objects, particularly where an object is removed from its context.

It is tempting to think that more is better: a new object will enhance your collection, and you may be able to offer it the best possible care. But this will not always be the case.

Ask yourself:

- How will the new object fit into your collection as a whole?
- Do you have the human, financial and physical resources to care for and display it?

The reputation of any collection, however small, tends to develop over the years as visitors and researchers spread the word. Eventually, your collection may be nationally or even internationally known. Similarly, a preservation site such as a working steam railway may grow into a regional focus for related activities, such as training or heavy engineering works. As your collection's reputation grows, the more likely it is that you will be offered new objects.

Whether you have just received a tempting offer, or are actively seeking material, the question is the same: how do you decide whether to accept a new object? It could be that a new object will enhance your existing collection – perhaps it:

- Fills a chronological gap;
- Is an example of a type previously unrepresented in your collection;
- May even have the potential to become a `star' exhibit that creates increased interest - and attracts extra visitors to your site.

Yet the decision to accept the object may have undesirable consequences. For example:

- The new object may not fit in with the rest of your collection and visitors may wonder what it is doing there;
- It may have an adverse effect on your resources, with additional expenditure of time, money and staff;
- Even worse, it might be an unsuitable object that draws money and staff away from your core activities - a net *loss* to your collection.

The basis of the decision must be your **Acquisition and disposal policy**. If you do not have a policy, your acquisitions will always have an *ad hoc*, spur of the moment character, and mistakes are more likely.

2.1 The Acquisition and Disposal Policy

By drawing up a clear policy – and sticking to it – you will probably avoid most of the problems associated with unsuitable collections. This policy must be written down, not simply `understood', and must be reviewed at planned, regular intervals. It should include:

- Descriptions of the existing collections;
- Criteria for future collecting policy, including themes and subject areas;
- The time period and/or geographical area that the collection covers;
- Constraints on collecting -- for example, those imposed by inadequate staffing, storage or **conservation** resources;

- Reference to the policies of other organisations collecting in broadly similar fields -- this will help to avoid unnecessary duplication;
- The date for the next review of the policy - the interval between reviews should normally not be greater than five years;
- Reference to any acquisitions that not covered by the policy;
- reference to arrangements for loans entering or leaving the collection;
- A statement setting out the organisation's acceptance of legal and ethical acquisition and disposal procedures.

2.2 Putting the Policy into practice

The acquisitions policy provides the framework for your decisions, but you must consider the wider implications of acquiring the potential object:

- How important is the object?
- Will you have the time, expertise and staff to care for it?
- Is there a suitable display or storage space?

Larger and working objects often have higher maintenance costs: it is important that you have a good idea of how you will meet these at the time you acquire an object.

Wherever possible, try to ensure that fixed objects remain in-situ. This may have legal implications: for example, machinery within a **scheduled** monument is itself scheduled, and that the re-erection of large machines may require planning permission.

Remember too that the archaeological and historical integrity of a site must be respected.

Note: English Heritage, or its Scottish, Welsh or Northern Ireland counterparts, can give advice on sensitive sites.

If you need to dismantle the object for any reason -- for example, to move it to a new site -- the procedure and parts should be systematically recorded, including the site prior to commencing the dismantling. These records should be kept in the **object file**. The dismantling and subsequent reassembly now form part of the object's history. At the very least, the records will be useful when the object is reassembled; but they will also preserve details of anything revealed during dismantling. You should also try to acquire with the object any information and documentation associated with it -- technical data, operating logs, and details of who used it, paid for it, developed it or maintained it.

Note: Creating a policy is described in detail in the Museum Registration Standard and AIM Guideline *Museum Collecting Policies and Loan Agreements*.

Note: *SPECTRUM* includes advice on recording this associated information.

What happens if you are unable to accept the object? Hopefully, your collection is not the place of last resort, or that the object will be destroyed if you do not accept it. As part of your acquisitions practice, set up a procedure for passing information to other preservation bodies who may be interested in the object. Whether or not you acquire the object, do remember to keep the donor and any other parties involved informed. These contacts help to maintain the goodwill and cooperation of collectors, donors and museums.

2.3 Sources of advice and assistance

Advice on drafting an **acquisition and disposal policy** can be obtained from your regional Museums Development Officer, or from the Accreditation Team at MLA.

The Association for Industrial Archaeology has published a handbook and recording form to guide voluntary societies and individuals in recording and transferring data to Sites and Monuments Records. The system is known as the *Index Record of Industrial Sites* (IRIS). Copies of the handbook are available from the Association for Industrial Archaeology.

The MLA Preservation of Industrial and Scientific Material Grant Fund (PRISM) can make awards towards the purchase and conservation/restoration of technological material.

The Heritage Lottery Fund has funded a number of industrial and transport type projects including restoration to working order.

3. Care and Conservation

Objects in a collection can be utilized in many different ways: for example, some working objects may be able to perform their original functions. But objects are primarily sources of evidence and enlightenment about the past. If an object is not cared for and preserved from damage or decay, this evidence will be lost to future generations. How should these two considerations be balanced?

The appropriate level of care for an object depends upon its importance. At one extreme, an interesting but commonplace and robust object of which many examples survive may need very little attention or could be restored to running order; and visitors could be given full access to it. At the other extreme, rare objects of national or even international significance will need considerable care and attention, and access to it controlled more tightly. Each situation has different resource implications for the custodians.

Note: National and international lists of certain kinds of large object have been compiled, such as:

- Aircraft (BAPC)
- Ships (NHSC)
- Horse-drawn vehicles (Science Museum)
- Trams (National Tramway Museum, Crich)

The MLA operates the Designation Scheme that gives special recognition to pre-eminent collections in archives, libraries and museums in England.

- Every object is assessed for its importance and its use within the collection, and its care needs identified.
- The condition of all the objects is regularly checked.
- Every collection has regular access to appropriate specialist and technical help, including curatorial skills and conservation skills.
- Everyone responsible for the care of larger and/or working objects undertakes regular and appropriate training on operating procedure, conservation and maintenance, and health and safety requirements.

An assessment of the object's importance is therefore of primary importance in deciding how it should be cared for. This will normally include careful research into its history and consultation with suitable experts. Once you have established the level of care the object demands, you must draw up a **care plan** for it (see Box 1). At the same time, you should also know whether your existing levels of care are working for your existing collection: to discover this, you must check the collection's condition at regular intervals. This checking process is part of the **collection condition survey**.

3.1 Auditing the collection

There are three types of collection audit:

- A sample `stocktake' -- is everything there? For a large collection, where counting every object would be too time-consuming, you should try to account for a random selection of the items in your **accession register**.
- Are all the objects are documented; again, checking a sample is probably more practical than reviewing the whole collection.
- The **collection condition survey**.

Checking the condition of objects: the `collection condition survey'

Once you establish that the objects and their documentation are where you expect them to be, it is time for you to examine their condition. Are any objects deteriorating or showing signs of damage? This check can also be undertaken by sampling a cross-section of the collection, but this time you must be careful to sample the different environments of your various display and storage areas. To take a very simple example, imagine that your collection is housed in a building with three main spaces: a dry and sunlit front room, a damp and darker back room, and an upstairs gallery under an un-felted roof. In this case, not only would you sample different types of object and material -- wood, ceramics, metals and so on -- you would also make sure that there was a range of samples from each of the three rooms.

The condition of the objects is a vital clue to the quality of both your care and the environment in which it is housed. You will be looking for damage -- which will usually be evident on a single examination -- and any deterioration in the condition of objects -- which involves two or more checks conducted at intervals (you will of course examine and record the condition of any new object in your collection).

Clear symptoms of active deterioration include:

- Corrosion (such as rust)
- Serious physical damage (such as breaks, cracks and separated or missing parts)
- Flaking paint
- Pest infestation (such as moth, woodworm, rodents, birds)
- Rot or mould
- Cracks or splits resulting from expansion or contraction caused by humidity and/or temperature change

Other symptoms may be less obvious but are nevertheless still serious and include:

- Stress faults that may only appear if the wrong treatment is applied or the object is inadequately supported
- Surface colour changes

The causes of damage are numerous but include the action of residual chemicals such as cleaning agents, fuels, hydraulic fluids etc, or contaminants associated with the object's original use, or general neglect of the objects and the buildings in which they are housed.

Once you detect deterioration, you must look for its possible causes: the object's environment may be inappropriate, storage spaces may be overcrowded, your control of handling and access may be inadequate. There may even be a fundamental incompatibility between the materials used in the object: for example, two dissimilar metals in contact can sometimes produce an electrical effect that results in the `sacrificial corrosion' of one of them. Most materials have a limited life but this can be extended if the environmental conditions are appropriate. Establishing these conditions for your collection is the essence of preventive conservation. You should also be aware of more general risks, including theft, vandalism, fire, water damage and building faults.

Note: Remember that there is no one `right' environment: different kinds of object and materials require different types of environment.

3.2 Remedial conservation

Damage or deterioration will provide evidence of problems, but you will probably want to repair the damage or at least arrest the decay. This kind of work -- which falls within the specialist sphere of **remedial conservation** -- is perfectly possible *provided* the historical integrity of the object is maintained.

Objects should only be dismantled when this is unavoidable, and then only to the extent necessary; they should be reassembled as soon as is practicable. Take the greatest care, make detailed records at every stage (especially before dismantling), and include drawings and photographs if you can. Label the parts and keep them together. Where a part must be replaced, mark the original and retain it in the collection, and indelibly mark new or reproduction parts with the date of manufacture and the organisation's name.

Repair and restoration work will require the specialized skills of craftsmen, engineers and technicians. You could also call upon the services of a **conservator** to advise on the treatment. They will have considerable experience of the long term preservation of objects and understand the implications of using particular methods and materials on historic artefacts. The approach taken should be based on an assessment of the importance and of the condition of the object and a clear decision on how the organisation intends to use the object in its collection.

Museum workers adhere to professional guidelines and codes of practice, such as those of the Institute of Conservation (Icon), the Museums Association or the International Council of Museums (ICOM).

Note: See the Association of Independent Museum (AIM) leaflet *Using Museum Consultants* and the Conservation Register website www.conservationregister.com.

3.3 Training for staff and volunteers

Many important social and industrial history collections -- and many larger objects -- are in the care of museums and preservation bodies run entirely by volunteers, or with a very small professional staff. This has important implications for the training of all concerned and recourse to specialists such as engineers, craftsmen and conservators.

Remember that however small and resource-starved your organisation may be, if one its declared aims is to preserve the collections for public benefit, then there is a duty to care for the objects. Consequently, continuous access to specialist help should be a priority, and at the very least you should organize regular inspections. The care of larger and working objects also brings an opportunity to preserve traditional craft skills, such as those of the wheelwright, fitter or boatbuilder (see Box 3). Ideally, they would combine these skills with the expertise of the conservator or **curator**. This does happen, but many organisations operate successfully with a combination of locally available technical or craft specialists and curatorial or conservation advice from another museum or preservation group, or a subject specialist network.

The preservation of traditional craft manufacturing skills and working practices is now seen as an important aspect of heritage preservation. For example, some railway preservation groups have engineering facilities and skilled manpower that is not readily available in the mainstream of British industry. The preservation industry is sustaining these skills. Some collections have taken a pro-active role in documenting such skills -- former textile workers in the cotton and woollen mills are the backbone of many historic industrial sites and are responsible for operating the machinery and maintaining it in good working order. These skills are being recorded and plans made to establish training schemes so that they will not be lost, and a new generation of skilled operatives will be available.

3.4 The Care Plan

The care plan (or `conservation/maintenance plan') sets out the programme of care agreed between a **conservator** or other specialist and the staff or volunteers who will carry it out. It includes an assessment of the object's condition when received, the action required for its care, materials to be used, and the time scale for care activities, as well as mundane items like simple dusting and cleaning procedures. Regular revision of both the assessment and the care programme is vital, as the status of an object is likely to change over time.

Each object's plan should also contain a written account of the object's importance and use within the collection, and any special circumstances that may affect its future care -- for example, where the object:

- Will only be retained for a limited time; or
- Is being preserved mainly for its form and function rather than its fabric (so a boat remaining afloat will require constant renewals and repairs of timber, coatings, cordage, etc);
- Has been acquired primarily for demonstration, or to provide spare parts.

In general, only the largest and best-resourced organisations can practise the highest standard of care as described in *Standards in the Museum Care of Larger and Working Objects* for its whole collection. Most organisations will provide a high level of care on the objects they have identified as most important to the collection, normally those that are particularly rare or vulnerable, and provide a simple or basic care level of care for the rest.

The main features of a simple care programme are as follows:

Collection condition: a conservator or other person with relevant experience undertakes an annual object condition check.

Environmental monitoring: all display, storage and workshop areas are monitored and the results are systematically analysed.

Environmental control: **relative humidity**, temperature and light are controlled in some way (though *stability* is more important than the actual limits).

Pest control: there is a programme that involves good building maintenance and thorough cleaning, the exclusion of food and drink residues etc, and pest monitoring and trapping.

Maintenance: there is an appropriate preventive maintenance and service programme for the building, its services, and all monitoring and control equipment.

Documentation: all procedures are logged, and data are readily accessible.

Quality control: the whole care programme is itself subject to continuous monitoring and review.

3.5 Sources of advice and assistance

The Science Museum and other national museums, the large regional museums of science and industry, Regional Agencies, and county-wide Consultative Committees and Forums can advise about local specialist staff who are able to give guidance and supervision.

You will find useful advice on writing a **care plan** for larger objects, and on planning **audits**, in:

Museums & Galleries Commission (MGC). 1994. *Standards in the Museum Care of Larger & Working Objects*. London: MGC. (Available on Collections Link website www.collectionslink.org.uk).

Keene, Suzanne. 1996. *Managing Conservation in Museums*. Oxford: Butterworth-Heinemann in association with the Science Museum.

4. Making, Keeping and Using Records

You may feel that recording information about the objects in your collection is a chore of secondary importance. This is understandable -- filling out forms and writing notes can appear to be a time-consuming distraction from the main business of caring for your collection. But this is an illusion. An object without accompanying records exists in a vacuum, and is of little value. Keeping records is every bit as important as caring for the object itself.

It is a fundamental responsibility of every museum-type organisation to make and maintain comprehensive records for the objects in the collection. **Documentation** is the usual term for the making and maintaining of these records, but is also used to describe the records themselves. For example, drawing up an object's **care plan** is part of the documentation process, and the plan itself is part of the object's documentation. The term `documentation' may suggest piles of neglected and dusty papers that rarely see the light of day. However, this is not the case, good records are at the heart of any collection and are likely to be regularly accessed items, and are often in the form of a computerized database.

- Every object is documented to the minimum standards required for registration under the Museum Library and Archive Council's Museum Registration Standard, as set out in *SPECTRUM: The UK Museum Documentation Standard*.
- Every larger object has its own care plan.
- Every working object has its own operating manual and an operating log.
- All records, including paper, photographs, microform, disk, electronic tape, etc, are kept to the standards set out in Box 2.

The care plan (see section 3.4) is only one -- albeit vital -- part of a larger or working object's documentation. In addition, you need to record an object's history in the conventional sense of its creation, development and use, and original social and economic context. An object also has a `collection history' -- what has happened to it since it was `rescued' or restored, or otherwise entered storage or a collection environment. It is worth remembering that many objects have spent more time in a collection than as working objects. This collection history then becomes part of the larger history of the object. Documentation even includes the very mundane aspect of keeping track of the object -- where it has been, and where it is now. Note: UK documentation standards are described in the Collections Trust (formerly the MDA) publication *SPECTRUM: The UK Museum Documentation Standard*.

Apart from the care plan, the most important kinds of documentation are your records of the entry and exit of objects, and of accessions and loans.

4.1 Entry and exit records

There must be a separate written record for every item that enters the building, whether it is intended for the permanent collection or not. This requirement includes loan items and objects submitted for identification. When the time comes to return an item to its owner, you may either simply endorse this entry record or create a separate exit record instead. Do not confuse an entry record with an entry in the **accession register** (see below).

4.2 Accession records

Every collection should maintain an accession register in written or computerized form that:

- Records the formal acceptance of items into the organisation's permanent collection;
- Allocates a permanent identity number; and
- Provides enough information to identify and manage the object.

The accession record can be used for **location and movement recording**: the register should contain the object's location, and any subsequent movement or change can be recorded there. Each accessioned item should also be **security marked** or labelled with its permanent accession number, using a method that does not damage the object and which is robust enough to survive the use to which the object is put.

Note: Advice on methods and materials for marking and labelling objects are described on the Collections Link website www.collectionslink.org.uk.

4.3 Loan records

Your collection management system must include records of both incoming and outgoing loans. All loans should be checked (the term 'audited' is sometimes used) on a regular basis, and it is wise to review their terms and conditions from time to time. Never agree to `permanent loans': the term is self-contradictory and could lead to future arguments about ownership or who is responsible for the care and management of the object. There is nothing wrong with long loans provided the term is fixed; a long loan should be reviewed at intervals during the term.

Note: There is more on loans and loan policy in Chapter 5.

4.4 Information retrieval

Information is useless if nobody knows where it is stored or how to retrieve it. This means that you need to tell users -- and your own staff and volunteers -- where and how your documentation is stored and what indexes are available for its retrieval. The accession number provides an obvious means of indexing the collection, though you should offer at least one other approach -- for example through location, donor or subject category -- depending on the needs of your users and the format in which the records are held.

4.5 Protecting documentation

Because an object's supporting documentation is as important as the object itself, it follows that all records and documents must receive equally high standards of care and physical security. There is no point in lavishing attention upon a prize object if its accompanying documentation is mouldering away in a damp basement.

These strictures apply equally to the organisation's own documentation for an object -- accession records, care plans and the like -- and the primary records that often accompany larger and working objects. These primary records are effectively objects in their own right and include original plans and engineers' drawings, manufacturers' manuals, parts catalogues, log books, personal ephemera, as well as photographs, film and video, audio tape and so on. As far as possible, you must copy or duplicate the originals so that the information they contain is available while they themselves remain in safe storage. Keep the originals and the copies in separate buildings as a precaution against one set being damaged.

Records about industrial archaeological sites are held with the National Monuments Records maintained by the three national Royal Commissions on Historical Monuments. The relevant organisation should be made aware of any records you hold regarding such a site in your care.

If your organisation holds records relating to an individual or a business, then this fact should be made known to your local record office so it can be listed in the National Register of Archives maintained by the Royal Commission on Historical Manuscripts.

4.6 Sources of advice and assistance

Collections Trust (formerly the MDA) determines standards for collection **documentation**. It also publishes appropriate guidance, record cards and computer programs, and offers general advice on all aspects of documentation on its Collections Link website www.collectionslink.org.uk.

Documentation: A practical guide published by the Collections Trust is an invaluable introduction to documentation of museum collections.

Informal advice on protecting documentation is also available from the Association for Industrial Archaeology, County Record Offices, the liaison branch of the Scottish Record Office, and from the Royal Commissions.

Other useful publications include:

Social History and Industrial Collections Working Party. 1993 (2nd edn). *Social History and Industrial Classification*. Cambridge: Museum Documentation Association.

5. Access, Loans & Research

Access policies:

Standards for exchanging exhibitions
www.collectionslink.org.uk/organise_exhibitions/exchanging_exhibitions

Access and Education
www.collectionslink.org.uk/Increase_Access/develop_access/access_and_education

A collection is not simply a dead storehouse of valuable or interesting objects. It is a living institution that seeks to inform and enlighten by bringing people and collections together. Museums and related organisations therefore encourage the widest possible access by all sections of the public, even though this may sometimes create additional strains upon the duty to protect and conserve the objects in its care.

Presenting your collection to the world

You probably want your objects to be seen by as many visitors as possible. Yet the ideal of full and open access brings problems. For example, visitors can accidentally -- even deliberately -- damage objects. People in a room generate heat and moisture, which coupled with the constant opening and closing of doors to other areas disrupts the all-important steady environment required for the collection. Ironically, such uncontrolled access would be self-defeating: if an object is damaged or even destroyed as a result of bad poor organisation, then future generations will be denied access to it.

- As much access as possible is allowed to the collections, by all sections of the community.
- Lender and borrower both sign a written agreement covering all aspects of any loan, including a specified period.
- Research into the collections by both staff or volunteers and others is encouraged.

Successful access management rests on these two principles:

- Public access in the present must be balanced against preservation for the future.
- Different forms of access are appropriate to different organisations, objects and users' needs.

What is `appropriate access'? A non-specialist visitor may be content to view a motor vehicle, say, from behind a barrier, whereas a researcher (see below) may require `hands on' access. People also have different physical abilities. Ask yourself whether visually or hearing impaired visitors will be able to fully appreciate your collection. What about physical access? Is there good access for people in wheelchairs or who have difficulty walking to galleries and viewing areas, especially for objects housed outdoors? But do not think only in terms of physical access. Making available copies of engineering drawings, photographs or videos, and publishing catalogues and guides or setting up a World Wide Web site are all ways of increasing access.

5.1 'Both borrower and lender be . . .'

A loan is simply a different form of access that allows visitors at other sites to see objects from your collection. There should normally be a presumption in favour of lending items from the collection -- whether for exhibition, research or demonstration. However, a loan is a source of new risks for an object: movement and transportation make damage more likely and can also create conditions that accelerate decay. Careful management is the answer, and should reduce these risks to a minimum.

Setting loan conditions

No loan should be arranged unless both parties agree to a written set of conditions. These will be based on certain standard requirements governing the term of the loan, how the object will be moved to its temporary site, what will happen to it once it is there and how it will be returned. There must also be provisions for the review, renewal and termination of the loan -- in particular, no loan should be for an indefinite period or described as `permanent'.

Note: Loan conditions should appear in the object's documentation (see Chapter 3)

Objects are particularly vulnerable to damage during transit, so the conditions will also include stipulations on transport arrangements, whether by air, sea, rail or road -- not forgetting lifting and carrying arrangements in transit and at the destination.

What will happen to the object once it is in position at the borrower's site? Your care and management responsibilities now have to be conducted by proxy, as it were, so you must ensure that all important aspects of the **care plan** are built into the loan conditions. These will include regular condition assessments and reports, environmental monitoring and control, limits on conservation work, display requirements, security arrangements, and access and use.

There will also be legal and financial matters that it would be folly to ignore, including hire or operating charges, the cost of maintenance and repairs, and any percentage of earnings (say, for film or TV work) that is payable to the lender. And adequate insurance against loss or damage is extremely important, both for the loan period and for all transit and handling.

It is particularly important that you regularly monitor the condition of your object. You may reasonably expect the borrower to pay for travel and subsistence on an agreed number of monitoring visits during the loan period, and to provide appropriate access and workshop facilities for an inspection during a monitoring visit.

Working objects create special problems that need to be addressed as an explicit part of the loan agreement. These will cover:

Note: The management of working objects is discussed in Chapter 5, including:

- Who may operate the object;
- How the object will be displayed or stored between periods of operation;
- Routine maintenance, and limits on necessary repairs;
- Standards for recording operation and maintenance;
- The frequency and nature of operation (such as limits on times, dates, mileage, speeds and loadings);
- Details of approved fuels, oils, water treatment processes, and so on.

5.2 The importance of research

Research is fundamental to a collection's function and purpose, though its form will vary greatly. The research may be focused on an object, on wider historical or scientific issues, or even on the history of the collection itself.

In essence, research is a specialized form of access and use that allows selected individuals to examine objects at close range and in detail. Except where their work requires variations from the usual norms, researchers will be governed by the general access conditions -- and loan conditions, where an object leaves the site for examination. As in the case of loans, research will be undertaken only on the basis of an agreement setting out the scope and conditions of the work.

5.3 Sources of advice and assistance

For more information on access and loans, see:

Association of Independent Museums (AIM). `Museum Collecting Policies and Loan Agreements'. *AIM Guideline 14*. AIM.

Museums, Libraries and Archives Council (MLA) *Disability Guides* available in hard copy by contacting: Central Books Ltd at email: mo@centralbooks.com Tel: 0845 458 9910.

Inspiring Learning for All framework at www.inspiringlearningforall.gov.uk.

6. To Work, or Not To Work?

Working objects are a source of delight and information to a wide audience. A complex machine may remain a mystery when presented as a static exhibit, but its function and use can become immediately evident when it starts to work. For example, a visitor who has never seen textile machinery at work will have difficulty understanding a cotton spinning mule, let alone the working conditions of its Victorian operators; and a non-working electronic computer presents nothing but its relatively uninformative casing to the public. Yet working an object adds an additional layer of complexity to everyday museum practice: can it be reconciled with the mandates of conservation and care?

The public image of `larger and working objects' is probably that of significant and imposing machines restored to full working order. For most visitors, the sights, sounds and smells of a working steam locomotive make it an intrinsically more interesting and enlightening object than its non-working counterpart. There is something `unnatural' about a dead steam locomotive forbiddingly roped off on the floor of a warm gallery, festooned with `keep off' signs.

- Only those objects identified in their care plans as permitted to be worked, are worked.
- Every object to be worked has an operating manual, and is worked only in accordance with that manual.
- Appropriate training is provided to all who operate working objects, and appropriate supervision is given to trainees.
- Every time an object is worked a written record is made.

Yet the operation of machines creates particular problems, and often appears to cut across the custodian's duty to preserve and care for the objects. Perhaps unsurprisingly, the question `To work, or not to work?' is the subject of intense debate in museums and preservation bodies. The debate is frequently difficult to resolve, because there are convincing arguments for and against working.

6.1 Against working – and for working

As soon as an object begins to work, its physical nature changes: in particular, boilers, moving parts and other key components wear out. Worse, the materials used in historic objects are likely to be less durable than modern equivalents, making wear more rapid. And these materials may no longer be obtainable, which means that worn out components have to be replaced by replicas made of sophisticated modern alloys, high-tech composites or other `alien' materials. This problem is compounded if the worn out parts were originally produced using craft skills that are now lost.

Wear is not the only danger. Operating machinery is subject to health and safety regulations that may require alterations to the object. For example, riveted components may have to be replaced by welded fabrications, asbestos lagging has to be removed from boilers and pipework, or a tachograph must be fitted to an historic heavy vehicle.

Note: See Chapter 9 for more on health and safety implications.

The greatest loss of information about an historic working object most often occurs during the process of restoration to working order. The remains of original paint or surface finishes are grit blasted, original packing material in joints is cleaned off and replaced with new, worn or broken parts are replaced, marks which showed how a machine was set up are cleaned off, and the whole structure is vigorously cleaned and then re-painted. Such situations used not to be uncommon, though many organisations have now adopted a more thoughtful approach, taking care to record in detail what was found, what was removed, how this was done and what it was replaced with. The worn or broken parts are not disposed of but retained and preserved as part of the collection, and if this is impractical then a sample is kept.

Proponents of the `against' argument emphasize that the primary duty is to care for and conserve the objects in their care. Avoidable wear and alteration are not consistent with the goals of conservation. We must not prevent future generations from `reading' the information locked up in an object's physical state. When an object is operated, much of this information is lost forever. This is a very powerful argument when there are relatively few examples of the type still in existence. Another is that there is the risk of total loss, as in the case of aircraft.

For working

Imagine a steam locomotive built in 1897 and withdrawn from service in 1964 after service in many parts of Britain, first under different railway companies and then in the later nationalized system. During its lifetime much of the locomotive will have been replaced during overhauls, repairs and modifications -- including running gear, tyres and wheelsets, valves, gauges and pipework, and boilers, tubes and other fire and water surfaces. It is also highly likely that the universal railway practice of swapping components and assemblies between locomotives has carried this process still further. So how much of the machine that retires in 1964 is physically continuous with the machine that rolled out of the shops in 1897?

Now take the case one stage further. Imagine that a preservation society finally rescues this locomotive from a scrapyard in 1982. The heavily corroded machine -- minus many historically and financially valuable components that have been stolen or sold (or perhaps cannibalized by other preservation societies!) -- is transported to the society's site where volunteers take five years to restore it to working order. How much of the 1897 machine is physically present in the 1987 restoration? Virtually none of it: the `preserved' locomotive is in effect a replica, or at best an evolutionary descendant, of the 1897 original.

This example is an extreme case, but characterizes the key problem of the working object. To a greater or lesser extent, the `original' object is long gone: what remains is a continuity of operation, usage and working practice, not of an unchanging physical object. In other words, the essence of the working object is what it *does*. According to this argument, the body that operates the object *is* following good conservation practice, but it is conserving the form and function of the object rather than its physical make-up.

Making the decision

For each of the objects in your care that in principle *can* be worked, you will have to decide whether it *should* be worked. Your museum or society will probably already have a general policy towards working -- indeed, many societies are set up specifically to run one or more working exhibits -- but there will be other factors. You must refer back to why you acquired the object in the first place, and review both its wider importance and its status in your collection. Many of the salient factors will already be recorded in the object's **care plan**.

Did you acquire the object to preserve it for as long as possible, or for research, or public enjoyment or education? Is the object the only one of its kind -- in which case there may be no option but to forbid working (or to build a working replica)? Or is it one of many -- in which case some centres can practise `object' conservation and others `operation' conservation? Whatever you decide, you should discuss the options with specialists in that class of object -- and your policy for the object will need regular review.

You will probably decide that some objects can be worked, that some others can be worked only occasionally and with great care, and that the remainder must not be worked at all. If you are in any doubt, the safest policy is obviously not to operate. In general terms, there should be a presumption *against* operating objects unless the resources, both human and financial, are available.

6.2 Regulating the operation of working objects

Although you may have decided that it is appropriate and safe to operate an object, it is clear that the period and nature of this working must be carefully controlled. The control must extend to who should operate the object and how they should operate it, and must be accompanied by suitable **documentation**. Each working object needs at least three sets of documents to govern its operation:

- The care plan (see Chapter 1)
- An operating manual
- An operating log

The **operating manual** must include comprehensive instructions for the operation, inspection and maintenance of the object, together with a list of those authorized to perform the work. The manual will also set out the agreed limits on all operations in terms of times, loads, speeds and other appropriate parameters. These limits should state the final point beyond which further operations would not be allowed because of an unacceptable loss of original material -- an important stipulation that should also be recorded in the care plan.

All operating details are recorded in the **operating log**. This, the third essential document, will contain times and dates of working, the names of the operator(s), the reason for each period of operation, fuels and lubricants used, maintenance operations and replacement parts, loadings, speeds and other measurable conditions, and any noted effects or changes.

These important controls on operation presuppose two other factors: inspection and training. Regular inspection of the object, whether informally during normal operations or in greater detail at routine intervals such as boiler inspections or MoT, is vital. The condition of the object will determine both maintenance practice and the course of operations in the future. Training is related to operating practice: those who are authorized to operate and maintain working objects must have suitable training and possess the appropriate certificates.

Note: See `Sources of Advice and Help' at the end of this chapter for more information on operator training.

6.3 Important considerations when operating working objects

There are several potential pitfalls confronting those who manage and operate working objects, including:

- operating instructions
- fuels and lubricants
- listed buildings

The *operating instructions* for an elderly machine or vehicle may be lost, but where they exist they must be used with caution. They may contain instructions or describe practices that conflict with good conservation practice or current health and safety legislation, or that presuppose a ready supply of spare parts. In military manuals, recommended practices may assume unacceptably low safety standards that reflect wartime conditions rather than the needs of the public.

Modern *fuels and lubricants* are often totally unsuitable for older machinery -- for example, modern motor oils should not be used in old vehicles. Original specifications, where these are known, may need interpretation to discover the nearest modern equivalents. But it's not all bad news: open gearing is one example where modern lubricants do a better job than earlier types of grease and oil.

Note: See `Sources of Advice and Help' at the end of this chapter for suppliers of suitable lubricants.

Finally, *historic building legislation* and other similar restrictions can have a significant effect on objects housed in the building. Fixed machinery in a **listed** building may be governed by the listing of the building -- in which case you may undertake `like for like' repairs, but you may not move or significantly alter the machinery without consent. Or it may be **scheduled** in its own right -- in which case you may not undertake restoration or any other work that affects its fabric without scheduled monument consent.

6.4 Preserving the Intangible

The traditional image of a museum is as a repository of relics -- the priceless vase, the mummy case, the fragments of ancient pottery. Nowadays, most people are aware that museums have moved beyond this essentially Victorian `collecting' stage: now there are hands-on exhibits, and demonstrations of working objects are commonplace. Yet the popular view still sees a museum's function overwhelmingly in terms of *objects*. It does not see -- or it ignores -- the operating, manufacturing and repair skills preserved and sometimes rediscovered by research into working objects.

There are two immediate challenges to any organisation wanting to operate an historic object: How should the object be operated? How can worn or broken parts be replaced or repaired?

The operating methods will eventually be enshrined in the object's **operating manual**, but it is unlikely that anyone will come upon a complete set of ready-made working procedures. Rather, these will have to be developed over time, using such sources as:

- Original documentation and manuals associated with the object;
- Information provided by those who built or worked the objects;
- Present-day or historic general manuals and handbooks for drivers, operators, pilots, seamen etc;
- Old photographs, engravings, drawings, film and other audio-visual sources;
- Experience, trial and error, and (cautious!) experimentation;
- Manuals, documentation and experiences from other centres and societies operating similar objects;

These and similar sources will also be useful when parts wear out or break. Here your inquiries and searches will reach further, into the realms of traditional crafts and materials. You may need to research the practices of medieval craft guilds, or call upon farriers, smiths, wheelwrights, wainwrights, upholsterers, gilders, signwriters...Larger museums and preservation societies can - and do - become centres of craft skills that serve other smaller organizations. Steam locomotive repair and overhaul shops are a case in point -- some are businesses operating on a fairly large scale, functional replacements for the once-common locomotive depots that disappeared with the steam era.

You will have to decide whether materials should be replaced like for like -- using white lead paint, say -- or by modern substitutes. If you opt for traditional materials, should you then insist that they are applied or worked by traditional methods? An example: a turned wooden component *can* -- very easily -- be commercially produced on a modern electrically powered lathe. It can also be made using traditional methods -- roughly adzed from coppiced timber held in a knee-vice, then finished on a hand-built pole lathe. The two methods will probably produce indistinguishable objects, but the second provides a marvellous opportunity to recover and demonstrate vanishing crafts -- including coppicing and adzing, and building and operating a pole lathe. Which option is more in tune with the ethos and purpose of the living collection?

6.5 Sources of advice and assistance

There are several advisory bodies that produce codes of practice, or can that advise on aspects of operation and operator training, including:

- Association of Railway Preservation Societies
- Association of Independent Railways
- Computer Conservation Society
- Steam Boat Association of Great Britain
- British Aviation Preservation Council
- National Vintage Tractor and Engine Club
- National Tramway Museum

See list of address at the end of this publication for other organisations and contact addresses.

The National Traction Engine Trust produces a *Code of Practice for Traction Engines and Similar vehicles*, though this is normally available only to members of the Trust Details from M. O. Davies, the Chairman of the NTET Engine Owners' Subcommittee. The book contains guidance on safety at traction engine rallies, but its advice can be applied to all temporary displays of working machinery.

Advice on lubrication is available from a number of commercial companies, including most of the major oil refiners and/or suppliers. Specialist suppliers include Morris Lubricants (blenders of oil for steam engines, vehicles and locomotives), Senator Oil (oils for older motor vehicles). Help with difficult problems can be obtained from the Institute of Tribology at the University of Leeds.

Advice on listing (for machinery in **listed buildings**) should be sought from the local planning authority in the first instance. Advice on **scheduling** should be sought from the English Heritage or other national agency.

Helpful publications include:

Mann, P. R. 1990. `The implications of using museum vehicles', In Zeuner, D. (ed.), *World Forum for Motor Museums: The Way Ahead.* National Motor Museum: Beaulieu.

National Traction Engine Trust (NTET). 1992. *Code of Practice for Traction Engines and Similar vehicles*. (Note: This is normally available only to members of the Trust. Details from M. O. Davies, Chairman, NTET Engine Owners' Subcommittee, Hill Farm, Avon Dassett, Leamington Spa, CV33 0AA.).

Spectre, P. H. 1981. `The Issues of Maritime Preservation', in *Wooden Boat*, No 38.

Ware, M. 1980. `Restoration of Motor Cars', reprinted from *Transport Museums*, Vol 7.

Waitman Mimi., ‘Criteria for deciding whether an instrument should be played’ Annex E in *Standards for the Museum Care of Musical Instruments,* MGC/MLA (revised version 2005) (available on the Collections Link website www.collectionslink.org.uk).

7. Understanding and Controlling the Environment

Your collection will probably be housed in a variety of display and storage spaces. You may already be acutely aware of your collection's environment, because so many larger objects have to be kept outdoors or in partially sheltered conditions. But bringing an object indoors does not remove it from environmental danger.

In practical terms, the storage or display environment presents itself as a complex of interlocking light, temperature and humidity conditions further modified by the possible incursions of pollutants and pests. Even visitors -- the life blood of a public collection -- create significant effects. Your aim is first to discover what these conditions and effects are, then to maintain them as stably as possible within predetermined limits.

- Temperature and relative humidity are regularly measured.
- Light falling on light-sensitive objects is regularly measured.
- Buildings housing objects are regularly maintained.
- Only objects assessed as suitable are displayed outside and this status is reviewed at regular intervals.
- Only as a last resort are objects stored outside, and only then for as short a time as possible.

7.1 Temperature and humidity

Two of the most crucial environmental parameters are temperature and humidity. We are all used to the experience and measurement of temperature, but are less used to thinking about **humidity** -- the amount of moisture in the air, usually expressed as **relative humidity** (RH). Temperature and humidity -- and their effects on objects -- are closely intertwined, so both have to be checked and controlled together.

What are the ideal levels of temperature and RH? A moment's reflection should show that this question is unanswerable in most situations. Most objects of any size are made up of many different materials, each of which responds differently to temperature and humidity, so even for a single object there can be no ideal set of conditions. Other practical complications include the number and variety of objects in the collection, and the fact that many collections have only a limited capability to control their internal environments.

Note: The MGC publication *Museum Collections in Industrial Buildings: A Selection and Adaptation Guide* (available on Collections Link website www.collectionslink.org.uk) describes how the buildings *can* provide the appropriate level of protection for the collection.

The `official' recommended levels of temperature and humidity found in many published sources should be used with great care. Over time, objects made of organic materials such as wood or leather become acclimatized to relatively stable environmental conditions, and any attempt to `correct' conditions to some theoretical ideal could do more harm than good. Change means stress, and stress can cause damage and accelerate decay. *Environmental stability should be the target*, not some precise ideal level. If in any doubt, seek expert advice.

Note: See May Cassar's *Environmental Management: Guidelines for Museums and Galleries* for a complete guide to the museum environment.

7.2 Light

There can be no displays without light. Unfortunately, both natural and artificial light can change and damage materials as diverse as paper and plastics. Paints fade and may lose their protective properties, wood discolours, many plastics and other organic materials become brittle or weak. If temperature and humidity conditions are favourable, light may promote the growth of algae.

The effects of light on objects depends on:

- the nature of the light (daylight, tungsten lamps etc)
- the intensity of the light reaching the object
- the duration of the exposure

You must therefore set up a **monitoring programme** for these three parameters if you wish to control light effects in objects in your collection. The **ultraviolet** (UV) component of sunlight and other sources can be especially damaging, so this will need to be measured separately. Then you must identify **sensitive** objects (or parts of objects such as upholstery or painted coachwork) and set limits for their exposure to light, using recommended limits from published sources.

Limits are usually set in **lux hours per year** -- light **intensity** is measured in lux, and this is multiplied by the annual exposure in hours. To take a simple example, imagine that your monitoring programme establishes that an object is exposed to an average of 200 lux for 2,000 hours per year -- that is, 400,000 lux hours. If published guidelines recommend an annual maximum of 200,000 lux hours for the most vulnerable material in that object, you should either reduce the light intensity to 100 lux or the annual period of exposure to 1000 hours or find some way of providing protection to the vulnerable components. The figures in this example are typical for sensitive items such as photographs and paper -- the type of material commonly used in association with larger or working objects.

An object may be robust with respect to light but vulnerable to heat -- for example, metal objects expand as their temperature increases, which may lead to permanent distortion, or the displacement of coatings or inlays. Some light sources produce high levels of heat, which may be significant in cramped spaces or where lamps are close to objects. Among artificial sources this is particularly true of **tungsten lamps**, but some types of `cold' lighting use transformers that generate heat. Sunlight, of course, is associated with heat that may be intense and that varies with latitude, weather, season and time of day. High temperatures can also occur in a building with a glass roof or large area of window simply as a result of the effect of the sun.

Once you have set light limits, how do you achieve them? At its most sophisticated, the control of daylight and artificial light is linked to programmable electronic systems, but these are far beyond the resources of most collections and may be inappropriate in traditional buildings. Simple tried and tested methods are very effective: curtains, blinds, screens and opaque dustsheets will stop or reduce light. Background lighting can be reduced by using spotlighting for key areas and visitor-operated lighting for vulnerable objects. Simple push-type time-delay switches are better than conventional switches because they do not rely on visitors -- or staff -- remembering to switch them off. UV control requires special filters and varnishes for windows and lamps -- though these degrade over time and must be regularly checked.

7.3 Pollution

Working objects themselves may produce pollutants that must be kept away from other parts of the collection. For example, steam locomotives produce smoke, soot and dust in quantities that may even violate clean air regulations or cause a local nuisance.

There are also many less obvious pollution dangers created by materials and equipment used within the building environment, such as ammonia in floor cleaning preparations and ozone produced by photocopiers and laser printers.

Building and decorating materials give off particles (such as sawdust and concrete dust) and vapours (such as ammonia and water), especially when newly applied.

Microporous sealants offer a possible solution: when applied to dry surfaces they control dust while still allowing the material to breathe. All display and storage materials can be tested for any possible harmful effects -- manufactured boards, natural fibres such as wool felt, fire retardant coatings, recently applied adhesives, cleaning materials, and some hardwoods such as oak can give off potentially harmful gases and organic vapours.

Some of these pollutants may not be aggressive to robust objects such as motor vehicles, boats or stationary engines, but may be towards decorative elements and associated display materials such as your photographs or medals or textiles.

7.4 `People effects'

Providing access to the collections for visitors, researchers and staff is essential, complicates environmental control. Windows transmit light and heat, open doors disrupt temperature and humidity conditions and allow the ingress of outside air that may be polluted. Visitors may bring in dust and dirt, as well as significant quantities of moisture during wet weather. Even soaps, cosmetics, deodorants and other everyday products may release their volatile components into the environment. These may not present an immediate danger to robust objects, but they could harm delicate electrical contacts or microprocessors that control them.

Note: Locked doors, sealed windows and other restrictions on the movement of visitors must not conflict with health, fire or safety regulations.

People naturally produce both heat and moisture as a result of breathing and normal metabolism. An individual can release 100 ml of water per hour and the same amount of heat as a 60 watt light bulb. If you compare the temperature and humidity data at different times of day with visitor numbers and opening hours, you should be able to detect these effects in your own collection. Visitors also love to touch objects and turn knobs or press buttons. At the very least this leaves disfiguring fingerprints.

Simple remedies can help to offset many `people effects', though increased heat and moisture may require more active intervention. Outside air and dirt brought in by visitors can be kept at bay by extra outer doors, the buffering effect of porches and foyers -- and even good doormats. A cloakroom for wet outdoor clothing is an asset.

7.5 Buildings - the Main Line of Environmental Defence

The buildings are the main defence in the battle against environmental instability. Their all-important **buffering** effect is enhanced if the fabric of walls, roofs and other structural elements is well insulated and well maintained. A poorly insulated wall, for example, will soon transmit a sudden change in outdoor temperature to the indoor space, destabilizing the indoor environment as a result.

Buildings used to house collections range from corrugated iron sheds to purpose-built, air-conditioned palaces. Much can be done to improve existing buildings at a relatively low cost. For example, draught-proofing, thermal insulation and multiple glazing are ways in which temperature fluctuations can be reduced, provided essential air movements within the building are preserved. You should consider simple building improvements before you commit yourself to ambitious environmental systems. Good, sound buildings and sensible environmental zoning (see below) may reduce or even eliminate the need for expensive dehumidifiers and other gadgetry.

Two caveats: any modifications to historic buildings may require listed building or similar consents; and building advice and work must be provided by individuals or companies familiar with the special building requirements for storing and displaying historic artefacts.

Environmental zoning

Few collections can keep all their larger and working objects in ideal buildings, so it is important that the most significant or vulnerable objects are kept in the best available conditions. A combination of observation, careful monitoring and common sense will tell you which buildings or parts of buildings offer the best environment for the collection. To take a very simple example, a two-roomed building may have a damp north-facing back room and sunny south-facing front room; obviously, you will not display damp-sensitive objects in the back room.

Once you have identified these environmental differences, you can create zones by establishing groups of rooms with similar environmental characteristics. The zoning exercise will also highlight those areas suitable for local space conditioning -- a much more efficient way of spending your limited resources than trying to condition the whole building. If you find zones that are uneconomical to condition, why not use them for cloakrooms, kitchens, gift shops and other non-collection purposes? Remember that you can use conditioned display cases to produce mini-zones within a larger space.

Building services: the second line of defence

It is vital to ensure that the building services -- lighting, heating, ventilation, water supply -- are properly maintained and operating at their highest possible efficiency. Efficient building services will also save energy, with consequent benefits to the larger environment and to your budget. Even elderly boilers can sometimes be coaxed into yielding better performance.

Modern **building management systems** provide centralized control of all mechanical and electrical building services. Although expensive to install, they offer several advantages over manual, ad hoc control -- for example, they immediately sound an alarm when temperature or humidity exceed preset limits, they can log ambient conditions and produce graphs, and they are valuable for monitoring and regulating energy consumption.

Maintenance

Without maintenance, a good building can become a bad building in a short space of years. Building maintenance is not an optional extra or a low-priority item, and this must be reflected in your expenditure budget. All buildings housing objects should be regularly inspected to ensure that they provide secure protection against the weather and are generally fit for their purpose. In particular, the building must be watertight, so you should seek out and repair all possible sources of damp -- including failed or non-existent damp-proof membranes, leaking pipes and water tanks, faulty guttering and missing roof tiles.

7.6 Environmental Monitoring and Control

A stable environment is the single greatest asset when caring for and conserve the collection (see Chapter 6). But how do you measure this environment, and what happens when your buildings (see Chapter 4) do not keep the environment within acceptable limits?

‘Monitoring' is the usual name given to the regular measurement of the important parameters -- temperature, relative humidity and light. These are examined over time in the context of planned **monitoring programme**, which governs their year-round measurement and recording in all storage and display areas. You will also have to take regular measurements out of doors, otherwise you will not know how good -- or bad -- your buildings are at **buffering** the outdoor environment. And check your data against visitor numbers (see `People effects' in Chapter 6).

Measurement . . .

There is a bare minimum of measuring equipment that you must have and use:

- A whirling **hygrometer**
- A light meter, and
- An ultraviolet meter

These must be regularly calibrated against standard instruments. Hygrometers in particular become inaccurate very easily. Everyone who uses them must be properly trained - again, hygrometers are easy to misread.

The simplest system of measurement relies on **spot readings** -- individual measurements taken manually at specific places and times of day. More conveniently, mechanical recording **thermohygrographs** record temperature and relative humidity continuously on 7 or 30 day charts.

The most sophisticated -- and expensive -- systems perform continuous monitoring with the aid of electronic equipment. Central **dataloggers** take the process a stage further by recording the output from remote sensors strategically placed around the building.

. . . And control

Your buildings are the main line of environmental defence. If you focus your attention on their condition, and set aside an adequate maintenance and repair budget, you will achieve a good measure of environmental stability. However, certain conditions -- and especially `people effects' -- will produce unacceptable variations in the indoor environment. To control these, you will need humidifiers, dehumidifiers and other devices designed to change the local temperature and/or relative humidity.

Control devices can be portable -- providing a `plug in' solution to a local or temporary problem, and often the only realistic option -- or built in to the larger building control system. At the highest level of sophistication, electronically managed control devices can be linked to datalogging systems to provide automatic environmental regulation. But none of this equipment can offer a `quick fix' to deeper problems: get the building right first. And remember that all control devices use energy to achieve their effects -- effects that will include an inflated electricity bill.

A warning: expensive building-wide air-conditioning is usually not the answer, except as an integrated aspect of large-scale, purpose-built display and storage spaces. Simple improvements are much more likely to provide cost-effective solutions to your environmental problems.

7.7 Objects Housed Outside

Many collections choose to house large and robust objects outdoors. The reason may be that the object was acquired in anticipation of resources being available to provide suitable protection indoors, or the object might be considered suitable for outdoor display, for a time at least. Whatever the reason, some basic preventive measures will help reduce the rate of deterioration.

These general notes are intended for objects that are not intended to be operated.

- Choose a well-drained site and build a simple base-pad that can support the weight of the object and keep it from contact with damp soil. Concrete, gravel or stone are suitable;
- If appropriate, mount the machinery on concrete blocks or treated wood such as old railway sleepers to lift it off the ground. Cushion the contact points with wood or rubber;
- Vehicles with wooden wheels or rubber tyres should be raised on axle stands;
- Keep all moving parts oiled;
- Keep oil in sump fresh and coat internal parts by occasionally turning over the mechanism if possible;
- Make all internal spaces with moving parts air-tight and protect with vapour phase inhibiting oils;
- Protect or remove absorbent material such as upholstery or lagging (Don't forget to label it and record the fact in the object file);
- Identify areas where rain-water may collect and take action to prevent this happening;
- Block or screen all openings where rubbish may collect or offer a home for birds, rats or other mammals;
- Remove objects that may be attractive to vandals or opportunist thieves such as identification plates, bright work, decorative elements, gauges, knobs etc. Any small holes may be plugged using plastic stoppers;
- Remove coal, wood or the remains of other fuels or cargo;
- Put up a notice saying what the object is. Include warning if there are hazards or you wish to restrict access.

Provide temporary cover if at all possible. A tarpaulin or reinforced plastic sheeting draped over the object will give some protection but its effectiveness can be improved greatly if used in conjunction with a scaffolding framework. The covering is lifted off the object and provides well ventilated protection. An open-sided shed offer a more permanent solution to providing protection from rain and sunlight, and may be more appropriate to the nature of the site -- a barn, for instance. A single wall offering protection from the prevailing wind is a further improvement. Design all shelters so that rain-water is directed away from the storage area.

A range of protective wax coatings have been developed for protecting military or agricultural equipment. These should be used to give added protection to items housed outdoors. It is not possible totally to prevent the deterioration of objects housed outdoors but the procedures outlined above, combined with a programme of regular inspection and maintenance programme, offers the best option if satisfactory indoor storage is not possible and the object is suitable. However, it should not be assumed that because an object was built to operate outdoors, it can withstand long-term storage outdoors.

7.8 Sources of advice and assistance

May Cassar's *Environmental Management: Guidelines for Museums and Galleries* published by Routledge is a comprehensive introduction to the whole field.

Advice on keeping objects out of doors can be obtained from:

- The Science Museum
- The Imperial War Museum
- The National Railway Museum and other national museums
- The large regional museums of science and industry such as those in Manchester and Newcastle

Useful information is contained in the following:

Bordass, W. (ed May Cassar). 1996. *Museum Collections in Industrial Buildings: A Selection and Adaptation Guide*. London: Museums & Galleries Commission. Available from the Museums, Libraries and Archives Council.

Staniforth, Sarah, Bob Hayes and Linda Bullock. 1994. `Appropriate Technologies for Relative Humidity Control for Museum Collections Housed in Historic Houses. In *Preventive Conservation: Practice Theory and Research*, eds. Ashok Roy and Perry Smith. 123--128. London: International Institute for Conservation.

8. Damage, Dust, Dirt & Pests

Once a stable and appropriate environment for the objects is set up, there still remain many potential sources of damage. Large and working objects are not necessarily more robust than most decorative art objects, especially if they are poorly supported or mounted. Visitors can accidentally damage objects, careless operation can produce rapid wear or failure of the components of working objects, over-zealous cleaning may do more harm than good...

Imagine an object standing in a display space under good, stable environmental conditions. Even this is not always enough to ensure that the object remains safe and intact. There are a number of everyday threats to its well-being.

Perhaps large numbers of visitors pass very close to the object: inevitably, some of them will brush against or bump into it. A busy cleaner hits the base of the object or its support with a vacuum cleaner or a mop. An enthusiastic volunteer cleans the object by rubbing off marks and stains and brushing off the dust.

- Every object has a strong enough support and sufficient space and protection to enable it to be accessed for study, cleaning and moving.
- Objects are protected as far as possible from dust and dirt; all possible measures are taken to reduce the need for cleaning to a minimum.
- Cleaning is as gentle as possible, and is undertaken by trained people.
- Objects are moved as little as possible, unless this is one of their functions in the collection.
- The collection is regularly inspected for pest damage, or any signs of physical or chemical deterioration. These inspections are recorded in the object's care plan.

Each of these activities can cause damage: paints, coatings and platings chip or scratch, important signs of ageing and other evidence disappear, materials are abraded, fabrics fray, cleaning fluids cause discoloration or corrosion...The potential for damage is considerably increased if the object is heavy or unwieldy, particularly where it rests upon a makeshift stand. A falling object may be disastrously damaged -- and can easily cause injury. It simply isn't true that larger objects are more robust in virtue of their size.

Display stands, mounts and supports may be mundane, and everyday cleaning of the building interior and the collection may appear to be only marginally relevant to standards of care, but both are of central importance.

8.1 Space & support

Space
Large or working objects need adequate space for access, inspection, cleaning and moving.

Floors, stands, mounts
Floors, stand and mounts must be strong enough to support much more than the weight of the object, with a large safety factor. And remember to test your floor for people as well as objects on display! A crowd of visitors standing close to an object will increase loads in the vicinity: 15 - 20 people together weigh a tonne or more.

Self-support?
Check that the object can support its **own** weight for extended periods. In particular, some kinds of wooden-framed machines may be at risk in this respect.

Access equipment
All access equipment (gantries, ladders etc) must meet safety standards and the appropriate regulations or British Standard, and must be regularly inspected.

Factors to consider in designing & constructing supports
Three important factors must be taken into account:

- Stability & loading patterns: a large and heavy object on a small base may be relatively unstable, depending on its weight distribution. For example, overhanging components may need to be propped or stayed to prevent the object from toppling over. The small base also increases the pressure exerted by the object on the contact surface of the support, compared to an object of the same weight spread over a larger area -- necessitating a proportionally stronger support.
- Dynamic loads: Working mechanical objects produce dynamic loads. For example, a stationary steam engine will apply a rhythmically varying load to its supporting structure as well as the static load created by the machine's own weight. Machines incorporating components that accelerate and decelerate very rapidly -- such as mechanical punches, hammers and stamps -- also create significant shock or impact loads. Such loads are of short duration but can be very high.
- Mechanical resonance and vibration present an additional complication for the design of supports and mountings. Constant vibration can loosen many kinds of fastenings and structures, threatening both the integrity of the object and the security of the support. Regular inspection of nuts, rivets, cotters, split pins and other vulnerable components is essential. Resonance can be very dangerous. All mechanical structures, from small supporting frames or mounts to floors and even whole buildings, exhibit resonant frequencies. An applied force that varies `in tune' with the resonant frequency of a structure can produce disproportionately large and sometimes destructive vibrations in that structure. A structural engineer may be required to help with these more complex loading problems.

8.2 Protecting larger objects from physical damage

Accidental damage is an ever-present danger to objects on display. Careful handling can reduce the risk of damage caused by staff and volunteers, but the casual or occasional visitor is less aware of the risks. Deliberate damage and vandalism are predominantly security matters, but much of the accident risk is associated with the ways in which visitors come into contact with the collection. The risk is reduced if that contact is well managed.

Many visitors naturally suppose that a large object is robust, and the temptation to meddle with a working exhibit may be almost irresistible. An object sited close to a main route through the display space may be bumped or brushed against many times during the course of an average day. The effects of these types of contact will depend on whether the object is vulnerable: if it is, it should be moved or given increased protection. In other words, careful siting of vulnerable objects will reduce the risk of accidental damage to the more delicate gauges, pipework or brightwork that are part of working machines.

Other safeguards include the use of ropes or fences to separate visitors and display spaces, protective screens and barriers for vulnerable objects or surfaces, and even the replacement of original parts by replicas. Visitor access around and over larger objects can be shaped and guided by ramps, steps and clearly defined walkways.

8.3 Keeping the space clean

Any building or open area in constant use requires regular cleaning, and object display areas or stores are no exception. However, simple preventive measures and good housekeeping will keep dust and dirt and rubbish to a minimum. For example, loop-piled doormats will keep out much of the dirt adhering to visitors' shoes; dust sheets will protect objects in storage; dust-generating concrete floors can be sealed; and windows can be closed and sealed provided ventilation air can get in by other (controlled) means. Objects kept outdoors or in large poorly sealed sheds should be protected against splashed mud, wind-driven rain, salts or dust, bird or animal droppings, and litter.

Note: The cleaning of objects and cleaning the premises are completely separate activities, and must be planned and executed separately (see below).

As part of a regular and effective cleaning regime, all surfaces should be vacuum cleaned, *not* swept -- sweeping simply moves much of the dirt and dust to other parts of the building. Curtains and dust sheets should be regularly washed. Cleaning materials should not give off damaging fumes.

Note: Use a vacuum cleaner fitted with an ultra-fine filter that conforms to BS 5412.

See MLA publication *Standards in the Museum Care of Musical Instruments*.

8.4 Cleaning objects

Objects should only be cleaned as part of a carefully managed cleaning regime using approved methods and materials. Remember that a large proportion of object cleaning is effectively conservation work, so the cleaning programme will benefit from the guidance of a conservator. When you draw up the programme, you should ask the following questions:

- How important is the object, and what level of care should it receive?
- *Why* are you cleaning the object?
- Is the `dirt' doing any damage -- indeed, could it be historical evidence?
- Will cleaning harm the object -- what will affect the dirt without affecting the object?
- What will the object look like after cleaning?
- Will cleaning affect the stability of the object and lead to increased corrosion?
- Once the object is cleaned, how often will it need cleaning in future?
- Is there a suitable treatment, and if so how does it work and when should it stop?
- Is the treatment safe for both person and object?

Care is needed for even the simpler forms of cleaning -- dusting and wet cleaning. Dusting can scratch objects, cause breakages, stir up more dust and even encourage corrosion. It may also disturb hazardous substances such as powdery red lead and white lead paints, black leading, asbestos coatings and powder residues, old luminous surfaces, powdery metal corrosion products, discharges from electrical components, and microbial dusts and residues. Such hazards may require protective clothing and masks, and sometimes dust or fume extraction equipment.

Wet cleaning must always be approached with caution. Many household cleaners contain physically damaging abrasive powders so may no be suitable. Solvents, detergents, and water-based solutions may change the surface of the object or contaminate neighbouring parts. If the object has been made or repaired using water-based adhesives, wet cleaning could threaten the integrity of the object. Surfaces such as flaking painted surfaces, porous ceramics, unpainted wood and corroded metal surfaces should not normally be washed.

Some parts of the collection -- particularly working objects -- will need to be cleaned on a regular basis. Depending on the type of object, normal operations will eventually lead to an accumulation of grime composed of such materials as soot, dust, fuel or coolant residues, oil and grease. This kind of cleaning is arguably a form of maintenance. Indeed, good maintenance standards and correct operating practices are likely to minimize the production of dirt and waste. For example, worn bearing seals or packings will leak oil; and poor steam locomotive firing or driving practice can create excessive soot and smoke.

Note: Remember that it is important to preserve practices as well as objects.

This `maintenance cleaning' provides another excellent opportunity for research into traditional operating and maintenance practice. Traditional cleaning methods, such as the cleaning of piping and other brightwork, may be appropriate -- though only on materials and components that are not intrinsically of historical significance. Metal polishing is a case in point: traditional abrasive methods wear away the metal, and should only be used on commonplace materials that are normally replaced at intervals during an object's working life. If a sufficiently large number of components may not be cleaned without damage, there is a good case for not operating the object.

Note: To work or not to work? see Chapter 5.

One final form of `cleaning' is that needed when an object is severely corroded or is encrusted with unwanted materials. This kind of cleaning -- which may involve fairly drastic processes such as shotblasting or chemical descaling -- is an aspect of restoration or **remedial conservation**.

To summarize: object cleaning must be clearly separated from the everyday `domestic' cleaning of the building itself. It can be conveniently distinguished into three types:

- Cleaning as **preventive conservation**, to protect the object from (further) damage;
- `Maintenance cleaning', required to keep an object in good -- often working – condition;
- Cleaning as part of a restoration programme.

8.5 Pests

There is one additional source of potential damage to the collection that cannot be ignored. Pests large and small -- rats, mice, birds, insects, fungi, algae, bacteria -- are always at large, waiting to invade storage and display spaces wherever poor preventive management allows them in. The elements of a successful pest control strategy are:

- Good housekeeping practice, including regular cleaning programmes, removal of rubbish and general tidiness;
- Regular inspection of the building for signs of pests supplemented with a trapping programme;
- The inspection of all incoming objects *and* the associated packing materials;
- A rapid response to any infestations -- to be undertaken or supervised by trained and experienced people, as required under health and safety legislation.

Many traditional pesticides are now regarded as unsafe, and are being replaced by new methods (involving freezing and inert gases, for example). The use and storage of hazardous chemicals are governed by law, so it is best to entrust pest eradication to specialists contractors. Be aware of complications: not all pests can be killed with impunity -- think, for example, of protected species like bats or barn owls which may roost in large buildings that may be serving as storage spaces.

Note: The storage and use of pesticides is controlled under the Control of Pesticides Regulations, 1986.

8.6 Moving Objects

Whenever you move an object, you run three main risks: physical damage to the object; physical injury to staff, volunteers or the public; and environmental stress.

The larger they come . . .

Careless handling can result in damage to any size of object, but large and working objects present obvious problems. They can be heavy and unwieldy, and awkward to manipulate and manoeuvre. Even where an object was designed to be mobile, it may now be too old or fragile to move under its own power or on its own wheels.

The sheer weight and size of many objects makes specialist help essential. Choose crane and haulage contractors on the basis of proven experience in this type of work, and ensure that they cooperate closely with staff. Any staff or volunteers working on the move must be adequately trained and aware of the dangers -- to the object and to themselves.

A major move needs careful planning and supervision. One experienced and capable person should be in charge of the whole operation. Routes will have to be checked for load clearance, weight restrictions and other problems, and may need to be cleared with the police. The object's original documentation sometimes provides information about lifting points and methods and the overall weight, but these may no longer apply if, for example, lifting eyes or jacking points have corroded -- always check the condition of the object before moving it. And follow the Government Indemnity Scheme's guidelines (available from the MLA).

Other points that may arise during the planning stage include:

- Previous moves: has the object been moved before, and if so, what happened?
- Disassembly: can the load be better managed if it is partly dismantled?
- Cradles and frames: build or order any necessary supporting frameworks.
- Keeping things together: remove all loose items and components and drain all fluids.
- Route selection: choose a route that causes minimum stress to the object -- a smooth detour is better than a bumpy short-cut.
- Stability: make sure that loads are secured against slippage or movement in transit.

Safe manual handling

Manual lifting and handling carry high risks of personal injury. To reduce the risk, keep manual handling and carrying to a minimum. If some kind of lifting is necessary, carry out a risk assessment -- for staff and object -- first. Wherever possible, use trolleys, trucks and lifts. Be aware of your responsibilities under the Health & Safety at Work Act 1974.

Weight alone is not a sufficient guide to whether an object can be manually lifted. How is the weight distributed, and how stable is the object? And how is the object to be held in relation to the person who will lift it? Clearly, a weight held at arm's length is more difficult to handle than one held close to the body.

The Manual Handling Regulations set a 25 kg maximum for loads carried at elbow height close to a man's body; the equivalent figure for women is 16.7 kg. Reduce these figures by at least 5 kg for loads carried in any other position, and by 10 kg when lifting from points below elbow height. Do not attempt to carry a heavy load for more than 10 metres.

Finally, check that your way is clear -- loose carpets or mats, obstacles, polished floors, cramped access or corridors and poor lighting can all contribute to injury and damage.

Environmental stress

Remember that the principal weapon in the conservation armoury is a stable environment. Movement usually involves transferring the object from one environment to another, so this all-important stability disappears and stress is the result.

One way of avoiding this problem is to make sure that the environment at the destination is as similar as possible to the environment at the source. But what happens during transit -- especially when the journey is long, or involves many stages? At worst, the object may be stressed when it leaves its source, stressed again during its journey -- perhaps by extremes of weather -- and stressed yet again when it is transferred to the new destination.

The secret is to create a stable mini-environment using good, well insulating packing materials that do not damage the object (for example, by being dirty, or through fastenings cutting into the object). The packaging must not only protect the object against knocks and abrasion; it must also preserve the surrounding temperature and relative humidity for as long as possible. If the journey will take time -- involving international travel, for example -- you may need to consider active control methods to preserve the mini-environment.

8.7 Sources of advice and assistance

Advice on pesticides is available from all regional offices of the Health and Safety Executive.

Several organizations, including some commercial conservation firms, offer a testing service for the suitability of materials for use in the exhibition or storage of specimens.

Guidance on manual handling will be found in the Health and Safety Executive's *Manual Handling: Guidance on Regulations (Manual Handling Operations Regulations 1992)*.

May Cassar's *Environmental Management: Guidelines for Museums and Galleries,* Routledge (1995) contains considerable detail on this range of problems. Other useful publications are:

Pinniger D. 2001. *Pest Management in Museums*, Archives and Historic Houses. Archetype Publications, London, England. 115 pp.

Collections Trust 2008. *Pest Management: a practical guide*. Cambridge: Collections Trust.

The National Trust, 2005, *The Manual of Housekeeping*, Elsevier Science and Technology.

9. Trains & Boats & Planes: Some Specialist Aspects of Care

Every object benefits from the stable environment that is the basis of good collection care -- a truism that applies to all classes of objects. Larger and working objects are no exception, and though the operation of `live' exhibits brings new conservation and management problems to solve, the application of the basic principles takes care of most everyday activities. Even so, it is worth examining the special care and conservation demands of some common larger and working objects. The classes of objects reviewed in this chapter -- steam boilers, boats and aircraft -- only make up a sample of the huge variety of objects now in collections, but the principles can be extended to other types of object. For example, aircraft and boats create problems of stable mechanical support, and steam boilers introduce a range of corrosion problems.

The general principles of care and conservation apply to all classes of object. However, many larger and working objects create special management and protection problems that must be specifically addressed. Four common classes of object are reviewed here: boats, steam boilers, aircraft and internal combustion engines.

9.1 Steam boilers

The steam boiler lies at the heart of nearly all stationary, fairground and marine steam engines, railway locomotives, traction and showmen's engines and steam rollers. Boilers come in a huge array of forms and degrees of sophistication, from the simplest low-pressure steam generator to relatively modern high-pressure vessels with complex tube layouts and multi-row superheaters.

Safety issues are paramount: frequent boiler explosions during the early years of the railways demonstrated the destructive and often deadly consequences of inadequate boiler safety. Museums and preservation societies operating steam exhibits are fully aware that regular boiler inspections and tests are a statutory obligation. All operational boilers and pressure vessels must be maintained to meet the standards set by their certifying authority, which is usually an insurance company.

Note: Insurance company surveyors provide expert advice, and must be consulted before repairs are undertaken.

Sources of potential damage to boilers

It is convenient to think in terms of the fire side and water side of steam boilers. The two main dangers to boilers are thermal stress and corrosion. Thermal stress from too-rapid heating or cooling can create various forms of `thermal straining' -- the distortion of the boiler components and the joints between them -- and may also induce metallurgical changes. Corrosion reduces the strength of the metal by thinning it and creating irregularities that act as a focus for stress concentrations; eventually, safety is compromised. It is natural to think of corrosion as exclusively a water-side problem, but there are several sources of fire-side corrosion.

Thermal stress can be substantially reduced by good operating practice. Remember that the sudden cooling of hot surfaces is as much a source of stress as rapid heating. For example, operators should guard against:

- Excessively rapid fire raising
- The ingress of cold air, or inadequate baffling
- Flame impingement on surfaces caused by improper combustion (bad firing)
- Feeding cold water after the fire is out
- The presence of oil on the water side (which increases the temperature needed to raise steam)

Corrosion may also be reduced by careful operating practices. The widespread use of steel and iron in boiler construction means that rust is a principal enemy; remember that it is not water alone, but water in combination with oxygen, that causes rapid rusting. Anti-corrosion measures must therefore seek to exclude oxygen, as well as any salts that may cause corrosion when in solution in the feed water.

Operators should try to prevent:

- Acid feed water (from peaty soil, for example)
- Air and hence oxygen from entering the feed water (via injectors, for example)
- Water and air standing in water lines and steam spaces
- The accumulation of sludge and debris in water spaces
- Oil introduced with the feed water

Hard or otherwise impure feed water is not necessarily superior to acid water. The subsequent scale build-up acts as an insulator (thus reducing thermal efficiency), progressively narrows water lines, and allows corrosion to proceed unseen underneath the scale. Some form of feed water treatment will probably be necessary.

Fire-side corrosion is less obvious but still a danger. The principal source is the corrosive effect of certain harmful combustion by-products, but water and steam leaks introduce water-side types of corrosion into the fire-side. Dangers include:

- The use of high sulphur fuel
- Ashes or clinker not cleaned out after use
- Any steam or water leaks to the fire side
- Condensation on fire surfaces during storage

Other types of corrosion may be important in some cases. For example, dissimilar metals used in boiler construction may produce sacrificial corrosion.

Effective maintenance practices

It is not easy to make a neat distinction between operating and maintenance practices for steam engines, as much of the routine attention they must receive could fall under either head. Besides regular inspection, routine maintenance involves the avoidance of conditions favourable to corrosion. Boilers should not be left full of water for longer than necessary, and never for longer than ten days. Salt water must never be used as a feed or for flushing.

One important procedure is the blow down, which should be performed at least every seven to ten days of boiler use. The boiler is emptied while still warm, then dried by a flow of air at low pressure over the water surfaces. The remaining warmth will aid the drying process.

The above applies to the relatively small boilers of non-condensing engines. With re-circulating plant the volumes of treated and de-oxygenated water are very high and such plant would not normally be emptied between inspections (which for continuous certification cannot be more than 14 months apart). A dry water side is essential for any boiler that is to be taken out of service for an extended period; in this case, you should also clean and oil the fire side surfaces and remove the firebars.

You may wish to consider whether your preserved boiler needs to be insured for as high a pressure as when in commercial service. If your boiler never runs at 60psi but you have a boiler certificate for 100psi, the boiler is going to be needlessly stressed to 150psi during the necessary periodic hydraulic tests. If the safety valves were re-set to 65psi then testing to 100psi would be sufficient.

Note: See Chapter 9 for more on safety.

9.2 Boats

The care of boats can be more difficult than that of any other larger object. Boats kept on land require good support to retain their shape and structural integrity. Small boats are best placed on customized bases with good keel support and fitted hull chocks; large vessels should be placed on closely spaced keel blocks and strategically placed side shores. Vessels with extended fore and aft overhang must be well supported in these areas to prevent hull distortion.

Keeping the boat in the water creates additional difficulties. The vessel may look at its most natural condition when afloat, but there are high maintenance costs -- and at intervals parts must be replaced. The decision to keep a boat in the water should only be taken after very careful consideration and must be regularly reviewed.

Wooden boats kept in salt water should not be washed down with fresh water as this can lead to rot.

The roofed cover of a traditional boathouse offers the best protection to a floating exhibit. Awnings and screens are a reasonable substitute where there is no boathouse, though many vessels have to remain uncovered. Unprotected vessels should be turned periodically to present a different face to the sun and the prevailing weather. Keep moored vessels clear of quay or pontoon sides -- fenders can cause severe chafing -- unless the craft has to be kept close for safe boarding without a gangway.

Traditional weatherproofing materials require appropriate maintenance, including the caulking of hull and deck seams and the paying of tarred surfaces. Metal hull corrosion is often concentrated at the air/water surface; the remedy is to vary the displacement and hence the waterline by periodically adding or removing ballast or weights.

A boat's internal spaces must be kept well ventilated and as dry as possible to discourage corrosion and rot. Keep lockers and other enclosed spaces open to encourage air circulation, and remove non-essential on-board equipment to separate storage. Fans or dehumidifiers may be necessary on larger vessels, especially during the winter. Regularly inspect the boat for weather and water leaks, paying special attention to hidden areas. Consider fitting an automatic bilge pump.

Your **care plan** will include hull inspection and maintenance; this entails taking the boat out of the water at intervals -- annually in the case of small craft. But the best way to monitor and maintain the condition of a floating boat -- particularly a powered craft -- is to *use* it. Never leave a floating boat untended or unused for long periods.

9.3 Aircraft

Flying aircraft require airworthiness certification and demand skilled attention and maintenance that is beyond the scope of this book. However, even though your collection may be unable to consider operational aircraft, there may be scope for one or more static exhibits and some aircraft are now being restored to enable them to a condition where they can taxy though not to fly.

Aircraft are designed to have the minimum possible weight consistent with the requirements of strength and safety. Many parts of an airframe are not designed to take a person's weight -- the fuselage or skin of a wing could easily be distorted or ruptured, for example. This means that in most cases, visitors should not be allowed on to the aircraft -- and staff must take great care to place their weight *only* on designated parts of the airframe. Safe load-bearing areas are often marked on modern aircraft. Ramps and steps can be used to give visitors a closer view of cockpits and other interesting features.

The undercarriage is normally designed to take the weight of the whole aircraft. On aircraft with retractable undercarriages, the associated hydraulic and locking systems will need careful monitoring and maintenance. Hydraulic fluid must be regularly checked and topped up if necessary -- using the correct aircraft-grade fluids. Periodically, you must flush and refill the system, and replace all seals. Tyre pressures should be checked regularly.

Although the undercarriage can support the aircraft, other parts of the plane probably cannot. This is especially important if you intend to suspend the aircraft from the roof or a gantry. Suspending an aircraft in a typical in-flight attitude -- diving or banking, for example -- does add drama to the display, but requires great care. Before you go ahead, you will need to undertake or commission a plan that includes a stress analysis of the airframe, the roof or supporting structure, and all associated fittings. You are advised to seek specialist help, especially for the stress analysis and the suspension work itself. Aircraft that have spent a long time outside and exposed to the elements are particularly unstable in many area including jacking, lifting and otherwise accepted strong points.

Aircraft which are unlikely to be restored to air worthiness should have their hydraulic systems drained as these are likely to become a constant source of leaks if left. It is unwise to rely on the residual pressure of the system to keep the gear locked down, even though most undercarriages provide an overcentre lock in the linkeage. Separate pieces of ground equipment -- ground locks -- were produced for almost all aircraft and these should be fitted when the aircraft is on the ground, especially when being moved. If an aircraft is not to be moved with any frequency, it is worth considering supporting it on axle stands, which take the weight of the wheels and will allow the tyres to be deflated.

Air Publications (APs) and Tech Orders (TOs for US military aircraft) are available through many of the national museums or larger collections. These museums are also sympathetic to requests from smaller organisations for the loan of ground equipment.

9.4 Internal combustion engines

Internal combustion engines have been used for over 100 years to power various modes of transport, and although their size and fuel type vary, their basic method of operation is the same. The approach to the care on internal combustion engines (ICE) will depend on whether they are to remain operable or not.

Stored Engines:

Once withdrawn from service the engine will need to be cleaned thoroughly. Ideally, this would be by stripping the engine into its component parts and cleaning each one. But if the resources are not available, the outer engine surfaces at least should be cleaned with a suitable water-based degreaser, brushed onto the engine and left to soak before washing off with plenty of water. A pressure washer will make this process easier. Allow to dry thoroughly before carefully inspecting the engine components for any corrosion which will need appropriate treatment.

Remove the water from the cooling system and thoroughly flush the engine through with water in order to remove any traces of anti-freeze and loose corrosion deposits. The use of hot water will help with drying. Any radiators will likewise need flushing through.

Drain off the old lubricating oil and remove the oil filter, cleaning or disposing of the latter. It is worth removing the sump (if it has a wet lubrication system) and rocker cover, thoroughly cleaning them and the oil strainer in order to remove all contamination.

Any fuel left in the system must be carefully removed. It is wise to backfeed a quantity of very light mineral oil (eg. Castrol Calibration Fluid C or Astrolan 301) through the fuel lines and carburettor. This can be left in the system to act as an inhibiting fluid.

Finally, the interior of the engine should be inhibited before storage by adding an appropriate oil (Castrol Storage Oil 20 or Astrolan 302). Oil is sprayed into each cylinder, through the inlet and exhaust ports, and added to the lubrication system. The engine should then be turned over several times to ensure oil has been adequately circulated. It is worth coating any bright metal parts with a little grease or wax to prevent corrosion. Blank off any exposed apertures. Put a sign on it noting it has been inhibited with the date.

Running Engines:

Make sure that running engines use the correctly specified lubricating oils. Modern oils are often inappropriate for use on old engines. The use of the wrong oil can cause rapid deterioration. The correct grades of oil can be ascertained either with reference to a service manual or by contacting a manufacturer. Similarly, the correct sparking plugs should always be used so as to ensure that the engine functions correctly.

Add a suitable inhibitor/anti-freeze to the water cooling system to prevent internal corrosion. Ensure that all the waterways are clear and hoses are in good condition. Check the condition of the fan belt: it is not too loose or too tight.

When not in use it is wise to disconnect the battery supply. Always check the electrical wiring to make sure it is safe and so avoid the possibility of a short circuit and fire.

Remember to service the engine regularly and carry out all the necessary checks, referring to the original service manual if available.

Suppliers:

Castrol (U.K.) Ltd, Industrial Division, Burmah Castrol House, Pipers Way, Swindon, Wiltshire, SN3 1RE Tel: 01793 512712

Astor Chemical Ltd, Tavistock Road, West Drayton, Middlesex UB7 7RA Tel: 01895 445511

Preventive oils:

Castrol: Storage Oil 20, Rustilo 633, Calibration Fluid C
Astor Chemicals: Astrolan 301, Astrolan 302, Astrolan DA2519

9.5 Sources of advice and assistance

Advice on boats can be obtained from the Boat Museum (Waterways Trust), the Maritime Trust and the Scottish Fisheries Museum.

Essential advice on most aspects of the care of steam boilers is contained in the Health and Safety Executive's booklet *HS(G) 29: Locomotive Boilers*.

Advice on aircraft can be obtained from the British Aviation Preservation Council, the Science Museum and the Imperial War Museum (Duxford).

10. Is your collection safe?

`Visiting historic collections' is not likely to appear high on a list of life insurance risks: people do not ordinarily think of a museum as a dangerous place. However, large objects -- particularly those from the industrial past -- can present many dangers in terms of their size, weight and materials. Working objects greatly increase the range of potential hazards. Yet visitors may still regard the museum as inherently safe, so the protective measures adopted must be at least more obvious, if not more stringent, than their counterparts in industry, where there is perhaps a greater awareness of the risks. Museums and preservation societies have a duty to safeguard both visitors and staff -- a duty that is in many cases enforced by legislation.

- The organisation complies with both the letter and the spirit of all legislation designed to protect the health and safety of people on the site.
- A safety policy covering all aspects of the organisation's work is produced.
- All staff and volunteers receive regular training in health and safety aspects, and are fully familiar with the organisation's safety policy.
- If objects are operated, the safety policy sets out arrangements for dealing with any hazards likely to arise from their operation.
- All working objects comply with all relevant statutory requirements.
- Objects are only operated by designated personnel fully trained in safety and operating procedures.

Most of the chapters in this book are directed towards ways of minimizing the risks to objects. But what of the risks that the collection poses to the public? These risks may be far from apparent, though the public character of most museums means that general health and safety principles must apply -- to the provision of fire exits, for example. Larger and working objects greatly increase the risks, and this risk is particularly high when staff or volunteers are working on objects.

10.1 Safety Policy

Every museum or preservation society must have a **safety policy**. This will apply mainly to the well-being of the public, though staff and volunteers working on the collection are just as entitled to protection as the occasional visitor. The safety policy -- which must be regularly reviewed -- will make provision for at least the following items:

- The identification and monitoring of hazards associated with both existing objects and new accessions;
- The adoption of practices and measures that eliminate or reduce identified hazards;
- Safety information for public and staff, including the labelling of hazards;
- Safety equipment and appropriate protective clothing for staff and volunteers;
- Sufficient first aid materials, and expertise among staff;
- Measures to deal with general emergencies (such as fire evacuation procedures);
- Measures deal with types of emergency specific to the collection (such as a derailment on a preserved railway, or a capsized boat);
- Appropriate training for staff and volunteers in first aid, safety procedures and the safety policy itself.

There are many types of potential hazard, including unsafe or unstable mountings and supports, dangerous substances (such as solvents, radioactive substances (including luminous paint) and lead-based paints), and high voltages in electrical or electronic equipment (such as early televisions). If in doubt, you should call in an expert -- or experts -- particularly when making an initial safety survey or to identify unknown but potentially dangerous substances.

Note: If you wish to use white lead-based paints for authenticity then you will require permission. The supplier will provide you with the relevant forms to complete.

When seeking out hazards, don't forget the more mundane aspects of safety, such as the provision of handrails, fences and adequate lighting. If a visitor falls into an uncovered inspection pit in a gloomy building, your safety policy has failed. Everyday management is involved too: for example, first aid training for staff or volunteers is a wise precaution, but its value is compromised if you do not make sure that there is at least one qualified first aider on duty at all times.

Unless they constitute historical evidence, hazardous chemicals and other dangerous substances should be removed. Only use licensed companies to dispose of such waste -- and be aware that your museum or society is responsible for the material until it is certified *at the point of disposal*. It is not enough to accept an undertaking from a company that it will dispose of your waste at an appointed place: if the waste ends up somewhere else -- and this sometimes happens -- *you* are the polluter, even if you hold a signed receipt from the driver. *Never* take dangerous waste to a public landfill site, and *never* pour chemicals into sinks or drains. The same applies to environmentally damaging materials such as waste oils and refrigerants: many local authorities operate disposal schemes for the most common types of harmful waste.

Any potentially hazardous substances that remain with your collection must be clearly labelled and kept secured. Record their details in the appropriate object file, inventories and any other relevant documentation, and undertake any COSHH assessments that may be necessary. Your safety policy must include information about all such substances, including remedies for poisons and emergency procedures and telephone numbers. Inform the local fire service and hospitals about the hazards on your site, listing harmful substances and their locations.

10.2 Working objects

It is much more likely that visitors will be aware of the hazards of working exhibits, which add greatly to the safety burden of a museum or preservation society. Moving machinery is an obvious danger: crane jibs, tank turrets, working locomotives or road vehicles, textile machinery and other large or heavy items in motion can kill the unwary. A further problem is that historic machinery was often designed and built with scant regard for safety, at least by modern standards: exposed drive belts, gearing and reciprocating parts are common. Even the rural romance of the slow-moving water or wind mill conceals a crude but relatively powerful machine driving unprotected gear chains: many older mills have claimed at least one life during their history.

The safety of working objects in the collection depends on:

- Fully specified and documented working procedures;
- Safe operation by trained personnel only;
- Keeping visitors away from potentially hazardous operations, using fences, guards and distance;
- Compliance with all relevant legal requirements;
- The organisation's own comprehensive and regularly reviewed safety policy;
- The careful management of visitors in hazardous surroundings, including the provision of protective clothing where necessary.

The safety policy should include a code of practice for each (or each type of) working object in the collection. This will specify how the object is to be operated, and who will operate it -- either in terms of named individuals or in terms of the training and experience of approved operators. Some kinds of operators (such as drivers and pilots) must hold appropriate licences. Any necessary emergency drills or evacuation procedures must be included in the code of practice.

Some older road or agricultural machinery may be animal powered. Once again, an animal such as a draught horse may be slow-moving in normal circumstances, but this does not mean that visitors can be allowed unrestricted access. Only trained staff should handle animals -- for example, horses harnessed to agricultural machinery (which is itself notoriously dangerous).

A final point: is your insurance adequate to cover the full range of risks -- including third party and public liability -- associated with your site?

10.3 A Forest of Legislation

Caring for larger objects, and working objects in particular, is subject to a mass of legislation. Most of this legislation is concerned with safety. Among the most important pieces of statute law are:

- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995
- Management of Health and Safety at Work (Amendment) Regulations 1994
- Construction (Design and Management) Regulations 1994
- Provision and Use of Work Equipment Regulations 1992, (Amendments 1994
- Health and Safety (General Provisions) Regulations 1992
- Management of Health and Safety at Work Regulations 1992
- Manual Handling Operations Regulations 1992
- Workplace (Health, Safety & Welfare) Regulations 1992
- Personal Protective Equipment (EC Directive) Regulations 1992, and Amendments 1993, 1994
- Personal Protective Equipment at Work Regulations 1992
- Transport and Works Act 1992
- Environmental Protection Act 1990
- Control of Pesticides Regulations 1986
- Safety Signs Regulations 1980
- Control of Substances Hazardous to Health Regulations 1988
- Health and Safety at Work Act 1974
- Offices, Shops and Railway Premises Act 1963
- Factories Acts 1961

Museums and preservation societies also fall under the remit of many different inspectorates. For further information contact the HSE Public Information Centre, Tel: 0114 289 2345 (office hours only).

10.4 Sources of advice and assistance

The Health and Safety Commission and the Health and Safety Executive publish a great deal of information which is of interest to collection managers. Many publications are available free of charge from HSE Books. A full list of current Health and Safety Commission / Health and Safety Executive publications, *Publications in Series*, is published twice yearly.

The Health & Safety Executive has a number of local offices throughout the UK, and should be consulted at an early stage. They also publish *Essentials of Health and Safety at Work*, a helpful introduction to the Health and Safety laws. HM Pollution Inspectorate and the National Radiological Protection Board may also have an interest in certain specialist collections.

The National Traction Engine Trust publish a code of practice on the safe management of traction engine rallies.

The local authority environment office may be able to help with contact names for local experts in hazardous chemicals, and the local Waste Regulation Authority will offer advice on the disposal of hazardous materials.

Two organizations able to offer advice and help to members are the Royal Society for the Prevention of Accidents and the British Safety Council.

Advice on all aspects of training for staff and volunteers can be obtained from the British Association of Friends of Museums.

11. Security

Thefts of art treasures make headlines, and vandalism and malicious damage have been newsworthy ever since the Portland Vase was first smashed. Larger and working objects may rarely have the glamour -- or the money value -- of an internationally renowned painting, but they are certainly prone to theft and damage. An unscrupulous collector may pay a high price for a locomotive number plate. Components can be sold for scrap. And vandals seem particularly drawn to highly restored and finished objects: it is as though the more `perfect' the object, the more satisfying the damage. No object, and certainly no collection, can be made completely invulnerable to intruders: invulnerability would mean zero access. The objective must be to reduce the risk of theft or vandalism to an acceptably small level. Although bars on windows and sophisticated alarm systems are the most visible sign of security, vigilance and the intelligent management of public and researchers' access are the crucial ingredients of the successful security policy.

- The structure of the building, or the perimeter of an open site, is secure enough to deter an attack by a thief or vandal.
- Windows, doors and perimeter gates are sufficiently secure to deter anyone from trying to get in, or will delay an intruder long enough to enable a supporting alarm to trigger a response before the intruder can enter, steal and escape.
- All openings in the building fabric, such as doors, windows and roof lights, fall within the protected zone of an intruder detector.
- An appropriate level of invigilation is exercised.
- Nobody is allowed into object stores unless accompanied by an authorized person.
- The bona fides of all researchers and others with access to objects are checked and recorded; all those with such privileged access are adequately supervised.
- A strict policy regarding the possession of keys is in force.
- A copy set of the accession register and other key documentation is stored off the main site.

Historic collections and objects are obviously vulnerable to thieves and vandals. Larger objects are not necessarily less vulnerable to attack, and what cannot be taken away or moved may still be damaged, defaced by graffiti, or deprived of component parts. Unsecured moving objects are also vulnerable, and may pose a serious safety hazard if they are operated by an intruder.

There are three main lines of defence against unauthorized access to objects:

- Physical barriers (such as walls, fences and locked doors);
- The effective management of access (such as careful invigilation, identity badges and key restrictions);
- Security devices (such as detectors, cameras and alarms).

A successful security system will achieve the right balance between these three elements, so that a weakness in one area (such as the building fabric) is countered by strengths in other areas (such as a good alarm system and effective invigilation).

Security will be hit-and-miss unless a comprehensive security policy is set out and regularly reviewed for effectiveness, and in the light of changing risks. Objects should be assessed for vulnerability to theft or damage. Larger and working objects are particularly vulnerable to dismantling and the theft of components for spare parts or even scrap value. Another class of security risk involves items that may threaten public safety if they are stolen: weapons and militaria are the prime example.

11.1 Physical barriers

Any barrier that stops an intruder from reaching the collection, or at least slows an intruder's progress, may be enough to prevent unauthorized access -- particularly by opportunists. Outdoor sites will benefit from high fences and matching lockable gates. The main building structure performs a similar function for indoor collections if its walls and roof are strong, but its effectiveness will be compromised by insecure -- or unsecured -- doors, windows and other openings.

Ideally, exterior doors will be of solid construction -- for example, wooden doors should be at least 50mm thick. Strong doors must be matched by security-standard mortice deadlocks, though emergency exits must be outward-opening and fitted with quick-release bars. The hinge side of doors can be a weak point, so fit hinge bolts or similar protection. Glazed windows and roof lights are insecure without locks and/or bars, and are doubly insecure if they are easy to reach -- on the ground floor, for example, or next to a ledge, balcony or flat roof.

Indeed, do you need all the existing doors and windows? If you are sure that some openings are redundant -- after access, safety exit, ventilation and light requirements are met -- you could fill them in using brickwork or another suitable medium. Any infill should be at least as strong as the surrounding walls, in terms of both materials and the bonding or fitting methods. Such changes presuppose that you have control over the buildings: if you are only renting or borrowing accommodation, or the building is listed or of historic interest, major alterations may be forbidden.

Note: For more advice on building modifications see the Managing Risk section of Collections Link website www.collectionslink.org.uk.

Security zoning may help to keep the most valuable or vulnerable objects safe from intruders. The secure zones house the best objects, whereas relatively robust, immovable or unimportant objects will be displayed or stored in areas where high security would be difficult or uneconomic to achieve.

11.2 The effective management of access

As any intruder knows, the best way to get through a locked door is by using the key. No physical barrier is effective against poor or careless security management. Security can only be maintained if:

- Enough attendants are on duty;
- No unauthorized person has access to keys or other security devices or codes;
- Authorization for researchers and others seeking close access is checked, controlled and supervised.

The appropriate number of attendants depends upon the security requirements of the site (or the relevant security zone), and once determined should not be reduced except at a security review. If the prescribed level of security cannot be attained (if staff are absent, for example), then you should be prepared to close the exhibit or gallery, or even the whole building or site. Extra cover -- perhaps provided by a specialist security firm -- may be needed for special events which attract large numbers of visitors or take place at unusual hours.

There should be no more keys than is strictly necessary, and the number of keyholders must be kept to a minimum. Any unused keys must be kept within the building in a secure key cabinet or safe -- and identified by a coding system rather than by informative labels that could aid an intruder. Keys should only be issued against a signature. Similar restrictions apply to lock and security alarm codes: door lock number codes should not normally be given to outsiders, for example.

Unfortunately, researchers have been responsible for serious thefts from collections. Even the most senior researchers should be obliged to follow the organisation's written security guidelines. The bona fides and credentials of all researchers and applicants for access must be followed up and recorded, and their work must be monitored. A security badge system may help to identify researchers, conservators and other authorized outsiders.

It is important that all staff, whether paid or volunteers, who act as invigilators have received the appropriate training and are kept up to date with what is happening in the site. Many organisations have developed manuals for their gallery staff which act both as a training manual and a reference source of information about the collection and its collections in order to answer visitors' questions. Gallery or site invigilators are very important as they are the people who principally interact with the visitors. Your collection may be judged as much by their knowledge and attitude as the content and quality of the exhibits. Most important of all is that the invigilator knows how to behave and what action to take in the event of an emergency.

11.3 Technological aids to security

Movement and heat sensors, cameras and automatic alarm systems will probably be needed for part if not all of the collection, especially where the building is temporary or lightly constructed. These devices should first deter the intruder, or failing that will signal the security breach by means of a local alarm and through a link to a police or monitoring station. Some camera-based systems also provide evidence for the possible identification of intruders.

Detectors are triggered by movement or body heat, or a combination of the two; these can be linked with sensors that detect open or broken windows and opened doors, and light beams or pressure pads that register movement through spaces or over surfaces. Connections between the parts of the system must be so arranged that any break, such as a cut wire, will trigger the alarm -- though the system must not be so complex that it is prone to mysterious and irritating false alarms.

The system should qualify for a National Approved Council for Security Systems (NACOSS) certificate and meet *BS 4737: Intruder Alarm Systems in Buildings* specification should be fitted by a company recognised and approved by NACOSS for such installations. Installations should also satisfy conditions laid down by the Association of Chief Police Officers (ACPO). The link to the alarm company's central monitoring system will probably incur the cost of an extra telephone line, though some systems now use a radio link. As few people as possible should be given the lock/unlock and call-back codes. Change these codes from time to time.

Alarm systems need regular routine servicing (for example, the failure of the back-up battery can trigger the alarm), and may require occasional updates (say, from land line to radio link). A degree of sales resistance is healthy -- security alarm companies will naturally try to sell you regular upgrades -- but it is a sad fact that there is a constant battle between criminals and alarm designers which means that any alarm system is only effective for a limited period. It is also wise to read the small print on the insurance policy: this may specify a particular minimum level of security system whose absence or disrepair will void the policy.

If your organisation uses a camera-based system, it is important to ensure that there is a sufficient number of video tapes for recording at least a one-week period in order to avoid taping over vital information that the police might require. Secure storage and marking of the tapes is equally important. The viewing of tapes taken when the site was unattended should be undertaken regularly by a designated individual in order that any suspicious activity can be noted and acted upon. Similarly, it is important that someone regularly checks the quality of the image and for any damage to the camera equipment. These are basic points but the police frequently come across situations where there is only one tape and as a result any information recorded during the night is immediately taped over the following day, and is therefore of no use if an incident has occurred.

11.4 Sources of advice and assistance

Security advice is available on the Collections Link website www.collectionslink.org.ukl and for Government Indemnity Scheme applications from the Museums, Libraries and Archives Council's Museums Security Adviser.

The following publications are useful:

Resource: The Council for Museums, Archives and Libraries (now MLA), 2003, *Security in Museums, Archives and Libraries: A practical guide*. This is available online at www.collectionslink,org.uk.

Kluwer Handbooks. loose-leaf title with regular update. *Handbook of Security*. New Malden, Surrey: Croner Publications.

12. Doom & disaster: planning for the worst

Care and conservation focus on individual objects, albeit in the context of a coherent collection. From this focus, accidental damage to an important object could be described as a `disaster' for an area of scholarship, or for our knowledge of a particular practice or period. Yet the term `disaster' is perhaps best reserved for a major event that has the potential to damage or destroy a significant part of the collection. For example, a major fire could reduce a collection to ashes and place it beyond the reach of any remedial conservation. Fire is indeed one of the principal dangers, with flood a close second. Other hazards include large-scale theft and vandalism.

Some accidents or misfortunes are so large that they could be fairly described as disasters, events with the potential to totally destroy an object or damage large parts of the collection. Some types of disasters can be averted by appropriate training and careful planning; others -- such as storm damage -- cannot be averted, though their impact can be substantially reduced.

The two greatest sources of large-scale damage to the collection are fire and flood. `Natural' floods, such as those from rivers in low-lying areas, resemble other natural phenomena -- storms, earthquakes, etc -- in that they are largely unavoidable. Flooding caused by burst pipes or tanks resembles the threat of fire, in that there is scope for prevention measures. Under some circumstances, a serious vandal attack could produce disastrous results, though vandalism is largely a security matter that will figure in the organisation's security plan. A theft of computer equipment from a collection that kept its documentation in electronic form but without adequate back-ups could also rank as a disaster.

Note: Security is discussed in Chapter 10.

Whatever the risk of a particular type of disaster, its effects can be minimized by careful planning in the form of a **disaster response plan**. The plan will focus on three key objectives: public safety, disaster prevention and damage limitation.

Public safety is the overriding concern in all disaster planning. Disaster prevention contributes to public safety, of course, but is only practicable where the disaster is `man made' (such as most fires and internal flooding, and major vandalism). Where the potential disaster is the result of a natural phenomenon, such as a hurricane, prevention is effectively impossible. Damage limitation, by contrast, is always a factor in the organisation's disaster plan.

- A disaster response plan is prepared for the protection and rescue of the collections in the event of fire, flood or other catastrophe. This plan makes specific provision for the rescue of larger objects.
- All staff and volunteers receive regular training in how to respond to disasters.
- As far as possible, no pipes or tanks are permitted in new buildings in areas where collections are kept; every effort is made to exclude pipework from such areas in old buildings.
- Adequate drainage is provided in buildings where there is a possibility of flooding.
- No object that can be raised (if necessary on a pallet, with lifting gear), is placed lower than 6" (150mm) above the floor.
- Special precautions are taken to prevent flooding in larger objects kept outdoors.
- Special precautions are taken to prevent flooding in ships and boats kept afloat.
- Appropriate precautions are taken in buildings or on sites liable to flood.
- The advice of the Fire Officer is regularly sought and followed.
- The buildings are designed or adapted to minimize the risk of fire and to prevent its spread. On an open site, the risk of fire is considered before deciding the placement and species of grass, plants, bushes and trees.
- The premises are equipped with fire-fighting equipment as recommended by the Fire Officer and that complies with BS 5423 (Portable Fire Extinguishers) and BS 5306 (Fire Extinguishing Installations and Equipment on Premises).
- Primary records and object documentation are kept in fireproof cabinets; copy records and back-up computer disks are kept in a different building.
- All staff and volunteers regularly attend training in fire prevention and response.

12.1 The disaster response plan

Every organisation should have a disaster response plan, a written document setting out procedures to be followed in an emergency. Like all plans, it should be documented and subject to regular review and revision. Staff will be familiar with its general contents through discussion and their own copies of the document, and there must be regular training sessions and emergency exercises. In the interests of serving the three objectives -- safety, prevention and damage limitation -- each plan should cover the following factors:

- Liaison with all appropriate emergency services;
- Emergency telephone numbers, including staff home numbers;
- An accurate plan of the site and buildings that shows all services, hazardous stores etc;
- Damage limitation and rescue priorities for the collection *and the documentation*;
- Contact details for experts, other similar collections (for agreed emergency storage), suppliers (such as hauliers), and services;
- Details of all emergency equipment on site (every site should have a `disasters box' containing mops, overalls etc);
- Arrangements for dealing with breaches of security caused by building damage etc;
- Safety measures to be applied during the emergency and subsequent salvage operations;
- A disaster budget, together with an authorization system that permits on-the-spot staff to make spending decisions.

Fire is potentially the most damaging -- and life-threatening -- of all sources of disaster. Fire safety is founded upon effective fire prevention measures: in other words, not letting fires start is the single greatest contribution to the safety of people and the collection. The crucial aspect of fire prevention is the identification of fire risks. You must therefore seek out both actual and potential sources of ignition in the presence of combustible materials and fire-supporting oxygen.

You will require detective work and lateral thinking to identify some potential risks. Not all ignition sources are as obvious as an open flame: fires can be lit by sparks from short circuits or high-voltage discharges; by heat from seized bearings, burnt-out electric motors, exposed exhaust pipes; by embers and cinders in steam engine exhausts and ash pans; by sunlight focused through glasses and lenses; by chemical reactions, and so on. Regular inspection and maintenance can prevent many of these dangers. You should examine the potential fire hazards associated with a larger or working object as part of your evaluation at accession, or when assessing its fitness for operation.

Note: Your local fire station or fire prevention officer can help -- and see Chapter 8 for some typical fire risks.

Other essential measures

Fire prevention backed up by everyday vigilance is the basis of fire safety, but a fire may still start. You must also install fire detection systems -- smoke and heat detectors and the associated alarm systems -- and set up fire escape routes and exits. Many of these measures are governed by statutes and regulations; all of them must be supported by equally effective procedures and clear public information. For example, any no-smoking policy must be both well advertised and consistently enforced. And fire drills are a chore, but help to save lives.

Note: The Fire Precautions Act 1971 requires certain buildings to hold a fire certificate; alarm systems are governed by BS 5839.

The preservation of life is paramount. Once the escape routes and exits have been ~ identified and labelled, they must be kept clear at all times. Emergency exits must never be locked or blocked while people are in the building. Make sure that objects do not encroach on the escape routes and exits: it is not enough that people `can still get through' if they weave around objects or step over obstacles. Fires cause panic, and just one small obstacle may be enough to induce a crush of people rushing to leave by a restricted exit.

Fires can be contained if the various areas of the building are insulated from one another. Fire prevention experts classify building materials and doors in terms of their ability to hold back fire and smoke for a specified time (remember that smoke is also a killer, and can cause major damage). Walls should be insulated to withstand at least half an hour, and preferably one hour. Fire and smoke resisting doors -- identified by suitable signs -- must be kept closed at all times, or they are useless. Do not provide hold-back catches, clips or wedges for these doors.

These defensive measures help to preserve both life -- by increasing the time available for the safe and orderly evacuation of the building -- and the collection. Compared to such measures, installed or portable fire-fighting equipment in the form of sprinklers, extinguishers, fire buckets and fire beaters, is still essential but is of secondary importance. Automatic sprinkler systems can be highly effective (but beware water damage). Somebody present at the start of a fire may be able to prevent it spreading by the timely use of sand or water; and an extinguisher may provide a few extra seconds of evacuation time for visitors; but firefighting is best left to experts. Untrained people rarely appreciate the rapidity of fire spread and the danger of flashovers, smoke and other hazards.

Note: Make sure that all staff know how to use the firefighting equipment -- and that they are aware of the dangers.

12.2 Common fire risks associated with larger & working objects

Standard fire prevention and fire safety procedures apply to all classes of museums, though larger working objects introduce extra fire risks. An assessment of any potential hazards associated with an object should form part of the formal process of acquisition. In most cases, these risks can be substantially reduced by careful management, maintenance and operating procedures, as outlined in the following notes.

Steam-powered objects

Working vehicles in use

Steam-powered vehicles do not present a large fire risk if certain basic precautions are observed:

- Never leave a vehicle in steam unattended;
- Regularly check and maintain spark arresters (which should always be in place);
- Clear ash pans regularly;
- Drivers must be vigilant near dry vegetation, thatched buildings and other easily combustible materials;
- Only dispose of hot ash or smokebox char in a designated place;
- Completely clear out the fire before leaving an engine;
- Allow an engine to cool before covering it;
- Do not overfill oil lamps; destroy oily rags;
- Regularly remove deposits of lubricants, coal dust etc from the firebox, ash pan and foundation ring;
- Make sure that lagging that will come into contact with very hot surfaces, such as the smoke box, is non-combustible.

Steam vehicles as exhibits

Make sure that all combustible materials are removed or cleaned out before taking the vehicle into the building. Any essential lubricants, rags should be kept in a safe cabinet.

Stationary steam engines in use

A well maintained stationary steam engine presents a relatively small fire risk. Turn off any gravity-feed lubricators whenever the engine is stopped. Some historic machines may present a risk if they are carelessly operated. Remember that where the steam raising plant is modern, an historic engine -- particularly a reciprocating engine -- may impose unusual operating conditions on it. Where the steam raising plant is itself historic, detailed operating procedures -- including safe shutdown procedures -- must be laid down in the operating manual.

Motor vehicles

Vehicles in use

A well maintained historic vehicle presents a relatively small fire risk. Most of the risks are associated with sparks from the electrical system igniting fuel or lubricants.

- Take great care (no smoking or naked flames etc) when inspecting the fuel system and any electrical wiring or apparatus in close proximity to it;
- Ideally, fit a stop valve or tap in the fuel line;
- Insulate the battery terminals and connections to prevent accidental short circuits, and make sure the battery is secure;
- Check wiring regularly, and *completely* replace any faulty wires;
- Fit fuses of the correct rating, as specified by the manufacturer;
- Check the ammeter regularly -- unexpected discharges may indicate wiring faults;
- CO_2 fire extinguishers should be kept in the vehicle and nearby;
- Vehicle firefighting systems (such as those in tanks) must be operational.

Motor vehicles as exhibits

Ideally, any vehicle brought indoors for display should be entirely drained of fuel. Disconnect the fuel lines to allow the whole system to be flushed or blown through to disperse any fuel vapour -- and remember to empty fuel pumps, filters and carburettors too. Switch off or disconnect vehicle batteries; preferably, remove them from vehicles altogether. Stored batteries will deteriorate unless charged at intervals, and must be protected against short circuits. Vehicles fitted with magnetos should be earthed.

If the worst happens and there is a fire, you may be able to save the vehicle if it can be pushed out of danger on its own wheels. Make sure that tyres are correctly inflated and that the wheels are free to rotate.

Boats

Equip all boats in your care with dry powder or CO_2 fire extinguishers, and fit larger vessels with smoke and fire detection and alarm systems. You will also need to draft an emergency evacuation plan for any large vessel that is open to the public: such vessels constitute a significant indoor space that is usually compromised by small exits and passageways. Distress flares and other pyrotechnic items must be regularly renewed, or removed altogether if they are not required.

One serious source of fire risk in boats is the accumulation of heavier-than-air gas or fuel vapour in the bilges -- which must be frequently ventilated. Bilge-gas explosions cause a large proportion of boat fires. Bottled gas and petrol are the principal dangers.

Risks from bottled gas

Bottled gas is heavier than air and readily settles in bilges. If gas must be used, then fit a gas detection and alarm system. Wherever possible, house gas bottles in a sealed enclosure that vents over the side of the vessel. Remove any gas bottles that are not required; those that remain must be switched off at the bottle when not in use.

Risks from fuel

Boats are normally powered by diesel or petrol engines, though a few craft still use coal. Sensibly used, diesel fuel and coal are relatively safe, but petrol is almost as dangerous as bottled gas. Unless the engine is in use, remove all petrol from the tanks and ventilate them. When filling tanks, avoid spillage into the bilges or on to adjacent water. If fuel is spilled in the boat, ventilate the hull immediately. Do not allow smoking or naked lights in the vicinity of the boat when it is being refuelled with petrol (indeed, smoking should never be permitted in any part of a preserved boat).

Risks associated with electrical systems

Only use electricity on a boat where it is absolutely essential. Electricity should be supplied to water-borne craft only through an isolating transformer and an earth leakage circuit breaker. Use the lowest possible fuse ratings for the anticipated load -- which is probably less than it was during the vessel's working life -- particularly where the original wiring is still in use.

Aircraft

Aircraft in use

Maintenance and fire safety procedures for live aircraft are very strictly controlled by the UK's Civil Aviation Authority or an equivalent body (some aircraft may be registered with foreign authorities such as the US Federal Aviation Authority).

Aircraft as exhibits

Wood and fabric aircraft are high-risk items that need special care -- for example, if work carried out nearby produces sparks. For all exhibited aircraft, drain the fuel system and remove the batteries as you would for motor vehicles (see above); purge the entire fuel system with air or, better still, nitrogen, to remove pockets of fuel or vapour. Earth aircraft fitted with magnetos. Drain pressure vessels -- especially oxygen cylinders -- and remove all pyrotechnic devices, such as the cartridges from ejection seats, engine starters and Very pistols.

Electrical and electronic equipment

This broad category -- ranging from old electromechanical machinery to very recent computer hardware -- creates a range of different fire risks, but most come down to ignition via heating or the production of a spark. As always, good management and operating practices should reduce all risks:

- Ensure that equipment is installed by suitably qualified electrical engineers;
- Provide installations with IEE-specified switchgear that reduces the danger of arcing or overheating;
- Arrange exhibits and displays so that any heat generated does not reach combustible materials;
- Where overheating is possible, force-ventilate the equipment and place a thermal cut-out in the supply line;
- Only use lamps that comply with BS 4533 and BS 3456, and make sure that they are adequately ventilated;
- Set up comprehensive precautions against unauthorized switch-on.

12.3 Flood

Prevention may not be an option in the case of natural flooding caused by the sea, rivers, lakes and ponds, but careful risk-assessment and planning can prevent some of the worst effects. Water authorities and companies and local government will provide advice and information on flood risks. Always ask local residents who have lived in the area for many years; they may be able to remember floods and their severity. Even if a river has only burst its banks once in living memory, this does not mean that the flood risk is low: the river may flood again this year, and that single inundation could destroy the collection. In the worst case, the severity of a possible flood could provide a reason to reject a new potential location or to move from an existing one.

Traditional flood defences may be appropriate at some sites, including stop boards in doorways, bunds, flood channels, and sandbags. Where a body of water is managed with the aid of sluices, gates or other devices, practical defensive measures will depend on who has control: is it the organisation (for example, where a mill pond is part of the site) or another body (as in the case of a canal or river)? Where you control the water, you must make arrangements to deal with overflows, draining and emergencies, and review them regularly -- preferably in conjunction with the fire brigade.

Flooding from pipes and tanks

Water from leaking pipes and tanks -- and rainwater entering a badly maintained building -- is an obvious source of water damage. One equally obvious remedy is good maintenance and housekeeping: well supported pipework whose joints are regularly checked should not leak, and lagging will help to prevent bursts caused by freezing. However, good practice for a collection must far exceed domestic standards of prudence: the working guideline must be `If a flood can occur, one day it will'.

Ideally, pipework should be excluded from stores and display areas altogether, though building regulations and conditions in older buildings may make this an impossible goal. A compromise may be possible: pipes can be run at ground level, for example, and objects raised off the floor. Leak detectors and automatic cut-off valves are valuable aids, and sink taps should be of the spring-loaded automatic type to prevent them being left on. Your disaster response plan should include information about all pipework, valves, taps and stop-cocks.

Note: Pipework and stop-cocks should be labelled in accordance with *BS 1710, Identification of Pipelines and Services*.

Tanks and similar storage vessels can release large quantities of fluids in a short time if they are damaged. Wherever possible, these heavy items should not be installed anywhere above the collection, ruling out roofs, roof voids and upper storeys. This creates problems -- not least because water tanks are commonly placed high to create a gravity-fed water supply. Ground floor or outdoor storage tanks therefore entail pumped water circulation, which may not be feasible. Parts of working objects that use or store water -- such as the tanks and boilers of steam plant -- should be drained before they are brought indoors.

Two aspects of flooding that are easily overlooked are the water damage associated with firefighting, and drainage. Good drainage is an important defence against flood damage: the quicker flood water leaves the site the better.

12.4 Other hazards – wind & lightning

High winds can also be a danger. They can knock down structures in exposed situations, cause havoc with boats however secure the moorings, and debris carried by the wind can damage objects and cause severe injuries to people.

Lightning has caused damage at a number of sites and tall buildings and structures should be protected by a lightening conductor.

12.5 Sources of advice and assistance

The Institute of Conservation (Icon) maintains an online register of private conservators throughout the UK, see www.conservationregister.com.

In some areas, Emergency Conservation Networks are available.

The National Preservation Office video *If Disaster Strikes* is useful for training. Contact your regional museum development officer for advice on disaster contingency planning or consult the website www.collectionslink.org.uk.

When seeking advice on the prevention of fire, remember that, after the preservation of life, most specialists will be concerned with the preservation of buildings to enable a firm to get back into business. Your main concern, following preservation of life, will probably be to preserve the collections.

The local authority's Fire Prevention Officer and Building Control Department will both be glad to give advice.

Information about UK fire authorities and companies offering prevention and detection services is given in the *Security and Fire Prevention Yearbook*, available from Paramount Publishing. Other useful information, such as safety data sheets, can be obtained from the Fire Protection Association.

The Fire Brigade will provide advice on the prevention of flooding.

Useful publications include:

East Midlands Museums Service (EMMS). *The Museums and Records Office Emergency Manual*. Nottingham: EMMS (available as a cd).

Society of Industrial Emergency Services Officers, *Guide to Emergency Planning*, Paramount Publishing, Borehamwood.

13. Useful Information

13.1 Glossary

Accession number	A unique number assigned to an object at the time of accession; the number will be recorded and is often marked on the object itself (*see* accession register, security mark).
Accession register	A book, database or other part of a collection's documentation in which all accessions are recorded.
Accredited museum	A museum which has met the criteria set down for MLA's Museum Accreditation Scheme (formerly Registration).
Acquisition and disposal policy	A written policy, carefully formulated and regularly reviewed, which governs all accessions, disposals, loans and other movement of objects into and out of the collection; without such a policy, acquisitions can be haphazard, and in the long term resources squandered as the collection loses integrity and incoherence.
Audit	Three types of audit should be routinely undertaken: stocktakes and checks against the accession register; checks against documentation; and the all-important **Conservation condition survey**.
BMS or **building management system**	A centralized electronic control system for electrical and mechanical building systems such as lighting, heating and ventilation.
Collection condition Survey	A survey of the condition of items in a collection. An overall assessment may be supplemented by sample surveys to monitor the on-going condition of the collection. This is sometimes referred to as a conservation audit.
Conservation	All actions aimed at the safeguarding of cultural property for the future. The purpose of conservation is to study, record, retain and restore the culturally significant qualities of the object with the least possible intervention.
Conservation audit	*see* **Collection condition survey**
Conservator	Both **conservators** and **restorers** share the following aims: • To preserve the integrity of the item, including evidence of its history and manufacture; • To try to use methods which are reversible and materials that can be removed without damage to the item itself; • To record all stages of their work.

Curator	Keeper or custodian of a museum or other collection.
Disaster response plan	A written document that sets out procedures to be followed in an emergency. Its general contents should be known to all staff through discussion, regular training sessions and emergency exercises.
Entry record	An entry in the collection's documentation that records every incoming item, whether intended for accession into the collection or not, including items temporarily on the premises (*see* **Exit record**, **Accession register**).
Exit record	An entry in the collection's documentation that records every outgoing item (*see* **Entry record**).
Humidity	The amount of moisture (water vapour) in air (*see* **Relative humidity**).
Intensity (of light)	The `strength' of light falling upon a surface, now usually measured in lux (1 lux = 1 lumen per square metre).
Listed building	A building with special protected status through designation by bodies such as English Heritage, Historic Scotland, Cadw and DENI.
Location and movement recording	Entries in the collection's documentation (for example, in the accession register) that record the object's location within the site and any subsequent movements.
Lux hours per year	This is a measure of the period of exposure to light. For example, take an object illuminated to 100 lux light level for 2,250 hours during an average year. In this case the cumulative exposure is 225,000 lux-hours. If the level of illumination were doubled and the period of exposure halved, the cumulative exposure would remain the same.
Monitoring programme	A systematic process of measurement of key parameters - typically temperature, relative humidity and light - conducted over a period.
Operating log	A document recording the details of every occasion on which an object is worked.
Operating manual	A document setting out the procedures, requirements and conditions attendant upon the operation of a working object.
Relative humidity	The amount of moisture in the air relative to the water-bearing capacity of the air at a given temperature. Normally expressed as a percentage.
Safety policy	A comprehensive, written, policy covering the hazards present in the collection and how to deal with them. The policy will include a code of practice for the operation of working objects.

Security mark	Also ‘accession number’: an indelible mark that identifies an object; the mark is often the collection's accession number for that object (*see* **Accession numbe**r).
Scheduled	(of a building or site) listed for preservation or protection. A status conferred by bodies such as English Heritage, Historic Scotland, Cadw, DENI.
Stability	(of environment) a stable environment is free of frequent and/or large changes in the important parameters of temperature, relative humidity and light.
Stability	(of machine/support) the resistance of a structure to physical displacement; a structure is not stable if it can be displaced - tipped over, for example - by a relatively small force.
Tungsten lamp	The familiar `light bulb' - a type of electric lamp that produces light through the electrical heating of a tungsten filament; tungsten lamps produce significant quantities of heat.
Ultraviolet light (UV)	a portion of the electromagnetic spectrum that lies beyond the blue/violet end of the visible spectrum; ultraviolet light can cause considerable damage to objects made of organic material such as wood, textiles, leather or paper, and to painted or decorated surfaces on any substrate.

13.2 References

Selected basic publications are listed below, others are listed at the end of the individual sections. More detailed and current information is available from the appropriate organisation listed in **Section 13.3**. For technical advice contact the relevant specialist in a national or regional museum that holds a collection of the type of object you are interested in. However, the greatest source of expertise is likely to be found through the specialist groups and societies, some of which are also listed in 13.3. Many have regular publications and most have very informative websites.

Note: Most publications of bodies such as Collections Trust, MDA, Museum Documentation Association, Museums Galleries Scotland, Museums & Galleries Commission (MGC), Resource, Museums, Libraries and Archives Council (MLA) are available as free downloads from the Collections Link website www.collectionslink.org.uk. Most of the other statutory and public bodies now make their publications available online.

British Standards Institution, PAS 197:2009 *Code of practice for cultural collections management*.

Collections Trust, 2008. *Documentation: a practical guide*. Cambridge: Collections Trust.

Collections Trust 2008. *Pest Management: a practical guide*. Cambridge: Collections Trust.

Collections Trust, 2009. *SPECTRUM: The UK Museum Documentation Standard*. Cambridge: Collections Trust (available on Collections Trust website www.collectionstrust.org.uk)

Collections Trust, 2009. *Collections Management: a practical guide*. Cambridge: Collections Trust.

Croner Publications. loose-leaf title with regular updates. *Croner's Health and Safety at Work*. New Malden, Surrey: Croner Publications.

Health & Safety Executive, *Manual Handling; Guidance on Regulations (Manual Handling Operations Regulations 1992)*. Sheffield: HSE.

Kluwer Handbooks. loose-leaf title with regular update. *Handbook of Security*. New Malden, Surrey: Croner Publications.

Museums Association (MA). 2007. Code of Ethics for Museums, London: MA.

The National Trust, 2005, The Manual of Housekeeping, Elsevier Science and Technology.

Thompson, J. M. A. et al (eds). 1992 (2nd edition). *Manual of Curatorship*. Oxford: Butterworth-Heinemann/Museums Association.

13.3 Useful Addresses

This list contains the name and web address (where available) of organisations and institutions referred to in the text, together with other related organizations and societies. Some of the specialist groups may be involved in Subject Specialist Networks (SSNs) – see Collections Link website http://www.collectionslink.org.uk for details of these.

Those marked † may be able to advise on specific conservation/restoration projects. Those marked * either hold or are gathering lists of objects in preservation.

There are also many local industrial archaeology societies and specialist preservation groups: the bodies listed below should be able to direct you to those in your area.

Arkwright Society – www.arkwrightsociety.org.uk

Association for Industrial Archaeology – www.industrial-archaeology.org.uk

Association of British Transport and Engineering Museums – www.abtem.co.uk

* Association of Independent Museums – www.aim-museums.co.uk

Association of Independent Railways – see Heritage Railway Association

Association of Railway Preservation Societies – see Heritage Railway Association

British Aviation Preservation Council – www.bapc.org.uk

British Safety Council – www.britsafe.org

British Standards Institution – www.bsigroup.co.uk

British Textile Technology Group – www.bttg.co.uk

Cadw Welsh Historic Monuments – www.cadw.wales.gov.uk

Cinema Organ Society – www.cinema-organs.org.uk

Collections Trust – www.collectionstrust.org.uk

Computer Conservation Society – www.computerconservationsociety.org

Creative and Cultural Skills – Sector Skills Council – www.cciskills.org.uk

Cutty Sark Maritime Trust – now renamed The Maritime Trust

Department of Culture, Arts and Leisure, Northern Ireland – www.dcalni.gov.uk

Department of Environment Northern Ireland – www.doeni.gov.uk

English Heritage – www.english-heritage.org.uk

Fair Organ Preservation Society – www.fops.org

Fairground Heritage Trust – www.fairground-heritage.org.uk

Fire Protection Association – www.thefpa.co.uk

Health and Safety Executive – HSE Infoline – Tel: www.hse.gov.uk

Health and Safety Executive – Publications – www.hsebooks.com/Books

Heritage Lottery Fund – www.hlf.org.uk

Heritage Railway Association – www.heritagerailways.com/hra.html and http://ukhrail.uel.ac.uk

Historic Commercial Vehicle Society – www.hcvs.co.uk

Historic Scotland – www.historic-scotland.gov.uk

Historical Metallurgy Society – http://hist-met.org

Historical Organs Information

Imperial War Museum Duxford – www.iwm.org.uk

Industrial Locomotive Society – www.industrial-loco.org.uk

Inland Waterways Association – www.waterways.org.uk

Inland Waterways Heritage Network – www.canaljunction.com/iwhn

Institute of Agricultural History – c/o Museum of English Rural Life – www.reading.ac.uk/merl

Institute of Conservation – www.icon.org.uk

International Stationary Steam Engine Society – www.isses.org

Light Aircraft Association – www.lightaircraftassociation.co.uk

MDA – See Collections Trust

Morris Lubricants – www.morrislubricants.co.uk

Museums Galleries Scotland (formerly Scottish Museums Council) – www.museumsgalleriesscotland.org.uk

Museum of English Rural Life – www.ruralhistory.org

Museum of Science and Industry in Manchester – www.msim.org.uk

Museums Association – www.museumsassociation.org

Museums Libraries and Archives Council – www.mla.gov.uk

Narrow Gauge Railway Society – www.ngrs.demon.co.uk

National Association of Farriers, Blacksmiths & Agricultural Engineers

National Association of Road Transport Museums – www.nartm.org.uk

National Fund for Acquisitions – see National Museums of Scotland

† * National Historic Ships Committee – www.nhsc.org.uk

National Maritime Museum – www.nmm.ac.uk

National Museums & Galleries of Wales – www.nmgw.ac.uk

National Museums of Scotland – www.nms.ac.uk

National Preservation Office – www.bl.uk/npo

National Printing Heritage Trust – http://homepage.mac.com/justin.knopp/npht/index.html

National Railway Museum – www.nrm.org.uk

National Register of Historic Vessels (NRHV) – see National Historic Ships Committee

* National Traction Engine Trust – www.ntet.co.uk

National Tramway Museum – www.tramway.co.uk

National Vintage Tractor and Engine Club – www.nvtec.co.uk

Newcomen Society for the Study of the History of Engineering – www.newcomen.com
† North-West Textile Museums Group

Northern Ireland Museums Council

† Northern Mill Engine Society – www.nmes.org

Old Gaffers Association – www.oldgaffersassociation.org/_sgg/f10000.htm

Ordnance Society – http://freespace.virgin.net/ordnance.society

Plastics Historical Society – www.plastiquarian.com

Paddle Steamer Preservation Society – www.heritagesteamers.co.uk

Popular Flying Association – see Light Aircraft Association

Preservation of Industrial and Scientific Material Grant Fund (Prism) – www.mla.gov.uk/what/support/grants/PRISM

Railway and Canal Historical Society – www.rchs.org.uk/trial/gwpf.php?wpage=home

Railway Heritage Trust – www.brb.gov.uk/railwayheritage

Road Locomotive Society – www.roadloco.org

Royal Commission on Ancient and Historical Monuments in Wales/National Monuments Record for Wales – www.rcahmw.gov.uk

Royal Commission on Ancient and Historical Monuments of Scotland/National Monuments Record of Scotland – www.rcahms.gov.uk

Royal Commission on the Historical Monuments of England/National Monuments Record Centre – www.buildingconservation.com/directory/ad137.htm

Royal Society for the Prevention of Accidents – www.rospa.com
Science and Industry Collections Group – www.sicg.org.uk

Science Museum – www.sciencemuseum.org.uk
See also National Railway Museum
Scottish Conservation Bureau (Historic Scotland) – www.historic-scotland.gov.uk

Scottish Industrial Heritage Society – http://sihs.co.uk/

Scottish Railway Preservation Society – www.srps.org.uk

Senator Oil & Chemicals Ltd – Tel: 01293 613322; Fax: 01293 613311

† Society for the Protection of Ancient Buildings – www.spab.org.uk

Society for the Protection of Ancient Buildings (Wind and Watermill section) – www.spab.org.uk/html/spab-mills

Standing Conference on Archives and Museums (SCAM) – twww.archivesandmuseums.org.uk/scam/home.htm

Steam Boat Association of Great Britain – www.steamboat.org.uk

The Maritime Trust – www.gmt2000.co.uk/meridian/orgs/orgm0a1.htm

The National Archives – www.nationalarchives.gov.uk

Tool and Trades History Society – www.taths.org.uk

Tyne and Wear Museums – www.twmuseums.org.uk

Ulster Folk and Transport Museum – www.magni.org.uk

* Veteran Car Club of Great Britain – www.vccofgb.co.uk

Victorian Society – www.victorian-society.org.uk

Vintage Sports-Car Club – www.vscc.co.uk/vsccweb

Welsh Mills Society/Cymdeithas Melinau Cymru – www.welshmills.org.uk

Windmills and Watermills Section see Society for the Protection of Ancient Buildings

13.4 Grants

Grants for acquisition and conservation of industrial and scientific material are available from the MLA PRISM Fund, which covers England and Wales. Similar schemes, covering acquisitions only, are run by the National Museums of Scotland and the Northern Ireland Museums Council.

Museums Libraries and Archives Council PRISM Fund
Web: www.mla.gov.uk

National Fund for Acquisitions
http://aww.nms.ac.uk

Northern Ireland Museums Council
www.nimc.co.uk

Heritage Lottery Fund (and the National Heritage Memorial Fund) are able to support the cost of acquisition and conservation projects in the UK. Details can be obtained from: www.hlf.org.uk