

Guidelines for Pest Prevention

2006

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1. Objective

This document outlines an integrated pest management [IPM] strategy to prevent damage to collections by controlling the pests that can infest objects, houses and museums.

2. What is IPM?

IPM is a system for managing pests through monitoring and documentation so that any problems are noticed at an early stage, hopefully before any damage has occurred. This is achieved by making an individual or a small team responsible for pest monitoring thus ensuring that traps are deployed properly and checked regularly. IPM also requires collection spaces whether display or storage to be cleaned regularly and so assists in maintaining general standards of collection care. If an infestation does occur then the IPM strategy will help you to manage the problem efficiently and effectively.

2.1 Policy and plans

You should ensure that IPM is identified as a specific issue within existing management plans and policies. You need to decide where it fits? Perhaps as part of an overarching environmental strategy or within an existing collection care plan.

This template offers you a basic model but you can adapt it to suit your needs and circumstances. The strategy covers display, storage and acquisition and is designed to fit with existing systems such as Benchmarks in Collection Care which can be used to support Museums Accreditation.

Remember you don't need large resources to implement an effective IPM strategy. What you do need is commitment and understanding of its importance across your organisation, from the director to the cleaner.

3. Principles of Pest Management

3.1 Monitoring

Pest monitoring is the key to IPM as it provides the information on the incidence and distribution of pests, which in turn enables cleaning and treatment to be targeted. Insect traps should be placed throughout the building and checked at least four times a year. More traps should be used in areas where there are vulnerable objects. Data from inspection and trapping should be reviewed and analysed regularly and a simple report produced annually.

3.2 Housekeeping

Dead insects and other organic debris, which accumulate in display and storage areas, provide a major source of food for insect pests. Dead cluster flies can often be a source of woolly bear infestations in historic houses.

The main source of food for rodent pests is from food consumed by staff and visitors. Therefore, good housekeeping to eliminate sources of food, harbourage

and breeding environments within the building is the keystone of IPM.

All areas should be regularly cleaned. Areas where there could be a reservoir of pests should be surveyed, problems identified and action taken to remove the risk. You may use a plan drawing of the building or site and rate the potential risk of each area by colour or number. The external and internal features of the building and its environment should also be surveyed to identify potential problems. Uncleaned chimney flues can be a particular source of pest problems. Others include; mammal, bird and insect nests, rubbish, drainage, lighting, plants and flowers, window ledges, ducting, building voids etc.

Selected eating areas must be designated and maintained. Food must not be permitted outside these areas and areas where food is consumed must have a strict cleaning regime.

3.3 Quarantine

It is essential to prevent pests from being introduced into collection areas on infested objects. To achieve this, it is desirable to have an effective quarantine and treatment procedure. All objects must be carefully checked for pests before they are brought into stores or display areas.

If there is any possibility that objects brought into the museum have an infestation, they should be isolated (keep in a separate location away from other objects and wrap in polythene) and inspected by a specialist. The object may then require treatment - ask for advice on an appropriate treatment if you are unsure. The results of any inspections and details of treatments should be added to the object's documentation.

4. Implementing the Strategy

4.1 Responsibility

One person should be appointed as 'Pest Coordinator' responsible for IPM. It is often possible to find someone who has an interest in entomology who will willingly take up the responsibility otherwise it should be someone whose area of responsibility fits the best i.e. a collections/house manager. Where possible they should be supported by their line manager and/or site manager and an external pest specialist who can assist with identification and give general advice. Try making contact with local universities or look for local special interest groups who may be able to help. If you are a larger organisation or museum you may find helpful to put a 'pest team' together. The team should be made up of staff from different areas and can help to develop a shared understanding of IPM and other issues.

- The coordinator will focus on the supervision and coordination of the pest strategy, including waste management, access, maintenance, sanitation, housekeeping, environmental monitoring, pest monitoring, trapping, treatment and quarantine.
- The coordinator will also determine what treatments are carried out by any pest control contractor.

4.2 Training

Staff awareness, involvement and cooperation are essential for an effective Pest Management Programme.

- All site staff should be involved with or have some knowledge of pests and their danger to the collections. This will enable them to identify any dangers or suspected presence of insects anywhere in the building.
- Regular introductory pest awareness sessions will be held for all staff. Short briefings to targeted groups such as front of house staff can be an effective way of getting the message across.
- Staff checking traps should be able to recognize all key pest species.

4.3 Pest Monitoring

Insect traps should be placed in all collection areas. The traps and vulnerable objects should be regularly inspected. Structural timbers that show signs of insect attack should be checked each year. It is a good idea to monitor all year round but it is essential to monitor between March and July as this is the time of year when pests are at their most active.

- Make a checklist for annual inspections.
- Locate and assess susceptible objects/collections.
- Determine which areas of structural timber need to be checked.
- Locate pest entry points to the building e.g. window ledges, doors.
- Place insect traps in selected areas.
- Record trap locations on floor plans of the site.
- Check traps at least 4 times per year.
- Record data from insect traps.
- Plot trap catches on a plan of the building.
- If possible, create a database to record trapping details.
- The Museum IPM Co-coordinator and pest prevention team should review and analyse data regularly and produce an annual summary.

4.4 Checking of objects

- All incoming objects and new acquisitions must be inspected.
- Previously identified susceptible objects, collections and all vulnerable material should be periodically checked.
- Suspect material should be quarantined and treated if necessary.

5. Environment & Pests

5.1 Environment

The following are needed for insects to flourish:

Food (skin, hair, wool, feathers, starch, dirt, dust, etc)
Heat
Moisture
Oxygen

Most museums and historic houses have many inaccessible, unusable areas including old ventilation ducts and chimneys. These can harbour organic material and are the main sources of insect pests, which can then attack objects in collections. Dead insects and other organic debris can accumulate in other inaccessible areas in storage such as under shelves, in double glazing and behind stacked objects. All of these areas must be identified and cleaned regularly to remove these sources of food for pests.

5.2 Insect Pests

It is the larvae of pests which cause the damage and they feed less at low temperatures. When the temperature is raised then their levels of damage increase. The optimum temperature for many pests is 22-25°C which is also very comfortable for humans. High levels of relative humidity can also encourage pests. Where conditions are 60% or above on a regular basis then moisture sources must be identified and dealt with if possible. These include; ground water, drainage and leaking roofs, and internal sources such as water systems, condensation, wet cleaning, cooking and washing.

The larvae [or woolly bears] of carpet beetles are one of the most common and destructive pests of textiles. Other pest problems such as clothes moths, woodworm and biscuit beetles may also cause serious damage to collections. Other insects which are often found, such as spider beetles, are rarely a threat to collections but indicate a source of food such as dead flies or bird nests in dead spaces.

Many insect pests such as woodworm, will not flourish in environments with a low relative humidity [RH] of less than 55%. Problems with silverfish and booklice will only occur when there are locally high moisture levels above 65%.

Death watch beetle only attacks structural oak which has been exposed to high levels of moisture at some time.

Summary of the common insect pests and their damage		
Pest	Type of damage	Materials damaged
Woodworm/ Furniture beetle <i>Anobium punctatum</i>	Small 2mm round exit holes, gritty frass in tunnels	Sapwood of hardwoods, ply with animal glue, some composite cellulose materials and books
Death-watch beetle <i>Xestobium rufovillosum</i>	Large 3mm exit holes, rounded frass in tunnels	Structural hardwoods particularly when in contact with damp walls
Powderpost beetle <i>Lyctus brunneus</i>	Small 2mm round exit holes, fine talc-like frass in tunnels	Starchy wood
Wood weevil <i>Euophryum confine</i>	Surface damage and holes on damp wood	Damp wood, paper and books
Carpet beetle <i>Anthrenus sp</i>	Irregular holes in textiles, loose fur, short hairy cast skins of larvae	Bird and mammal skins, insect specimens, wool textiles
Carpet/Fur beetle <i>Attagenus sp</i>	Irregular holes in textiles, loose fur, long banded cast skins of larvae	Bird and mammal skins, insect specimens, wool textiles
Webbing clothes moth <i>Tineola bisselliella</i>	Large irregular holes with quantities of silk webbing tubes and gritty frass	Wool, fur and feather textiles. Bird and mammal skins
Case-bearing clothes moth <i>Tinea pellionella</i>	Irregular holes and grazed fabric with loose silk bags	Wool, fur and feather textiles, bird and mammal skins
Biscuit beetle <i>Stegobium paniceum</i>	Round exit holes and gritty dust	Dried food and spices, starchy plant specimens and seed heads, papier-mâché, freeze dried animal specimens
Cigarette beetle <i>Lasioderma serricorne</i>	Round exit holes and gritty dust	Dried food and tobacco, starchy plant specimens and seed heads, freeze dried animal specimens
Spider beetle <i>Ptinus sp</i>	Some holes or cavities, spherical silk pupal bags	Starchy dried plant specimens and seed heads, animal specimens
Booklouse <i>Liposcelis sp</i>	Scratched and eroded surface of materials	Starchy paper and glues.
Silverfish <i>Lepisma sp</i>	Irregular scratched and eroded surface of materials	Damp paper and textiles, animal glue Silverfish are very partial to paper labels on objects.
Frass is the fine powdery debris left by insects and is mostly excrement not fragments of the material it is boring through or eating.		

5.3 Rodents

The house mouse (*Mus domesticus*) can cause problems in museums and historic houses. There is very little food for mice in display and storage areas and they rely on human food from cafes and staff mess areas. Once established in the building, they can then spread and damage objects by gnawing and shredding. Rodents can also present a health risk from their droppings and urine. The key principles of rodent control are proofing to keep them out of the building and good housekeeping to deny them food. Baits containing rodenticides should only be used to control an established infestation and not as a preventative measure. Old rodent baits should be removed to prevent them becoming food sources for insects.

6. Control

6.1 Treatment of the environment checklist

- Good housekeeping is of utmost importance. All floors in collection areas should be vacuum cleaned regularly. Including underneath and behind storage furniture, enclosed spaces, cavities and light diffusers.
- Kitchen, office areas and hallways should be kept free of rubbish and be kept clean. Wet mopping of non-storage areas should only be carried out if necessary.
- Object storage areas must be kept clean and should be vacuum cleaned twice a year. The floor must not be wet mopped.
- All vacuum cleaner bags must be disposed of after use.
- All rubbish should be removed and disposed of outside every day.
- Food should be restricted designated non-collection areas, which should be vacuum- cleaned after use.
- Use pest-resistant material in storage areas where possible. Wool felt and wool carpet should not be used.
- Insect traps and rodent baits must be replaced regularly so as not to become a source of infestation. Poison baits often cause the rodent to die in inaccessible places and the carcass provides food for insects. Loose grain bait in rodent bait trays should never be used.
- Check and clean internal building areas; window ledges, ducting, vent systems, fireplaces.
- Maintain the building in good repair e.g. eliminate cracks and holes in the fabric of the building.
- Where possible, eliminate external material attractive to pests; nests, rubbish, drainage, lighting, plants and flowers.
- Where possible and appropriate, place and maintain insect screens on windows that may be opened.
- Where possible, proof doors against entry by rodents.
- Where possible, attach bird netting or anti-roosting wire to prevent nesting and roosting on ledges. Heavy wire mesh prevents rodent access through vents. Wire mesh can also be placed over chimneys.

6.2 Specific action in response to pests in the building environment

After cleaning, selected areas can be targeted for treatment using approved insecticides Residual sprays are targeted on wall floor angles and desiccant dust

in dead spaces e.g. in ducts or under plinths. Examples of insecticides that can be used are, Constrain (a water based permethrin micro-emulsion) and Agrodust (desiccant dust).

Treatments against structural woodborers such as woodworm or deathwatch beetle should only be carried out after consultation with an external pest advisor.

6.3 Specific action in response to infestations in objects

Decisions on treatment of objects must be made in consultation with appropriate conservation staff. Always seek professional advice when considering treatment.

Options for treatment include; CO₂ fumigation, nitrogen anoxia, freezing, Thermo Lignum heat treatment and remedial conservation of objects.

6.4 Legal and ethical constraints on treatments - COSHH

- Pesticides can only legally be used as labeled; this means most products may only be used in public and storage areas by qualified personnel.
- Constrain and Agrodust are approved for use by museum personnel.
- Care should be taken when they are used in public areas and the safety officer should always be consulted.
- Residual chemicals should not be used on objects unless approved by a conservator.
- Rodenticide baits must only be used by a pest control contractor.

7. Checklist for your IPM Strategy

- Each museum or historic house should appoint one person to act as IPM Co-coordinator.
- If possible, there should be a pest prevention team which will consist of the IPM Co-coordinator, the Site Manager and an external IPM specialist.
- The building should be pest-proofed to prevent rodents and insects gaining access through doors and windows.
- Bird nests should be removed and steps should be taken to keep chimney flues clean and install proofing to prevent roosting and nest construction.
- All the areas must be kept clean. This includes public and staff areas as well as storage and other "hidden" areas. Office areas and hallways should be kept free of rubbish.
- Storage areas should be vacuum cleaned regularly, preferably twice a year.
- Insect traps must be placed in display and storage areas and inspected at least four times a year. Results should be analysed and summarized annually.

- All new acquisitions and incoming objects must be checked and, if treatment is necessary, this should be done before they are put on display or into storage.
- The consumption of food by staff and public should be restricted to designated areas. Food should not be eaten in collections storage areas.
- Rodent baits must be removed or replaced regularly so as not to become a source of infestation.
- Training must be given enabling staff to identify any dangers or suspected presence of insects anywhere in the building.