Northern Ireland Museums Council

Guidance on Hazardous Collections

Introduction

For museum managers a day to day health and safety concern is the assessment and management of risks relating to visitors and their interaction with the museum's building, events and activities. The prevalence of dealing with related matters means that they become part of the management routine. Similarly, museum governing bodies have statutory duties concerning the health and safety of their employees, most of which are generic, with many museums reviewing their associated procedures on a regular basis. One notable health and safety risk which can adversely affect the public, but more so museum staff and volunteers, is working with hazardous collections. Given that it does not usually feature as part of a museum's health and safety routine, that it can be technically complex and its 'behind the scenes' nature, the risks associated with managing such collections can easily be overlooked or not given the serious consideration due. This guidance sets out to define what is understood by hazardous collections, highlight what sorts of artefacts and collections can pose the greatest risks to health, and to signpost ways in which such risks may be mitigated or addressed.

Health and Safety and Collections

The Health and Safety at Work Order (Northern Ireland) 1978 and the Management of Health and Safety at Work Regulations (Northern Ireland) 2001 require bodies to ensure, so far as is reasonably practicable, the health and safety of employees and others who may be affected by what it does or fails to do. For museums this includes their staff, any volunteers, casual and contract staff, and extends to the public who visit them.

There are standard duties of care for employers that include making the workplace safe, for instance; ensuring that plant and machinery is safe to use, taking precautions to reduce the risk of injury through the manual handling of objects, providing protective clothing or equipment, storing things so they are least likely to fall and cause injuries, and ensuring safe working practices are set up and followed. It is easily appreciated that such rudimentary concerns are applicable to the storage and handling of museum collections generally, where associated risks centre mainly on the weight of objects, working at a height, loose parts, sharp edges and points, and such like.

Many museums, however, hold what are deemed 'hazardous substances' within their collections. These may be defined as objects whose specific physical properties pose particular dangers, or which are or have components that are toxic, or have the potential to become toxic over time. Particular aspects of health and safety legislation can relate to these.

The COSHH regulations specify the eight measures that employers must follow to prevent or limit their employees' exposure to hazardous substances.

The measures are:

- assess the risks
- decide what precautions are needed
- prevent or adequately control exposure
- ensure that control measures are used and maintained
- monitor the exposure
- carry out appropriate health surveillance
- prepare plans and procedures to deal with accidents, incidents and emergencies
- ensure employees are properly informed, trained and supervised

See
https://www.health-ni.gov.uk/articles/control-substances-hazardous-health-regulations-northern-ireland-coshh-2003
http://www.legislation.gov.uk/nisr/2003/34/introduction/made?view=plain

Amongst the wider range of statutory duties, employers are required to make sure that all materials are handled, stored and used safely, and to prevent or control exposure to substances that may damage a person's health. They must also tell staff about any potential hazards from the work undertaken and give information, instructions, training and supervision as needed. In addition, employers must check that the right work equipment is provided, that it is properly used and regularly maintained, and that precautions are taken against the risks caused by chemical hazards, electrical equipment, noise and radiation.

In short, it is most important that people working with museum collections are told of the hazards associated with different types of materials they may come across, and are in a position to manage the associated risks accordingly. On this basis, the National Museums Scotland has established a pertinent 'golden rule' applicable to all museum collections, which states that,

Anything collected before 1900 should be considered contaminated and anything collected before 1960 should be handled with caution.

See http://www.nms.ac.uk/media/175600/hazards-in-museum-collections-nms.pdf

Royal Cornwall Museum has produced a detailed policy on hazardous substances in collections, with good guidance on risks and treatments.
http://www.collectionstrust.org.uk/media/documents/c1/a653/f6/royal_cornwall_hazards_policy_2012.pdf

Hazardous Collections

The range of potentially dangerous and toxic artefacts and specimens in museum collections is huge and consequently the descriptions below cover the most common examples of hazardous objects. It cannot be taken as being an exhaustive listing. As will be appreciated the associated risks tend to be either physical, chemical, biological or arise from radiation hazards. This section seeks to illustrate the types of objects that may prove hazardous, the principal health risks and to signpost sources of associated expertise and guidance.

Physical

Beyond the common risks associated with handling museum collections, there are some types of objects where their physical nature means that particular care is required. These include

Firearms
The Home Office has issued a guide on firearms licensing law which provides information useful to museums with such weaponry in their collections.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/518193/Guidance_on_Firearms_Licensing_Law_April_2016_v20.pdf

This includes guidance on deactivation, prohibited weapons, antique and historic weapons, and transportation, with Chapter 17 focusing on museums and firearms licenses. It should be noted, however, that the Firearms Act 1968, as amended, does not extend to Northern Ireland, which is subject to separate legislation.

The Firearms (Northern Ireland) Order 2004 has specific licensing provision for such items held by museums in Northern Ireland, which allows the Secretary of State to grant a licence to a museum to acquire, hold and exhibit firearms without the need to hold a firearms certificate, so long as s/he is satisfied with the museum's arrangements for keeping and exhibiting such material and that there is no danger to public safety. Such licenses have a five-year duration and licensing is administered by the Department of Justice https://www.gov.uk/museum-firearms-licence-northern-ireland

Museums need to routinely check that they hold a valid license for all firearms and ammunition held, that they attend to deactivation requirements accordingly and that such items are held securely and stored appropriately. Such actions will mitigate to a degree the risk of a museum not meeting its legal obligations.

For further information contact:
Firearms and Explosives Branch, Department of Justice, Block B, Castle Buildings, Stormont Estate, Belfast BT4 3SG. Tel: 028 9052 0057

The main risks to health associated with handling firearms in museum collections concern injury through the discharge of a bullet or charge, through ignition or flashing of residual gunpowder, injuries resulting from trying to operate a mechanism or when dismantling an item. In view of this it is recommended that museums draw up firearm handling guidance for staff that includes such direction as not pointing a gun at anyone, not trying to load or fit ammunition, not dismantling armaments without foreknowledge and training, not looking or blowing down a barrel and calling for expert assistance if in any doubt.

Weapons
Collections with knives, spear, arrows, clubs and other non-mechanised weaponry tend to pose risks associated with their sharp edges and weight, and thus appropriate handling procedures should be in place and protective equipment needs to be supplied and used.

In addition, especial care is required for similar objects in ethnographic collections as these may be coated with poisons or contaminated with biohazardous materials such as blood containing viable pathogens. (see *Medicines, Drugs and Poisons* below)

Medical and Veterinary Equipment
Care is required when handling any 'sharps' within collections as these have a propensity to cause cuts and puncture wounds. These may include lancets, scalpels, needles (hypodermic, suture and phlebotomy), saws, razors, scissors, glass ampules and the like.

As with *Weapons*, these objects must be handled with caution, as historic objects may contain viable pathogens or toxic or controlled substances. Such items can be found in unexpected places, such as pockets, the lining of doctors' bags, containers used as 'first aid' boxes, so vigilance is required.

The Royal College of Nursing provides detailed, transferable guidance on 'sharps safety' which is available at https://www2.rcn.org.uk/__data/assets/pdf_file/0008/418490/004135.pdf

Chemical

Fluid-preserved Natural History collections
The preserving fluids used have particular risks attached:

- Formaldehyde is poisonous. Contact with skin can result in dermatitis and its fumes are highly irritating and carcinogenic.
- Formalin is non-flammable but toxic, and is also an irritant and a carcinogen.
- Alcohol and industrial methylated spirit are mild irritants, but as both are flammable, there is a risk of ignition or explosion at high temperatures.
- Other preservatives may have non-hazardous vapour but many are still toxic, so all preservatives require careful handling.

Taxidermy and Biological collections
Across such collections, and including ethnographic artefacts and some textiles, pesticides are frequently found, having been applied during the last 200 years as a preservative and to prevent insect damage. Thus DDT, arsenic trioxide, mercuric chloride or a mixture of these and other compounds, and naphthalene (moth balls), were widely used both on the specimens directly, but also in the storage drawers and cabinets. All are dangerous to human health. As such care must be taken in handling such items as a matter of course and it is worth assuming that such preservatives are present.

A good overview of the risks associated with natural history collections may be found at http://sharemuseumseast.org.uk/wp-content/uploads/2013/12/Nigel-Larkin-Moving-Natural-Sciences-Collections.pdf

For further information, the Collections Trust has published Standards in the Museum Care of Biological, see http://www.collectionstrust.org.uk/media/documents/c1/a81/f6/000074.pdf

From time to time the Natural History Museum provides training on the safe working with natural history collections, see http://www.nhm.ac.uk/business-services/training/working-safely-with-natural-history-collections.html

Asbestos
The term "asbestos" refers to the fibrous form of naturally occurring silicate minerals. Three types of asbestos (chrysotile, amosite, crocidolite) were processed and widely applied as insulation material against heat, cold, fire and sounds since the late 19th century. As a result of an increasing awareness of asbestos' health hazards in public, the material was banned in most western countries during the final third of the twentieth century. Fibres of a specific size can cause asbestosis, lung cancer and the very rarely occurring mesothelioma, but only if breathed in regularly and/or in high concentration. However, even handling asbestos containing objects can pose health risks because of the airborne fibres. There are no safe exposure levels, so particular care should be exercised.

Given its properties it can be found in a wide range of objects in museum collections: from the industrial (vehicle brake shoes, gaskets, electrical insulation, industrial protection suits, classic cars, railway rolling stock, for example), to the domestic (protective clothing, ironing boards). It is also prevalent in geological collections, in some ceramics (such as floor tiles), and gas masks.

Further details on all aspects of asbestos see http://www.hse.gov.uk/asbestos/

Some museums have produced specific policies concerning asbestos, the RAF Museum being an example,
http://www.rafmuseum.org.uk/documents/policies/asbestos_policy_V1_Jan_2012.pdf

Mercury
As a neurotoxin, mercury can be absorbed by the body through direct contact, ingestion, or inhalation of mercury vapour and can cause chronic effects. Given its particular properties, it was widely used over the last 300 years and can be found in barometers, thermometers, medical equipment (and dental amalgams) and in physics apparatus. Given its reflective qualities it was used as a reflective coating for mirrors, and it had particular applications in millinery - for making felt, and most likely the origin of the phrase 'as mad as a hatter'.

It was also used in medicinal and fungicidal compounds, in several kinds of light bulbs, wall paints and artists' materials; in cinnabar and vermillion pigments, for example. You may also come across it in the form of mercuric salts within geological collections and mercury-based compounds were used previously as insecticides and preservatives in taxidermy and ethnology collections.

Lead
Lead and lead compounds can enter the body by ingestion, inhalation, or absorption. Exposure to lead carries significant risks and associate symptoms include headaches, stomach pains and anaemia. Other serious health effects consequent to prolonged exposure include kidney damage, nerve and brain damage and infertility.

Lead was widely used in various ways in the past, many of which are readily identifiable. It has been used as a building material, (Roofing, flashing, gutters, downspouts, and masonry ties) but is likely to turn up in museum collections in various ways – in weaponry, including bullets and lead shot; in maritime and industrial collections (weights, linings, leaded seams on vintage cars, seals, cable sheathing, radiation shields); in domestic objects (water cisterns, older food storage tins, pewter utensils); in funerary and garden collections (urns, caskets, planters, statuary); children's toys and ephemera (toy soldiers, children's jewellery, tokens, medals); and as a component stained glass.

Care should be taken too when dealing with objects containing lead where its presence is not as apparent, as in batteries and rechargeable lead-acid batteries, paints and pigments, medicines and cosmetics, ceramic glazes and enamels, together with some older plastics.

Further information on caring for metals in museum collections is available through http://www.collectionstrust.org.uk/media/documents/c1/a130/f6/003024.pdf

With advice on lead in collections at http://canada.pch.gc.ca/eng/1439925170022

Plastics
Plastics come is a multitude of forms, with some now being found to be less stable than others. A good overview of the various types is provided by the Social History Curators Group
http://www.shcg.org.uk/domains/shcg.org.uk/local/media/downloads/Plastics_Lesson_booklet.pdf

Museum staff should be aware that some of the early cellulose-based plastics are liable to irreversible degradation and in this process can give off acidic fumes that are hazardous to health.

Nitric oxide, nitrous oxide, and nitrous dioxide are all released as gases from the decomposition of cellulose nitrate film stock. In the presence of atmospheric moisture, these gases combine with water to form nitric acid, which is potentially damaging to surrounding materials and to anyone handling such artefacts without appropriate protection. However, cellulose nitrate materials are also extreme flammability, and thus require specific storage conditions.

Further information is available at https://www.nedcc.org/free-resources/preservation-leaflets/5.-photographs/5.1-a-short-guide-to-film-base-photographic-materials-identification,-care,-and-duplication
And
http://www.hse.gov.uk/pubns/indg469.pdf

Given the relatively recent and widespread use of plastic in a wide range of artefacts that are now entering museum collections, the full range of associated risks are yet to be identified. Curators and conservators are beginning to appreciate the degradation reactions of polymers, the effects of volatile organic compounds and the associated processes of care and conservation may prove to have health risks.

See https://www.si.edu/mci/downloads/articles/ecoEXCHANGE-Winter2009.pdf

Medicines, Drugs and Poisons
Old medicines and their packaging should be regarded as dangerous, particularly if they are more than 30 years old. They can contain arsenic, strychnine and mercury compounds, lead or radium, and other toxic substances. The associated dangers are sometimes heightened through the substances used to dilute or act as the medium of the medicine either evaporating or changing over time.

Previously, medicines sometimes incorporated substances which are now deemed illegal. For instance, cocaine was an original ingredient of Coca Cola, and morphine featured in such 19th century preparations as 'Mrs Winslow's Soothing Syrup' that was recommended for restless and teething babies. While the content of such preparations were often known and recorded, this was not always the case with folk and home prepared remedies and lotions. These too should be treated as being potentially toxic.

Ethnographic collections have been found to contain poisonous materials, whether in the form of plant samples, seeds, residues on weaponry or ritual materials or in the form of compounds used for medical purposes.

The Museum of the Royal Pharmaceutical Society has issued guidance on the safe handling of collections of historic medicines and pharmaceuticals, including the associated legal issues. See https://www.rpharms.com/museum-pdfs/health-and-safety.pdf

The ICOM-CC Working Group on Ethnographic Collections has produced a range of support material relating to the care of ethnographic collections, including the associated risks. See
http://www.icom-cc.org/84/Biocides%20in%20Collections%20/#.WACdVOUrJD8
And http://collections.rmsc.org/LibCat/links/Biocides_Bibliography.pdf

Biological

Moulds
Mould is a commonly used term to cover the wide spectrum of fungi which occur naturally. To grow, spores require humidity of 65% and above, temperature to be between 10 and 35 degrees, lower light levels or darkness, still air conditions and an organic food source. Museum collections abound with organic materials that can support mould spores - textiles,

paper, books (including glues and bindings), leather, wood, natural history specimens, food stuffs, etc., together with any dust and dirt that is allowed to gather on artefacts and specimens.

Mould spores and associated mycotoxins can result in respiratory infections, allergic rhinitis and asthma, but in some people an allergic reaction to fungal spores may be more serious.

Controlling the museum environment to minimise the optimum conditions required for mould growth is essential, and mould growth is significantly retarded by robust cleaning programmes.

Guidance from the National Preservation Office: The Prevention and Treatment of Mould Outbreaks in Collections
http://www.collectionstrust.org.uk/media/documents/c1/a101/f6/000499.pdf

Human remains
A commonly accepted definition of human remains used with the museum context is as follows - all non-processed, processed or preserved forms of human bodies and parts thereof, which includes bones, mummies, bog bodies, soft tissues, organs, tissue sections, embryos, foetuses, skin, hair, fingernails and toenails and cremated remains, together with all ritual objects into which human remains as defined above have been knowingly incorporated.

The most likely sources of risk associated with human remains appear to be the presence of pathogens, psychological stress and contamination by heavy metals, such as lead. Such risks, together with the ethical and legal concerns have been examined by English Heritage see https://content.historicengland.org.uk/images-books/publications/human-remains-excavated-from-christian-burial-grounds-in-england/16602humanremains1.pdf/ with further guidance available within the British Museum publication, *Regarding the Dead*, see www.britishmuseum.org/PDF/Regarding-the-Dead-Chapter-5_02102015.pdf

Radiation

Geological specimens
Radioactivity occurs naturally, with certain minerals emitting levels of ionising radiation which are harmful to human health. While the Ionising Radiation Regulations (1999) set out the requirements for the protection of persons exposed as a result of work with radioactive materials, geological specimens fall completely out of scope of the Radioactive Substances Act 1993, as it applies in Northern Ireland. Nevertheless, significant work has been undertaken on the identification and management radioactive geological specimens, for example
http://www.geocurator.org/pubs/images%20and%20docs/Radioactive%20Specimens.pdf

Radioactive artefacts
The range of potentially harmful objects, due to radiation, within museum collections is notably larger than might be anticipated. From the early twentieth century, when it was considered a source of 'brightness and energy' radium was used in all manner of products, such as cigarettes, condoms, makeup, suppositories, toothpaste and even chocolate. Such widespread use is perhaps now surprising given the health risk from radiation poisoning - anaemia, bone deterioration, leukaemia and such like.

Radium-226 was used to paint watches, aircraft gauges, door knobs, religious icons, light switches and the like. During the 1920' 'uranium glass' containing uranium oxide and also known as 'vaseline glass', became popular as tableware. Uranium oxide has also been used as a pigment for ceramics. Residual traces of radioactive material can also remain on

various scientific, medical, dental and veterinary instruments. Such items require particular consideration in their storage and handling.

The Ministry of Defence has produced a leaflet on the Management of Radiation Protection in Defence targeted particularly at museums within the defence estate, with the associated guidance being transferable and applicable to the museum sector generally, See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/383657/JSP392_Lft_31_Museums.pdf

Unidentified and Mislabelled Items
It is prudent to assume that all cabinets, boxes, drawers, jars, bottles or tubes that are unlabelled (and sometimes mislabelled) are toxic unless it can be proven otherwise. The same applies to items which may have labels in Latin, in a foreign language, or that may use ambiguous or out-of-date terminology for potentially harmful materials; for instance, asbestos is known by myriad names – Chrysotile, Amosite, Crocidolite, Tremolite, Anthophyllite, Actinolite amongst them. Care should also be taken with substances known by producer names, such as 'Fowler's Solution', a potassium arsenic solution that was prescribed as a general tonic from the late eighteenth century until 1936.

Conservation Treatments
As will be appreciated, attempts to preserve objects in the past often involved using substances that are now deemed toxic, yet even contemporary conservation treatments are not without health risks and all due precautions should be taken. For instance, the process of using potassium cyanide in the past to clean gold and silver objects can leave a white residue that if wetted produces toxic hydrogen cyanide.

It is recommended that museums secure the services of a registered conservator to undertake an assessment of potentially contaminated artefacts. See the Institute of Conservation register at http://www.conservationregister.com/

Treatment and Mitigation of Risks
Various steps are recommended that will help reduce the dangers and risks associated with hazardous objects and collections. These are outlined below and include:

Recognition of responsibilities
Ensuring that your museum governing body and senior executive are aware of their statutory responsibilities under the prevailing general Health and Safety legislation and the Control of Substances Hazardous to Health Regulations is an essential first step. This is closely followed by the completion of a risk assessment and the compilation of a timed and resourced action plan to cover hazardous collections.

Collections Audit
Undertake a comprehensive audit of the collection to identify any dangerous or potentially hazardous materials and items within the collection.
The UK Museum Collections Management Standard – Spectrum – provides guidance on the audit of object information, see
http://support.collectorsystems.com/PDF/14_Audit_SPECTRUM_4_04.pdf

Risk Assessment
It is recommended that a museum which holds any form of hazardous material should complete a risk assessment on a timely basis.

You may wish to adopt a stepped approach, that can include the following;

- Identify the hazard,
- Decide who or what may be harmed and how,

- For each hazard, evaluate the chance, big or small, of harm actually being done and decide whether existing precautions are adequate or whether more should be done,
- Record the significant findings of risk assessment, such as the main risks and the measures you have taken to deal with them,
- Review the assessment from time to time, and revise if necessary.

Various templates exist that can be used or adapted for use at your museum, and which can be downloaded from the web. See http://www.hse.gov.uk/risk/casestudies/

Investigation and identification

The potential risk associated with hazardous items should be drawn to the attention of staff responsible for receiving donations from the public, with an associated assessment being undertaken prior to the object entering the museum. To assist in identifying hazards, some museums have invested in a handheld X-ray fluorescent (XRF) analyser or spectrometer to aid the identification of the chemical composition of artefacts and specimens.

When in doubt refer to an expert in the related field to investigate and identify hazardous artefacts or the presence of hazardous materials within the museum environment.

As a precautionary measure restricted access and isolation may be implemented for new accessions until they have been investigated property.

Guidance on object investigation and assessment is available at http://www.museumoflondon.org.uk/Resources/e-learning/handling-museum-objects/s02p01.html

Good Housekeeping and Management

Best practice in the handling and care of museum objects should, of course, be implemented at all times. But with potentially hazardous materials certain other general precautions are required, and in addition certain statutory and regulatory requirements are necessary when handling such hazardous substances as asbestos and radioactive materials.

As a minimum museum managers should;

- Draw up appropriate written operating and handling procedures, preferably agreed by the museum's governing body and compiled with expert input.
- Ensure that staff are aware of these procedures and that they receive proper training on a timely basis
- Post the procedures in the stores and work place, issuing them as required to researchers, visitors and volunteers who may have cause to handle such collections
- Provide the necessary protective equipment – the right tvpe of gloves, lab coats, and other types of protective clothing, together with safety glasses, masks, respirators, extractors and the like, where appropriate.
- Institute a regime of good practice, which may stipulate, for instance:
    - The wash of hands before and after handling objects, even when using gloves
    - Not permitting contaminated clothing to be worn outside the prescribed area of contact
    - Not permitting individuals to smoke, eat, drink, apply lipstick or balm, or contact lenses near contaminated or hazardous materials
    - Being conscious of personal habits that could prove a risk – touching the face, rubbing eyes, putting pencils in the mouth, etc.
    - What to do in the case of materials coming in contact with the skin or mucous membranes

    - What to do in the event of a spill, leakage or other accident while handling the hazardous object
- Ensure that access and handling is restricted and defined.

Storage and Labelling

Once the artefact or environment has been investigated for hazardous materials, it is necessary ensure that the associated documentation records that it contains or is made from a particular chemical or compound, and the nature of the associated hazard or risk. For instance, in Modes Complete the Object Requirements stored element group can be used to capture this information.

All storage boxes should be of a material that can contain the hazard and display the appropriate warning label
See for labelling generally
http://www.collectionstrust.org.uk/images/documents/c1/a453/f6/Labelling_and_Marking_booklet.pdf
and for warning signs
http://www.hse.gov.uk/pubns/priced/l64.pdf

Disposal

If after considering such matters as the value of an object, the risks of it being a hazard, the associated resource implications and other factors (see the Disposal Toolkit - https://www.museumsassociation.org/collections/disposal-toolkit) the decision is taken to deaccession a hazardous item, its nature and/or chemical composition may require that it is disposed of in accordance with the prevailing Hazardous Waste Regulations. Details on what comprises hazardous waste, and its consignment are available at https://www.daera-ni.gov.uk/articles/hazardous-waste Disposal may require that items are transported by a registered or exempt waste carrier.

Emergency Plans

Consideration should be given to documenting all hazardous materials within the building, perhaps noting their nature and location on any building plans. As part of the liaison with the Fire and Rescue Service such items should be highlighted, and its advice sought on their storage.

The procedures drawn up in connection with hazardous collections should also be precise in the steps to be taken should there be any form of incident or accident occur. Depending upon the circumstances, a museum may be required to report certain accidents, injuries, diseases and dangerous occurrences to either the Health and Safety Executive for Northern Ireland or the local authority.

Further details are available at https://www.hseni.gov.uk/content/report-incident

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