

Hazardous Materials in Medical Collections

Introduction

Museum collections often contain objects that pose a risk to other objects in the collection or to museum workers and visitors. Before any action is taken with potentially hazardous objects it may be necessary to make some difficult decisions. There are no hard and fast rules for dealing with hazardous objects, so this Fact Sheet can only offer guidelines on what to consider and where to seek help. One thing is certain—dealing with hazardous objects usually requires more than simple common sense.

This paper deals specifically with the sorts of objects found in medical, pharmaceutical, first aid or hospital collections, but there is also an appendix listing other sorts of hazards found in general museum collections.

General Considerations

In medical collections, materials that are most likely to cause concern to museum workers are: sharp instruments, equipment that might be contaminated with human tissue, medications and drugs that are dangerous or prohibited, radioactive apparatus, and bottled anatomical specimens. Before going on to consider each of these groups, there are some general things that may be said.

Hazardous objects do not only exist in medical collections. In any type of collection there are usually objects that can pose a hazard to museum workers and visitors, and to other objects.

- Even if an object is potentially hazardous, this does not necessarily mean that it should be deaccessioned or disposed of - there are other ways of managing such objects.
- Many considerations vie with each other when decisions are being made about what to do with hazardous objects. For example: What is the relative risk posed by the object? How significant is the object? How can its integrity be maintained?
- Sometimes an item's very dangerousness or illicitness is an integral part of its interest as a museum object.
- Any measures taken with hazardous objects should be done so with a view to managing and minimising risk, but 'nil risk' is virtually impossible.
- The key to safety is awareness of any potential hazards, so that risks can be managed appropriately.
- Once an object has been identified as hazardous it should have a tag attached describing the hazard and giving advice on the object's proper handling.
- In many instances the best way of minimising risk is simply to handle objects carefully and thoughtfully.

- Gloves are worn when handling museum objects not only to protect the object but to protect the person doing the handling. It is also a good idea to wear a lab coat in the museum storage area. Gloves and lab coats should be washed frequently but not with other clothes.
- In any instances when gloves are not worn, care should be taken not to touch the mouth or eyes after handling museum objects, and hands should be washed thoroughly. In storage areas it is unwise to eat or drink, apply lipstick or contact lenses, lick fingers, or put thread or pencils in the mouth.
- Museum staff should not spend long periods of time in closed storage areas, and these areas should not be used as work places.
- Storage and work areas should be kept clean and free of dust and debris that can harbour harmful substances.
- Measures can and should be taken to protect museum visitors from causing themselves harm - these include displaying objects in locked cases away from inquisitive fingers, and storing them under secure conditions when not on display.
- Museum objects should not be used in 'hands-on' demonstrations for children or adults unless they have been tested for the presence of toxic or hazardous substances.
- Seek expert advice. There are many experts and authorities that can offer help in dealing with particular hazards. It is a good idea to cultivate such people and organisations in your own locality and get them interested in your museum.
- Remember, however, that authorities whose usual business does not involve dealing with museum objects are likely to have different priorities to yours. It is wise to weigh up their advice against what you believe are the proper purposes and practices of a museum.
- If you finally come to the decision that you cannot safely manage an object in your own collection, consider offering it to another museum where there are suitable facilities.

Hazardous Materials in Medical Collections

Sharps

Sharp instruments such as scalpels, knives, hypodermic syringes, etc. present the possibility of injury to museum workers. As this Fact Sheet will emphasise over and over again, an important key to minimising hazards is careful and thoughtful handling of objects. Nevertheless, if instruments are not in their original protective packaging, some conservators place small blocks of archival foam over their pointed end. Of course there is always the possibility of injuring oneself while doing this. See also under 'Contaminated material' below.

Thermometers

Clinical thermometers may be considered a hazard because of the potential spillage of mercury if a thermometer is broken. As well as handling them carefully, it is a good idea to store thermometers in padded boxes if they do not have their original protective packaging. Some conservators use archival cardboard and foam to make boxes.

Contaminated material

Museum workers sometimes worry that surgical instruments and other medical implements or appliances might have remnants of human tissue or body fluids on them. They are concerned about the possibility of contracting a disease if this human material is infected with pathogens like HIV, hepatitis, etc.

The first thing to be said here is that all manner of museum objects carry traces of human usage. Art works and ethnographic objects, for instance, may be made from human blood, hair, bone, or urine. But as well as these obvious examples, think of the different objects in a general collection that may have been, at some stage in their history, touched, licked, kissed, wiped, fondled, shed on, sat upon, spat on or accidentally bled or vomited on. There is always the possibility that these carry remnants of human material and pathogens. Medical implements differ only in that the possibility of infectivity may be somewhat higher.

So the important thing to remember is that all museum objects, whether medical or otherwise, should be handled with caution and gloves should always be worn to protect the handler.

With most pathogens (including, for example, hepatitis viruses) the danger of catching a disease from soiled material passes within a matter of weeks of the object being soiled. Some bacteria can survive for years, however, including anthrax and tetanus. Generally a disease of animals, anthrax can infect humans through the skin, or by ingestion or inhalation. Anthrax vaccines are available for people who work with live animals or handle animal products (such as animal hair).

It is advisable for people working with any kind of museum object to keep their tetanus booster shots up to date. This is especially important for older people, because they often neglect to have their 10-yearly boosters. Tetanus bacteria generally enter the body through a puncture wound or scratch – a particular reason why any type of sharp or pointed object should be handled with care.

One type of pathogen that remains infective virtually forever is the prion. These are the agents responsible for several neurodegenerative diseases in mammals, including Creutzfeldt-Jakob disease (CJD) and ‘mad cow’ disease. But because prions are transmitted through eating or inoculation there is little if any likelihood of contracting these diseases from soiled museum objects.

Nevertheless, your museum staff may be so concerned about implements that appear to be soiled, that they would like to have them sterilised. In this instance you could approach the sterile processing department of your local hospital where they may be happy to help you by sterilising your objects. But before you decide to do this there are some matters you should consider carefully.

Firstly, you need to be aware that the hospital will have different priorities from a museum. Their rigorous cleaning and sterilisation procedures for modern surgical instruments are likely to be far too harsh for your museum objects and might cause them damage. Hospital decontamination procedures are described in Reilly (1991). See M&G NSW Fact Sheet [Hazardous materials – Written reference list](#)

Secondly, is it worth obliterating the evidence of usage from an object? Might it not be important to preserve traces of the object’s history? Is the danger of infection so great that it cannot be managed by careful handling of the object? These are matters that your committee needs to discuss before deciding on whether to get items cleaned.

One sterilising treatment that is less likely to damage instruments is gamma irradiation. ANSTO ([Australian Nuclear Science and Technology Organisation](#)) operates a number of gamma irradiation facilities that can process museum items. Objects can be irradiated through a museum’s packaging and do not need to be directly handled by ANSTO staff, thus minimizing the risk of accidental damage. However, the high dose of radiation needed to sterilise items that are not ‘clean’ in a microbiological sense may affect polymeric materials (e.g. plastics) and organic material. The price for irradiation depends on the quantity of material and the dose needed.

There are also three commercial gamma irradiation facilities in Australia, owned by [Steritech](#) Pty Ltd, in Sydney, Brisbane and Melbourne.

Drugs and medications

Pharmaceutical collections may contain items that pose a hazard to the rest of the museum’s collection. For example, some have the potential to stain or damage nearby objects if they leak or their packaging is damaged. Some may be flammable and so should be stored in cool conditions appropriate for flammable substances. Their containers should be sealed, as described below, to prevent evaporation or spills.

Of course, items in pharmaceutical collections are also hazardous for humans. All medications and remedies should be regarded as having the potential to cause harm if they are used excessively or inappropriately, and some may be particularly toxic or addictive. Therefore, medications in a museum collection have the potential to cause harm if someone gets it into their head to ingest them.

Pharmaceutical products are now classified on a Poisons List under the [Poisons and Therapeutic Goods Act](#). Regulations may vary from state to state but in NSW this Act is administered by the [Pharmaceutical Services Branch](#) of the NSW Department of Health. The products that are likely to worry museum custodians include Schedule 4 (prescription drugs), Schedule 7 (dangerous poisons), and Schedule 8 (drugs of addiction).

Amongst the ingredients of old pharmaceuticals and patent medicines there are also likely to be addictive substances that were previously not prohibited. Opium and/or alcohol, for example, can be found not only in Tincture of Opium but in remedies such as laudanum, Paregoric and Chlorodyn, as well as cough mixtures, tonics and baby soothers. Other old remedies, including general tonics and homoeopathic tablets, may contain poisons like arsenic and strychnine. Some, including skin creams and antiseptics, may contain mercury.

Before any decisions are made about dealing with items like those described above, it should be remembered that drugs and medications are preserved in your collection because they have scientific or historical significance. They have been collected in order to study and illustrate the history of therapy and pharmacy. It is hardly ever essential to destroy or dispose of these items or to empty their containers, even if they are hazardous. Other courses of action should be considered before any drastic measures are taken.

In NSW it is not an offence to keep Schedule 4 (prescription) drugs in a collection (although it is an offence to **supply** them). Strictly speaking it is an offence to keep Schedule 8 (addictive) drugs. If you are concerned about this, the Pharmaceutical Services Branch of the NSW Department of Health can issue your museum with an authority allowing them to be retained.

Nevertheless, some museum custodians, when concerned about keeping potentially dangerous or prohibited medications, decide to remove substances from their containers and display only the containers. It is debatable whether this is an appropriate action to take. Visitors to historical displays of medicines are interested in whether the contents of jars and bottles are real, particularly whether now-illegal drugs like laudanum are real. The circumstances under which substances became prohibited form part of the history of your collection. Visitors derive a sense of satisfaction from knowing that the objects they are looking at are genuine and complete because, after all, museums are places where people come to see real things. For these reasons, you should give serious thought before making any decision to separate contents from their containers. A thoughtful discussion of pharmaceuticals in museum collections can be found in Kondratas (1991). [See the M&G NSW Fact Sheet, [Hazardous materials: Written reference list](#)]

If you make the decision to keep the contents of bottles, you could consider sealing them to prevent evaporation of the contents and to prevent spills that might happen if they are accidentally tipped over. Some conservators use silicone sealant for this, diluted with petroleum spirits so that it can be injected under the lip of the lid with a syringe.

Of course it is important that all pharmaceuticals be displayed and stored securely, where unauthorised hands cannot get at them. They should be stored and moved carefully to minimize the risk of accidental breakage. They should be handled safely and gloves should be worn. Particular care should be taken with powders - all powdered substances in museum collections should be considered potentially harmful if ingested or inhaled.

If in the end you decide that emptying contents or disposing of whole objects is your preferred option, this must be done responsibly. Contents must not be emptied where they will pollute the environment and substances in containers must not be discarded where others might find them. The Pharmaceutical Services Branch of the NSW Department of Health can arrange for disposal of items.

The Pharmaceutical Services Branch administers the Poisons and Therapeutic Goods Act in NSW. The Duty Pharmacists there will give advice on medications and drugs in your collection, including those that may be harmful, and can advise on methods of safe storage. If you request it, they can issue an authority for your museum to be in possession of pharmaceuticals (see contact details in M&G NSW fact sheet, [Hazardous material assistance and advice organisations](#)).

Picric acid and other explosives

One particularly dangerous substance that turns up in medical collections is picric acid. This compound is used in the manufacture of explosives, dyes and insecticides. It is also an efficient antiseptic and this is why bottles of picric acid are often found in first aid kits dating from the 1930-1940s or earlier.

Picric acid is toxic and an irritant to skin and eyes. It is flammable in liquid form but it evaporates away leaving crystals that are highly explosive. These crystals form even more explosive picrate salts if they are given the opportunity to react with concrete or metals, such as the metal lids of bottles. Crystals may form in the threads of screw-on caps. Picric acid and picrate salt crystals can be detonated by heat, impact or friction. Stories of museums and school chemistry labs blowing up may be apocryphal but all authorities warn that picric acid is explosive when dry and some refer to instances where people's hands have been blown off when handling dried-out bottles of the substance.

If you find a bottle of picric acid in your collection, you should leave it where it is while you seek help. It is important not to shake the bottle, drop it or try to take the lid off.

The NSW Fire Brigades can assist with the disposal of picric acid and your local fire brigade will respond if you ring the emergency telephone number 000. The normal procedure for fire brigades is to take the bottle of picric acid away packed in sand and blow it up in a safe place (such as the local tip). This has happened with several Australian museums where picric acid has been found in collections.

However, as a museum, you would presumably prefer to maintain the integrity of your first aid kit by at least retaining the picric acid bottle if not its contents. If you call the Fire Brigade you need to stress this at the outset. They will probably cooperate by using a water spray bottle to dissolve the crystals before disposing of them and returning the empty bottle to you. Better still, you should first seek advice from the Hazmat Officer at the NSW Fire Brigades (see contact details in M&G NSW fact sheet, [Hazardous material assistance and advice organisations](#)).

Information about the potential explosiveness of gauze burn dressings impregnated with picric acid is hard to find but, once again, advice can be sought from Hazmat if you find these in your collection.

Ether, an anaesthetic common in old medical kits, is another substance that forms explosives as it breaks down or evaporates. Seek advice from Hazmat.

Radioactive material

Items associated with the therapeutic use of radioactive materials are sometimes found in museum collections. From 1900 onwards the radioactive and extremely toxic substance Radium-226 and the radioactive gas Radon-222 were used to kill tumours. A highly informative explanation of radioactive sources in medical museums can be found in Frame (1991). [See M&G NSW fact sheet, [Hazardous materials – Written reference list](#).]

The 'sources' of radium and radon are potentially hazardous. Radium-226 sources include needles for inserting directly into tumours, tubes for placing inside body cavities, and small plaques. There are also small 'seeds' enclosing Radon-222 gas. These different sources were often prone to leakage either of radium itself or the by-products of its radioactive decay. Leaking sources can contaminate their surrounds. They pose a serious health risk and can endanger entire museum collections.

Less likely to be hazardous are the applicators or moulds into which these radioactive sources were sometimes placed. They came in different shapes to fit different parts of the body and were made of clay, metal, wood or plastic. Normally applicators are not radioactive unless a source has been inadvertently left inside or contamination has occurred from a leaking source.

Quack cures are another kind of radioactive item that can turn up in medical collections. From early in the 1900s to as late as the 1960s, manufacturers promised cures for all kinds of ailments with their patent radioactive water, drinks, and tonics; radium and uranium water 'vitalizers', 'revigorators' and 'ionic chargers'; radon 'generators' and 'emanators'; and radioactive pads and trusses. Often these health cures contained 'Rad-' or 'Radi-' in the title. While some of the cures contain virtually no radioactive material, others contain substantial quantities. More recently, in the 1980-1990s, a Japanese company produced a uranium-coated NAC (nicotine alkaloid control) plate for 'denaturing' harmful elements in cigarettes.

In all cases where a museum object is suspected of being radioactive, assistance is available from the Radiation Control Section of the [NSW Environmental Protection Authority](#). Staff there can help determine if an object should be considered dangerous and will advise on safe handling, storing and displaying of radioactive items.

It is acceptable to retain low-level radioactive material in your collection. However, in some cases health and safety issues will outweigh considerations of an object's historical significance and disposal may be necessary. The Radiation Control Section can assist with disposal.

On display cases in which radioactive items are exhibited it is wise to place a notice to the effect that 'radioactive material is enclosed'. Since it is only low-level radioactive material that you would be displaying, this notice does not need to be alarmist or obtrusive. Radioactive material in storage should be labelled with information for museum workers (as should all potentially hazardous material in museum collections). After handling radioactive objects and before eating, museum workers should wash their hands and face. Better still, gloves and mask should be worn and then discarded.

X-ray equipment

While X-rays have a cumulative deleterious effect on health, X-ray machines only present a hazard when switched on. They do not contain any residual radiation and only emanate X-rays when turned on. Strictly speaking, X-ray machines that are operational should be licensed through the Radiation Control Section of the NSW Environmental Protection Authority, which administers the NSW Radiation Control Act. If you have an X-ray machine in your collection you might consider disabling it or removing its electrical power cord if this can be done without compromising its integrity.

Advice can be sought from the [NSW Environmental Protection Authority](#). Remember that whenever you contact an authority whose usual business does not involve dealing with museums, it is wise to explain the special needs and practices involved in managing a museum collection.

Fluoroscopes are X-ray machines in which the image is not stored on film but displayed on a fluorescent glass screen. Since the invention of fluoroscopes, many different substances have been used as the coating on fluorescent screens. These coatings do not contain any radiation. However as the devices age the coatings may start to flake off as a yellow or white powder. As with any powdered substances, these powders should be considered as having the potential to be chemically toxic if ingested or inhaled. Gloves and masks should be worn when handling fluoroscope screens.

Lead

Lead can appear in many different items in museums, but in medical collections it is most often seen in radiation shields including X-ray shielding screens, aprons and gloves. If lead is solid it can be handled freely as long as gloves are worn - preferably disposable gloves that can be thrown away afterwards. However, if it has deteriorated so that it is powdery or friable, the greatest likelihood of lead poisoning is by inhalation. Items in this condition are handled with particular care by conservators wearing masks, who either package them to contain the lead dust or consolidate them to prevent the dust leaving the surface.

Anatomical specimens

Anatomy and pathology specimens preserved in fluid present a number of hazards although the preserved body parts themselves are generally inert and unlikely to be infective. Older specimens may be preserved in formaldehyde (formalin), now recognised as a carcinogen, in alcohol, or in other substances about which little is known. While newer preservatives are generally safer, even some of these have been found to be carcinogenic.

The newer types of jars in which the specimens are kept are usually made of Perspex, but older ones are glass and likely to have sharp edges that present a hazard to people handling them. In addition, the black, tar-based sealants holding the lids in place can be carcinogenic.

Once again the key to risk reduction is careful handling. Gloves should be worn when jars are being moved (latex gloves to prevent the jar slipping from your hands, not cotton gloves). Jars should only be handled in a well-ventilated area to minimize the likelihood of breathing in vapours. In laboratories specialising in anatomy and pathology collections, the jars are handled on ducted workbenches by people wearing laboratory coats or aprons.

Be aware that alcohol is highly flammable and formalin is also flammable, but to a lesser extent. Strictly speaking these specimens should be treated in the same way as bulk flammable chemicals and stored in cool, vented, fireproof storage areas.

Documenting and Labelling Hazardous Objects

Information about the hazardous (or potentially hazardous) nature of an object should be kept in two places - as part of the documentation of the object in your museum database or catalogue, and on a label attached to the object itself. Paper or Tyvek® tags are usually suitable for labelling objects.

In these same two places, there should be advice about safe storage and handling of the object, the correct precautions for accident prevention, and the action to be taken in the event of an accident. As well, details about any treatment the object has been given should also be recorded (for example, if the contents of a bottle have been discarded and replaced with a harmless substitute, or if an instrument has been sterilised).

In this way, handlers of an object are alerted to any possible hazards, and resources are not wasted treating objects that have already been treated.

Preparing a Hazard Management Plan

Strictly speaking, all museums should undertake comprehensive surveys of their collections to identify hazardous materials. Based on this survey, they should prepare a Hazard Management Plan for hazard monitoring and management. The plan should also cover new hazards, including hazards as they are discovered in the collection, new objects as they enter the collection, and incoming loans. In practice such an exercise is extremely time-consuming both for museums with large collections and for small museums that do not have conservators on staff. Wain (1992) acknowledges this problem but describes the approach taken by the Museum of Victoria. See M&G NSW fact sheet, [Hazardous Materials -Written reference list](#) for details.

Workplace Health and Safety Legislation

Under the [Work Health and Safety \(WHS\) Regulation 2011](#), employers must consult with employees on matters affecting their health, safety and welfare. This is a requirement that all museums need to be aware of because it means that they will need to have systems in place that provide meaningful and timely consultation on a range of matters, including new and existing acquisitions that are potentially hazardous (including manual handling risks).

The WHS Regulation 2011 takes a risk management approach to WH&S, requiring systematic hazard identification, risk assessment and risk control of the existing work environment, work practices and systems of work. Under the WH&S regulation, specific attention must be paid to: fall prevention, electricity, asbestos, working spaces, lighting, heat and cold, noise, atmosphere, working at heights, fire prevention, confined spaces, hazardous substances, hazardous processes, manual handling, appropriate supervision and training, and first aid and emergency response.

[WorkCover NSW](#) can provide advice on WH&S legislation, hazard management, and other matters to do with workplace safety (see contact details in below).

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This Fact Sheet was written by Megan Hicks, Curator of health and medicine at the Powerhouse Museum, while on secondment as a Regional Services Officer at the Museums and Galleries Foundation of NSW in 2002.

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Peter Stacey, Hazmat, NSW Fire Brigades

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Museums & Galleries of NSW Fact Sheet Hazardous materials – Written reference list

<http://mgnsw.org.au/sector/resources/online-resources/risk-management/hazardous-materialswritten-reference-list/>

ANSTO: Gamma irradiation and dosimetry services

<http://www.ansto.gov.au/BusinessServices/irradiationanddosimetrieservices/index.htm>

NSW Legislation: Poisons and Therapeutic Goods Regulation 2008

<http://www.legislation.nsw.gov.au/#/view/regulation/2008/392/whole>

Museums & Galleries of NSW fact sheet, Hazardous material assistance and advice organisations

<http://mgnsw.org.au/sector/resources/online-resources/risk-management/hazardous-material-assistance-and-advice-organisations/>

NSW Legislation: Work Health and Safety Regulation 2011

<http://www.legislation.nsw.gov.au/#/view/regulation/2011/674>