Access and the Consequences of Damage

Introduction

This paper presents a brief outline of part of a study being undertaken for the degree of MPhil in Conservation with the Royal College of Art and the Victoria & Albert Museum, London

Conservation may be seen as the management of damage and all conservators will recognise that the requirement for access to collections lies at the heart of their work. The *raison d'etre* of museum collections is to provide information and in palaeontology collections this demands access at many levels, from molecules to mammoths, and commonly with a high degree of intervention. Whether or not a balance is achieved between the level of accessibility to the collections and the information they hold, and their preservation might be assessed by considering the damage which results from access and its consequences.

Risks and Damage

The risk assessment technique developed by Waller (Waller, 1994, 1995), provides a quantitative analysis of risks through the calculation of Risk Magnitude (MR) as the product of Probability x Fraction Susceptible to the Risk x Loss in Value. The resulting figures mean little on their own and the value of Waller's technique relies on the comparisons of Risk Magnitudes. However, much depends on the parameters chosen and how the value of collections is viewed. The consequences of the identified risk tend to be defined as a far from tangible loss in value and are presumed to be negative and synonymous with damage. This may not always be the case. The three key events in the damage process are the Risk, the Failure Event, and the Consequences. Damage is not a measure of loss in value although loss in value may be one of the consequences of damage. In fossils, damage is the normal state and as Ashley-Smith (Ashley-Smith, 1995) observed, perceptions of damage in an object vary from one observer to another. Equally some actions or situations, perceived by some to involve risks, may have a beneficial outcome and the consequences are not always negative.

Consequences

"Accidents" are very specific and acute failure events which result in damage to people or objects. Working in occupational health studies of accidents in the furniture industry of Finland, Aaltonen et al (Aaltonen et al, 1996,) have produced a model based on two premises which are readily transferable to the field of conservation and its management:

Information about the consequences will motivate the prevention of accidents.

and

The information on the controllable accident costs will affect the motivation of the top management to invest in accident prevention.

The Ten Agents of Deterioration

An issue by issue guide to the risks facing museum collections

2. Flood

Introduction

This is the second part in our pull-out guide to risks facing museum collections. In this issue we look at Flood. The following 3 articles describe different causes of flood. All these incidents occurred recently and we are grateful for the contributors putting 'pen to paper' whilst still most likely mopping up!

Whilst there are various preventative measures one can take, and a disaster plan in place, often the flood itself will trigger different measures for the emergent removal and protection of the specimens. Sally Ann Yates offers some useful advice on effective salvage methods.

The next issue will deal with 'Pests'. Articles are invited on experience of breakouts, control methods and conservation of damaged specimens. Please also note the 2 events at The NHM and The Conservation Centre featured on page 5 of this newsletter.

Donna Hughes

Burst pipe at Hampshire County Council Museums Service, 6th January 1997

A Happy New Year, especially to our site manager at Chilcomb House in the form of a burst pipe in the loo in the Old House store, situated near the front entrance. Above the burst is a small storeroom with paintings, some prints, drawings, ephemera and books. Water flooded behind the old-fashioned fuse box but did not seep into it. Both water supply and power were turned off before anyone entered the building! Water also flowed into the corridor and seeped through into stores, through carpets and under doors. Luck was on our side, however, a further one hour of incoming water would have started to affect the nearby main store for prints and ephemera.

As usual, prompt action saved nearly all the material - emergency lighting was set up using an on-site petrol generator since no mains electricity or lights could be used. Puddles were vacuumed away and staff quickly removed artefacts to safe and dry stores. Bubble-wrapped paintings were immediately unwrapped to remove trapped water. These were slightly moist and could simply be blotted dry - a few more hours and they would have required extensive drying and conservation. The affected area itself and moist objects were not warmed due to likelihood of warping. Instead, sheets of blotting paper were used to draw moisture out of the worst affected items and portable de-humidifiers were quickly installed. The air-drying programme was entirely successful.

The casualties were two school photographs and some unimportant picture frames whose gesso became detached. The silver linings to this cloud were not only the prompt discovery of the flood, just in time forestalling a more serious disaster, the water bypassing the fuse box but also a review of the plumbing, electricity and other services to this building. We hope that these will be renewed with an up-to-date system as soon as possible.

Simon Moore
Hampshire County Museum Servicee

Flood in the Biology Stores at Bristol Museum

During autumn and winter months of 1996 the Bristol City Museum & Art Gallery suffered a series of floods. This report concentrates on the first and largest of those floods in the biology stores and discusses how techniques were developed for dealing with subsequent floods.

Background information

On the morning of Sunday 29th September a roof gully area was discovered, by patrolling security staff, to be flooding. The rain had been heavy for several days and the gully drains had been blocked by debris. The water had reached a depth of 2 ft in places and was flooding into the adjoining Geology store. The museum has a disaster plan and the Conservation Manager was called out to supervise this emergency. The Fire Brigade found the gully difficult to access and were unable to pump the water out. Subsequently, contractors cleared the blocked drains by rodding, thus releasing a huge volume of water into the drainage system.

What caused the flood in the biology store?

The water gushed through the drainage system at high pressure

until it hit another blockage (or was it the original blockage which had been pushed further down the system?). The majority of the water then exited through an unsealed drain cover located in the biology store. The Conservation Manger left, after the initial flood had been cleared, to check the basement stores and found that the Biology store was flooded to a height of about an inch throughout, with significant seepage into two adjoining stores.

Why did the drains block?

- The pipe diameter was reduced by a slow build up of lime scale or concretions, particularly where two sections of pipe are joined.
- The heavy rains washed leaf litter, general dirt and pigeon debris (possibly including a carcass) off the roof areas into the drains causing further obstructions.

Immediate action

The museum was closed and all staff on site helped. As it was a Sunday, collections staff were contacted from the emergency call out register, which lists who to phone when different areas of the museum are affected. Where possible, objects at risk were moved away from the water. The clean up operation was organised by the senior staff with specialist collections staff advising on their particular stores and additional help from front of house staff. The bulk of the water was directed to an un-blocked drain situated nearby. A chain of people with brooms and mops was formed, and the water from the biology store, was released by opening and closing the main door, thereby controlling the volume of water sent to the drain. The main aisles in the biology store were cleared of water within three hours, however water leaking from under cabinets and in hollows of the uneven floor, remained for most of the day. A few support people were essential to phone extra staff and equipment suppliers, and to bring in food and drink for the hot and exhausted team. After a while, it was easier to leave the floor to dry by evaporation through the action of dehumidifiers.

Equipment used

Some useful equipment was already stored nearby in our 'disaster cabinets'. Wellies, polythene and rubber gloves were needed (especially as sewage contamination was suspected). Wet vacuums were essential for tackling deep water. Once the level of water was down to a few centimetres we used mops, brushes and disinfectant, all of which were conveniently accessible from the cleaners store. Corrugated cardboard was used to make the floors less slippery and for drawing water out from under cabinets. Equipment such as mop heads had then to be discarded due to possible sewage contamination. It was essential to set funds aside to restock on emergency equipment.

We found the following items useful in tackling subsequent floods. Rubber "squeegees" (large windscreen wipers on poles) were very useful for directing water. Also planks of wood with a rubber/plastic cover along three sides were placed as barricades and were used as impermeable props for wooden furniture. Sandbags, supplied by contractors, were also used. Later more powerful wet vacs were purchased.

Extent of damage

After such a dramatic flood we were very lucky to have sustained relatively little specimen damage. This was mainly because we had a disaster plan and most of the biology collection was already raised off the floor by various means. Some cabinets are placed on wheeled metal trolleys and other cabinets have large ornate feet or deep scuff boards which raise the bottom of the cabinet. The worst casualties were items which were stored directly on, or close to, the floor. These were a case backdrop painting by a well known Bristol artist, three large elephant skulls and three herbarium specimens. The damaged painting was treated immediately by the Paintings Conservator by facing the paint with tissue and placing it inside an improvised humidity tent. Because of this quick action only 15% of the painting was damaged and that is treatable. The herbarium specimens were assessed by Paper Conservators and placed between blotting paper to dry. The elephant skulls were moved to benching and allowed to dry at the same rate as the rest of the store. The greatest amount of damage was to materials such as empty boxes, bubble wrap and polythene, these were potentially contaminated by sewage and had to be discarded. Without the specialist knowledge and vulnerable object assessment from the collections staff on site, the specimen damage could have been much worse.

What happened next?

Three industrial dehumidifiers were used to slowly reduce the 80% relative humidity. General dampness, rather than direct contact with water, was a concern.

The Natural History galleries

The flood originated in the main natural history gallery, where more than 280 specimens of taxidermy were displayed. Around 300 more mounted mammals were stored under cased displays. It took some time for the news to "trickle down" to the Natural History curators. By the time I learned that our gallery was affected, the Fire Brigade had arrived and were wrestling with a powerful jet of water spraying horizontally from a wall. The water on the floor was visibly spreading and rising. I was unaware then of how rapidly it was draining into lower floors of the building.

Specimens stored in cupboards under display cases appeared to be most at risk, as the water rose almost to the level of the first shelf (10 cm). Initially, I was the only member of staff available to begin moving these specimens to the safety of nearby offices. A colleague soon joined me, but it took an hour before any further help was available. (Most of the staff were part of a human chain rescuing paintings from stores below). Despite the obvious risk to the specimens of being handled, the risk from the rising water seemed greater. We removed all the undercase specimens to nearby offices but left the displays intact.

After the flooding stopped, Natural History curators, the Head of Collections and the Principal Conservator discussed the best course of action to safeguard the specimens on display. The dioramas that received the direct force of the water jet contained polar bear, reindeer, musk ox, arctic fox and a rather grubby lemming.

There was no obvious sign of wetness inside the cases: these 1970s dioramas were built to last! We decided that the risk to the diorama specimens from hurried handling would be greater than leaving them in their cases. We opened the gallery windows, installed a portable dehumidifier and left the gallery to dry.

The next day, we removed the case fronts of the dioramas to allow any moisture to evaporate. There was no sign that water had got into any case, but the floorboards beneath were still wet. Our initial examination showed that only two specimens had become noticeably damp, a deerskin and a polecat. I had overlooked their store cupboard when we cleared the gallery. Dampness had seeped up from the floor and the closed cupboard door prevented evaporation.

The Assistant Director decided almost at once not to reopen the Natural History Galleries. The galleries were soon to be closed anyway for refurbishment and to accommodate new interactive science exhibits. The flood brought forward gallery closure only by four weeks. We decided to use two galleries unaffected by the flood for temporary storage of mounted mammals from the store cupboards. We have now fitted out an office with shelving and will pack and move the specimens there shortly. At the same time, a specialist natural history conservator will assess the condition of taxidermy specimens.

Other collections

At the height of the flood, most efforts were directed to the rescue of some 300 paintings from a picture store below the Natural History Galleries. Staff formed a chain to move paintings to safety. The cascade of water from the ceiling of the picture store damaged the plaster. Soon, staff were in some danger of being hit by failing sections. They also found themselves working in near-darkness as there is no natural light in the store and no emergency lighting.

The wet pictures were leaned against walls around the galleries and allowed to dry out overnight. Most of the paintings were glazed and backed. Consequently, damage proved to be mainly to the frames rather than to the canvasses.

The archaeology collections in the basement were also affected by the flood. Fortunately, little sensitive material was stored there and the damage has mainly been to furniture and to the fabric of the walls, floors and ceilings.

Apres la deluge

The museum remained closed the day after the flood, but it took only a few days for most of the public areas to be re-opened. Three natural history galleries will remain closed for the summer. One art gallery is temporarily fitted out with racking whilst the damage to the picture store is made good, and also is still closed.

The local media showed enormous interest in the incident, especially in the dramatic rescue of the paintings. The publicity has been mainly positive, emphasising the dedication of staff and the effective way in which the museum coped with a crisis.

The public have expressed considerable disappointment at the closure of the natural history

galleries. Although no real damage occurred to displays, the wooden floor of the affected gallery began to lift as it dried out. Four weeks later, the raised floorboards are a minor hazard and still appear to be moving.

What have we learned?

1. The prompt action of staff meant that little serious damage has occurred to specimens or paintings. Had the incident occurred at a weekend or overnight, however, the potential damage was considerable.
2. The museum is reviewing the need for high pressure fire hoses in the building, particularly as the water authority and not the museum controls the stop valve.
3. The large quantities of water made ceilings unsafe.
4. Sturdy cases, raised off the floor, protected Natural History specimens from the immediate effects of the flood. Had specimens been on open display, they would have been badly damaged, many probably destroyed.
5. The museum's management team is gathering comments and feedback on the incident from staff. The museum's disaster plan will shortly be reviewed in the light of experience gained by the flood.

Gabriela MacKinnon
Birmingham Museum

Editor's Note
Following their flood, Bristol are thinking of purchasing absorbent water protection cushions. These are thin pillows which, with a dry weight of 400 grams, can absorb 23 litres of water in 3 minutes. *Spirebourne Ltd* who sell this product (Sorbarix®A20) can provide more information; tel/fax: 01428 644483. I would be interested in hearing from anyone who has used this product.

Some Considerations on Water Damage to Museum Collections

Disaster pre-planning is vital to ensure that damage to artefacts is kept to a minimum and that environmental conditions are stabilised as soon as possible. Risks need to be evaluated and a contingency plan carefully developed to reflect the needs and characteristics of the collection(s) and building(s) (ref.1 + 2). One of the greatest risks to Museum collections is water and the following are some ideas for consideration when assessing risks and salvage operations for museum collections.

Water in disaster situations is often primarily considered in terms of its relationship with fire. Indeed, the major damage to objects can be caused by the water used to extinguish the fire, rather than the fire itself. Of course, water damage can occur totally in its own right, arising from leaking roofs or gutters, burst pipes or even a tap left running.

Water may rise or it may fall. Storing and displaying objects away from floor level is an immediate advantage for protection against flooding. If water is rising, lower shelves can be emptied first, or the bottom drawer of a plan chest or cabinet may be emptied or removed, together with its contents.Take care that cabinets or shelves do not become top heavy and unstable. If water is falling, polythene sheeting can be useful to create a barrier and direct water away from objects.

If items are enclosed within a container - e.g. a cabinet, box, display case or frame, considerable protection can be offered against water ingress. The containers need to be solid enough to withstand water penetration and display cases need to have reliable ceilings. Boxes made from good quality card will protect their contents for a surprising length of time. Of course it depends on the quantity of water involved, as most materials and constructions used for Museum storage and display cannot withstand submersion. Call out procedures by which staff can be contacted on a 24 hour basis are vital - the faster objects can be salvaged and treated the better.

Floors below the flooded area must be checked and areas cleared or sheeted over as a precaution until the flood has been fully cleared up and the source dealt with.

Humidity in flood situations can be

a great problem. Reducing the temperature in the area can help control rises in Relative Humidity. Ensuring speedy access to dehumidifiers, aquavacs and pumping equipment is important. Many types of object can be adversely affected by high RH levels, for example : metals, archaeological material, paper, photographs, plant specimens, skins, wood and plant models made fully or partly of celluloid. Materials react differently depending on their particular characteristics and prevalent conditions. Damage may be by swelling, warping, distortion, corrosion, or blocking (e.g.swollen paper or photographic emulsion adhering to the glazing of its frame). These states will leave the objects even more vulnerable to physical and chemical degradation.

Some items or their components may be soluble in water e.g. fungi, watercolour and manuscript pigments, mould damaged gelatine photographic emulsions and scales would become detached from butterfly wings. Fungi would also be damaged by high humidity or localised wetting , being then prey to the growth of other parasitic fungi. Some minerals may deliquesce and dissolve, such as halite; or change in nature, such as pyrite, which oxidises above 60% RH; high RH also causes compressional stress in outer layers of hygrostatic geological specimens (ref. 3). Items from seed collections can change in appearance as well as the internal chemical make up and possibly prove impossible to re-dry to their natural state.

An increase in acidity or alkalinity introduced to materials by flood water can produce irreversible changes to colour, density and material state. Water seeping through masonry can carry salts into the environment. The combination of high humidity and pollutants from materials like wet wood or dust can exacerbate corrosion problems for metals.

Salvage areas (i.e. areas where wet items are moved to for treatment and packing) should be carefully chosen so that unaffected collection material is not endangered by rising humidity levels.

Where water is used to combat a fire, hazards can include shattering of materials being too rapidly cooled, such as marble or glass.

Air drying alone can cause objects to retain water borne contaminants, therefore immersion in clean cold water may be necessary to remove surface deposits and pollutant components which may have been absorbed. Of course this must be evaluated according to the type and nature of the objects in question.

Although air drying offers the greatest control (one may consider reducing the RH slowly by use of microclimates), freezing followed by controlled thaw or freeze drying are options for many forms of organic material. Freezing can be useful to create time if there are too many items for conservators to control dry before further damage takes place, or other factors such as mould growth asserts a presence. Careful wrapping is necessary in clear polythene with all openings sealed using polythene tape, parcel tape or heat sealing (ref.4). Speed of freezing is critical to keep ice crystal size to a minimum. There are several disaster recovery companies in the UK, and appropriate telephone numbers should be recorded in the contingency plan (ref.5).

Supplies for emergency use should be identified and purchased, and where possible kept solely for this use. NMGM keeps stocks of blotting paper, polythene sheeting and gloves in major collection stores. There is also a back up store of a much larger range of materials, equipment and personal protective clothing. This store is kept in large sealed container trolleys which can be loaded onto a van and quickly transported to the emergency site.

Sprinkler systems provide early fire supervision and operates at the seat of the fire, controlling it while in its infancy and thereby enabling a building to defend itself. New technology has introduced reliable systems with low maintenance requirement (ref.6).

Water detection systems are also useful where a risk of flooding is high and the systems range from a self contained battery operated unit to multi zone alarm detection which can be interlinked with the buildings existing security systems. (ref.7)

Health and safety must be considered. Water which may be in contact with electrical circuitry must be isolated - risks should never be taken. Other dangers may be present, such as slippery floors or contamination by sewerage or other contaminants which could cause diseases such as Weil's, which is spread by rats.

NMGM has suffered several floods during recent years. One example

being at the Museum of Liverpool Life, sited on the waters edge of the River Mersey, where a combination of springtime high tide and wind direction took waves over the dock wall to beat against the walls and windows of the Museum. Water penetrated through damaged pointing of the wall structure. Thankfully no objects were affected, the alarm being raised and removable objects taken to a safe area. Lessons learnt included provision of more sandbags and a strict procedure of closing the external window shutters at the earliest sign of danger. Building maintenance inspections have also been brought within a tighter time scale and a battery operated water detector has been installed.

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6. Focus on Sprinkler Systems, Fire Prevention 1992 (247), pub Fire Protection Association

7. AquaSentry - PMD Technologies Ltd, Cromwell House, Elland Road, Brighouse, HD6 2RG.

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Sally Ann Yates
National Museums & Galleries on Merseyside

The Great Red River Valley Deluge of '97

Museums in the Canadian Province of Manitoba have this year been intensely preoccupied with preparations against possible flood damage, as reported in the CAC (Canadian Association for Conservation of Cultural Property) Bulletin, Vol. 33, No. 2, June 1997. The flooding in the Red River Valley could turn out to be the worst in recorded history. The concern is not only the threat of overland flooding but also sewer backup.

At the Manitoba Museum of Man and Nature they were concerned that a flood backup augmented by heavy rain would cause flooding within the building faster than they could react to it. They decided to remove the thousands of artifacts out of the lower level storage below ground level. To this end four artifact removal teams were created from all available museum staff. Each team had twelve members comprising two supervisors (a conservator and a curator), two registrars to record artifacts as they were a) removed from storage and b) placed in temporary locations, respectively, and eight artifact movers. Half of the movers in a team worked in the lower level removing artifacts while the other half re-stored the artifacts in the upper levels. Each of the four teams worked a rotating half day shift and although five days had been allocated for the operation the bulk of the work was done in two and a half days. The museum now plans to use this opportunity to reorganise and upgrade the storage areas as the artifacts are moved back in place.

The Provincial Archives of Manitoba had no such need for relocation, as their records are stored on the second and third floors of the building. However, their concern was for the operation and general security of the building, as, if the basement flooding reaches over one foot the power must be shut off. Emergency power would not be adequate to maintain heating and ventilation nor day to day operations. In a very severe flood the powerhouse would be shut down and the electronic security system would fail! The Emergency Management Organisation would take charge at that point. Museum staff prepared a one page Emergency Plan for distribution to key government staff detailing people to be contacted and when.

The collection areas at Whinipeg Art Gallery are all below ground and when the seriousness of the

flood became apparent a dike was constructed around the Gallery and it was decided to evacuate the basement. A round-the-clock work plan was drawn up. The plan did not take into account the fact that in the event of the basement flooding the goods lift would not operate; it was realised therefore, that the plan would have to be enacted well in advance of flooding, and was begun immediately. Upstairs galleries, the staff lounge, the board room, the lecture hall and the meeting room were used for temporary relocation of collections. Much of the Inuit sculpture and decorative art collection was not moved due to fragility. The operation was completed in less than a week and monitoring of the basement by Engineering and Security staff was ongoing. Inevitably there would be disruptions to the public programmes and space rentals but the Gallery did not have to close completely and the operation resulted in a sense of collective 'ownership' of the collection with staff from diverse parts of the Gallery, for once, working together.

In the run up to, and throughout, this unsettling period the Manitoba Heritage Conservation Service (MHCS) has been preparing and offering help and advice to museums in the area., but fortunately, there have so far been no reports of flood damage. The MHCS is now developing a workshop for its clients on Disaster Preparedness, in readiness for the next challenge.

Tracey Seddon
National Museums & Galleries on Merseyside

The consequences are depicted in tree diagrams, Accident Consequence Trees, designed to be inclusive and comprehensive and extending a consideration of the accident phenomena and cost beyond the narrow view of personal injury, damage to property and loss in productivity (Fig. 1).

Not all the consequences will be relevant in all cases. Applied to conservation, this model takes us beyond the notion of damage to a specimen as the final and only outcome of the risk and failure event and suggests a more complete view of the consequences of accidents or damage. It also offers another view of losses and gains in value.

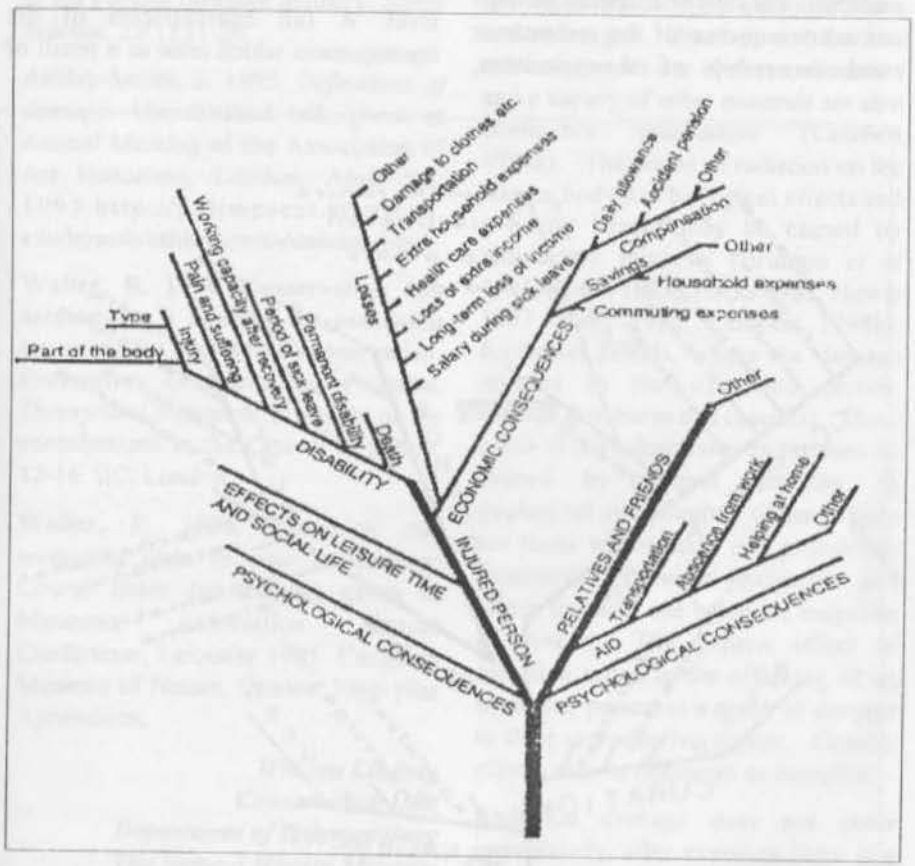

Figure 1. An example of the Accident Consequence Tree for an individual (Aaltonen *et al.* 1996)