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PREVENTIVE CONSERVATION: REDUCING RISKS TO COLLECTIONS
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SOURCES OF INFORMATION
FOR CULTURAL HERITAGE RISK MANAGEMENT

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AA: Author abstract

ICCROM: ICCROM abstract

RW: Robert Waller notes

SM: Stefan Michalski notes

A. Risk Management outside the heritage field

Books and articles

AS/NZS 4360:2004 : Australian/new Zealand Standard for Risk Management

2004, 28 pages, ISBN: 0-7337-5904-1

AA: Provides a generic guide for managing risk. It may be applied to a wide range of activities or operations of any public, private or community enterprise, or group.

Against the Gods: The Remarkable Story of Risk

Bernstein, Peter L., John Wiley & Sons, 1998, 400 p. ISBN: 0471295639

RW. A very well written and entertaining book about the history of risk. Its focus is on financial and particularly investment risk but is of general interest. It discusses the development of the concepts and mathematics behind risk analysis beginning with the earliest games of chance and proceeding through to complex computer-based investment strategies.

Cartographies of Danger: Mapping Hazards in America

Monmonier, Mark, The University of Chicago Press, Chicago and London, 1995, xiv+363pp.

Introduction to Decision Analysis, A Practitioner's Guide to Improving Decision Quality

David C. Skinner, Probabilistic Publishing, USA, 2001, 370p.

AA: Introduction to Decision Analysis is a practical, step-by-step guide to making better decisions. The book is designed for the practicing manager, technical professional, and decision analyst. The book provides proven techniques based on solid experience to help face complex, challenging, uncertain, and ambiguous choices. Decision analysis provides a process whereby all parties affected by the decision can be involved and participate in building a win-win solution. New to the second edition are: new thinking about uncertainty and ambiguity, Monte Carlo simulation, guides to implementing large projects, "How 2" guides, and full interactive integration.

How do societies manage risks?

Mileti D.S. and Peek-Gottschlich L.A., In: *Rational Decision-making in the Preservation of Cultural Property* edited by Baer N.S. and F. Snickars, Berlin: Dahlem University Press, 2001, p. 35-45. ISBN 3-934504-07-8

AA: Two fundamental approaches of societies in dealing with and managing the risk of losses from the occurrence of natural disasters are reviewed in order to raise questions and draw parallels for the preservation of cultural property from the yield of natural hazards. The two risk management approaches in the natural hazards field that are identified include dichotomizing risk and redistributing risk, costs, and losses onto others. These fundamental approaches are summarized and then related to how they result from the tendency of societies to adhere to the approach that most closely fits with the basic value system of that society, rather than the approach that might work best.

Probabilistic Risk Assessment and Management for Engineers and Scientists

Kumamoto, Hiromitsu, Henley, Ernest J., Institute of Electrical and Electronics Engineers, Inc. New York, USA, 1996

Risk Analysis and Society, An Interdisciplinary Characterization of the Field

McDaniels, Timothy and J. Small, Mitchell (eds.), Cambridge University Press, 2004

AA: This book provides an interdisciplinary and international characterization of the state of the art and science of risk analysis. Such an analysis is needed to ensure better management of choices concerning environmental, health and technology-based hazards that increasingly affect peoples' lives on an international scale. Including chapters by many of the world's leading risk researchers, this comprehensive work will provide insight into the scope of important social and technical issues that influence risks and their management.

The Logic of Failure

Dorner, D., Perseus Press; 1996, 222 p. ISBN: 0201479486

RW: This book describes the ways in which humans have difficulty in managing complex systems over time. In particular, the problems of maintaining a sense of priority in managing systems that provide little or no meaningful

and timely feedback about the effect of implemented strategies. This speaks directly to the difficulties in preventive conservation planning where the consequences of measures taken will usually not be known for decades, if ever.

The Psychology of Judgment and Decision Making

Plous, S.. McGraw-Hill Higher Education, 1993, 352 p. ISBN: 0070504776

RW: This book provides a very engaging and enlightening review of the ways we, as humans, make judgments under uncertainty. Heuristics (rules of thumb for thinking) and their resulting biases are explained. An interesting feature of this book is that representative questions, from many of the psychological studies referred to in the book, have been grouped together into a questionnaire at the beginning of the book. By completing this before reading the book, we can see to which fallacies we are subject before we are influenced by recently reading about a particular heuristic or bias. The book helps establish a sound perspective for considering the quality of our judgments in complex situations.

The rational manager; a systematic approach to problem solving and decision making

Kepner, C.H and Tregoe, B.B. Kepner-Tregoe, Princeton NJ. 1976

SM: A classic and readable book on basic decision-making using lists of pros and cons, etc.

The wisdom of crowds

Surowiecki, James. Doubleday, New York. 2004.

SM : A readable and entertaining book on how to get the best “collective wisdom” out of groups of people. Useful ideas for how to collect risk assessment expertise from museum staff. Explains when (and why) it is best to let individuals contribute prior to any group dynamics, and when (and how) to use groups in committees. Contains many of the elements that are more technically described in the literature on “eliciting expert opinion.”

Uncertainty, A guide to Dealing with Uncertainty in Quantitative Risk and Policy Analysis

Morgan, M. Granger and Henrion, Max, with a chapter by Small, Mitchell, Cambridge University Press, 1990

Web pages

Presidential/Congressional Commission on Risk Assessment and Risk Management, Final Report, 1997.

Download at <http://www.riskworld.com/Nreports/nr7me001.htm>

Risk Management, Australian/New Zealand Standard, AS/NZ 4360:2004.

Can be purchased online at www.saiglobal.com/shop/Script/search.asp . The glossary in its 1999 form, as well as a full training program, at <http://www.riskmanagement.qld.gov.au>

Institution of Occupational Safety and Health, Risk Management Toolkit

<http://www.iosh.co.uk/index.cfm?go=technical.details&scid=13>

Society for Risk Analysis (SRA)

Provides an open forum for anyone interested in risk analysis

<http://www.sra.org/>

Understanding Risk Analysis, American Chemical Society, 1998

<http://www.rff.org/rff/Publications/loader.cfm?url=/commonspot/security/getfile.cfm&PageID=14418>

United Nations International Strategy for Disaster Reduction

<http://www.unisdr.org>

B. Risk management within the heritage field - general

Books and articles

An integrated approach to risk assessments and condition surveys

Taylor, Joel, In: *Journal of the American Institute for Conservation*, Vol. 44, N. 2, 2005, p. 127-141, ill., ISSN 0197-1360

ICCROM: Discusses the integration of risk assessment and collection condition surveys, with reference to the uncertainties inherent in each of these two procedures. While condition surveys provide information on a collection's immediate condition, risk assessments add predictive aspects on the collection's potential for deterioration. Looking at probable causes of damage in a condition assessment can provide a link to the agents of deterioration examined in a risk assessment. Combining these two complementary assessments can provide useful insights and clarify priorities for the collection's management goals. Comparison of the advantages and disadvantages of two types of evaluation processes in visual perception, top-down and bottom-up, are discussed as they apply to the integration of the two assessments. Additionally, the article describes the use of an integrated assessment approach for a survey of the English Heritage collections. In conclusion, it was found that integrating condition surveys with risk assessments could increase the knowledge and understanding of current and future expectations of a collection.

Archival management: preliminary risk assessment

Halfen, Lawrence N., In: *The abbey newsletter*, Vol. 27, N. 2, 2004, p. 13-15, ISSN 0276-8291

Assessing the Values of Cultural Heritage: Research Report

de la Torre, Marta (ed.); Los Angeles: The Getty Conservation Institute, 2002, 123 p.

AA : This report covers the assessment of values and consultations with the stakeholders, and it explores methods already used in ethnography, geography, economics, and environmental conservation.

http://www.getty.edu/conservation/publications/pdf_publications/assessing.pdf

Assessment and management of risks to cultural property

Baer, N.S.; Baer, N.S. (ed.); Sabbioni, C. (ed.); Sors, André I. (ed.), In: *Science, technology, and European cultural heritage: proceedings of the European symposium, Bologna, Italy, 13-16 June 1989*, Guildford, Surrey: Butterworth-Heinemann Publishers, 1991, p. 27-36, figs. ISBN 0-7506-0237-6

AA : Formal computations of risk are now a common-place in the nuclear power and chemical industries. Similarly, those responsible for the preservation of cultural property in museums, libraries and archives are beginning to consider more objective decision-making procedures for selecting conservation options. The process whereby sources of risk are identified and quantified forms the discipline of risk assessment while the selection among alternative policies developed in response to that risk is known as risk management. Sources of risk to cultural property are identified and characterized. Examples of risk management for cultural property based on laboratory data, e.g. the setting of light levels for exhibitions are presented.

Care and preservation of collections

Michalski, Stefan, In: *Running a Museum: A Practical Handbook* edited by P. Boylan, Paris: International Council of Museums & UNESCO, 2004, p. 51-90

AA : Conservation and preservation literature can often seem to be dominated by huge (and ultimately unachievable) lists of things to do. One can become so busy following parts of this good advice that there is never time to stand back to see if this really is the best way to achieve the fundamental objective of preserving the collection. This chapter therefore adopts a recently developed way of viewing the preservation and conservation of collections as a whole, before focusing in on the details. At the same time, collection preservation remains an intensely practical business in which detailed practical advice is needed alongside this new way of thinking. Therefore this chapter also contains many practical examples and case studies (based on real events or an amalgam of real cases) drawing on the author's experience in surveying and advising museums, large and small, in many countries, including Egypt and Kuwait. Deciding priorities and assessing risks are among the topics discussed.

Climate Change and the Historic Environment

Cassar, May, London: Centre for Sustainable Heritage, university College London, 2005, 104 p.

AA : Commissioned in 2002 by English Heritage, the report and underpinning research provides a view on the potential impact of various climate change scenarios on a range of historic assets over time.

Conservation risk assessment: a strategy for managing resources for preventive conservation

Waller, Robert , In: Preventive conservation practice, theory and research: preprints of the contributions to the Ottawa congress, 12-16 September 1994 / Roy, Ashok (ed.); Smith, Perry (ed.); IIC. London: International Institute for Conservation of Historic and Artistic Works, 1994, p. 12-16, fig., table.

Conservation skills: judgement, method and decision making

Caple, Chris , London: Routledge, 2000 ; XIV, 232 p. : ill. ; 25 cm. ISBN 0-415-18881-4

ICCROM: An overview of the issues facing conservators of historic and artistic works. This extensive work not only describes the nature of conservation but also provides an ethical framework to which the conservation of objects as diverse as 'old masters' to the ephemera of the twentieth century can be related. Drawing on case studies of well-known objects such as the body of the Lindow Man, Michaelangelo's Sistine Chapel frescoes and the Statue of Liberty, the author addresses the following issues: perception, judgment and learning; reasons for preserving the past; the nature and history of conservation; conservation ethics; recording, investigating, cleaning of objects; stabilization and restoration; preventive conservation; decision making and responsibilities.

Cost/benefits appraisals for collection care: a practical guide

Cassar, M., London: Great Britain Museums and Galleries Commission, 1998.

AA : This book demonstrates how museums can move away from decisions based solely on cost, towards a more balanced assessment of benefits of different decisions. 2 case studies demonstrate the use of cost/benefit appraisals in conservation and collection care decisions.

Covering Your Assets: Facilities and Risk Management in Museums

Merritt Elizabeth E. (ed.); Washington D.C.: American Association of Museums, 2005, 203 p.

AA : Presents the results of a national survey on how museums develop, set and implement policy for facilities use and risk management. Featuring insightful essays on best practices from experts inside and outside the museum field, the book compares and contrasts the very latest data on how museums around the country operate their facilities, manage space and risk, and prepare for emergencies.

Cultural property risk analysis model: development and application to preventive conservation at the Canadian Museum of Nature

Waller, Robert R. , Göteborg: Acta Universitatis Gothoburgensis, 2003 ; XVI, 189 p. : fig., tables ; 28 cm. , (Göteborg Studies in Conservation, 13) , Doctoral Dissertation, Göteborg University. Institute of Conservation, Göteborg, Sweden ISBN 91-7346-475-9, ISSN 0284-6578

AA : A cultural property risk analysis model was developed to guide priorities for resource allocation to preventive conservation under conditions of uncertainty. This model recognizes the preservation system as a subsystem within a collection management system, which, in turns, nests within progressively broader systems. Within this set of systems and subsystems, the contribution of preventive conservation to the continuance and betterment of humanity is recognized. Carefully defining the scope of the preservation system ensures clear understanding of interactions with surrounding systems. The risk analysis model then disaggregates risk through hierarchies both of sources of risk and of divisions of collections. The level of technical risk analysis varies throughout these hierarchies depending on the potential significance of the disaggregate portion considered. This approach makes the entire modeling process as efficient as possible. This approach is applicable to all forms of cultural property. Its broader adoption will benefit the fields of preventive conservation, conservation research, and cultural heritage management.

Dalla carta di rischio archeologico di Cesena alla tutela preventiva urbana in Europa

Gelichi, Sauro (ed.) / Comune di Cesena. Assessorato all'urbanistica. Cesena, Italy , Firenze: All'insegna del giglio, 2001 ; 118 p. ISBN 19990305-19990306.

Defining suitability of museum galleries by risk mapping

Bradley, Susan , In: *Triennial meeting (14th), The Hague, 12-16 September 2005: preprints* / ICOM Committee for conservation. London: James & James, 2005, p. 574-581, figs., ISBN 1-84407-253-3

AA : In the British Museum, attitudes towards the exhibition of objects in museum galleries are changing. Adaptation of existing galleries can go ahead within tight financial constraints and without a feasibility study phase, limiting the opportunity for conservation specifications to be implemented and creating opportunities for new exhibits without considering preservation needs. To ensure that conservation concerns are taken into account, a gallery risk mapping exercise has been begun at the British Museum. Published work on risk assessment in conservation which has focused on objects has been adapted to nine environmental factors (temperature, relative humidity, ambient pollutants, particulates, visible light, ultraviolet light, vibration, and insect pests). The outcome will provide planners with the information to design object-friendly galleries.

Developing professional uncertainty

Ashley-Smith, Jonathan , In: *Tradition and innovation: advances in conservation*. Contributions to the IIC Melbourne congress, 10-14 October 2000 / Roy, Ashok; Smith, Perry (ed.); International Institute for Conservation (IIC). London, United Kingdom. London: IIC, 2000, p. 14-17, fig., ISBN 0-9500525-9-0

Descriptors / Mots-clés

AA : Hard Sciences such as chemistry contain small but significant areas of unpredictability. Where there is complexity there may be greater unpredictability. This is the case with the relationship between museum collections and their environments. The deterministic laws of science can only be applied to museum objects with great uncertainty, made even greater by the value judgments that drive museum policy. Study of individual objects will lower that uncertainty, but in general a probabilistic approach to future outcomes is the only one that can be used with confidence.

Effective preservation: from reaction to prediction

Waller, Robert; Michalski, Stefan , In: *Conservation: the Getty Conservation Institute newsletter*, Vol. 19, N. 1, 2004, p. 4-9, ill.,

http://www.getty.edu/conservation/publications/newsletters/19_1/feature.html

Fragments of the world: uses of museum collections

Keene, Suzanne , Oxford: Elsevier Butterworth-Heinemann, 2005 ; X, 198 p. : ill. ; 23,5 cm. , ISBN 0-7506-6472-X

AA: The role of the museum is changing, from object- and collections-centred to people-centred. Further, there are political pressures on museums to make proper use of all their resources, including the stored collections. What then, is the purpose of the collections, besides exhibition? How can we defend their value? What will be the effects of digitization? Should collections be disposed of or dispersed? The book examines these questions using clearly explained cultural theory with examples of collections used for research, learning, memory and identity, creativity and enjoyment, from around the world.

Gestion des risques par l'étude de l'environnement

Arnold, Andreas , In: *Entretien continu du patrimoine culturel contre la pollution fondé sur les actes du séminaire "Entretien continu du patrimoine culturel contre la détérioration due à la pollution et à d'autres facteurs similaires: évaluation, gestion des risques et sensibilisation du public"*. Séminaire organisé conjointement par le Conseil de l'Europe et le Riksantikvarieämbetet (Direction nationale du patrimoine) / Conseil de l'Europe = Council of Europe. Strasbourg, France. Strasbourg: Editions du Conseil de l'Europe, 2000, p. 55-63, (Patrimoine culturel, n. 40) , ISBN 92-871-4232-7

Group report: paradigms for rational decision-making in the preservation of cultural property

Ashworth G.J., Rapporteur , In: *Rational Decision-making in the Preservation of Cultural Property* / edited by Baer N.S. and F. Snickars, Berlin: Dahlem University Press, 2001, p. 277-293. ISBN 3-934504-07-8

AA : Decision-making is a central task in the preservation of cultural property. This chapter explores potential paradigms from which a system of rational decision-making can be constructed. The usefulness of the economic paradigm and economic rationality for this task is considered, especially cost-benefit analysis and utility. This is then compared with other possible approaches, such as decision-making models in bounded rationality, simple marketing paradigms, and risk management strategies. Some practical organizational aspects using decision trees and economic rationalism are introduced. Conclusions are drawn on the implications of a global approach and upon the usefulness of the economic approach.

Group Report: Values and Society

R. Nanda, Rapporteur, In: *Rational Decision-making in the Preservation of Cultural Property* / edited by Baer N.S. and F. Snickars, Berlin: Dahlem University Press, 2001, p. 211-222. ISBN 3-934504-07-8

AA : Preservation of objects and sites of cultural value now involves or influences many actors; in turn, what is preserved, depends on decisions based on "value" criteria. These values are often complex, diverse, continuously evolving, and influenced by society—local and global. In today's world economy, where interest in cultural heritage transcends national boundaries and where the range of cultural objects and properties has broadened manifold, it is imperative to ensure that preservation decision-makers take into account a variety of factors before concluding on "what" should be preserved and "how." A sustainable approach towards preservation coupled by the availability of a platform to share views and the involvement of the public should guide preservation decisions in the future. The future of the preservation movement should be based not on elite ideas but on the involvement of the masses, led by the process of consultation, partnership, and management.

Interfacing research and risk management for a better safeguarding of cultural heritage

Brokerhof, Agnes et al. in *Proceedings of the 7th European Conference "SAUVEUR"*, Safeguarded cultural heritage, Understanding & Viability of the Enlarged Europe, 31st May – 3rd June 2006, Prague, Czech Republic, ITAM, Institute of Theoretical and Applied Mechanics of the Academy of Sciences of the Czech Republic, Volume 2 – Posters, p. 1030 - 1033

Les facteurs quantifiables: la gestion interne du risque

Kleitz, Marie-Odile , In: Biodétérioration et désinfection des collections d'archives et de bibliothèques: actes des deuxièmes journées sur la conservation préventive, Arles, 18 et 19 novembre 1996 / Desproges, Camille (ed.); Arles: Centre de conservation du livre, 1999, p. 64-87. ISBN 2-913624-01-4

Know risk

Jeggle, Terry (ed.) / United Nations Inter-agency secretariat of the International Strategy for Disaster Reduction (UN-ISDR). Geneva, Switzerland , Geneva: United Nations ISDR, 2005 ; 376 p. : ill., figs., tables ; 30 cm. , ISBN 92-1-132024-0

Managing conservation in museums

Keene, Suzanne , London: Butterworth Heinemann, 1996 ; XI, 265 p. : fig., tables ; 23 cm. , ISBN 0-7506-2384-5
ICCROM: This book aims to show conservators and other professionals in museums and libraries that professional management information can be as useful to them as is their own specialist expertise. It reviews the climate in which museums operate today, and then describes the most up-to-date and relevant management techniques. The management information techniques which are explained and skeptically reviewed include performance indicators, strategic planning decision making and priority setting, data analysis and presentation, risk and cost-benefit analysis, and information analysis. These are applied to preventive conservation, work management and conservation planning. In this way, a link is established between the world of professional management and the current priorities and preoccupations of conservators. These are set in the context of the present museum management climate.

Negotiating the climate: a plan for the appraisal of control options in historic houses

Taylor, Joel , In: *The conservator*, N. 26, 2002, p. 85-92, figs., tables ISSN 0140-0096

AA : A decision making tool for assessing priorities for climate control in historic houses has been piloted at two English Heritage (EH) historic houses. The tool, an environmental management plan (EMP), had been designed by EH to help decision-making regarding control strategy by bringing together all the relevant information and expertise at the same time. The focal point of the EMP is a facilitated meeting between various stakeholders and experts about the importance of the climate issues and the effectiveness of different control options, using a framework based on cost-benefit analysis. This article reports trials of such meetings to reach agreed broad solutions about climate control at Kenwood House and Chiswick House. It is shown that by careful pre-planning, use of a prepared decision matrix and an external facilitator, agreed solutions can be achieved in 1 day. Attention is drawn to the need for the issues affecting the decision to be extremely well defined, and to the importance of negotiation.

Out of the darkness

Keene, Suzanne , In: *Museums journal*, Vol. 105, N. 8, 2005, p. 26-29, ill., ISSN 0027-416X

A paradigm shift for preventive conservation, and a software tool to facilitate the transition

Waller, Robert; Michalski, Stefan , In: *Triennial meeting (14th), The Hague, 12-16 September 2005: preprints / ICOM Committee for conservation*. London: James & James, 2005, p. 733-738, figs., ISBN 1-84407-253-3

AA : Historically, like other industries and agencies that assess and manage risk, conservation adopted a process-control model of preservation. These industries and agencies recognize the process model is fundamentally inadequate and are replacing it with a predictive model based on anticipated risk. Over the past decade, preventive conservation also witnessed the development of systematic and predictive methodologies, but on a somewhat ad hoc basis. This article introduces a more rigorous intellectual framework adapted from the risk analysis and operations research fields. A comprehensive predictive model is necessarily complex and dependent on large amounts of shared expert knowledge but is possible.

Practical uses of risk analysis

Ashley-Smith, Jonathan , In: *The paper conservator*, Vol. 25, 2001, p. 59-63 ISSN 0309-4227

AA : What distinguishes professional conservators from others who have a practical involvement with historic objects is the reflective nature of their decision-making. Decisions about practical treatments involve elements of risk: probabilities of unwanted outcomes that reduce the value of the treated object. The continuing development of

conservators should be aimed at reducing the uncertainty of decision outcomes by increasing knowledge, and decreasing the uncertainty of action outcomes by increasing practical skill.

Preparación ante el riesgo: un manual para el manejo del patrimonio cultural mundial

Stovel, Herb / UNESCO. World Heritage Centre = Centre du patrimoine mondial. Paris, France / ICCROM. Rome, Italy, Rome: ICCROM, 2003 ; X, 196 p. : ills., tables ; 24 cm. , ISBN 92-9077-182-8

Preserving what is valued

Clavir, M.; Museums, Conservation and First Nations. UBC Press 2002, The University of British Columbia, ISBN 0-7748-0860-8.

Rational Decision-making in the Preservation of Cultural Property

Baer N.S. (ed.); F. Snickars (ed.), Berlin: Dahlem University Press, 2001, 304 p. ISBN 3-934504-07-8

AA: The term value is most often used in the context of relative monetary worth. It is in this context that economists and other social scientists have sought to define the value of such environmental goals as clean air and clean water, leading to concepts of "green values." Yet the terms implies more than simple financial valuation, especially when applied to often intangible public goods, as it also considers the relative place that such goals hold in the choices we as individuals and society as a whole make. Those charged with the stewardship of cultural property, be it an individual document in an archive, an historic landscape or an entire art city on the World Heritage List, are faced daily with decisions based on often conflicting value systems. It has become obvious that public policy — as determined by such socioeconomic concepts as environmental accounting, cost-benefit analysis, sustainable development, valuation of loss of cultural property, and intergenerational equity — plays a major role in determining what cultural properties will be saved: which books, documents, artifacts, and monuments. So also, public policy determines which portions of our cultural history will be lost to decay and development. In a synthetic approach, an international interdisciplinary group of experts drawn from the social and physical sciences together with specialists from the fields of architectural preservation, museums, and library and archive preservation confronted these issues. The usefulness of "World Heritage" as a planning concept, the mechanisms by which society sets its priorities, the balance between short- and long-term risk factors, the definition of what constitutes the artifact in the information age, and the validity of the application of the value systems of industrialized nations to the cultural property of developing nations are considered in the examination of the applicability of economic and other models to rational decision-making in the preservation of cultural property at the several levels of society and institutions.

Risicoanalyse in Museum Amstelkring, Ons'Lieve Heer op Solder: Wallers "Cultural property at risk analysis model" toegepast op een uniek historisch gebouw en zijn collectie

Muller, Tine , In: *CR: interdisciplinair vakblad voor conservering en restauratie*, Jaargang 5, N. 3, 2004, p. 30-37, ills., ISSN 1566-3876

Descriptors / Mots-clés

AA : Museum Amstelkring, Ons'Lieve Heer op Solder and the ICN extensively researched the museum building and its collection to establish the influence of a series of risk factors defined in Robert Waller's Cultural property risk analysis model. His method is based on quantifying chances of risks for different parts of a collection, with the aid of a calculation system. The results show the different risk factors and provide an instrument for management decisions for the complete collections. Ten generic risk factors can be divided into three types: seldom occurring but catastrophic, hardly ever occurring with considerable damage and frequently occurring with only slight damage. Fine tuning these combinations for every part of the collection of Museum Amstelkring gave a result of 58 specific risks, with an explanation how they can occur. It is necessary to establish the value of the different parts of the collection beforehand. These values can be cultural, artistic, historic, functional or emotional. The analysis helps awareness of the knowledge of the collection and omissions. Risk assessment influences management decisions and teambuilding within the organisation. Risk assessment is an aid for the formulation of procedures within the organisation, for (technical) adjustments that need financial and proposals for further research to fine-tune the calculations.

Risikoabschätzung als Werkzeug der präventiven Konservierung: die Sammlung der Schack-Galerie in München

Herdin, Marcus , In: *Restaura: Zeitschrift für Kunsttechniken, Restaurierung und Museumsfragen*, Jahrgang 109, Heft 6, 2003, p. 400-407, ills., figs., tables, ISSN 0933-4017

AA : Risk assessment is a comprehensive description and assessment of the various damaging factors. The gathered information (data on environment, light, pollutants, etc.) is then evaluated in relation to each other. As an example, risk assessment was conducted for the collection of Adolph Friedrich Graf von Schack, especially built for it in Munich's Prinzregentenstraße, a much traveled and congested street. From a conservation point of view, the building

possesses a number of deficits. The heating system cannot be adjusted as needed. Drafty windows make controlling the environment difficult and allow pollutants to enter. The wall-to-wall carpets in the exhibition rooms are dust collectors. The dimming system on the overhead lights is inadequate which means additional unsatisfactory environmental and light conditions for the collection. The main risk factors determined are: environment, light, gaseous and solid air pollutants. Various software and graphs are used to evaluate and demonstrate the measuring results. The recommendations drawn from the assessment are manifold. For example, dividing the gallery into zones could stabilize, in particular, the environment in the entrance area. The drafty windows and the entire heating system need attention, respectively the heating system should be replaced with one that provides an even temperature.

Risk assessment for object conservation

Ashley-Smith, Jonathan , Oxford: Butterworth Heinemann, 1999 ; XIV, 358 p. : ill., fig. ; 23 cm., ISBN 07506 2853 7

ICCROM: This book explains the mechanisms of deterioration of museum artifacts, quantifying the probability that damages will occur and estimating the rate of progress when it does. The principles outlined and the information provided from a foundation for cost-benefit analysis of conservation proposals. It also gives comprehensive explanations of scientific or mathematical material to take into consideration the readers who have no background in these areas, alongside a basic introduction. The structure of the book provides a logical progression through tools concepts information and examples.

Risk assessment of Museum Amstelkring: application to an historic building and its collections and the consequences for preservation management

Brokerhof, Agnes W.; Luger, Tessa; Ankersmit, Bart; Bergevoet, Frank; Schillemans, Robert; Schoutens, Peter; Muller, Tine; Kiers, Judikje; Muething, Garnet; Waller, Robert , In: *Triennial meeting (14th), The Hague, 12-16 September 2005: preprints / ICOM Committee for conservation*. London: James & James, 2005, p. 590-596, figs., ISBN 1-84407-253-3

AA : Museum Amstelkring is an historic building with a hidden church and mixed collections. It attracts a large number of visitors and the church is still in use. The museum is concerned that it can no longer adequately balance preservation and presentation requirements. ICN was asked to give an integral advice on preventive conservation, visitor impact, and collection management, and to investigate whether building an extension to the museum might ease the pressure on the main building and create better opportunities for the collection. A complete risk assessment and other investigations were carried out to attach objective measures to perceived issues and quantify risks so that their relative importance could be determined. This approach enables museum management to prioritize and make well reasoned decisions about improvements and investments. For museum staff it draws attention to weaknesses in working procedures while for conservation scientists it reveals issues that need further research.

The impact of climate change on cultural heritage: evidence and response

Cassar, May; Pender, Robyn , In: *Triennial meeting (14th), The Hague, 12-16 September 2005: preprints / ICOM Committee for conservation*. London: James & James, 2005, p. 610-616, figs., ICOM Committee for conservation triennial meeting, 14th, The Hague, Netherlands, 20050912-20050916. ISBN 1-84407-253-3

Risk assessment: a tool to compare alternative courses of action for the conservation of iron-gall ink containing objects

Pedersoli, José Luiz, Jr; Reißland, Birgit , In: *Restaurator: international journal for the preservation of library and archival material*, Vol. 24, N. 4, 2003, p. 205-226, tables, ISSN 0034-5806

AA : A framework for the quantitative estimation of the risks associated with possible courses of action for the conservation of iron-gall ink containing paper objects has been developed. It includes the identification of all possible undesired effects resulting from each course of action, followed by the estimation of the probability that a given undesired effect will occur, as well as of the loss of value it would lead to. Four alternative courses of action were considered in this study: 1) no action, 2) preventive conservation, 3) combined calcium phytate/calcium bicarbonate treatment and 4) paper splitting. Because the magnitude of risk closely depends on the condition of a particular object, it is suggested that risk assessment for entire collections should be preceded by dividing the collection into sub-group of objects having similar condition. By quantifying the risks involved in different possible scenarios, a comparison among conservation alternatives may become more objective, and decision-making is likely to be based on a better informed judgement.

Risk management at the Fitzwilliam Museum, Cambridge

Greeves, Margaret , In: *Journal of architectural conservation*, Vol. 7, N. 3, 2001, p. 67-79, ills., ISSN 1355-6207
Descriptors / Mots-clés

AA : The Fitzwilliam Museum, Cambridge, is a Grade I listed building housing an internationally important art collection of half a million objects. The building and the collections belong to the University of Cambridge, of which the museum forms a department. Maintenance of the fabric and equipment is the responsibility of the university's Estate Management and Building Service, with whom museum staff work closely to ensure appropriate conditions for the collections and the reduction of risks objects and staff. Following the drafting of a conservation plan and an examination of risks and their management, this case study reviews the museum's risks. It proposes the development of a building bible and attention to staff communication as essential elements of the risk management strategy it outlines. A second paper will examine the effectiveness of the conservation plan in relation o maintenance works and an extension of 3,000 square meters, which will be built in 2002-3.

Risk management by environmental monitoring

Arnold, Andreas , In: *Sustained care of the cultural heritage against pollution*. Based on the seminar entitled "Sustained care of the cultural heritage against deterioration due to pollution and other similar factors: evaluation, risk, management and public awareness". Seminar organised jointly by the Council of Europe and the Riksanntkvarieämbetet (National Heritage Board) / Council of Europe = Conseil de l'Europe. Strasbourg, France. Strasbourg: Council of Europe Publishing, 2000, p. 53-61, Cultural heritage, n. 40. ISBN 92-871-4233-5

Risk management of digital information: a file format investigation

Lawrence, Gregory W.; Kehoe, William R.; Rieger, Oya Y.; Walters, William H.; Kenney, Anne R. / Council on Library and Information Resources. Washington, United States , Washington, D.C.: Council on Library and Information Resources, 2000 ; VIII, 75 p. : tables ; 28 cm. , ISBN 1-887334-78-5

Risk management, value and decision-making

Baer, Norbert S., In: *The paper conservator*, Vol. 25, 2001, p. 53-58 ISSN 0309-4227

AA : In over three decades of teaching at the Conservation Center of the Institute of Fine Arts, New York, the author has explored a number of organizing principles to synthesize the vast body of materials science encountered in the conservation of cultural property. Among these has been the concept of risk management as defined by various committees of the National Academy of Sciences. This led logical to the question of value and values. In the recent past, the author has engaged in interdisciplinary dialogue with economists, mathematicians and political scientists, considering mechanisms of decision-making in the preservation of cultural property. Using selected examples drawn from the assignments the author has given his students, the evolution in his teaching methods and the parallel evolution of the discipline of conservation are examined.

Risk map: a project to aid decision-making in the protection, preservation and conservation of Italian cultural heritage

Accardo, Giorgio; Altieri, Antonella; Cacace, Carlo; Giani, Elisabetta; Giovagnoli, Annamaria , In: *Conservation science 2002: papers from the conference held in Edinburgh, Scotland 22-24 May 2002* / Townsend, Joyce H. (ed.); Eremin, Katherine (ed.); Adriaens, Annemie (ed.); London: Archetype Publications, 2003, p. 44-49. ISBN 1-873132-88-3

AA : The Risk Map of Cultural Heritage is a current research project of Istituto Centrale del Restauro (ICR) which was undertaken in order to plan in a more rational and economical way the maintenance, conservation and restoration of architectural and archaeological monuments of Italian cultural heritage. The first step of the project was to produce a Geographic Information System (GIS), which works as a data processing centre and is located in the Physics Laboratory of ICR. The GIS collects, processes and manages both cartographic and alphanumeric data, generated from the peripheral units based in many Italian towns - Soprintendenze - which are territorial departments of the Ministry of Culture. The connection between environmental danger in the territory and the risk situation for the monument can be highlighted more specifically through a mapping process, i.e. the overlapping of computerised maps with information content (air pollution, climate, earthquake, etc.) and the distribution of cultural assets. The second step was to ensure that the data mentioned above were homogeneous through the definition of standardised schedules at different levels of detail. The schedules concern information both on the environment and the conservation state of the monuments.

A risk model for collection preservation

Waller, Robert , In: *Triennial meeting (13th), Rio de Janeiro, 22-27 September 2002: preprints* / ICOM Committee for conservation. London: James & James, 2002, p. 102-107, figs., table. ISBN 1-902916-30-1

Sharing responsibility for conservation decisions

Michalski, Stefan, In: *Durability and change: the science, responsibility, and cost of sustaining cultural heritage*. Report of the Dahlem workshop..., December 6-11, 1992 / Krumbein, Wolfgang E. (ed.); Brimblecombe, Peter (ed.);

Cosgrove, Denis E. (ed.); Staniforth, Sarah (ed.) , Chichester: John Wiley, 1994, p. 241-258., Berlin, Germany, ISBN 0-471-95221-4

Significance: a guide to assessing the significance of cultural heritage objects and collections

Russell, Roslyn; Winkworth, Kylie / Heritage Collections Council. Canberra, Australia , Canberra: Heritage Collections Council, 2001 ; 72 p. : ill. ; 29,5 cm. ISBN 0-642-75094-7

Sustainability and precaution, part 2: how precautionary should we be?

Ashley-Smith, Jonathan , In: *V & A conservation journal*, N. 44, 2003, p. 2-3, ISSN 0967-2273

http://www.vam.ac.uk/res_cons/conservation/journal/number_44/sustainability-precaution-2/index.html

Teaching risk management of collections internationally

Antomarchi, C.; Brokerhof, A; Michalski, S.; Verger, I.; Waller, R. R. , In: *Collections: a journal for museum and archives professionals* / Vol. 2, N. 2, November 2005, p. 117-140. ISSN 1550-1906

AA : Risk assessment and the purpose it serves, risk management, are widely adopted by business, institutions, and governments, seeking to minimize future losses of all kinds. If the preservation goal of museums is stated as the delivery of the collection to some future point in time with as little loss in value as possible, then risk assessment and risk management provide the only rational means to reach this goal. Difficulties arise due to uncertainty and complexity. A three-week course on this method has been designed, and recently offered, by ICCROM (the International Center for the Study of the Preservation and Restoration of Cultural Property) and the Canadian Conservation Institute (CCI), with the collaboration of leading experts from the Canadian Museum of Nature (CMN) and the Netherlands Institute for Cultural Heritage (ICN). Demand for the knowledge was strong, as shown by the number and diversity of applicants worldwide. Great care and effort was taken with the design of the learning process and the supporting resources, in order to overcome the known, and profound, challenges of the subject. The result has been successful.

Valuing Cultural Heritage, Applying Environmental Valuation Techniques to Historic Buildings, Monuments and Artifacts

Navrud, Stale and Ready, Richard C. (eds.), Edward Elgar Publishing Limited, Cheltenham, 2002

AA: What value do we place on our cultural heritage, and to what extent should we preserve historic and culturally important sites and artefacts from the ravages of weather, pollution, development and use by the general public? This innovative book attempts to answer these important questions by exploring how non-market valuation techniques – used extensively in environmental economics – can be applied to cultural heritage.

The book includes twelve comprehensive case studies that estimate public values for a diverse set of cultural goods. The authors demonstrate the potential utility of these techniques, and highlight the important social values that cultural heritage can generate. Given limited resources, such studies can help set priorities and aid the decision making process in terms of their preservation, restoration and use. The authors conclude by reviewing the majority of cultural valuation studies done to date, and draw some general conclusions about the results achieved and the potential benefits, as well as the limitations, of valuing these types of goods.

This highly original book will be of great use and interest to academics in the fields of environmental, resource, and cultural economics, as well as NGOs and policymakers involved in cultural heritage at the national, international and global level.

Valuation model for paper conservation research: a new approach for setting research priorities

Porci, H.J., Ligterink, F.J., de Bruin, G. and Scholten S., in *Preservation management for libraries, archives and museums*, edited by Gorman, G.E. and Shep S.J., Facet Publishing, 2007. xviii, p. 83-96. 206 p. ISBN 1-85604-574-9

The Value and Valuation of Natural Science Collections

Nudds, J. R. and Pettitt, C. W., eds./ *Proceedings of the International Conference*, Manchester, 1995.; Manchester, U.K. London, U.K.: The Geological Society; 1997; c1997: p. 211-214. 276 p. ISBN: 1-897799-76-4.

Values and heritage conservation: research report

Avrami, Erica (ed.); Mason, Randall (ed.); Torre, Marta de la (ed.) / Getty Conservation Institute. Los Angeles, United States , Los Angeles: Getty Conservation Institute, 2000 ; 96 p. : 27,5 cm.

download at http://www.getty.edu/conservation/publications/pdf_publications/valuesrpt.pdf

Why is risk assessment / risk management important to conservation = L'importance de l'évaluation des risques et la gestion des risques en conservation

Inch, Jeanne in CCI newsletter = Bulletin de l'ICC, 36, 2005, No of p. 6, ISSN: 1180-3223

BCIN: The article discusses the use of risk assessment and risk management, currently being used by government

and business as a decision-making tool. The museum community is turning to risk assessment of collections to help the institutions set priorities and infrastructure to protect their collections. It describes the work being done at CCI with courses given with ICCROM in 2005 in Rome and to be held in Ottawa in October 2006 entitled "Preventive conservation: reducing risks to collections".

Web pages

Collections Risk Management The next frontier

Brokerhof Agnes W.

Presentation at the CMA Cultural Property Protection Conference, Ottawa, 16 January 2006

<http://www.museums.ca/protection/en/presentations/Brokerhof.pdf>

Perceptions of damage

Ashley-Smith Jonathan, EC Advanced Study Course "Cultural Heritage Protection In A Sustainable Society, Technical Notes, 2003

AA : Advances in measurement of decay rates and the scientific understanding of deterioration mechanisms are discussed in relation to the development of ideas of acceptable damage and sustainable change.

C. Risk management within the heritage field - specific to emergency preparedness

Books and articles

Building an emergency plan: a guide for museums and other cultural institutions

Dorge, Valerie (comp.); Jones, Sharon L. (comp.) / Getty Conservation Institute. Los Angeles, United States, Los Angeles: Getty Trust Publications, 1999 ; VIII, 208 p. : ill. ; 28 cm. , ISBN 0-89236-551-X

http://www.getty.edu/conservation/publications/pdf_publications/emergency_plan.pdf

Community-based disaster risk management: integration to socio-economic development process & Field practitioners' handbook

Asian Disaster Preparedness Center (ADPC)/ ADPC, Bangkok, 2004.

Developing state-wide emergency and disaster preparedness expertise

Watkins, Stephanie , In: *Journal of the American Institute for Conservation*, Vol. 39, N. 1, 2000, p. 165-172, ISSN 0197-1360

AA : The Federal Emergency Management Agency (FEMA) has developed an emergency response training program, which is divided into five sections: orientation, drill tabletop, functional, and full-scale. Each section provides skills that are expanded through subsequent exercises. Suggestions are given for implementing the FEMA training model to the needs of cultural institutions. The Missouri Local Records Preservation Program's archivists were trained in emergency preparedness and response methods for books, papers, photographs, and electronic media by adapting FEMA's model. This article concludes with resources for developing similar training programs.

Don't take the risk! A management plan can prevent disaster = Évitez les risques grâce à un plan de gestion

Turner, Susan D. , In: *Heritage = Patrimoine*, Vol. 6, N. 2, 2003, p. 24-25 (English), 24-25 (French), ill., ISSN 1480-6924

Help! A Survivor's Guide to Emergency Preparedness Museums Alberta Museum Excellence Series: Book 3

Ball, Cynthia & Yardley-Jones, Audrey (eds), (Edmonton: Museums Alberta), 2001.

Planning for disaster

Linnerooth-Bayer, Joanne / International institute for applied systems analysis (IIASA). Laxenburg, Austria , In: *Options*, , Summer (2006), p. 18-19, ill.,

ICCROM: Can natural disasters be avoided and their consequences made less catastrophic? If so, how can we

measure which preventive actions are most effective and efficient? These questions are critical to developing countries that find themselves particularly vulnerable to natural disasters and their effects. A series of IIASA studies highlight how countries and people can make themselves not only more secure against natural disaster but also less vulnerable to their consequences. Three approaches to assess disaster management are presented: cost-benefit analysis (CBA); the IIASA CATSIM model; model-based participatory processes for assessing risk financing options.

Preparing for the worst, planning for the best: protecting our cultural heritage from disaster.

Proceedings of a conference sponsored by the IFLA preservation and conservation section, the IFLA Core Activity for Preservation and Conservation and the Council on Library and Information Resources, Inc., with the Akademie der Wissenschaften and the Staatsbibliothek zu Berlin, Berlin, Germany, July 30-August 1, 2003

Wellheiser, Johanna G. (ed.); Gwinn, Nancy E. (ed.) / International Federation of Library Associations and Institutions IFLA. Den Haag, Netherlands / Council on Library and Information Resources (CLIR). Washington, United States, München: Saur, K.G., 2005 ; 192 p. : ill. ; 21, 5 cm. , (IFLA publications, 111). ISBN 3-598-21842-7

ICCROM: Proceedings of a conference held by the International Federation of Library Associations and Institutions (IFLA) on disaster preparedness and recovery. The publication consists of sixteen papers divided into six sections that cover: national policy planning, efforts by the International Committee of the Blue Shield (ICBS), institutional planning, case studies of disaster preparedness and recovery, example cases of risk assessments, and methods for conserving and restoring damaged collections. Cases cover a wide geographical area in addition to a broad range of themes, such as psychological repercussions of the destruction of cultural property, lessons learned from natural disasters, and mitigation measures organisations can take to minimise risk and damage. Chapters are applicable to any collecting institution.

Risk preparedness for cultural properties: development of guidelines for emergency response. 1997 Kobe/Tokyo international symposium

Saito, Hidetoshi (ed.) , Tokyo: Chuo-Koron Bijutsu Shuppan, 1999 ; [24], 499 p. : ill. . ISBN 4-8055-0370-X

Risk preparedness: a management manual for World Cultural Heritage

Stovel, Herb / ICCROM. Rome, Italy / UNESCO. Paris, France, Rome: ICCROM, 1998 ; 145 p. : ill. ; 24 cm. , ISBN 92-9077-152-6

Significance, A Guide To Assessing The Significance Of Cultural Heritage Objects And Collections

Commonwealth of Australia 2001 on behalf of the Heritage Collections Council.

http://sector.amol.org.au/publications_archive/museum_management/significance

Websites

Getty Conservation Institute emergency plans

http://www.getty.edu/conservation/publications/pdf_publications/emergency_plan.pdf

MEP (Museums Emergency Programme) bibliography

<http://gcibibs.getty.edu/asp/>

Museum-security

<http://www.museum-security.org/indexdefinitief.html>

FEMA's risk mitigation library (vast resource)

<http://www.fema.gov/library/index.jsp>

H-Net museum

www.h-net.org/~museum/flood.html

Eastern European area

D. Risk Information by agent of deterioration

1. Physical forces - general

Books and articles

Earthquake risk assessment - a short guideline

Swiss reinsurance company, Zurich: Swiss reinsurance company, 1982 ; 50, ill., 30 cm ,

ICCROM : Aspects and factors of seismic risk assessment: a short guide to the evaluation of earthquake risks in relation with: zone, subsoil, building material, regularity of buildings, sensitivity, design material workmanship, fire exposure.

Evaluation of earthquake damage mitigation methods for museum objects

Agbabian, Mihran S.; Ginell, William S.; Masri, Sami F.; Nigbor, Robert L. , Marina del Rey, California: Getty Conservation Institute, s.d. ; 20 p. 4 pl. ; 28 cm.

AA : Discusses procedures for the evaluation of some of the earthquake damage mitigation methods in use or under development in the J. Paul Getty Museum. Generic models for various categories of objects were formulated and analytical techniques have been devised that allow the assessment of the susceptibility of objects to rocking, overturning, sliding, and stress failure when subjected to earthquake-induced forces. Failure criteria are discussed and examples of categories of mechanical methods reducing transmitted forces are given. Experimental verification of some of the analytical formulations have been undertaken on object models using sine, swept sine, and simulated earthquake accelerogram inputs to laboratory-scale shake tables. The conception and ideas given are generally applicable to other museums and cultural heritage repositories.

Mount-making for museum objects

Barclay, Robert L.; Bergeron, André; Dignard, Carole; Schlichting, Carl (ill.) Ottawa: Canadian Conservation Institute, 1998 ; 57 p. : fig., ill. ; 23 cm. , ISBN 0-660-17531-2

Seismic stabilization of historic adobe structures

Ginell, William S.; Tolles, E. Leroy , In: Journal of the American Institute for Conservation, Vol. 39, N. 1, 2000, p. 147-163, fig., tables, ISSN 0197-1360

1. Physical forces - Collections in transit

Books and articles

Art in transit. Handbook for packing and transporting paintings

Richard, Mervin; Mecklenburg, Marion F.; Mervill, Ross M. , Washington, DC: National Gallery of Art, 1991 ; Pagination multiple : figs., 29 cm , ISBN 0-89468-165-6

AA : Handbook describing procedures that will enable packers, registrars, curators and conservators to effectively use the results of the research of specialists in the field of art in transit, in particular in the packing and shipping of paintings. The handbook is divided into 10 sections : assessing risks, transit climate conditions, temperature protection, relative humidity protection, shock and vibration hazards, shock protection, vibration protection, packing cases, role of the courier, glossary. This handbook serves as a companion to the publication "art in transit : studies in the transport of paintings" (Proceedings of the International conference on the packing and transportation of paintings, London, 9-13 Sept. 1991.)

A Circular Slide Rule for Protective Package Design

Marcon, Paul J.; Mecklenburg, Marion F. (ed.) , In: *Art in Transit: Studies in the Transport of Paintings*, Washington, DC: National Gallery of Art, 1991, p. 14. ISBN 0-89468-163-X

AA : One of the greatest hazards an item will face during shipment is potentially damaging levels of shock. Some of the most severe shocks that are likely to occur during shipment are usually the result of accidental drops or mishandling. Routine handling operations such as stacking, loading, and unloading can also produce significant and potentially harmful levels of shock. In order to protect items from damage, design procedures and performance data for cushioning materials are available for use. The design procedures involve using tables, interpreting graphs, and

performing repetitive calculations. The circular slide rule, described in this paper is based on common design methods and procedures, and frees an art packer from the tasks mentioned above. With the help of the slide rule, a packer can quickly select a cushioning material that will provide a quantifiable level of shock isolation by dialing the weight of a package the weight of the object to be packed, and the objects surface area. This paper provides a description of the slide rule and sample applications for its use.

Mechanical Risks to Large paintings such as Guernica during Transit

Michalski S., Marcon P, In: *El Guernica y los problemas eticos y tecnicos de la manipulation de obras de arte*, Fundación Marcelino Botín. Santander, Spain, 2002 ;p. 87-98

SM : Contains useful fragility data for paintings on canvas, in terms of the maximum drop they will tolerate before suffering damage. Also provides estimates on what diameter very large paintings can be rolled without risk of cracking.

Packing and transport of hollow plaster sculpture

Marcon, Paul J.; Harrington, Michael; Heinrichs, Paul; Couture-Rigert, Doris , In: *Triennial meeting (12th), Lyon, 29 August-3 September 1999: preprints. Vol. 1 / ICOM. Committee for conservation . London: James & James, 1999, p. 77-82.. ISBN 1-873936-92-3*

AA : Protective packaging strategies for the safe shipment of 35 fragile hollow plaster sculptures are described. These include a multi-criteria decision method, based on size, geometry, and surface finishes, that was used to rank-order sculpture vulnerability; double-case designs that simplified the protective packaging for the irregular-shaped sculptures; and several variations of the inner-case component of the double-case design that provided ease of handling and added protection for the fragile plaster works during display installation and removal. Effective material use and other benefits provided by the double-case package designs are discussed, and features that contribute to the optimum performance of a double-case system are presented.

Shock, vibration, and the shipping environment

Marcon, Paul J. , In: *Art in transit: studies in the transport of paintings. Proceedings of the International Conference on the packing and transportation of paintings. September, 9,10, and 11, 1991*, London. Edited by Mecklenburg, Marion F. / Washington, DC: National Gallery of Art, 1991, p. 121-132, Figures, ISBN 0-98468-163-X

AA : The shipping environment has been studied by the packaging field, military and resource organizations. As a result, substantial information on shipping hazards is available that can be applied to art shipments and artifact fragility test procedures. The following provides an overview of the shock and vibration inputs to package during shipment, the sources of these inputs, magnitude. Aspects of the shipping environment that are well defined are identified as well as areas where further research is required.

Websites

APA The Engineered Wood Association.

Wide range of publications, many free in .PDF format http://www.apawood.org/level_b.cfm?content=pub_main . See <http://www.apawood.org/pdfs/managed/M200A.pdf> for an excellent guide that includes practical information and step-by step instructions for fabricating large wooden shipping containers.

APA – materials handling guide

Drop-N-Tell

A web search of “Drop-N-Tell” will reveal a number of potential suppliers. Indicators can be purchased with the following sensitivities. Resettable indicators are best for demonstration purposes. Non-resettable units are intended for package monitoring. Indicator sensitivities: 5, 10, 15, 25, 50 along one axis only.

Omni-G <http://www.chatsworthdata.com/impact-o-graph/indicators.htm>, fixed G ranges from 2 G to 300 G. The indicators are a bit bulkier than the drop-n-tells but they are sensitive to shocks in all directions. They are a good choice for demonstrations and package testing applications.

IoPP (Institute of Packaging Professionals).

<http://www.iopp.org>

Many other packaging organizations also publish information on the web.

PadCad, Canadian Conservation Institute

A 30 day trial version of PadCAD, a computer program can be downloaded at http://www.cci-icc.gc.ca/whats-new/padcad-download_e.shtml. See http://www.cci-icc.gc.ca/whats-new/newsletter_e.shtml, Newsletter No.22 for packaging articles.

2. Thieves and vandals

Books and articles

Museum security and protection: a handbook for cultural heritage institutions

Liston, David (ed.) / ICOM. Paris, France / International Committee on Museum Security, London: Routledge, 1993 ; XIII, 319 p. ISBN 0-415-07509-2

Security hardware and security system: planning for museums

Kelly, Wayne, In: *Canadian Conservation Institute technical bulletin*, N. 19, 1998, p. 1-16, fig., ISSN 0706-4152

ICCROM : Theft and vandalism of our cultural collections is escalating every year. This publication is intended to help managers of cultural institutions to better their preparations against the ever-increasing threat of theft and vandalism. Numerous, inexpensive methods of improving security protection and various types of currently available sensors and computerized alarm systems are illustrated and described. Various types of sensors and their placement within a standardized level of protection proposed for each area in a cultural facility are also recommended.

Website

Museum-security

<http://www.museum-security.org/indexdefinitief.html>

3. Fire

Books and articles

A decision logic for trading between fire safety measures

Harmathy, T.Z. et al, In: *Fire and Materials*, 14, 1989, p. 1-10.

An Introduction to Fire Detection, Alarm, and Automatic Fire Sprinklers

Artim, Nick. In: *Preservation of library & archival materials: a manual*, Ogden, Shereyn (ed.) / Northeast Document Conservation Center. Andover, Massachusetts, United States - 3rd rev. and enlarged ed. 1999 ; ISBN 0-963-4685-2-9

Automatic Sprinkler Systems for Museums (also in French)

Baril, P. In: *CCI Note* No. 2/8. Ottawa: Canadian Conservation Institute, 1998.

Can you stand the heat? A fire safety primer for libraries, archives, and museums

Trinkley, Michael, Atlanta: Solinet Conservation Services, 1993 ; VII, 70 p. : fig. ; 23 cm. ,

ICCROM : Responsible stewardship of our collections requires that all collections-holding repositories take seriously the risk of fire and engage in planning designed to protect not only the collections, but also - and even more importantly - human life. This paper is written to provide libraries, archives, and museums with an introduction to fire safety in simple, easy to understand terms. The nature of fire, its destructive powers, and how it typically affects both staff and patrons are briefly discussed. Detailed explanations are offered of all the fire detection and suppression devices typically used in repositories, and their features and benefits are analyzed. The paper also stresses the importance of conducting periodic fire safety inspections and outlines the necessary elements of a fire safety programme for an institution.

Considering fire-safety improvements to historic buildings

Kaplan, Marilyn E. , In: *APT bulletin*, Vol. 34, N. 4, 2003, p. 10-17, tables, ISSN 0044-9466

AA : Technical and analytical advances have created the potential for unprecedented levels of fire safety to be achieved in buildings. Installations must be carefully considered, given the potentially significant physical impact they have on historic spaces and features. Solutions should be selected based on a building's unique hazards, the long-term cost and life expectancy of a system, and the appropriateness of considering alternate or additional fire-safety means achieved by fire prevention backed by rigorous management policies.

Evaluation des risques d'incendie dans les bâtiments patrimoniaux à Winnipeg = Fire risk assessment for heritage buildings in Winnipeg

Bugailiskis, Giles; Wagner, Jim; Richardson, Ken , In: *Heritage = Patrimoine*, Vol. 7, N. 2, 2004, p. 27-29 (French), 27-29 (English), ill., ISSN 1480-6924

The fire at the Royal Saskatchewan Museum, part 1: salvage, initial response, and the implications for disaster planning. Part 2: removal of soot from the artifacts and recovery of the building

Spafford-Ricci, Sarah; Graham, Fiona , In: *Journal of the American Institute for Conservation*, Vol. 39, N. 1, 2000, p. 15-56, fig., ISSN 0197-1360

Fire prevention programs for museums

Baril, Paul , In: *Canadian Conservation Institute Technical Bulletin*, n. 18, 1997, p. 1-12, fig., ISSN 0706-4152

ICCROM : Fire damages and destroys Canadian collections every year. This Technical Bulletin is intended to help museums develop and implement effective fire prevention programmes. It describes the ways and means to develop and implement a successful, comprehensive, yet not overbearing programme. Numerous examples are provided to help museum staff prepare documents and procedures.

Fire Protection Issues for Historic Buildings (also in French)

Baril, P. In: *CCI Note* No. 2/6. Ottawa: Canadian Conservation Institute, 1998.

Fire Protection Measures for the Royal Palaces

Bailey, Sir Alan, Insall, Donald and Philip Kilshaw. (Report). London: Department of National Heritage, May 1993.

Museum Fires and Losses (also in French)

Baril, P. In: *CCI Note* No. 2/7. Ottawa: Canadian Conservation Institute, 1998.

NFPA 13. Installation of Sprinkler Systems.

NFPA 13A. Inspection, Testing and Maintenance of Sprinkler Systems.

NFPA 232A. Guide for Fire Protection for Archives and Record Centers

NFPA 750. Water Mist Fire Protection Systems.

NFPA 909. Code for the Protection of Cultural Resources

NFPA 914. Fire Protection of Historic Structures.

National Fire Protection Association. Quincy, MA, United States.

Principaux risques d'incendies dans les musées: quelques règles de prudence

Calas, Jean-Marie , In: *Prévention 2000: la prévention des sinistres dans les aires de stockage du patrimoine, Draguignan - Figanières, 7-10 novembre 2000 = Prevention 2000: prevention of disasters in cultural storage areas, Draguignan - Figanières, 7-10 November 2000* / Rebière, Jacques (ed.); Mourey, William (ed.); Centre archéologique du Var. Draguignan, France. Draguignan: Centre archéologique du Var. Laboratoire de conservation, restauration et recherches, 2003, p. 175-177. ISBN 2-905757-01-9

AA : This paper recaps some administrative and practical measures to avoid fire in buildings where cultural heritage is preserved. The necessary cooperation between curators, conservators and security specialists for the choice and management of alarm systems and fire fighting methods adapted to the building's configuration is emphasized.

The treasury building fire of 1996: protecting cultural resources in a non-museum environment

Mohr, Paula A. , In: *Journal of the American Institute for Conservation*, Vol. 39, N. 1, 2000, p. 57-63, fig., ISSN 0197-1360

4. Water

Books and articles

Disaster recovery at the University of Alberta, or, every flood has a silver lining

Ellis, Shirley , In: *Journal of the American Institute for Conservation*, Vol. 39, N. 1, 2000, p. 117-126, table, ISSN 0197-1360

Disaster recovery of modern information carriers: compact discs, magnetic tapes, and magnetic disks

Iraci, Joe , In: *CCI Technical bulletin*, N. 25, 2002, p. 1-15, ills., figs., ISSN 0706-4152

ICCROM : This bulletin summarizes some procedures for the disaster recovery of modern information carriers such as CDs, magnetic diskettes, and magnetic tapes following immersion in tap water, seawater, and dirty water. Procedures are also given for dealing with media that have hard-to-remove deposits on them or have been exposed to heat, dust/dirt, mould, and shock. These procedures are a compilation of information from the few case histories published.

Emergency Treatment of Water-Damaged Paintings on Canvas

CCI Note 10/5, revised July 1996. Ottawa: Canadian Conservation Institute

Freeze-drying Vellum

Parker, Tony, In: *Library Conservation News*, (London: British Library), October 1991, no.33, p. 4 - 6.

Midnight in the garden of soggy and damp: the New Year's Eve disaster at the Virginia Historical Society

Rusch, Stacy; Herro, Holly , In: *Journal of the American Institute for Conservation*, Vol. 39, N. 1, 2000, p. 127-134, fig., table, ISSN 0197-1360

AA : On New Year's Eve 1993, a burst fire-suppression pipe flooded the Virginia Historical Society with 8,000 gallons of water. Unprocessed manuscripts, rare books, general collections materials, portraits, museum objects, and furniture were affected. The staff, assisted by the Virginia Conservation Association, Chubb Insurance personnel, and Servpro, responded quickly. The book collections were treated in various ways, including freeze-drying, and rehousing. Some items were repaired at the historical society; others were sent to outside contractors for drying and conservation. The process of recovery and rehabilitation of the collection required 1,222,5 staff and volunteer hours and 10 months for completion. The final cost was \$76,000. The article discusses recommendations and procedures learned from this experience that will benefit other instructions.

An ounce of prevention: integrated disaster planning for archives, libraries, and record centres

Wellheiser, Johanna; Scott, Jude - 2nd. ed. , Lanham, Maryland: Scarecrow Press, 2002 ; XVI, 284 p. ; 28 cm. , ISBN 0-8108 4176-2

A Primer on Disaster Preparedness, Management and Response: Paper-based Materials

National Archives & Records Administration. October 1993:

http://www.archives.gov/preservation/pdf/primer_disaster_preparedness.pdf

Salvage and recovery of water, fire and smoke damaged library buildings and their contents

Fischer, Mark W.A., In: *Redefining Disasters: A Decade of Counter-Disaster Planning*, Preprints (Sydney: State Library of New South Wales), 1995, p.59 - 64.

Salvage of fire-damaged collections

Collins, Grant, in: *Redefining Disasters: A Decade of Counter-Disaster Planning*, Preprints (Sydney: State Library of New South Wales), 1995, p. 41 - 46.

Vacuum freeze-drying of paper-based materials

Fischer, Mark W.A., In: *Redefining Disasters: A Decade of Counter-Disaster Planning*, Preprints (Sydney: State Library of New South Wales), 1995, p.65- 68.

Websites

American Institute for Conservation

<http://aic.stanford.edu/library/online/disaster/tentip.html>

Conservation center for art and historic artefacts

<http://www.ccaha.org/disaster.html>

Conservation on line

<http://palimpsest.stanford.edu/byauth/tremain/coated.html> <http://palimpsest.stanford.edu/byorg/nps/npsafter.html>
<http://palimpsest.stanford.edu/waac/wn/wn10/wn10-2/wn10-202.html>

Library of congress

<http://www.loc.gov/preserv/emerg/dry.html>

Museum-Security

<http://www.museum-security.org/indexdefinitief.html>

National Archives & Records Administration

<http://www.archives.gov/preservation/emergency-prep/lessons-learned.html>

See proceedings of the 17th Annual Preservation Conference, March 21, 2002, especially articles by Brothers, Peter. Damage Mitigation and Recovery: Magnetic Media; Ludwig, Kathy. Efficacy of Various Recovery Techniques; Markham, Roger. Recovery of Film; Page, Susan. Fire Recovery: A Case Study; Podany, Jerry. Objects Recovery,

North East Document Conservation Center

Technical leaflets:

<http://www.nedcc.org/plam3/tleaf38.htm>

<http://www.nedcc.org/plam3/tleaf37.htm>

<http://www.nedcc.org/plam3/tleaf39.htm>

5. Pests

Books and articles

Controlling insect pests with low temperature (also in French)

Strang, T., In: *CCI Note* No. 3/3. Ottawa: Canadian Conservation Institute, 1997.

Controlling vertebrate pests in museums = La lutte contre les vertébrés nuisibles dans les musées

Strang, Thomas J. K.; Dawson, John E. , In: Canadian Conservation Institute Technical bulletin = Institut Canadien de Conservation Bulletin technique, n. 13, 1991, p. 1-9 (English), 1-11 (French), ISSN 0706-4152

ICCROM: When vertebrate animals, particularly rodents, gain access to museum collections, they can soil or destroy artifacts. Prompt identification of the pest and the use of suitable methods to control it are essential. In most cases, nonchemical methods can be used to control vertebrate pests in museums; chemical methods are also discussed.

A guide to museum pest control

Zycherman, Lynda A. (ed.); Schrock, John Richard (ed.) / American Institute for Conservation of Historic and Artistic Works. Foundation , Washington, District of Columbia. Association of Systematics Collections, 1988, 205 p. , ISBN 0-942924-14-2

ICCROM: An American manual on pest control on museums providing information updated to 1986. Topics were organized in four sections. 1) Policy, law and liability: includes a summary of the 1980 Fumigation Conference and update on USA regulation, statutes and liabilities. 2) Pest and pest identification: includes a guide to pests and their targets with detailed information on cockroaches, wood-infesting coleoptera, dermestid, and anobiid beetles. 3) Treatment: contains a glossary of pesticides, articles on uses and effects of pesticides, articles on uses and effects of pesticides, insecticides, fumigant hazards and on minimizing use of chemical measures. 4) References: includes an extensive bibliography and index on pest control literature.

Insect trapping: the key to pest management

Pinniger, David B.; Blyth, Valerie; Kingsley, Helen, In: *Third Nordic symposium on insect pest control in museums, Stockholm, 24-25 September 1998: proceedings* / Akerlund, Monika (ed.); Bergh, Jan-Erik (ed.); Stenmark, Arnold (ed.); Wallenborg, Irma (ed.); Naturhistoriska riksmuseet. Stockholm, Sweden. Stockholm: 1998, p. 96-107

AA : Museums and historic houses reduce the risk of pest damage by adopting insect pest management (IPM) programme. This will include: monitoring for pests, modifying the environments to discourage pest attack and targeting treatment only where it is needed. This paper discusses the key IPM component of trapping. Many different traps are available, the most effective are simple sticky blunder traps. Traps with pheromone lures can be effective against a known target species.

Integrated pest management for collections: proceedings of 2001: a pest odyssey, a joint conference, London, 1-3 October 2001

Kingsley, Helen (ed.); Pinniger, David B. (ed.); Xavier-Rowe, Amber (ed.); Winsor, Peter (ed.) / English Heritage. London, United Kingdom / Science Museum. London, United Kingdom / National Preservation Office. London, United Kingdom, London: James & James, 2001 ; 156 p. . ISBN 1-85074-802-0

Nonchemical treatment processes for disinfestation of insects and fungi in library collections

Wellheiser, Johanna G. , München: K.G. Saur, 1992 ; VIII, 118 p. ; 21 cm. , (International Federation of Library Associations and institutions publications, 60) , ISBN 3-598-21788-9

Pest management in museums, archives and historic houses

Pinniger, David B.; Townsend, Annette (ill.), London: Archetype, 2001; IX, 115 p.: ills. ; 23,5 cm. , ISBN 1-873132-86-7

Preventing infestation: Control strategies and detection methods (also in French)

Strang, T., In: *CCI Note* No. 3/1. Ottawa: Canadian Conservation Institute, 1997.

Principles of heat disinfestations

Strang, T. , In: *Integrated pest management for collections: proceedings of 2001: a pest odyssey, a joint conference, London, 1-3 October 2001* / Kingsley, Helen (ed.); Pinniger, David B. (ed.); Xavier-Rowe, Amber (ed.); Winsor, Peter (ed.) / English Heritage. London, United Kingdom / Science Museum. London, United Kingdom / National Preservation Office. London, United Kingdom, London: James & James, 2001, p. 114-129. ISBN 1-85074-802-0

Solarization: a cheap but effective method to disinfest museum objects

Brokerhof, Agnes W. , In: *Triennial meeting (13th), Rio de Janeiro, 22-27 September 2002: preprints* / ICOM Committee for conservation. London: James & James, 2002, p. 15-20, ISBN 1-902916-30-1

6. Contaminants and pollutants

Books and articles

Air Contaminants

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers). Chapter 12 in *Heating, Ventilating, and Air-Conditioning: Fundamentals*. ASHRAE Handbook. Atlanta: 2001.

Airborne pollutants in museums, galleries, and archives: risk assessment, control strategies, and preservation management (also in French)

Tétreault, Jean , Ottawa: Canadian Conservation Institute = Institut canadien de conservation, 2003 ; 174 p. : ills., figs., tables ; 28 cm. , ISBN 0-662-34059-0

ICCROM : This book attempts to define the key airborne pollutants for indoor museums environments and provide some basic tools to assess the risk to collections exposed to these pollutants. It also establishes guidelines for control strategies that give flexible, pragmatic solutions and provides a simple tool for cost-benefit analysis that can fulfill the principles and policy of individual museums.

Coatings for display and storage in museums (also in French)

Tétreault, Jean , In: *CCI Technical Bulletin*, N. 21, 1999, p. 1-46, fig., tables, ISSN 0706-4152

ICCROM : Coatings are used in museums, archives, and galleries for new construction, storage facilities, or exhibitions; but coatings have the potential to cause damage (such as corrosion and discoloration) to objects either by direct contact or the emission of volatile compounds. Most problems caused by contact can be solved by using interleaves, and problems related to volatile emission can be controlled by selecting appropriate coatings and allowing adequate drying periods. Coatings formed by oxidative polymerization (such as oil-based or alkyd coatings) emit harmful volatile compounds and should be avoided in conservation contexts. Other types of coatings are usually acceptable provided sufficient drying time is allowed: 4 days is usually enough in a ventilated room, but up to 4 weeks may be required in airtight enclosures such as well-sealed display cases and cabinets. The general recommendations in this document are based on the nature and use of the coatings rather than their trade names, as formulations may change. Information on the nature of coatings can be obtained from technical data or material safety data sheets, or tests can be run to determine the properties of a coating. The use of appropriate procedures and mitigation strategies will minimize any risk of damage.

Control of Gaseous Indoor Air Contaminants

ASHRAE., Chapter 44 in *Heating, Ventilating, and Air-Conditioning: Applications*. ASHRAE Handbook. Atlanta: 1999.

Display materials: the good, the bad and the ugly

Tétreault, Jean, In: *Exhibitions and conservation: pre-prints of the SSCR conference held in Edinburgh 21 & 22 April 1994* / Sage, Jo (ed.); Scottish Society for Conservation & Restoration. Edinburgh, United Kingdom, 1994, p. 79-87. ISBN 0950 8068 70

AA : The aim of this paper is to establish an approach for the use of display materials by minimizing the risk of damaging artefacts. This preventive approach is based on the understanding of the nature of artefacts and materials and their possible interactions in the same environment. Appropriate selection of materials and adequate control of their noxious compounds are the keys to reaching compatibility between display materials and artefacts during an exhibition.

Gaseous pollution in the museum environment: the uses and abuses of monitoring campaigns

Blades, Nigel , In: *The conservator*, N. 22, 1998, p. 44-48, ISSN 0140-0096

AA : Pollution studies in museums have been greatly advanced in recent years by the development of diffusion tube techniques for a range of important gases. This article discusses the advantages of diffusion tubes, and how they might be used successfully in the museum environment. Limitations of pollution monitoring such as the incomplete state of present knowledge, and the difficulties in interpretation that this causes, are also explored.

Guidelines on pollution control in museum buildings

Blades, Nigel; Oreszczyn, Tadj; Bordass, Bill; Cassar, May, In: *Museum practice* , *Supplement N. 15*, 2000, p. 1-27,

Internal pollutants, risk assessment and conservation priorities

Waller, Robert , In: *Triennial meeting (12th), Lyon, 29 August-3 September 1999: preprints. Vol. 1* / ICOM. Committee for conservation. London: James & James, 1999, p. 113-118. ISBN 1-873936-92-3

AA : The application of a risk assessment framework, using the parameters Fraction Susceptible, Loss in Value, Probability and Extent, to interpret the significance of internal pollutant concentration distribution in a systematic mineral collection, is demonstrated. This interpretation facilitates the application of conservation research findings to setting collection care priorities and strategically identifies the highest priorities for further conservation research.

Pollutants in the museum environment: practical strategies for problem solving, exhibition and storage

Hatchfield, Pamela B. , London: Archetype Publications, 2002 ; XI, 203 p. : ill., tables ; 27,5 cm. , ISBN 1-873132-96-4 .

The pollution problem in perspective

Bradley, Susan; Thickett, David , In: *Triennial meeting (12th), Lyon, 29 August-3 September 1999: preprints. Vol. 1* / ICOM. Committee for conservation . London: James & James, 1999, p. 8-13. ISBN 1-873936-92-3

Descriptors / Mots-clés

AA : The effect of the indoor pollutant gases reduced sulphides and organic acids and aldehydes on artefacts in the British Museum collections has been the subject of a long-term study. An evaluation of the data from the study, and experimental work, has shown that alteration by sulphide pollutants is most difficult to prevent; that carbonyl pollutants can be present but not cause alteration of objects; and that five factors influence the alteration of objects. These are the composition and conservation history of the object, the concentration of pollutant gas, the relative humidity and the temperature.

Websites**Indoor Air Quality in museums and archives**

www.iaq.dk

Papers and abstracts of all the conferences

PreservArt database, CCQ

<http://preservart.ccq.mcc.gouv.qc.ca>

Tétreault CCI links to pollutant info

www.cci-icc.gc.ca/links/pollutants/index_e.shtml

7. UV and light

Books and articles

The continuing development of a practical lighting policy for works of art on paper and other object types at the Victoria and Albert Museum

Ashley-Smith, Jonathan; Derbyshire, Alan; Pretzel, Boris , In: *Triennial meeting (13th), Rio de Janeiro, 22-27 September 2002: preprints* / ICOM Committee for conservation. London: James & James, 2002, p. 3-8. ISBN 1-902916-30-1

Control of Damage to Museum Objects by Optical Radiation

Anon., Publication CIE 157:2004, ISBN 3 901 906 27 4

ICCROM : The report comprises three parts. The first part reviews the scientific principles that govern the processes of radiation-induced damage to museum objects with the aim of providing fundamental information for museum conservators and research workers. The second part reviews current knowledge and recent research to provide a commentary on the efforts of researchers to better understand how these processes may be retarded or eliminated in the museum environment. The final part gives the committee's recommendations for lighting in museums in the form of a practical procedure that covers setting up a new display and monitoring the lighting during the life of the display. This procedure takes account of the research findings that have been reviewed as well as recommendations published by other organizations, and is modeled on current practice in several of the world's leading museum institutions. The Report is written in English, with a short summary in French and German. It consists of 35 pages with 6 figures and 8 tables, and is readily available at the CIE National Committees or the CIE Central Bureau in Vienna.

The Lighting Decision

Michalski, S. , In: *Fabric of an exhibition: an interdisciplinary approach. Preprints of a conference...*, Ottawa, Canada, September 22 to 25, 1997 = *L' étoffe d'une exposition: une approche pluridisciplinaire. Prétirages de la conférence.*, Ottawa, Canada, 22 au 25 septembre 1997 / Canadian Conservation Institute = Institut canadien de conservation. Ottawa, Canada. ISBN 0-660-60261-X

SM : Contains the rationale behind suggestions for adjustment of lux level for visibility, and for object sensitivity. Contains a table of light sensitivity ratings for historic textile dyes.

Lighting for museums and art galleries

CIBSE, 1994 ; The Chartered Institution of Building Services Engineers, London, 56 p.

Museum and art gallery lighting: a recommended practice

Illuminating Engineering Society of North America (IESNA). New York, United States ,1996; 91 p, (IESNA RP, 30-96) , ISBN 0-87995-132-X

8. Incorrect relative humidity and incorrect temperature

Books and articles

(ASHRAE Handbook chapter) Museums Libraries and Archives

Anon, Chapter 21 Museums Libraries and Archives, in *2003 ASHRAE Handbook. Heating, Ventilating, and Air-Conditioning APPLICATIONS, SI Edition*. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc: Atlanta.

SM : This is the handbook used by all North American HVAC engineers, and referred to in many other countries. This chapter is the standard reference for RH, temperature, and pollutant specifications in museums. It is the only published environmental control specification for museums based on a risk assessment approach to various levels of control of RH and temperature fluctuation. Contains a useful summary of the various forms of incorrect RH.

Climate control priorities and solutions for collections in historic buildings

Michalski, Stefan , In: *Forum*, Vol. 12, N. 4, 1998, p. 8-14, ISSN 0893-9403

Guidelines for humidity and temperature for Canadian archives (also in French)

Michalski, Stefan , In: CCI Technical Bulletin # N. 23, 2000, Ottawa: Canadian Conservation Institute p. 20 ISSN 0706-4152

ICCROM : This bulleting discusses the temperature and humidity recommendations for archives, and explains how

and why they have changed. It also provides practical strategies and straightforward advice to help you meet these new guidelines and protect your collections.

SM : The endnotes provide an extensive review of the literature on ageing rates of paper, tape, photographic materials, and dependence on climate conditions. Several graphs and tables for estimating effect of temperature and humidity on lifetimes.

Let's be honest: realistic environmental parameters for loaned objects

Ashley-Smith, Jonathan; Umney, Nick; Ford, David , In: *Preventive conservation practice, theory and research: preprints of the contributions to the Ottawa congress, 12-16 September 1994* / Roy, Ashok (ed.); Smith, Perry (ed.); IIC. London London: International Institute for Conservation of Historic and Artistic Works, 1994, p. 28-31.

Mould prevention and collection recovery: guidelines for heritage collections (also in French)

Guild, Sherry; MacDonald, Maureen , In: *CCI Technical Bulletin*, N. 26, 2004, Ottawa: Canadian Conservation Institute p. 1-34, ills., figs., tables, ISSN 0706-4152

ICCROM : Mould infestation in heritage collections can damage artifacts and may pose a health risk to individuals who work with these collections. This Technical Bulletin presents information on mould morphology, prevention of mould growth, actions to take should mould occur and health effects relating to mould exposure. It informs the reader how to remove mould growth from artifacts and it describes the appropriate personal protective equipment to wear when working in a mould-contaminated environment or when working with mould-infested artifacts.

One response to a collection-wide mold outbreak: how bad can it be - how good can it get?

Dicus, Diana Hobart , In: *Journal of the American Institute for Conservation*, Vol. 39, N. 1, 2000, p. 85-105, ISSN 0197-1360

AA : In August 1995, the Detroit Historical Museum began a 19-month emergency response to a collection-wide mold outbreak in the artifact storage area of the Collection Resource Center at its Historic Fort Wayne site. The center houses an 18,000square foot storage area holding 51,000items from the Detroit Historical Museum's social and urban history collections. The \$900,000 emergency response involved the museum's administrative, curatorial, and maintenance staff; 3 contract conservators; a temporary project staff of 17; and representatives of the Detroit Historical Society, the City of Detroit, and the Detroit Historical Museums' insurer. Management of the project included large-scale and long-term collection assessment, environment stabilization, documentation, procurement, training, health and safety, protection, and individual treatment of objects. The successful outcome of the project depended upon decision making, project documentation systems, budgeting, personal organization, morale, productivity, and quality control.

Quantified risk reduction in the humidity dilemma

Michalski, Stefan , In: *APT bulletin*, vol. 27, N. 3, 1996, p. 25-29, fig.,tables, ISSN 0044-9466

AA: Current knowledge implies that one can never accurately predict an optimum relative humidity for a historic structure housing artifacts. Sensible monitoring and a reasoned response will always be necessary.

Relative humidity re-examined

Erhardt, David; Mecklenburg, Marion F. , In: *Preventive conservation practice, theory and research: preprints of the contributions to the Ottawa congress, 12-16 September 1994* / Roy, Ashok (ed.); Smith, Perry (ed.); IIC. London London: International Institute for Conservation of Historic and Artistic Works, 1994, p. 32-38.

ICCROM : "This paper presents results of materials research on museum objects conducted by the authors that leads them to the conclusion that many museum artifacts can safely withstand wider fluctuations in relative humidity than previously accepted by many conservators. The publication of this paper, and the claim by the authors that adoption of these more liberal relative humidity limits could save museums significant amounts of money, resulted in the re-examination and evaluation of RH standards that continues today. These more liberal RH guidelines are important for museums in historic buildings who plan to implement practical climate control concepts" (sic. Kershner & Baker)

Relative humidity: a discussion of correct/incorrect values

Michalski, Stefan , In: *Triennial meeting (10th), Washington, DC, 22-27 August 1993: preprints* / Paris: ICOM, 1993, p. 624-629

AA : Relative humidity specifications for museums became very stringent during the 1960s and 1970s, without detailed explanation. The Canadian Conservation Institute has reviewed the relevant data in order to answer common cost/benefit questions, not just stipulate "correct" RH. Mechanical, biological, and chemical deterioration all rise

sharply beyond 75 per cent RH, and increase significantly for every increment to 100 per cent RH. Fracture in rigid, constrained organic artifacts, given a relaxed state at some middle RH, becomes probable in one cycle only for a drop of minus 25 per cent to minus 50 per cent RH. Fatigue models imply that each reduction of fluctuations to one half of this critical value will reduce deterioration per cycle to 0.01 per cent-0.00001 per cent. Many flexible or sliding assemblies are immune since constraint is missing.