



PREVENTIVE CONSERVATION: REDUCING RISKS TO COLLECTIONS  
International Course, 7-25 September 2009 - Beijing, China

**SOURCES OF INFORMATION  
FOR CULTURAL HERITAGE RISK MANAGEMENT**

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**AA:** Author abstract

**AATA:** AATA abstract

**BCIN:** BCIN 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

***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](http://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

#### ***Advancing research in risk management applications to cultural property***

Brokerhof, Agnes; Meul, Veerle; Michalski, Stefan; Pedersoli, José Luiz / ICCROM. Roma, Italy, In: *ICCROM newsletter*, n. 33, 2007, p. 10-11, ill., tables, ISSN 1010-2639  
[http://www.iccrom.org/pdf/ICCROM\\_news133-2007\\_en.pdf](http://www.iccrom.org/pdf/ICCROM_news133-2007_en.pdf)

#### ***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.

[http://206.180.235.133/jaic/articles/jaic44-02-006\\_indx.html](http://206.180.235.133/jaic/articles/jaic44-02-006_indx.html)

#### ***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](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.

#### ***Avanços em conservação preventiva: pesquisa científica aplicada, estratégias de risco, estruturas e governo***

Bourdeau, James In Um olhar contemporâneo sobre a preservação do patrimônio cultural material, Title of Series: Livros do Museu Histórico Nacional, Seminário Internacional (2007 : Museu Histórico Nacional), Museu Histórico Nacional, Rio de Janeiro, Brazil, 2008, p.p. 201-217 ISBN: 9788585822095

#### ***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.

<http://unesdoc.unesco.org/images/0014/001410/141067e.pdf>

### ***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.

<http://eprints.ucl.ac.uk/2082/1/2082.pdf>

### ***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.

[http://www.ucl.ac.uk/sustainableheritage/cost\\_benefits.pdf](http://www.ucl.ac.uk/sustainableheritage/cost_benefits.pdf)

### ***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.

**Cultural property risk assessment: matching approach with purpose**

Waller, R. Robert, in book. 15th triennial conference, New Delhi, 22-26 September 2008: preprints/ICOM Committee for Conservation. Bridgland, Janet (Editor). ICOM Committee for Conservation (2008), pp. 815-819, [English w. English, French, + Spanish summaries]. 1 fig., refs. [ISBN 978-81-8424-344-4].

**AA:** Numerous approaches have been used or proposed for assessing risks to cultural properties. These approaches range from single degree of belief probability estimates and acceptability judgements through simple linguistic scales such as large, medium, and small risks, and semiquantitative scales to quantitative measures. A sampling of the diversity of approaches encountered is presented. Advantages and disadvantages of different approaches are described. The relation between the accountability framework within which decisions are made and the selection of an appropriate scale is discussed.

**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 a risk assessment model for iron gall ink on paper**

Tse, Season and Waller, Robert, In book. *15th triennial conference, New Delhi, 22-26 September 2008: preprints/ICOM Committee for Conservation*. Bridgland, Janet (Editor). ICOM Committee for Conservation (2008), pp. 301-309, [English w. English, French, + Spanish summaries]. 3 figs., 2 tables, refs. [ISBN 978-81-8424-344-4].

**AA:** Describes a process of applying a risk analysis process to develop and interpret a survey that will predict future deterioration based on the best available scientific knowledge of rate-influencing factors. The process began with the development of an iron gall ink conceptual risk model, followed by design of a survey form to collect data required for quantitative risk assessment calculations. Combining findings from iron gall ink and paper research, and data from collection surveys, the goal is to design a quantitative model and eventually a Web-based tool useful for archives and museums.

**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](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 7<sup>th</sup> European Conference “SAUVEUR”*, Safeguarded cultural heritage, Understanding & Viability of the Enlarged Europe, 31<sup>st</sup> May – 3<sup>rd</sup> 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.

### **Metodologija za pripravo ovrednotenja razmer v arhivskih depojih/Methodology for risk assessment survey in archival storage**

Denisa, Maja; Vodopivec, Jedert , In: Razmere v arhivskih depojih: (ne)znano v arhivskih fondih in zbirkah, medarhivsko sodelovanje: 23. zborovanje Arhivskega Društva Slovenije, Velenje, 10. do 12. oktober 2007: zbornik referatov / Arhivsko društvo Slovenije. Ljubljana, Slovenia. Ljubljana: Arhivsko društvo Slovenije, 2007, p. 36-44, tables, Zborovanju Arhivskega društva Slovenije, 23, Velenje, Slovenia, 20071010-20071012. ISBN 978-961-6143-25-7 [Slovenian + Slovenian; English summary]

### **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. : ill., 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.

**Razmere v arhivskih depojih: (ne)znano v arhivskih fondih in zbirkah, medarhivsko sodelovanje: 23. zborovanje Arhivskega Drustva Slovenije, Velenje, 10. do 12. oktober 2007: zbornik referatov / Survey on archives storage: the known and unknown in archival fonds and collections, inter-archive meeting: 23rd conference of the Association of Slovenian Archives, Velenje, 10-12 October 2007: proceedings**

Nared, Andrej, ed. Arhivsko drustvo Slovenije, Ljubljana, 2007 [Slovenian + Slovenian; English summary]

**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, ill., 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, ill., 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 and digital repositories: the case of DRAMBORA***

Bermès, Emmanuelle, *International preservation news: a newsletter of the IFLA Programme on Preservation and Conservation = Internationale Nachrichten der Konservierung = Les nouvelles internationales de préservation = Mezhdunarodnye novosti konservatsii* no. 41 (2007 July), pp. 8 [English].

**AATA:** The Digital Repository Audit Method Based On Risk Assessment (DRAMBORA) can be used to evaluate activities within an institution for their effectiveness in long-term digital preservation. A DRAMBORA audit considers all activities that may have an impact on the preservation of digital objects, assembling evidence to gain an objective understanding, the purpose being to evaluate vulnerabilities and risk for any given institution conducting the self-assessment.

<http://archive.ifla.org/VI/4/news/ipnn41.pdf>

***Risk management at the Fitzwilliam Museum, Cambridge***

Greeves, Margaret , In: *Journal of architectural conservation*, Vol. 7, N. 3, 2001, p. 67-79, ill., 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 Riksanthvarieämbetet (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: methodological principles = Gérer les risques: principes méthodologiques***

Bermès, Emmanuelle, *International preservation news: a newsletter of the IFLA Programme on Preservation and Conservation = Internationale Nachrichten der Konservierung = Les nouvelles internationales de préservation = Mezhdunarodnye novosti konservatsii* no. 41 (2007 July), pp. 4-7 [English + French w. Spanish summary]

**AATA:** Describes the application of risk management principles in the library environment. The rationale for invoking risk management is that activities in libraries generate risks and that measures can be taken to manage them. First it is important to understand what an acceptable level of risk is, given the mission and resources of the institution. The author lays out steps in risk management, which include definition of context, needs, and objectives and identification of specific risks, each defined in terms of institutional vulnerability and severity of threat. A matrix displaying impact and likelihood scores is a tool for viewing the most critical risks, and it will facilitate planning and prioritization of mitigation actions. Plans should be implemented to reduce the level of each risk. While this is most effective for internal risks, which are to a greater extent controllable, external risks should be dealt with by planning actions to minimize their impact should they occur or, if possible, to transfer risk by acquiring insurance when appropriate. An iterative approach to assessing, reassessing, and managing risk in an ongoing manner is recommended.

<http://archive.ifla.org/VI/4/news/ipnn41.pdf>

***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

***Safeguarding the significance of ensembles: value assessments in Risk Management for Cultural Heritage.***

Meul, Veerle, In book. 15th triennial conference, New Delhi, 22-26 September 2008: preprints/ICOM Committee for Conservation. Bridgland, Janet (Editor). ICOM Committee for Conservation (2008), pp. 1048-1055, [English w. English, French, + Spanish summaries]. 5 figs. (2 color), 1 table, refs. [ISBN 978-81-8424-344-4].

**AA:** Risk Management for Cultural Heritage is a promising alternative to inadequate standards for preventive conservation in the management of heritage ensembles--meaningful complexes of movable and immovable heritage. An exploratory research project, based on a literature study and interviews, was undertaken for ICCROM to inform the value assessments in this methodology. The study argues that an explicit assessment of significance should precede risk identification and that a consistent terminology, criteria, and procedures should be adopted. Ensembles should be assessed as a whole, within the framework of values-centered management of heritage places. A statement of significance should reflect the diverse values of all relevant stakeholders, identify the key features and immaterial characteristics of the ensemble, and include an assessment of the relative importance of its components. A procedure is suggested for assessing loss of significance, relying largely on sound participatory decision-making inspired by impact assessments in environmental conservation.

***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  
[http://www.collectionsaustralia.net/sector\\_info\\_item/5](http://www.collectionsaustralia.net/sector_info_item/5)

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

***Social discount rate: modelling collection value to future generations, and understanding the difference between short-term and long-term preservation actions***

Michalski, Stefan, In book. 15th triennial conference, New Delhi, 22-26 September 2008: preprints/ICOM Committee for Conservation. Bridgland, Janet (Editor). ICOM Committee for Conservation (2008), pp. 751-758, [English w. English, French, + Spanish summaries]. 6 figs. (3 color), 2 tables, refs. [ISBN 978-81-8424-344-4].  
 AA: The Canadian Conservation Institute (CCI) is developing a computer model of collection value in order to clarify risk-based decision-making. A fundamental design issue is the accrual of value over time and the weighting of the future by the "social discount curve." In the process of exploring this problem, the history of ideas in utilitarian moral philosophy over the last 200 years was found to provide useful clarity and terminology. An Analytica® model of collection value over time is presented, with a preliminary study of the role of discount rate and multiple values on preservation decisions.

***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***

Porcl, 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.

[http://www.getty.edu/conservation/publications/pdf\\_publications/valuesrpt.pdf](http://www.getty.edu/conservation/publications/pdf_publications/valuesrpt.pdf)

***What's causing the damage! The use of a combined, solution-based risk assessment and condition audit***

Fry, Claire; et alii , In: *Museum microclimates: contributions to the Copenhagen conference, 19-23 November 2007* / Padfield, Tim (ed); Borchersen, Karen (ed); Nationalmuseet = National Museum of Denmark. Copenhagen, Denmark. Copenhagen: National Museum of Denmark, 2007, p. 107-114, ill., *Museum microclimates: conference*, Copenhagen, Denmark, 20071119-20071123. ISBN 978-87-7602-081-1

**ICCROM:** The English Heritage Collections Conservation team cares for a mixed collection distributed among 136 historic sites. The article describes the recent process at English Heritage to combine a sampled condition survey and a solution-based risk assessment into a single condition audit, thereby providing a practical methodology to guide the complex collection care needs for this type of distributed collection. The methodology involves four phases: viewing locations within a site and counting objects, sample selection, condition survey, and risk assessment. A specially-designed database based on Microsoft Access helps field auditors input the condition data for the objects selected to be surveyed. The database then generates scores on the risk levels present in various sites, thereby informing decisions on how to address those risks and improve collections care. The audit is proving to be a key tool in increasing knowledge of the risks to the collections and in providing prioritised solutions and costs to reduce these risks, as well as influencing management and guiding research.

<http://www.natmus.dk/sw53828.asp>

**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**

***Collection risk assessment – Royal BC Museum***

Hughes, G. Presented at the CMA Cultural Property Protection Conference, Ottawa, 16 January 2006.

[www.museums.ca/protection/en/presentations/Hughes.pps](http://www.museums.ca/protection/en/presentations/Hughes.pps)

***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.

[http://www.ucl.ac.uk/sustainableheritage/Archive\\_0906/sustainableheritage/sustainableheritage/learning/asc2/participants/JASTech\\_notes2003.pdf](http://www.ucl.ac.uk/sustainableheritage/Archive_0906/sustainableheritage/sustainableheritage/learning/asc2/participants/JASTech_notes2003.pdf)

***Preventive Conservation Case Study: Preventive Conservation in the Context of a Historic House Museum***

[http://www.getty.edu/conservation/education/case/case\\_component1.html](http://www.getty.edu/conservation/education/case/case_component1.html)

***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](http://sector.amol.org.au/publications_archive/museum_management/significance)

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

### Books and articles

***2nd international conference on risk management: planning risk preparedness for cultural heritage against natural disasters, 16-18 January 2008, Nara, Japan: report***

Cultural Heritage Protection Cooperation Office. Asia/Pacific Cultural Centre for UNESCO (ACCU). Nara, Japan , Nara: ACCU, 2008 ; 104 p. : ill. ; 29 cm. , *International conference on risk management: planning risk preparedness for cultural heritage against natural disasters*, 2, Nara, Japan, 20080116-20080118

***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](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.

***Cultural heritage risk management, world conference on disaster reduction: proceedings, Kyoto and Kobe, Japan, 15th-22th January 2005***

Jigyasu, Rohit; Masuda, Kanefusa / Research Center for Disaster Mitigation of Urban Cultural Heritage, Ritsumeikan University. Kyoto, Japan , Kyoto: Rits-DMUCH, 2005 ; 234 p. : ill. ; 22 cm. , *Cultural heritage risk management: world conference on disaster reduction*, Kyoto, Kobe, Japan, 20050115-20050122.

***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.

[http://aic.stanford.edu/jaic/articles/jaic39-01-013\\_indx.html](http://aic.stanford.edu/jaic/articles/jaic39-01-013_indx.html)

***Disaster is just a step away: working at being a step ahead***

Verberne-Khurshid, F.; Boitelle, René; Ormond, Devi; and van Gulik, Robien, In book. *15th triennial conference, New Delhi, 22-26 September 2008: preprints/ICOM Committee for Conservation*. Bridgland, Janet (Editor). ICOM Committee for Conservation (2008), pp. 798-807, [English w. English, French, + Spanish summaries]. 4 tables, refs. [ISBN 978-81-8424-344-4].

**AA:** Outlines the work done to date by the Collections Emergency Preparedness Project group which was created in 2004 by Dutch institutional conservators. The group's aim is to ensure that a comprehensive Collections Emergency Preparedness (CEP) plan is available to cultural institutions in the Netherlands so that it can be integrated into their general disaster plan. According to the project group, collection retrieval is integrally linked to many other factors, such as risk management prior to eventual disasters, implementing procedural guidelines for staff, and regular training sessions. It also involves merging collection emergency preparedness with that of the emergency plan for facilities (FEP). Examples are given in various tables aimed at streamlining and managing these interrelated subjects. The project group has been working at acquiring an official status within the Dutch Association of Museums (NMV) in order to secure future maintenance of the plan.

***Disaster Management in Archives, Libraries and Museums***

Matthews G, Smith Y, Knowles G. Ashgate, Aldershot, 2009 224, p. ISBN: 0754672735

***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.

***New problems in the study of disaster prevention based on disaster risk governance***

Nagasaka, Toshinari , In: Science & technology trends, N. 27, April (2008), p. 77-92, ill., ISSN 1349-3671  
<http://www.nistep.go.jp/achiev/ftx/eng/stfc/stt027e/qr27pdf/STTqr2705.pdf>

***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.

***Preventive Measures for the Safeguard of Cultural Heritage in the Event of Armed Conflict***

Maniscalco, Fabio , In: *Web journal*, N. 1, Gennaio/Giugno (2007), p. 67-96, ill., ISSN 1827-8868

**ICCROM:** Notwithstanding the recent publication of the volume "World Heritage and War", the Author of this paper aims at taking advantage of the large diffusion granted by the "Web Journal on Cultural Patrimony" to give an overview of the practical activities which specialists should carry out, in wartime, to protect the cultural property. Actually, these activities have been rarely carried out during the last conflicts.

<http://www.webjournal.unior.it/Dati/19/73/Web%20Journal%203.%20salvaguardia%20bcc%20guerra.pdf>

***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

[http://www.iccrom.org/pdf/ICCROM\\_17\\_RiskPreparedness\\_en.pdf](http://www.iccrom.org/pdf/ICCROM_17_RiskPreparedness_en.pdf)

## Websites

### **EUR-OPA Major Hazards**

[http://www.coe.int/t/dg4/majorhazards/default\\_en.asp](http://www.coe.int/t/dg4/majorhazards/default_en.asp)

### **Getty Conservation Institute emergency plans**

[http://www.getty.edu/conservation/publications/pdf\\_publications/emergency\\_plan.pdf](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 (Eastern European area)**

[www.h-net.org/~museum/flood.html](http://www.h-net.org/~museum/flood.html)

## 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**

Aghabian, 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.

<http://desastres.usac.edu.gt/documentos/pdf/eng/doc7132/doc7132-contenido.pdf>

##### **Investigation of precaution measures against earthquake for antiques**

Zheng, Hui-juan, *Wen wu bao hu yu kao gu ke xue* 19, no. 2 (2007 May), pp. 26-33 [Chinese w. Chinese + English summaries]. 6 figs., 6 tables, 5 refs.

**AA**: The National Palace Museum in Taipei has an important collection of ancient porcelains and jades. There is room for improvement in protecting those objects on display in the event of an earthquake. It is therefore essential and urgent to investigate anti-earthquake measures for these artifacts. The present study adopted traditional anti-earthquake measures (museum wax, Teflon, rubber pads, and anti-earthquake plastic pads), a seismic isolation table, and exhibit cases secured by electromagnets to investigate the effectiveness of protecting these objects during earthquakes. The experiments were conducted on the earthquake platform at the National Center for Research on Earthquake Engineering (NCREE). The results showed effectiveness in decreasing order for museum wax, Teflon, rubber pads, and anti-earthquake plastic pads, among traditional measures. The seismic isolation table inside an exhibit case didn't show good performance for an earthquake with acceleration less than 300 gals, but it exhibited a

significant seismic reduction (up to 60%) for one with a Richter scale reading higher than 6 or 7 (acceleration between 300 and 400 gals). The exhibit cases without electromagnets showed rocking when acceleration exceeded 300 ergs. On the other hand, display cases secured by electromagnets didn't show rocking until acceleration was over 800 gals. The results indicated that securing exhibit cases with electromagnets had a good effect on anti-earthquake motion. It is concluded that using museum wax as an anti-earthquake measure is most economical. The isolator is an acceptable alternative, but the space available in exhibit cases is crucial for this measure.

#### ***Istanbul at the threshold: an evaluation of the seismic risk in Istanbul***

Pyper Griffiths, Jacob H.; Irfanoglu, Ayhan; Pujol, Santiago , In: *Earthquake spectra*, Vol. 23, n. 1, February (2007), p. 63-75, ill., tables, ISSN 8755-2930

**ICCROM:** There is no convincing evidence indicating that future ground motion in at least two-thirds of Istanbul, Turkey, shall be less demanding than the ground motions that devastated the city of Düzce, Turkey, in 1999. Comparison of vulnerability indices calibrated for Turkish construction indicates that the structures of the buildings in Istanbul are no better than the structures of buildings in Düzce. On the basis of these arguments, we project that a future earthquake near Istanbul may cause severe damage or collapse approximately quarter of a million buildings. Leaving the vulnerable buildings as they are and organizing for emergency response is not an option for Istanbul.

#### ***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

[http://aic.stanford.edu/jaic/articles/jaic39-01-012\\_idx.html](http://aic.stanford.edu/jaic/articles/jaic39-01-012_idx.html)

#### ***Vibration impact: methods and results of some recent studies***

Thorn, Andrew, In book. 15th triennial conference, New Delhi, 22-26 September 2008: preprints/ICOM Committee for Conservation. Bridgland, Janet (Editor). ICOM Committee for Conservation (2008), pp. 783-790, [English w. English, French, + Spanish summaries]. 6 color figs., refs., 1 note. [ISBN 978-81-8424-344-4].

**AA:** Vibration impact has been studied where high impact and often short term threats are perceived. This presentation considers the impact of constant low level vibration as a significant on-going destabilizing mechanism, and focuses on available equipment and presents several case studies to illustrate the problem and the slight short comings of current instruments.

## **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.

### ***Risk assessment during art loan and transportation at the Byzantine and Christian Museum of Athens***

Papadimitriou, Maria and Vamvakari, Elpida, In book. *Conservation and access: contributions to the London Congress 15-19 September 2008*. Saunders, David; Townsend, Joyce H; and Woodcock, Sally, Editors. International Institute for Conservation of Historic and Artistic Works (2008), pp. 69-75, [English w. English summary]. 3 figs., 7 tables, 30 refs. [ISBN 0-9548169-2-7].

**AA**: The Byzantine and Christian Museum of Athens frequently undertakes art loans within the framework of international cultural exchanges, education, and research. An artifact is exposed to considerably more risks in transit than while it remains within a museum's premises. In reference to such risks, differences of perception are, moreover, noted between the various categories of personnel engaged in art transportation operations. For these reasons, a quantitative and qualitative risk analytical method was adopted for exhibits in transit. The purposes of this process were: the identification, assessment, and evaluation of principal causes of damage; the development of strategic actions for improved management of potential risks; the planning of preventive actions for the optimum protection of artifacts. The results of this analytical process led to a series of proposals for various improvements in the organization and planning of transportation procedures. Careful planning and the meticulous preparation of shipping of the artifacts are part of a systematic preventive conservation program aiming at the elimination or the reduction of any hazards that, potentially, could cause an accident of irreversible consequences.

### ***Vibration as a hazard during the transportation of canvas paintings***

Lasyk, Łukasz; Łukowski, Michał; Bratasz, Łukasz; and Kozłowski, Roman, In book. *Conservation and access: contributions to the London Congress 15-19 September 2008*. Saunders, David; Townsend, Joyce H; and Woodcock, Sally, Editors. International Institute for Conservation of Historic and Artistic Works (2008), pp. 64-68, [English w. English summary]. 8 figs., 11 refs. [ISBN 0-9548169-2-7].

**AA:** The assessment of vibration levels that cause damage to canvas paintings travelling on loan has been hampered by the lack of direct measurements of the dimensional change of the canvas. The application of triangulation laser displacement sensors in this study has allowed direct, continuous in situ monitoring of the vibration of canvas during packing, handling and transporting by road of three nineteenth-century oil paintings from the collection of the National Museum in Cracow, Poland. The measurements showed various levels of vibration primarily influenced by the packing method: paintings wrapped in tissue and transported in soft cardboard boxes were better cushioned from the vibration than a painting rigidly fixed in a wooden case. However, increased levels of vibration were always measured during packing the paintings and transferring the cases or boxes to and from the road vehicle, which emphasizes the need to train the staff to handle the paintings with care when they are still in the museum. The strains induced by the vibration levels recorded were much lower than the critical levels of tolerable strain for the nineteenth-century canvas paintings quoted in the conservation literature. Therefore the paintings are unlikely to be endangered by fracture or fatigue damage under the transportation conditions monitored.

### **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](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.

#### ***Physical forces***

Ten Agents of Deterioration at the Canadian Conservation Institute web-site

<http://www.cci-icc.gc.ca/crc/articles/mcpm/chap01-eng.aspx>

#### ***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](http://www.cci-icc.gc.ca/whats-new/padcad-download_e.shtml). See [http://www.cci-icc.gc.ca/whats-new/newsletter\\_e.shtml](http://www.cci-icc.gc.ca/whats-new/newsletter_e.shtml), Newsletter No.22 for packaging articles.

## 2. Thieves and vandals

### Books and articles

#### ***The benefits of access through handling outweigh the risks***

Pye, Elizabeth, In book. *Conservation and access: contributions to the London Congress 15-19 September 2008*. Saunders, David; Townsend, Joyce H; and Woodcock, Sally, Editors. International Institute for Conservation of Historic and Artistic Works (2008), pp. 162-165, [English w. English summary]. 38 refs. [ISBN 0-9548169-2-7].

**AA:** There is growing appreciation of the importance of the neglected sense of touch in reaching an understanding of the world. By limiting handling in museums, many people are denied information and enjoyment, particularly blind and partially sighted people. Conservators regularly assess and grade objects for their vulnerability to light; a similar approach could be applied to grading the "handleability" of objects and making unused collections accessible through touch.

#### ***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.

#### ***Security in museums, archives and libraries: a practical guide***

Resource: The Council for Museums, Archives and Libraries. London, United Kingdom , London: Resource: The Council for Museums, Archives and Libraries, 2003 ; VIII, 175 p. : figs., tables ; 30 cm. , ISBN 1-903743-13-3

#### ***Stolen manuscript: lessons learnt***

Sanson, Jacqueline, *International preservation news: a newsletter of the IFLA Programme on Preservation and Conservation = Internationale Nachrichten der Konservierung = Les nouvelles internationales de preservation = Mezhdunarodnye novosti konservatsii* no. 45 (2008), pp. 16 [English]. 1 color ill.

**AATA:** Between February 1998 and 2003, a number of rare manuscripts and documents in the special collections of the National Library of France were found to have been stolen. Because of these thefts, the Library launched a security plan that included a general access control system, stamping and systematic marking of collection items, and identification requirements for readers.

<http://archive.ifla.org/VI/4/news/ipnn45.pdf>

### Websites

#### ***Museum-security***

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

#### ***Thieves and vandals***

Ten Agents of Deterioration at the Canadian Conservation Institute web-site

<http://www.cci-icc.gc.ca/crc/articles/mcpm/chap02-eng.aspx>

### 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, Sherelyn (ed.) / Northeast Document Conservation Center. Andover, Massachusetts, United States - 3rd rev. and enlarged ed. 1999 ; ISBN 0-963-4685-2-9

[http://nedcc.org/resources/leaflets/3Emergency\\_Management/02IntroToFireDetection.php](http://nedcc.org/resources/leaflets/3Emergency_Management/02IntroToFireDetection.php)

##### ***A study of fire safety protection and emergency response strategies for historic timber frame constructed property***

Chein, Shen Wen; Lin, Meng Rong; and Huang, Yi Hui, *Wenhua zichan baocun xuecan* 1, no. 1 (2007), pp. 27-37 [Chinese w. Chinese + English summaries]. 10 ills. (9 color), 3 tables, 9 refs.

**AATA:** Based on a study of education, fire safety management, fire safety protection technology, and appropriate protection strategies for various cases, this project aimed to establish reasonable and operable fire protection and response strategies for historic timber-frame properties. Available fire statistics reveal that the major causes of destruction of historic timber constructions are: malfunction of electrical installations, malfunction of heating equipment, smoking materials, and arson. Many fire investigation reports for historic properties reveal that lack of appropriate fire suppression systems, fire detection systems, and delay in fire notification result in the fire spreading. Appropriate initial emergency response action is a key factor in whether a fire in a building can be controlled in a zoned area. In general, many historic structures did not have appropriate fire protection systems installed; consequently, fire could spread, and damage would be inestimable because of the delay in sounding the alarm.

##### ***Automatic Sprinkler Systems for Museums (also in French)***

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

##### ***Bother about burning: fire tests and practical experiments to develop best practices***

Wassink, Bihanne; Porck, Henk , In: *Papierrestaurierung*, Vol. 8, n. 4, 2007, p. 33-35, ill., ISSN 1563-2628

**ICCROM:** The occurrence of several fire disasters that struck important collections of cultural heritage in recent years has raised the concern about fire risk. The Nationaal Archief (Dutch National Archives) and the Koninklijke Bibliotheek (National Library of the Netherlands) have recently been involved in tests on dispensable books, archival documents and other objects representative of our cultural heritage which were deliberately set on fire. First of all, the aim was to obtain practical knowledge of the various types of damage inflicted by fire, heat, soot and water on a range of materials. The second aim was to study the protection offered by storing items in boxes and other kinds of protective materials. Thirdly, we wanted to ascertain what method of emergency treatment would be most effective in minimising lasting damage and subsequent restoration costs. Finally, we intended to use the trials to evaluate, update and improve our existing disaster plans. The practical experiments have provided valuable information offering a clearer idea of how best to deal with fire and water-damaged materials, the importance of protective containers and the effect of rinsing and bandaging of water-damaged books prior to drying. The study was conducted within the framework of The Hague Prevention Network through which a range of cultural institutions is being assisted by the fire service, police and municipality to draw up disaster plans.

##### ***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.

**COST Action C17 - built heritage : fire loss to historic buildings : conference proceedings**

Historic Scotland. Technical Conservation, Research and Education Group;European Cooperation in the Field of Scientific and Technical Research (Organization);European Science Foundation (Corp. Author) (2008)

**Die Generalsanierung der Herzogin-Anna-Amalia-Bibliothek in Weimar nach der Brandkatastrophe 2004: Darstellung der holzrestauratorischen Maßnahmen im Rokokosaal**

Flade, Jochen , In: *Beiträge zur Erhaltung von Kunst- und Kulturgut*, n. 1, 2009, p. 29-51, ill.,

**AA:** A few weeks before the renovation of the Herzogin-Anna-Amalia-Library (1761-66) in Weimar, Germany, was to begin, a disastrous fire from the second to the fourth of September 2004 caused the destruction of the entire roof truss and the mansard floor, reaching up to the second floor of the Rococo Room. About 50,000 volumes of the library's archive were destroyed, and 62,000 were seriously damaged by the water used to extinguish the fire. Immediately after the building had been cleaned of the layers of rubble, its general redevelopment was undertaken. This included an evaluation of the damage as well as the planning of the restoration of the famous Rococo Room--a wooden, two-story library room in Rococo style. During the conservation and restoration of the library, carried out by four competent wood restoration workshops, new problems arose in addition to the usual tasks. They were caused by fungal infestation, subsidence of the wooden subconstruction, the partial reconstruction of stairs, and climatic peculiarities. A scientific analysis of historic glazes on the friezes in the floor became necessary so that exemplary decisions could be made concerning preservation.

**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

[http://aic.stanford.edu/jaic/articles/jaic39-01-003\\_idx.html](http://aic.stanford.edu/jaic/articles/jaic39-01-003_idx.html)

**The fire at Sungnyemun and its lessons**

Kang, Hyeon , In: *Korean heritage*, Vol. 1, n. 2, Autumn (2008), p. 13-18, ill., ISSN 2005-0151

***Fire behavior and fire protection procedures for wooden historical buildings***

Wang, Song-Yon *Wenhua zichan baocun xuecan* 1, no. 1 (2007), pp. 18-26 [Chinese w. Chinese + English summaries]. 6 ill. (4 color), 3 tables, 11 refs.

**AA:** Describes the danger to wooden historic buildings resulting from fire and proposes fire protection procedures. The design of a safe cross section for wooden buildings is possible for constructions with round cross-sectional members over 15 cm in diameter. The surface of beam or column members in Chinese traditional buildings and European-style buildings could have timber an additional 25 mm, 35 mm, 50 mm, or 60 mm thick in order to increase the duration of fire resistance to 30 min., 45 min., and 1 hr., respectively. Construction members in Japanese wooden buildings should be covered with fire retardant materials. All wooden historic buildings should be fitted with automatic fire detectors and alarms or extinguishers. Fire hydrants should be installed around the buildings. Interior electrical devices and wires should be checked and maintained periodically. Early firefighting is important for fire control and to prevent spreading.

***Fire risk assessment for collections in museums***

Tétreault, J. *The Journal of the Canadian Association for Conservation*, vol. 33, 2008, p. 3-21

**AA:** Loss of collections in museums can be significant during a fire. It is important that museums put control measures in place to prevent a fire, to detect a fire, and to respond quickly if a fire does occur. To evaluate potential collection losses due to fire over a certain period of time, substantial information is required and there is little quantitative data for fires in museums. It was decided to obtain this data by collecting fire museum records from Canadian fire authorities as well as from fire authorities in other countries and by consulting with experts. This project has resulted in establishing fire Control Levels for museums and in creating a set of reference materials to help risk assessors evaluate the potential collection losses due to a fire. According to experts consulted in this study, having an active fire safety committee composed of staff and management is one of the key elements in fire prevention. Such a committee helps promote awareness and identify problems, as well as propose solutions and ensure that these solutions are applied to minimize risk of fire in an institution.

For optimal protection, museums are encouraged to have a fire alarm system that is monitored continuously as well as an automatic fire suppression system.

[http://www.kb.nl/kvce/tetreault\\_fire\\_risk\\_assessment\\_cac.pdf](http://www.kb.nl/kvce/tetreault_fire_risk_assessment_cac.pdf)

***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.

***Minimum Invasive Fire Detection for Protection of Heritage – Research Report***

Jensen Geir, Riksantikvaren the Norwegian Directorate for Cultural Heritage and Historic Scotland: Technical Conservation, Research and Education Group, Oslo 2005

<http://www.riksantikvaren.no/filestore/DetectionContentsandExecutivesummaryonly.pdf>

***Manual Fire Extinguishing Equipment for Protection of Heritage– Research Report***

Jensen Geir, Sommer-Larsen, Anne, Riksantikvaren the Norwegian Directorate for Cultural Heritage and Historic Scotland: Technical Conservation, Research and Education Group, Oslo 2005

<http://www.riksantikvaren.no/filestore/ManualContentsandExecutivesummaryonly.pdf>

***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.

**Kulturgüter effektiv schützen: Die neuen Sicherungsrichtlinien für Museen und Ausstellungshäuser**

Vorderwülbecke, Paulus, In: *Museum aktuell*, Februar, n. 155, 2009, p. 14-18, ill., ISSN 1433-3848

**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.

**Science and technology trends relating to fire and disaster management: towards innovations of fire and disaster management**

Matsubara, Yoshiyuki; Urashima, Kuniko , In: *Science & technology trends*, N. 26, January (2008), p. 86-103, ill., ISSN 1349-3671

<http://www.nistep.go.jp/achiev/ftx/eng/stfc/st026e/qr26pdf/STTqr2606.pdf>

**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

[http://aic.stanford.edu/jaic/articles/jaic39-01-004\\_indx.html](http://aic.stanford.edu/jaic/articles/jaic39-01-004_indx.html)

## Websites

### Fire

Ten Agents of Deterioration at the Canadian Conservation Institute web-site

<http://www.cci-icc.gc.ca/crc/articles/mcpm/chap04-eng.aspx>

## 4. Water

### Books and articles

**Die zerstörerische Kraft des Wassers im August 2002 in Sachsen**

Sprenger, Petra , In: *Konservieren Restaurieren*, Vol. 11, 2007, p. 149-154, ill. , table, *Wasser*, Wien, Austria, 20061110-20061111.

**ICCROM**: The massive flood disaster, which occurred in August of 2002, caused enormous damage to the holdings of archives. The flooding affected county, municipal, church, university and company archives in Saxony. The removal of flood-incurred damage to documents and archives by means of conservation treatment was finished only in 2005. The floods have shown that forecasts and advance warning time margins for the archives in question were partly incalculable, with the consequence that flooding happened surprisingly fast.

***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

[http://aic.stanford.edu/jaic/articles/jaic39-01-009\\_idx.html](http://aic.stanford.edu/jaic/articles/jaic39-01-009_idx.html)

***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

***Flooding hits Kelham Island Museum***

Martin, David *ICON news: the magazine of the Institute of Conservation* no. 12 (2007 Sep), pp. 22-23 [English]. 2 color ills.

**AATA:** Describes the flooding in the display and storage areas of the Kelham Island Museum in Sheffield, England, on 25 June 2007, the response of museum staff, and the success of the emergency plans. Staff members were able to enter the building the next day and organize/prioritize the salvage operation. The first priority, works on paper, were moved to a large unaffected room to dry. Objects requiring special treatment were sent directly to standby local conservators. A temporary paintings conservation studio was set up. Very few objects were damaged irretrievably. Decisions still have to be made on treatment priority or disposal on remaining objects and emergency plan review and updating.

***Freeze-drying Vellum***

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

***Hot water damage: a case study of the Library of the Culture Palace for Nationalities***

Zhang, Zhiqing and Zhao, Daying, *International preservation news: a newsletter of the IFLA Programme on Preservation and Conservation = Internationale Nachrichten der Konservierung = Les nouvelles internationales de preservation = Mezhdunarodnye novosti konservatsii* no. 41 (2007 Jul), pp. 22-25 [English].

**AATA:** Reviews damage caused by a burst hot water pipe at the Library of the Culture Palace for Nationalities of China (LCPN) as well as remedial action and lessons learned from the disaster. On 15 November 2005, when the central heating system in Beijing was turned on, large heating pipe running adjacent to library book stacks burst, flooding the drainage system and overflowing into the basement stack area. The steam triggered the fire sprinklers, which damaged material on the upper shelves, compounding the damage. The water temperature and steam made access impossible until the water cooled somewhat. Because of the heat of the water, damage was unusually severe, and the presence of water softener in the water added to the damage. On-site response to the emergency and the use of freeze-drying facilities are briefly described. Lessons learned include the fact that the fire sprinklers compounded the problem; the library had no water-sensing alarms; the heat of the water retarded response time; and staff was initially unaware that the fire sprinklers had been activated. Many of the rare books were on open shelves and not in protective coverings. Plans for preventing future occurrences include maintaining the pipelines, altering the drainage system so it can handle a future occurrence, creating protective barriers for the collection, and monitoring the stacks for moisture infiltration. A list of preventive measures is compiled. The importance of risk assessment as well as a disaster management plan and quick response time are discussed.

<http://archive.ifla.org/VI/4/news/ipnn41.pdf>

***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 institutions.

[http://aic.stanford.edu/jaic/articles/jaic39-01-010\\_indx.html](http://aic.stanford.edu/jaic/articles/jaic39-01-010_indx.html)

***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](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.

***Water in Buildings: An Architect's Guide to Moisture and Mold***

William B. Rose, John Wiley & Sons, Inc. Hoboken, New Jersey 2005, ISBN: 978-0-471-46850-9, 288 p.

## 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>

**Water**

Ten Agents of Deterioration at the Canadian Conservation Institute web-site  
<http://www.cci-icc.gc.ca/crc/articles/mcpm/chap05-eng.aspx>

**5. Pests****Books and articles*****Buggy biz: integrated pest management in collections; Fluffy stuff: integrated control of mould in archives***

Brokerhof, Agnes W.; Van Zanen, Bert; Van de Watering, Ko; Porck, Henk; Den Teuling, Arnold / Netherlands Institute for Cultural Heritage (ICN). Amsterdam, Netherlands - 2nd ed. , Amsterdam: Netherlands Institute for Cultural Heritage (ICN), 2007 ; 79, 39 p. : ill. ; 20 cm. , Tête bêche. ISBN 978-90-72905-51-2

***Combatting Pests of Cultural Property***

Strang Tom; Kigawa Rika in *CCI Technical Bulletin*, N. 29, 2004, Ottawa: Canadian Conservation Institute p. 1-44, ill., figs., tables, ISBN: 798-0-660-19899-6

**AA:** Pests can be very destructive to both aesthetic elements and the structural integrity of collections, historic buildings, and objects. Protection against pests requires attention to the collection's environment, containment, discovery of pests, response to pests, and remediation actions. Reducing loss of value over time is the goal of preventive conservation strategies. Integrated pest management (IPM) practices are part of this process. Having a safe work environment and minimizing adverse effects to objects from chemical exposure is a background concern. Effectiveness of any control procedure or treatment can be measured by reducing the extent and repeated incidence of the problem. Basic pests of collections, and a structured approach to pest reduction activities, are presented. A survey method with remediation activities appropriate to pest infestation findings is given to help start an IPM program for a wide range of collections from outdoor installations to state-of-the art preservation facilities.

***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

***Levels of IPM control: matching conditions to performance and effort***

Strang, Tom; Kigawa, Rika , In: *Collection forum*, Vol. 21, n. 1-2, Fall (2006), p. 96-116, tables, ISSN 0831-4985  
**ICCROM:** A scale in order of increasing improvement of pest control is presented to cover a wide range of situations from no resistance to pests to comprehensive control. Seven levels of IPM control are developed from this scale and for each level there are subsequently described appropriate remedial integrated pest management (IPM) solutions to the more significant vulnerabilities. These are intended to be a good starting point for IPM planning or instruction. Threshold 'Plan B' details have also been identified for each level, so the user can achieve the basics first and look to improve standards in the future. The levels provide an important benchmark for assessing long-term movements up, down or within the scale of standards. A prognosis is given for each level, forecasting the course of pest infestation and estimating rates of deterioration, which are discussed for obdurate, robust, soft and delicate materials. This provides a useful framework during collections surveying for classifying risks to collections from pest activities.

***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.: ill. ; 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

***Risk zones for IPM: from concept to implementation***

Doyle, Adrian M.; Pinniger, David; Ryder, Suzanne , In: *Collection forum*, Vol. 22, N. 1-2, Fall (2007), p. 23-31, ill., ISSN 0831-4985

**ICCROM:** The Natural History Museum in London is the first national museum to introduce a museum-wide integrated pest management (IPM) strategy based on a concept of risk zones. This system is based on the principle of pest prevention within a museum building, which will always have a resident population of pest insects. The loss of dichlorvos [DDVP] resulted in an urgent need to implement a museum-wide IPM program to protect vulnerable collections in both storage areas and displays. With such a large, diverse collection in a complex series of interconnecting buildings, it was necessary to break the program down into sections. A key to this was the decision to define and adopt the concept of "Risk Zones" from high risk A, to low risk D, for all areas of the museum. The article describes the development of ideas and subsequent implementation of the "Risk Zone" concept in the Natural History Museum, including the outstations, and makes observations on the need to identify priorities and the importance of training staff at all levels. Risk concepts and staff awareness are an effective method, which can be adopted by other institutions as part of an IPM program.

***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

## Website

### **Combating Pests of Cultural Property**

Ten Agents of Deterioration at the Canadian Conservation Institute web-site

<http://www.cci-icc.gc.ca/crc/articles/mcpm/chap06-eng.aspx>

## 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. : ill., 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.

#### **Economics of dust**

Lloyd, Helen; Brimblecombe, Peter; and Lithgow, Katy, *Studies in conservation* 52, no. 2 (2007), pp. 135-146 [English w. English, French, German, + Spanish summaries]. 11 figs., 26 refs., 1 appendix.

**AA**: Dust presents a physical risk to objects and reduces evidential value; it also creates a perception of poor standards of care. However, cleaning also imposes risks of damage, takes time, and costs money. The presence of visitors induces much of the dust found in properties, so increasing or extending access has implications for

housekeeping that are rarely discussed in economic terms, despite the fact that dust control represents the most expensive element of preventive conservation in historic houses. The range of preventive and protective measures that minimize the deposition of dust also carry costs that often relate to visitor flow. Simple economic calculations show the balance between the costs of cleaning and of other equipment and materials in National Trust properties. The cost per visitor initially reduces with increased numbers of people, but at high flow rates, expenditure can increase because of the cost of cleaning. The per capita conservation costs become less than UK £2 per visitor at reasonable visitor flow rates (about 30,000 per annum), although, in the calculations presented here for an idealized medium-sized property, costs begin to increase as visitor flow rises above 60,000 per annum. Recognizing the economic importance of managing dust is thus essential in assessing the level of access consistent with maintaining appropriate standards of presentation and collections care.

#### **Experience with dust measurements in three Dutch museums**

Wei, W.; Joosten, I.; Keim, K.; Douna, H.; Mekking, W.; Reuss, M.; and Wagemakers, J. *Zeitschrift für Kunsttechnologie und Konservierung* 21, no. 2 (2007), pp. 261-269 [English w. English summary]. 11 figs., 2 tables, 15 refs.

**AA:** A study is being conducted over several years in three Dutch museums to determine the relationship between "objective" quantitative measurements of dust accumulation and the subjective evaluation of the term "too dusty." The rate of dust accumulation is being determined by measuring the loss of the gloss of glass microscope slides with time due to the collection of dust and the change in area coverage on conductive carbon stickers used for scanning electron microscopy (SEM). The chemical composition of the dust is being determined from these stickers using electron dispersive spectroscopy (EDS). The ultimate goal is to develop a simple objective method for museums to measure dust accumulation in order to determine when they have "too much dust" based on their own subjective definition of dustiness. The results of this study after almost two years indicate that gloss measurements can show changes in the rate of accumulation of dust in an air-conditioned museum due, among other things, to changes in visitor numbers and routing, major external events such as changes in weather and seasons, and construction activity. In a museum with open windows and doors (such as a historic prison), gloss measurements cannot always distinguish between dust sources. For such cases, chemical analysis of the dust composition is also required. There appears to be a relationship between the gloss measurements and the area coverage of dust. However, further measurements and statistical analysis are necessary to confirm this and to establish the validity of using gloss measurements for dust measurements.

#### **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.

#### **Managing dust in historic houses – a visitor/conservator interface**

Brimblecombe, P, Frame K, Knight, B, Lithgow, K, Lloyd, H, Thickett, D, Yoon Y H, In: *Triennial meeting (14th), The Hague, 12-16 September 2005: preprints* / ICOM Committee for conservation. London: James & James, 2005, p. 662-669, figs., ISBN 1-84407-253-3

#### **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*****Dust in historic houses***

<http://www.nationaltrust.org.uk/main/w-collections-dust>

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

[www.iaq.dk](http://www.iaq.dk)

Papers and abstracts of all the conferences

***Pollutants***

Ten Agents of Deterioration at the Canadian Conservation Institute web-site

<http://www.cci-icc.gc.ca/crc/articles/mcpm/chap07-eng.aspx>

***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](http://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.

**Development of LightCheck Ultra. A novel dosimeter for monitoring lighting conditions of highly photosensitive artefacts in museums**

Dupont, Anne-Laurence; et alii , In: Studies in conservation, Vol. 53, N. 1, 2008, p. 49-72, ill., tables, ISSN 0039-3630

ICCR0M: This article presents the development and optimization of an ultrasensitive light dosimeter, especially designed for the preventive risk assessment of damage to highly photosensitive artefacts. This indicator, named LightCheck® Ultra, is composed of a photosensitive dye/polymer layer applied on a paper support. The indicator is characterized by a progressive colour variation as the exposure to light increases. Initially blue, the colour successively changes through purple and pink to white, under the effect of visible light. The colour variation was investigated under different environmental conditions. The light-induced alterations under study were evaluated using various light sources and illuminance levels. The impact of other factors unconnected to light (such as temperature, humidity, indoor air pollution — atmospheric and volatile organics — and oxygen) was also studied. The behaviour of the indicator in the field in selected museums and historic houses was assessed in parallel with the laboratory experiments at each development stage. Finally, the calibration was carried out and a reference colour scale was provided for fast and easy reading of the indicator. By means of this reference colour scale, the colour exhibited by the dosimeter after an exposure can be easily correlated to a quantitative indication of the light dose received. The phases of development and testing of this novel light dosimeter are presented in detail, from the early design to the final product.

**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

**Now you see it, now you don't: lighting decisions for the Ardabil carpet based on the probability of visual perception and rates of fading.**

Pretzel, Boris In book. *15th triennial conference, New Delhi, 22-26 September 2008: preprints/ICOM Committee for Conservation*. Bridgland, Janet (Editor). ICOM Committee for Conservation (2008), pp. 759-765, [English w. English, French, + Spanish summaries]. 7 figs. (6 color), 1 table, refs. [ISBN 978-81-8424-344-4].

**AA**: The Ardabil carpet forms the center piece of the Jameel Gallery of Islamic Art at the Victoria & Albert Museum, London, that opened in July 2006. Given the importance of the carpet to the collection, its prominence in the Gallery, and its size, the carpet will be displayed continuously for the duration of the gallery lifetime (over 25 years). To assure the carpet's longevity and to be able to make valid decisions about the benefits ensuing from different lighting proposals, changes in the carpet on exposure must be determined and expressed in terms of visibility. This presentation describes the experiments on the carpet to determine, with a high degree of confidence, the response of different colors to illumination, together with the research resulting in a model of the likelihood of detecting a given color change. Combining these two pieces of research, the solution of illuminating the carpet for 10 minutes in every half-hour while the gallery is open ensures an appropriate balance between the immediate visual impact and the long term preservation of the appearance of this uniquely beautiful carpet.

**Optimum access at minimum risk: the dilemma of displaying Japanese woodblock prints**

Brokerhof, Agnes W., Reuss, Margrit, MacKinnon, Fiona, Ligterink, Frank, Neevel, Han, Fekrsanati, Farideh and Scott, Graeme, In book. *Conservation and access: contributions to the London Congress 15-19 September 2008*. Saunders, David; Townsend, Joyce H; and Woodcock, Sally, Editors. International Institute for Conservation of Historic and Artistic Works (2008), pp. 82-87, [English w. English summary]. 6 figs. (4 color), 3 tables, 11 refs. [ISBN 0-9548169-2-7].

**AA:** This paper describes the evaluation of the lighting policy that the National Museum of Ethnology in Leiden, Netherlands, developed for the display of its nineteenth-century Japanese woodblock prints. Colour measurements during one year on exhibition showed changes that exceeded the limit of one ‘just noticeable change’ in 50 years specified in the policy. In a series of experiments, members of a test panel were all able to perceive the magnitude of colour difference measured in the prints during exhibition when presented with patches of colour side by side, but only half the panel could distinguish the same change when it was seen in the context of a multicoloured image. The change measured in the prints was judged by the panel to represent an average ‘loss of value’ of 9%, and deemed to be acceptable over a period of 160 years. The outcome suggests exposure of the prints should be further limited for the benefit of future access.

## Websites

### ***Light, Ultraviolet and Infrared***

Ten Agents of Deterioration at the Canadian Conservation Institute web-site

<http://www.cci-icc.gc.ca/crc/articles/mcpm/chap08-eng.aspx>

## 8. Incorrect relative humidity and incorrect temperature

### Books and articles

#### ***Applying the outcome of climate research in collection risk management, or a challenge to our research efforts***

Brokerhof, Agnes W., In: *Museum microclimates: contributions to the Copenhagen conference, 19-23 November 2007* / Padfield, Tim (ed); Borchersen, Karen (ed); Nationalmuseet = National Museum of Denmark. Copenhagen, Denmark. Copenhagen: National Museum of Denmark, 2007, p. 115-121, fig., *Museum microclimates: conference*, Copenhagen, Denmark, 20071119-20071123. ISBN 978-87-7602-081-1

**ICCROM:** Studies into the deterioration of materials due to interaction with their surroundings can provide insight into the mechanisms and rates of decay, leading to the development of solutions for conservation problems. Current practice tends to focus on the definition of guidelines and standards as a way to mitigate these risks, yet the author argues that collection risk management would be a more effective way to use the data on materials deterioration. Four types of climate research are identified in the field of museum climate, air quality and light: decay mechanisms; dose-effect relationships; measuring and monitoring; and finally the generation of standards and guidelines defined as “safe levels of exposure”. Yet an alternate and more effective solution, one that takes advantage of the flexibility provided by a good understanding of dose-effect relationships, would be a systematic approach of collection risk assessment, which ranks and prioritizes conservation needs and mitigates the most relevant ones in a cost-effective manner. For this, the author discusses the use of risk scenarios and scenario pools to quantify risk in terms of probabilities, rates and level of impact. The translation of material decay into loss of collection value is presented as the next important direction in risk research.

<http://www.natmus.dk/sw53828.asp>

#### ***Applying science to the question of museum climate***

Erhardt, David; Tumosa, Charles S.; Mecklenburg, Marion F. , In: *Museum microclimates: contributions to the Copenhagen conference, 19-23 November 2007* / Padfield, Tim (ed); Borchersen, Karen (ed); Nationalmuseet = National Museum of Denmark. Copenhagen, Denmark. Copenhagen: National Museum of Denmark, 2007, p. 11-17, *Museum microclimates: conference*, Copenhagen, Denmark, 20071119-20071123. ISBN 978-87-7602-081-1

**ICCROM:** Critically examines the history and development of museum climate recommendations during the 20th century. The authors find that initially there was only minimal scientific support for the environmental values and ranges selected, and that not enough effort was put into establishing the effects of environment on materials and objects. “Best guesses” were subsequently codified as best practices, although they often had less to do with the preservation of objects than with the mechanical limitations of HVAC systems, constraints imposed by the exterior climate or historic building regulations, or implementation and maintenance costs. Recent research has provided a general scientific basis for determining appropriate museum climate values, and in particular, safe variation or fluctuation ranges for temperature and relative humidity. These results were initially criticized, since they differed from earlier practice, but they have proven valid over time and are now increasingly accepted.

<http://www.natmus.dk/sw53828.asp>

**(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.

**Double the life for each five-degree drop, more than double the life for each halving of relative humidity**

Michalski, Stefan , In: *Triennial meeting (13th), Rio de Janeiro, 22-27 September 2002: preprints / ICOM Committee for conservation*. London: James & James, 2002, p. 66-72, fig., *ICOM Committee for conservation triennial meeting (13)*, Rio de Janeiro, Brazil, 20020922-20020927. ISBN 1-902916-30-1

**Museum microclimates: contributions to the Copenhagen conference, 19-23 November 2007**

Padfield, Timothy; Borchersen, Karen; and Christensen, Mads Chr., Editors. Nationalmuseet (Denmark) (2007), [English w. English summary]. 5 figs. (3 color), 283 p. : figs., tables, refs. [ISBN 978-87-7602-080-4; 87-7602-080-0].

**ICCROM**: Presents the proceedings of the Museum Microclimates conference, which took place in Copenhagen at the National Museum of Denmark from 19-23 November 2007. The articles present current opinion and research on the preservation of objects through adjustments to their environmental conditions, both in historic buildings and in purpose-built structures. Issues discussed include: considering whether strict official standards for ambient environmental levels are in fact useful; conducting risk assessment; evaluating and satisfying divergent climatic requirements for visitors and for different types of materials; applying active control measures through the mechanical supply of air to museum environments and display cases; and instituting passive control measures in both temperate and tropical or subtropical climates. The articles are grouped into the following themes: the effects of the environment on artifacts; measuring and monitoring environmental levels, including temperature, relative humidity, and air pollution; surveys of actual collections to understand climatic effects; the use of enclosures to control climate; and issues concerning showcases and picture frames.

<http://www.padfield.org/tim/cfys/mm/index.html>

**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.

**The Ideal Climate, Risk Management, the ASHRAE Chapter, Proofed Fluctuations, and Toward a Full Risk Analysis Model**

Michalski, S Experts' Roundtable on Sustainable Climate Management Strategies in Tenerife, Spain Getty Conservation Institute, 2007

[http://www.getty.edu/conservation/science/climate/paper\\_michalski.pdf](http://www.getty.edu/conservation/science/climate/paper_michalski.pdf)

**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.

[http://aic.stanford.edu/jaic/articles/jaic39-01-007\\_indx.html](http://aic.stanford.edu/jaic/articles/jaic39-01-007_indx.html)

***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.

## Websites

***Conservation Physics***

<http://www.padfield.org/tim/cfys/>

***Incorrect Relative Humidity***

Ten Agents of Deterioration at the Canadian Conservation Institute web-site

<http://www.cci-icc.gc.ca/crc/articles/mcpm/chap10-eng.aspx>

***Incorrect Temperature***

Ten Agents of Deterioration at the Canadian Conservation Institute web-site

<http://www.cci-icc.gc.ca/crc/articles/mcpm/chap09-eng.aspx>