

**NATIONAL ENDOWMENT
FOR THE HUMANITIES**

SAMPLE APPLICATION NARRATIVE



Preservation and Access Research and Development
Institution: New York Public Library

**The New York Public Library, Astor, Lenox and Tilden Foundations
Proposal to National Endowment for the Humanities
Preservation and Access / Research and Development Program**

Developing Data Models and Best Practices for Diagnosis and Improvement of Preservation Environments

Project Description

The preservation community has well-established guidelines for good preservation environments and access to monitoring and analysis equipment that is inexpensive, accurate, and simple to use. Despite these advances, few cultural institutions maintain widespread environmental conditions that are beneficial to their collections. *A Public Trust at Risk: The Heritage Health Index Report on the State of America's Collections* provided results from the first comprehensive survey to assess the condition and preservation needs of U.S. collections. Nineteen percent of institutions surveyed identified environmental controls as an "Urgent Need," and more than 50 percent of institutions reported damage to their collections from environmental conditions.

The New York Public Library and its research partner, the Image Permanence Institute (IPI) at the Rochester Institute of Technology, seek \$351,077 for a two-year project to define best practices for monitoring, evaluating, and optimizing storage conditions from an environmental perspective. The Library proposes to carry out research into fundamental environmental control issues, and based on this research, develop user-centered tools for communicating about and managing environmental problems. The Library will conduct research into:

- How to collect and manage environmental data in a way that expresses their relationships
- Physical locations where data must be collected, and in what quantity, to yield information useful to understanding the environment and determining the improvements needed
- What organizational issues influence the success or failure of environmental projects
- How to best communicate environmental needs and suggest improvements to different stakeholders within an institution, with the intent of establishing and maintaining the best possible environments.

In many organizations, the expertise and responsibility to develop and maintain an effective preservation environment is fragmented among various areas, presenting a major barrier to successful environmental control planning and implementation. This project builds on earlier efforts that identified a need to better understand how environmental analysis can be presented to and shared among preservation staff, facilities managers, curators, library administration, and other organizational stakeholders. The project focuses on technology by which large amounts of information generated by environmental monitoring can be made conveniently accessible and comprehensible to those who can make use of it.

The Library will implement an environmental monitoring system to document the preservation conditions in five buildings that house research materials. The data gathered will be managed through the enhancement of a prototype data management system to provide high-level analysis of the Library's raw data and tailored environmental monitoring reports. Through a series of system evaluations, the Library will develop the interfaces needed to present information to various stakeholders in terms that will resonate with them. The project will produce best practices for environmental monitoring in the form of data models and procedures for data collection, as well as sample code for environmental data management system interfaces and documentation of how organizational stakeholders may build consensus and make decisions about environmental control. These project tools and documentation, which will be made publicly accessible, which will help libraries, museums, and other repositories realize good preservation environments for the long-term care of their collections.

The New York Public Library, Astor, Lenox and Tilden Foundations

**Proposal to National Endowment for the Humanities
Preservation and Access / Research and Development Grant Application
January 1, 2007 – December 31, 2008**

Developing Data Models and Best Practices for Diagnosis and Improvement of Preservation Environments

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Preservation and Access / Research and Development Program
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\$351,077**

Developing Data Models and Best Practices for Diagnosis and Improvement of Preservation Environments

Significance

The environment is the most persistent force influencing the longevity of collections, affecting them every minute of every day. The combined effects of poor and unstable temperature and relative humidity drive the rate of chemical deterioration among collection media housed in libraries, archives, and museums. Stabilization of the environment through controlled, consistent, and moderate temperature and relative humidity forestalls physical and chemical damage caused by the absorption or release of moisture and provides a deterrent against mold growth, corrosion, and insect infestation. A good environment pays dividends year after year, while a poor environment causes cumulative and irreversible damage, which in turn, shortens the life expectancies of collection artifacts.

The preservation community has well-established guidelines for good preservation environments and access to digital monitoring and analysis equipment that is inexpensive, accurate, and simple to use. Despite these advances, few institutions maintain widespread environmental conditions that are beneficial to collections. *A Public Trust at Risk: The Heritage Health Index Report on the State of America's Collections*, published in December 2005, provided results from the first comprehensive survey to assess the condition and preservation needs of U.S. collections. The report indicated that 19 percent of institutions surveyed identified environmental controls as an "Urgent Need," and more than 50 percent of institutions reported damage to their collections from environmental conditions¹. To achieve responsible stewardship of collections, institutions must close the gap between identifying environmental problems and addressing them.

Successful stewardship in the area of environmental concern depends upon three core activities. First, the complete environment must be documented so that data will exist in meaningful relationship to one another. Second, environmental data must be tied to improvements that capitalize on existing resources to the greatest degree possible. Finally, the costs and benefits associated with environmental improvement and neglect must be quantified and presented to the various stakeholders in terms that are comprehensible and actionable.

There are a number of organizational issues that can affect whether environmental control methods are implemented and how effective those methods are. In many organizations, the expertise and responsibility to develop and maintain an effective preservation environment is fragmented among various areas, presenting a major barrier to successful environmental control planning and implementation. It is common to have the stakeholders in environmental control reporting to different authorities, who have different criteria for success. The facilities manager may be concerned with fiscal pressures or providing comfort to a building's occupants. Curators and public service librarians may need to balance the comfort of the collection's users against the desired preservation temperature and illumination levels in exhibition areas and reading rooms. Just as those who are responsible for the day-to-day environmental issues answer to different areas within the organization, the expertise necessary to define and attain an ideal environment is scattered. Conservators and preservation administrators have expertise in the proper

storage conditions for the materials in the collections, while facilities managers have the skills to operate the building systems necessary to create that environment. Curators provide crucial knowledge about the contents and usage patterns of the collections that must be brought to bear on the determination of appropriate conditions. Library administrators, building owners, and representatives of parent organizations will have financial concerns related to any activity that changes operating costs.

In addition, libraries often share a building with other organizations that have distinctly different facilities needs. Colleges and universities have this arrangement as a matter of course, with dedicated subject libraries sharing space with a department's teaching and research facilities. The importance of the library as a community center brings collections storage together with a wide range of other activities. Laboratories, classrooms, meeting halls, and auditoriums all may adjoin collections areas and, with different environmental requirements, compete for the time and attention of facilities managers.

Any effort to advance environmental management must acknowledge and address organizational constraints such as those named above. With a \$351,077 grant from the National Endowment for the Humanities (NEH), The New York Public Library proposes to implement an environmental monitoring system, carry out research into fundamental environmental control issues, and based on this research, develop user-centered mechanisms for stakeholders, such as conservators, library administrators, building managers, and facilities staff, to communicate about and manage environmental problems. The key research topics the Library will address are:

- How to collect and manage environmental data in a way that expresses their relationships (see page 8 for details on the types of data to be compiled),
- Physical locations where environmental data must be collected, and in what quantity, to yield information that is useful to understanding the environment and determining the improvements needed,
- What organizational issues influence the success or failure of environmental projects, and
- How to best communicate environmental needs and suggest improvements to different stakeholders within an institution, with the intent of establishing and maintaining the best possible environment.

Background

The New York Public Library

The New York Public Library is one of the world's premier research institutions. Its four Research Libraries include the Humanities and Social Sciences Library; the Schomburg Center for Research in Black Culture; the Library for the Performing Arts; and the Science, Industry and Business Library. Each year, 1.7 million people use the vast and comprehensive collections of research materials, including rare books and unique primary source materials, on the culture, history, science, business, and literature of the world. Together, The Research Libraries hold 43.5 million items in their collections, of which only 15.6 million are books and book-like materials; the remainder consist of audio recordings, films, videotapes, maps, sheet music, prints, clippings, and various other categories of holdings. With materials in the collections dating from the third millennium BCE to the present day, the Library has vast preservation needs, making it a particularly appropriate venue for this Research and Development project.

The Library also is the ideal institution to explore the organizational issues that affect the environmental aspect of cultural stewardship. It is a privately managed, nonprofit organization with a public mission, operating with both private and public stakeholders. The four Research Libraries provide sites of widely varying size that must be monitored, complex tenancy and ownership arrangements, multiple building management partners, and representations of a century of architectural practice. The Research Libraries'

facilities range in design from a turn-of-the-century Beaux-Arts palace to a contemporary commercial block, and include a Carnegie library and a mid-century modernist structure, along with renovated and repurposed spaces. This complex assortment of facilities and organizational arrangements provides an opportunity to study the process of refining climate control systems in architectural and administrative situations that will be relevant to a wide audience within the cultural heritage community. Many of the dynamics present at The New York Public Library reflect the tenancy arrangement of university libraries, housed within multi-use buildings and with main libraries and satellite libraries dedicated to particular subjects.

In addition, the co-ownership and tenancy relationships at the Library for the Performing Arts and the Science, Industry and Business Library allow the project to explore the best presentation of preservation environmental issues to stakeholders outside the library itself, and with varying degrees of direct benefit for the preservation of collections. The Library for the Performing Arts is owned by Lincoln Center, Inc., with the Library as a resident organization and permanent tenant. Facilities operations at the building housing the Science, Industry and Business Library are governed by a board made up of representatives from the Graduate Center of the City University of New York, the Oxford University Press, and The New York Public Library. Each tenant owns a condominium interest in the building, but all share similar missions and values. Although the successful operation of the building facilities is a benefit to all partners, all of whom operate libraries in the building, and the care of the Library's collection benefits CUNY, whose students use the Library, any changes in operation or capital expenditures must be weighed against competing needs. Similar situations can often be found in university libraries that offer services within departmental buildings and operate within the complex world of campus politics.

In this project, the Library will be able to model problems that pertain to institutions both large and small, public and private, and autonomous and dependent on parent organizations. As a result, one of the benefits of this project is its broad applicability to these many different types of institutions and the challenges they face.

The Library has made a renewed commitment to preservation with the appointment of Evelyn Frangakis as the Aaron and Clara Greenhut Rabinowitz Chief Librarian for Preservation and Shelly Smith as Head of Conservation Treatment. The creation of the new Collections Care unit, and the appointment of Helga Borck as its Head, has provided an organizational home for proactive preservation strategies. Environmental initiatives have been identified as a focus within the Collections Care unit, and the appointment of Jacob Nadal as the Library's first Field Service Librarian includes specific responsibility for environmental monitoring at all four Research Libraries. All of these program areas reside in the Barbara Goldsmith Preservation Division, which serves the preventive and corrective preservation needs of The Research Libraries of The New York Public Library (see the Library's Organizational Profile, attached to this application, for more details about the Preservation Division).

Project Partners

The New York Public Library's successful implementation of this Research and Development project will require the involvement of specialists in preservation research and development, facilities engineering, and software development—the Image Permanence Institute at the Rochester Institute of Technology (IPI), Herzog/Wheeler and Associates, and Zak Software, Inc.

The Library will contract with the Image Permanence Institute as the lead research partner in this project. IPI has more than twenty years of experience serving the needs of cultural institutions through preservation research and the development of simple tools to prolong the life of institutional collections (see IPI's Organizational Profile, attached to the application). IPI worked with the Library of Congress and The New York Public Library in pilot studies in environmental monitoring and improvement (see

Project History section for more information on IPI's work with The New York Public Library).

With funding from the Andrew W. Mellon Foundation and the National Endowment for the Humanities, IPI pioneered the techniques for environmental optimization that will be used in this project. IPI designed Climate Notebook, environmental analysis software, and the Preservation Environment Monitor datalogger, and provides technical support and advice to hundreds of users of these tools. For a project at the National Museum of Denmark, IPI developed a prototype data management system called myclimatedata. The software integrates information about building systems and facilities with environmental data to aid in curatorial decision-making. This project will adopt and build upon the software and hardware already developed by IPI, and draw upon IPI's broad understanding of material preservation, environmental monitoring, software design, and mechanical system performance.

Along with IPI, the Library will work closely with IPI's consulting partners Herzog/Wheeler and Associates and Zak Software to collect and analyze data, develop action steps for improvement, and facilitate communication among stakeholders.

IPI will contract with the energy efficiency consulting firm Herzog/Wheeler and Associates to document and analyze the Library buildings' mechanical systems. Herzog/Wheeler was involved in the second NEH-funded field trial of tools for environmental monitoring, which included training for advanced users of Climate Notebook environmental analysis software. Herzog/Wheeler has worked as a consultant and partner to the Image Permanence Institute in optimization projects with the Library of Congress and The New York Public Library, and environmental monitoring and analysis projects with the Library of Congress and National Museum of Denmark. It has also partnered with the Image Permanence Institute in working with the National Archives and Records Administration and the Library of Congress on mechanical system design in new collection storage building designs.

The Image Permanence Institute will contract with Zak Software, Inc. for software development in this project. Zak Software was involved with the design and creation of the Climate Notebook environmental analysis software program, the initial training during the first field trial of the software, and subsequent training for advanced users during the second field trial. Zak Software has worked as a consultant and partner to the Image Permanence Institute during optimization projects with the Library of Congress and The New York Public Library, and environmental monitoring and analysis projects with the Library of Congress and National Museum of Denmark. Zak Software has worked with a number of cultural institutions to develop the DPlan for disaster preparedness planning, Zpests for integrated pest management, and Artifact Tracker for documenting, tracking, and reporting on items and services performed by conservation labs.

Additional background information on the consultants are included in the Staff section of this proposal.

Project History

Although the preservation environment has been well defined by previous research, the process of establishing this environment within organizations has received little development. To help define this process, the Library will draw upon the research and development activities that have been carried out by the Image Permanence Institute and its partner institutions over the last ten years, some of which have been supported, in part, by the National Endowment for the Humanities (please see Research Background, an attachment to this proposal, for details of this research). This project will utilize and build on the tools IPI has created for environmental analysis, including the Preservation Environment Monitor datalogger, a simple means for data gathering, and Climate Notebook software, an application used to organize, track, and analyze data on environmental conditions, using metrics to quantify the quality of the

preservation environment. Both tools were field-tested with NEH support, in an effort involving nearly 200 libraries, museums, and archives. Subsequent software development by IPI for the National Museum of Denmark led to myclimatedata, a prototype data management system. This prototype, for which IPI has retained the rights, will be adapted in this project to produce a web-based collection storage information system that meets the data needs of The New York Public Library.

The Library will also draw upon lessons learned from its own participation in a small pilot project led by IPI and Herzog/Wheeler from 1999 to 2005. The Andrew W. Mellon Foundation provided funding to IPI for a six-year preservation management project to work with the Library of Congress and The New York Public Library to: monitor large cultural institution environments over an extended period of time; gain understanding of how existing systems are running through the collaboration of facilities staff, collections curators, and preservation staff; and understand how to run systems better to facilitate optimal environments for the spaces. For IPI, the overarching goal of the research project was to provide useful application systems that will benefit all cultural communities in the future. The Library's goal was to be able to make cost-effective decisions about providing the best possible environmental control for three specific collections storage spaces in its Humanities and Social Sciences Library. The effort led to an understanding of the challenges in the Humanities and Social Sciences Library's main stacks (served by nine different air handlers), a new rare book vault, and the fine art print storage rooms, as well as recommendations and concrete improvements within the existing systems. The project identified an increased supply of chilled water as the top priority for HVAC improvement. The chilled water upgrade was installed in summer 2005, improving the preservation environment throughout the building as a result.

Methodology

In this project, the Library proposes to implement an environmental monitoring system to collect data, manage the data through the adaptation of the prototype software, and develop the analyses and presentation of the data to help various user groups and stakeholders make good preservation decisions.

Environmental monitoring and building systems improvement

The New York Public Library is contracting with IPI to collect environmental data using Preservation Environment Monitors (PEMs) and ACR dataloggers in the storage areas and HVAC systems of five Library buildings—its four Research Libraries and the Rose Building, a storage and processing annex in which performing arts materials are held. All of these facilities hold materials in a variety of formats, and four of them provide public service, as well. Compact shelving is used extensively in the Humanities and Social Sciences Library; Science, Industry and Business Library; and the Library for the Performing Arts for the storage of books, papers, photographs, and audio-visual media. Divided floor stacks shelving predominates in the Science, Industry and Business Library; the Schomburg Center; and the Rose Building.

The landmark Humanities and Social Sciences Library is built on a seven-story Sneed Ironworks hanging stacks. This design is found in several of the major research libraries in the United States, including Harvard University and the University of Illinois at Urbana-Champaign. Renovations to the Library building have added several spaces with dedicated environmental controls. Within the special collections units, there are also many areas that serve both as storage space and reading room or exhibition hall. In addition, the Library contains three full-time exhibition venues. The Library's Bryant Park Stacks Extension, an underground complex, has two storage spaces, each with its own temperature and humidity requirements. Special collections material, primarily archival collections, realia, and rare books, share the larger of these environments with humanities general collections. The temperature goals for this space are

68° F / 40% RH. The goals for the smaller vault, which holds microform masters, are 60° F / 40% RH.

At present, 24 Preservation Environment Monitors are deployed in the Humanities and Social Sciences Library. Fourteen are providing complete monitoring of the hanging stacks, while the remaining ten provide representative coverage for the special collections areas and the Bryant Park Stacks Extension. While the Library is able to spot problems, this deployment still does not produce enough detail for assessment of the environment and its effects on specific collections.

The Science, Industry and Business Library is housed in a renovated commercial block, which opened as the B. Altman department store in 1914. The New York Public Library renovated the facility and moved the science and business collections into this space in 1996, making it the most uniformly modern facility among The Research Libraries. Materials in the Science, Industry and Business Library are stored in five stacks levels that subdivide three floors of the building. Special collections are stored in separate security cages within the stacks. The HVAC system at this Library is intended to produce a standard environment for hybrid storage and work areas, approximately 70° F and less than 50% RH. However, there is no environmental monitoring installed within the stacks to verify these conditions.

In the Schomburg Center, there are several smaller storage and exhibition areas, including a Carnegie library now used as an exhibition hall and storage space, as well as the painting and sculpture storage racks in the Center's Art and Artifacts Division. As with some of the other facilities, the HVAC system should produce an environment of 70° F and less than 50% RH for the mix of storage and work areas, but the Library has no dedicated environmental controls to ascertain whether this environment exists. The Schomburg Center is just completing the renovation of significant areas in both the General Research Division and Rare Books and Manuscripts reading rooms, including new ductwork and HVAC equipment. This renovation provides the Library with an opportunity to work with contractors and to ensure that proper conditions are established from the start, giving critical attention to the role of environmental monitoring.

At the Library for the Performing Arts, the majority of the collections are housed in two separate storage spaces: the first is a basement area partially below grade with an added mezzanine level for overflow storage, and the second is a more traditional single-floor library stacks on an upper floor. At this time, the preservation environment in the stacks is not being monitored to determine whether the standard goal of approximately 70° F and less than 50% RH is being maintained.

The Rose Building is part of the Lincoln Center complex. Performing arts collections are found in three rooms, separated by short hallways and working spaces, with an office area on the floor above. A standalone HVAC unit has been added to supplement the building HVAC system, with mixed results. Unfortunately, the ability of the systems to maintain proper conditions around the clock is questionable. An initial study based on daily morning and evening measurements by an archivist showed fluctuations in the media storage room, and the Library has placed two dataloggers in that space to help diagnose problems with the standalone HVAC unit and the media storage area. However, no other environmental monitoring equipment has been installed in the building's storage spaces.

In the five buildings, the Library will install a data monitoring system consisting of 120 dataloggers; 72 PEMs will be installed in the storage spaces, and 48 ACR dataloggers will be installed in the building's systems. This total includes the contribution of 24 existing PEMs by the Library and 28 ACR dataloggers that will be loaned to the project by IPI. Another 48 PEMs and 20 ACR dataloggers will be purchased, at cost, with grant funds. The spatial relationships of the dataloggers in each building will link the conditions observed in the storage spaces to the conditions in the systems that serve them. Analysis of this data can isolate areas of concern and tie them to specific elements of the building systems. Contextual data such as time of day and local weather conditions will be used to aid in this diagnosis. Data compiled

will include:

- Temperature and Relative Humidity in library building spaces, recorded every 15 minutes by each datalogger
- Locations of distinct collection storage sites
- Locations of the dataloggers within each site
- Relationships between dataloggers (e.g., the relationship of the datalogger in the duct work to the datalogger in the collection area the duct work services)
- Locations of significant architectural elements and building systems within each site
- Prevailing weather conditions (temperature and relative humidity)
- Inclement weather or emergency conditions at each site (e.g., rain, snow, street flooding, winds)

In addition to the organizational characteristics found at the Library, as outlined in the Background section of this proposal narrative, the wide variance in weather conditions affecting the Library's building presents further opportunity to test a variety of scenarios and trade-offs in building systems operation. The seasonal weather variations in New York provide average outside weather ranging from 26° F to 85° F and 51% RH to 79% RH, with extremes from -4° to 105° F. This range ensures that the processes developed at the Library will have wide relevance to institutions across the United States.

Starting with the data collection and monitoring process, the Library will document the factors that lead to success and failure in promoting a preservation environment. Using flowcharts and decision trees, the Library will explain the particular preservation choices made in response to various environmental conditions. The environmental monitoring plan will be continually refined based on the outcomes of the data model and user interface evaluations, which are described in the sections that follow. The resulting process documentation will enable a wide range of institutions to improve conditions by providing an essential framework for making preservation decisions.

For most institutions, proposed changes to the operations of building systems will need to capitalize on the potential of the currently installed systems and identify the optimal combination of preservation quality and energy use possible within these systems. Doing so allows for immediate increases in preservation capacity and ensures that ongoing usage, maintenance, or alteration to the building systems can be assessed against a well-documented baseline. Analysis of data collected through the monitoring process will highlight areas of weakness in the current building systems, allowing institutions to easily identify their specific and most crucial preservation needs.

Data management software development

With each datalogger collecting samples of temperature and relative humidity every 15 minutes, a large environmental monitoring project such as this will involve tens of millions of data points each year. The quantity of data and the need to compare various combinations of data require a data management system. A successful system must do more than collect data, however. It must be able to establish meaningful relationships between the data that can be tied ultimately to distinct costs and benefits that will resonate with a variety of stakeholders.

This project will employ and enhance a prototype web-based collection storage information system developed by IPI and the National Museum of Denmark. The prototype system, called myclimatedata, integrates information about storage locations, mechanical systems, collection management, material preservation, and data collection activities in an easily accessible format, and connects the location data to environmental analysis functions in Climate Notebook software. It uses static reports from Climate Notebook to create comparative displays of environmental data. (Please see the National Museum of Denmark's letter in the appendices, which describes the impact of this system and the relevance of the

tool for libraries, archives, and other museums.) Working with IPI—which has retained the rights to the actual structure and implementation of this prototype system—and Zak Software, the Library will build upon the prototype’s three-part data storage system to create a complete relational model for environmental data storage and new web interfaces that allow for the dynamic generation of reports for different user groups. The project will develop a set of interfaces that are targeted to particular stakeholder groups, with appropriate terminology and detail of data, and use these interfaces to provide live access to the data.

The key functionality of the software will include:

- Data models that encompass environmental data and relationships between data elements
- Interfaces, including navigational and instructional screens
- Reports with filtered views or comparisons of the data

Leon Zak of Zak Software, Inc. will work with IPI and Library staff to develop, test, evaluate, and refine software for the collection storage information system to meet the needs of a range of Library stakeholders. The web programming for the Library prototype will use javascript and ASP, and run on a Microsoft SQL server. Mr. Zak and Jacob Nadal of The New York Public Library will collaborate on the definition of the XML structures (the data models) that will be derived from the prototype created by Mr. Zak.

The software interface design process will follow standard user-centered design procedures. A wide variety of usability testing protocols exist, but all involve prototyping, testing, analyzing, and refining a work in progress. Nielsen’s model of heuristic evaluation closely matches the needs of this project, with its focus on small groups of experts and repeated low-cost prototyping². Each quarter, the project staff will convene stakeholder/user groups from each building to evaluate iterations of the software’s data models and interfaces. The groups will include:³

- Conservators and preservation staff
- Curators and collection managers
- Facilities engineers and building managers
- Library administration and building owners

This user-centered evaluation method will ensure that the data models remain coherent and supports effective interfaces while the database of climate information grows in size and complexity. Heuristic evaluation can be repeated at intervals through the project, allowing staff to re-test the system to be certain that it remains useful to novice users as well as those whose understanding of environmental issues has increased throughout the project.

The refined data models and user-interface guidelines that arise from this process will be made available to other institutions on a public website hosted by the Library. These tools may be used by other institutions in their efforts to develop custom databases to manage, analyze, and present information about their preservation environments. The data models will be released publicly as XML Schema. Defining a public Schema, one that is independent of methods for presenting and manipulating the data, will facilitate development of interoperable management tools. These tools may be tailored to the specific needs of an institution or type of user without requiring changes to a standardized data model or trapping data in a proprietary storage and display system. This method is also of great value for long-term data preservation purposes as it is resistant to changing technologies. Emerging Web 2.0 technologies such as AJAX (Asynchronous JavaScript And XML) provide methods for creating rich, interactive interfaces to XML data. The Library will provide a demonstration system of this kind of interface as a resource on the publicly accessible website. The sample will utilize a subset of the Library’s institutional data in XML,

such as from a special collections area or single stack level, as well as sample web interfaces to allow a user of the public website to look at a set of data and manipulate it live to produce different views. Therefore, in addition to serving as a starting place for institutions seeking to develop their own systems, the project's public website offers a test environment, as well, using a sample dataset.

The anticipated outcomes of this project in the area of software development are:

- Data models and XML Schema for environmental data that will serve as a foundation for building relational databases, exchanging data between institutions, and migrating data from current systems into future systems;
- An interactive demonstration system showing transformations of XML data into XHTML for web viewing; and
- A set of user-interface guidelines with best practices in presenting environmental data for various user groups (heuristics documents).

Please refer to the appendices for illustrations of sample outcomes.

Presenting data to stakeholder groups

Stakeholder groups will be convened throughout the project not only to contribute to the design of the interfaces and data models, but also to review the data itself and discuss ways to address problems found in the preservation environment. The Library will be able to introduce different presentations of the data to the groups, and document the response of each type of user to the information. Through this process, the Library will be able to gain insight into what factors are important to each group, and what information each group requires in order to make preservation decisions, which will be captured in the heuristics documents mentioned above. The Library will also determine, with the input of Herzog/Wheeler and Associates, the costs and benefits of maintaining the current building systems, and altering them, if necessary, to improve environmental conditions. In previous projects, IPI and Herzog/Wheeler have found common energy-saving opportunities include situations where fans are not slowed at unoccupied hours, excessive outside air volumes, lights on all night, and unnecessary sub-cooling at times of the year (spring and fall) when no dehumidification is required. This information will be integrated into the presentations to the stakeholder groups.

The organizational issues affecting preservation decisions and recommendations, and how these issues are addressed by the stakeholders, will be recorded during the project. This documentation will illuminate the concerns of the various users as to the need for environmental control; the deployment of monitoring equipment in the buildings; the uses of spaces, including multi-purpose spaces; the physical challenges inherent in certain building types; any complications arising from tenancy arrangements; changes to building operating costs; and other issues. From this process, the Library and the Image Permanence Institute will be able to produce a publication, such as a white paper, on whether and how the involvement of various stakeholder groups results in support for environmental control.

By the end of the first year of the project, the Library will have engaged stakeholders at every level on the issue of environmental control, and gathered sufficient data on its preservation environments to identify critical changes. During the second year of the project, the Library will be able to offer a strategy for improving environmental conditions with the support of the different stakeholder groups.

At the conclusion of this two-year effort, the Library, in concert with the Image Permanence Institute, will put forth a number of products that will inform and facilitate other institutions' efforts to realize the best possible preservation environments, including:

- Flowcharts and decision-making documents for the process of installing monitors and collecting data
- Data models for environmental data, including XML Schema for storage and transmission of this type of data
- Heuristics documents on the needs identified by each stakeholder group during the design and usability testing for the web interfaces (user interface guidelines)
- A demonstration system with sample code from the Library's system interface, to show the web programming used to provide access to the data
- Publications discussing the organizational issues facing environmental projects, and proposing a cost-benefit framework for presenting environmental data

Each of these outcomes will be made publicly available on a website hosted by The New York Public Library, and promoted widely throughout the cultural and preservation communities (see Dissemination). A number of the outcomes will also be made available on IPI's website. As a best practice guideline, these products will help preservation and facilities officers ensure that they are collecting the necessary information and asking the most important questions as they deal with the issues of their own institutions. The products will be available to the cultural and preservation communities for further evaluation in the future. They will not serve as the final word on how to effect environmental change at a particular institution, but as a benchmark for assessment and discussion of efforts within these communities.

Plan of Work

The project will begin by convening all stakeholder groups, including conservators, preservation staff, curators, collections managers, facilities engineers, building managers, Library administration, and building owners in a meeting to share information about the project's goals and secure the stakeholders' cooperation and participation.

The Image Permanence Institute and Herzog/Wheeler and Associates will visit the Library six times during the two-year project, and provide consulting services between visits. During the first quarter of the project, Library staff, IPI, and Herzog/Wheeler will conduct an initial walk-through of the five buildings and review site plans to determine where the PEMs and ACR dataloggers will be installed. In a return visit during the same quarter, the dataloggers will be deployed throughout the buildings. IPI and Herzog/Wheeler will return at the start of the second quarter to collect and upload the environmental data recorded by the dataloggers, which will also give them an opportunity to check that the equipment is successfully capturing the needed data. With the exception of two visits by IPI and Herzog/Wheeler to collect and evaluate data, the project manager will collect and upload the data every quarter for the duration of the project, and send the data to IPI and Herzog/Wheeler for review off-site. Following each quarter's data collection, a facilities working group comprised of the building managers of the four Research Libraries will meet to review the state of the building environments, mark areas of concern, and plan for changes in operations to the appropriate systems.

Beginning in the first quarter, Zak Software, working with IPI and the Library, will adapt the prototype data management system to meet the data collection needs of this project. Zak Software will also work with the project manager to develop non-functional interfaces to the data management system for use in the heuristic evaluations. Groups of preservation staff, facilities staff and building managers, curatorial staff, Library administration, and building owners will be convened in turn during the first three quarters to participate in the interface evaluation and review data reports. In the final quarter of the first year, the Library will convene user groups a second time to review additional non-functional iterations of the interfaces, created based on the input of stakeholders in the previous evaluation sessions. At the start of the second year, the Library will use the evaluation results to develop live interfaces for the web system, which will be evaluated and, as needed, refined in the third quarter of the second year by stakeholder groups.

The efforts of the first year will produce the follow technical documents for the Library's use: the XML Schema for the data models, sample code for the system interfaces, and heuristics documents (guidelines developed from the user interface evaluations).

Through its work in this project, Herzog/Wheeler will help establish an understanding of the mechanical systems in each storage area, their functional capacity from a preservation perspective, and whether environmental conditions could be implemented with existing equipment. This work will also indicate what other areas and collections would be affected if changes were made to climates in specific locations. As part of this process, Herzog/Wheeler will also examine opportunities to reduce energy consumption. This information will be essential to helping the Library's stakeholders consider how to move forward with improvements in the preservation environment.

In the second year of the project, Herzog/Wheeler and IPI will join the Library's project staff in a presentation to the Library's stakeholders on the overall indications from the monitoring process. Drawing upon insight gained in the heuristic evaluations, the presenters will now be able to provide information in ways that will resonate with the stakeholders, and will make recommendations for improvements in the system that acknowledge the interests and concerns of the different groups. Following this presentation, the Library's Goldsmith Preservation Division will seek support and approval for the desired alterations to the building systems; if the Division is successful, the alterations will be implemented by the middle of the project's second year. By the final quarter of the project, all data collection and user group evaluation will have concluded, with final revisions being made to the system interfaces and reports. In the final quarter, project staff and consultants will focus on compiling research notes and data to produce the project's outputs for public access. These products and reports will be completed and disseminated in the last quarter of the project.

Year 1: Quarter 1

- Project director convenes all stakeholders for kickoff meeting. Participants: All project staff, IPI, Herzog/Wheeler, Zak Software, facilities staff, curatorial staff, preservation staff, Library administration, and oversight committee.
- IPI and Herzog/Wheeler conduct walk-through of buildings and review site plans. Participants: All project staff, facilities staff, and curatorial staff.
- Project director leads planning for and documentation of distribution of PEMs and ACR dataloggers. Participants: All project staff, IPI, Herzog/Wheeler, and facilities staff.
- IPI and Herzog/Wheeler, with guidance provided by project director, deploy PEMs and ACR dataloggers. Participants: All project staff, IPI, and Herzog/Wheeler.
- Zak Software adapts prototype data management system to meet the data needs of the Library. Participants: Zak Software, all project staff, IPI, and Herzog/Wheeler.
- Project manager develops non-functional data management system interfaces and usability test tools for evaluation. Participants: Project manager, IPI, and Zak Software.
- Head of Collections Care Unit, as chair, convenes monthly oversight committee meetings for project communication and facilitation. Participants: All project staff and oversight committee.

Year 1: Quarter 2

- IPI and Herzog/Wheeler collect and upload environmental data for evaluation. Participants: IPI, Herzog/Wheeler, and project manager.
- Project manager convenes facilities working group to review data. Participants: All project staff and facilities working group.
- Project manager conducts user evaluation sessions with preservation staff and facilities staff using

non-functional interfaces. Participants: Project manager, preservation staff, and facilities staff.

- Project manager makes revisions to system interface, based on evaluation. Participants: Project manager, IPI, and Zak Software.
- Project manager completes first draft of data models. Participants: All project staff, IPI, and Zak Software.
- Head of Collections Care Unit, as chair, convenes monthly oversight committee meetings for project communication and facilitation. Participants: All project staff and oversight committee.

Year 1: Quarter 3

- Project manager collects and uploads environmental data, and sends data to IPI and Herzog/Wheeler for evaluation. Participants: Project manager, IPI, and Herzog/Wheeler.
- Project manager convenes facilities working group to review data. Participants: All project staff and facilities working group.
- Project manager conducts user evaluation sessions with facilities working group, curatorial staff, Library administration, and building owners using prototype interfaces. Participants: Project manager, facilities working group, curatorial staff, and Library administration.
- Project manager makes revisions to system interface and data models, based on evaluation. Participants: Project manager, IPI, and Zak Software.
- Head of Collections Care Unit, as chair, convenes monthly oversight committee meetings for project communication and facilitation. Participants: All project staff and oversight committee.

Year 1: Quarter 4

- Project manager collects and uploads environmental data, and sends data to IPI and Herzog/Wheeler for evaluation. Participants: Project manager, IPI, and Herzog/Wheeler.
- Project manager convenes facilities working group to review data. Participants: All project staff and facilities working group.
- Project manager conducts second (final) round of user evaluation sessions with all groups using non-functional interfaces, and evaluates need for new functions in data management system. Participants: Project manager, facilities staff, preservation staff, curatorial staff, and Library administration.
- Project manager makes revisions to system interface and data models, based on evaluation. Participants: Project manager, IPI, and Zak Software.
- Herzog/Wheeler provides advice on integrating required contextual information (e.g., utilities costs, local weather conditions) into data assessment. Participants: Herzog/Wheeler, IPI, and all project staff.
- Project director convenes stakeholders meeting to review project process and progress. Participants: All project staff, facilities staff, preservation staff, curatorial staff, Library administration, and oversight committee.
- Head of Collections Care Unit, as chair, convenes monthly oversight committee meetings for project communication and facilitation. Participants: All project staff and oversight committee.

Year 2: Quarter 1

- IPI and Herzog/Wheeler collect and upload environmental data. Participants: IPI, Herzog/Wheeler, and project manager.
- Project manager convenes facilities working group to review data. Participants: All project staff and facilities working group.
- Project manager compiles user evaluations to guide development of (live) web system interfaces. Participant: Project manager.

- Project manager sets final data models. Participants: All project staff, IPI, Herzog/Wheeler, and Zak Software.
- Project manager and IPI produce draft of technical documents: XML schema, sample code, and heuristics documents (user interface guidelines). Participants: All project staff, IPI, Herzog/Wheeler, and Zak Software.
- Head of Collections Care Unit, as chair, convenes monthly oversight committee meetings for project communication and facilitation. Participants: All project staff and oversight committee.

Year 2: Quarter 2

- Project manager collects and uploads environmental data, and sends data to IPI and Herzog/Wheeler for evaluation. Participants: Project manager, IPI, and Herzog/Wheeler.
- Project manager convenes facilities working group to review data. Participants: All project staff and facilities working group.
- Project director, IPI, and Herzog/Wheeler present overall indications from data collection and make recommendations to stakeholders for needed improvements. Participants: All project staff, IPI, Herzog/Wheeler, facilities staff, preservation staff, curatorial staff, Library administration, and oversight committee.
- Project director obtains support and approval from stakeholders for recommended alterations to building systems. Participants: Project director, facilities staff, preservation staff, curatorial staff, Library administration, and oversight committee.
- Guided by project staff, facilities staff makes alterations to building systems, based on recommendations approved by stakeholders. Participants: All project staff and facilities staff.
- Project manager develops new (live) web system interfaces based on user evaluations. Participants: Project manager, IPI, and Zak Software.
- Project manager reviews web interfaces with project staff and oversight committee. Participants: All project staff and oversight committee.
- Project manager makes revisions to web interface based on staff review and develops additional reports that may be needed. Participants: Project manager, IPI, and Zak Software.
- Head of Collections Care Unit, as chair, convenes monthly oversight committee meetings for project communication and facilitation. Participants: All project staff and oversight committee.

Year 2: Quarter 3

- Project manager collects and uploads environmental data, and sends data to IPI and Herzog/Wheeler for evaluation. Participants: Project manager, IPI, and Herzog/Wheeler.
- Project manager convenes facilities working group to review data. Participants: All project staff and facilities working group.
- Project manager conducts evaluation sessions on live system interfaces with stakeholder groups. Participants: Project manager, facilities staff, preservation staff, curatorial staff, and Library administration.
- Project manager makes final revisions to interfaces and reports. Participants: Project manager, IPI, and Zak Software.
- Project staff, IPI, and Herzog/Wheeler compile data and research notes in preparation for production of outputs. Participants: All project staff, IPI, and Herzog/Wheeler.
- Head of Collections Care Unit, as chair, convenes monthly oversight committee meetings for project communication and facilitation. Participants: All project staff and oversight committee.

Year 2: Quarter 4

- Head of Collections Care Unit, as chair, convenes monthly oversight committee meetings for project communication and facilitation. Participants: All project staff and oversight committee.
- Project staff and consultants prepare and begin to disseminate final project products and reports, including:
 - Methodology for establishing environmental monitoring program. Participants: All project staff, IPI, and Herzog/Wheeler.
 - Methodology for assessment of environmental problems. Participants: All project staff, IPI, and Herzog/Wheeler.
 - XML schema covering environmental data and data relationships. Participants: Project manager, IPI, and Zak Software.
 - Sample code (using web system for managing environmental data). Participants: Project manager, IPI, and Zak Software.
 - Heuristics/usability documentation (using web system for managing and presenting environmental data). Participants: Project manager.

Staff

The New York Public Library

Evelyn Frangakis, Aaron and Clara Greenhut Rabinowitz Chief Librarian for Preservation, will be project director (7% FTE), providing overall direction and guidance to the effort. She will be active in the planning and implementation of the proposed project, liaise with the Image Permanence Institute, and monitor the work of project staff and consultants. She will participate on the oversight committee and facilities working group. In addition, Ms. Frangakis, along with other Library staff, will disseminate information about the project's goals and progress to organizations outside the Library. Ms. Frangakis' current areas of oversight include conservation, binding/shelf preparation, collections care, and reformatting programs. She leads the planning for Library-wide preservation initiatives. Prior to joining the Library in March 2004, Ms. Frangakis served as Preservation Officer in the National Agricultural Library at the U.S. Department of Agriculture, where she developed and implemented preservation efforts, including working with federal, state, and international research and agricultural institutions. In addition to her responsibilities at the Library, Ms. Frangakis has served as Director of the Rutgers University Preservation Management Institute since 1998.

Jacob Nadal, Field Service Librarian, will be the project manager (50% FTE). Mr. Nadal will manage the day-to-day activities related to the installation and maintenance of the proposed environmental monitoring system, development and evaluation of the data management system, communication of environmental information to stakeholder groups, project documentation, and production of project outcomes and tools. In his current position at the Library, Mr. Nadal serves as a liaison between the Barbara Goldsmith Preservation Division and the Library's curatorial units. He is actively involved with facilities and environmental issues, maintaining the current environmental monitoring program and working with the Office of Capital Planning and Construction to address preservation issues related to construction and renovation. He also serves as the lead on emergency planning, coordinating response and preparedness activities among The Research Libraries and the offsite depository consortium of Princeton University, Columbia University, and The New York Public Library. Prior to joining the Library in September 2005, Mr. Nadal served as Head of the E. Lingle Craig Preservation Lab at the Indiana University Libraries, where he led a comprehensive preservation program that served 17 facilities. Mr. Nadal has also been active in information technology and digital library projects through the Craig Preservation Lab's work on digital reformatting and his service on the administrative team for the Indiana University Digital Library

Program. His software usability and database design background includes developing databases for the Kasemake automated enclosures system and assisting in usability testing and development of the Indiana University Libraries Intranet system.

Helga Borck, Head of the Collections Care Unit of the Barbara Goldsmith Preservation Division, will directly supervise and facilitate the work of the project manager (10% FTE). In addition, Ms. Borck will chair the oversight committee of this project (described at the end of the Staff section). Since Ms. Borck joined the professional staff of The New York Public Library in 1973, she has served in a number of capacities within Technical Services and Access Services, and has provided oversight for numerous projects, gaining a firm understanding of the Library's spaces and collections, their organization, and their history. In her current position, Ms. Borck manages preventive preservation activities, book repair, housing of materials, collection stabilization, environmental monitoring, disaster preparedness and recovery, and field services operations. Ms. Borck was involved with the pilot environmental monitoring project conducted at the Library several years ago with the Image Permanence Institute and Herzog/Wheeler and Associates, and continues to work with both consultants on ongoing environmental data collection at the Library.

The project involves the coordination of activities at multiple sites, and will require ongoing communication between project staff and Library staff at all levels. An **Oversight Committee** will be convened to review all aspects of project work and ensure successful completion of each stage of the project. The committee will meet monthly to review project progress and the results of user group discussions and quarterly data collection, making project adjustments as necessary. It will be chaired by Helga Borck, Head of the Collections Care Unit, and will include the Project Director and Project Manager, as well as the Directors of the four Research Libraries, the Director for Technical Services, and the Director of Facilities Operations for all four Research Libraries and 85 Branch Libraries.

In addition, a **Facilities Working Group**, comprised of the building managers for the four Research Libraries, will meet quarterly, following the collection and upload of data, in order to review the state of the overall building environments and plan for changes in the operations of the appropriate systems. Members of the facilities working group will coordinate their efforts with the Library's Office of Capital Planning and Construction and the Director of Facilities Operations.

Image Permanence Institute

The non-profit **Image Permanence Institute**, based at the Rochester Institute of Technology, is one of a small number of organizations involved in research and development of preservation technology. Its staff works in six principal areas: research on information media stability, collection management and environmental standards, ISO standards development for imaging media preservation, testing of archival and imaging materials, training photograph conservators, and outreach through publications and consultation. The Background and Project History sections of this proposal discuss IPI's relevant experience and expertise in environmental monitoring and software design.

James Reilly, Director of the Image Permanence Institute, will oversee all aspects of the research not performed by Library staff (25% in Year 1, 20% in Year 2). He will direct the work during IPI's site visits and oversee the participation of Herzog/Wheeler and Associates and Zak Software. He will advise the Library on the placement of PEM dataloggers in the storage spaces, work on the design on the web prototype with Leon Zak, collaborate with Peter Herzog and June Wheeler on the monitoring of the mechanical systems in the five NYPL buildings, and work with Jacob Nadal and Library staff on the data models and evaluation of the user interface. He will also assist the Library in creating the documentation of best practices in the overall environmental optimization effort, and participate in publishing and disseminating information.

Patricia Ford, IPI staff scientist, will be involved in the design of the prototype web system and take the lead in capturing the information on storage spaces, mechanical systems, and collection objects that needs to be in the web database (20% in Year 1, 15% in Year 2). She will participate in site visits, making sure that all the steps in the process are documented and that the database meets the needs of the Library. Her nearly twenty years of experience as a collections manager, and her experience in helping design the National Museum of Denmark web environmental database, will be used to ensure the functionality of the web based environmental systems. Ms. Ford also worked with The New York Public Library during IPI's Andrew W. Mellon Foundation-funded project.

Edward Zinn, IPI staff scientist, will be directly involved with the infrastructure monitoring aspects of the project, including PEMS and ACR dataloggers and their calibration, repair, and placement, as well as data collection and upload to the web (15% in Year 1 and Year 2). He will participate in site visits and work on data interpretation in the periods between visits. Mr. Zinn had a large role in the creation and success of IPI's hardware and software for environmental monitoring, and worked with the Library during IPI's Andrew W. Mellon Foundation-funded project.

Beverly Murrell Frasier, IPI senior accountant, will be responsible for all of the expense tracking, Rochester Institute of Technology internal reporting and grant accounting, invoicing of The New York Public Library, and other aspects of the financial side of the project (10% in Year 1, 5% in Year 2).

Jane Pestke, IPI business manager, will oversee all of the administrative tasks of the project on behalf of IPI, including travel arrangements, purchasing, coordination with Herzog/Wheeler and Associates and Zak Software, and report generation (5% in Year 1 and Year 2).

Herzog/Wheeler and Associates

Herzog/Wheeler and Associates specializes in systematic energy cost management and brings general expertise in building systems and facilities management to the project. Herzog/Wheeler's approach emphasizes long-term solutions to cost reduction utilizing a management-based approach and staff training. Herzog/Wheeler has collaborated with IPI in the past on the Preservation Environmental Monitor and Climate Notebook software field trials. It regularly participates in preservation workshops and presentations for the humanities community, and its work on optimizing preservation environments was featured at the National Archives and Records Administration's 2006 Annual Preservation Conference.

In this project, Herzog/Wheeler and Associates will provide information on the function of mechanical systems in the Library buildings and share its knowledge of diagnostic methods and performance analysis. Peter Herzog will investigate the mechanical systems and analyze system performance and energy savings, while June Wheeler will be responsible for placing the ACR dataloggers in the mechanical systems, and organizing and interpreting the data from the dataloggers. Together, they will work together with all project staff to determine the optimum climate possible and provide suggestions for improvement to existing mechanical systems. Like IPI, Herzog/Wheeler endorses a management-based approach to environmental monitoring and analysis, which includes information sharing and staff training.

Zak Software

IPI's Climate Notebook desktop software is widely used in the cultural and preservation communities, and its work with the National Museum of Denmark has led to the development of a prototype web-based environmental data management system that will be adapted to meet the goals of this project. For

software development, the Image Permanence Institute will contract with **Zak Software**. Zak Software has been involved with the creation of numerous software packages for the heritage community, including Climate Notebook, Zpests, Artifact Tracker, and the myclimatedata web system for the National Museum of Denmark. Leon Zak of Zak Software will work with IPI and Library staff to develop, test, evaluate, and refine software for the collection storage information system to meet the needs of a range of Library stakeholders.

Dissemination

Through the project, the Library will define the process of implementing environmental control methods by documenting the decision-making of preservation stakeholders, from choosing locations for monitoring to arriving at recommendations for improvement. This research will advance a set of best practices for evaluating environmental conditions and realizing the best possible environment for collections. Project materials and tools produced will be made available at the end of this project on a public website hosted and maintained by The New York Public Library. A number of these tools will be made available on IPI's website, as well.

In this Research and Development project, the Library and the Image Permanence Institute agree that IPI will retain the rights to the actual structure and implementation of the prototype system, but not to the generic designs and XML data models, which will be published for any institution to use. IPI has the intention in the future to create a nonprofit, cost-recovery basis service for any institution to keep their data and preventive conservation database on the web, and this project prototype is a necessary step along the road to creating such a system in the future.

The results of the Research and Development project will be presented to the library community through publications in library and preservation literature, and through presentations at the meetings and conferences of groups such as the American Institute for Conservation, Society of American Archivists, Association of Research Libraries, and American Library Association, including to the Preservation Administrators Discussion Group and the Library Administration and Management Association Building and Equipment Section. Articles will be submitted to journals such as *Restaurator*, *College and Research Libraries*, *D-Lib Magazine*, *Library Administration and Management*, and *Library Resources and Technical Services*, as well as the publications of the Library Information Technology Association, Society of American Archivists, Heritage Preservation, and Council on Library and Information Resources. The presentations, publications, and the availability of resources will be promoted through the Preservation Administrators Discussion Group, Conservation DistList, Archives, DigLib, JISC digital preservation, and museum community electronic listservs.

Notes

¹ Heritage Preservation, Inc. *A Public Trust At Risk: The Heritage Health Index Report on the State of America's Collections*. Washington, D.C., 2005. pp. 51-55.

² Nielsen, J. *Heuristic evaluation*. In Nielsen, J., and Mack, R.L. (Eds.), *Usability Inspection Methods*. John Wiley & Sons: New York, NY, 1994.

³ Virzi, R.A., "Refining the Test Phase of Usability Evaluation: How Many Subjects is Enough?" *Human Factors*, 1992. 34(4): p. 457-468.)

⁴ World Wide Web Consortium. *XML Schema 1.1*. <http://www.w3.org/XML/Schema>