Introduction

At its Annual Membership Meeting in May 2003, SOLINET hosted a pre-conference, "Under Construction: Preservation Issues during Building Projects and Renovations." This workshop, sponsored in part by a grant from the National Endowment for the Humanities, Division of Preservation and Access, brought together a panel of librarians, archivists, administrators, architects, and other allied professionals who shared their experiences in recent building, renovation, and move projects. Whereas once not considered essential, involvement of library and archival professionals in such projects is no longer overlooked as many lessons have been learned in reviewing buildings that fail to function due to the absence of our input. The information presented at this pre-conference proved invaluable to cultural resource administrators as more institutions are redefining their space to ensure that they function at a level that supports the core mission of protecting and preserving the collections.

Having recently managed a project to build a new state archives, I was gratified to see this type of information being shared. The papers presented at the workshop provided a basic primer on environmental issues for library, archives, and museum professionals. The papers varied in degree of detail and topics and included a step-by-step guide to planning a library expansion or renovation, how to plan the move of library collections, fire protection standards, and a full discussion of best practices and standards for library, archives, and museum environments.

Ann Hamilton, of Georgia Southern University, presented a comprehensive and thorough checklist for renovation that can easily be adapted by an institution of any size. The step-by-step approach carefully considers all of the preliminary work that must be done prior to construction, including how to involve staff to selecting architects and consultants. Ms. Hamilton also stressed the need to communicate with staff during all phases of construction. Notification of patrons and other area repositories through a newsletter, bulletin, or website should also be considered.

The paper presented by **Mary Molinaro** of University of Kentucky was a classic case study of how to plan, design, build, and move a library. Ms. Molinaro carefully described the project from conception to completion and included many of the physical, fiscal, technological, emotional, and political pitfalls that are associated with such big projects. The goals of the new facility were clearly articulated, and there was staff involvement and creative problem solving, all of which are essential in the success of a building project. Perhaps one of the most important points made in this presentation was that the presence of librarians at the table with the architects and

construction managers, in the words of Ms. Molinaro, "gave us a voice when those critical decisions needed to be made."

Scott Devine covered many details that are most often overlooked during library and archives construction projects. It is an accepted fact that the likelihood of a disaster increases significantly during renovation projects, yet rarely do institutions update and redistribute disaster response plans prior to construction activities. Mr. Devine emphasized the need for ongoing staff training in this area as a major component to success in mitigating damage at any time within a repository. Even less often are risk managers contacted or insurance policies reviewed for coverage of collections, furnishings and equipment. You can also find good advice on how to best protect collections and how to select temporary storage space during construction.

Moreover, Mr. Devine stressed revisiting food, drink, and housekeeping policies, which should also be distributed to all construction staff. Important issues such as worksite inspections, security, communication with staff and user communities, understanding the impact of revisions and contingency funds are also carefully presented in such a way that readers understand the complex nature of building or renovation projects but can also see them as tasks that are easily accomplished with proper planning.

Fire protection during renovation projects is an essential safety element. **Debbie Freeland** approached this fairly technical subject through thoughtful interpretation of the National Fire Protection Association (NFPA) 909 Code for the Protection of Cultural Resources. The importance of the newly revised code is the emphasis on planning through stressing the importance of pre-construction meetings between administrators and contractors to identify risks and establish appropriate fire safety and security requirements. The new standard also gives institutions important authority that never existed before of enforcing their "own protection standards" during construction. This is the type of information with which all cultural resource administrators should be armed prior to beginning a renovation project. Ms. Freeland's presentation also provided updated information on a variety of fire protection systems, their advantages, disadvantages, and the appropriate situations for each.

Alfred Lemmon's paper on moving collections proved to be a thorough and helpful guide for how to plan and execute a move safely and efficiently. Mr. Lemmon listed seven steps that proved to be invaluable during the move of his collections. Other keys to successful moves mentioned were planning, inventorying collections and resources, preparation of collections, training for staff and movers, security, developing clear guidelines and procedures, and having a system of tracking items throughout the process. This presentation also listed recommended readings on moving collections.

Remarks from **Michael Trinkley** on the "ideal" preservation environment provided the best of current theory and practice for the preservation of cultural collections. Mr. Trinkley's discussion of all of the elements that affect the continued existence of library and archives material was educational, informative, and practical. The detailed discussion of the effects of temperature, relative humidity, light, and particulate matter on the preservation of cultural material served as a reminder of what all cultural resource administrators should have as the top priority within their institutions.

Mr. Trinkley's paper updated us on current science of the preservation environment and provided useful information that will help us make more informed decisions as we contemplate the preservation needs of our collections. Important in Mr. Trinkley's remarks was the statement that, "preservation is a science and, like all sciences, it changes." It is important to remember that while we may be armed with the latest knowledge today, it is incumbent upon us as professionals to continue to build on that knowledge. By keeping current on these issues, we improve our ability to carry out our responsibilities as keepers of our culture.

The papers presented during this pre-conference provide excellent up-to-date information that is essential to librarians, archivists, and museum professionals who are contemplating renovations, expansions, or new facilities, or those who may just need to ensure that they are providing the best possible environment for the protection of the collections. The range and experience of presenters on this panel points to the complex nature of the challenge that we face each day in carrying out the most important of our core functions. The topics covered in this workshop remain the first line of defense for the preservation of our nation's cultural and historical resources. We should be enlightened by the quality and clarity of the information presented, armed with new tools to address these issues, and encouraged to share our knowledge with others.

Brenda S. Banks
Deputy Director
Georgia Archives

Preservation and Collections Care Issues
during Building Projects and Renovations

Proceedings from a SOLINET Preservation Conference
SOLINET Annual Membership Meeting, Atlanta, GA
May 30, 2003

The "Ideal" Preservation Environment

Michael Trinkley, Ph.D.
Director, Chicora Foundation, Inc.

Let me caution you about the title. I am not a big proponent of "ideals." The world is a tough place, and "ideal" situations occur rarely and, it seems, with only great masses of cash, which libraries today have little of. But more about that in a few minutes.
In anticipation of this discussion – almost as if by plan – the ALA published its April issue of American Libraries, which included the article "Building for the Future: Annual Facilities Showcase." I eagerly flipped the pages, past all the bad news of censorship and budget cuts, looking forward to extraordinary preservation wonders. When I finished, what I was wondering is how important preservation is to libraries.

Here is a brief sampling of what I read: "liberal use of natural daylight," "bright reading areas," "skylights," "open atrium," "natural light," "a coffee shop," "natural and artificial lighting," "clerestory," "outdoor patio," and so forth. Virtually everything that as a preservation consultant I would argue is antithetical to preservation. And many of these were award winners.

Now there were a few rays of good news amidst the dismal swamp of mangled and bungled preservation. For example, at the Brooklyn College Library there are "state-of the-art environmental controls to preserve books, audio and digital collections, and artwork." And the new facility of the Archie K. Davis Center of the Moravian Archives is heralded as "fire- and flood-proof."

Now I do not mean to focus on negativity, but I do have to wonder if we, as preservationists, have done a very good job when I see so many award-winning buildings that appear to be incorporating designs that will lead to insect infestations, premature fading and binding deterioration, early onset of brittle paper, and in general, the premature demise of presumably important and valuable collections. I should point out that my feelings are made more complex by serving as a consultant to several architectural firms, being occasionally consulted by others, and doing a very large number of preservation assessments. I see mistakes that are old and cold, as well as mistakes taking place immediately in front of me, often in spite of my involvement.

But because my remarks, presumably, are to outline good ideas rather than critique bad ones, let me move on and explain what we ought to be thinking about, rather than wondering what on earth designers were thinking about at some facilities.

One last issue, when we speak of standards, we usually mean standards to preserve organic-based materials from deterioration. We leave aside, if you will, the threats from natural disasters, theft, and mishandling. Deterioration, however, is a rather generic term. And it can take many forms; there is pollutant-induced deterioration, light-induced deterioration, biological deterioration, and physical deterioration. I will limit my comments to pollutant-induced and physical problems, only briefly mentioning light and leaving pests for another day. Pollutant-induced deterioration has a strong relative humidity (RH) dependency and involves chemical reactions. Physical deterioration involves changes, especially rapid changes, in temperature and relative humidity. But please remember that by using this distinction, I am creating an entirely arbitrary construct. In reality it is impossible to so easily separate all of the things that affect collections.

Why Worry?

Perhaps a good place to start is to understand why environmental controls are important. For the moment, let's not worry with what they should be; let's just concentrate on why we should be concerned.

I am also not going through the ethical responsibility we have as managers of collections. Nor will I talk about the fiduciary responsibilities of those managing public collections. And I will not even mention the legal responsibilities of records offices. Instead, let's just look at what happens to collections under different conditions.

Anyone even remotely familiar with preservation has been told how bad heat and humidity are to paper collections. And probably many of you have gone through mold outbreaks. You realize that paper is a hygroscopic material. A few of you who have gone to preservation workshops in the past have certainly heard that heat speeds the chemical reactions by which acid destroys the cellulose fibers in paper and bindings. You recall that the presence of water in the air accelerates the chemical reactions even more. High relative humidities will cause the paper to become pulpy and cause vellum to become distorted. You may also realize that as temperature and relative humidity increase, so too will your chances of pest infestations.

The problem with these approaches, however, is that they are difficult to quantify. How bad is 60 percent relative humidity, as compared with 50 percent? And is 75 degrees Fahrenheit really that much worse than 68 degrees? And how do you convince a county administrator, or college dean, that keeping the air conditioning on overnight is worth the cost?

Let's assume, for the moment, that your collection consists of 19th and early 20th century papers, things that are acidic and have, relatively speaking, a short life span. For the sake of our discussion, let's say the paper will last, at 50 percent relative humidity, 100 years. By increasing the relative humidity to 60 percent, but holding the temperature constant, what is the effect? Given the recent research, I can tell you that the paper will now last only about 85 years.

And what of the example where the temperature is increased from 68 degrees to 75 degrees? Assuming that we hold the relative humidity constant, this change reduces the life expectancy of our paper from 100 years to only 40 years. The situation gets worse if we are dealing with poor quality paper, such as newsprint. Under the best circumstances, the life expectancy may be only 30 years. Increasing the temperature as little as 7 degrees can reduce that life to only 4 years!

Isoperms: A Way to Evaluate Environmental Conditions

Some, perhaps even many of you, have heard of this research by Don Sebera. Called "isoperms," they provide a tool to help quantify your environmental decisions. It helps you understand the effect of environmental factors like temperature and relative humidity on the useful life expectancy of paper-based collections.

This technique is one that more institutions should use to evaluate their collection storage conditions. The complete report, Isoperms: An Environmental Management Tool, is available for only $10, one of the best bargains on the market today. But, until you have a chance to look at it in depth, it is helpful to understand a little bit more about the concept. For example, what does the value of 1.0 on the graph mean? It is really pretty simple. All of the temperature and relative humidity pairs along that line will yield the same level of permanence. In other words, 72 degrees Fahrenheit and 30 percent RH will preserve paper as well as 66 degrees and 62 percent RH, assuming, of course, that all other factors are equal.

As you move to the left, toward those lines numbered 2, 3, 5, 10, 25, and so on, you are increasing the permanence of paper. Those combinations of temperature and humidity falling on the 10 line (for example, 49 degrees and 50 percent) will preserve paper 10 times as long as conditions falling on the 1 line (for example, the 66 degrees and 62 percent RH we spoke of a moment ago). If we are speaking of a newspaper collection whose life span at 1 might be 20 years, we have now increased that life span to 20 times 10, or 200 years. If the collection was acid-free paper with a life expectancy along the 1 line of 200 years, we have now increased its life span to 200 times 10, or 2,000 years.

Conversely, if we move to the right on the isoperm chart, then we are facing conditions that will decrease the expected life span of the collection. Moving from the 1 line to the 0.33 line means that the collection will last only a third as long. A 20-year paper will now last only 20 times 0.33 or 6.6 years.

Now, with this all said, let’s understand that there are some places on the isoperm chart we do not want to go. For example, we rule out the levels above 65 percent relative humidity because we know the risk of mold at these levels is extraordinary. And we rule out those relative humidity levels below 20 percent because we know that paper is too brittle in that range.

It is also interesting to take a look at the levels used by many architects and engineers to plan environmental conditions in buildings. When we compare the ASHRAE human

comfort zone with the isoperm chart, we can quickly see that nearly two-thirds of the potential comfort settings are below our preservation threshold line of 1. In other words, designing for human comfort, most of the time, will result in premature aging and deterioration of collections.

Isoperms can also help us evaluate set points and tolerance limits. For example, a set point of 70 degrees Fahrenheit ± 5 degrees and 55 percent RH ± 5 percent covers isoperms from about 1.5 to 0.4. It is possible that much of the time the system would be operating in ranges that are less than ideal. Reducing the relative humidity set point by 5 percent would improve the situation, as would reducing the temperature set point by even a few degrees.

The isoperm concept even helps us if we find that we must allow seasonal fluctuations in our building. Please understand, such fluctuations are not good, and I do not recommend them, but if they must occur, Don Sebera's work allows us to make the most of a bad situation.

Now also understand that a week in good conditions can not make up for, or off-set, a week or even a day under poor conditions. Environmental effects are cumulative and once exposed to poor conditions, there is nothing we can do to "rejuvenate" a collection. That is why it is so important to prevent bad environmental conditions.

A modification of isoperms is the concept of a preservation index, as well as a time-weighted preservation index to evaluate cumulative effect, over time, of changing temperature and relative humidity conditions. The preservation index (PI), which assumes constant temperature and humidity, is the easiest to understand. The chart reveals that storage conditions of 57 degrees Fahrenheit and 50 percent will have a PI of 95 years. This means that under these stable conditions, it will take about 95 years for that collection to degrade. It might be marginally useful, something like brittle newspaper can still be read, but it can hardly be considered a productive research tool.

Time-weighted averages take into account that bad conditions cannot be mitigated by periods of good conditions. We can not, in other words, simply average preservation index values to get a time-weighted value; the math is a little more complex because the reciprocals of life expectancy are averaged, not the life expectancy values themselves. For those interested in this technique, refer to The Commission on Preservation and Access document, New Tools for Preservation: Assessing Long-Term Environmental Effects on Library and Archives Collections.

Having discussed paper, it is important to also mention that the Image Permanence Institute has developed a similar device: a storage guide for acetate film. For example, we can determine that film stored at 72 degrees Fahrenheit and 50 percent has an effective life of about 35 years. At 75 degrees Fahrenheit and 60 percent RH we have reduced the life to 20 years.

It is reassuring to realize that when we look at these three techniques, we find that they all

project similar rates of deterioration. Even though we have different researchers using different approaches to different types of material, all come up with almost surprisingly similar results. But this is good because it gives us even more assurance that when we use one of the various techniques to project life span, we are probably pretty close.

Armed with this kind of information, we are in a much better position to explain to administrators, physical plant directors, deans – and even architects – why environmental controls are so essential. We are in a position to provide simple, yet accurate, graphs (complete with detailed scientific data) to support our contentions that conditions in the facility are not only damaging the collections, but are having a real, bottom-line, dollarsand-cents impact on a capital investment: our library collection. We have the tools to take the discussion from the level of "this high temperature and stagnant air is really bad for our books" to "these conditions of 82 degrees Fahrenheit and 65 percent RH are reducing the life expectancy of our collection by about 85 percent; collections that would be lasting 100 years will now last only 15 years." And this, of course, can be translated into budget increases; cost of replacement; additional staff to order, catalog, and shelve collections; and added costs for rebinding collections temporarily and increased costs in other repairs.

So, What's Ideal?

So, now we not only know why preservation is important, but also can intelligently argue the case, at least in relative terms. I am still, however, asked, "So, what should I tell my physical plant? What should the temperature and relative humidity be in my library?" While the people asking the question may not realize it, what they are actually asking is, "What should I establish as the set point for my environmental control program?"

For about a decade I have been answering that question with a question: "Well, how important is your collection and how long do you want it to last?" Let's be honest; if we are dealing with a branch library with a largely transitory collection, we must be willing to accept very different environmental standards than if we are dealing with a research library collection, or archival collection.

In other words, to understand the elusive concept of "the ideal" you must understand your collections and its value. Will people want your collections, or will those collections be important, in 100 years? If so they need a substantially higher level of care than the circulating fiction books at a branch library that will probably have little redeeming interest 10 years from now.

That does not mean we should abuse our public library collections. Every extra circulation is postponement of replacement. Yet, clearly we must be flexible. That is the key to workable standards.

I also advocate a very different standard for new construction than I do when trying to get a pre-existing system to work or solve a mold outbreak. There is a tremendous difference between designing a system appropriate to one's needs and beating an inappropriate

system into some semblance of submission.

So, if we are talking about new construction, our standard should be appropriate for our collection. We should consider providing our architect with an isoperm chart and explaining that any set point and associated operating parameters to the left of a particular isoperm line will be acceptable, assuming it provides some facsimile of human comfort.

Under these circumstances, we are probably looking at a set point of about 45 ±5 percent RH and 67 degrees ±2 degrees Fahrenheit. The set point would provide us with an isoperm of about 1.2. To really do much better we find ourselves significantly outside the realm of human comfort and our architect will already be telling us how expensive the system we want will be to operate. Well, as I have said before, preservation costs. There are ways of reducing the operating cost, and, in fact, there is even some data that suggest set points in this range may, long-term, be less costly and more healthy to people, than those closer to the ASHRAE comfort zone.

Nevertheless, there is room for negotiating. And the biggest negotiating factor is segregating collections from staff offices and patron use areas. In other words, design two systems: one for people, where collections will spend very little of their life, and the other for the collections, where people need to be for only brief periods. In such a situation you can ensure that the collections get the climate control they need, while reducing human-comfort complaints as well as reducing long-term operating costs. Of course, there will be an increase in short-term or initial costs because you will likely need components for two systems. But even this has a significant up-side because with proper design, it provides redundancy. If one compressor or chiller goes out, you may lose your fine control, but you do not need to lose everything.

Now, if we are talking about applying a standard to an existing system, the approach is a little different. In such a case we should provide our mechanical engineer with an isoperm chart and explain that we need to be as close to the 1 line as he or she can get us, within the constraints of available money. If we can not get over the line all the time, then we should go on and explain that any fluctuations should be such that we stay as close to the 1 line as possible, for as long as possible.

In essence, we are recognizing that a pre-existing system probably can not achieve what our collection needs, and deserves, so we will have to accept whatever we can get. Improving on that will then be left up to tricks of the preservation trade, such as increasing ventilation and using protective enclosures as buffers.

Understanding Temperature and Humidity

I have focused on temperature and humidity. They are the "meat and potatoes" of preservation, and it is important to understand not only how they affect collections, but also how they are controlled by HVAC systems. This, in turn, means understanding how temperature and humidity are interconnected and how systems work.

As unpalatable as it seems, if you can not understand the technology, you are doomed to living forever in the shadow of "THEY." You know, "they" say it can not be done, "they" say it is too expensive, "they" say it is not necessary. If ever there was truth in the statement that "knowledge is power," it is here. My goal, however, is not to make you experts in HVAC, but rather to provide you with a brief introduction, enough to help you get started.

First, understand that we are speaking about relative humidity. When we speak of 40 percent RH, we are speaking of the percent of moisture that the air could hold, at a given temperature, if saturated. We are not talking about specific humidity, or the actual amount of moisture in the air. Consequently, temperature and relative humidity, for all practical purposes, are inter-connected. You can not generally tinker with one, without affecting the other. In other words, if the temperature is 70 degrees Fahrenheit and the relative humidity is 50 percent, by increasing the temperature to 75 degrees Fahrenheit, we will drop the relative humidity to about 42 percent. As the air is warmed, it can hold more moisture. Assuming we do not allow any more moisture to be introduced, the relative humidity drops. Naturally, if we dropped the temperature from 70 degrees to 65 degrees, we would find that our relative humidity would jump from 50 percent to nearly 60 percent.

This helps explain why tinkering with an HVAC system is rarely a good idea. I have frequently heard offers from physical plant personnel to deal with humidity problems by raising (or lowering) the temperature. But taking advantage of the natural physics of air and moisture is rarely adequate to deal with root problems.
More often what we need is to either dehumidify or humidify the air, either taking water out or adding water, all the while holding the temperature (more or less) constant. Consequently, it is important to understand how an HVAC system goes about controlling humidity.

Let's start with a very simple, basic HVAC system, something on a very small scale. For example, something we might find in an apartment or even a small commercial building. These are typically called packaged DX or direct expansion systems. They cool the air by passing it over coils that are filled with a coolant that absorbs the heat from the air. This usually draws off some water from the air because cool air can not hold as much moisture as warm air. The water is caught below the coils in a condensate pan that is usually piped outside. This is also the slow drip you see from a window air conditioner or occasionally from so-called central air conditioners. The warmed coolant is also piped outside to the condenser, where a fan is used to again cool the pressurized gas to a liquid, and the process is repeated. Included in this system, of course, would be some form of filtration, but we will talk about that later.

Even huge institutional systems are essentially the same. A chiller may provide chilled water for the coolant, a cooling tower may be used instead of a condenser to dispel the absorbed heat, and a boiler may be used instead of electricity to provide heat, but the principles are the same. The only issue I would throw at you for larger systems is, as I mentioned earlier, the need for redundancy. Although equipment well installed and cared

for with a preventive maintenance program will have life expectancies of 30 years, failures do occur. When the system goes down, there should be redundancy, especially in chillers and boilers, to provide some buffering potential.

Very simple air conditioning systems are pretty good at cooling, but really do not do a very good job at dehumidifying. Although some moisture is driven off (lowering the specific humidity), the amount is relatively small because we are not cooling the air all that much. If we tried to drive off more moisture by dropping the temperature of the coils, we would end up dumping a lot of very cold air in the space we were trying to condition and probably get complaints from the occupants.

In addition, if we were to measure the relative humidity of the cooled air right off the coils, we would find that it is near saturation – as much water as possible was driven off, leaving the air, at the temperature resulting from the cooling, fully loaded with moisture. This air is then mixed with the air in the rest of the space we are cooling, and this mixing results in a slight lowering of the relative humidity. Why? Well, as the air is warmed it does not contain as much moisture as it can hold, so the relative humidity is slightly lower. Nevertheless, this is not particularly efficient, and it certainly is not appropriate for collections.

What this system needs is something called reheat. These are heating coils that are installed in the airflow just past the cooling coils. With these in place and operable, what we can now do is reduce the temperature of the cooling coils far lower than before, driving off much larger quantities of moisture or specific humidity. The very cold air, which is at or near to saturation, is then passed over the reheat coils. There the air is heated up, and this reduces the relative humidity of the air. The dehumidified air is then dumped back into the space.

Reheat can be provided by electric heat or by hot water piped through coils. Occasionally, you will find systems with reheat where the reheat as been turned off in order to, guess what, save money. And money is saved, but the collections are put at risk. More often, however, you will find systems designed with either no reheat, or inadequate reheat because the engineer did not realize the importance, or complexity, of dehumidification in a library setting.

Reheat often can be added to existing systems. In addition, it is often possible to obtain better dehumidification by replacing coil assemblies. Sometimes even cleaning the coils can make a difference in performance.

One tremendous difference between libraries and other buildings is that libraries have very little heat load. That is, there is not much in a library or collection storage area that generates heat. Even the fluorescent lamps, which can usually be counted on to produce some heat, are turned off in closed stacks. There are relatively few people in libraries, at least on a per square foot basis, because most of the space is taken up with ranges or other forms of storage. The heat in "normal" buildings is counted on to lower the relative humidity of the air passed over the cooling coils, in essence to provide something like

free reheat. But this does not happen in libraries, archives, and museums. This is also why some institutions that have bought Liebert units are disappointed in their performance. Lieberts are typically designed for computer rooms, where a lot of heat is generated. Therefore they have relatively limited reheat capability and often do not dehumidify as well as collection managers think they ought to.

Dehumidification can also be achieved using desiccants. Many of you may be familiar with the use of desiccant wheels that slowly revolve in the air stream collecting moisture and then expelling that moisture during a heating cycle. One of the foremost manufacturers is Munters. There was a time when desiccant dehumidification was not thought appropriate for collections. Not only were the systems large and difficult to operate, but there was concern that the abrasive desiccant could enter the air stream. These concerns are things of the past, and desiccant systems are used in clean room settings, as well as schools and grocery stores.

In addition to the desiccant wheels, there are also liquid desiccants, such as those manufactured by Kathabar. These have the added benefit of the liquid being able to remove and kill more than 90 percent of all bacteria, viruses, and molds. While this sounds like it would be out of the reach of libraries, museums, and archives, these systems are actually more energy efficient than the wheels and are usually easier to operate.

There is yet one more system worthy of brief mention. Heat pipes are another form of reheat, although significantly less costly to operate than traditional reheat. The warm to hot outside air is passed over special metal pipes that are particularly designed to pick up and transfer the heat, hence they are called heat pipes. This heat is then transferred to the air downstream of the cooling coils, where it serves to reheat the overcooled air. In essence, cheap reheat. One of the primary manufacturers is Heat Pipe Technology, a fairly easy name to remember. The company produces packaged dehumidifiers using this technology, which can be put into new systems or used as add-ons to existing systems.

The point here is simple. Dehumidification must be achieved by either reheat or by desiccants. We can not get enough dehumidification using simple coils and nothing else. It just plain will not work; do not believe what anyone tells you.

Even in the South we occasionally need to add moisture to the air, most notably in the winter when the building is heated. There are a number of options for humidification, but the best option is to have steam humidification in each zone of your building. Devices that provide humidity by spraying water or that introduce water into the system as a liquid, rather than steam, should be avoided. Not only do water systems tend to have higher maintenance and greater potential for harboring mold, bacteria, and viruses, but if they fail, they are more likely to wet collections. The zoned approach is critical because it is likely that different areas will require different levels of humidification. Humidification steam should be clean. It should not come from the boiler a number of chemicals are added to boilers to control pipe corrosion. These chemicals, which tend to be alkaline, should not be put into the air as aerosols. They are both unhealthy and also damaging to

collections. So, the appropriate technique is to require a steam generator using deionized water, although this generator itself can be heated by boiler water.

Humidification, however, requires that you have humidity-tolerant building envelope. Otherwise, as you add moisture to the air, you will find it condensing on the cooler walls, ceilings, and windows. This, in turn, will likely cause significant structural damage, especially if the moisture condenses between the inner and outer walls. For some reason too many contractors act as though vapor barriers are code words in some foreign tongue. Even when designed appropriately, contractors seem determined to ignore their placement or to put so many holes in them they look like confetti afterwards.

In addition, it is essential that humidification systems have sensors to detect if the space, or duct work, is being over humidified. These sensors should warn of the water problem and shut the system down.

And this is also probably a good time to mention that when we have water running over collections, as either steam pipes, or condensate lines, or cold water for cooling coils, sooner or later there will be a problem, especially if your institution relies on deferred maintenance. From a design perspective the only water pipes I would allow over a collection are pipes for a sprinkler system. There the benefits far outweigh the very minimal risk. Other piping, however, should be routed in non-collection areas. And all cold water pipes must be insulated. Without insulation condensation will form and these pipes will drip, just like there is a leak.

No excuses, no trying to cut corners. If you are in a building where pipes are already present overhead, then invest in water detection devices to minimize the inevitable damage and plan ahead, stockpiling plastic sheets and blotting paper.

What are Other HVAC Concerns?

Temperature and humidity are only the beginning of our concerns. An HVAC system also consists of appropriate controls – devices that allow adjustment of temperature and humidity. Typically these are pneumatic, using air pressure to adjust or control dampers, valves, and other systems. These are little boxes on the wall that, when adjusted, make a whistling noise a few seconds later. Pneumatic controls are inexpensive to install, very durable, simple to operate, but they are notoriously inaccurate. Adjustments are required at least annually, and probably more often, perhaps even monthly. And I have never heard of a physical plant staff able to take the time to make the necessary adjustments on anything approaching a routine basis. Consequently, even a relatively good system can be compromised by inaccurate controls.

There are better devices, called electronic controls. Only slightly more expensive, these devices provide greater accuracy and allow very easy remote control of space conditions. They can also be integrated with direct digital control using computers and software programs to maintain the system. While not suitable for every operation, when appropriate they can provide significant energy savings and extraordinary simplicity

combined with very precise control.

Some architects and engineers try to save a few dollars by installing the sensors in return ducts, justifying the decision by noting that this placement provides an average of conditions. Sometimes they will even make it sound like they are doing you a favor. In reality, they are not. We do not want averages of conditions from several spaces, we want the actual conditions within those spaces. So sensors should be mounted in collection storage areas – where your collections actually spend the bulk of their time.

Another major choice that confronts most institutions in the design phase is the choice of either a constant air volume system (CAV) or a variable air volume (VAV) system. In a constant volume system the air handlers provide a constant volume of cool air to the conditioned space. Zone thermostats and humidistats control the reheat to satisfy thermal and humidity demands. But the amount of air is always constant. In VAV, or variable air volume systems, it is the air flow into the space that is adjusted. Although this saves money, it also places the collection at risk. First and foremost, it is virtually impossible to adequately dehumidify with a VAV system. The increased humidity levels and reduced air flow combine to create a scenario where mold is not just possible, but more often than not, a way of life. In addition, a VAV system does a generally poor job of filtration because the air volume is often much lower than necessary to remove particulates from the air.

The last energy-savings idea foisted on museums, libraries, and archives by architects and engineers is the air economizer. There are those nice fall and spring days where, especially early in the morning, it is crisp and cool. Of course the relative humidity is often 80 percent, but you really do not feel it because the air is so cool. Well, an air economizer uses the outside air on such days to provide "free cooling" to the building. Rather than cooling and dehumidifying, the system simply dumps outside air in the building – with no dehumidification and often with little filtration. So, you get free cool air, and then develop mold problems.

Devices like the VAV system and air economizers are perhaps suitable for office buildings where human comfort is the only concern. But, as we discussed earlier, our collections need conditions far superior to ASHRAE's human comfort indices. In addition, office buildings that are typically rental expect to repaint and re-carpet on a routine basis, and this significantly reduces mold levels. Most institutions can not afford this same level of upkeep. I will also mention that recent studies are beginning to discover that these systems are not all that good for indoor air quality. In fact, we are slowly realizing that dehumidification in summer and humidification in winter are not just good for the collections; they are also good for people.

When discussing VAV and CAV systems, it is important to understand how essential ventilation is to the health of collections. I have seen otherwise well-designed systems, capable of providing at least minimal levels of control, that were sabotaged by either poorly designed duct work or by institutions that changed the position of their interior walls or ranges without realizing the impact those changes have on air movement.

Simply put, we have to get the conditioned air to the collections. Otherwise, we create dead spots of high humidity where mold repeatedly occurs although no one at the institution can understand why.

Proper design of duct work and ventilation rates is as complex as the proper design of dehumidification. It should not be left to chance. Significant deviations from the ductwork design and routes by the mechanical firm can affect the capability of the system to function as designed. Longer duct runs, smaller ducts, and more turns will all increase the static pressure, reducing the amount of air actually distributed through the system. As the flow decreases, so too does the system's ability to heat, cool, humidify, and dehumidify.

Beyond temperature and humidity, institutions get into trouble by short-changing filtration. Using inferior particulate filtration results in increased housekeeping costs, greater collection of dusts that promote mold, increased potential for pest infestations, and exposure of patrons and staff to allergens.

Engineers have been working on filtration and within the past few years there have been some significant changes in the ways that particulate filters are classified. ASHRAE 52.2, Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size, requires filter manufacturers to identify their filters abilities to remove airborne particles in specific size ranges from 0.3 microns to 10 microns. This allows you to select your filter based on the size of the debris you expect to be present and what needs to be eliminated from the collections.

For a valuable collection, it seems reasonable to filter down to 0.7 microns – allowing the removal of atmospheric dusts, molds, and pollens. This would not only improve the longevity of the collections but very likely the health of the building’s occupants.

And what about gaseous pollutants, things such as ozone, oxides of nitrogen, and sulfur dioxide? These have a variety of sources, some within the building (like printers and copiers that belch ozone), but many on the outside. Most are by-products of what we call civilization: smog, industrial pollution, and auto exhaust. There are also a variety of other pollutants, such as formaldehyde and solvents or VOCs (volatile organic compounds), most of which are found primarily within new buildings and are often associated with new construction. These are the products of "better living through chemistry." And all of these can dramatically affect our collections (not to mention our health).

The normal background concentration of sulfur dioxide is about 6 to 30 ppb. For oxides of nitrogen it is 1 to 15 ppb, and for ozone it is typically less than 1 ppb. In urban areas, however, these levels are significantly higher. For example, peak concentrations of sulfur dioxide are about 100 to 750 ppb, oxides of nitrogen are 40 to 100 ppb, and ozone may be at 40 ppb. In fact, in the York County, South Carolina area, just south of Charlotte, ozone peaks at 138 ppb. In rural South Carolina the nitrogen oxide levels are about 20 ppb. And sulfur dioxide in downtown areas is upwards of 110 ppb. So you can see that the levels

are very real.

The next question, of course, is at what level are collections affected. We know that outside pollutants can be remarkably buffered from our collection by the building envelope, assuming it is tight and well-constructed, and assuming that we are not relying on an air economizer or dumping large quantities of outside air in our institution, and that our air intake is not right next to the loading dock where all the trucks allow their motors to idle. Interior construction features, like wall board, act as sinks, absorbing large quantities of pollutants.

But, of course there is a limit, especially if we are allowing outdoor pollution in, or if we are creating indoor pollution.

You will also hear from many people that such-and-such level is safe, according to the Environmental Protection Agency (EPA) or Occupational Safety and Health Administration (OSHA). For example, federal standards to protect human health limit sulfur dioxide to 140 ppb, oxides of nitrogen to 53 ppb, and ozone to 120 ppb. But if we think about it, it is totally inappropriate to use these to gauge the health of our collections. As living organisms we, thankfully, have the ability to filter out, excrete, and otherwise get rid of, a lot of pollutants. When you think about it, the human body is incredibly well-designed. Our collections, however, have no such ability and even low levels, background levels in the low teens, cause damage. Silver tarnishes, the pennies in the dish on your bedside table darken, the pewter mug you put your beer in discolors. These are all visible signs of what these pollutants do. Not so visible are other chemical reactions. Sulfur dioxide and oxides of nitrogen combine with the moisture in the air to form sulfuric acid and nitric acid, both of which aggressively attack paper and bindings. Ozone is a powerful oxidant, and it breaks every carbon double bond it comes into contact with. Consequently, it can destroy virtually all organic material: textiles, paper, furniture, leather, fur, and feathers. It can even increase the oxidation, or tarnishing, of silver and copper.

As a consequence, the current recommendations are that sulfur dioxide be kept below 0.35 ppb, that oxides of nitrogen be kept below 2.65 ppb, and that ozone be kept below 0.94 ppb. As you can gather from our discussions, these are very low levels.

There are filters for gaseous pollutants, but first I encourage institutions to eliminate as many sources of pollution as possible. In the design phase, avoid the air economizer, locate ducts where there is no chance of pollution, install good vapor barriers, design the HVAC system to use the smallest amount of outside air approved by your code jurisdiction, and then keep doors and windows closed. Also, design for a pollution-free interior. Instruct your architect to use water-based adhesives in lieu of solvents. Use only products with low VOC emissions. Avoid products that are known to off-gas large quantities of formaldehyde or acetic acid. Where necessary, use sealants to trap off gassing.

Once these steps have been taken, if it is still necessary to further clean the air, then the

only reliable approach is the use of a media, typically either activated carbon or potassium permanganate. Both can do very respectable jobs and the only real difference is that carbon can release absorbed contaminates, while potassium permanganate results in a chemical change that binds the pollutants. Another difference is that carbon is black and stays black, regardless of its condition, while potassium permanganate changes color from purple to brown as it is exhausted. Consequently, for most applications potassium permanganate, such as sold by Purafil, is probably preferable.

What about Light?

So far I have focused on heat and humidity. Let's turn to light: daylight, fluorescent lamps, skylights, halogen lamps, whatever. For temperature and humidity we have isoperms; is there anything similar for light? Actually there is. The talented and inventive staff at the Canadian Conservation Institute have come up with a light damage scale. While intended primarily for museums and focusing on fading, the scale can also be used in a general sense to predict increased chemical deterioration as a result of light activity.

The scale has two sides and while both are useful, we will concentrate on Side One, which is used to calculate light damage. It reveals three scales: time in days or years, intensity (using lux), and ultraviolet (UV) light. I should mention right now that our concern over light is not limited to UV light; in other words, filtering UV out does not make light "OK." So, we have two UV scales: one for where there is much UV light, such as in daylight or through the use of many fluorescent lamps, and the other for little UV, such as with tungsten lights, UV-filtered fluorescent lamps, or UV-filtered daylight. The scale allows us to visually see the damage to blue dye standards. Without going into the chemistry, the blue wool standard is well-accepted by museums as a valid measurement of light damage. The scale allows us to graphically compare damage caused by different light levels.

For example, 20,000 lux – a level entirely consistent with "liberal use of natural daylight," "bright reading areas," "skylights," "open atrium," and "natural light," so eloquently described by the ALA – will lead to the fading of even the most resistant dyes within 10 years. And even if virtually all of the UV light is filtered out, these same conditions will lead to the fading and deterioration of all but the most resistant collections within the same time frame. By dropping back to 1,000 lux, on the other hand, the same level of damage will not occur for 50 years. And by limiting light to 200 lux we can ensure that this level of damage will not be seen for 100 years.

Summary

By way of a summary let's go over where we have been. In terms of temperature and relative humidity, I have suggested that institutions first evaluate the value of their collections, making a careful decision what they wish to preserve and for how long. That, in turn, can be used to guide temperature and humidity set points using an isoperm approach. I then suggested that a set point of about 45±5 percent RH and 67º±2 degrees Fahrenheit for critical collections. I might point out that such a set point would also do

wonders in reducing the levels of mold outbreaks in collections and might even improve the health of staff working in the building.

We also touched on the fact that there is more to making systems work than just establishing set points. We know, for example, that VAV (variable air volume) systems do not allow precise control of temperature and humidity and while they may be acceptable for people (although I am dubious), they are not appropriate for valuable collections. We know, too, that air economizers, incorporated into systems in the name of economy, serve to introduce huge quantities of unconditioned and unfiltered air into collections and that they will wreak havoc on any efforts to control relative humidity. In fact, some notable mold outbreaks can be traced back to the use of air economizers. We also realize that any effort to control relative humidity in the South is doomed unless reheat is incorporated into the HVAC system. Attempting to dehumidify through coolingbased systems alone just does not work. Period.

Then we briefly discussed filtration, both particulate and gaseous. For particulate filtration I recommended looking at the conditions you were seeking to control and evaluating filtration on that basis. In general, however, I suggest looking to control particles down to about 0.7 micron. It is these small particles that do the greatest damage to collections, causing abrasion and providing a fertile breeding ground for mold. In terms of gaseous filtration I am beginning to urge far more effort. We have too long shrugged our shoulders, thinking that the control of gases was just too expensive. I am now beginning to believe that for valuable collections it may be too expensive to ignore the damage that gaseous pollution is doing, and certainly the state and federal governments seem disinclined in today's economy to take the problem seriously.

Finally, I discussed light damage, noting that the Canadian Conservation Institute's Light Damage Scale allows us to estimate light damage and compare the damage anticipated based on different levels and types of light. Again, we should evaluate the "ideal" based on the value of our collection. If we want it to last 100 years, keep the light levels below 300 lux for most collections, 165 lux for very important collections, and 55 lux for the most valuable. There is no acceptable level of ultraviolet light, and preservation standards rightfully demand that it be filtered out to levels no greater than 75 γW/l.

The simple solution, of course, is to design for preservation. It is far easier to do it correctly during the initial design and construction than to make it right afterwards. For small institutions that perhaps are not able to make everything right, there are still some stop-gap measures.

In terms of temperature and humidity, begin with your building. High and/or fluctuating humidity levels often mean that there is a failure in the building envelope. A roof may need replacing. You may need to install sweeps on doors. Gutters may be clogged and be introducing moisture through the walls. Sprinklers outside may be hitting your foundation. Trees may be overhanging your building and delaying drying. Look for maintenance improvements. Especially inquire if your institution has adopted a deferred maintenance program. Your problem may lie not entirely with the system, but the

maintenance of your facilities may be contributing.

Look also at how well your HVAC system is being maintained. Does your institution, for example, have a preventive-maintenance service contract? Perhaps you need an outside contractor to come in and evaluate if the system is performing to its peak potential?

I caution you, however, to avoid the tweaking or tinkering approach to HVAC maintenance. This involves making multiple adjustments in the hope that something will help improve the situation. Usually the tinkering only makes matters worse, but even if there is an improvement, it is usually impossible to determine, among all the things done, what was significant. An active water leak requires immediate attention. A poorly performing HVAC system requires study and evaluation. Avoid the temptation to "do something, even if it is wrong."

While not a permanent solution, you will likely find improvement for localized problems by using industrial fans. Purchase high-velocity fans, upwards of 6,000 to 10,000 cfm. These will move enough air in collection storage areas to make a real difference. Be sure that they are properly grounded and that you do not use extension cords.

Dehumidifiers can be a useful, short- or moderate-term solution, although I discourage them as a final, or long-term, solution. Keep in mind that this is another area where size matters. A typical consumer model dehumidifier is usually rated between 25 and 30 pints or about 3 to 4 gallons, meaning that in a 24-hour period that is the maximum amount of water it can pull out of the air. Under high-moisture conditions this is enough for about 1,000 to 1,500 square feet if the entire area is open and there is good air circulation. Otherwise, performance will be dramatically reduced. Consumer models are also not meant for rugged, continuous operation. Under that sort of stress, they typically have a life span of four or five years.

If you have a serious enough problem to warrant a portable dehumidifier, you should seriously consider an industrial quality model. A company such as Ebac Systems produces dehumidifiers with capacities of 13 to 28 gallons per 24 hours. These also frequently have automatic pump-outs, capable of pumping the condensate for considerable distances to drains – an essential feature for continuous operation.

One of the best steps you can take to help deal with particulates is to reduce the load of "dust" within the building. Install better, and longer, runners outside to remove more debris from patrons’ shoes. Implement a more aggressive housekeeping program. Tile or wood floors should be damp mopped daily, with high traffic areas perhaps even more frequently. Avoid the use of carpet. It is difficult to clean, a reservoir for moisture and mold, and adds large quantities of particulates into the air as the fibers break down. If you have carpet, recognize that you need to vacuum it several times a week, depending on traffic. Weekly cleaning, which so many institutions have gotten used to, simply will not deal with the large quantities of particulates introduced into buildings with poor filtration systems.

Not only must you improve the frequency of cleaning, but also the equipment used. Get rid of that old vacuum and insist that HEPA vacs be used. If you can not afford them, insist that bag quality be improved and that bags be changed more frequently.

Also remember that you can deal with small collection spaces using, in essence, spot treatments. For example, for special collections you might consider using one or more HEPA air filters. While these typically have a fairly low movement of air, they include a HEPA filter and often a charcoal prefilter. Just remember to change the charcoal prefilter at least monthly.

If you are at an institution with a small HVAC system, you may discover that you can replace your current fiberglass filters with a high-efficiency filter. Although it may only provide 30 percent ASHRAE Arrestance, it will still be far better than what you are currently using. Just verify with your HVAC company that the existing fan motor can accommodate the additional resistance of the new filter.

Also, ensure that the filters you do have are being changed as they should. Here is a little trick. Ask your physical plant how often they change the filters. I will wager that most respond with something like, "every six months," or worse, "when they are dirty." Both answers are probably wrong.

Filter life can really only be judged by the drop in pressure across their face as they become "dirty" or clogged with debris. And the only way to determine this pressure drop is for the air handler to be fitted with a manometer or mangehelic gauge. Most architects and engineers leave off these essential items, even though they cost only $20 or $30. Not only will they tell you when filters need to be replaced, but they will also prevent you from wasting money by replacing filters before their time.

Now gaseous pollutants are a little more difficult to deal with. Keeping your building closed will help. You should also eliminate, or segregate, pollution sources inside the building. Smoking should be eliminated. Copiers should be housed together and vented outside. Printers should be isolated from collections. Repair work and even maintenance activities should only use low VOC products. Also helpful, at least in small areas, are the charcoal prefilters on portable HEPA air filters. And there are even some companies, such as Cameron-Yakima, that produce replacement filters impregnated with potassium permanganate or charcoal.

Beyond these suggestions, another valuable tool is buffering the collection, creating a barrier between the collection and the problem be it temperature, humidity, dust, or gaseous pollutants. This buffering approach is great for museums and archives, although it is admittedly difficult for circulating collections.

One of the most common barriers in archives, records centers, and special collections are the boxes materials are stored in. Hopefully they are minimally pH neutral and have an alkaline buffer. The better products are also lig-free and ground-wood free. These containers offer an exceptional buffer between the harsh world around them and the

papers within them. My only caution is that even the best storage materials, over time, will exhaust their buffering capability and become acidic. This happens, obviously, much more quickly under adverse storage conditions. So, do not assume that appropriate housing is a once-in-a-lifetime undertaking. Periodically take your pH pen to your boxes and folders. Replace those that have failed.

Over the past five years the number of products has dramatically increased. For example, Masterpack offers a variety of barrier products, especially Nomex and Nomex-Mylar. These two products slow rapid changes in humidity, help protect against off-gassing of compounds like formaldehyde, are mold resistant, resist penetration by dust and other particles, and are themselves free of chemical additives. They can be used to line display and packing cases, can be used as liners on shelves, and might even be appropriate for other uses, such as lining the interior of vaults or special collection rooms to better isolate them and create "rooms within rooms."

Conservation Resources, several years ago, introduced what it calls Microchamber Products. These are typical folders, boxes, and other enclosures with specially activated carbons or molecular sieves that buffer out gaseous pollutants. Although these products are modestly more expensive, the test results reveal a dramatic improvement in storage conditions.

Finally, allow me to remind you that preservation is a science and, like all sciences, it changes. What we know today will be modified within a few years by additional research. New products will come on the market, while older ones become obsolete and disappear. As a result, “ideal” is a moving target. Just as you hire an architect to ensure your building is safe and meets codes, you should consider hiring a preservation consultant to ensure that your facility takes appropriate care of your collections.

SOLINET Preservation Field Services, 1-800-999-8558

Preservation and Collections Care Issues
during Building Projects and Renovations

Proceedings from a SOLINET Preservation Conference
SOLINET Annual Membership Meeting, Atlanta, GA
May 30, 2003

Connecting the Community of Scholars: a Library Building from Planning to Reality

Mary Molinaro
Director, Young Library, University of Kentucky

Good morning. I would like to thank Tina Mason and the SOLINET staff for inviting me to participate in this seminar. I will be sharing some of the experiences we had at the University of Kentucky when we built and moved into a new central library. I will give you a general overview of the building project, will discuss collection issues leading up to the move, will describe the move process, and will touch on some of the things we learned from the experience.

There are many aspects of our building project that are also interesting, but that we do not have time to address here today, including a reorganization of the staff; the selection of technology and how to make technology decisions; and setting policies for services, funding strategies, etc. I would be happy to answer questions about any of these aspects of our work during break, but for this session I am focusing primarily on collection preparation and move-related issues.

The William T. Young Library stands in the middle of 30 acres of green space slightly away from the central part of campus. The building is 365,000 square feet of space (8 acres under roof) with a central feature being a majestic central atrium that surrounds a large rotunda.

We built this library knowing that we would be nearly full from the start. The building holds 1.2 million volumes, and the idea was to have the most frequently used 1.2 million volumes in the building and other items in storage. We have an on-campus storage facility, and we contract with an off-campus storage facility as well.

This library was built as a transitional facility (transitional between print and electronic access) with an emphasis on public study spaces, lots of network bandwidth, and less emphasis on space for book collections. The entire circulating collection is on compact shelving, which has been very successful. Problems with contention for time in the aisles between patrons and shelvers have simply not materialized.

Even though our Special Collections and Archives are in another building, we had an opportunity to include a Conservation Lab in the new building. While the separation of the lab from Special Collections is not optimal, the arrangement has worked better than expected. Our preservation program encompasses a wide variety of conservation services,

ranging from maintenance of the circulation collection to very specialized conservation treatments for rare materials. Measures are taken to protect the material during transport. The building was built with the emphasis on public spaces rather than staff spaces and book storage. To economize on space, most staff offices are built as open offices. Only a few offices have doors and even top administration had to learn how to work in an open office situation.

The architect, Michael McKinnell, mentioned at the dedication that it was his intent for this building to "connect the community of scholars." The building is designed around a rotunda and atrium, with a large skylight above. Reading rooms are adjacent to the atrium to take advantage of the light that floods in during the daytime. Generally speaking, spaces for people are adjacent to natural light sources while books and journals are situated away from natural light.

The William T. Young Library serves the Social Sciences, Humanities, and Life Sciences. Four collections were merged from the old central library, the Biological Sciences Library, the print material from the Agriculture Library, and everything older than 10 years from the Medical Center. How do you make four collections become one? With a lot of planning!

The building was designed by Michael McKinnell, principal architect with Kallmann McKinnell and Wood of Boston, Massachusetts. There was no general contractor for the project, but the university hired a construction management firm, Lehrer, McGovern and Bovis. The library also had one librarian who devoted 100 percent of her effort for the duration of the project. She attended all meetings with the architects and construction personnel and served as a liaison with the library faculty and staff.

Planning for this new facility began in earnest in 1990. The library staff started describing what kinds of spaces were needed for each unit. All of these program sheets were coordinated, and it was agreed on what units needed to be adjacent to others, etc. The collections were assessed to determine needs for shelf space. This was complicated because we weren't entirely sure which collections were slated to come to the new facility. There were political issues to work out among faculty who preferred branch libraries near their offices, administrators who wanted the real estate back in the colleges, librarians who could see the benefits and cost effectiveness of consolidated collections, etc. A program was finally agreed upon, presented to the architect (who had been selected by a university committee) and plans were finally drawn. The blueprints were unveiled in September 1993.

During the early stages of the project, the Kentucky legislature authorized funding for the initial planning for the building with the idea that the construction funding would be authorized during the next biennium. When the time came for the next phase of the project the legislature specifically excluded any capital projects for funding. The university made an appeal to private donors, including university faculty, staff, and students, and raised most of the funding. The local city/county government also issued some bonds, which were subsequently paid off by the UK Athletics Association.

Groundbreaking took place at the end of 1994 and construction lasted through the spring of 1998. The collection was moved during the summer of 1998.

Two factors were crucial to preparing the collection for the move. We realized that we had to finally complete long-standing projects of converting records to online format and the reclassification of the collection from Dewey to LC. We had been working on both of these projects for years, but the move made it imperative to bring both of these to completion. An overview of our collection projects will provide a context for what we were facing with a move looming on the horizon.

University of Kentucky Libraries stopped using the Dewey Decimal classification in 1978 and began classifying material using the Library of Congress Classification. Because it was a relatively small discrete collection the reference collection was immediately reclassified into LC. Serials all continued to be shelved in Dewey order and serials catalogers continued cataloging new items in Dewey.

Materials were shelved in a split collection, which was the beginning of complications for both library staff and for patrons. As we looked toward a move of the collection we could finally see light at the end of the tunnel for these issues. We could look forward to finally integrating the collection into one classification sequence when we moved to the new building. In 1985, we began converting the paper catalog to an online system. This was a major effort that lasted for years.

When we knew that we were going to be moving the collection, retrospective conversion was identified as a key step needed on the path to reclassification. The building project was well under way and so solutions were explored that would enable us to finish quickly so that we could move on to reclassification. Outsourcing and automation were examined as potential solutions. We converted 132,324 records at a cost of $469,502, and the shelflist in Tech Services was completely converted. Temporary project staff was hired to accomplish this task. Issues with computer hardware and software were addressed to enable the task to be completed efficiently. An upgrade of the computer hardware in Tech Services was an added benefit of this project.

In July 1996 the reclassification project was begun with a project manager, one full-time librarian, one full-time technician, and 1 FTE student assistant. The project team had one year to assign LC call numbers to all Dewey records in the online catalog without valid LC call numbers in the 050 or 090 field, to create spine labels for all serials that were being moved to the new library, and to oversee the creation of spine labels for all monographs going to the new library. A committee whose primary tasks included working out contract details for the label production and planning for the next phase supported this work.

For the reclassification project we had students who copied multiple 090 fields from OCLC and copied any 050 field that contained two call numbers in the records for review. If this was not successful the copy catalogers looked at the item and searched for other editions of the books with a similar call number. If this was still unsuccessful then a

librarian handled the item as original cataloging.

The project team worked from reports generated from NOTIS. NOTIS generated reports that identified materials that lacked LC numbers, reports for the vendor to generate labels for monographs, and for a report of serial titles to be used for spine labels. Once the retrospective conversion and reclassification projects were reaching completion, the focus turned to database cleanup and planning for the move.

Some of the most contentious issues in planning for this move were political in nature. At the discussions around the planning table we heard comments reflecting ownership issues such as, "My patrons won't recognize serial X bound in red!" or "What if we have our own library someday?" or "Our materials circulate for 60 days instead of 30!" Consensus was necessary to make the new library into one library and not a collection of materials with policies based on where the items used to be!

Everyone working on the planning had to agree on standards even for such mundane things as location labels. A plethora of conventions was discovered in the various libraries that were scheduled to come together. For instance, an asterisk on a label in one location meant it was a serial, in another location it signified oversize collection, and in a third it indicated special collections.

We also had to work toward consensus on policies and labeling. We knew this was going to be a big change for all patrons in one way or another. The guiding factor used for all decisions was what would be best for the largest number of patrons. We also wanted to make sure that what we decided was going down the correct path for the future. If we moved a collection in five years, we did not want to have to change the label from 4th floor to 5th floor! Think globally and long term when deciding on location names.
At the same time we were working on eliminating duplication. Policies were in place for some time to prevent duplication from library to library. There was in fact some duplication, however, and we had to make decisions on which serial runs to keep. Some of the conversations came down to color of binding, but we decided on a policy to keep the best and most complete runs. For monographs we decided to work on the duplication after the move. This has turned out to be a huge project, but we still feel this was the best way to handle this.

When the conversation turned to call number labels, there were some requirements that were defined from the beginning. These included the need to have the books labeled on the inside and on the cover. We also knew that the movers would be applying the spine labels during the move, so the labels had to be able to be applied quickly and without heat and still adhere to the binding.

The criteria for the labels were developed and used when we approached vendors for a bid. The labels had to be white, acid free, flexible 1-2 mm polyester with adhesive that was pressure sensitive in order to achieve a permanent bond. We knew that it was not feasible for the movers to apply overlays, so this was a requirement as well. The font had to fit 10 characters on a line and had to be easily readable. The committee determined

that the label set for each item would include a spine label and an information label. The information label was to include the Dewey call number, the author and title (for matching purposes), and the LC call number.

When considering location labels the ability to stick was one primary criterion. We had discovered that barcodes never fell off, so we inquired of a company that produced barcodes to see if they could make the location labels. They could do it and so we contracted for 20 or so colors for the various locations. Full words were used – no abbreviations. These location labels were applied ahead of time by hundreds of hours of volunteers. We generally paired a library staff member with a community or campus volunteer. One of the volunteers was a 91-year-old woman who did many, many hours of label application. It was weeks of work, but paid off at move time.

For duplicate monographs it was decided that the decision on the best copy to keep would be made after the move. Duplicate serial runs were compared for completeness and condition and the best set was kept. Our duplicate Medical Center serials were put in storage with the hope that we will someday have a larger Medical Center Library.

In planning for the specifics of where the collection would be shelved, the shelves and collections were measured in all four locations. All of the data were placed in a spreadsheet. The moving company actually created the final plan. The company had a specific software program to manage the process that mapped the collection to the specific shelf where each call number would be shelved. Accurate measuring is key to the success of this part of the process. We had to identify discrete collections for some locations in the building. The rotunda on the 5th floor is in a very visible position, so we had to identify a collection that would fit and that would be appropriate for this very important part of the building.

In the final stages of planning for the move, there were many suggestions from patrons about the best way to move the collection. These ideas included using long line of students to pass the books, asking members of the university community to check out ten books each and to return them to the new building, or using the Physical Plant Division staff. The best advice is to use a good mover!

The criteria for the move included such things as 1) Materials are to be available within 24 hours by request from a patron, 2) Dewey materials are to be re-labeled to LC, 3) the collection is to be cleaned before moving into new building. The mover was selected through a bid process based on a Request for Proposal (RFP). Several bids were considered before the bid was awarded to the William B. Meyer Company, which specializes in library moves. Personnel from Meyer took our data and then made a plan for the move.

The library opened April 3, 1998, but it was determined that moving the collection mid-semester would be too disruptive to students, so we opened as a great study hall and scheduled the collection move for late spring after finals were completed. The mover estimated that the move would be completed in July, making the move a project taking

approximately three months. The move turned out to be the most complicated move the mover had undertaken and was finally completed in October. The move was complicated by the fact that there were four collections to integrate and so many books to be relabeled with LC call numbers and then integrated.

There was some concern for protection of the new library building from damage by the mover's carts, etc. The movers conscientiously put down cardboard and plastic protection on the floors and in the doorways. Special one-face carts were provided by the movers.

The move was accomplished largely by our students hired by the mover. The students were familiar (we hoped!) with call number schemes and thus required less training. There were times when nearly every table was covered with books, but the movers could successfully retrieve materials within 24 hours of receiving a request.

We anticipated that there would be a large number of books that were found to have no labels and a number of labels that had no corresponding book. We also knew that we only had one label printed for monographic sets and series, and we would have to generate additional labels for the other volumes. We designated this issue, "books without labels and labels without books." The books without labels were handled immediately through a triage unit during the move. 4,199 books identified, converted and reclassified from May-September 1998. The labels without books were mostly duplicates. Five years later we are finishing the identification and labeling process. Most of these had already been relabeled as books without labels. With monographic sets and series the contract with the label vendor only specified one label per copy statement. The library created 72,761 volume labels.

We took the opportunity when building the library to include a conservation laboratory. This was a new venture for us, and there was a big learning curve in deciding what to specify when equipping the lab. Equipment included a fume hood, a freeze dryer, and an encapsulator. We also had to train ourselves and our students in how to operate all of the new equipment. The new lab allowed us the opportunity to hire a conservator to manage the facility.

So what did we learn? We learned that good communication was the key to success. Having a librarian at the table with the architects and the construction managers gave us a voice when those critical decisions needed to be made. Most problems that we encountered were due to internal management issues or poor communication. The more people we asked to think about difficult problems the more creative the solutions that were found.

It has been a long road, but we now are lucky enough to have a library that is the heart of the campus and that *does* connect the community of scholars. Thank you for your time and attention. It has been a pleasure speaking with you.

SOLINET Preservation Field Services, 1-800-999-8558

Preservation and Collections Care Issues
during Building Projects and Renovations

Proceedings from a SOLINET Preservation Conference
SOLINET Annual Membership Meeting, Atlanta, GA
May 30, 2003

Creating Today's ARC Takes More Than Forty Days and Forty Nights: a Checklist for a Project with a Renovation and/or an Addition

Ann Hamilton
Associate Dean of the Library, Georgia Southern University

The library at Georgia Southern University is in the process of planning an expansion and renovation that will almost double the size of the existing building. The completed building will include more than 231,000 square feet for an increase of more than 122,000 square feet. The unique feature of this building for its area will be an Automated Retrieval System (ARS) that provides space for the ARC to which the title of this article refers. ARC is the acronym for an Automated Retrieval Collection. When planning for the building project began, the official term for the new system was Automated Storage and Retrieval System (ASRS). Following advice from other libraries, Georgia Southern chose to drop the term "storage" early in the process because that word can strike fear into the hearts of faculty and other researchers. The ARC will allow materials that are used less often to be stored within the expanded building in the same type of high-density

Library Employee Removing Material from Bin

ARS Aisle

storage already installed at California State University Northridge, Eastern Michigan University, Sonoma State University, the University of Nevada Las Vegas, and planned for a number of additional libraries. This article provides a checklist of items to keep in mind when planning the expansion and/or renovation of an existing building. It includes considerations from the beginning of the project until the final planning stages before construction begins.

ARS Pictures Courtesy of HK Systems, Inc.

Rendering by Cliff Minor **Zach S. Henderson Library 2006**

In the Beginning

- If possible, assign a single person to serve as coordinator of the project. This helps keep the project focused.

- Be sure you have a good working relationship with those responsible for planning building projects within your organization. This facilitates communication within the organization and with the architects.

- Make every effort to ensure that the architectural firm chosen for your project has experience building libraries. The more experienced the firm is in constructing libraries the less time must be devoted to explaining the requirements for the building design.

- Require that the architectural firm have a librarian consultant on its team. A consultant is helpful in convincing the architects what is best for the library and its constituents when a difference of opinion occurs during the early design stages.

- Require that the consultant be knowledgeable in preservation issues. Preservation is of concern to all types of libraries. It is particularly important that the consultant be able to assist the library in ensuring that preservation is addressed at the most effective level for the specific library's needs.

- Ask to attend **all** meetings where the building project will be discussed. There are few things worse than learning after the fact that something critical to the project was changed or omitted without the librarians' knowledge.

- Ensure that the project coordinator has direct contact with the primary contact in the architectural firm. This can go a long way toward ensuring that the library's needs are effectively communicated. It is especially important when the project includes an unusual feature like the ARC.

- If possible, visit new libraries similar to the one you are planning. The more opportunities you have to see how other libraries have been designed and built, the better idea you can have of the dos and don'ts of that process. Such visits also offer the opportunity to take a fresh look at ways local plans might be changed for the better.

As the Project Planning Continues

- Establish a planning committee within your organization that represents employees, users, and any other appropriate group(s) and hold meetings of that committee throughout the planning phase and during the construction phase(s) as appropriate. This cannot be emphasized too much! The opportunity for input and involvement can help increase buy-in during the process and greater acceptance when the project is completed.

- Provide regular opportunities for input from employees and users. This helps provide greater interest and buy-in for the final design.

- Hold public meetings to share information about the project as early as possible in the process. This provides the opportunity for the community to become familiar with the project.

- Establish a website where information about the building project can be updated regularly. This offers the opportunity to provide updated information as the project proceeds.

- If possible establish a building feedback form on the website. This offers the opportunity for the community to ask questions and offer suggestions as the project progresses.

- If you have any unusual services, e.g., 24-hour service during regular terms, be sure that the ability to continue those services is included in all project planning.

- As soon as models and renderings are available, display them in the library and on the website.

As the Beginning Date for Construction Nears

- Think of **everything** that is done within the library, how it is done, who does it, and where it is done and prepare a list of questions to be addressed by the architects and their consultants as the phasing of the project is planned. A few examples include procedures and interactions for all departments, workflow during each phase, delivery access, and services provided outside the building such as bike racks. It helps to keep a list of the answers to the questions so that everyone has the same information about what has been agreed upon.

- As you get answers to your questions, prepare a schedule of what the library has to do to prepare for construction and who will be responsible for accomplishing those tasks.

- Plan additional communications about the project so that users are not surprised by construction fences, loss of parking, etc. For example, if you are on a college campus be sure the students know about the project before they leave for the summer if construction will begin before the fall term starts.

- If your building will include any unusual installations such are the ARC (Automated Retrieval Collection) planned at Georgia Southern University, search the literature for similar projects and contact other libraries with similar facilities for planning and/or phasing suggestions.

- If the expansion/renovation will take place in phases, determine how access to collections will be maintained throughout the project. In the case of a combined renovation and expansion, this can be particularly challenging.

- Be prepared to adapt plans and schedules because something is almost guaranteed to happen that will require change(s).

SOLINET Preservation Field Services, 1-800-999-8558

Preservation and Collections Care Issues
during Building Projects and Renovations

Proceedings from a SOLINET Preservation Conference
SOLINET Annual Membership Meeting, Atlanta, GA
May 30, 2003

What Your Contractor Never Told You: Strategies for Protecting Your Collections during Construction and Renovation

Scott W. Devine
Head, Preservation Department, North Carolina State University Libraries

Introduction

A high level of staff involvement is necessary for the successful completion of any renovation or building project. Protecting your collections begins early in the planning stages and must be considered throughout the project. Consultation with a qualified risk manager at the beginning of your project will help to ensure that the appropriate decisions are made at the appropriate time. The basic elements of a library preservation program, including a disaster response plan and a pest management program, should be in place before your project begins. Ensuring that these basic preventive measures have been addressed prior to construction will allow you to deal effectively with problems that invariably arise from moving collections and renovating existing facilities. Protecting your collection during the actual construction phase of the project necessitates a more hands-on approach and will include performing worksite inspections, ensuring adequate security, and maintaining good communication with your risk manager and legal counsel when you need assistance in managing contract renegotiations and revisions.

You should not underestimate the administrative challenges in organizing a construction or renovation project. Your ability to clearly define and distribute responsibilities across your organization and your willingness to openly communicate progress as well as setbacks to staff and users will determine the success of your project. Some of the worst damage to institutions during building and renovation comes not from damage to collections, but from staff turnover related to frustration or from diminished user satisfaction based on problems with service. Implementing the suggestions contained within this article will help to ensure that you emerge from your project with a facility that meets your collections needs as well as the needs of your staff and users.

Disaster Planning

Rarely does a construction or renovation project progress without some resulting damage to collections, either from dust, water, or structural damage. A good disaster response plan and staff training will result in a more efficient response to the emergency and a greater chance of minimizing loss. A good disaster response plan will include basic salvage guidelines for all materials in the collection, staff contact numbers, a list of supplies and services with updated contact numbers, a set of building plans, and

information on purchasing authority. Disaster response kits, including plastic sheeting and other basic supplies needed for immediate response, should be placed throughout the institution, especially in areas currently undergoing renovation.

In addition to disaster response kits, ongoing staff training is critical to a successful disaster response initiative, and training should be done at least once a year as a refresher for long-term staff and as an introduction for new staff. Training sessions need not be daylong exercises involving large quantities of wet books. Ongoing training that allows staff to regularly handle wet materials and think about salvage priorities will be more effective in the long term than elaborately staged mock disasters scheduled irregularly. A simple half-day workshop, scheduled at least once a year, that allows staff to handle wet books, photographs, film, and magnetic media will be sufficient to maintain an awareness and comfort level that will allow staff to function efficiently in the event of an actual disaster.

Having a pre-established agreement with a major disaster response vendor, such as BMS CAT or Munters, will expedite getting a salvage crew on site for major disasters. Such agreements do not typically bind an institution to using the services of a specific company, but rather provide essential background information, such as composition and size of the collections, that will help the responding agency deal more quickly with mobilizing and organizing salvage efforts.

Protecting Your Collections

It is essential in the early planning stages of your project that a risk manager, perhaps someone from your institution's facilities office, be involved in helping you calculate the risk to your collections. Of primary concern should be the decision of whether or not to move collections. The risks associated with moving a collection must be balanced with the risks associated with remaining in a building that is undergoing renovation. Estimates from a qualified mover with experience in handling library collections should be compared with the potential costs of disaster recovery and replacement if collections remain in a building being renovated. Insurance issues should be carefully evaluated. If a contractor recommends that collections should be moved and you decide not to follow this advice, your institution will likely be responsible for any construction-related damage.

If collections are moved, existing insurance policies should be reviewed. Collections are often insured based on where they are housed. If you move collections without consulting your insurance agent or responsible party, the collections may not be insured in the new location. Thus, if anything happens during the move or at the new location, the collections may not be eligible for insurance coverage. The advice of a qualified risk manager will be crucial in dealing with these issues.

If collections are going to be relocated, optional storage areas should be carefully evaluated. The benefits of moving collections to a temporary location may be diminished if the new location is not secure, has an inadequate HVAC system, or makes the

collection inaccessible to users. Issues of bibliographic control should be considered as well; if selected materials are moved to a new location, that location should be adequately reflected in the library catalog.

If you decide to leave collections in a building that is being renovated, you should discuss early the issues involved in isolating construction zones. Contractors can often build barriers around construction zones or create barriers around stack areas that will help minimize damage from dust and other construction-related pollutants. However, these issues must be discussed early in the bid process. If you ask the contractor to create barriers or isolate construction zones after work has commenced, it will not only slow down work on the project, but it will also cost considerably more than if the additional work were incorporated into the original bid for the project.

Protective enclosures may be created for specific items, and if there are collections that require boxing, this may be a good time to address those needs. Boxing can protect materials that are being moved as well as provide a good microenvironment for materials near a construction area. The costs of a large-scale protective enclosure project, even the temporary shrink-wrapping of materials for transport, can be considerable. Financial resources and timelines for the completion of the work should be carefully evaluated at the beginning of the planning phase to ensure that adequate time and resources are available.

Integrated Pest Management

Pest management is crucial during a renovation project. Your building will be open more than usual, with potentially more access points: the loading dock alone may be left open for hours at a time, not to mention temporary walls and barriers that will likely be in place for months. Regular monitoring of the building will be essential. Pest strips should be placed at all entry points and monitored weekly or bi-weekly as needed. Exterior building treatments, monitored quarterly and perhaps more frequently during periods of heavy rain, will help to minimize the number of seasonal pests approaching your building. Coupled with a rigorous monitoring program, exterior pest treatments often eliminate the need for potentially dangerous interior treatments that may pose a health concern for staff and users.

Construction and renovation projects also represent a good time to review housekeeping and food and drink policies. Housekeeping procedures may need to be re-evaluated or modified to address excess dust generated from construction. Housekeeping and Facilities staff should be updated on construction schedules on a regular basis so that they can anticipate trouble areas. Staff should be reminded to take extra care if food is allowed in the building. Work areas should be checked at the end of each day to make sure that no food remains overnight. Trash cans should be emptied regularly, and leftover lunches and snacks should be emptied in an outdoor receptacle rather than being allowed to sit in an office trash can for any length of time. Procedures should be in place to make sure that food is not left in the building on weekends or holidays.

Worksite Inspections
Regular worksite inspections represent one of the best ways to prevent damage to collections. First, you should work to educate your contractor about the importance of your collections: understanding why a collection is valuable and how it is used will often make contractors proceed with greater care. Time spent discussing the collection with the contractor will also allow you to begin to develop a relationship with your contractor. You should review the contractor's work plan and schedule so that you are clear on what is going to happen. Make it clear to your contractor that you expect to be made aware, daily if necessary, of any changes in the work plan. Next, you should clarify your expectations regarding the worksite, including cleaning of the site, how it should be left at the end of the day, and expectations regarding the use of food, drink, and tobacco. One staff member, preferably someone having a vested interest in the area being renovated; who knows the physical space; and is aware of any special needs of the collections in that area, should be appointed as a worksite liaison.

The worksite liaison should also be responsible for preventive and responsive inspections. Preventive inspections will involve checking the worksite daily or weekly as needed to make sure that worksite expectations are being met and to ensure that the contractor has regular contact with an interested staff member. Responsive inspections are equally, if not more, important and will involve the willingness to check the worksite at odd hours, often during periods of heavy wind or rain or any time when the building project might be compromised by inclement weather.

Security
Strategies should be identified early for dealing with the increased number of individuals who will have access to your building. With construction personnel, architects, building planners, and subcontractors, there will be many new people wandering around all parts of your building. All construction-related personnel should be identified with institution-issued name badges, and these badges should be required wear at all times.

In addition, your institution may need to invest in additional security, especially for portions of the building that are left vulnerable to break-in. Buildings undergoing construction can represent an easy target to potential thieves or vandals; the buildings are often easier to gain access to after hours and are usually unattended. Consequently, employing overnight security guards or working with the local police to increase patrols will be good strategies.

Contract Negotiations and Revisions
Even the best-planned projects cannot take everything into account, and there will doubtless be changes or oversights or simply unexpected expenses that will need to be addressed. Your responsibility will be to ensure that the money allocated to your project is maximized for the improvement of your facilities, the longevity of your collections, and the quality of space for the people you serve. Change orders (e.g., changes to the final design, changes in electrical requirements, or changes in shelving requirements) can

represent a tremendous drain on resources. Prior to getting a bid accepted, contractors are competing with each other, and as a result you'll maximize your chances of getting the best price. Once the bid has been awarded and the contractor has established the schedule, changes will be costly, often 20 to 30 percent more than normal, as there will be no incentive for the contractor to price competitively.

Ten percent of any building or renovation fund will go to a contingency fund simply to cover unexpected events in the course of the project, such as a need for asbestos abatement in an area where asbestos was not known to exist. If change orders are requested after the bid is accepted, the changes may be paid for out of the contingency budget, but there is often not enough money in the contingency budget to cover the changes as well as the unexpected expenses. As a result, you may find yourself in the position of either trying to locate additional funds for your project or having to give up some desirable "extras" so that more essential changes can be accommodated.

In order to avoid costly change orders or modifications to the construction process, good planning is essential. Generally, the methods and means regarding how your project is completed will be up to the contractor unless you have been specific about how you want things done. If you have specific requirements regarding how you want work done or how collections will be moved, these concerns must be communicated upfront to your institution's risk manager, facilities manager, and legal counsel. Contract options should be discussed beforehand, and your requirements should be clearly articulated so that they are written into the contract rather than waiting to sort out critical issues later.

One particular issue that should be resolved prior to going to bid is responsibility for damage. Any damage to your collections will be the responsibility of the contractor unless you have been advised by the contractor to move collections and choose not to do so. For this reason, issues such as the need to move collections must be discussed prior to the bid award. If the contractor is responsible for damage to your collections, the contractor's insurance agent will generally have control over who does the cleanup. If you have a preference as to how and who will care for your collections in a disaster, a sole exclusive rights amendment should be added to the contract giving you this right.

This is not to say that you could not exercise your right to call in the vendor of your choice without a sole exclusive rights amendment. However, if it's not in your contract, you may be facing a long negotiation process with your contractor's insurance company to get payment for it, and coverage may be less than 100 percent.

Defining Responsibilities

Construction and renovation projects are complex endeavors and cannot be delegated to one individual. Many institutions make the mistake of delegating these responsibilities to one key administrator who is already too overworked to devote adequate time to the project. Although you will need a high-level administrator as your institution's primary contact with architects, contractors, and building planners, you must realize that a successful building project comes from having the work carefully distributed between

various departments, including Administration, Facilities, Technical Services, Public Services, and External Relations. In a complex organization, even seemingly simple decisions can have wide-ranging impact. It is essential that representatives from every major department or unit be included in decision-making. Formation of an ad hoc committee or task force is the best way to ensure that all aspects of your project are adequately represented in both the planning and implementation stages of your project.

Communication

Both staff morale and user satisfaction can suffer during a renovation. Establishing and maintaining a website for the project will provide staff with up-to-date information about how the project is proceeding. Regular emails and announcements, especially in regard to daily events such as excessive drilling or other construction-related noise, will do much to reduce staff frustration. Regular meetings open to all staff will also help involve staff in the process and give people the opportunity to voice their concerns and ideas.

Public awareness of renovation projects is critical. User satisfaction is one of the most important objectives of a service-based institution and must be safeguarded during a building project that disrupts services. Exhibits and signs aimed at demonstrating the advantages of the project will help users understand and appreciate the need for any inconveniences represented by construction or temporary disruption of services. Good use of the local media, including newspaper, radio, and television, will allow you to keep the general public up to date and on board with the construction progress.

Conclusion

Management of a construction or renovation project is a complex administrative endeavor best undertaken collaboratively within the institution. The key to successful collaboration will be based on the willingness to clearly define responsibilities for all aspects of your project. Protecting your physical collections is one of the most critical aspects of protecting your institution as a whole. Careful planning is essential and begins with addressing the pros and cons of moving and understanding the construction process well enough to know when protective measures are necessary. Working with a qualified risk manager during the contract negotiation phase of the project is the best way to financially protect your institution and maximize your investment in the project. Careful evaluation of security and regular worksite inspections will help to ensure the safety of both the collections and the building as well as staff and users. Good communication with staff and users will be necessary to make sure that your project proceeds smoothly and with minimal disruption of services.

SOLINET Preservation Field Services, 1-800-999-8558

Preservation and Collections Care Issues
during Building Projects and Renovations

Proceedings from a SOLINET Preservation Conference
SOLINET Annual Membership Meeting, Atlanta, GA
May 30, 2003

The Moving of Collections

Alfred E. Lemmon
Director, Williams Research Center, Historic New Orleans Collection

Whether a library, museum, or archive, there are two basic, interrelated criteria for the successful moving of collections: a firm knowledge of your institution, and a thorough inventory of your collections. Specifically concerning the inventory of holdings, it is necessary not only to have an inventory of collections, but also of available resources, both internal and external, and conditions or circumstances that could impact a planned move.

Whether it be a routine weekly move, the transporting of a large collection being acquired by your institution, the movement of loaned objects for an exhibition, or the actual moving of your institution's holdings to a new complex, a firm knowledge of the material, its condition, the care required, and the ability to "track" it during the move are basic components of a successful move. If your institution possesses rare materials, they will require special consideration during a move. Likewise, odd-sized collections (i.e. maps or architectural drawings) require that special plans be prepared to transport your holdings.

As all functions will be impacted, you must have a firm knowledge of your institution. One must know the institution's clientele. If they are primarily of an academic background, a move must be planned that would accommodate their schedule. Every institution's situation is different. While it is dangerous to adapt plans and policies prepared for other institutions, insights into a successful move can be gathered from a variety of institutions.

Every institution transfers material on a fairly routine basis. Whether from the main branch of the public library to a branch library or to the off-site storage facility of a research library, such moves must follow established guidelines. If the moves are makeshift, the potential for disaster increases. Therefore, if something is to be transferred from one unit to another, preparations should be undertaken not only to safely move the item physically, but also to register its new location. It is ideal when there are institutional forms that note the date, time, original location, and the temporary location of items being moved. Realistically, it should be a self-carboning form. One copy of the completed form is maintained by the "inventory officer," another copy stays with the item, and the final copy is placed in the item's original location. Materials must be prepared for safe transport, and placed in one specific location to await transfer. When transferred to another complex, all responsible parties involved must sign off on the

transfer. Regardless of the nature of the move, all items must be properly prepared for transit to ensure that no damage results to the individual items.

Institutions routinely acquire large collections. Inventories are of paramount importance with such incoming collections. They are frequently the most detailed existing accounts of the recent acquisition. It is not unusual for two or three staff members to travel to another city to prepare both an inventory and the material for shipment. A photographic record of such a transfer of collections can prove to be an invaluable aid in the movement of collections. It serves to document condition, original order, and, in the event of an unfortunate incident, document the careful preparations undertaken.

For present purposes, this paper addresses specifically the moving of collections to a new building, either a new construction or an older building recently renovated. However, the same insights apply to all examples of the movement of collections.

The moving of an entire collection into a new building provides special, wonderful opportunities for an institution. A "move" is one of the more stressful events in a human's life. Yet, it is a wonderful opportunity. First, the move provides the institution with the opportunity to verify its holdings, to check for condition of materials, and to improve upon the actual storage of the material. A move also provides an institution with the opportunity to inventory staff resources, vendor resources, and unsuspecting, invaluable resources.

A move is an excellent opportunity for the public relations officer and hence the development officer. However, remember what is glamorous may not be advantageous to the well-being of your collections. For example, it is not acceptable to publish the floor plans, or any other information, that could jeopardize the security of the collections.

In preparation for a move, it is imperative that there be

1. A thorough inventory of the material to determine the quantity, formats and media involved: books, over-sized books, maps, documents, three-dimensional objects, manuscript collections, microfilm, sound recordings, electronic media, drawings, architectural plans, and videos, etc.
2. A reasonable estimate of the amount of time required for the move.
3. A determination of the status of incoming acquisitions and serials and a plan to handle them.
4. An assurance that shelving and other storage units are installed on time and staff properly trained in their use.
5. Communication with the public.
6. Time to update location records.
7. Time to properly move the staff and their equipment.

As preparations begin for the move, it is wise to inventory staff skills and appropriately assign responsibility. The most highly skilled staff should be free to do only what they can do and less complex tasks should be delegated to other staff members. When exploring the possibility of temporary, additional staff, it is important to remember that

they must have training and supervision. Ensure all parties are aware of their responsibilities through actual instruction and through appropriate signage. Gabriella Albrecht-Kunszeri and Maida H. Loescher in their excellent article "Moving Archival Records: Guidelines for Preservation" (Comma, 2001-3/4) correctly stressed the importance of the above but also that all individuals involved in the project be aware of certain basic parameters. They stressed that all material must be in a housing that will both protect and support them during the move. The authors emphasized that there be no contact with actual accessioned materials, but rather only with the actual moving containers. All containers must be properly labeled and the storage sequence of the collections must be maintained. All packaging materials must be archivally acceptable and stable. Collections of a similar nature should be moved together. Specifically addressing preservation issues that urged readers to be realistic and schedule only the amount of rehousing that time will permit.

It is critical to be able to monitor the location of materials. A relatively simple form will assist in that task. Triplicate, self-carboning forms are easily made (See example.) The first copy stays with the person who maintains the records of the institution, the second copy goes with the staff member serving as courier for that particular transfer, and the third copy goes to the destination. In all instances, the material should be checked at each stage of transport. When it leaves its original location, when it is loaded onto the moving van, when it arrives at the new facility, and when it reaches its new storage location. During the actual move, it is critical that staff and contracted movers have precise written instructions. It is advisable to have an orientation session to review all guidelines. It may be necessary to have several sessions, each one specific to the different types of material being handled.

Specifically concerning moveable shelving, make sure that the staff and movers are thoroughly familiar with their operation. It can take longer to place material on moveable shelving, depending upon the number of aisles the unit has. As there are fewer aisles available, you must carefully consider space for incoming materials.

Basic guidelines, such as the prohibition of smoking, eating, drinking, and storage of food and beverages in the vicinity of collections, must be reviewed. All must be instructed in the proper handling of materials, i.e. use of both hands in moving containers. All individuals involved in the move should be instructed as to how to handle the actual containers with your collection, and the devices used to transport them. Specific instructions concerning the proper stacking of containers, and the direction that should be maintained, either vertically or horizontally, should be given verbally and reinforced with appropriate signage. Make sure that non-staff members wear a uniform and/or badge. Volunteers, if used, should have appropriate identification, and so should actual employees of the moving company.

When considering transport devices, note that "dollies" with carpeted surfaces are highly useful. Pallets are a popular moving device. Material is placed on the pallet, which is in turn shrink wrapped. However, as one does not always know where pallets have been, they are potentially dangerous. They can be infested and could infest not only

your collections, but also your new building.

Rolling bookcases are particularly valuable, either with fixed or adjustable shelving and closed on three sides. It is useful to have not only a canvas cover to close the fourth side, but also rods to insert through the cart to make sure material does not shift.

In general, the surfaces of the cart or crate should be smooth and their design should permit the movers to handle the material as little as possible. It is critical that the transport devices be sturdy enough to handle the maximum amount of weight. Handles are critical and should be exceptionally large. The movers will frequently wear gloves, thereby needing a larger handle to accommodate the gloves. Secondly, a larger handle also permits better control of the cart or crate.

All vehicles involved in the move must have a clean, enclosed, covered cargo area and must be equipped with a fire extinguisher. Security concerns dictate that their purpose not be identified. Be sure, for the safety of collections, not to mix types of material in the same vehicle (in other words, do not move documents in a truck with furniture or glass negatives). Depending upon the stability of the climate, the vehicle should be climate-controlled. Finally, once loaded, make sure that the cargo door is locked and sealed. A staff member should be in the vehicle for the duration of the move. The route that the vehicle takes should be approved by the person in charge of the move. The move should also take place during non-peak traffic hours. If the move is to an adjacent building, it is wise to construct a covered ramp between the two buildings.

Materials must be appropriately prepared for the actual move. Books, depending upon the nature of the collections, can be placed on book carts, shrink wrapped and moved, or in the case of rare volumes each one may have to be placed in separate bubble wrap and then in a container. Manuscript collections and documents are housed in boxes, and can be easily moved. However, it is critical to verify that the contents of the boxes are secure and cannot move within the box during the move. If they can move, then the box should be filled with bubble wrap. Once the individual boxes are ready to move, several can be joined together and placed in a larger container.

Maps, architectural drawings, posters, and other oversize materials should be removed from the flat files storage systems. They should be placed in special crates for transportation. If you are able to recycle crates, or borrow crates, you must know where the crates have been stored. They should be stored and maintained in a climate-controlled, insect-free, secure environment.

It is necessary not only to care for collections while in transit, but to carefully protect all equipment. For example, when moving audiovisual equipment, microfilm reader/printers and other copiers, it is wise to review with the vendor guidelines for moving the equipment. Given the cost of flat file storage units and microfilm cabinets, extreme care should be taken in the moving of such furnishings. Do not attempt to move the drawers in the actual flat file or microfilm cabinet. The drawers should be removed and placed in protective wrappers for the move.

Certain materials will be too large to be practically transported in crates. In these cases, a large tube, wrapped in archival paper, is highly useful. The item in transit can be rolled on the tube. It should then be placed in a specially made container.

Microforms require special care during transit. People generally think microforms do not deserve the same amount of attention, as they are only copies of material. However, it could take a long time to replace microfilm damaged in a move. This is particularly true when the microfilm is the result of a foreign micrographics program. The prospect of acquiring replacement copies could be daunting. Furthermore, even in the case of readily available commercial microfilm, it can take time to replace the damaged rolls.

Audio discs require special handling because of their delicate nature. They should be placed in specially constructed containers. One can adapt an oversize archival storage box by preparing an interior constructed of ethafoam. The items are protected not only during the move but during their life on the shelf. Glass plates should be transported in a similar fashion. After placing them in a container, the container should be wrapped in bubble wrap before being transported.

Finally, it is necessary to review weather conditions and schedule a move during a period when they are optimum. For example, one would be hesitant to move collections in the Southeastern United States during August and September, when there is a potential for high hurricane activity. It is critical to survey all passageways and entrances in the buildings. If there is a loading dock, it should be covered. If it is not, one should consider investing in a rental canopy. When the collections arrive at the unloading entrance, it is critical that they be able to be easily unloaded. Part of the plans should include provisions for them to be unloaded so that the items traveling to the furthest point in the new building are removed from the moving van first.

A top priority is to place all records properly in their new locations. Containers should be placed on the shelves in their proper orientation. At no point in the move should they be stacked beyond safe limits. Containers should not be left on the floor, but placed a few inches off the floor. Plastic crates used to ship cold drinks are ideal for this purpose.

The vendor who supplied the shelving should be able to provide you with elevations of your shelving. As a result, it is possible to assign specific locations for everything and have a visual image of where items go. It is tremendously helpful to assign shelf numbers. Therefore, should something be out of order, it is easy to find the correct location.

When movers are interviewed, do not go exclusively by price. Be sure that they have experience moving a library, archive, or fine arts collection. Make sure they have proper insurance. Their staff must wear uniforms with proper identification. Do not hesitate to do a security check of their staff, or at least ask if it is possible to do a background check. After all material is safely on the new shelves, it is imperative to conduct an inventory. Search not only for damaged collections, but also carefully check all labels to see how they survived the transfer. Finally, it is critical to carefully update all of your location

records.

The literature on moving collections is not extensive. However, the recent article by Albrecht-Kuszeri and Maida H. Loescher, “Moving Archival Records: Guidelines for Preservation,” (Comma, 2001.3-4, 259-284) should be carefully consulted by anyone involved in a pending move. Other useful publications include Elizabeth Chamberlain Habich’s, “Preparing a Request for Proposal” (Moving Library Collections: A Management Handbook; Westport: Greenwood Press, 1998) and L. Suzanne Kellerman’s “Moving Fragile Materials: Shrink Wrapping at Penn State,” (Collection Management, 18, #2, 1993). Two excellent essays addressed specifically the larger question of space planning: Ruth A. Fraley and Carol Lee Anderson’s Library Space Planning: How to Assess, Allocate, and Reorganize Collections, Resources, and Physical Facilities.(New York: Neal-Schuman Publishers, Inc. 1990) and Mary Todd Glaser’s “Storage Solutions for Oversized Paper Artifacts,” Section 4, Technical Leaflet 9 in Preservation of Library and Archival Materials: A Manual, 3rd edition, (Andover: Northeast Document Conservation Center, 1999). Finally, do not hesitate to consult with colleagues who have recently moved into a new facility.

SOLINET Preservation Field Services, 1-800-999-8558

Preservation and Collections Care Issues
during Building Projects and Renovations

Proceedings from a SOLINET Preservation Conference
SOLINET Annual Membership Meeting, Atlanta, GA
May 30, 2003

Fire Protection during Alterations and Renovations

Deborah Freeland
Area Vice President, Arthur J. Gallagher & Co.

As long as libraries have existed, they have been prey to destruction by fire. According to a special study by the National Fire Protection Association, during the past 20 years we have averaged 198 major fires in libraries in the United States ***EACH YEAR***. These statistics are deplorable. Millions of valuable books, recordings, and other material — often including irreplaceable manuscripts, collections, and rare books — are lost each year. And many of these fires could have been prevented.

The results and representative fires are published in NFPA 909, *Code for the Protection of Cultural Resources — Including Museums, Libraries, Places of Worship and Historic Properties*, one of the National Fire Codes. The study further breaks down the fire data by cause of loss:

Incendiary or suspicious	40.1%
Electrical	19.9%
Other equipment	8.2%
Open flame, ember or torch	5.8%
Smoking materials	5.8%
Heating equipment	5.8%
Cooking equipment	4.0%
Appliance, tool, or air conditioning	3.9%
Child playing	2.4%
Natural causes	1.7%
Exposure to other hostile fire	1.4%
Other heat, spark or flame	0.9%

And probably at no time is a library more susceptible to fire than during periods of construction, alteration, or renovation. During these periods, work on electrical systems and hot work greatly increase the risk of fire caused by these hazards. The presence of contractors and other visitors jeopardizes security and increases the likelihood that an arsonist or vandal will be able to gain access to the property undetected. Add the housekeeping issues presented by construction activities, and the formula is one for disaster.

So what can be done to mitigate the risk of loss? First and foremost is setting the ground rules with the contractors. The newest version of NFPA 909 calls for a pre-construction meeting between library, university, or museum directors or key staff and contractors to

brief the contractors on specific concerns, the location and protection of collections, finishings, and character-defining building features, as well as to identify and establish security and fire safety requirements. The standard also gives the institution the authority to enforce its own protection standards even at the construction site and to stop construction activities when they are felt to jeopardize the safety or security of the facility or its contents. This is a major deviation from standard practice on construction sites, where the contractor generally answers only to jurisdictional authorities and may dismiss the concerns of the building owner.

Actual oversight by the institution should include the following:

- Site security and monitoring of contractors and visitors
- Isolation of construction from the existing building and collections
- Limitation of impairments to existing protection systems
- Location and handling of any flammable liquids and gasses
- Removal of rubbish and combustibles
- Supervision of hot work and other sources of ignition
- Handling of sprinklers and other fire protection system components
- Acceptance testing of protection system components
- Location and type of portable extinguishers to be used in the proximity of
- collections

Detailed precautions in each of these areas are outlined in NFPA 909. Not all jurisdictions have adopted this relatively new document; however, it does incorporate up-to-date information specific to protection of cultural facilities, and many institutions are using it as a design standard prior to its adoption in an effort to minimize their risk and the exposure to their collections. A brief summary of the major issues follows.

Site Security

Fencing or other barriers should be provided to limit access to the construction area, and only authorized workers should be admitted. This is especially hard to control when a number of subcontractors are on the site at one time. Coordination with the contractor is critical. Any existing guard service should be extended to cover at least a visual check of the construction area as part of the regular rounds. Again, construction sites are especially susceptible to arson. And emergency notification procedures and devices should be identified up front, with all workers and security staff instructed on the locations of telephones and alarms as well as on emergency communication procedures.

Isolation of Construction Areas

The areas under construction must be isolated to reduce the likelihood of a fire spreading from the construction area into the existing structure. This can be accomplished by physical separation by the use of fire retardant tarps or sheeting, or gypsum board partitions or barriers. Construct firewalls and exit enclosures required for the completed building as early as possible. Locate equipment with combustion engines (such as

compressors, hoists, and pumps) so exhausts are not facing combustible materials or HVAC air intakes. Strictly limit the amount of combustible construction materials allowed within the building, and make sure they do not block exits, fire protection system controls, hydrants, or fire department accessways. And restrict smoking to designated areas where combustibles are limited and ashtrays and extinguishers are provided.

Limitation of Impairments; Location and Type of Portable Extinguishers
Maintain existing fire protection systems, such as building sprinklers, hydrants, and alarm systems, in working order as much as possible, and minimize the extent and duration of any impairments as much as possible. Water supply for fire protection must be available throughout all stages of construction. Make sure fire hydrants and fire department connections for sprinkler systems are readily accessible, that contractors' trucks do not block roads or access by fire trucks, and that closed valves are clearly identified. Also, ensure that portable fire extinguishers provided by the contractor for use in the construction area are suitable for use on any collections nearby.

Location and Handling of Flammable Liquids and Gasses
Flammable liquids and gasses within the existing building should be limited to one day's supply, containers should be protected from damage and exposure to high temperatures, and should be locked up at the end of the day in approved storage cabinets or a storage area at least 50 feet from the main construction project, and secured to prevent access by vandals. Gasoline-powered engines, such as those used in compressors and hoists, as well as fuel storage, flammable gas storage, and service areas, should not be allowed in the existing building. On-site recharging of gas cylinders should be prohibited.

Removal of Rubbish and Combustibles
Trash and combustible storage provide ready kindling for arsonists and vandals, as well as being a hazard in themselves. Trash should be removed daily, trash receptacles should be provided, and combustible storage should be minimized.

Supervision of Hot Work
Use of hot work, including equipment used for paint removal, soldering, brazing, welding, and roofing, should not be permitted in or near the existing premises unless there is no viable alternative. When there is no alternative, establish a hot work permit program that requires removal of combustibles from the area, a fire extinguisher nearby, and possibly a fire watch at the ready. All use of flammable or combustible liquids in the area should be limited, and a system established for monitoring the area for three hours after work is finished.

Handling of System Components and Acceptance Testing
Proper handling of system components, especially more sensitive items such as quick

response sprinklers (see below) is critical to ensure proper operation and avoid malfunctions. New acceptance tests must be done for fire protection systems and alarm systems both to ensure that they function properly and, for sprinkler systems, to make sure that they will withstand the required pressure, are free of debris, and that piping has not been damaged. If collections are nearby, it is generally prudent to test the sprinkler systems with air pressure prior to the hydrostatic testing.

Finally, one of the most effective means of reducing fire losses during construction and renovation is one of the simplest and least expensive: a walk-through of the construction area and any exposed portions of the existing facility about a half hour after workers have left for the day, and again an hour later. A large number of fires could be prevented or extinguished at their earliest stages by checking for hazards that may be inadvertently left by contractors. This includes equipment that has not been turned off, access areas that have not been locked, damaged electricals, combustibles and flammable liquids that have not been safely stored away, as well as smoke that would signal a slow smoldering fire.

NEW TECHNOLOGY IN FIRE PROTECTION

Because many contractors and fire system salespeople have really capitalized on, and often taken advantage of, the fear of libraries and similar cultural institutions of water damage in hyping new technology, I would be remiss in not commenting on some of the new and changing products and technology in the area of fire protection that might be proposed in the course of library renovations, both good and bad.

Quick Response Sprinklers

Because these sprinklers are designed to react much faster to fires than ordinary sprinklers, extinguishment begins when the fire is at a much smaller size, so smoke, heat, and fire damage are minimized. This is useful for critical higher-valued collections, and is the type of protection ultimately chosen by the Library of Congress and a number of other well-known institutions. However, these sprinklers, especially those equipped with the tiny 3mm glass bulb, are also more sensitive to damage, particularly during installation. Extra precautions need to be taken and contractors carefully supervised to reduce the likelihood of accidental discharge resulting from damage during installation. In areas with higher valued or irreplaceable collections, consideration should be given to using metal fusible-link operated sprinklers in place of the more popular glass bulb sprinklers.

Failsafe Preaction Systems

In preaction sprinkler systems the overhead piping is filled with air, and water is not introduced into the piping until a smoke detector is activated. Until a few months ago, all preaction systems had one inherent problem: a single point of failure between the smoke detection and the sprinklers. In other words, if the single control panel failed or lost power, or the smoke detector failed, both the detection and the suppression systems were

rendered useless. Recently, one sprinkler control valve manufacturer, Viking, developed a failsafe preaction system that overcomes the control panel problem, and other manufacturers are expected to follow. This technology is quickly being embraced by both the cultural and semi-conductor manufacturing communities. It is based on existing technology, so there are not the same concerns about potential problems associated with new technology. And a final word on preaction systems: double interlock systems, which introduce a delay into the extinguishment process and allow a fire to grow significantly larger before they start to function, are almost never appropriate for collections and highvalued occupancies; single-interlock systems are recommended.

Halocarbon Extinguishing Agents

The halocarbon (gaseous) extinguishing agents such as Halon were never very effective at extinguishing deep-seated fires such as those in papers and books. They were much better at putting out fires in computer equipment where the gas would be sucked into the equipment itself. However, preying on the fear of many in the library community, contractors advertised these systems for collections storage rooms. Even the Library of Congress succumbed and installed such a system; after reviewing test data, the system was subsequently removed and ultimately replaced with quick-response sprinklers. Additional considerations include the fact that FM 200, which is being touted as a primary replacement for Halon, is a greenhouse gas, is currently not permitted in the European Union countries, and would be banned under the Kyoto protocol. Also, these systems require more extensive maintenance than standard sprinklers. There is a risk of cardio-toxicity so evacuation is required upon agent discharge. Both Halon and FM 200, when exposed to fire, break down into corrosive by-products, including hydrofluoric acid (the longer it takes to extinguish the fire, the greater the amount of breakdown products). The latter is of special concern to those trying to protect valuable collections.

Very Early Warning Smoke Detection

These smoke detection systems represent the latest technology in fire detection. They work by drawing in samples of the air in a room and identifying specific products of combustion, the various molecules generated by out-gassing (rather than waiting for smoke to build to the point it obscures vision and travels to a traditional detector). Their goal is to detect a pre-fire condition before it actually becomes a fire, and long before the fire is putting out noxious smoke and threatening life and property. They can detect concentrations of smoke and pre-combustion particles one-thousandth the size required for conventional smoke detector activation, and are also effective in areas where regular smoke detectors don't work as well — like spaces with high ceilings or high airflow. So the result is that they can detect a pre-fire condition hours (in the case of the one museum I worked with, more than seven days!) before conventional smoke detectors can, triggering an alarm that allows a fire to be averted. Architects like these systems, too, because the sampling devices are transparent tubes, somewhat like very long straws, that are unobtrusive, instead of the big round smoke detectors that we are used to. These are especially recommended for rare book areas and other high-valued collections where it is critical that a fire be detected at its earliest stage.

Water Mist Extinguishing Systems

Water mist systems, currently used primarily for engine rooms in ships, are perhaps the most promising new technology for protecting libraries and collections from fire. Similar to sprinkler systems, these use a fixed water supply to extinguish a fire, primarily by cooling. However, the water is pressurized to form a mist or fog that fills the room. The mist droplets are small enough to minimize the wetting of surfaces, so water damage is minimized. This technology is fairly new, listed equipment for installations is still very limited, there are a number of design issues (not the least of which is that there are very few contractors who have any knowledge or experience in actually designing and installing them) and there have been very few installations in cultural properties so reliability data has not yet been established. Installations are also quite expensive, because standard design criteria and a network of system distributors and installers are not yet in place. I would hesitate to install such new technology in critical areas until it becomes more widely accepted and field-tested, unless other options are not available. But, in the future this promises to be an excellent tool for libraries and cultural properties.

Compact Modular Storage

Perhaps the greatest challenge for fire protection engineers is the current trend toward compact modular storage. Fires in this densely packed shelving, when filled with combustible storage such as books and papers, are extremely difficult to control and generally result in a total loss of everything stored within the module and the associated fire area. Testing conducted for the Canadian National Archives demonstrated the following scenario: when a fire occurs in the storage, the solid shelves radiate the heat downward, and also trap the smoke and heat, so that operation of smoke detectors and sprinklers is greatly delayed. Meanwhile, as the fire smolders and the oxygen supply becomes limited, flammable gasses build up under the shelves. As the fire grows, eventually the sprinkler system will activate, but the shelves shield the burning material from the water. And when the fire department responds and opens the module to better access the oxygen-starved fire, the flammable gasses that have built up under the shelves flash over. Additionally, salvage and cleanup are very difficult and tedious, as access is difficult and only a limited number can work on extracting materials — one shelf unit at a time, and the modular solid shelf configuration is also reportedly a problem from a mold standpoint.

Appropriate protection has yet to be defined to the extent that it can be incorporated into the codes. However, a combination of high-density, quick-response, wet pipe sprinkler systems, early warning smoke detection, spacers between units, and vertical metal barriers for each shelf, has been demonstrated to be effective in reducing the extent of the loss.

I would end my comments with a caution, in the words of Steve Bush, retired head of safety and fire protection for the National Library of Congress:

"If I could give one piece of advice to people responsible for protection of libraries: BEWARE OF NEW TECHNOLOGY! Some cultural property professionals will grasp at

any fire protection device that is perceived to protect their collections from water damage without realizing that it may not perform as promised and may even introduce new hazards or risks. Would you want your facility to be the guinea pig for debugging a new product?"

*NFPA 909, Code for the Protection of Cultural Resources, is available through the National Fire Protection Association or as a part of a full National Fire Codes subscription.
SOLINET Preservation Field Services, 1-800-999-8558