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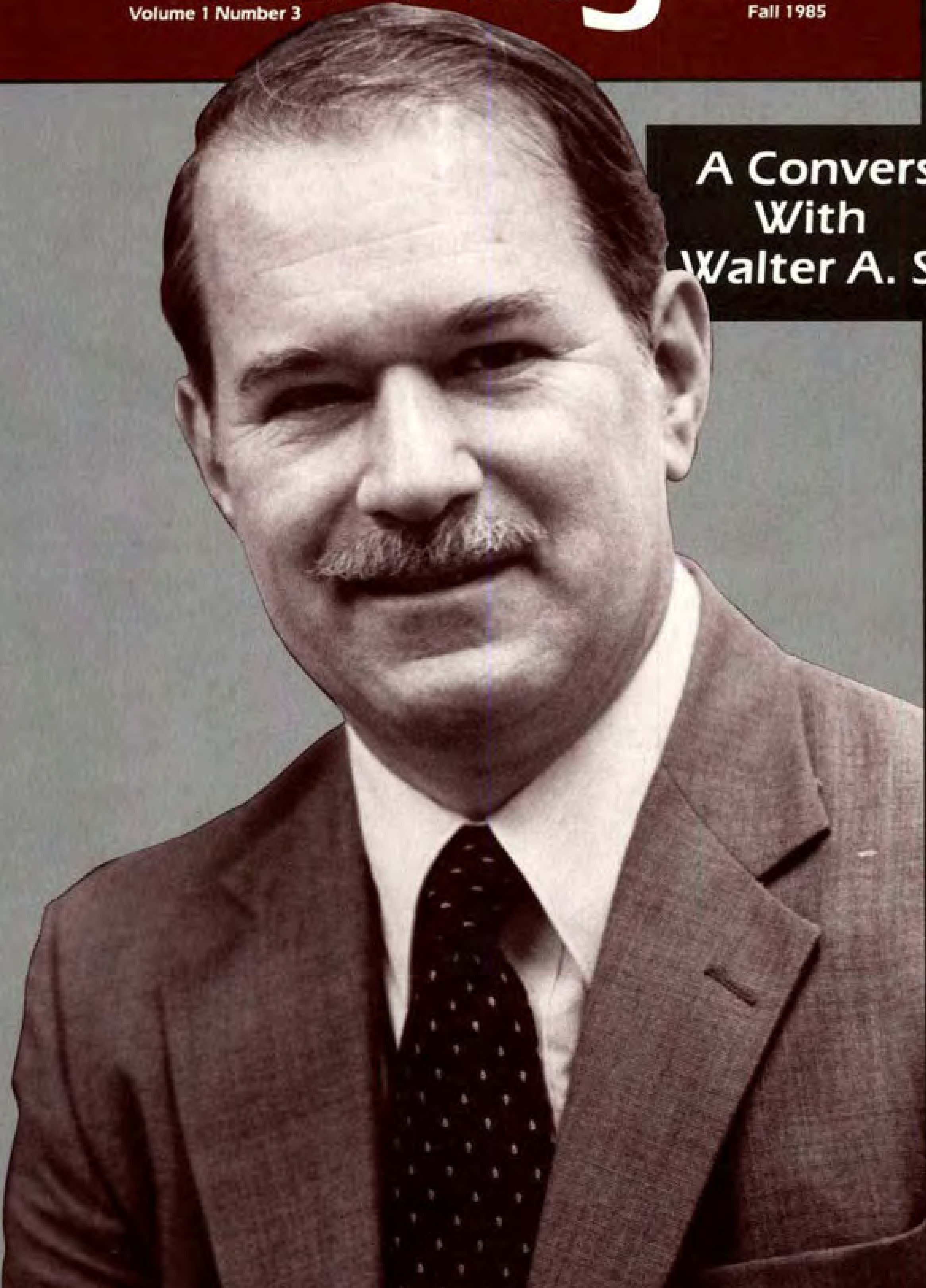

A Conversation With Walter A. Schaw

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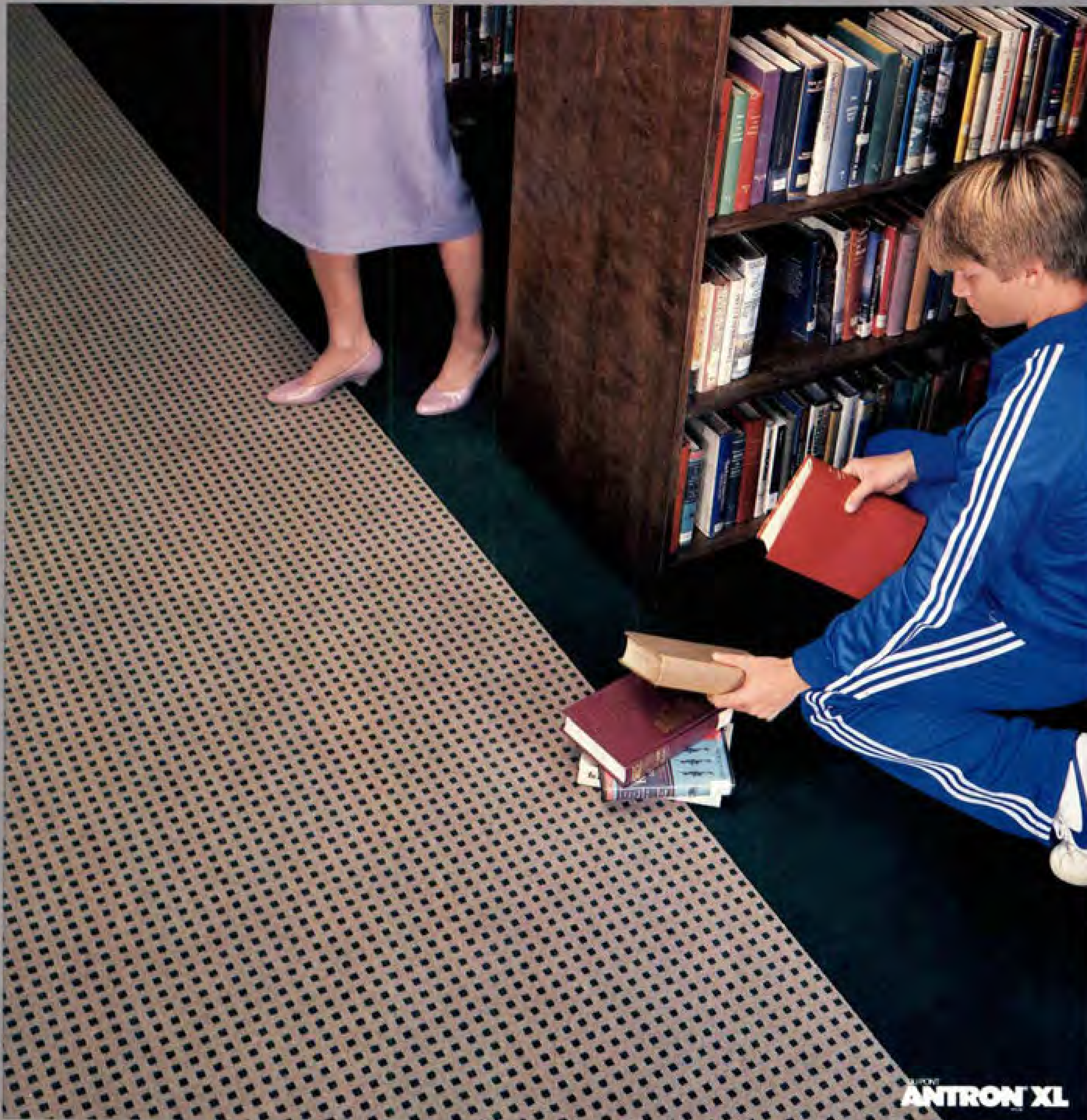

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A Conversation With Walter A. Schaw

by Steve Howard

At its 72nd Annual Meeting last July in San Diego, Calif., the Board of Directors of the Association of Physical Plant Administrators of Universities and Colleges (APPA) introduced Walter A. Schaw to the membership of the Association as its executive director. Schaw was chosen from a field of 150 applicants by a search committee chaired by Rex O. Dillow, who also served as acting executive director until Schaw's position was effective in mid-August.

Schaw's most recent employment was six years as director of alumni communications for the Indiana University Alumni Association, Bloomington, Ind. His major accomplishment was the development of an on-line alumni record system for the eight-campus university system. He also oversaw a 54 percent growth in membership income for the association.

Before joining Indiana University, Schaw served as executive director of the American Institute of Plant Engineers in Cincinnati, Ohio from 1970 to 1978. From 1963 to 1970 he handled membership development, program promotion, and other responsibilities for the American Foundrymen's Society in Des Plaines, Ill. Three years prior to that he served as managing editor of the Journal newspapers in Lansing, Ill.

Schaw's current volunteer service includes chairman of the board of the Nonprofit Mailers Federation and member of the American Council on Education's Task Force on Regulatory Reform. In 1984 he served as faculty chair for a summer institute on computer applications for the Council for the Advancement and Support of Education.

Schaw is a 1959 graduate of Valparaiso University and has been designated a Certified Association Executive (CAE) by the American Society of Association Executives.

"The Association is extremely fortunate to have somebody of Walter Schaw's caliber, background, and ability as its new executive director," said William W. Whitman, APPA president and director of physical plant at Iowa State University. "He is known to many on college campuses across the country for his previous experience with plant engineers as well as with alumni directors. Walt's ability to communicate and to get the job done will serve APPA well in the years to come."

The following is an interview conducted with Walter Schaw in August before he began his tenure with APPA, whose purpose is to promote excellence in the administration, care, operation, planning, and development of facilities in support of the teaching and research functions of colleges and universities.

—S.H.

Steve Howard is editor of Facilities Manager *and APPA's director of publications.*

What are your short-term and long-term plans for APPA?

My short-term plan is to visit the six regions and as many campuses and talk with as many members as I can within the next few months. Listening will be the most important thing I can do right how. My observation of the staff tells me that I will be quite free to be in the field and assured that the shop will be in fine order. We have a good team at work at the APPA headquarters, and I am pleased to be part of it.

Another short-term priority is to better understand the organization and the relationships of APPA's governing bodies and officers. No two associations are exactly alike, and you simply need to meet and work with the individuals involved before you can appreciate the things that are unique about the way they operate. I need to know that before I can become fully effective. My initial exposure at San Diego, however, gives me considerable confidence that little momentum need be lost because a new person is on board. I am pleased to be working for, and with, people such as President Bill Whitman, President-Elect Val Peterson, and Immediate Past President Herb Collier.

My long-term plan—and right now I define long-term as eighteen months—is to help identify and prioritize the needs of the membership and how APPA might respond. To be successful this requires input from as many members as is both practical and possible. That is why my short-term objective is to begin informally with input from my regional and campus visits.

Why is facilities management so important to higher education?

First, let me qualify my answers. I have not yet reported to the APPA office to assume my new duties. However, I am happy to have the opportunity to venture some opinions from my experience with the American Institute of Plant Engineers and at Indiana University.

The physical plant of a college or university campus is one of the most tangible aspects of higher education. A well-managed facility means that elevators work, snow gets shoveled, and buildings are clean and comfortable—all of which says, "This is a pleasant place to be." Part of our significance to higher education is to construct and maintain the best possible environment for teaching, research, and learning. We have to accomplish this in spite of sometimes rapid social and technological change and fierce competition for whatever dollars are available.

Some may see funds for maintenance as fewer dollars for faculty salaries or academic programs. Yet, if facilities are allowed to suffer from deferred maintenance, the environment that has been conducive to learning—and to attracting student, parent, and alumni constituents—may permanently erode..

There is a less tangible aspect to facilities management and its importance to education. Buildings and campuses are important not only as a pleasant and comfortable environment, but they also speak of the values that higher education represents. We select certain structures—Old Main or the ivy-draped library, for example—as symbols that speak of great traditions, of ideals, and of aspirations. Our physical plant's importance to higher education is not only in its function to provide living and working space, but as a reflection of who we are, what we are about, and even what we dream about.

What do you see as the future of higher education?

We can look ahead and see declines in enrollment for some if not all schools. We can predict a plateau of public funding in the form of state appropriations or student loans. Faculty,

particularly those related to new technologies, will be difficult to retain as the price tag of dedication becomes too high to ignore. And already fierce internal competition for existing dollars will require each request for funds to be both well-defined and persuasively presented.

We may continue to turn to annual tuition increases as a short-term fix, but if we do we may accelerate the decline in enrollments. We may also be jeopardizing what I believe is essential to our American democracy—an affordable, quality education available to all as their birthright. Increasing student loans apace with tuition is not the kind of educational opportunity my generation enjoyed. I do not claim to have answers, but I strongly believe that the principal object of education must be to pass on to new generations no less than what we ourselves were given: the opportunity, unconditioned by birth, wealth, or position, to become whatever we could by becoming educated.

I fear that in the tendency to repeatedly solve the problems of only the immediate fiscal year, our greater purposes in higher education may be at risk. The condition of the physical plant is a reasonably accurate reflection of the institution's well-being. Nonetheless, a campus may appear quite beautiful, but I would ask, "How large is your deferred maintenance problem, and what will that mean ten years from now if it continues to grow?" H.G. Wells once said that civilization is a race between education and catastrophe. We may be in on a last lap, but we have to win.

How can facilities administrators keep their heads above water in the competition for the limited campus dollars available each year?

Based on my experience with plant engineers, the need and the ability to communicate effectively probably contributes the most toward persuading others that we simply need those funds. The ability to persuade means not only to present your case concisely and clearly, but to try to stand in the shoes of the person to whom you are speaking, be it the business officer, the president, or the board of trustees. You will not present them with eighty pages of engineering detail, but you will have that prepared in advance for support, if needed.

Whenever we are selling anything, whether it is a pair of shoes or a scrubber for a smokestack, we are addressing the needs of somebody else and hoping that they will take the action that we desire. In other words, we need to identify and sell the people we report to on our needs, such as deferred maintenance or a power plant retrofit, and then furnish the language that will help those people sell it in turn to the board of trustees or the state legislature, for example.

Many facilities problems may be put off too long, and the problems only compound themselves. Part of our persuasion has to point out the consequences of putting off in future years what ought to be done today. Basically, that means that if the campus starts looking seedy or if unrepaired structures have caused damages or injuries, parents may not be interested in paying thousands of dollars to enroll their children.

How should the director of physical plant be viewed by other campus administrators? What is his or her place in the scheme of things?

There are obvious answers if one looks at not only the proportion of annual maintenance and construction to total university budgets, but also the true value of the real estate occupied by the institution. A specialized manager is required. Few people would quarrel if we said that the person in charge of the campus computer center has to possess specific technical and management qualifications. We tend to listen to the recommendations of that computer center manager, and we don't try to second-guess him. We respect the need for expertise in that area, and we respect the impact of their decisions. I suggest that facilities management is no different. Maybe not as glamorous, but no different.

If one looks within the job function, we begin to appreciate the special kind of manager we need. The variety of work a physical plant administrator is responsible for may boggle the minds of professors and administrators accustomed to a single area of interest or responsibility. Manager, engineer, crew boss, planner, conservationist, purchaser, controller, and more are wrapped up in one human being.

Beyond the value of the work to be done and the variety of talents required to do it, there is another significant value to facilities managers. We so badly need someone to persuade us to keep our physical plants in good working order, and it is the director of physical plant who has the expertise to sell the specifics as well as get the job done. Without this person, and given the pressures of priorities in most institutions, it would not be long before the toilets stopped working, the air conditioning went out, and bricks began falling off that new building.

Whatever facilities managers do to promote their department to the various campus constituencies—students, faculty, staff, and administration—it must be deliberately planned for and executed. We cannot just sit and wait for the chancellor to ask to have a tour of the physical plant. We need to arrange short briefings on new projects or revised procedures and invite the chancellor, deans, and department heads. Follow this up with a walk-through inspection of the facilities. In other words, we need to promote ourselves and show why we are so important to the functioning of the campus. There has to be very deliberate exposure because if we don't do it, nobody else is going to do it for us.

What do you see as the greatest problem facing facilities management today?

As an admitted novice in spite of my eight years with plant engineers, I am on dangerous ground by answering. I will venture an opinion, however, that the scope and size of deferred maintenance on the few campuses I am familiar with suggests that this may be our biggest problem. Replacement or environmental modification of power plants may also be in the running as a top problem.

From my former side of higher education with alumni relations, I can appreciate the difficulty in solving some of these problems. Who can get a donor to put a plaque on a new smokestack? Who can convince the vice president for administration that an elevator ought to be replaced instead of fixed for the thirty-seventh time, especially when that VP is preoccupied with a costly new central computing mainframe?

What can APPA do to help its members solve these problems?

First, we ask our members to identify those "greatest problems." Second, we assess what stands in the way of solving the problem and think beyond traditional association answers or our perceived limitations. It is up to us to tailor our response to the need, not to what we are already doing. We may find that our profession has excellent skills in managing people and technology, but are we good persuaders? Is the importance of our function recognized and understood?

How can APPA's publications and educational programs help meet these needs?

Let me speak in general terms on that. There is always the temptation to be everything to everyone—to try to satisfy all the needs or as many as possible. And that's not necessarily bad. That is part of our inclination of being a service-oriented group to membership. But we cannot be good at everything, so we have to identify where the greatest needs are and focus on those. Not that we scrap everything else, but where do we lend the weight of the staff funding and the volunteers? I don't have the answer to those questions, but that is the approach I will operate under as executive director, in concert with the officers, Board of Directors, and the staff.

Could you briefly describe your work as director of alumni communications at Indiana University?

I had responsibility for all alumni publications, of which there were about 60 periodicals and 150 total publications offered, within the eight-campus Indiana University system. I also had responsibility for developing computer systems based on my involvement as project manager of the system for 300,000 alumni records that are now on-line. I supervised development of the data base in that system, which contains detailed information on 60,000 IU alumni to date. Part of that data is critical to a $200 million capital campaign now in progress at the university. I was responsible for alumni printing and mailing operations as well, which encompassed in the neighborhood of 5 million printed pieces and 4.5 million mailed pieces each year.

How has the plant engineering/facilities management profession changed since your years with the American Institute of Plant Engineers?

In the mid-seventies we saw a dilution of the job function of the profession. Certain areas that we had been traditionally responsible for suddenly came into the limelight, none more explosively than energy management after the OPEC oil embargo. All of a sudden people started popping up with the title of energy manager, and they weren't necessarily drawn from plant engineering. It was important to define the profession, so we instituted a certification program for plant engineers.

Some of the challenges we have are inherent with how the profession views itself. I had fun sometimes by asking members how large their budget was, and they would answer, "Oh, it's $8 million." And I would say, "Tell me, do you perceive yourself primarily as an engineer or as a manager?" And some of the time they would come back with, "Heck, I'm an engineer, not a manager!" My response was that there is no way you cannot be a manager first if you have responsibility for an $8 million budget.

Because some did not see themselves as managers, those with traditional plant engineering backgrounds have not necessarily been promoted to vice president of plant engineering, or they may have had people from other disciplines inserted over them. Not because the others knew more about plant engineering, but because of the way they presented themselves. There are many fine engineers who enjoy solving detailed problems, but who are not comfortable standing in front of a board of trustees doing a "dog-and-pony show" to persuade.

How will your background at IU and AIPE help you in your new position with APPA?

I would include in that background my early years in journalism, which shaped me as a communicator in every job I've had since. My years with plant engineering followed eight years with foundry people, where I lost my awe of technology and learned to synthesize and communicate ideas related to technology. With AIPE my chief contribution was as a communicator and a person who could get to know enough about the profession to have a working knowledge. My six years at Indiana University taught me to appreciate the daily situations that physical plant administrators are faced with. I have had to go before vice presidents more than once and fight for a buck. I have also had to learn how to motivate and discipline people within a set of personnel policies in a public institution that made those decisions a lot tougher to make than in industry. And yet, as a result, I think I'm a better manager and understand some of the same concerns that plant administrators experience. I don't pretend to fully appreciate what they do or how they do it, but I expect to know more from my field visits.

Please describe your volunteer work with the Nonprofit Mailers Federation and the American Council on Education's Task Force on Regulatory Reform.

The benefit of both groups is that I have come into contact with many, many universities across the country, and it has given me exposure to other associations such as NACUBO [National Association of College and University Business Officers]. I'll quickly address the mail issue here. In early 1982 we sustained a 50 percent increase in nonprofit postal rates, and I went to Washington to see who was working on the issue. I found our education groups spread over a number of issues and that nobody was focusing necessarily on mail.

We informally organized a group of state universities to begin lobbying on our own, and before long we had hooked up with a professional staff in Washington and began the Nonprofit Mailers Federation. In July 1982 we won the first reduction in postage since Calvin Coolidge's time. Our success from then to now has been one million dollars a month in savings for higher education alone.

The upshot of this example is that it demonstrated that universities and colleges working together can have a powerful influence on what goes on in Washington. I was told when I first came to town that there were a group of well-financed, well-organized, for-profit mailers who controlled what happened with rates. I was also told that there was little chance to change that. My response was to say that if grass roots activity doesn't work in this nation, then we are in deep trouble. I refused to believe what I was told, by a knowledgeable congressman in fact, and I am glad to say that I was right and he was wrong.

I have established many relationships with college presidents, alumni directors, and others on campus. If called upon to testify or organize an effort against a piece of legislation that would be harmful to APPA's members, I know what to do and how to get it done. I am not going to predict how these relationships will benefit me, or when my lobbying skills will be called upon, but it is something that I'm bringing with me that will be available for the good of APPA.

Membership development and retention is a problem with many associations. How do you feel about its importance?

In association work we sometimes become distracted by projects other than what I would call the root basics. The ability to attract and retain members is square one of the effectiveness of any association. If you are not able to attract new members or keep the ones you've got, there is a fundamental flaw in how you are operating as an association. Members vote with their dues. If they don't renew they are generally saying, "The services you provide are not worth what you are charging my institution." When that happens, you had better take a hard look at the association and determine where the basic problems lie. While non-dues sources of income are important to most associations, we can become distracted and forget why we in fact exist. And that attitude will be reflected in the ability to attract or retain members.

You have been designated a Certified Association Executive by the American Society of Association Executives. Could you explain the significance and usefulness of that designation?

Certification in any field should mean transferability of skills. If we certify people in plant engineering, for example, an employer should assume a certain set of basic skills that are transferable to any plant, whether it is in a chemical plant or an auto factory. Now there are limits to what that implies, but it does assume a minimum level of skills and familiarity with the profession that can be transferred.

The same applies in association management. To achieve CAE status you have to have been a chief executive officer for at least three years, as I was with AIPE. I also had to complete an examination that tested my ability and skills on a broad range of types of associations. When I first got into it I thought, "Gee, this ought to be duck soup." I had been in association management at that time for about ten years. Well, this educated me. There are many different kinds of associations, and I gained a much broader grounding in associations as a whole than I would have if I had not gone through the certification process.

What attracts you to the world of association management?

Nothing gives me more personal satisfaction than to see people working together in pursuit of a common belief or idea, not because they are paid for it but because they believe in it. Our effectiveness in this country to cause change is based on our ability to pursue ideas freely. It's an essential ingredient to who we are as Americans and is virtually unique to the rest of the world. Tocqueville said that 150 years ago.

What attracted you particularly to APPA?

All of a sudden my whole career made sense. My background in communications, plant engineering, and higher education all come together at APPA, and my heart is truly in the executive director position.

Is there anything you would like to add in conclusion?

Only that I have never joined or become affiliated with any group that has made me feel more welcome and more wanted than APPA has. I will do my very best to live up to the expectations and confidence of the membership. ■

Schaw, left, confers with Robert W. Brunnemer, Indiana University's director of physical plant, before joining APPA at its Alexandria, Virginia headquarters.

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Systems Analysis Approach to Work Control

by Ed Schon

Work planning, cost accounting, and record keeping are time consuming tasks. Physical plant administrators are expected to know where their resources have been used, are being used, and will be used. They are also expected to have perfect recall of all details. As infallibility escapes most of us, we need a method to keep track of current activities and project future ones.

Manual work control systems are limited in effectiveness by the labor intensity of the work and the storage space required for paper records. If a manager wishes to automate work order processing, thereby improving responsiveness and access to data, a new series of problems are created. Decisions must be made on what computer hardware and programs will be required to create an automated work order system. Will you need access to a large central computer, or will a personal computer (PC) be sufficient? Will special programming be necessary, or will an off-the-shelf, "canned" program work?

Although you will probably need advice in making your decisions, there is much preparatory work you can do to establish what will be expected of the system. By asking yourself some of the same questions a systems analyst would, you will be better prepared to evaluate the advice you eventually receive.

The answers to the following questions will be pertinent to what data you must gather, how it must be processed, and what the finished product will be. This quick overview is meant to be thought provoking, not a thorough description of a systems analysis effort.

Ed Schon is assistant director, physical plant administration, at Old Dominion University in Norfolk, Va.

Question 1: What is the objective of the project?

Purpose: Once a purpose is stated, obstacles that prevent you from reaching your objective can be identified. Obstacle identification leads into identifying methods for overcoming the obstacles; therefore, only after the obstacles have been identified will you be in a position to seriously consider computerization as an alternative.

Stating an objective also provides a benchmark for evaluating the utility of the project components.

Question 2: What reports will be generated for whom and for what purpose?

Purpose: In order to know what data to collect, you have to know where you will end up. This is the same as planning materials for a construction project. Answering for whom and for what purpose will determine report layout, type of paper used (flimsy for transmittal, 20 lb. bond for file, or carbonless for copies), and the type of printer purchased. A heavier printer will be required if multiple sheet carbonless forms are used.

Question 3: What data is needed for the reports?

Purpose: You need to review your data requirements. Will the cost of collecting a type of information be justified by its utility in the report? You may find that in order to collect certain pieces of data, unrealistic time demands will be placed on operational staff. Your system will fail if you cannot assure the cooperation of the craftsmen who fill out the work logs.

Question 4: What calculations and comparisons of data will be needed to process the raw data into the necessary reports?

Purpose: This question is important in determinig the complexity and power of the program that you need. A program that provides for averages and totals will be less complex and costly than one that provides a statistical analysis of data. Sorting work orders by craft, building, priority, etc., will be important. You should get a program that will allow for flexibility and growth in sorting requirements. A good rule of thumb is to assume that you have not planned for all contingencies. Experience has shown that people will always find new ways to use computers.

Question 5: Will the parameters of the program (free vs. recharge items,

report contents) be subject to change? How often?

Purpose: This will determine how much program maintenance is needed. If the program cannot be updated in a timely manner, you will periodically revert to a manual system. You will have to determine how long you can function with inaccurate or no reports before program maintenance must be performed.

Question 6: How many characters (letters or numbers) will be in the average work order?

Purpose: In order to calculate the amount of data storage, you need to know how many work orders will be generated and for how long. (For a discussion of how to translate a work order into bits of data, see **Appendix A.**)

Question 7: What is the average length of time you will need to have immediate access to a work order?

Purpose: When you have determined the time periods that you wish to study, the amount of data accumulated during that period, and the average number of work orders carried over from the last period, you can calculate the amount of on-line data storage you need. On-line storage is immediately accessible by the computer.

With the answers to these questions, the manager will be prepared to discuss the project. The two most common sources of advice are an institution's computer center and computer retailers. The computer center staff will probably have greater computer expertise than the staff of a retail shop. However, just as retailers will be biased toward their products, the computer center staff may be biased toward their central system.

Almost by definition, a systems analysis effort is assessing the needs of people.

While more data processing managers are accepting the inevitability of the expanded use of PCs, they may feel that the dispersion of computer power threatens their position. Actually, PCs and mainframes are complementary. There are routine tasks that can be performed by the personal computer, while more complex tasks are performed by the mainframe in communication with the PC. The mainframe's communication capabilities can also be used to provide communications among PCs, which leads to sharing of data. A cooperative effort can be beneficial to both the PC user and the data processing department.

A computer store can be a good source of information if you can find someone who has a technical understanding of the product. Aside from the obvious product bias of a salesperson, lack of knowledge is a problem in the sales staff of some computer shops. Your first effort here should be to make sure your salesperson knows more about computers than what is in their sales manual. If you do get bad advice, you may not discover the error until you attempt to expand your system. A second opinion and a little self education will be your best protection.

The decision of contracting for a custom program versus a canned program deserves more attention.

It is common for managers, when considering program needs, to feel that their operation is so unique that only a custom designed program will work. In some cases this is true; however, the success in application of currently available database management programs indicates most operations could use a canned program successfully.

Depending on the experience of the programmer, 80-plus hours of programming and testing can be expected to turn out a work order program. Naturally, time (cost) varies directly with complexity. One of the most complex efforts from a programming standpoint is to write routines that will allow the user to alter the program from a terminal. If you do not have this option, you will have to wait for a programmer to update the program. Updating a program is an additional expense.

When deciding on using a canned program versus a custom program, you should realize that programming is as much an art as a science. The final program will reflect the programmer's creativity and knowledge in a unique structure for solving a problem. Therefore, documentation of how the program works will be necessary when the program is updated. If a student wrote the program, you will also have a continuity problem due to the high turnover rate in student employees.

With a canned database management program, the user can establish files, determine processing methods, and configure various reports. Updating the program can be quickly performed to meet changing needs. Training is necessary, of course, but it should not be difficult to find a student to implement the program if a regular staff member is not available. Documentation of the process will still be necessary; however, with a fraction of the complexity required for a custom program. The canned program will usually prove to be cheaper than a custom program, especially when you consider features and maintenance costs.

A third source of advice and programs are your fellow APPA members. Computerized work control has been around long enough that you probably will not have to travel too far to see a system in operation. Once you have an idea of the scope of the task ahead, quite possibly the most effective way of determining the applicability of different approaches is to see them in action.

Implicit in the evaluation of hardware and programs is the concern for people. Unless a totally unacceptable personnel situation exists, there will be more utility in making the computer system relevant to the capabilities of the staff rather than requiring extensive retraining of employees. More effort in preparation will be needed, but computer systems use can be simplified to accommodate people.

Almost by definition, a systems analysis effort is assessing the needs of people. Were it not for human needs, computers would be unnecessary. A true systems analysis relies heavily on interviews and observation of current efforts, thus assuring the input of the users. If the users see the effect of their participation in the system installed system, they will feel a certain amount of ownership. The feeling that it is their system will be helpful if problems occur, and group cooperation is necessary for a solution.

Make sure your computer salesperson knows more about computers than what is in their sales manuals.

At a recent seminar an automated work center manager was complaining that there was resistance by the craftsmen and their supervisors in filling out work orders. When asked what involvement the craftsmen had, the manager responded, "They participate—they provide the work order information." Our seminar leader pointed out that this was cooperation, not participation. Had a systems analysis been performed, before data collection began, the concerns of the supervisors and the workers could have been factored into the system.

The lesson to be learned is that you need to have both a good computer system and the positive attitude of the staff. Participation is the key.

Appendix A

Data storage consists of bits, characters, records, and files. A common code used in storage of data is IBM's 8-bit EBCDIC code. Each character (letter or number) requires 8 bits of memory space; consequently 128,000 (128K) bits of available random access memory (RAM) will be able to store 16,000 characters ($128{,}000 \div 8 = 16{,}000$).

Characters are organized into records. A record in our case would be a work order. An average record length can be calculated by counting the number of characters needed for required information such as account numbers, dates, etc., and allowing characters for comments. If a record length of 130 characters was decided upon, a total of 123 records could be stored with 16,000 characters of memory ($16{,}000 \div 123$).

Records are then organized by files. Files are usually labeled by a code word that represents the file content; for example, WRKFIL. Multiple files are then organized into a database. This organization is the same as a filing cabinet: each cabinet (database) has multiple folders (files), with individual entries (records). ■

Asbestos Control Technology in Schools and Public Buildings

by
Dorothy L. Stansel, M.A., C.I.H.

Asbestos has been used as a building material for many years, with the greatest concentration of use during the 1940s and 1950s. The past use includes fireproofing, thermal insulation, and soundproofing. It was sprayed onto structural beams and ceilings in public buildings, wrapped around steam and hot water pipes, and applied in a cement form to the outside of boilers. Most older buildings that have not been substantially remodeled during the past twenty years contain significant quantities of asbestos, and there is a current demand to assess the hazard that asbestos in buildings presently and potentially represents.

Risk Assessment for Friable Asbestos

The health hazards associated with asbestos are pulmonary and it is important to help the public understand that for asbestos to be hazardous it has to be in a form which can be breathed. Under normal daily use products such as vinyl asbestos floor tiles and house siding do not release asbestos fibers into the air. "Friable" asbestos, however, is another matter.

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The Environmental Protection Agency (EPA) defines "friable" asbestos as asbestos which is "easily crumbled or turned to powdery dust by hand pressure." It is usually used to denote and evaluate the condition of asbestos sprayed onto beams and ceilings in public or commercial buildings. Only in rare cases does it apply to badly damaged pipe lagging or the covering of old furnaces and boilers.

Two common public errors are the belief that all asbestos in a building is arbitrarily hazardous and should be removed, and that the friability of asbestos can be assessed safely by crumbling the asbestos-containing materials in one's hand. Removing the asbestos will eliminate the problems once and forever, but if the cost or logistics are prohibitive other methods of control can be considered as well. The composition of the asbestos, its location and condition, as well as the degree of damage should all be assessed before deciding what should be done. Two important rating schemes have been developed which attempt to facilitate these decision making processes. Both schemes consider the macroscopic physical appearance and condition of the asbestos.

The Ferris Index

In the rating scheme developed by Dr. Benjamin Ferris, Harvard School of Public Health, the Ferris Index = (A + C + F + L) × P, where A = Accessibility; C = Condition; F = Friability; L = Location; and P = Percentage.

Accessibility is the ease with which the asbestos fibers can become airborne as a consequence of the architectural design, the location of the asbestos, or the activities which are occurring in the building. It is rated as follows:

1 = Totally enclosed (i.e., behind a suspended ceiling).
2 = Inaccessible, beyond the reach of the population using the building.
3 = Accessible in low activity areas only.
4 = Accessible in high activity areas such as gyms, cafeterias, hallways, and stairways.

Condition rates the asbestos according to the degree of visual degradation:

1 = No damage at all, the condition is very good.
2 = Mild damage.
3 = Moderate damage.
4 = Evidence of severe damage with areas missing, hanging loosely or showing signs of delamination and water damage.

Friability refers to the extent to which the material can be broken apart when a person or object makes contact with it:

1 = Non-friable or firmly bound.
2 = Slightly friable.
3 = Moderately friable.
4 = Very friable, breaks apart with very little pressure.

Location:
1 = Material not located in air plenum.
2 = Material located in air plenum.

Percentage of asbestos contained in the material is rated as follows:
0 = Less than one percent.
1 = One to ten percent.
2 = Eleven to twenty-five percent.
3 = Twenty-six to fifty percent.
4 = Fifty-one percent or more.

All of these values are substituted into the following equation:
Ferris Index = (Access. + Cond. + Fri. + Loc.) × Percent

The recommended actions are as follows:

0-4	No action
5-9	Review in 2 to 3 years
10-15	Review in one year
16-20	Surveillance or control
21 or over	Control

Another Risk Assessment Tool

The Canadian Ministry of Labour has published the chart shown in **Table 1** as another method for determining what action should be taken. It is less specific and offers a broader interpretation. The categories are also listed in Table 1.

Air Sampling for Asbestos

Since asbestos is not hazardous until it gets into the air, measuring the airborne concentration of asbestos supplements information derived from the two other rating schemes. The EPA has strongly stated that air samples are useless in determining the status of friable asbestos. But, while deciding on the appropriate control technology to use based on the physical assessment of the material, air samples are extremely important in determining the state of degradation and a time frame for action. There have been incidences when friable asbestos in an undisturbed location do not contribute fibers to the air. But there have also been cases where elevated levels occur when the asbestos is not badly damaged. Air sampling is necessary to find these exceptional occurrences. The supplemental information from air sampling is also very valuable for setting priorities for the abatement program and in choosing between several areas with which to start.

Air Quality Standards for Asbestos

Unfortunately, no standards defining legally acceptable airborne asbestos concentrations for the general public

Table 1
Canadian Ministry of Labour Decision Guide

	Asbestos Not in Return Air Plenum *Less than 20% asbestos*	*Asbestos Present in Return Air Plenum* *Greater than 20% asbestos*	
Immediate Control	2 H's or 3 M's	1 H or 3 M's	Control Required Unless 3 L's and
Control Required	1 H or 2 M's	1 M	Less Than 20%
No Control	1 M or 3 L's	3 L's	Asbestos

The rating schemes are as follows:

Accessibility
High (H) = High activity areas
Medium (M) = Low activity or areas beyond occupant's reach
Low (L) = Enclosed

Condition
High (H) = Severe damage
Medium (M) = Mild-moderate damage
Low (L) = Good condition

Friability
High (H) = Easily breaks apart
Medium (M) = Mild-moderate
Low (L) = Firmly bound

Sampling pump and filter for air samples.

exist. The occupational health laws have been very specific about what a "normal healthy adult worker" may experience while on the job, and data exists as to the typical outdoor concentration, 0.001-0.003 fibers/cc in rural or suburban areas and 0.005-0.009 fibers/cc in urban areas. (It is extremely important for the public to realize that the air inside a building cannot be expected to be any cleaner or to contain less asbestos than normal outside air.) When multiple air samples show the asbestos concentration inside a building is elevated two to four times over the outside concentration but is definitely not high enough to require action under the occupational health and safety laws, the data then indicates a continuing source of airborne asbestos and a need for a control technology.

The Occupational Safety & Health Administration (OSHA) has defined an "action level" for airborne asbestos at 0.1 fibers/cc., which is considerably lower than the standard itself. At that level, an employer is expected to start taking serious steps to reduce his employee exposure. He also needs to provide medical exams, air monitoring, and elaborate record keeping. This 0.1 fibers/cc action level is also a significant level for public administrators to be aware of when deciding what to do about asbestos building materials.

If the air levels are distinctly below 0.1 fibers/cc or close to the outdoor level of 0.005 fibers/cc, a program of surveillance may be appropriate. But at an airborne level above 0.1 fibers/cc, steps to remove or control the asbestos are absolutely necessary. Between 0.005 fibers/cc and 0.1 fibers/cc one can use the protocol of comparing a battery of inside samples to those from outside. An average indoor concentration elevated from over two to four times the outside level indicates a source of asbestos that is becoming airborne.

Building Owner Liability

Since the only actual standards for permissible exposure to airborne asbestos fibers apply exclusively to the occupational setting, the formulation of levels considered safe for the public or in public buildings remains an unsettled issue. The employer is protected from excessive claims against him for asbestos-related occupational disease because the payments are made through the workmen's compensation system; but this is not so for the building owner

Workers removing asbestos from ceiling.

Friable asbestos above false ceiling.

when people who are not his employees are using the building.

Because there is concern for building owner liability and the size of claims that may be leveled against the building owner by the courts in the future, building owners tend to be extremely thorough and conservative when trying to assess the degree of asbestos hazard within their buildings.

The "state of the art" analytical method for determining the air concentration of asbestos fibers is to count the fibers on a filter by scanning electron microscopy or transmission electron microscopy rather than by the National Institute for Occupational Safety & Health (NIOSH) approved methods for occupational exposures using light microscopy. This method makes the smaller and thinner fibers substantially more visible by providing a magnification of 4,000 to 10,000 times rather than 400 times. For the values from the air samples to be useful they must be compared to values obtained from air sampled outside on a dry day and analyzed by the same manner. There is also a strong tendency to use what is termed aggressive sampling, where the pump is attached to an employee who is operating a leaf blower or equivalent apparatus to stir up any settled asbestos. The attempt here is not to provide representative air sampling but rather to document the greatest likely exposure.

The typical cost for a bulk analysis by polarized light microscopy and X-ray diffraction combined is $30-$35. The same cost is typical for a filter sample of air analyzed by phase contrast microscopy. Scanning electron microscopy or transmission electron microscopy will range from $300-$500 per sample.

Specifications for an Asbestos Building Survey

The first step in an asbestos abatement program is a complete building survey. The control technology recommended should be cost effective and address the long- and short-term asbestos risk. Some of the most important things to consider follow.

Selection of the Survey Team: The survey should be conducted by an individual with expertise in industrial hygiene and without any possible future involvement in the actual abatement activities other than as the owner's representative. Surveys performed by contractors or architectural firms should be recognized as not necessarily informed and/or unbiased.

Bulk Sample Analysis: The samples should be analyzed by polarized light microscopy with the composition verified independently by X-ray diffraction.

Risk Assessment: A well documented risk assessment instrument should be used to develop consistency and eliminate biasing the recommendations towards that which the client wants.

Air Samples: Air samples should be collected and analyzed by a standard, well recognized protocol. The samples must be large enough and enough fields counted to provide a sensitivity comparable to the outside air.

Laboratory Quality Control: Technicians who have been trained by the NIOSH short course and participate in the PAT (Proficiency Analytical Testing) program are qualified to establish laboratory quality control.

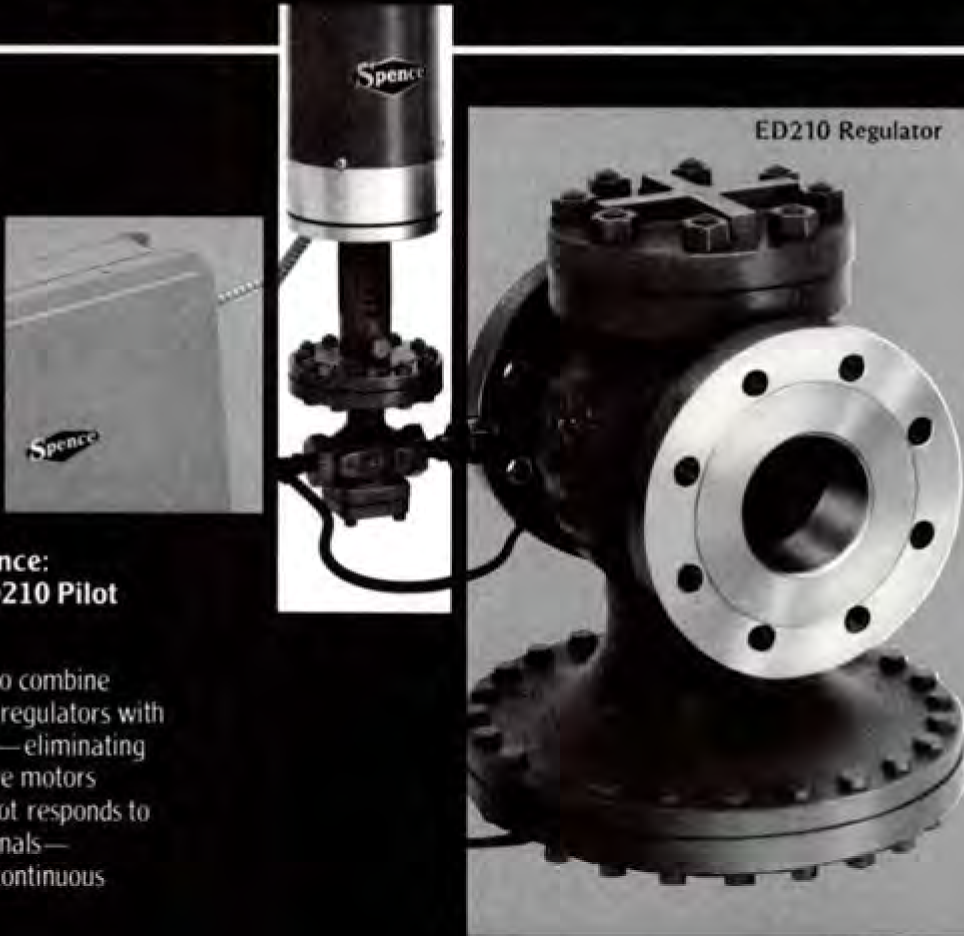
Pipe Lagging: A cataloging of the location, diameters, and length of pipes lagged with asbestos and instructions for labeling (or the actual labeling accomplished).

Final Report: To be useful the final report should contain information on the ceiling types in all buildings. For

Continued on page 18

Worker spraying penetrating sealer.

CONTINUOUS CONTROL.


ED210 Regulator

A new breakthrough from Spence: the electronically-controlled D210 Pilot for regulators.

The new D210 Pilot allows you to combine time-proven, cost-effective Spence regulators with state-of-the-art process controllers—eliminating the need for cumbersome, expensive motors and actuators. This sophisticated pilot responds to a variety of proportional control signals—including 4 to 20 mA—to provide continuous modulation of the main valve.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Designed for process control and HVAC applications, the D210 and D208 Pilots feature packless construction and are available with a back-up power supply. Spence main valves are offered in iron, bronze or steel construction in sizes from 3/8" to 12."

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Continued from page 16

those ceilings containing asbestos it should contain the following additional information: the percent composition and type of asbestos; the condition of the ceiling including location of any damaged spots; air sampling concentrations including the range and medium value in various locations; a recommendation as to the appropriate asbestos control technology; a recommendation as to the appropriate time-frame for completion of this control; and estimated costs if requested.

Asbestos Control Decision-Making

Following the asbestos survey report, the building owner may be expected to decide between four common procedures to control friable asbestos: 1) surveillance, 2) encapsulation, 3) enclosure, and 4) removal.

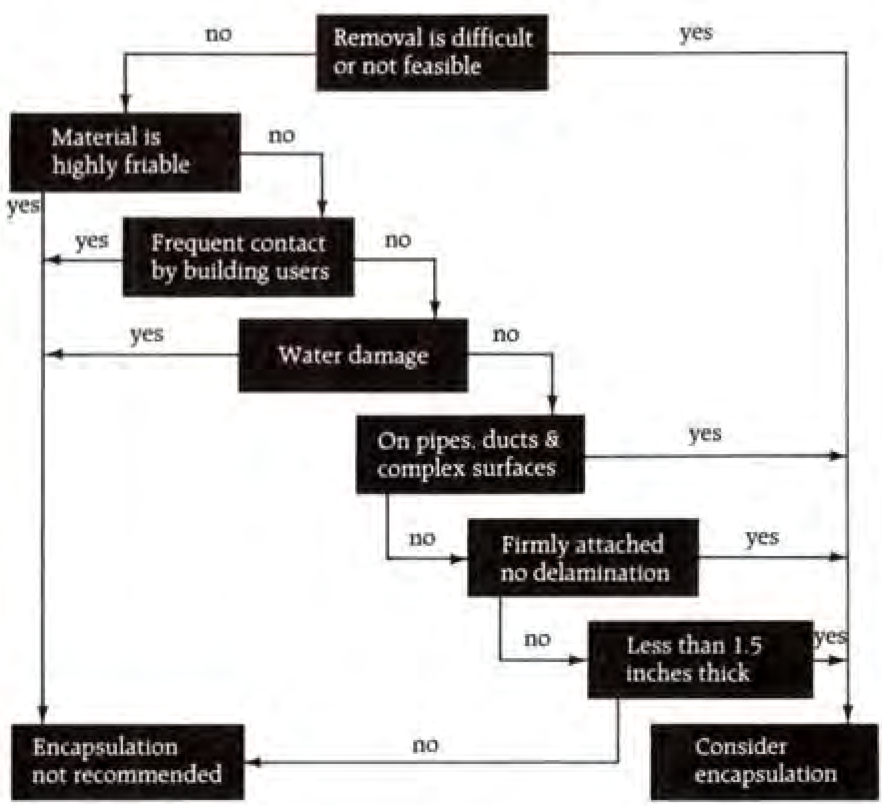
In *surveillance* a procedure is established for recording that the materials have been inspected for evidence of damage at predetermined intervals. The records should include a photograph or two plus the date, the results from air samples if taken, and the name of the person(s) responsible for the inspection. It is not a program of avoiding action but rather of verifying that deterioration has not occurred and nothing further is needed.

Encapsulation entails spraying, coating, or painting the asbestos with a bonding sealant which will keep the asbestos fibers glued together and eliminate any chance of friability developing. There are two types of encapsulating products commercially available: penetrating sealers which soak into the asbestos and glue the fibers together, and bridging encapsulants which form a continuous membrane on the surface that is impervious to fiber penetration. The two methods may be used separately or in combination.

Encapsulation is especially well-adapted for pipe lagging and may include covering the pipes with a pre-wet fiberglass cloth or vinyl wrap. It can also be used with boilers. But there are distinct limitations in using it with sprayed-on ceilings. Since the sealant rarely penetrates the asbestos further than about 3/8" it will add weight to a ceiling and may encourage delamination. The EPA has devised a useful guide for determining when it is appropriate to choose encapsulation. The flow-sheet is included in **Table 2**.

Mounting asbestos filters for phase contrast microscopy.

Table 2
Decision For Encapsulation



Very often *enclosure* is chosen as a control method in combination with encapsulation. Rarely should an enclosure method, such as putting a false ceiling in to limit the accessibility to overhead pipe lagging, be used by itself; but if one has decided to use regular planned surveillance and/or encapsulation, enclosing the asbestos may be an appropriate additional method of control. Enclosure is not a method to be recommended for badly damaged or friable asbestos ceilings since the carpentry work of adding the enclosure would in itself greatly increase the asbestos fibers released.

For most asbestos, and certainly for any which is badly damaged or friable, *removal* and disposal in an approved hazardous waste disposal site may be the only appropriate method of control. However, removal is not a simple procedure, and it is of the utmost importance that a building owner and/or the facilities manager understand this thoroughly. Because of the high cost of capital expenditures for asbestos vacs and negative air systems, it is rare to find a beginning contractor who can meet his costs and perform as satisfactorily as an experienced asbestos abatement contractor.

Air Concentrations of Asbestos During and After Asbestos Control

The bottom line for a school administrator in making an asbestos control technology decision rests with an answer to the question, "What levels of airborne asbestos can be expected before, during, and after the abatement and control or removal program?" Good and complete data on the airborne levels in any building can only be provided by an analytical testing laboratory. If the size and complexity of the job warrants it, such as in a removal from a continuously occupied building, there also should be a separate contract with an analytical testing laboratory who can provide industrial hygiene monitoring with the filter counting done on-site.

Between 1979 and 1981 asbestos was removed from twenty-four schools in the Seattle area with air monitoring before, during, and after removal provided by the industrial hygiene consultants from the Department of Environmental Health at the University of Washington. The data from the air sampling in these schools is shown in **Tables 3-5**. Before removal in these schools the airborne asbestos levels ranged from four to ten times the levels outside and/or in control schools having no asbestos in them. Immediately after removal, before reoccupancy of the building, the levels had dropped to a range from equal to the outside levels to five times it. One month after the removal all airborne asbestos levels had dropped appreciably and only two of the ten monitored schools showed anything statistically higher than the ambient outside levels. ■

Table 3
Airborne Asbestos Levels in Seattle Public Schools

Wet Removal	Before Removal (fibers/cc)	After Removal Before Re-Entry (fibers/cc)
Whittier	.046 ± .044 (18)*	.011 ± .009 (5)
Cooper	.035 ± .028 (20)	.013 ± .018 (9)
Fauntleroy	.034 ± .020 (7)	
McDonald	.030 ± .028 (13)	.039 ± .034 (6)
Magnolia	.030 ± .028 (24)	.009 ± .007 (7)
Bryant	.025 ± .013 (12)	.014 ± .015 (8)
Concord	.025 ± .026 (20)	.005 ± .004 (10)
Whitworth	.023 ± .013 (26)	.008 ± .008 (9)
Roosevelt	.022 ± .025 (27)	.024 ± .032 (8)

*Number of samples

Table 4
Airborne Asbestos Levels in Seattle Public Schools

Wet Removal	After Removal Before Re-Entry (fibers/cc)	Over One Month After Re-Entry (fibers/cc)
Emerson	.026 ± .016 (10)*	.001 ± .002 (2)
Mt. Rainier	.020 ± .018 (78)	.015 ± .007 (18)
Tyee	.020 ± .020 (22)	.004 ± .003 (18)
Bryant	.014 ± .015 (8)	.003 ± .003 (2)
Cooper	.013 ± .018 (9)	.003 ± .004 (4)
Madison	.013 ± .009 (7)	.010 ± .006 (9)
Magnolia	.009 ± .007 (7)	.008 ± .008 (4)
Whitworth	.008 ± .008 (9)	.003 ± .004 (4)
Concord	.005 ± .004 (10)	.006 ± .008 (4)
Franklin	.003 ± .002 (4)	.004 ± .005 (4)

*Number of samples

Table 5
Airborne Asbestos Levels in Seattle Public Schools

	Number of Schools	Asbestos Concentration (fibers/cc)
Before Removal	7	.027 ± .014
Immediately After Removal, Before Entry	13	.014 ± .010
Over One Month After Removal	10	.004 ± .003
Controls – Schools Never Containing Asbestos	4	.005 ± .002

Preparing a Service Contract for Elevator Maintenance

by Mohammad H. Qayoumi

Elevator maintenance is an important element in managing a physical facility, so proper care and prudent management decisions are needed. Some institutions have adopted the policy of servicing elevators by their own crew. This is a feasible option if there are enough elevators to justify having a full-time crew.

If an inhouse crew is servicing the elevator the facility manager can have better quality control over maintenance procedures. Moreover, the inhouse crew eventually gains an understanding of the peculiarities and idiosyncrasies of every elevator in the facility. This could possibly reduce down time during failures.

Normally, if a facility has a large number of low-rise buildings with relatively uncomplicated elevators, having an inhouse crew might be less expensive than having a service contract. On the other hand, with an inhouse crew the management has to establish and decide what level of spare parts they will keep for different brands. Keeping an adequate quantity of spare parts could be extremely expensive if the facility has many different types and brands of elevators.

In addition, public institutions are bound by civil service classification salary levels, which might make it hard for them to attract qualified candidates.

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Moreover, if you always have new buildings coming on line in your facilities, training could pose a problem. Generally, sending your crew to elevator maintenance workshops will be expensive and the absence hard to cover.

Therefore, we can safely assume that if a facility has a number of high-rise buildings and more complicated elevators, a service would then be less expensive than having an inhouse elevator maintenance crew.

This article will help you prepare your own specifications for service contracts for elevator maintenance. If new elevators are being installed in new or existing buildings within your facility, or if you choose to change over to contracted service on existing elevators, the following guidelines and specifications should assist you in writing a comprehensive service contract. (See **Addendum A** for the University of Cincinnati's current contract with a major elevator service company.)

Include the following items in your specifications.

1. The owner will get two complete sets of maintenance manuals, which shall include trouble-shooting sections, lubrication charts, schematics, list of parts, and recommended preventive maintenance.
2. The owner will receive at least eight hours of instruction on the operation and maintenance of every elevator.
3. The owner will receive any specialized tools and manuals.
4. The owner shall obtain a guarantee that the equipment and related spare parts for the elevator will not become obsolete for the average working life of the elevator.

There have been two different approaches to elevator service contracts. Some institutions have decided to classify elevators by manufacturer and have negotiated contracts with the service division of those elevators' manufacturers. This approach has several advantages. First, the manufacturer's representative has a better access to getting spare parts and engineering know-how on their elevators. Second, if there are any design upgrades, the owner will receive those as part of the service contract.

The disadvantage of this approach is cost. Generally, due to the proprietary nature of such contracts, the local manufacturer's representative rarely faces any competition. So his price will generally be higher than the open market rate.

On the other hand, some institutions have pioneered in awarding a service contract to one firm who would maintain all elevators regardless of brand. The companies who have provided such service can be the local service firm of an elevator manufacturer or an independent elevator servicing firm. The disadvantage of this approach is sometimes such firms might not be able to get spare parts as easily as a manufacturer's representative. Also, in the beginning it might take them longer to repair some elevators of a particular brand than the manufacturer's representative. But all things considered, this approach has its obvious economic advantages because it creates competition between different firms for getting the contract.

Presently, more and more institutions are following the second approach. The key for a successful service contract is preparing a comprehensive specification for this purpose. First, take an inventory of all elevators and break them down into the following classifications:

1. Escalators
2. Dumbwaiters
3. Freight elevators
4. Geared freight elevators
5. Gearless passenger elevators
6. Geared passenger elevators
7. Hydraulic passenger elevators
8. Oildraulic passenger elevators

Then, based on your order of importance, decide what type of service contract you would like for every elevator. There are mainly three types of service contracts:

a. Inspection contract
b. Minor maintenance contract
c. Full maintenance contract

Except for critical areas—such as with hospital operating room elevators where a 24-hour, seven-day-a-week service contract is required—it is cheaper to contract on a straight-time basis. A 24-hour-a-day contract on all elevators will be expensive and does not really provide much added convenience to the owner.

Also, ask the firms to give you a normal billing rate. This information will be helpful if you want them to perform work that is not part of the service contract. **Figure 1** shows typical hours and rates for regular and overtime elevator maintenance and stipulates when price adjustments may occur.

The servicing company must have been engaged in servicing elevators for at least three years.

Figure 1
Prices & Adjustments

Elevator Maintenance & Repair (1984-1985)

Labor rates and material costs for any emergency needs for the year that are not covered under the full maintenance and/or examination and lubrication service agreements.

Regular Working Hours
Monday–Friday, inclusive, 8:00 a.m. to 4:30 p.m.
Mechanic, straight time—$46.08 per hour
Helper, straight time—$32.26 per hour

Overtime Rates: (rates per hour)
1) Weekdays, 4:30 p.m. to 8:00 a.m. $69.12
2) Saturdays $69.12
3) Sundays and holidays $92.16
Parts: Shall be furnished at cost plus at list % for overhead and profit.
Car Mileage: For overtime call back service 23.5¢ per mile.

Price Adjustments

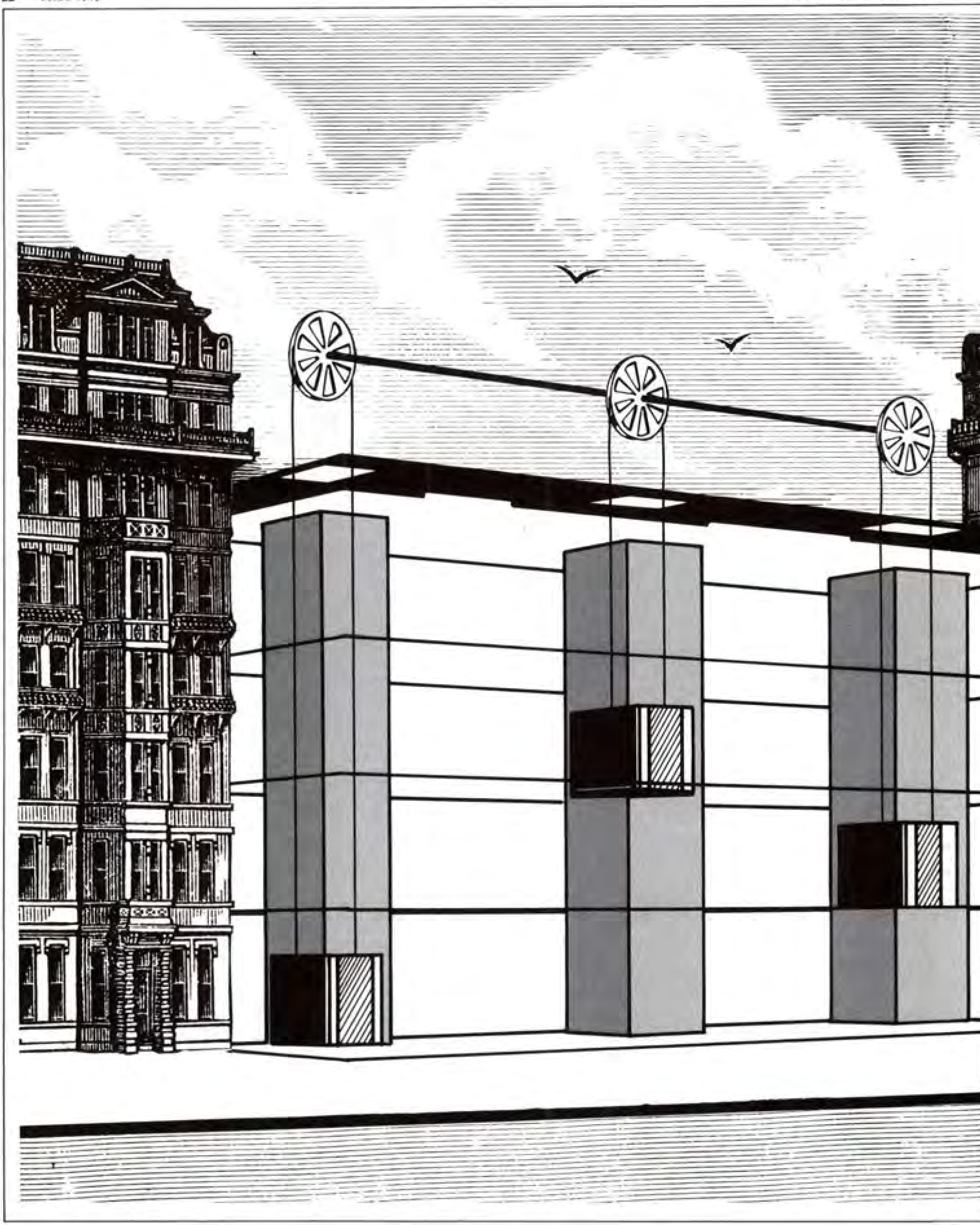
The agreement prices are subject to adjustment for each fiscal period (July 1 through June 30) in the following manner.

The *labor* portion of the agreement price shall be increased or decreased by the percentage of increase or decrease in the then current and published straight-time hourly rate for elevator constructors (mechanics), as compared with the rate for the previous fiscal year and in effect on April 1. The straight-time hourly rate for elevators constructors (mechanics) shall be the actual hourly rate paid to such mechanics, plus additive fringe benefits which may include, but are not limited to, pensions, vacations, paid holidays, group life insurance, sickness, and accident insurance and hospitalization insurance.

Current (April 1st) labor rate per hour including additive fringe benefits is $20.11.

The *material* portion of the agreement price shall be increased or decreased by the percentage of increase or decrease in the current *Producer Metals and Metal Products Commodity Index* (formerly *Wholesale Metals and Metal Products Index*), published by the U.S. Department of Labor, Bureau of Labor Statistics, as compared with the rate for the previous fiscal year and in effect on February 1.

Current (February 1) material rate index is 305.1. Adjustments shall be calculated and become effective July 1 for the next fiscal year (July 1 through June 30).



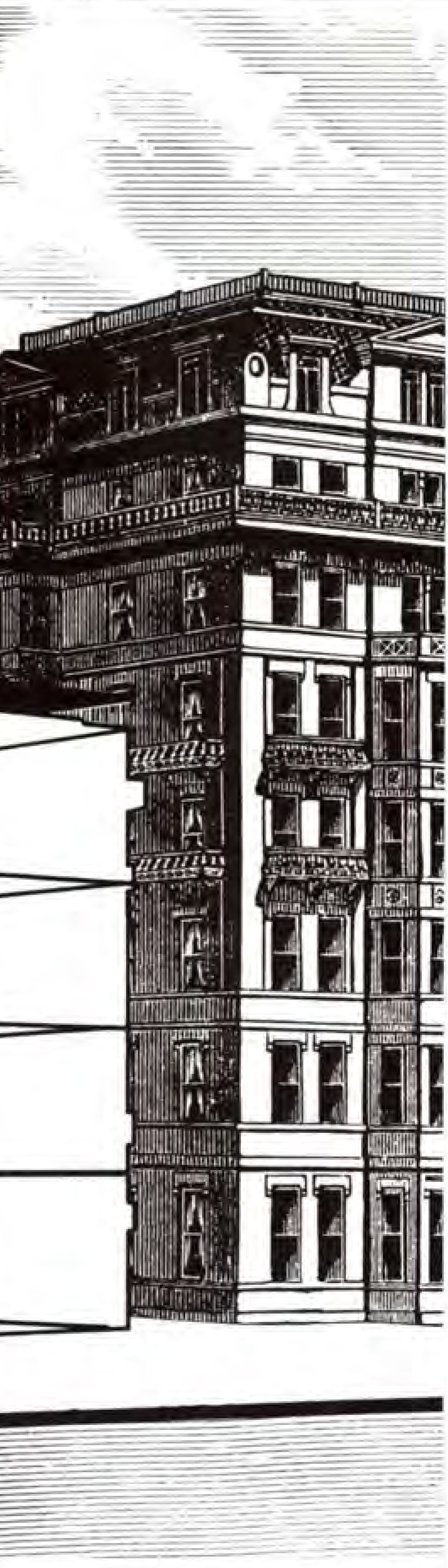


Figure 2
Equipment List for Elevator PM

Bearings
Brake magnet coils
Brakes
Buffers
Cams
Car & hoistway door hangers
Car door operating devices
Car door operators
Car flooring
Car operating panels
Car position indicators
Car safety devices
Coils
Commutators
Contacts
Control panel
Controller parts
Controllers
Corridor position indicators
Counterweights
Door operating devices
Door tracks & guides
Electric wiring
Gate hangers
Gears
Generators
Governors
Guide shoes
Hall lanterns
Heaters for oil reservoirs
Hoist machine
Indicators
Interlocks
Leveling devices
Magnet frames
Motor generator sets
Motors
Oiling devices
Packing for pistons
Pumps & valves for hydr. elevators
Push buttons
Relays
Resistance for motor & controllers
Rotating elements
Selectors
Sheaves
Signal bell
Signal systems
Starters
Switches on car & in hoistway
Telephone cables
Tension frames
Terminal & slow down devices
Thrusts
Traveling cables
Under car safeties
Windings
Wireropes & cables
Worms

Require the servicing technicians to sign in and out when they are in your facility. Also, require them to give a monthly written report on work performed on every elevator. This data gives the owner a maintenance history of each elevator. Moreover, from the data the owner can see how much it cost the servicing firm to maintain the elevators and what kinds of overhead and profit are associated with the service contract. It could be a useful piece of information during subsequent contract negotiations.

In the specification, mention the preventive maintenance (PM) that you want conducted in every elevator and at what frequency. The PM should include cleaning, lubricating, calibrating, adjusting, repairing, furnishing, and replacing parts of equipment as necessary. The PM should encompass at least the equipment listed in **Figure 2.**

A. Hydraulic Elevators

The PM for hydraulic elevators includes:

1. Examining and adjusting lubricant as required.
2. Repair or replacement of power unit, pump, motor, and controllers, valves, V-belts, strainers, springs, and gaskets.
3. Repair and replacement of controller relays, contacts, coils, timers, magnet frames, controller wiring, traveling cable, and components for operating circuit.
4. Repair or replacement of plunger, guide bearings, packing, packing gland, guide rail, guide shoes, retiring cams, landing door operators, limit switches, and interlocks.
5. Perform a hydraulic fluid analysis for contamination.

B. Electric Traction Elevators

The PM for electric traction elevators should include:

1. Adjusting and lubricating as required by manufacturer.
2. Repair or replacement of machine, motor, generator controllers including worms, gears, bearings, brakes, magnet coils, or brake motors, brake shoes, brushes, windings commutators, rotating elements, contacts, coils, resistance for operating and motor circuits, magnet frames, and other mechanical and electrical parts.

3. Equalizing tension on all hoisting ropes. Also, testing the safety devices and governors.

4. Replacing wire ropes as often as necessary to ensure adequate safety.

C. Escalators

The PM work should include:

1. Adjusting and lubricating as required using manufacturer's recommendations.

2. Repair or replace machine, worm, gear, drive chain, thrust bearing, main bearing, brake pulley, brake coil, lining, and related parts.

3. Repair or replace motor windings, rotor elements, and bearings.

4. Repair or replace upper drive bearings, tension sprocket bearings, lower and upper nevel bearings.

5. Repair or replace handrail, handrail drive chains, brush guards and roller guards, alignment devices, steps, step thread, step wheels, step chains, step axle bushings, comb plates, floor plates, and tracks.

6. Repair or replace relays, contactors, coils, resistances for operating transformers, and rectifiers.

D. Dumbwaiters

The PM on dumbwaiters should include:

1. Adjusting and lubricating as required based on manufacturer's recommendations.

2. Replacing or repairing machines, motors, bearings, windings, armatures, brakes, brake coils, and brake lining.

3. Repair and replace resistance for operating motor circuits, worms, gears, thrust bearings, sheaves, sheave bearings, machine bearings, controllers, selectors, relay panels, signal machines, motor generator sets, and starting panels.

4. Performing the necessary maintenance on interlocks, door hangers, door closers, retiring cams, car and landing door operators, safety edges, and switches.

Exclusions

The following items would normally be excluded from a service contract.

1. Any work on door panels, hinges, frames, gates, lighting fixtures and bulbs, indicator lights, push-button lights, mirrors, cabs, fuses, power switches feeders, hoistway enclosures, and oil hydraulic piston cylinders.

2. Any repair or replacement that was resulted from misuse or vandalism beyond the control of the service company except the normal wear and tear.

Suggestions on General Conditions

1. Work shall be performed only by qualified persons in a professional manner.

2. As work progresses, remove from the premises all debris resulting from the work and do necessary cleaning.

3. When entering the facility premises, the vehicles and personnel must be properly identifiable.

4. All work shall be done based on the latest issue of the American Standard Association and specifically the sections on "American Standard Safety Code for Elevators" and "American Standard Safety Practices for the Inspection of Elevators," and all other related federal, state, and local ordinances on elevator safety.

In addition to the above, include an option to add or delete elevators at negotiated rates. This will be useful if an elevator is under warranty during the time of the contract. Also, for financial reasons, some less important elevators might be deleted. Such a clause will make it possible. An out-of-fund clause is necessary for public institutions that might experience a budget cut during the contract period.

It is good practice to require the servicing company to conduct Esterline Recording Meter Tests and/or periodic Traffic Tests to ensure that the elevators' performance levels are sustained. Also, require the servicing company to submit to the owner a written report on the overall status of every elevator. The report should contain specific recommendations or repairs beyond the service contract to ensure the performance level of every elevator.

Specify a minimum amount of spare parts, i.e., coils, brushes, lubricants, wiping cloths, and other minor parts. The service company must keep these items in every elevator machine room for routine preventive maintenance. Also, specify a minimum inventory level for door operator motors, brake magnets, generator and motor brushes, controller switch contacts, selector switch contacts, solid state components, selector tapes, rollers, hoistway, limit switches, and any other essential parts you see fit. Such parts should be kept in a warehouse inventory locally or within a reasonable distance.

It is important to require a site visit by the service firms and get their written agreement that they will accept all your elevators as is. This will free the owner from any potential hassles later with the service firm on the condition of the elevators. Ask for the resumés of the service company technicians who will be maintaining your elevators. Also, get an agreement that the service company will not have any other person servicing your elevators without the owner's prior approval.

Specify a maximum time within which the servicing company must respond to service calls and provide competent service. Such a clause will give you leverage for prompt service during an emergency.

Finally, it is essential to mention that the servicing company must be equipped with special testing meters, instruments, and tools to facilitate prompt diagnosis, repair, or replacement without undue delays.

Qualification of Servicing Companies

1. The servicing firm has to demonstrate it possesses adequate financial resources, adequate spare parts inventory, and sufficient labor to perform the required service in a satisfactory manner.

2. The servicing company must have been engaged in servicing elevators for a period of not less than three years.

3. The service company must have inhouse and backup engineering capability to handle unique service problems. Also, it should maintain adequate supervision to control the activities of the technicians and the quality of work performed.

4. The service company shall have and maintain backup technicians qualified in all respects to assume the responsibilities of the service contract in the event of sickness, vacation, or termination of the assigned technician.

Based on the above criteria, it could be useful to pre-screen the prospective servicing companies by a prebid qualification.

Through the screening process you can look into each firm's references, the size of contracts they have had in the past, the number of qualified mechanics they have, and the kind of financial resources at their disposal. You can also extrapolate what possible impact your service contract will have on each firm if they were to undertake the task. As with any other maintenance contract, it will hardly be possible to write a specification to cover all possible aspects, but the above suggestions can be used as guidelines to meet the individual needs of your facility.

Addendum A
Sample Contract for Elevator Maintenance
Explanations for Abbreviation Codes

Type

D = Dumbwaiter
F = Freight
GF = Geared Freight
GLP = Gearless Passenger
GP = Geared Passenger
HP = Hydraulic Passenger
OP = Oildraulic Passenger
P = Passenger
S = Service

Location

MSB = Medical Sciences Building

Elevator-make

HAU = Haughton
WEST. = Westinghouse

Changes

Additions, deletions, or revisions in equipment shall be effective only when a change order is issued by the department of purchasing.

Specifications
General

1. The performance of work shall be in accordance with the following conditions and requirements

A. The work shall be performed in a proper workmanlike manner to the entire satisfaction of the university.

B. The work will be carried out in strict accordance with the latest applicable State of Ohio and city elevator ordinances, regulations, and requirements, and ANSI A 17.1 safety code.

C. Contractor shall protect all adjacent work, plantings, etc., and shall make good any damage thereto at his own expense.

D. Contractor shall clean up as the work progresses and shall remove from the premises all debris resulting from his operations.

E. If the contractor fails to prosecute the work expeditiously under this contract, then the university may, by written notice to the contractor, terminate the contract and award the work to someone else. The contractor shall be liable for any damages thereby incurred by the university including any additional cost as a result of awarding the work to another.

F. Upon completion and acceptance of all work required hereunder, the amount due the contractor under this contract shall be paid after the contractor shall have furnished the university with a release of all claims against the university arising under and by virtue of this contract. The university may, before making any payment, require the contractor to furnish releases or receipts from all persons performing work and supplying material to the contractor, if the university deems the same necessary in order to protect its interest.

G. Vehicles and personnel must be properly identifiable when entering university property. The elevator company will provide complete list of names (including supervisors) who may be on campus or in buildings inspecting or servicing elevator equipment.

2. Inspection prior to award

Prior to, and as a condition precedent to submitting his proposal, the contractor shall avail himself to the State of Ohio "elevator inspection reports" and other data, personally visit the various locations containing the elevators, and visually inspect the equipment. Failure to comply with this section will not relieve the successful contractor of full responsibility for performance of the service agreement.

3. Competence of the contractor

All labor furnished by the contractor shall be trained and thoroughly skilled in elevator maintenance and directly employed and supervised by said contractor. They will use all reasonable care to maintain the elevator equipment in proper and safe operating condition.

A. The elevator maintenance contractor shall maintain, in his employ during the term of the contract, a competent staff of qualified and thoroughly skilled elevator maintenance personnel to assure expedient and efficient maintenance service on routine minor repairs and adjustments and on major repairs and emergency calls.

B. The contractor shall have had a qualified service organization in active operation for a minimum of four years. This organization must have had a history of competent experience in maintaining specific type of automatic elevator systems as described in these specifications, and include sufficient qualified experienced supervisory personnel to guarantee satisfactory performance of the contract. In addition, the contractor shall furnish upon request a statement that he has under his direct employment and supervision the necessary personnel, organization, and facilities locally to properly fulfill all the services and conditions required under these specifications. All maintenance personnel used in fulfilling the requirements of this contract must be qualified to maintain this type of equipment. The contractor shall, upon request, give the contract number and building name of at least five similar installations the contractor presently has on service. Consideration wil not be given to bids submitted by an individual firm or corporation who has established on former projects, either government, municipal, or commercial, an unsatisfactory record of performance in connection with inspection or repair of elevators. The contracting officer reserves the right to determine the competency of contractors being considered for the award of this contract.

C. The elevator maintenance contractor, during the term that the agreement is in force, shall maintain an inventory on the job site, shop and place of business, sufficient normal replacement parts, components, materials, tools, equipment, and testing devices, to commence service adjustments and minor repairs, or parts replacements upon notification that elevator is malfunctioning or inoperable.

D. The elevator maintenance contractor shall assure, or present satisfactory evidence that he is able to acquire major replacement parts of suitable and genuine manufacture from a reliable source, and that such parts shall be compatible or interchangeable with the worn or defective parts replaced without damage to any other related part, or impairment to the operation of the elevator machinery and the expected life thereof.

4. Liability of the contractor

The contractor shall assume all liability for his operations under this contract and for all materials used. He shall furnish satisfactory certificates that he is covered by:

A. Workmen's compensation
B. Public liability & product liability, $500,000 each accident, $1,000,000 aggregate
C. Bodily injury liability, $500,000 each person, $1,000,000 each accident

Successful vendor will furnish insurance certificates to the department of purchasing immediately upon receipt of the contract.

5. Materials and parts

Materials and parts used shall be generally recognized in the trade as appropriate and safe for the specific use for which they are intended. The contractor shall be responsible for the selection of materials and parts that the manufacturer recommends as being most suitable.

6. Approval

The use of materials and parts other than those of the manufacturer of the elevator equipment must be approved in writing by the university.

7. Job material inventory

The contractor is to maintain a supply of contacts, coils, leads, generator brushes, lubricants, wiping cloths, and other minor parts in each elevator machine room for the performance of routine preventive maintenance.

8. Spare parts inventory

The contractor is to maintain a supply of, or have immediately available from the manufacturer, spare lending and replacement parts, including, but not limited to, generator rotating elements, door operator motors, brake magnets, generator and motor brushes, controller switch contacts, solid state components, selector tapes, door hangers, roller and hoistway limit switches.

9. Performance

The contractor is to maintain the original contract speed in feet per minute, the original performance time including acceleration and retardation as designed and installed by the manufacturer, and to perform the necessary adjustments as required to maintain the original door opening and closing time within limits of applicable codes.

10. Cancellation

The university reserves the right to make inspections and tests as and when deemed advisable, to ascertain that the requirements of this specification are being fulfilled. Should it be found that the requirements and standards herein specified are not being satisfactorily maintained, the university may immediately demand that the contractor, at his expense, place the elevators in condition to meet these requirements. This contract may be cancelled by either party at any time, provided nonperformance or sufficient cause can be shown.

A. *Contract contingent on availability of funds:* The term of the contract or the continuation of the contract, if continued, is contingent upon the availability of funds. Should funds be unavailable or not appropriated by the legislature of the State of Ohio, the contract is subject to cancellation. The option is maintained to reinstate and continue the contract should funds become available within a reasonable length of time. Should funds not be appropriated, neither the university nor any of its agents shall be liable for discharging such obligation.

11. Annual report

The contractor shall prepare and issue a typewritten itemized report to the university department once each year or more often as required.

The report shall make recommendations of specific terms of repair or maintenance that the contractor perceives and which are not included in this contract.

The recommendations contained in the report shall not be considered binding on the university.

12. Option to add or delete elevators

The university maintains the option to add elevators to the contract at the rates mutually agreed upon after warranty services have been fulfilled. In adding these elevators, consideration shall be given to the desirability of having all elevators in a particular building maintained by the same contractor. The university also reserves the right to remove units from service. By written notice the contract will be amended with terms and conditions to apply from the effective dates.

13. Callback, emergency, and special service calls

A. In the event of the failure of any covered elevator to operate properly, the university will notify the contractor and request immediate repair. For this purpose, the contractor shall maintain at all times office facilities, telephone, and personnel to promptly dispatch competent mechanics to repair any reported elevator.

B. The contractor shall attend to all calls within forty-five (45) minutes following notification. Continued failure to respond promptly or to provide competent service will be cause for the university to cancel the contract and require another contractor to perform the work at the expense of the contractor.

C. After each completed call, the contractor shall furnish a written report describing the cause of the elevator failure and the action taken to correct the failure.

Examination and lubrication service

1. Scope

The contractor shall provide all labor and lubricants necessary for and incidental to furnishing examination and lubrication on the elevators and/or dumbwaiters specified.

2. Work to be performed

Unless otherwise specified under the individual items, the contractor shall as a minimum once monthly examine, adjust, lubricate, and clean the equipment as follows.

A. Cleaning and oiling machine, motor, interlocks, and controller; greasing or oiling of guides, minor adjustments disclosed as reasonably necessary at the time of regular examinations, and furnishing the necessary lubricants, rope preservatives, and wiping cloths.

B. The contractor shall maintain hoistway, pit, machine room, and assigned elevator contractor work space in a clean, orderly condition, free of dirt, dust, and debris; pits and machine space shall be kept dry at all times.

C. The elevator contractor shall perform (as required) a full load or no load safety test and inspection and any other safety tests required by the State of Ohio. Copies of these test reports are to be forwarded to the state elevator division and to the university department for his file and record. Contractor shall resocket (reshackle) as required by the State of Ohio at no additional cost to the university.

D. All work included in the contract price shall be performed during the regular working hours of regular working days of the elevator trade. No work, parts, or supplies, except those specified herein, are included in the monthly rate. Should any additional callbacks or repairs be required, this work will be provided in addition to the contract price, at the contractor's billing rates for labor and materials specified in the contract.

Full Maintenance Agreement—Hydraulic Elevator Equipment Protection

1. Full maintenance service specifies a regular and systematic examination of the necessary repairs and replacements throughout the life of the contract. Examinations are to be made on a regular basis or as necessity demands. Service and inspection at least once (1) per month; however, if elevator usage dictates a need for more frequent servicing, the contractor shall be required to provide whatever is necessary to maintain the unit in good repair. However, the minimum number of inspections per month shall be performed. The inspection personnel are to contact the business manager, administrator, or authorized representative at the beginning of each visit in order to be advised if any particular point should be given special attention.

The contractor agrees to maintain the entire elevator equipment specified herein. Trained workers will be directly employed and supervised. If all or any part of the service to be rendered under this contract is delegated to authorized branches or agents, it is understood that the contractor is solely responsible to the University of Cincinnati for meeting and fulfilling all terms and conditions of this contract. The contractor will be qualified to keep the equipment properly adjusted and use all reasonable care to maintain the elevators in proper and safe operating condition.

2. The contractor shall regularly and systematically examine, adjust, lubricate as required, and, if conditions warrant, repair or replace power unit, pump, motor, and controller including:

A. Valves, including relief valve, pilot lowering, leveling and check valves, or any of the parts thereof.

B. V-belts, strainers, springs, and gaskets.

C. Controller relays, contacts, coils, timers, magnet frames and controller wiring, traveling cable, and components for entire operating circuit.

D. Plunger, guide bearings, packing, and packing gland.

E. Guide rails and guide shoes.

3. The contractor also agrees:

A. To furnish lubricants as specified by original manufacturer.

B. To maintain hydraulic fluid at proper operating level.

C. To make any adjustments, repairs, and replacements that may be advisable before the next regular examination.

D. To examine, lubricate, adjust, and if conditions warrant, repair or replace all accessory equipment, with exceptions as stated hereinafter.

4. The following items of elevator equipment are not included in the agreement: refinishing, repairing, or replacement of car enclosure, car doors, hoistway enclosures, hoistway door panels, frames and sills, car flooring and floor covering, light fixtures and lamps, main line power switches, breakers and feeders to controller, underground and/or buried piping and jack casing.

Make repair or renewals by reason of negligence or misuse of the equipment beyond the control of the contractor, except normal wear and tear.

5. The university will report immediately any condition that may indicate the need for correction before the next regular examination.

6. All work is to be performed during regular working hours of our regular working days unless otherwise specified.

7. If overtime work is requested by the university covering examinations, repairs, or emergency callback service, the university will pay for the difference between regular and overtime labor at the rates specified in the contract.

8. Either party may terminate the contract either at the end of the first year, or at the end of any subsequent year by giving the other party sixty (60) days prior written notice.

9. The elevator contractor shall perform (as required) a full load or no load safety test and inspection and any other safety tests required by the State of Ohio. Copies of these test reports are to be forwarded to the state elevator division and to the university department for his file and record.

Full Maintenance Agreement—Electric Traction Elevator Equipment Protection

1. Full maintenance service specifies a regular and systematic examination of the elevator equipment specified herein and to include necessary repairs and replacements throughout the life of the contract. Examinations are to be made on a regular basis or as necessity demands. Service and inspection at least once (1) per month; however, if elevator usage dictates a need for more frequent servicing, the contractor shall be

required to provide whatever is necessary to maintain the unit in good repair. However, the minimum number of inspections per month shall be performed. The inspection personnel are to contact the business manager, administrator, or authorized representative at the beginning of each visit in order to be advised if any particular point should be given special attention.

The contractor agrees to maintain the entire elevator equipment as specified herein. Trained workers will be directly employed and supervised. If all or any part of the service to be rendered under this contract is delegated to authorized branches or agents, it is understood that the contractor is solely responsible to the University of Cincinnati for meeting and fulfilling all terms and conditions of this contract. The contractor will be qualified to keep the equipment properly adjusted and use all reasonable care to maintain the elevators in proper and safe operating condition.

2. The contractor shall regularly and systematically examine, adjust, lubricate as required, and, if conditions warrant, repair or replace machine, motor, generator and controller parts including worms, gears, bearings, brake magnet coils, or brake motors, brake shoes, brushes, windings, commutators, rotating elements, contacts, coils, resistance for operating and motor circuits, magnet frames, and other mechanical and electrical parts.

3. The contractor shall agree:

A. To keep the guide rails properly lubricated at all times, except where roller guides are used, and when necessary to renew guide shoe gibs, or guide rollers when used, to ensure smooth and quiet operation.

B. To equalize periodically the tension on all hoisting ropes.

C. To renew all wire ropes as often as necessary to maintain an adequate factor of safety, and repair and/or replace conductor cables.

D. To furnish lubricants per original manufacturers' recommendations.

E. To make any adjustments, repairs, and replacements that be advisable before the next regular examination.

F.(a) Inspect and test all safety devices and governors, and equalize the tension on all hoisting ropes, as per the 1981 edition of *American Standard Safety Code for Elevators, Dumbwaiters, and Escalators.*

(b) All tests recommended in section 1001, "Periodic Tests and Inspections" including annual no load and five-year full load, shall be required with the exception of the 6-month test in section 1001.6A. The 12-month test in that section will be required.

(c) After award of contract, the contractor shall submit to each agency, within a reasonable time, an *approximate* schedule of when tests will be performed on the particular agency's units. This schedule shall include: (1) date of last test, and (2) approximate month in which the currently required test will be performed.

G. To examine, lubricate, adjust, and if conditions warrant, repair or replace all necessary equipment, with exceptions as stated hereinafter.

4. The following items of elevator equipment are not included in this agreement: refinishing, repairing, or replacement of car enclosure, car doors, hoistway enclosure, hoistway door panels, frames and sills, car flooring and floor covering, light fixtures and lamps, main line power switches, breakers and feeders to controller.

Make repair or renewals by reason of negligence or misuse of the equipment beyond the control of the contractor, except normal wear and tear.

5. The university will report immediately any condition that may indicate the need for correction before the next regular examination.

6. All work is to be performed during regular working hours of our regular working days unless otherwise specified.

7. If overtime work is requested by the university covering examinations, repairs, or emergency callback service, the university will pay for the difference between regular and overtime labor at the rates specified in the contract.

8. Either party may terminate the contract either at the end of the first year or at the end of any subsequent year by giving the other party sixty (60) days prior written notice. ■

Cutting Costs With Cooling Tower Water Conductivity Monitors

by Clyde I. Shay, Jr. and Kaye R. Straight

Ever increasing costs for water, chemicals, labor, and energy dictate that refrigeration and air conditioning cooling towers operate at optimum efficiency with maximum dependability. One major way to achieve this goal is by replacing the traditional mechanical cooling tower bleed control with an automatic electronic tower water conductivity monitor and bleed-off system.

Pure water theoretically contains no ionized impurities. However, each water source usually contains ionized impurities (TDS) of some type. The concentration of these impurities is a main determining factor of a tower operating pH as well as the point at which scale formation occurs.

Scale formation in a cooling tower is controlled in two ways. The primary mechanical control is the bleeding off of tower water and introduction of fresh water into the system. The secondary control introduces chemical scale inhibitors into the water. The electronic conductivity monitor is set for the limiting factor, i.e., hardness, alkalinity, silica, total pH, etc.

Washington State University operates forty-two cooling towers. These towers vary in age from less than one year to more than twenty years and range from 50 tons to 2,500 tons capacity. We have various types of cooling or refrigeration systems that incorporate the use of towers, such as reciprocating compressors, centrifugal compressors, and steam absorption units.

Many different types of cooling towers are utilized with type being a function of age, application, and capacity. While establishing our initial tower treatment program our goal was maximum reliability at reasonable cost, with the eventual objective being the development of a highly dependable system with overall minimum operating expense.

In developing our system at Washington State University we intentionally defined cooling tower bleed-off as being the total amount of water that leaves the cooling tower system, thus encompassing leakage, fan throw, and intentional waste. The required amount of tower bleed-off is in direct proportion to the evaporation rate.

At this point we experience the problem with the mechanical bleed-off system because the evaporation rate/total bleed-off relationship changes with system load, operating temperature, humidity, and air temperature. In reality, cooling tower operating conditions are in a constant state of change resulting in frequent mechanical bleed-off requirement changes, which were becom-

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ing quite expensive both in labor, water waste, and treatment costs. Usually the operator will anticipate the highest requirements for a given period based on past records and set the mechanical bleed-off system accordingly. During 75 percent of the operating time this setting will result either in water and chemical waste or scale formation.

Weekly Tower Checks

Our policy of checking every tower on a weekly basis was justified by the following:

1) Being a diversified research institution with many areas of emphasis, we have found that the reliable cooling of the research equipment became a critical part of our support for the research function.

2) Cooling water consumption was approaching 15 million gallons per calendar year and represented a significant operating cost for both water consumption and treatment chemicals.

3) The aquifer in the Pullman area provides water that contains 124 ppm of total hardness, 70 ppm of silica and has a pH of 7.5. Water of this quality, without treatment, has the capability of rendering an unattended cooling system inoperable within a two-week period.

4) Small amounts of scale formation were more expensive than the labor cost of mechanical bleed-off.

Over a two-week period as much as a 10 percent reduction in efficiency was experienced on a 200 ton/hour steam absorption unit that developed scale formation. The bottom line was an increased cost of $240 per week for steam production, which could have been eliminated by an $11.25 per week labor cost attributed to weekly or more frequent checks to include mechanical bleed-off and chemical adjustments.

In an attempt to optimize water and chemical usage with the mechanical bleed-off controls, we found that our maintenance on cooling towers was becoming more labor intensive. Modern water treatment technology came to the rescue providing an economical and viable alternative—the automatic electronic power conductivity monitor and bleed-off system.

This system operates by measuring the amount of ionized impurities in the cooling tower water in direct relationship to scale formation. The electronic conductivity monitor constantly meas-

Central chiller plant with 1000- and 2000-ton centrifugal chillers. Cooling towers are in open enclosures on left and right sides of building.

Monitor units serve the "open" cooling towers of the chiller plant.

ures this ionization and automatically activates the intentional bleed only when it is required, then shuts it off when the desired ionization level is reached.

This equipment will also monitor and provide the chemical control for the cleanup of systems that have indicated scale deposits. Our experience has shown a 20 percent increase of efficiency at a cost of less than one dollar per system ton. This is much more cost effective than the manual cleaning required when utilizating mechanical bleed-off and is much less aggressive to the total cooling tower system.

We no longer pretreat cooling tower makeup water and have eliminated the use of water softeners. Chemical treatment of the makeup water is accomplished by means of a water meter and a counter/timer package that controls a chemical feed pump. Intentional bleed-off is controlled by the electronic tower water conductivity monitor. Cooling tower discharge water is not given any further treatment before entering the storm sewer system, so the makeup water treatment chemicals must be environmentally safe.

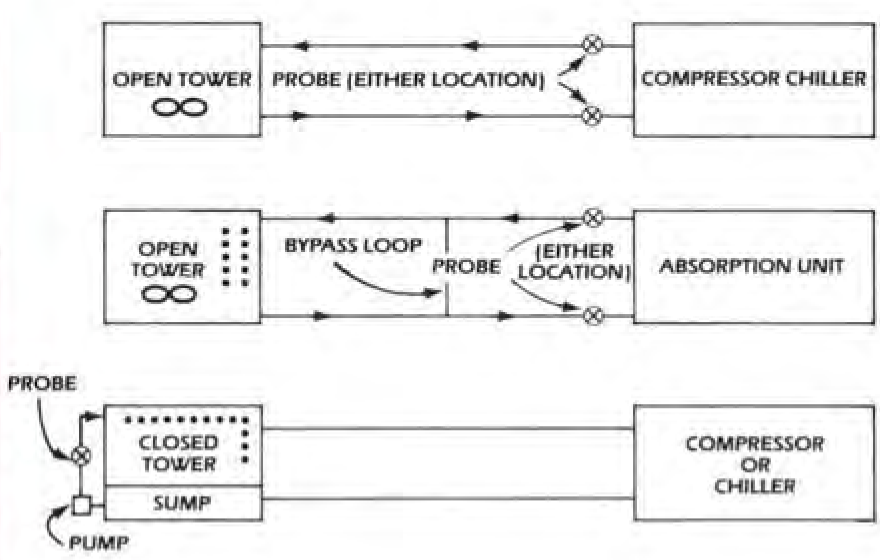
Washington State University has had two such units on line since 1976 and has experienced no maintenance or parts replacement for the electronic monitoring system to date. Subsequently we installed these monitors on the remainder of our twenty-four air conditioning cooling towers two years ago and are currently ordering and installing this equipment for eight of our refrigeration cooling towers.

Costs and Savings

The cost of the installation of each monitor was $522. The water meter and counter/timer package was in place and used for mechanical bleed-off operations; therefore, the only additional cost was for the conductivity monitor. The total cost to install a complete package from scratch would be slightly under $3,000, evidenced by us during a recent mechanical system remodel contract. A schematic of the probe location for each of the systems is found in **Figure 1.** Based on our records for the 1980, 1981, and 1983 cooling seasons, comparing costs of mechanical bleed-off (1981) to automatic monitoring (1983) on sixteen large cooling towers, we realized an average minimum labor savings of $9 per operating week per unit based on a

One of two "open" cooling towers.

Figure 1: Schematic of Probe Location



$20 per work hour total labor charge-out rate. The following information supports the claim:

A. W.S.U. Operating Criterion

(1) Water consumption to be held within 10% of optimum – adjust to achieve this level.
(2) Peak cooling season years 1980, 1981, 1983.
(3) Based on 16 towers average performance.
(4) Based on 10 weeks of peak cooling operation.

B. 1980—Mechanical Bleed-Off

(1) Frequency of tower imbalance-84%
(2) Number of adjustments-270
(3) Total cost of adjustments-$1,800
(4) Cost/Tower/Week - $11.25

C. 1981—Mechanical Bleed Off

(1) Frequency of tower imbalance-73%
(2) Number of adjustments needed-230
(3) Total cost of adjustments-$1,530
(4) Cost/Tower/Week = $9.56

D. 1982—Conversion to Automatic Monitors

E. 1983—Full Operation on Automatic Monitors

(1) Frequency of tower imbalance-8%
(2) Number of adjustments needed-13
(3) Total cost of adjustments-$86
(4) Cost/Tower/Week - (–$0.54)

Conclusion

During the 1984 cooling season our adjustments were reduced by an additional 25 percent. This is the level anticipated for future operations. Total cost savings comparing 1981 to 1983 operations was an average of $90.20 per tower (an annual total of $2,164.80 for the twenty-four cooling towers) for the ten-week peak cooling period.

Based on labor savings only, the installation of the automatic electronic tower water conductivity monitor and bleed-off systems will be paid for over six years of operation, i.e., by the completion of the 1988 cooling season. If savings in chemical costs and water consumption costs were also compared, this pay period would be shortened considerably. ■

"Open" cooling tower, served by conductivity monitor, located on roof of communications building.

Conductivity monitor for "open" cooling tower. Monitor is located in basement mechanical room of three-story communications building.

The Bookshelf

Energy Engineering

Fundamentals of Energy Engineering, by Albert Thumann, P.E., C.E.M., Atlanta: Fairmont Press, 1984. 446 pp. $29.95, hardcover.

Many books have been written in the past decade promoting energy management, but very few have as much to offer physical plant administrators as *Fundamentals of Energy Engineering*. Since most colleges and universities have already established some sort of program to control energy costs, all books concerning energy management are potentially useful. This book is truly exceptional, however, as it presents the basic concepts surrounding all widely accepted energy conservation methods and allows the reader to at least consider them all before selecting those most appropriate for the facility involved.

The book follows a logical sequence, beginning with a chapter on the current energy situation and ending with a chapter on energy management techniques. Thirteen other chapters complete the work, covering topics from energy economic analysis and energy auditing, to cogeneration, biomass technology, and active solar energy systems. Since the book covers the entire spectrum of energy engineering, there is information for every institution, regardless of size.

Chapters covering economic analyses and energy audits have special meaning for programs that are still being developed, while chapters on waste heat recovery systems, utility system optimization, cogeneration, and biomass technology might appeal to institutions searching for the next level of energy savings.

The information is presented in a manner that assumes little prior knowledge on the part of the reader. It proceeds from the basics and theory of energy utilization to more specific state-of-the-art applications and alternative solutions. While the book can be quite technical, the reader is not required to wrestle with high powered thermodynamic or economic calculations in order to understand the basic message of each section or chapter.

In fact, the chapter on maintenance and energy management programs is the least technical and probably most universally applicable and useful part of the book. In this chapter the author stresses the benefits of both programs, the former embracing the careful attention required by energy systems already in place; and the latter stressing the continuing necessity for maintaining energy awareness as a primary management goal. The key concepts that are conveyed here are easy to understand but often difficult to implement. To paraphrase the author, facility engineers must optimize the operation of all existing equipment and systems, while

constantly promoting energy conservation as an absolute requirement for all members of the institutional community.

One of the great strengths of *Fundamentals of Energy Engineering* is the author's use of information from manufacturers and other authors who have developed products or designs appropriate for use by energy engineers. For example, the chapter on cogeneration, by Carl E. Salas, P.E., covers only twelve pages yet concisely explains the benefits of cogeneration and how this system takes energy through two useful cycles rather than the conventional single process. The author's definition—"Cogeneration is the sequential production of electricity and heat, steam or useful work from the same fuel source"—should be reviewed carefully by facilities managers when new or renovated power plants are considered.

On the negative side, some information in the book is of limited value for most institutions. In particular, the chapter on synfuels discusses systems and processes for producing synthetic gases or liquids from coal; it would appear that few institutions would be able to construct and operate such systems under current technological and financial constraints. For similar reasons, the chapter on wind energy technology also seems inappropriate.

Another aspect of the book that deserves comment is the author's perspective on energy conservation. As the title states, this book attempts to present a framework for promoting conservation through the use of techniques and applications of "energy engineering." In addition to promoting the connection between engineering expertise and energy conservation, the author also promotes energy engineering as an emerging academic discipline, embracing the principles of engineering, architecture, and economics. Even if Energy Engineering 101 is never taught in college, this book will still retain its value for the reader.

In conclusion, *Fundamentals of Energy Engineering* is not a cookbook for specific strategies, but rather a general primer on energy conservation principles and systems. If, as the saying goes, a problem well defined is half solved, then this book will help solve many energy-related problems by assisting management in recognizing and defining their energy-related environment.

Copies are available for $29.95 from the Fairmont Press, Inc., P.O. Box 14227, Atlanta, GA 30324.

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Management Theory vs. Practice

Strategies for Managing Change, by William G. Dyer. Reading, Mass.: Addison-Wesley Publishing Company, Inc., 1984. 202 pp. $19.95, hardcover.

Any book in the field of management must become caught in the tension between the theoretical and the practical; that is, whether the author is writing primarily for the benefit of his or her fellow faculty and students, or for the practicing manager and consultant. As management theory, a work may take on the character of the sciences from which it properly draws: psychology, sociology, mathematics, and philosophy, to name a few. As a practical tool, it may take on any number of forms from a strategy analysis to a handbook or training manual.

In *Strategies for Managing Change*, William Dyer brings to the subject a great deal of knowledge and personal experience, both as a professor of management and as a consultant to many well-known firms. His background depicts the stated tension of these positions. If it is true that the theory and practice of management are complementary, then it should be possible to bring the two together in a single work, perhaps stressing one, but certainly not to the exclusion of the other. The author indeed has attempted to do this. Insofar as it deals in theory, the book is a concise 202 pages and touches on most of the major issues in the field. A number of practical insights are to be found in its pages. How far the two aspects are successfully brought together, however, and consequently how to evaluate the work as a whole, is more difficult.

A clue to evaluating the work can perhaps be attained from chapter 12, The Strategy of Adjustment to Expectations. Dyer states that a relationship always entails "certain expectations about the behavior of the other person and that problems arise when role expectations are at variance with role performance." The problem that arises in the relationship between the reader and the author is that Dyer leads the reader to expect a work that is primarily practical in character, yet fails to fully deliver.

The jacket of the book speaks of "specific suggestions" and how the book will "show you how" to handle a number of difficult management situations. In the preface, Dyer explicitly states that "it is for both the manager and the professional change agent that this volume has been prepared." If these expectations are ever truly met they are done so very slowly. The latter half of the work does contain good practical insights, but I suspect that the "shirt-sleeves" manager or the executive administrator will become impatient with it rather quickly.

Although the author does not attempt to develop a new theory within the book, his tone and language resemble the abstract presentation of an academic work. For example, when speaking of the difficulty of interpersonal communication, Dyer says, "The behavior of A may be a very clear representation of his or her intentions, but if B has a clogged filter or perceptual screen and perceives the behavior quite differently than was intended, the resulting impact will not be what A desired." Of course, such abstractness can greatly extend the applicability of the concept, but it can be tiresome when it is not clearly relevant to the discussion.

Dyer also has a tendency to engage in speculations that are only tangential to the subject. For example, in the second chapter the reader expects to find an historical overview of management issues as indicated by its title, Emergence of Planned Change. The author begins this chapter by quoting Genesis 18, in which Jethro counseled Moses on the management of the tribes of Israel and was therefore, according to Dyer, the first management consultant. From that point he jumps to 1930 with a short discussion of the Harvard Hawthorne studies and then moves on to describe a few subsequent topics in the literature.

Several questions arise in the mind of the reader, namely, what, if anything, happened in the field between 1200 B.C. (or thereabouts) and 1930. More interestingly, even if less importantly, was Jethro really the first management consultant? Earlier examples can probably be found in Indian and Egyptian texts and even in the Bible itself when God was purported to have been counseled by Lucifer concerning the destiny of mankind. As the story goes, the latter ultimately disagreed with management, and, as a result, must have also gained the dubious distinction of being the first management consultant to have been permanently "fired."

The above considerations notwithstanding, Dyer's work would be excellent reading for a management course, or as an introduction for a manager or consultant who wished to become familiar with the literature of the field. It contains a valuable bibliography and some interesting case studies. The work as a whole reflects the breadth and depth of the author's talents and, although it may not be a volume that practicing managers would keep on their desks, it is a likely candidate for the office reading table.

Strategies for Managing Change is available for $19.95 from most bookstores and from Addison-Wesley Publishing Company, Reading, MA 01867.

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Health Maintenance for the Successful Manager

The Hardy Executive: Health Under Stress, by Salvatore R. Maddi and Suzanne C. Kobasa. Homewood, Ill.: Dow Jones-Irwin, 1984, 131 pp. $19.95, hardcover.

Few persons in positions of responsibility escape the impact stress can place on their daily lives. Studies examining the effects of stress on managers/executives have been plentiful in the last several years. In *The Hardy Executive*, however, authors Maddi and Kobasa approach the topic from a different perspective—that stressful events do not have to debilitate and, indeed, can even result in positive outcomes.

The authors conducted a longitudinal study of executives at Illinois Bell Telephone during the breakup of the Bell System. The study followed the lives of these executives who were faced with significant readjustments in their working environment, i.e., stress-related events. Through a high rate of participation, quantitative data was collected rather easily over a period of several years.

The book develops the theory that "hardiness helps executives cope with stressful life events in a way that prevents the strain that leads to illness." Hardiness is defined as a combination of the personality characteristics of commitment, control, and challenge. Thus, when faced with stressful life events, those persons having more resistance resources such as hardiness are less likely to be debilitated. Maddi and Kobasa found that "despite the anxieties and risks they encounter, these people find their lifestyle generally exciting and satisfying, in part because it is strenuous."

The premise at first sounds superficial. In fact, an indepth study based upon such a theory appears unworthy of serious scientific examination. Yet, the topic is so engrossing that the reader moves from skeptic to cheerleader supporting the authors' endeavor.

Maddi and Kobasa examine their theory in a step-by-step progression using examples from their study to develop a model of stress resistance. Refined questionnaires measured hardiness, which was shown to be a buffer against the debilitating effect of stress. Compared with other more commonly known buffers such as exercise and social support, hardiness proved to be the most powerful trait in protecting against illness.

As a director of physical plant who faces daily stressful events, I found myself ultimately wanting the theory to be proven. Any resource offering resistance to stress and its effect on health appears attractive. Of course, reading about hardiness does not mean one automatically acquires the trait. However, Maddi and Kobasa feel that personality hardiness can be learned at any time of life. They suggest that counseling can offer ways of overcoming attitudes of alienation, powerlessness, and threat, thereby building hardiness. This can be achieved through four interrelated techniques—focusing, situational reconstruction, compensatory self-improvement, and paradoxical intention. Each technique emphasizes the reaction to present life rather than the interpretation of the past as purported by more traditional therapies.

The book is short, easy to read, and thought-provoking. The key word is hardiness. It can offset the negative effects of stress.

The Hardy Executive: Health Under Stress is available for $19.95 from Dow Jones-Irwin, 1818 Ridge Road, Homewood, IL 60430.

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