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A Conversation With Walter A. Schaw  

by Steve Howard ........................................ 3

Systems Analysis Approach to Work Control  

by Ed Schon .............................................. 10

Asbestos Control Technology  
in Schools and Public Buildings  

by Dorothy L. Stansel ......................... 13

Preparing a Service  
Contract for Elevator Maintenance  

by Mohammad H. Qayoumi .................. 20

Cutting Costs With Cooling Tower  
Water Conductivity Monitors  

by Clyde I. Shay, Jr. and  
Kaye R. Straight ......................... 29

The Bookshelf ........................................ 33

Reviewed in this issue:  
Fundamentals of Energy Engineering  
Strategies for Managing Change  
The Hardy Executive: Health Under Stress

Guidelines for Authors ......................... 35
Classifieds ............................................. 36
Index of Advertisers ......................... 36
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A Conversation With Walter A. Schaw

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.
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 now. 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 tuitions 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 unrepaird 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
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, purchasing, 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 being 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 ex-
ecutive director, in concert with the of-
fice, 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 In-
diana University system. I also had re-
sponsibility 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 con-
tains detailed information on 60,000 IU
alumni to date. Part of that data is criti-
cal to a $200 million capital campaign
now in progress at the university. I was
responsible for alumni printing and
mailing operations as well, which en-
compassed 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 dilu-
tion of the job function of the profes-
sion. Certain areas that we had been
traditionally responsible for suddenly
came into the limelight. Some more ex-
plosively 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 engineer-
ing. It was important to define the pro-
ession, 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 mil-
don.' And I would say, 'Tell me, do you
perceive yourself primarily as an en-
gineer 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
groups spread over a number of issues
and that nobody was focusing neces-
sarily 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 Cal-
vil Coolidge's time. Our success from
then to now has been one million dol-
ars a month in savings for higher edu-
cation alone.

The upshot of this example is that it
demonstrated that universities and col-
leges working together can have a pow-
erful 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 hap-
pened 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 na-
tion, then we are in deep trouble. I re-
fused to believe what I was told, by a
knowable 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 direct-
ors, 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 re-
lationships 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 reten-
tion is a problem with many associa-
tions. How do you feel about its impor-
tance?

In association work we sometimes
decome distracted by projects other
than what I would call the root basics.
The ability to attract and retain mem-
bers 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 gen-
erally 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 AIE. I also had to complete an examination that tested my ability and

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

**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.
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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 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.

**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 determining 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 you to gather, store, and retrieve data based on a program of your choice.

**Question 5: Will the parameters of the program (free vs. recharge items, etc.) be necessary, or will an off-the-shelf "canned" program work?**

Purpose: This question is important in determining 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 you to gather, store, and retrieve data based on a program of your choice.

---

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

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

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 ÷ 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 ÷ 123).

Records are then organized by files. Files are usually labeled by a code word that represents the file content; for example, WRRFIL. 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 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 building 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 that 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.

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:

\[
\text{Ferris Index} = (\text{Access.} + \text{Cond.} + \text{Fri.} + \text{Loc.}) \times \text{Percent}
\]

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...
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.
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-$55. 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

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.

A substantial energy-saving opportunity from Spence. The electronic D208 Pilot makes actuation of a steam regulator as simple as turning a light on and off.

Steam systems lose heat to their surroundings when pressurized. If the system is not being used, shutting it off results in energy savings. Programmed automatic actuation of a steam regulator permits savings in both manpower and energy.

When activated, the electronic D208 provides an automatically-controlled safe, slow start-up of a Spence pressure or temperature regulator. Programmed automatic actuation of a Spence regulator thus becomes a reality.

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 ⅜" to 12".

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Spence Engineering Company, Inc.
P.O. Box 230, 150 Goldenham Road, Walden, New York 12586
Tel. (914) 778-5566, Telex: 926-476
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.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Decision For Encapsulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material is highly friable</td>
<td>no</td>
</tr>
<tr>
<td>yes</td>
<td>Frequent contact by building users</td>
</tr>
<tr>
<td>yes</td>
<td>Water damage</td>
</tr>
<tr>
<td>no</td>
<td>On pipes, ducts &amp; complex surfaces</td>
</tr>
<tr>
<td>yes</td>
<td>Consider encapsulation</td>
</tr>
<tr>
<td>no</td>
<td>Less than 1.5 inches thick</td>
</tr>
<tr>
<td>yes</td>
<td>Encapsulation not recommended</td>
</tr>
<tr>
<td>no</td>
<td>Firmly attached no delamination</td>
</tr>
<tr>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>

Mounting asbestos filters for phase contrast microscopy.
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 1970 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

<table>
<thead>
<tr>
<th>Table 3</th>
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<tbody>
<tr>
<td><strong>Airborne Asbestos Levels in Seattle Public Schools</strong></td>
</tr>
<tr>
<td>Wet Removal</td>
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<td>---</td>
</tr>
<tr>
<td>Whittier</td>
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<tr>
<td>Cooper</td>
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<tr>
<td>Fauntleroy</td>
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<tr>
<td>McDonald</td>
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<tr>
<td>Magnolia</td>
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<tr>
<td>Bryant</td>
</tr>
<tr>
<td>Concord</td>
</tr>
<tr>
<td>Whitworth</td>
</tr>
<tr>
<td>Roosevelt</td>
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</tbody>
</table>

*Number of samples

<table>
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<tr>
<th>Table 4</th>
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<tbody>
<tr>
<td><strong>Airborne Asbestos Levels in Seattle Public Schools</strong></td>
</tr>
<tr>
<td>Wet Removal</td>
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<tr>
<td>---</td>
</tr>
<tr>
<td>Emerson</td>
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<tr>
<td>Mt. Rainier</td>
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<tr>
<td>Tyee</td>
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<tr>
<td>Bryant</td>
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<td>Cooper</td>
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<td>Madison</td>
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<td>Magnolia</td>
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<td>Whitworth</td>
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<tr>
<td>Concord</td>
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<tr>
<td>Franklin</td>
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</table>

*Number of samples

<table>
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<tr>
<th>Table 5</th>
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<tbody>
<tr>
<td><strong>Airborne Asbestos Levels in Seattle Public Schools</strong></td>
</tr>
<tr>
<td>Number of Schools</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Before Removal</td>
</tr>
<tr>
<td>Immediately After Removal, Before Entry</td>
</tr>
<tr>
<td>Over One Month After Removal Controls–Schools Never Containing Asbestos</td>
</tr>
<tr>
<td>Controls–Schools Never Containing Asbestos</td>
</tr>
</tbody>
</table>

After removal, the levels outside and/or in control schools having no asbestos in them. Immediately after removal, before re-occupancy 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.
Preparation of a Service Contract for Elevator Maintenance

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.

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

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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. Oldfashioned 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 $23.54 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 elevator 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).
Requirement 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 cases, 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.

### Figure 2
#### Equipment List for Elevator PM

<table>
<thead>
<tr>
<th>Bearings</th>
<th>Hoist machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake magnet coils</td>
<td>Indicators</td>
</tr>
<tr>
<td>Brakes</td>
<td>Interlocks</td>
</tr>
<tr>
<td>Buffers</td>
<td>Leveling devices</td>
</tr>
<tr>
<td>Cams</td>
<td>Magnet frames</td>
</tr>
<tr>
<td>Car &amp; hoistway door hangers</td>
<td>Motor generator sets</td>
</tr>
<tr>
<td>Car door operating devices</td>
<td>Motors</td>
</tr>
<tr>
<td>Car door operators</td>
<td>Oiling devices</td>
</tr>
<tr>
<td>Car flooring</td>
<td>Packing for pistons</td>
</tr>
<tr>
<td>Car operating panels</td>
<td>Pumps &amp; valves for hyd. elevators</td>
</tr>
<tr>
<td>Car position indicators</td>
<td>Push buttons</td>
</tr>
<tr>
<td>Car safety devices</td>
<td>Relays</td>
</tr>
<tr>
<td>Coils</td>
<td>Resistance for motor &amp; controllers</td>
</tr>
<tr>
<td>Commutators</td>
<td>Rotating elements</td>
</tr>
<tr>
<td>Contacts</td>
<td>Selectors</td>
</tr>
<tr>
<td>Control panel</td>
<td>Sheaves</td>
</tr>
<tr>
<td>Controller parts</td>
<td>Signal bell</td>
</tr>
<tr>
<td>Controllers</td>
<td>Signal systems</td>
</tr>
<tr>
<td>Corridor position indicators</td>
<td>Starters</td>
</tr>
<tr>
<td>Counterweights</td>
<td>Switches on car &amp; in hoistway</td>
</tr>
<tr>
<td>Door operating devices</td>
<td>Telephone cables</td>
</tr>
<tr>
<td>Door tracks &amp; guides</td>
<td>Tension frames</td>
</tr>
<tr>
<td>Electric wiring</td>
<td>Terminal &amp; slow down devices</td>
</tr>
<tr>
<td>Gate hangers</td>
<td>Thrusts</td>
</tr>
<tr>
<td>Gears</td>
<td>Traveling cables</td>
</tr>
<tr>
<td>Generators</td>
<td>Under car safeties</td>
</tr>
<tr>
<td>Governors</td>
<td>Windings</td>
</tr>
<tr>
<td>Guide shoes</td>
<td>Wireropes &amp; cables</td>
</tr>
<tr>
<td>Hall lanterns</td>
<td>Worms</td>
</tr>
<tr>
<td>Heaters for oil reservoirs</td>
<td></td>
</tr>
</tbody>
</table>
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 re-
quired using manufacturer's recom-
mendations.
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 level bearings.
5. Repair or replace handrail, hard-
rail 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, contact-
tors, coils, resistances for operating
transmitters, and rectifiers.

D. Dumbwaiters
The PM on dumbwaiters should in-
clude:
1. Adjusting and lubricating as re-
quired based on manufacturer's recom-
endations.
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 bear-
ings, machine bearings, controllers,
selectors, relay panels, signal machines,
motor generator sets, and starting
panels.
4. Performing the necessary main-
tenance on interlocks, door hangers, door
closers, refrigeration, 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 com-
pany 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 "Ameri-
can Standard Safety Practices for the
Inspection of Elevators." and all other
related federal, state, and local ordi-
nances 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 term of the contract. Also, for fi-
nancial 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
services of a company to conduct Esterline
Recording Meter Tests and/or periodic
Traffic Tests to ensure that the
elevator's performance levels are sus-
tained. Also, require the servicing com-
pany 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 writ-
ten 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 resumes
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,
instrumemes, and tools to facilitate
prompt diagnosis, repair, or replace-
ment without undue delays.

Qualification of Servicing Companies
1. The servicing firm has to demon-
strate it possesses adequate financial
resources, adequate spare parts inven-
tory, 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 no less than three years.
3. The service company must have
inhouse and backup engineering capa-
ibility to handle unique service prob-
lems. 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 qual-
ified in all respects to assume the re-
 sponsibilities 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 pre-bid quali-
fication.

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 as-
psects, but the above suggestions can be
used as guidelines to meet the indi-
vidual needs of your facility.
Addendum A
Sample Contract for Elevator Maintenance

Explanations for Abbreviation Codes

<table>
<thead>
<tr>
<th>Type</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Dumb waiter</td>
</tr>
<tr>
<td>F</td>
<td>Freight</td>
</tr>
<tr>
<td>GF</td>
<td>Geared Freight</td>
</tr>
<tr>
<td>GLP</td>
<td>Gearless Passenger</td>
</tr>
<tr>
<td>GP</td>
<td>Geared Passenger</td>
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<tr>
<td>HP</td>
<td>Hydraulic Passenger</td>
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<tr>
<td>OP</td>
<td>Old Fashioned Passenger</td>
</tr>
<tr>
<td>P</td>
<td>Passenger</td>
</tr>
<tr>
<td>S</td>
<td>Service</td>
</tr>
</tbody>
</table>

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, 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 a 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 submit 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 performed and thoroughly executed by the contractor. They shall, 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 used his direct employment and supervision of 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 will 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

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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, loads, 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 replace-

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 non-performance 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.

B. 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

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 heistway, 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, strainipes, springs and gaskets.
C. Controller relays, contacts, colins, timers, magnet frames and controller wiring, traveling cable, and components of 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 necessary equipment, with exceptions as stated hereinafter.

4. The following items of elevator equipment are not included in the agreement:

- Refinishing, repainting, 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

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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 glides, 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.
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...
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-
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 utilizing 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

---

**Figure 1: Schematic of Probe Location**

- **Open Tower**
- **Probe (Either Location)**
- **Compressor Chiller**

- **Closed Tower**
- **Bypass Loop**
- **Probe (Either Location)**
- **Absorption Unit**

- **Pump**
- **Sump**
- **Compressor or Chiller**
$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.
(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.
Energy Engineering
Fundamentals of Energy Engineering, by
Albert Thumann, P.E., C.E.M., Atlanta,
Fairmont Press, 1984. 446 pp. $29.95. hard-
cover.

Many books have been written in
the past decade promoting energy
management, but very few have as
much to offer physical plant adminis-
trators 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, how-
ever, as it presents the basic concepts sur-
rounding 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 tech-
niques. Thirteen other chapters complete
the work, covering topics from
economic analyses and energy
auditing, to cogeneration, biomass
energy systems. Since the book covers the
entire spectrum of energy engineering,
there is information for everyone,
regardless of size.

Chapters covering economic analyses
and energy audits have special meaning
for programs that are still being de-
veloped, while chapters on waste heat
recovery systems, utility system op-
timization, 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 knowl-
edge on the part of the reader. It pro-
cesses 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 thermody-
namic 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 Bookshelf

the former embracing the careful at-
tention required by energy systems already
in place, and the latter stressing the
continuing necessity for maintaining
energy awareness as a primary manage-
ment 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 conserva-
tion as an absolute requirement for all
members of the institutional community.

One of the great strengths of Funda-
mentals of Energy Engineering is the
author's use of information from man-
ufacturers and other authors who have
developed products or designs appro-
priate 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—
"Cogenation is the sequential produc-
tion 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 informa-
tion 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
and technology also seems inappropriate.

Another aspect of the book that
deserves comment is the author's per-
spective on energy conservation. As the
title states, this book attempts to pre-
sent a framework for promoting con-
servation through the use of techniques
and applications of "energy engineer-
ing." In addition to promoting the con-
nection between engineering expertise
and energy conservation, the author
also promotes energy engineering as an
emerging academic discipline, embrac-
ing 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 gen-
eral 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 as-
sisting management in recognizing and
defining their energy-related environ-
ment.

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

—John M. Casey, P.E.
Manager, Engineering Department
University of Georgia
Athens, Ga.
Management Theory vs. Practice


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.

—J. Gary Brown
Senior Analyst/Programmer
Northwestern University
Evanson, Ill.

**Health Maintenance for the Successful Manager**


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 in-depth 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 a 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 portrayed 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, Ill. 60430.

—Larry E. Nokes
Director of Physical Plant
Pittsburg State University
Pittsburg, Kans.

**Guidelines for Authors**

If you would like to submit a professional management or technical paper to *Facilities Manager*, the following information should help you prepare your article.

1. Articles are needed on all subjects relating to the facilities management functions at colleges, universities, school districts, hospitals, state and federal buildings, commercial properties, and military bases. Articles dealing with easily-adaptable techniques or solutions stand the best chance of being accepted for publication.

2. All articles submitted to *Facilities Manager* must be original and previously unpublished. Adapted speeches or other presentations are acceptable, as long as they have not been published in conference proceedings. Simultaneous submissions are not accepted. Articles from consulting firms and other companies are welcome but cannot be proprietary in nature.

3. If you are unsure about a topic's suitability for *Facilities Manager*, send a query letter briefly outlining your article idea and the manner in which you plan to present it. Articles must be typed, double-spaced, or they will be returned unread.

4. All articles should be between 10 and 25 pages in length.

5. Footnotes, end notes, and bibliographies are accepted if they add to the substance of the article. *Facilities Manager* follows the Chicago Manual of Style in all questions of style and format.

6. Illustrations are welcome and strongly recommended. Figures, graphs, charts, printouts, etc., must be camera-ready and in black-and-white. Photographs should be crisp, high-contrast black-and-white glossy, either 5" x 7" or 8" x 10". Art will not be returned unless specifically requested by the author.

7. Submit two clean copies of the manuscript to Steve Howard, Editor, *Facilities Manager*, 1446 Duke Street, Alexandria, VA 22314-3492. All articles are reviewed by APRA's Professional Affairs Committee, whose decisions are final. All articles should be accompanied by a self-addressed, stamped 9" x 12" envelope. Authors will receive a response in four to six weeks.

8. Authors are unpaid but will receive reprints of their published article or copies of the magazine. They may also subscribe to *Facilities Manager* at half price.

9. If you have any questions or require further information, call Steve Howard at 703-684-1446.

10. Good luck! We look forward to reading your manuscript.
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