property damage in the transportation process by training? The answer is yes. Time and space do not permit me to elaborate on this, but suffice it to say that a recent controlled emergency response training program conducted by the Office of Civil Defense in Oklahoma reduced the yearly average of response personnel injury/death in hazardous material transportation-related accidents by 90 percent. Evaluation of the effectiveness of accident prevention training is more difficult. I am not aware of any final program evaluation in this area; however, I am familiar with one under way. My opinion is that it will be increasingly difficult to have safety programs (including regulatory requirements, training programs, etc.) approved during this decade unless we can evaluate total program effectiveness in terms of reduced death, injury, and property damage. Any safety program, including training, that cannot be evaluated in terms of reduced injury, death, and property damage should not receive any support.

Who would enforce whose regulations?

Enforcement of federal regulations is established by law. That is, an enabling congressional act or statute authorizes an administrator to regulate certain things. The regulations written under the authority of that congressional act have the weight and the power of the acts' penalty provisions behind them. Many states have adopted the federal hazardous materials regulations in whole or in part (adopted by exception). When adopted by a state, the federal regulation may be coded differently but would be enforceable by state agents. This is generally done on surface transportation by a public service commission or department of public safety personnel. When adopted by states, the regulations are enforceable on both intrastate and interstate surface carriers. The question is not one of who would enforce but rather who has the authority by law to enforce regulations.

Who designs curriculum and certifies graduates?

Curriculum is generally more successful if developed jointly by training specialists and experienced field personnel. However, it should be noted that training plans must be developed first. The training plan establishes the need for training (what is the problem). It then identifies what the attendees' job functions are. Then the training or course outcome (objectives) is very specifically listed--i.e., what is it that the student should be able to do after the instruction is given. The training plan is the contract and perhaps its most important function is that of agreement between the government agency that has the program authority and responsibility (including resource control) and those who provide the training. As for certification, I believe that inspectors at all levels of government who inspect and enforce the complex requirements of hazardous materials regulations related to accident prevention must be certified as to performance. This certification should consist of passing an approved training program and demonstrating skills on the job for a specific period of time. Again, the certification program must be administered by the government agency that has program authority and responsibility.

What are the cost considerations of training?

Poor training is no bargain at any price. As a general rule, you get what you pay for. Have your people received performance-based training in the transportation of hazardous materials? A decade plan suggests sound planning and continued areas of emphasis. A comprehensive plan with training as an area of emphasis suggests continuity. On-again off-again training programs are costly and expert hazardous material managers are impossible to recover from previously discontinued training programs. Organizations desiring to send personnel to distant training locations face constraints in the form of limited travel budgets and increasing travel costs. A need does exist to use training resources more effectively and efficiently to accommodate organizations whose personnel need training. One model to look at is the one developed by EPA. EPA uses a distributive training system under the direction of a central training facility with excellent results. DOT could conduct training under the supervision of its training arm for state and local governments and industry personnel. Certain training would be accomplished under contract with established training centers and universities to develop the capability of training at the centers and universities and at other locations as required. In cooperation with the transportation industry, this highly versatile capability associated with computer-based instruction and computer-managed instruction could be used. This would provide access to many contract learning centers throughout the United States and would adapt quickly to a fast need for teaching regulatory requirements in areas such as accident prevention and also in teaching transportation emergency response procedures. Also, terminals can be used at any location that has a telephone line to provide a wide distribution of training capability.

Segment I—Training Concepts Assessed

John Granito

Training usually is seen as planned learning activities designed to bring about changes in the behavior of the learner. In other words, we train people to do what we think they should in given situations. Typically we want personnel to perform defined tasks under specified conditions and in certain circumstances, so training directors work out carefully detailed projections of future situations and the sets of respondent behavior that experts believe is most desirable. Training programs should be based to a large extent on experts' predictions of future situations and problems so that students will be trained to bring incidents to a satisfactory resolution.

The ability of the expert to predict future problems depends on such skills as the ability to understand history, to analyze technical data, and to generate insights. An example is the well-known prediction of experts that exploding horizontal tanks usually burst at the rounded ends, and so attacking nozzle teams should approach from the direction of the sides. In that common lesson, training experts have predicted what is likely to happen--based on history and technical knowledge--and they attempt to modify the random behavior of emergency forces so that, through training, nozzle attack from the sides become habitual.

Almost all problems of training stem from that seemingly simple definition. Those who invest in training want to be sure that future situations will be met by "approved" behavior on the part of the trainees. Experience with hazardous materials

training points out the importance of the following concerns:

1. Training goals, or accurate prediction of future problems;
2. Reality-based curriculum, or sufficient attention to important details, logically presented;
3. Methods of teaching, or presentation of knowledge in interesting ways;
4. Performance-based instruction, or measurement of student progress;
5. Standardized instruction, or assurance that all students everywhere learn the same approved behavior;
6. Certified instructors, or guarantees that the teachers are competent;
7. Accredited providers, or assurance that the training school measures up to standards;
8. Certified or licensed graduates, or guarantees that students will behave as they are supposed to; and
9. In-service training, or provision for graduates to be updated.

The magnitude of these concerns implies a total system and this is what training should be. Unfortunately, the pressure for quick results often forces the operation of only a part of the training system, thus reducing the chance for long-term success. There may be conditions that call for "quick and dirty" training approaches, but the history of hazardous materials difficulties points toward a more thorough and comprehensive approach. Before more history passes, should we not envision a more integrated, comprehensive, and carefully planned approach to training? Many appear to agree that the time is ripe to improve training, but often the debate finds fingers pointing in other directions. Since many of the concepts important to a total training system are controversial and debatable, listing them, instead, as questions may help to stimulate thoughtful discussion:

1. Which personnel involved in hazardous materials, if any, should be subject to required training?
2. Which organizations should be recognized as the technical experts and arbiters for purposes of curriculum design?
3. What tie-ins and feedback loops should exist between field experiences and training designs, and how should they be maintained?
4. Which methods of instruction and technological aids should provide the teaching base, and in where and what kinds of facilities?
5. Which organizations, if any, should have the responsibility to accredit and standardize training curricula?
6. Should hazardous materials training instructors be certified and, if so, how and by whom?
7. Should students who complete training programs be certified and, if so, how and by whom?
8. Which organizations should offer hazardous materials training, should they be accredited, and, if so, by whom and under what conditions?
9. What should be the priority for personnel training, and what time line should be established?
10. Should a broad program of public education be mounted and, if so, how and by whom?

The results of good training are rather self-evident in terms of life and property safety, reduced costs, and improved public relations. However, the problems of designing and carrying out high-quality programs may be complex, involving not only the above concerns but also considerations of learning theory.

Oftentimes "education" is seen as learning that enables new situations to be handled, while "training" provides what is needed to carry out standard procedures. Therefore, different levels of training must rest on different kinds of education. Workers may be trained to perform the sequence of functions for operating a loading dock, but if something goes wrong, more and more understanding of principles (education) is needed as the problem escalates. Personnel are customarily trained to carry out standardized sequences, and this is effective to the degree that emergency scenarios have been anticipated by the experts and built into the training program. Difficulties arise, however, when scenarios in the real-life situation have not been anticipated.

Since a person's ability to deal with new, unanticipated change heavily depends on the ability to reason and draw valid conclusions, blocks of education, if not already present in the individual, need to be factored into the training design for persons such as supervisors of loading facilities and officers of emergency response teams, who might be expected to face the unexpected. Education that supports technical understanding and skill and that enables the individual to jump past what the instructor explained and trained for is especially important.

The challenge to training planners and managers is twofold: determine which blocks of education (in science and technology, for example) provide a first-level foundation for the piece of training in question, and decide which types of students need to master those blocks. To use fire department personnel as an example, firefighters need training to handle special foam equipment and to avoid errors in safety. Company officers need to supervise the firefighters, plus they need enough technical education to determine which type of foam is the preferred agent of choice. In addition to all of this, chief-level officers need to be able to calculate how many gallons of foam will be needed to successfully attack a particular volume of product contained in a storage tank of certain diameter.

Even those who are proponents of training sometimes neglect to consider that some training will be ineffective if students lack the education to extend thinking beyond what is presented in the course.

The second challenge, as already noted, is to modify student behavior in future situations where supervisors will not be present. If personnel would and could do all the right things, we would not need to train. When people encounter pressure to change, they typically consider their personal values, their personal gain, and the amount of inconvenience and difficulty the change will cause them. Behavior changes will become more permanent, more habitual, more repetitive, if the worker places value on the change and sees reward as a result.

Attitudinal change is probably basic to the kind of behavioral change we want in situations where safety is critical. The driver who is consistently safe, even in the absence of supervision, values the situation. Thus, training of personnel in the hazardous materials field must often aim at changing attitudes and values as well as the acquisition of knowledge and skills. Care and safety are often functions of attitude, even when excellent training is available.

TYPES OF TRAINING

There are very few jobs in the hazardous materials field that do not require both pre-service and in-service training. Pre-service training prepares people to carry out the basic tasks safely, and

in-service training aims at improved performance and updating. There are important differences between the two, not only in the level of material presented but also in the motivation of the individual student. Motivation to learn often is directly related to how much the student believes he or she already knows. The conventional wisdom that "a little learning is a dangerous thing" may have validity if a student views in-service training as unnecessary, boring, or even degrading. There even may be disagreements about what constitutes pre-service training, as with firefighters who fail to see the necessity for in-service training as hazardous materials responders, or truck drivers who are experienced, but not with placarded cargoes. If their in-service training is presented at the pre-service level, they may be antagonistic, believing that their previous experience will be sufficient.

Pre-service training may be easier to conduct because beginners are entirely new to the business and often are eager to become involved. But even here most people believe that they have some relevant experience. Thus, almost all training in hazardous materials fields is perceived by participants as some degree of in-service training, and curriculum designs and instructional styles should recognize this danger. This means that each individual student will enter the training class with a different set of attitudes, knowledge, and skills. Pretesting and individually paced instruction will get better performance results in the long run than will the easier and less expensive group instruction.

In-service instruction may deal with review of seldom used skills, such as use of emergency procedures; with the learning of brand-new knowledge and skills, such as how to contact and work with national response teams; or training on new equipment and with new procedures just incorporated into the organization. Specialized training needs to be distinct from standardized training, and carefully made decisions are needed as to which students are selected for it. Attitudes and aptitudes need to be considered. For example, there is a difference between first responders who set the mechanism in motion and the response teams who are expected to function with a mastery of the details. In-service training also must recognize the frequency with which students encounter reality. If skills are not used often in real situations, then simulations are necessary on a continuing basis. Unfortunately, the ability of individuals to remember and draw on previously learned knowledge and skills varies greatly. In high-quality, in-service training programs that variation is recognized. In quick-and-dirty programs it often is not.

To illustrate further not only the complexity of design but also the critical nature of in-service training, consider the differences often encountered by response teams accustomed to more typical incidents. The following operational areas encountered at a hazardous materials incident may well differ significantly from what public safety groups have experienced and trained for previously:

1. Incident magnitude,
2. Compounded incidents of long duration,
3. Technical assessment needs,
4. New response patterns,
5. Incident stage advancement,
6. Special skills,
7. Multiorganizational response,
8. Legal issues, and
9. Termination procedures and health concerns.

Not only must response forces learn new and appropriate behavioral response patterns, but they must unlearn behavior already assimilated through earlier training and experience. In actuality, they must keep both types of behavioral responses on ready file and be able to apply one or the other according to the dictates of the incidents. That kind of complexity is a challenge to the powers of typical training programs.

PROGRAM PLANNING

Comprehensive training begins with planning, and planning should begin with those who are in a position to see the behavior patterns of workers in field operations. Performance-based training usually is designed by first identifying the desired results and then working backward toward a design that will move the individual's starting point (which needs identifying) to the desired new behavior. The design needs to take into account three major variables: (a) the kind of knowledge, skills, and attitudes desired in the graduates; (b) the learning styles and abilities of students who will attend the course; and (c) the methods of instruction that will best match up the students with the curriculum. Also needed is a way of measuring whether each student has changed his or her behavior as desired. This last step is the core of performance-based instruction, and sometimes its application points to the need for student retraining or program redesign, which adds to the expense but will increase cost-effectiveness in the long run.

The responsibility for planning hazardous materials training programs should rest with a team comprised of field operations experts plus instructional experts. When either side plans alone, the tendency is to produce either sound behavioral objectives but without productive ways of attaining them or valid instructional approaches unfortunately aimed at inappropriate objectives. One possible way of assembling good instructional teams is to have concerned regulatory agencies bring together experienced field operators who desire improved and safer procedures with curriculum designers who have had success in working with similar kinds of students.

Comprehensive hazardous materials training implies that each group involved will be trained before work begins and periodically thereafter and that each important aspect of hazardous materials work will be analyzed to be sure an appropriate training program operates for it. The typical approach to this task is the construction of a task and worker matrix where major tasks are plotted against various worker types. Each intersection indicates a component of a comprehensive training program for a worker group. Emergency response teams serve as an example. One axis of the matrix lists types of response forces, such as police, public works, fire suppression, emergency medical, and environmental protection. The other axis lists major response tasks, such as evacuation, plugging, cooling, triage, diking, etc. The positive intersections outline which teams need which kind of training. One advantage of regional and national planning is that more cross checking occurs, and there are fewer chances of task-worker intersections being overlooked or neglected. Also, more comprehensive training is possible through a greater mix of participants and a sharing of resources. Local expertise is often lacking, and the ability to produce a valid curriculum, teaching aids, qualified instructors, etc., is limited. To conduct adequate hazardous materials training, local units must be plugged into the circuit of hazardous materials experts. This is not possible for the thousands of local units that need training, but regionalized-na-

tionalized delivery systems bring the greater strength to the smallest areas.

Key questions relate to the degree of trade-off necessary between local autonomy and larger organizational or governmental control and between broader-based resources and increased overall costs. Training costs money for both the private and public sectors. Government-mandated training for the public sector, such as police and fire, typically is paid for with tax dollars by a level of government. Mandated training for private-sector employees often is the financial burden of the private sector. At times, each side blames the other for increasingly costly incidents and insists that "the others" be trained to do the job or bear the cost of training the other team. In addition, some private industries are providing not only their own response teams but also training for public-sector personnel such as volunteer firefighters. Already designated training agencies such as the U.S. Fire Academy (FEMA) might well take on additional training responsibilities at regional levels.

It appears increasingly evident that the costs associated with incidents exceed the costs of training, but unless the training is performance-based and evaluated, costs per unit or per student trained are fairly meaningless. Three dollars per person for poorly trained students may prove to be more costly than double the price for well-trained people.

Although the possible transfer of training costs to other sectors is of short-term interest and it may be enticing to contemplate only modest training levels on a national basis, the long-term view must compare training costs for prevention and incident responses with the consequences of reduced training. The best response to a comprehensive problem would appear to be a comprehensive answer.

TRAINING PROGRAMS

Whoever manages a training program has responsibility to performance measurements. The issue of accountability is clouded, of course, by the many variables that come into play in real situations following the training. No teacher wants to take responsibility for graduates' performance in real life, although those who foot the bills do tend to hold schools responsible. Do we want a degree of accountability for those who provide hazardous materials training?

Standardized curriculums tend to help pinpoint weak spots in training because theoretically they eliminate one important variable. If experts identify sets of respondent behavior that are universally appropriate, why not standardize that content into the teaching outlines? Opponents cite local, regional, and circumstantial differences in real situations that necessitate particularized training, but the weight of the argument seems to fall on the side of standardization.

More complex are the cautions raised against the type of standardization that ignores differences in type of student groups and in individual students within the same group. There is a difference between saying we seek standardized behavioral outputs brought about by individualized training inputs and saying we seek standardized behavioral outputs brought about by standardized training inputs. Instructional methods tied more to the curriculum content than to the student's learning patterns are generally less effective. Careful definition must be given to standardization if benefits are to bless our efforts.

CERTIFICATION

The best instructors appear to be broad-based technical experts who can take each student as an individual learner and move from the known to the unknown, with appropriate attitudinal changes in students accomplished as well. When we seek these paragons we find them in short supply. Perhaps we should invest in training the trainers--i.e., in creating good hazardous materials instructors through a conscious regional or national effort. After all, the technical expertise concerning the content of hazardous materials is available, as are experts in the teaching-learning process. Good instructors, who take responsibility for student learning as well as teaching, can be produced; how to do this is scarcely a mystery. The FEMA instructor training course and other such courses could be modified to produce the specialized teachers we seek. If these train-the-trainer courses were standardized and performance-based and if graduate instructors were upgraded and refreshed through their own in-service training, we would indeed have certified instructors. The addition of a certified instructor to a standardized curriculum would appear to add strength to training programs.

A reasonable next question, then, is what should happen to a graduate who does not behave in the prescribed way after training? Performance standards can be established, of course, and sanctions imposed for those who do not meet them. Certified instructors who produce relatively large numbers of graduates who do not do well on the job could be questioned. Courses with poor records of graduate performance could be checked. The world of education is full of such examples, from trade schools to medical schools. Indeed, one mark of a profession is that the policing of standards and the exercise of sanctions is done by professional committees in addition to, or instead of, regulatory agencies. Just how professional do we care to become in the hazardous materials training business?

Many of the concepts related to performance standards, trained instructors, accredited schools and training programs, centralized control, and standardized course content relate to certification. What are some relevant forms of it?

Certification is a guarantee that the person certified either passed an approved training program or actually demonstrated the learned skills and knowledge. There are vast differences in these two basic forms of certification. The former depends on a standardized curriculum, approved instructors, and an accredited school or program. It is assumed that a student passing through that combination can do a reasonably good job on graduation, and thus a certificate or license is issued, usually by a regulatory agency, at that time. This is sometimes called approved-program certification and is based on trust plus periodic reviews of the training program by the higher or regulatory agency.

The latter form of certification applies a standardized examination at the conclusion of a training program and prior to the issuing of the certificate or license. The examination may be written only, as in the bar examination, or it may require writing and the demonstration of skills, as in a nursing or pilot's examination.

Beyond this level of certification, the regulatory agency or professional group may require in-service training and/or the maintenance of certain performance standards. Emergency medical technicians fall under this type of standard.

Certification choices range, then, from a simple certificate of attendance to judgment of performance in the field by a federal or state inspector, or a professional standards committee.

IMPROVING TRAINING AND PUBLIC EDUCATION

The typical citizen seldom sees any reference to good safety records and prompt handling of hazardous materials incidents, or even very much about good preventive measures. Therefore, both the public and private sectors should consider a coordinated program of public education to both reduce the number and severity of incidents and to highlight the steps being taken to permit the relatively safe enjoyment of countless products. Telling each other about our good work and safety record is not achieving the goal of public understanding. Perhaps all organizations and agencies involved should pull together a set of goals for public education that reflect an accurate assessment of our national state of affairs.

It may be that the natural groupings of organizations--railroad, highway transporters, manufacturing chemists, public safety agencies, regulatory agencies, etc.--could establish a national consortium dedicated to preventive training, response training, and public education, viewing the task from at least a regional but preferably a national platform. Such a consortium could consider not only public education and the several critical training issues touched on here, but also such additional issues as improved training and public education technology and reduced program costs.

Segment II—Technical Training

Fred Halvorsen

Does a problem exist in the training of personnel to ensure the safe transportation of hazardous materials, substances, and wastes? Does the transportation of these materials present an unreasonable hazard to an unsuspecting populace because of training deficiencies in response forces? Are local officials adequately informed so that they can make logical and reasonable training decisions? Is better, more advanced training of all facets of the transportation industry the answer to the problem? Is there a problem at all? Who should do the training, and who should be trained, and in what?

In my estimation, many problems do exist and especially in certain areas of training for responding to hazardous materials incidents. However, equipment, techniques, and expertise are available to solve all existing and foreseeable problems if sufficient time, effort, and monies are expended. What is needed is not new or unique solutions, but redirection and reemphasis of existing resources, better guidance from responsible federal agencies, and, if beneficial change is to occur, commitment and involvement from federal and state officials at all levels of the problems confronting us.

CATEGORIES OF HAZARDOUS MATERIALS TRAINING

Basically, all training for hazardous materials can be divided into three major categories--prevention, initial response, and reflective response. Prevention refers to those actions of the industry and the regulatory authorities that seek to ensure that the product is properly classified, packaged, labeled, documented, and handled in transportation in a safe manner. Initial response refers to the actions of industry and the various local, state, and federal response agencies taken immediately after a hazardous materials accident or incident that seek to minimize and control the effects of the accident or incident. Reflective response refers to those actions that are directed at cleaning up, neutralizing, or mopping up the spilled material after the initial controlling response actions at a hazardous materials accident or incident.

Preventive Aspects

DOT through its MTB and four modal administrations writes and enforces the regulations that govern the classification, packaging, labeling, marking, placarding, and documentation of hazardous materials in transportation. The purpose of these regulations is to place the product in a package that will safely contain the product during the expected rigors of transportation. The federal agencies are extremely active in enforcing these regulations as well as in seeking voluntary compliance from the shipping industry. Civil fines up to $10 000/day per violation are possible and fines are used effectively throughout the industry to ensure compliance. Wide dissemination of fines awarded is accomplished by a monthly newsletter. Regulatory agencies also seek voluntary compliance from industry and some use fines only as a last resort. The U.S. Coast Guard, for example, has used on-the-spot compliance while holding up a shipment as an effective tool in many port areas.

Training inspectors for the preventative role is essentially familiarization with the regulations followed by on-the-job training and experience. Inspectors can be effective immediately due to the fairly low risk involved and the fact that questions can be directed to superiors or directly to the MTB. As the inspector becomes more experienced, he or she becomes more effective and can check for more involved regulatory aspects. More importantly, industry has been extremely successful in voluntary compliance and, in many cases, industry's regulatory compliance efforts are more effective than those of the regulatory agencies. It is also important to note that besides the federal agencies, many states take an effective preventative role.

Overall, the effectiveness of the preventative aspect, which is basically compliance with the hazardous regulations in 49 CFR 170-179, is good and the training received is adequate. This evaluation is based on the number of accidents that can be attributed solely to lack of compliance with the regulations--historically, very few accidents can be so attributable.

Transportation incidents involving hazardous materials apparently occur proportionally to the number of vehicles carrying hazardous materials compared with the total number of vehicles. In other words, the presence of hazardous materials neither adds nor detracts from the possibility of a transportation incident.

Initial Response Aspects

If a transportation incident involving hazardous materials occurs, the responding personnel are most often, if not always, those response personnel who would respond to any transportation incident. Under many circumstances, it is likely that the first indication that hazardous materials are present is when the response personnel recognize through labeling, placarding, shipping papers, or from released product, or are told by the operator of the transportation vehicle that hazardous materials are involved. Their actions at that point may be supercritical. An incident improperly handled can become a serious accident or a catastrophe.

Unfortunately, the training that the first response personnel has likely received is minimal, if