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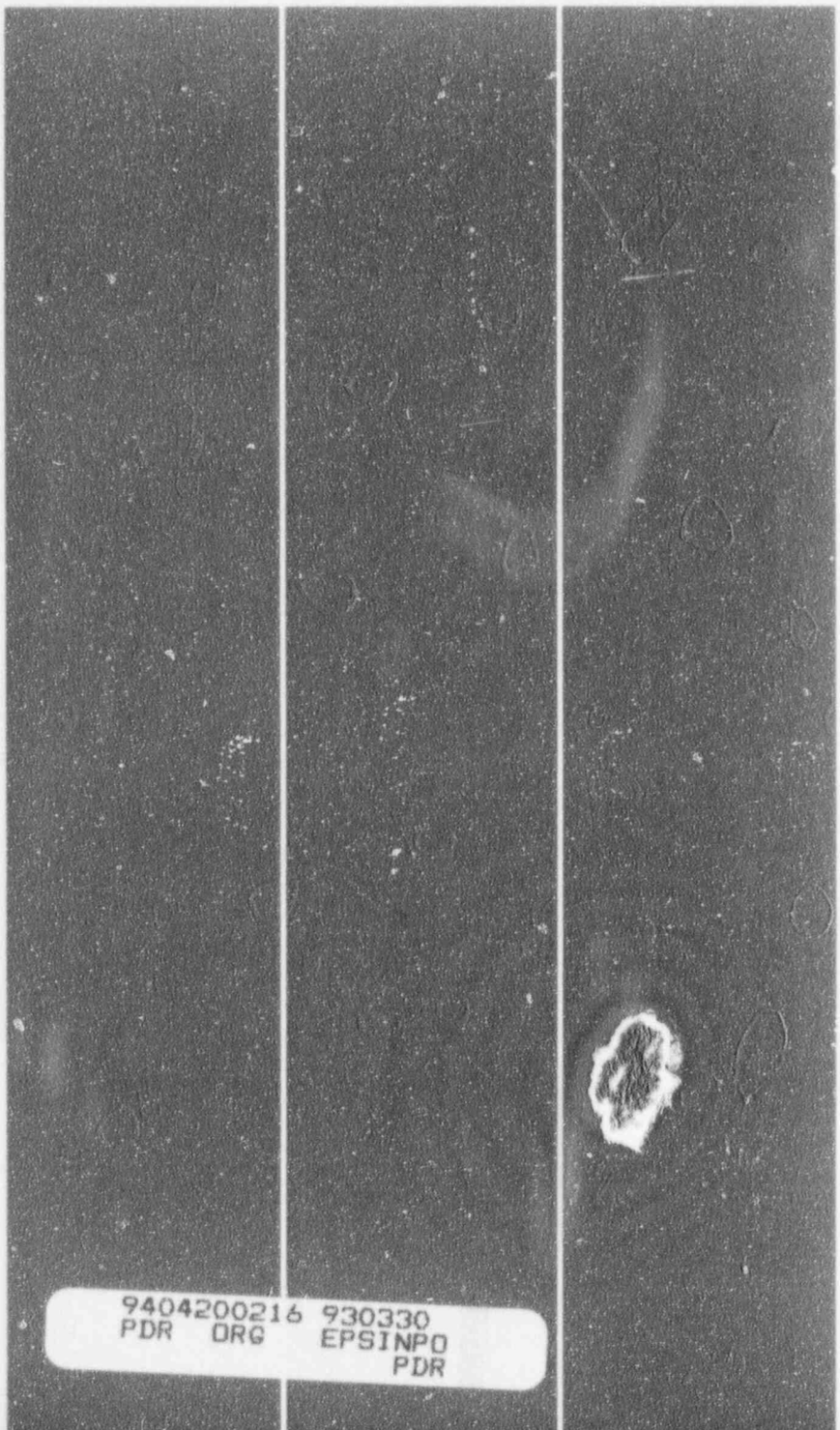

The Principles of Training System Development Manual, Addendum IV: Learning Objectives

NATIONAL ACADEMY FOR NUCLEAR TRAINING

PRINCIPLES OF TRAINING SYSTEM DEVELOPMENT ADDENDUM IV LEARNING OBJECTIVES

September 1993
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NATIONAL ACADEMY FOR NUCLEAR TRAINING

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The National Academy for Nuclear Training operates under the auspices of the Institute of Nuc ar Power Operations (INPO). The Academy provides a framework for a unified, coordinated industry approach to achieving and maintaining effective training and qualification. It also promotes pride and professionalism of nuclear plant personnel. The Academy integrates the training efforts of all U.S. nuclear utilities, the activities of the National Nuclear Accrediting Board, and the training-related activities of INPO.

EXECUTIVE SUMMARY

Performance-based training is the cornerstone of programs accredited by the National Academy for Nuclear Training. This systematic approach to training has been successfully adapted to the needs, constraints, and challenges of Academy members. While implementation of the systematic process varies across the nuclear utility industry, all applications share the following important features:

- analysis of training needs and the identification of the knowledge and skills required for safe, reliable job performance
- design of training based on learning objectives that define the specific capabilities training will develop in the trainees
- development of training materials and methods that facilitate trainees meeting the learning objectives
- implementation of training and evaluation of trainee and instructor performance
- evaluation of performance to confirm training program effectiveness, to learn from experience, and to direct needed refinements

The purpose of this addendum to INPO 85-006, *Principles of Training System Development*, is to provide guidance that can enhance the development of new learning objectives and the refinement of existing ones. It has been written in response to requests for guidance in this area from members of the National Academy for Nuclear Training.

Learning objectives are the foundation of performance-based training programs. Stated as observable trainee behaviors, learning objectives serve as the design basis for training. These statements define what trainees should value, know, and be able to do to perform their jobs safely and reliably. Affective learning objectives define the attitudes and values associated with effective job performance. Cognitive learning objectives identify what the trainee must know and be able to apply while performing job tasks. Psychomotor objectives identify the job tasks the trainee will be ready to qualify on after successfully completing training. Levels of performance are described for each of these three types of learning objectives.

The expression "corporate culture" refers to the values, traditions, and practices of a company. The influence of the corporate culture on learning objectives and the use of job and tasks analysis information and operating experiences are discussed. Because the type and level of a learning objective affect training methods, suggestions on selecting appropriate training methods are provided. Information on how to organize learning objectives and their use in trainee testing and program evaluation also is provided.

This document is organized into two parts. The text provides information on the types, bases, design, and development of learning objectives. An appendix provides example learning objective statements that can support development efforts.

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CHAPTER 1

INTRODUCTION

A. PURPOSE

This addendum to INPO 85-006, *Principles of Training System Development*, provides information on the function, design, development, and use of learning objectives in performance-based nuclear utility training systems. Training managers, developers, and instructors are the intended audiences. The content of this addendum addresses learning objectives that pertain to the attitudes, knowledge, and skills used by nuclear utility personnel to perform their professional duties. Utilities are encouraged to consider the guidance provided in this addendum when developing new learning objectives or refining existing ones.

B. DEFINITION

Learning objectives are defined in INPO 85-006, *Principles of Training System Development* (Section 3), as describing "what is to be learned in terms of measurable trainee performance."

Properly prepared learning objectives consist of the following parts:

- a statement of behavior (action) the trainee must exhibit
- the conditions under which the action will take place
- the standards of satisfactory performance

C. FUNCTIONS OF LEARNING OBJECTIVES

1. Training Requirements

Learning objectives identify what the trainee is expected to value, know, or be able to perform after successfully completing training. Developed prior to producing training program materials, clearly stated learning objectives offer the following advantages:

- Teamwork - by defining program and trainee requirements, learning objectives help program developers, instructors, and training managers better coordinate their efforts.
- Direction - by identifying common standards of trainee performance, learning objectives support improved training management.
- Economy - the combined benefits of improved teamwork and clear management direction support more efficient use of training resources.

2. Trainee Expectations

By specifying what trainees will be able to do after successfully completing training, learning objectives identify learning requirements, focus trainee activities, and support studying. This helps trainees make more productive use of their time and reduces the stress that can arise from uncertain performance expectations.

3. **Training Program Design**
   Instructional design is the efficient arrangement of learning experiences to support learning. Good designs promote learning, reduce the time required to meet the learning objectives, and are cost effective. Achieving this level of design can occur when sets of learning objectives are developed, sorted, and arranged into sequences that take advantage of the natural structure of the subject matter.

D. ORGANIZATION

The background, theory, and instructional implications of different types of learning objectives are described in chapters 1-4. Chapter 5 provides tips on developing learning objectives. An appendix includes example learning objective statements that can be adapted for operations, maintenance, and support training.

Chapter 1 explains the purpose and use of this addendum, defines learning objectives, discusses the functions of learning objectives, and describes the organization and content of this document.

Chapter 2 describes the affective, cognitive, and psychomotor performance areas. Affective learning objectives define the attitudes and values associated with effective job performance. Cognitive learning objectives identify what the trainee must know and be able to apply while performing job tasks. Psychomotor objectives identify the job tasks the trainee will be ready to qualify on after successfully completing training.

Chapter 3 examines the bases of affective, cognitive, and psychomotor learning objectives. The influence of company values, traditions, and practices (the corporate culture) and the use and limitations of job and task analyses are discussed. The parts of a learning objective also are described.

Chapter 4 discusses the instructional design and testing implications of affective, cognitive, and psychomotor learning objectives. This chapter is based on the premise that the type and level of learning objectives significantly influence the choice of instructional methods. Guidance for selecting appropriate methods is presented for each of the three types of learning objectives.

Chapter 5 concludes the text by discussing the development and organization of learning objectives. Program evaluation also is addressed.

Appendix A provides examples of learning objective conditions, action, and standards statements.

CHAPTER 2

TYPES OF LEARNING OBJECTIVES

Affective, cognitive, and psychomotor learning objectives identify what the trainee will value, know, and be able to perform, respectively, following training. While it is convenient to classify these aspects of job performance into three separate categories, in practice, most job tasks include aspects of all three.

This section defines four affective, six cognitive, and three psychomotor performance levels. These definitions include sample action verbs that could indicate objectives at each of the performance levels. The actual level of affective or cognitive learning objectives can be identified accurately only by reviewing the entire objective.

A. AFFECTIVE LEARNING OBJECTIVES

Affective objectives define the attitudes and values associated with reliable job performance. They identify the nontechnical aspects of effective performance by communicating company policy and culture. The corporate culture (Deal & Kennedy, 1982) is the overriding set of values, traditions, and practices that defines what is important and how it gets done.

Company policy, ethics, and professional standards are sources of affective learning objectives. By making company values visible, the use of affective learning objectives can reinforce the culture of a utility. In so doing, affective learning objectives contribute to enhanced teamwork and reinforce safe, reliable job performance. For example, new employee orientation, teamwork, and supervisory and management development programs generally include affective dimensions.

The following principles apply to the development and use of affective learning objectives at any level:

1. Role models have a powerful influence on attitude formation. When the actions of peers, supervisors, and managers support stated corporate values, employees tend to emulate and internalize these values.

2. An effective movie or videotape can introduce attitudes or values. Through dramatization, these media can elicit a response that deepens awareness.

3. Attitudes and values are reinforced by the individual's experiences. Those that confirm the value tend to strengthen and sustain it. Experiences that show the value to be ineffective can erode and, eventually, extinguish the value.

4. The absence of unity between stated company values, leader behavior, and operating practices will undermine desired values and replace them with ones compatible with actual practice.

Four levels of affective learning objectives are presented:

- awareness of the attitude
- reinforcement by behaving in accordance with the attitude

- promotion of a value by influencing others to adhere to it
- defense of a value against criticism or attack

These categories provide a method of describing four levels of affective objectives by using the strength of commitment. They are similar to the work of others (Krathwohl, Bloom, & Masia; 1964) and provide a framework for developing this type of objective. The categories progress from simple awareness to overt intervention. They represent one way of classifying objectives and, with the exception of "awareness," can be linked to observable behavior.

Awareness precedes behavior. Prior to adopting attitudes and values, an individual must become aware of them. This occurs through normal experience, training, and exposure to the job and corporate culture. Because of the difficulty of measuring awareness, learning objectives at this level are seldom appropriate. Example action verbs at the awareness level include *appreciate, recognize,* and *sense.*

Reinforcement of an attitude is the next affective level. At this stage, the behavior of the individual is compatible with the value. This does not mean that the employee necessarily agrees with the value, but only that the behavior conforms to it. A more desirable state exists when the individual both agrees with the value and behaves accordingly. Example verbs at the reinforcement level include, *adhere, exhibit,* or *follow.*

Promotion of a value is evident when the behavior of an individual conforms to the value and actively encourages others to adopt it. The individual advocates the value, extols its importance, and leads others to adopt it through example and support. Objectives related to safety margins, teamwork, and professionalism are generally at this level. Example verbs at the promotion level include *advocate, encourage,* or *model.*

Defense of a value is the highest affective level. Individuals at this level not only adhere to and promote the value but also support those who believe in the value and respond when someone attacks it. The response can range from a verbal reply to physical intervention. For example, learning objectives at this level are appropriate for personnel responsible for fitness-for-duty, plant safety, public relations, and plant security. Example verbs that may indicate a defense-level objective include *arrest, defend, intervene, or prevent.*

B. COGNITIVE LEARNING OBJECTIVES

Cognitive objectives define what the trainee must know and use to perform the job properly. The use of facts, principles, rules, and theory to perform under normal or uncertain conditions is addressed by cognitive objectives. Job analysis and task analysis, plant references and texts are some sources of cognitive learning objectives.

Six cognitive levels, supporting two kinds of performance, are considered significant (Bloom, 1956). These six levels of cognitive performance include the following:

- knowledge
- comprehension
- application
- diagnosis (analysis)

- development (synthesis)
- evaluation

Knowledge, comprehension, and application represent the lower levels of thinking and provide the information needed during normal task performance. Diagnosis (analysis), development (synthesis), and evaluation address higher levels of thinking that are required to perform under uncertain or emergency conditions. Most utility training programs include objectives to support normal and emergency operations. However, there is a need to enhance the higher cognitive objectives to support improved performance during uncertain conditions.

1. **Lower Cognitive Levels**

   Knowledge is the first and most basic level. It is defined as the ability to recall key facts. A trainee can be performing at this level when any action verbs such as the following are used in the learning objective: *define, label, list, name,* or *state.*

   Comprehension is the second cognitive level and is evident when the trainee is able to grasp the meaning of the material. Obtaining information from charts, graphs, indicators, and procedures illustrates performance at this level. For example, the following learning objective action verbs are appropriate: *identify, locate, obtain, read,* or *record.*

   Application is the third cognitive level and identifies the capability to use information learned at the knowledge and comprehension levels to solve routine problems. The following types of action verbs can be used at this level: *apply, calculate, derive, interpret, manage,* or *solve.*

2. **Higher Cognitive Levels**

   Diagnosis, also known as analysis, is the next level. Objectives at this level define those capabilities needed to break down new situations to reveal their organization, relationships, and potential faults. It is the first of the "higher-level" cognitive objectives and uses action verbs such as the following: *analyze, break down, classify, detect, diagnose, troubleshoot,* or *verify.*

   Development or synthesis refers to the ability to put together new solutions, methods, or procedures. Here, information mastered in prior levels is combined to produce an original result. Example action verbs include: *construct, create, develop, mitigate, plan,* or *write.*

   Evaluation is the highest level of cognitive activity. It defines those mental capabilities needed to maintain effective control in a dynamic, uncertain environment. For example, the following verbs can signal objectives at this level: *avert, control, defend, evaluate, judge, lead,* or *predict.*

C. PSYCHOMOTOR LEARNING OBJECTIVES

Psychomotor objectives define the physical actions exhibited when performing job tasks and are used in on-the-job, laboratory, and simulator training. Procedures, task analysis, and model performer analysis are three sources of psychomotor objectives. By defining task performance requirements, procedures are excellent sources of how job tasks are performed.

Task analysis offers additional insight by identifying the associated tools, equipment, and references used in task performance. Observation of model performers can complement both of

these methods by providing a way to study how the job is performed by the most skilled incumbents.

Psychomotor learning objectives include the following levels of performance:

- observation
- practice
- performance

These levels of performance can be used to identify objectives that, when met by trainees, enable them to achieve competency.

Observation of the task to be learned is the first level of psychomotor performance. At this level, trainees position themselves to watch a model performer demonstrate th behavior to be learned. During observation, it is helpful for trainees to share the same point of view as the model performer. The following example verbs are appropriate: *observe, record,* or *question.*

Practice performing the task enables the trainee to try the behavior in a controlled environment that permits error, provides feedback, and refines performance. For example, the following verbs can indicate an objective at this level: *demonstrate, show,* or *practice.*

Performance of the task is the third level of psychomotor learning objectives. At this stage, trainees have developed competency through observation and practice and are able to demonstrate the behavior for qualification. Example verbs include the following: *assemble, operate,* or *repair.*

CHAPTER 3

BASES OF LEARNING OBJECTIVES

Learning objectives are developed from a variety of sources including reference material, job incumbents, supervisors, and managers. This section describes methods for using these sources to develop learning objectives that define desired trainee attitudes, knowledge, and performance.

A. ROLE OF ANALYSIS

Learning objectives can be derived from the results of content analysis or three different types of task analysis.

1. Content Analysis

Content analysis is the process of identifying attitude, knowledge, and performance requirements through studied review of policies, procedures, and references. It is particularly useful when identifying affective learning objectives that describe the attitudes and values of the corporate culture.

The corporate culture is the principle source for developing objectives that specify the attitudes and values correlated with safe and effective job performance. Utility annual reports, corporate goals/objectives, and professional codes are potential sources of affective learning objectives. These documents identify the overall corporate philosophy to the public, stockholders, management, and employees. These can assist in defining the culture that training will help transmit to new employees and reinforce among incumbents.

When preparing learning objectives, it is essential to review current company documents to verify that the proposed training reinforces acknowledged company policies and priorities. This not only supports the company mission, but also can be used to develop affective learning objectives related to individual and team performance.

2. Task Analysis

Task analysis is the process of defining how a task is performed and what the individual must know and do to perform it safely and effectively. Subject-matter expert, model performer, and equipment- and procedure-based approaches represent three methods of task analysis. Each of these approaches is individually described in the following sections.

a. Subject-matter Expert

In the subject-matter expert task analysis method, a sample of employees and their supervisors draws upon their knowledge and experience to define job performance requirements. This approach has been used extensively in industry. Involving participants, initiating ownership, and capitalizing on employee experience are its strengths. Its major shortcoming arises from having individuals describe their own behavior. Such descriptions can be biased by the self image, job satisfaction, and motivation of the participants. Data also is affected by participants' knowledge and experience levels. Consequently, the resulting data can be limited to knowledge the participant is confident of and that which portrays the individual favorably.

b. **Model Performer**
Model performer task analysis is based on the assumption that the most skilled employees are a source of performance information that can be identified and systematically incorporated into the behaviors of others. In this approach, task behaviors, including the steps, sequence, tools, and techniques are observed or videotaped. Resulting data is then analyzed, included in appropriate initial and continuing training programs, and evaluated for its contribution to employee performance.

c. **Equipment- and Procedure-based**
Equipment- and procedure-based task analysis defines training content using the operating and maintenance parameters of actual equipment. This third method is significant because it offers some insight into how to develop learning objectives. Training developers work with engineers during equipment design to produce performance-based training systems concurrent with or following equipment and procedure development. Equipment specifications and procedures are the primary sources of content.

In the equipment- and procedure-based approach to task analysis, generic action statements are used to develop learning objectives. This approach is based on the premise that technical training has common objectives that apply across many areas. For example, individuals who operate or maintain plant systems would be expected to meet the following types of objectives:

- state the purpose of the _____ system
- name the major components of the _____ system
- match _____ system parameters to plant mode
- predict the effects of a loss of _____ on _____
- test a _____
- diagnose a _____ problem in a _____
- repair a _____

Used wisely, generic action statements can simplify development and provide a management tool for ensuring that objectives span the range of job performance requirements. Users should recognize that many training situations will require the development of unique learning objectives. Rigidly adhering to a set of generic statements in these situations may prevent needed learning objectives from being developed.

B. PARTS OF LEARNING OBJECTIVES

Effective learning objectives can be stated in a variety of formats. The most common format combines conditions, action, and standards statements to define when, what, and how well the trainee will perform. This combination explicitly defines the conditions under which the performance occurs; what attitude, knowledge, or behavior is exhibited; and the standards of acceptable performance.

1. Conditions

The conditions statement identifies the situation under which the attitude, knowledge, or performance applies. Conditions statements are often not specified. Using implied

conditions statements has an advantage of avoiding redundancy when the conditions are identical for a set of learning objectives. Implied conditions are appropriate in this situation. Their disadvantages stem from a tendency to produce imprecise learning objectives and inefficient instructional designs.

Implied conditions can mask the distinction between lower- and higher-level learning objectives. For example, an implied condition might be inferred to mean "under normal operating conditions" when the performance would actually be required "under all conditions." The implied condition could conceal from training developers, instructors, and trainees the need to perform at this higher level.

The advantages of stated, over implied, conditions statements are illustrated in the following table.

Implied conditions	Stated conditions
• none	• upon discovering an unconscious person who has no pulse • during shift turnover • while using section _____ of procedure _____ • given a change in _____

Stated conditions enhance precision, reinforce maintenance and operating practices, and can provide the situational cues associated with the appropriate response. Stated conditions can alert trainees to specific job conditions and prompt the proper response in the presence of the applicable conditions. For example, an implied condition to the learning objective action statement, "perform cardiopulmonary resuscitation," provides little information on when this action should occur. This action statement becomes more meaningful when the condition, "upon discovering an unconscious person who has no pulse," is stated.

Conditions statements also can separate lower- and higher-level objectives. Generally, condition statements that call for a response under any situation signal higher-level objectives. The following are examples:

- upon discovering an unconscious person who has no pulse
- using an approved maintenance work request
- upon observing suspected aberrant behavior
- in the presence of an entry condition for an emergency operating procedure and without prompting
- given alternative combinations of alarms and annunciators

(These will be combined with example actions and standards to form complete objectives.) Additional example conditions statements are provided in Appendix A.

Instructional design is affected by the conditions stated in the learning objectives. When teaching affective, cognitive, or psychomotor content, the instructional activities should approximate the actual conditions of performance. This experiential view of learning is developed in Chapter 4.

2. **Action**

Action statements identify the specific responses that the individual is expected to exhibit whenever the associated conditions statement is encountered. Each includes a verb and an object. The following action statements illustrate this format:

- perform cardiopulmonary resuscitation
- verify that the motor-operated valve torque limit switches are set at the specified thrust
- evaluate the situation
- take the correct immediate action
- diagnose the plant condition

The action verb is generally viewed as an indicator of the affective, cognitive, or psychomotor level of the learning objective. Example verbs were provided in Chapter 2 to illustrate each of the affective, cognitive, and psychomotor levels. In practice, the level of an objective is jointly affected by the conditions, verb, and standards. For this reason, action verbs can be used at more than one level.

3. **Standards**

Standards statements identify how well the action will be performed and can be implied or stated. Implied standards are appropriate when the performance expectation of the learning objective is obvious. The disadvantage of implied standards stems from invalid assumptions of clarity. In this case, confusion among instructors, trainees, and evaluators can inappropriately inflate or degrade performance expectations and reduce the reliability of trainee evaluations.

Standards statements can be qualitative or quantitative. The following standards statements illustrate these formats:

- until a pulse is restored
- needed to open and close against maximum differential pressure, temperature, and flow
- in accordance with section 4.1 of administrative procedure 06
- within 30 seconds
- accurately and before any automatic safeguard features actuate

Combining these standards statements with the earlier example conditions and action statements forms the following objectives:

- Upon discovering an unconscious person who has no pulse, perform cardiopulmonary resuscitation until a pulse is restored.

- Using an approved maintenance work request, verify that the motor-operated valve torque limit switches are set at the specified thrust needed to open and close against maximum differential pressure, temperature, and flow.

- Upon observing suspected aberrant behavior, evaluate the situation in accordance with section 4.1 of administrative procedure 06.

- In the presence of an entry condition for an emergency operating procedure and without being prompted, take the correct immediate action within 30 seconds.

- Given alternative combinations of alarms and annunciators, diagnose the plant condition accurately and before any automatic safeguard features actuate.

CHAPTER 4

LEARNING OBJECTIVES AND TRAINING METHODS

The performance levels of the learning objectives have a direct bearing on the type of instruction. This chapter explores the relationships between learning objectives and training methods. Some rules of thumb for training at each of the affective, cognitive, and psychomotor levels are included. Recognizing these relationships can improve the development process by helping development personnel consider training implications before learning objectives are completed.

The content of this chapter proceeds from the position that performance-based training systems use structured experiences to promote learning and improve retention. While reading, lecturing, and discussing are efficient ways of introducing information, they generally have less impact than more participative techniques. In contrast, approaches that directly involve the trainee in carefully planned experiences followed by thoughtful reflection help trainees achieve higher levels of performance and generally have a more lasting effect on learning and performance.

Methods such as role playing, case study, simulation, and structured group activities provide the trainee an internal basis for learning, add training fidelity, and increase the likelihood that the learned material will be retained and used by the trainee when applicable job situations arise.

Experiential learning occurs when a person engages in some activity, critically reflects on it, gains new insight, and puts the results to work (Pfieffer, 1988). According to this theory, providing the experience is more effective than describing it. Value clarification, coached practice, and simulator training are familiar applications of this idea. The approach can be used without the significant costs incurred by full-scale simulation. For example, instead of lecturing on the plant instruments, an instructor might distribute copies of historical trend charts that recorded significant plant evolutions or events. Participants review the data, discover what happened, and use this insight to improve their use of plant instrumentation. For new plants, startup test data can serve a similar purpose. Operating plants have the historical records that can provide an experiential basis for plant systems training.

Experiential techniques add training fidelity by providing participants with the same type of data they will encounter on the job. Recordings of the sounds emitted by certain equipment while operating normally and just before failure, odors produced by chemicals and fire protection systems, and in-plant assignments to locate equipment or trace system flow paths are other examples of the experiential techniques discussed in this chapter.

A. Affective Methods

Affective learning objectives are divided into lower- and higher-level performance. Awareness and reinforcement represent lower-level affective objectives and are limited to attitudes. Both the awareness and reinforcement levels can be met without personal commitment. Employees can follow industrial safety procedures at work without being convinced that they are necessary. These people would be unlikely to adhere to these same safety precautions while working at home. For example, they would not see the value of using eye protection when away from the plant.

Attitudes become values when individuals perform their duties at the promotion and defense levels. Learning objectives at these levels are distinguished by the level of personal commitment and signaled by the behavior of the individual. At these levels, the person is committed to the value and follows it in all applicable situations. For example, these individuals would use eye protection both on and off the job. Individuals performing at the promotion or defense level also encourage others to adhere to the value and will defend the value and support those who exhibit related behaviors.

The material that follows provides suggestions on learning objectives at the awareness, reinforcement, promotion, and defense levels. A series of statements is provided that describes learning at each of the four affective levels. These statements are followed by guidance on appropriate methods for training personnel to meet learning objectives at each of the affective levels. This information is included because the different levels of objectives suggest different training approaches. Without this recognition, training can be unnecessarily difficult and time consuming.

1. **Awareness**
   Awareness is the conscious sensation of an attitude or value. It results from daily experience and is the first step toward adopting a value.

   a. Experience can be random or systematic.

   b. The physical environment of the utility reflects company values.

   c. Posted materials suggest the emphasis given to company values.

   Awareness can be developed in the following ways:

   a. Introduce company values during initial employee training. Confirm that every new employee can identify these values and understands their bases and significance.

   b. Maintain the entire facility in a condition that sustains important company values, e.g., order, safety, and pride. Contradictions between stated values and job conditions cause confusion and decrease the credibility of related policies.

   c. Keep values visible through signs, posters, or related media. These techniques can remind employees of key values and operating principles as well as demonstrating pride in results with performance indicators.

2. **Reinforcement**
   Reinforcement occurs when the behavior of an individual is in accord with a desired value. This lower-level response can occur without the person actually subscribing to the value.

   a. Values that are developed by the team are more readily adopted than those introduced by others.

   b. When employee and company values agree, work becomes personally fulfilling.

c. Behavior that is rewarded tends to be repeated.

The following techniques can help achieve **reinforcement**:

a. Use employee-developed codes of values to identify applicable employee behaviors.

b. Identify behaviors that conform to company values.

c. Use the employee performance evaluation process to reinforce individual behaviors and company values.

3. **Promotion**

Promotion is evident when an individual takes action to advance acceptance of a value. Attitudes become values at the promotion level.

a. Accountable individuals accept ownership and responsibility for actions within and beyond the boundaries of a particular job.

b. Advocacy, expressing a concern or position, is an effective method of promoting a value.

c. Promotion is a way of expressing commitment to a value.

d. Modeling the associated behavior is a powerful way of advancing the acceptance of a value.

The following approaches facilitate the **promotion** response:

a. Ensure that individuals realize that they are accountable for the behavior of others.

b. Provide team training that includes exercises in value clarification and team maintenance.

c. Use team critiques of individual and team performance to promote desired values.

d. Exercise the team to reinforce appropriate values. Recognize individuals and teams that exemplify company values.

4. **Defense**

Defense is the highest affective response. At this level, the individual will actively intervene to prevent a value from being threatened or compromised.

a. The inclination to defend a value is in direct relation to the strength of belief. Strongly held values are more likely to be defended.

b. Cultural reinforcement deepens commitment.

c. Shared group experiences reinforce beliefs.

The following types of activities can promote a **defense** response:

a. Provide information from actual company experience that illustrates the importance of company values.

b. Recognize individuals who exemplify company values during training as well as through some combination of company publications, awards, and ceremonies.

c. Use role-playing techniques to exercise participants in recognizing and overcoming threats to company values.

Affective learning objectives help managers and employees describe the key elements of the company culture. Once identified, these aspects of employment can be routinely communicated and reinforced among all employees. This allows proper procedures to be learned more readily and effectively than through job experience alone. Learning "how things are done around here" is an important and sometimes neglected aspect of training programs. The information provided in this section suggests some systematic ways of complementing ordinary word-of-mouth approaches to learning the company culture and expected attitudes and values. These rules of thumb can help make expected values visible, define acceptable behavior, and decrease the time needed for new personnel to become fully effective team members.

B. Cognitive Methods

Cognitive learning objectives are divided into lower- and higher-level performances. Knowledge, comprehension, and application are the lower-level learning objectives that support performance under normal conditions. These three levels of performance are important because they support day-to-day plant operations. "Lower" only means that these learning objectives are not as complex as the higher levels of diagnosis, development, and evaluation.

Higher-level learning objectives define the cognitive performances necessary to handle new situations. They are based upon the recognition that operations, maintenance, and support personnel are vital influences on safety margins. Qualified personnel provide the primary way of detecting, analyzing, and correcting undesirable plant conditions. There are two major advantages of training to higher cognitive levels. First, the trainees are encouraged to think, recognize emerging problems, and mitigate or avert problems using procedures and teamwork. Second, training at higher cognitive levels allows future performance to occur at the more desirable lower level of routine application. This phenomenon was best expressed by one of the reactor operators after the 1987 North Anna steam generator tube rupture. When asked by an inspector if the crew had ever seen anything like this before, the operator is reported to have said, "Yes sir, 60 times." After seeing the inspector's reaction, he added, "59 in the simulator and once in the plant." Simulator training had equipped the crew to handle with confidence what otherwise could have been a new situation.

Like the prior discussion of affective learning objectives, the balance of this section describes a logical method for training at each cognitive level. This information is included because it illustrates the development implications of learning objectives at each of the six cognitive levels.

1. **Knowledge**
Knowledge is the ability to recall important facts. The following principles apply to learning at this level:

   a. Information presented first and last is more likely to be remembered. Generally, trainees will recall the first and last things presented during a lecture, videotape, or other type of presentation.

   b. Learning occurs when important information is obvious, attention is sustained, and the material is perceived as meaningful. It is difficult to learn if key information is concealed, distractions are present, or the content is viewed as trivial.

   c. Relational images promote memory. Many people use mental images to prompt their recall of important ideas. ALARA (as low as is reasonably achievable) is an example of an effective acronym for remembering a fundamental principle of radiation protection.

   d. Memory is built through concentration, repetition, and feedback.

   These principles suggest the following instructional choices for training at the **knowledge** level:

   a. Use introductions and summaries to preview and reinforce training content. Take advantage of the tendency to recall what is seen, heard, or read first and last.

   b. Relate content to trainee goals and job responsibilities. Make certain that trainees recognize the content is important to their own safety and job performance.

   c. Repeat important information and encourage trainees to develop their own memory techniques. While redundancy is to be avoided in normal discourse, it is essential for recall of important information when training.

   d. When training at this level, allow enough time for study and memory drills.

2. **Comprehension**
Comprehension, or being able to grasp meaning, is the next level of thinking. Fleming and Levie (1978) suggest the following ideas for learning at this level:

   a. Useful information is more likely to be remembered. When presenting information, discuss its applications and provide some meaningful reasons for studying it.

   b. Relating information to its uses is a must for understanding. Provide examples of why the content is important and necessary.

   c. Providing guided experience and feedback builds comprehension. This applies to learning at all levels. Trainees need practice and the knowledge of how well they are performing.

These ideas suggest the following instructional choices for training at the **comprehension** level:

a. Introduce examples and allow time for trainees to study them. Examples make abstract ideas concrete. They stimulate interest and are more effective when trainees have enough time to review them. Pause to be sure the examples are accurately perceived and have the desired impact.

b. When using examples, be sure to identify their similarities and distinguishing characteristics. Question trainees to confirm that they know these differences.

c. Have trainees get information from graphs, indicators, or procedures.

d. Provide feedback to confirm that trainees have developed comprehension of the material presented.

3. **Application**

Application means being able to use information to perform routine tasks. The following ideas are relevant to learning at this cognitive level:

a. The ability to apply information requires experience with a representative range of examples.

b. Being able to distinguish between correct and incorrect uses is a prerequisite to effective application. Trainees must know when a rule or principle applies before they can use it effectively.

c. The more difficult the application, the greater the need for examples and practice. Simple ideas are easy to learn; difficult ones take longer and require greater practice.

Given this guidance, the following instructional choices are appropriate for teaching application:

a. Start with obvious examples and move to more subtle ones as trainees demonstrate their mastery. Verify that trainees can accurately distinguish between examples and nonexamples.

b. Use enough examples to show the range of application. Multiple examples broaden understanding and reinforce learning.

c. Reinforce learning by providing practice across the normal application range. Effective practice sessions allow the trainee to make mistakes and progress from easy to difficult applications. Practice helps eliminate common errors and builds trainee confidence.

In summary, the first three levels of cognitive objectives were defined and guidance was offered on appropriate instructional methods. Discussion moved from simple recall to routine application. In an unchanging environment, there would be no need to train at any higher cognitive levels. The nuclear power industry changes, and those who operate, maintain, and

support it must be able to work safely and effectively under a variety of conditions. For this reason, guidance on instructional methods appropriate for teaching at the higher cognitive levels of diagnosis, development, and evaluation is provided. Training at these higher levels addresses cognitive performance during conditions of uncertainty or discovery. If a trainee discovers an alternative way of performing a task, this person is performing at a higher cognitive level even if the "new" method is already known by others. These characteristics of uncertainty and discovery are what distinguish higher- from lower-level objectives.

4. **Diagnosis**

Diagnosis (analysis) is the first of three higher cognitive levels and addresses the ability to break down situations to discover what has caused abnormal conditions to arise. The following ideas are relevant to learning at this level:

a. Abnormal conditions are signaled by their symptoms and effects. When things begin to go wrong, there are indications that conditions are degrading and problems are imminent.

b. Emerging symptoms are detected using a thorough knowledge of normal conditions, comprehension of interrelationships, and disciplined attention to change. Knowledge and vigilance are essential.

c. Effective communication and teamwork greatly increase diagnostic ability. The analysis capabilities of knowledgeable, experienced people working together is almost invariably synergistic.

Training at the diagnosis (analysis) level is facilitated using the following instructional choices:

a. Begin by reviewing normal conditions, trending key parameters, and identifying error-sensitive tasks or plant evolutions. Confirm that trainees are knowledgeable of these key factors. Set the stage for the onset of a problem situation.

b. Use case-study methods. By combining many aspects of a complex, new situation into a scenario, case studies provide an opportunity for learning diagnostic skills. Used effectively, case studies can stimulate trainee interest and provide a framework for exercising higher cognitive skills.

   Case studies are particularly useful for teaching plant/industry operating experiences by allowing trainees to apply what they have previously learned to situations they may have not yet encountered. Effective case studies provide trainees practice in detecting unusual conditions, analyzing emerging situations, spotting trends, and recognizing the need for corrective action. Thought-provoking questions facilitate learning at this level. Case studies should include information and activities that respond to the following factors:

   1. appreciation that the event occurred and has the potential to recur

   2. the sequence of events (scenario)

   3. a complete description of the event and factors affecting the event

4. an outline to emphasize understanding of the event; specifically, indications that the event had occurred, cause(s) of the event, factors that affected the severity of the event, and lessons learned from the event

c. Use simulator exercises, case studies, role playing, and reenactments to stress communication and teamwork. Confirm that participants are assigned meaningful duties and that each serves in more than one capacity. This is especially relevant to control room simulator training. For detailed guidance on simulator training, see INPO 86-026, *Guideline for Simulator Training.*

5. **Development**

Development (synthesis) is the next level of thinking and focuses on solving complex problems using original methods and solutions. While undesirable, it is possible that conditions will arise that require individuals to go beyond procedures or otherwise get in a situation where they have to improvise. There are several ways of developing these capabilities and controlling how employees approach novel conditions. Used effectively, these methods can push complex, new situations down to the routine application level. The following principles apply to training at the development level:

a. Problems have alternative solutions, and solutions vary in effectiveness and cost.

b. Effective solutions minimize risks, trade-offs, and costs. It is important that trainees not be satisfied with the first or most obvious solution. Good problem-solving is based on a systematic review of a broad range of alternatives.

c. Practice and feedback build development skill and confidence. As in prior levels, competency is built through guided practice.

The following instructional choices are appropriate for training at the development (synthesis) level:

a. Using case studies, simulation, or emergency preparedness drills, identify probable causes and alternative solutions. Direct trainees to separate symptoms and causes. Someone once said, "You can treat symptoms forever, or the causes once." Emphasize the need to determine the root cause(s).

b. Working as teams, have trainees weigh the risks, trade-offs, and costs of each alternative.

c. Provide trainees experience in selecting, implementing, and critiquing solutions. When using case-study methods to teach plant or industry operating experiences, make certain that trainees can identify the following:

1. plant-specific corrective actions that could prevent this or similar events at the plant

2. plant-specific actions that would mitigate the severity of the event should it occur at the plant

d. Provide individual and group performance feedback. Unless trainees are aware of how well they are doing, it is difficult for them to improve.

6. **Evaluation**
Evaluation is the highest cognitive level. It is the ability to control dynamic situations and is built upon a solid mastery of the mental skills developed in prior levels. Effective managers and leaders use evaluation skills frequently. The following guidance applies:

a. Evaluation is the process of sustaining and refining performance in a changing environment.

b. A thorough knowledge of systems, procedures, interrelationships, and alternatives is a prerequisite to effective evaluation.

c. Guided experiences help promote individual growth and competency.

These statements suggest the following instructional choices at the evaluation level:

a. Employ methods that have trainees evaluate observed performance against specific standards.

b. Promote an organizational climate of intellectual curiosity, healthy skepticism, disciplined observation, and informed adaptability.

c. Provide continuing training and opportunities for career-enhancing assignments. Professional development activities and rotating job assignments are two ways of doing this.

C. **Psychomotor Methods**
Plant procedures identify specific task-performance actions. When complemented by analysis results and related technical documentation, they provide the basis for psychomotor objectives. These objectives also define the specific conditions under which the task is performed and the standards of acceptable performance.

Psychomotor objectives are generally sequenced to correspond with procedural/task performance requirements. They are taught in the same sequence that they are performed. However, sometimes it may be necessary to deviate from the actual task performance sequence during training so that the easy steps are mastered before the difficult ones. After all the individual steps are learned, the task is practiced in the sequence defined in the applicable procedure.

The balance of this section describes a method for training at each psychomotor level. This information illustrates the development implications of learning objectives at each of the three psychomotor levels.

1. **Observation**
Observation is the active, disciplined process of learning from model performers.

a. Performance is variable.

b. Workers' own descriptions of their performance are not as accurate as independent observations.

c. Small variations in technique can account for significant differences in performance.

The following techniques facilitate learning at the observation levels:

a. Use model performers for demonstration.

b. Use verbal descriptions of employee performance with caution. Where possible, use videotaping, or similar objective techniques, to document performance.

c. Identify important differences between model and acceptable performances.

2. **Practice**
Practice is the process of trying newly acquired behaviors under safe, forgiving conditions.

a. Error is expected during practice.

b. Effective feedback accelerates learning.

c. Practice requires repetition and accounts for most of the time spent during psychomotor training.

Practice is more effective under the following conditions:

a. Provide timely, specific feedback on trainee progress and challenges.

b. Emphasize feedback that reinforces progress and success.

c. Plan enough time for practice and coaching.

The information presented on using examples at the application cognitive level (see page 18) also applies to practice. Gilbert and Gilbert (1988) provide additional insight into this subject.

3. **Performance**
Performance is displaying newly acquired behavior under controlled conditions.

a. Excessive stress degrades performance.

b. Conditions during the performance affect reliability.

c. Performance includes the opportunity to learn from experience.

Performance evaluations are more effective under the following conditions:

a. Inform trainees well in advance of performance evaluations.

b. Control the conditions so that they approximate actual job conditions and are the same for all trainees.

c. Use evaluations to confirm mastery and reinforce model performance.

CHAPTER 5

DEVELOPMENT OF LEARNING OBJECTIVES

Learning objectives are the design basis of performance-based training. As described in Chapter 4, the levels of affective, cognitive, and psychomotor learning objectives significantly influence instructional methods. This chapter and the examples provided in Appendix A offer an easy method of developing and organizing learning objectives.

A. METHODS OF DEVELOPMENT

There are several methods of developing learning objectives. The verb and template approaches are two of the most common. Verb approaches use lists of verbs at each level of performance to guide development work. This approach emphasizes the action statement and often results in objectives with implied conditions and standards of performance. As described in Chapter 3, the drawbacks of unstated conditions and standards include a tendency to produce imprecise objectives that represent lower levels of performance.

The template approach is similar to the verb method with three exceptions. First, the template approach extends the verb method by including example condition, action, and standard statements. Second, these example statements are arranged by learning objective performance levels. Third, the resulting structure, or template, is imposed on the subject matter to verify that applicable levels of performance are covered by objectives.

Bruno (1986) used this type of approach to develop effective lower- and higher-order cognitive learning objectives. In this application, training personnel were briefed on the applicable training development procedure and produced the learning objectives using a standard set of verbs arranged by cognitive level. Operations personnel provided periodic guidance and quality assurance support and approved addition of the resulting objectives as "cognitive tasks" into the respective plant training programs.

Appendix A is an example of a template approach to learning objective development. This appendix provides several examples of conditions, action, and standards statements that can support developing new learning objectives or refining existing ones. Users of the examples in this appendix are encouraged to adapt them to their needs and unique requirements.

The following strategy can facilitate the development of learning objectives:

1. Training developers and subject-matter experts should work together to produce learning objectives.

2. The use of implied conditions and standards statements should be minimized. Implied statements can reduce the capability of the learning objective to define trainee behaviors precisely.

3. The training implications of learning objectives should be considered as the learning objectives are written.

4. Draft learning objectives should be reviewed by plant and training personnel. This is desirable to confirm technical accuracy and to verify that the training is being developed on a sound foundation.

5. Draft learning objectives should elicit significant criticism. This is expected and indicates an aggressive review process. Revising learning objectives at this stage is more cost effective than waiting until later to revise the completed training program.

6. After learning objectives are approved by management, they are used to guide decisions of the selection and development of training materials. Material and training activities should be chosen based on how readily they enable the trainees to meet the learning objectives.

B. ORGANIZATION OF LEARNING OBJECTIVES

Complex subjects have an underlying structure that, when recognized, can simplify learning. Determining this structure and using it to organize learning objectives can help trainees learn more efficiently. Organizing learning objectives to take advantage of the relationships within the subject can reduce the time needed for trainees to meet the objectives and can be a source of training economies.

Experience is a great teacher. As a value is internalized, a complex subject learned, or a difficult skill mastered, the individual often becomes so adept that what was once challenging becomes routine. The difficulty in achieving full competency is easily forgotten. For example, this phenomenon can be seen by reflecting upon the mistakes everyone makes as they mature and solidify their personal values, the frustration involved in mastering the use of a new computer system, or the number of errors made while learning a new sport. Affective, cognitive, and psychomotor learning build competency and simplify performance.

While performance becomes less challenging with experience, the opposite relationship also holds. Difficulty appears greatest for the inexperienced. Initial perceptions of trainees can inflate the actual challenge of new performance requirements. As experience is gained, achievement and confidence rise.

Training economizes experience by providing trainees with a safe environment for experiencing failure, correcting mistakes, and practicing to achieve competence. Organizing learning objectives to mimic the structure of the subject matter is the key to helping trainees achieve mastery quickly.

Affective, cognitive, and psychomotor objectives can be used to classify instructional content into general categories of interest. Terminal and enabling learning objectives support efficient training designs. Terminal learning objectives identify the competency training is expected to produce. Enabling learning objectives define the steps whose completion results in meeting the terminal learning objective. The levels of performance within each category provide a way of arranging terminal and enabling learning objectives to take advantage of the organization of the material. INPO 85-006, *Principles of Training System Development Supplement* (Section 3) identifies the following four types of relationships that can exist among learning objectives:

- dependent - mastery of one requires prior mastery of another
- supportive - mastery of one helps master another

- common factor - both share the same action verb
- independent - no relationship exists; mastery of one is not related to mastery of another

Additional information on the relationships among learning objectives is provided in Section 3 of the supplement.

The four types of relationships can help organize learning objectives. Developing "organization charts" that show the logical relationships among learning objectives is an effective method. This approach includes the following steps:

1. Write each of the learning objectives to be organized on a card or POST-IT® note.

2. Use a team of two or more members to organize the learning objectives by arranging them on a table or posting them on a wall or board.

3. Encourage participants to move the objectives around to show different ways of organizing the material.

4. Recognize that there is generally more than one way of effectively stating and organizing learning objectives.

5. Use the four types of relationships described previously in the following ways:

   a. dependent - place dependent objectives above the one(s) they are dependent upon

   b. supportive - group these objectives in parallel

   c. common factor - use to combine learning objectives with the same action verb

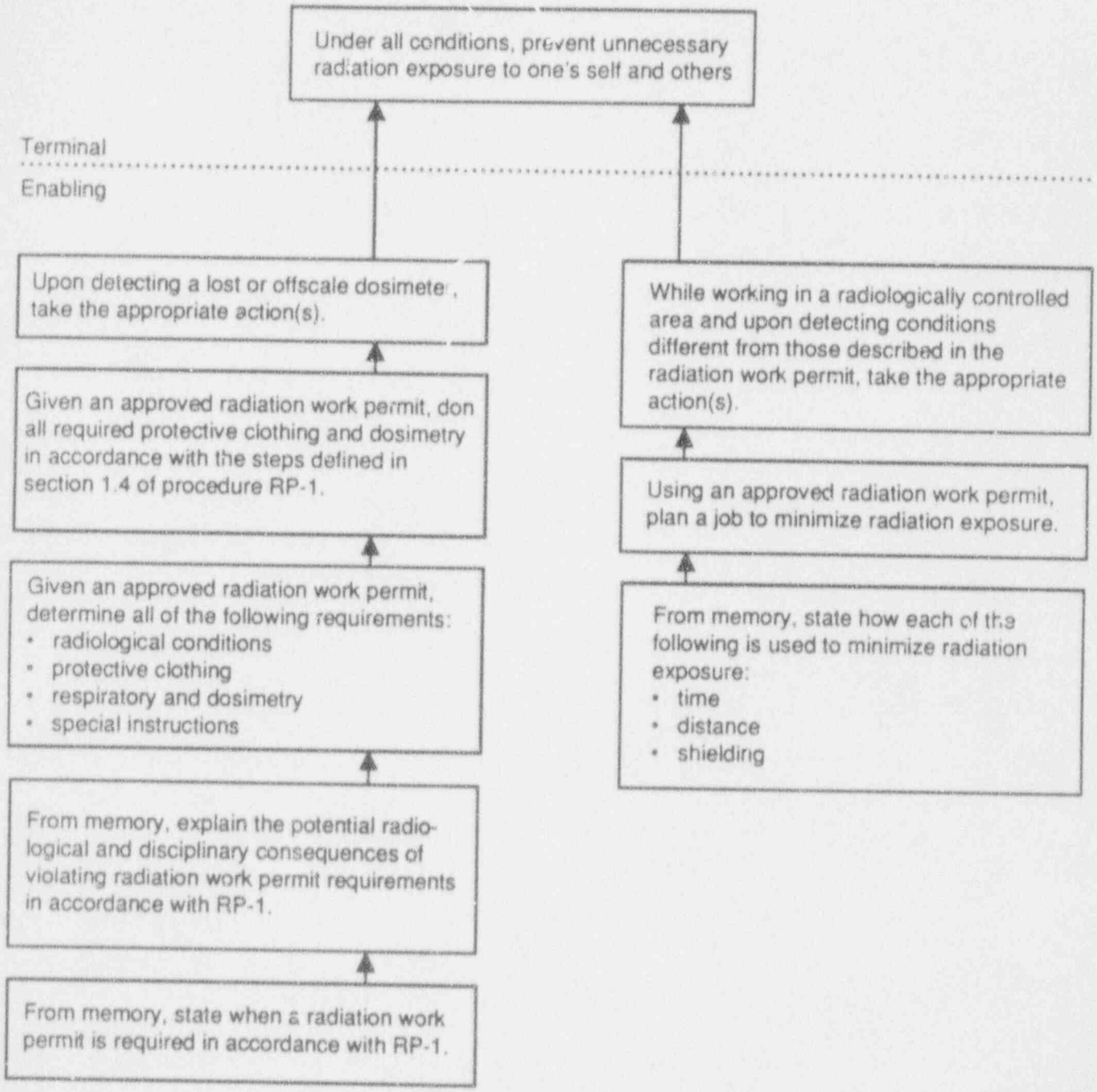
   d. independent - remove these objectives; identify where they can be included to exhibit dependent or supportive relationships

6. Make maximum use of dependent and supportive relationships. These are the keys to effective designs.

7. Show the completed organization chart to others and revise it as appropriate.

Figure 1 illustrates some of the relationships between terminal and enabling learning objectives. This example uses the concepts of personnel protection and work planning to organize learning objectives into two supportive paths. Within these paths, dependent objectives move from basic (bottom) to advanced (top) information. Radiation work permit requirements and minimizing radiation exposure learning objectives establish the foundations for the more advanced paths of handling lost or off-scale dosimetry and responding to conditions different from those described in the radiation work permit. Meeting these dependent learning objectives helps the trainee achieve the terminal learning objective of preventing unnecessary radiation exposure to one's self and others.

FIGURE 1



EXAMPLE RELATIONSHIPS BETWEEN TERMINAL AND ENABLING OBJECTIVES:
It is suggested that this figure be read from the bottom up to see how the enabling objectives logically build to the terminal objective using personnel protection and work planning examples.

Cognitive objectives also provide the information from which attitudes and values and psychomotor performance develop. People base their attitudes and values on what they know. Likewise, some basic knowledge is needed to perform even the most basic psychomotor behavior.

C. TESTING OF LEARNING OBJECTIVES

Valid test questions exhibit fidelity with learning objectives. Specifically, the test item approximates the conditions, assesses performance of the action statement, and requires the same standard of performance contained in the corresponding learning objective. Well-stated learning objectives suggest the content and format of associated test questions. INPO 88-002, *Principles of Training System Development: Addendum II, Examinations: Design, Development, and Implementation*, provides detailed guidance on testing cognitive and psychomotor performance.

Evaluating employee mastery of affective learning objectives presents unique challenges. Opinion is divided on evaluating employee performance of affective learning objectives. Some maintain that it is not possible to measure performance reliably using written tests. Proponents of this position point to the ease with which affective test questions can be faked. Specifically, a "correct" response can be provided even when the person does not practice the behavior. Others take the position that test questions can be developed to obtain the examinees' true affective responses. Utilities should determine the desirability of these options and select the one(s) that can reliably measure achievement.

Experience shows that individual behavior is the best indicator of attitudes and values. This suggests that attitudes and values may be more reliably evaluated during day-to-day supervision and reinforced through coaching and the employee performance appraisal system. In the training environment, a similar approach may be used and feedback provided to line managers and supervisors.

D. TRAINING PROGRAM EVALUATIC

Learning objectives provide an objecti[illegible]indicator of the capability of each trainee and a basis for program evaluations. Using the functional relationships between learning objectives and test items, performance can be assessed for individual trainees or across classes or programs. Performance on learning objectives is a common denominator for assessments at each of these levels.

Learning objectives should be reviewed when procedure changes, plant modifications, plant/industry events, or evaluation data indicate a need to revise training. Needed changes to learning objectives and related training materials are made so that training continues to prepare employees to perform their jobs safely and reliably.

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APPENDIX A
EXAMPLE CONDITIONS, ACTION, AND STANDARDS STATEMENTS

PURPOSE

The purpose of this appendix is to provide example conditions, action, and standards statements. These examples can be adapted to support writing learning objectives for operations, maintenance, or support training. A sample of examples is used to illustrate the kinds of statements that can be combined into completed learning objectives. The key to using these examples effectively is to recognize their limitations and to revise them to fit the training needs of the intended audiences.

EXAMPLE CONDITIONS STATEMENTS

The following phrases illustrate several types of conditions statements. They are a sample of many different possible combinations and include plant, job, information, and qualitative examples. Fill-in-the-blank spaces are included in statements that can be used in a variety of applications.

Plant

- During normal conditions,
- During plant mode ____,
- Given a ___ transient,
- Given a change in ____,
- Given ____ failure(s),
- Given immediate action conditions,
- Given entry-level conditions to technical specifications,
- Given entry-level conditions to abnormal (or emergency) procedures,
- Under all conditions,

Job

- During shift turnover,
- While performing plant rounds,
- While standing the ____ shift,
- While making ____ log entries,
- While alone in the ____,
- Prior to conducting ____,
- Given an unlabeled ____,
- Using the ____ (tools, equipment, etc.),

Information

- Using ____ procedures/references,
- Using available indicators,
- Using alternative indicators,
- Using ____ survey results,
- Using ____ surveillance test results,
- Upon receiving ____ annunciators/alarms,
- Given abnormal ____ indications,
- Given any abnormal indications,

Qualitative

- Upon request,
- From memory,
- Through observation,
- Using only sound,
- From smell alone,
- From touch alone,
- Upon direction,
- Without prompting,
- When in doubt,

EXAMPLE ACTION STATEMENTS

Example action statements are provided in the affective, cognitive, and psychomotor performance areas. Each set of examples uses a series of fill-in-the-blank statements arranged from higher to lower levels of performance. They are a sample of many possible combinations.

AFFECTIVE

- prevent ____
- encourage others to ____
- exhibit ____
- recognize that ____ is a corporate value

COGNITIVE

Purpose

- state the purpose of the ____ system

Safety Precautions

- encourage others to carry out the following safety precautions:
- predict the damage that each of the following can cause:
- list the precautions associated with the ____ system
- identify the personnel hazards or dangers associated with the ____ system

Design and Interrelationships

- predict the ____ system response during a ____ transient
- predict the effects of a loss or malfunction of ____ on ____
- explain the purpose of each of the following ____ system interlocks:
- identify normal and alternate ____ power supplies to the following:
- describe the functional dependencies that exist between the ____ and ____ systems
- match the following ____ system parameters to plant modes:
- locate the components of the ____ system

- draw a one-line diagram of the ____ system that shows its key components and physical connections with other systems
- name the major components of the ____ system
- state the design basis of the ____ system

Procedures

- report errors in ____ procedures
- use procedure ____ to ____
- describe the process for reporting errors or sources of confusion in ____ procedures
- list the consequences of improperly performing a ____
- select the procedure(s) for the ____ activity

Controls

- evaluate the loss of ____ control to determine alternative means for regaining control
- evaluate how the ____ control layout, design, and operation limitations might contribute to human performance error
- identify any peculiar features of ____ that might contribute to human error
- relate ____ control adjustments to their effects on the following system parameters:
- identify where the ____ system controls are located

Alarms

- verify a ____ alarm
- identify the ____ alarms expected during the following plant activities:
- recognize the setpoints of the ____ alarms
- locate the ____ alarm annunciator
- identify where the following ____ alarm sensors monitor the system:
- identify the alarms associated with the ____

Indicators

- detect ____ trends displayed by the ____ recorder
- recognize the failures modes of each of the ____ following monitors:
- match ____ indications to specific plant conditions
- obtain information from the ____ recorder
- locate where in the flow path each of the following indicators senses ____ system parameters:
- identify the monitors associated with the ____ system

Sampling

- evaluate the need for an additional ____ sample
- record the parameters of a ____ sample
- list the factors that can influence ____ analysis results
- identify the labeling information required on ____ samples
- determine the flushing/recirculation requirements for sampling the ____
- identify the sample points in the ____

Teamwork

- serve as a good role model
- critique individual and team performance
- manage conflict through collaboration
- exhibit initiative and leadership
- provide complete input and feedback
- advocate a position or concern
- inquire to obtain needed information

Operations

- avert a problem in the ____
- mitigate the effects of a ____ on the ____
- evaluate the ____ system response during a ____ event
- evaluate operating limitations of the ____ system
- predict how changing environmental conditions affect the ____ system
- predict the consequences of ____ component failure on the ____ system
- explain the bases for limiting conditions of operations and safety limits of the ____
- match plant events to the notification requirements of outside agencies
- relate ____ system status to the notification requirements of plant personnel
- relate individual performance responsibilities to each mode of plant operation
- place the ____ in a safe condition
- classify the following ____ system conditions into normal or abnormal:
- relate each ____ system test to the parameters it monitors
- select the applicable technical specifications for each of the following plant conditions:
- identify the correct ____ system alignments for each of the following conditions:
- determine the ____ alignment for ____
- state the reason for ____
- describe the normal operation of the ____ system

Diagnostics

- evaluate the effects of ____ corrective actions
- implement corrective actions ____
- evaluate alternatives
- assess the safety implications of each of the following recovery alternatives:

- determine the urgency of a ____ condition
- evaluate the potential for ____ to worsen
- predict the effects of ____ on other plant systems
- relate changes in ____ to the need for action
- detect ____ performance errors
- detect abnormal conditions
- detect changes in ____
- monitor the ____
- determine an alternative explanation of ____ conditions
- interpret the following conditions:
- use alternative indicators to confirm ____ conditions
- identify the symptoms associated with ____
- identify abnormal characteristics

PSYCHOMOTOR

- (any task or element statement is a possible psychomotor action statement)
- practice ____
- observe ____

EXAMPLE STANDARDS STATEMENTS

The following statements suggest the type of phrases that can identify the performance criteria that trainees must fulfill to meet learning objectives. This is not an exhaustive list and simply depicts some alternatives. Quantitative, procedural, and qualitative examples are provided. Fill-in-the-blank spaces are included in statements that can be used in a variety of applications. Users are encouraged to use statements that closely approximate actual performance criteria.

QUANTITATIVE

- with less than ____ errors
- to ± ____
- within ____ seconds/minutes/hours
- without producing more than ____ units of waste
- without receiving more than ____ mrems

PROCEDURAL

- in accordance with ALARA policy
- in accordance with the RWP
- in accordance with all certification criteria
- in accordance with applicable labor agreements
- in accordance with steps ____ through ____ of the emergency plan
- in accordance with steps ____ through ____ of procedure number ____

QUALITATIVE

- without error
- without spillage
- without breakage
- without loss of material
- without hesitation
- with absolute clarity

- on schedule
- on the first attempt
- before proceeding
- to minimize time and optimize distance and shielding
- to the accuracy of the instrument
- before conditions degrade
- prior to equipment damage
- prior to performing subsequent actions
- without entering a limiting condition of operation
- while remaining within technical specifications

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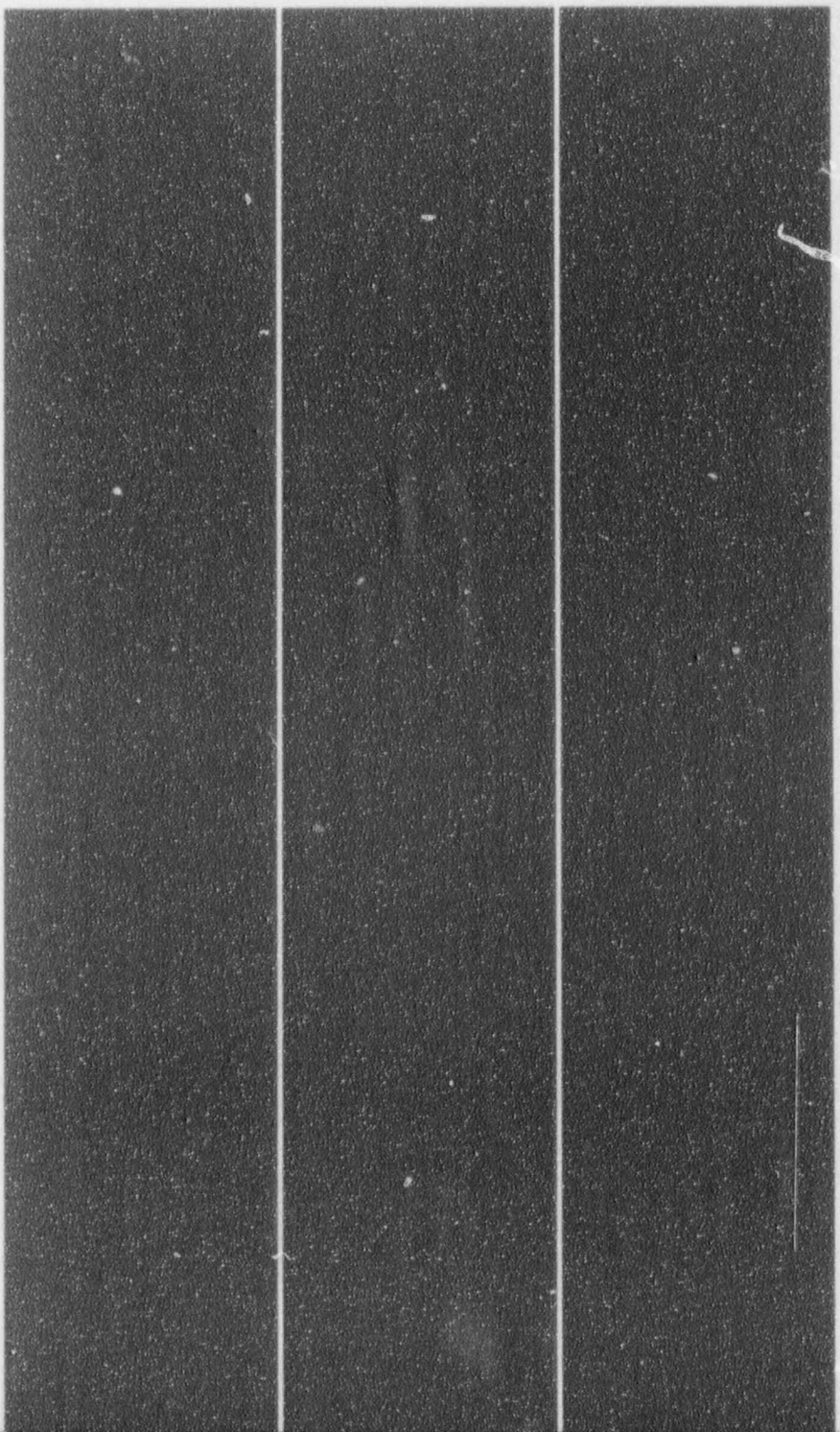

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