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DOE HANDBOOK

TRAINING PROGRAM HANDBOOK: A SYSTEMATIC APPROACH TO TRAINING



**U.S. Department of Energy
Washington, D.C. 20585**

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Page/Section	Change
Page vii/1 st paragraph	DOE O 426.2, <i>Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities</i> and DOE O 426.1, <i>Federal Technical Capability</i> . This Handbook contains no requirements.
Page vii/4 th paragraph	Brendan M. Burns, PE HS-32, FORS 1F-045 U.S. Department of Energy Washington, D. C. 20585 Phone (202) 586-2671 Facsimile (202) 586-3915
Page 1/Section 1.0	This commitment should be made by senior management from the beginning. Managementshould ...
Page 6/Section 2.1.3	An effective needs analysis involves subject matter experts (SMEs)
Page 6/Section 2.1.5	Any actions taken and decisions made during the needs analysis should be documented.
Page 17/Section 3.1	Care should be taken when developing and writing learning objectives. Trainees either clearly understand them, or they are of limited use. Related terminal objectives are then written ...
Page 17/Section 3.1.1	When writing a terminal objective, consider the training setting since it has to be balanced against available resources and facility constraints.
Page 17/Section 3.1.1.1	However, feedback should be provided.
Page 20/Section 3.1.2	All terminal objectives for tasks identified for inclusion in the training program should now be sequenced
Page 20/Section 3.1.2	They should be sequenced in a logical progression which takes into account the level of learning necessary to build to the

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	next objective.
Page 22/Section 6.	List of qualifications, courses of instruction, etc., that have to be completed prior to administration of the performance test
Page 22/Section 3.2.1	The testing reflects the stated terminal objective.
Page 23/Section 3.2.1	Key portions of a task should be "perform" items whenever existing facility conditions permit.
Page 23/Section 3.2.4	... the entry-level KSAs of the trainee should be considered.
Page 24/Section 3.2.5	Although a compromise, the conditions and standards applied during training and testing should be designed to be the ...
Page 25/Section 3.2.6	Any identified KSAs that are not included in the entry-level requirements should be incorporated into an enabling objective.
page 25/Section 3.2.7	scorable items should be clearly defined to distinguish between satisfactory and unsatisfactory performance.
Page 26/Section 3.3.2	Although at least one test item should be developed for each learning objective, ...
Page 26/Section 3.3.3	Test items should have answer keys written at this time.
Page 26/Section 3.4	tests are needed prior to implementing the training program.
Page 29/Section 3.5.4	DOE-HDBK-1001-96
Page 37/Section 4.3.1	Each learning activity should be analyzed to ...
Page 46/Section 5.1.3	... by identifying a clear indication of what will be learned ...
Page 54/Section 6.1.2.1.	Identify all actions or key points to be evaluated. Each should be important, observable, and measurable;
Page 60/Section 6.2	Program evaluation information should be analyzed before it is used to make changes in training.
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FOREWORD

This Department of Energy (DOE) Handbook, *DOE-HDBK-1 078-94, Training Program Handbook: A Systematic Approach to Training*, describes a systematic method for establishing and maintaining training programs that meet the requirements and expectations of DOE Orders DOE O 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities* and DOE O 426.1, *Federal Technical Capability*. This Handbook contains no requirements. The systematic approach to training (SAT) includes five distinct, yet interrelated, phases. These phases include analysis, design, development, implementation, and evaluation. SAT is consistent with other systematically based training systems such as performance-based training (PBT), training system development (TSD), instructional systems development (ISD), and other similar methods. For the purposes of this Handbook, SAT and PBT are interchangeable. The systematic approach method may also be used in conjunction with other DOE orders and directives that contain personnel training and qualification requirements.

This Handbook describes the more classical concept and approach to systematically establishing training programs. However, in some cases this classical approach has proven to be time- and labor-intensive, especially if excessive detail is expected. The risk and complexity associated with performance of a job or the nuclear hazard category of the facility affected may warrant the use of simpler, less detailed alternative methods to achieve results that are both satisfactory and effective. These methods are discussed in other Departmental and industry standards.

Users of this Handbook should consider the variety of training options that are available for establishing and maintaining personnel training and qualification programs. Blending classical and alternative systematic approaches to training methods often yields the most effective product. Finally, users should emphasize the fundamental goal of any training program as they use this Handbook; that is, to prepare workers to do their jobs safely, efficiently, and effectively, and to protect the work force, the public, and the environment.

Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this document should be addressed to:

Brendan M. Burns, PE
HS-32, FORS 1F-045
U.S. Department of Energy
Washington, D. C. 20585
Phone (202) 586-2671
Facsimile (202) 586-3915

by using the U.S. Department of Energy Standardization Document Improvement Proposal(DOE F 1300.X) appearing at the end of this document or by letter.

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This Handbook replaces DOE-STD-0102T, "TAP 2 Performance-Based Training Manual," of August 1993.

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ACRONYMS

DOE	Department of Energy
ECCS	Emergency Core Cooling System
ECS	Emergency Cooling System
EOL	End of Life
HP	Health Physics
KSA	Knowledge, skill, and ability
NE-1	Assistant Secretary for Nuclear Energy
OJT	On-the-job training
OR	Occurrence Report
OSHA	Occupational Safety and Health Act
P&E	Plant and Equipment
PER	Performance Evaluation Report
SD	Standing Directives
SER	Safety Evaluation Report
SME	Subject matter expert
SOP	Standard Operating Procedure
SP	Standard Practice
TAP	Training Accreditation Program
TES	Training/Evaluation Standard
TS	Technical Specifications (“Tech Specs”)

**TRAINING PROGRAM HANDBOOK: A SYSTEMATIC
APPROACH TO TRAINING**

1.1 INTRODUCTION

The cornerstone of safe operation of the Department of Energy (DOE) nuclear facilities is personnel performing the day-to-day functions which accomplish the facility mission. Training that is conducted efficiently and effectively and is directly related to the needs of the job (i.e., performance-based training) is fundamental to safe operation. Responsibility for the safe operation of these facilities is a line-management function. Therefore, achieving performance-based training requires commitment from the organization for which training is provided. This commitment includes making subject matter experts (SMEs) available for participation in and review of the products of the performance-based training process. It also includes budgeting and scheduling the time required for both initial and continuing training. This commitment should be made by senior management from the beginning. Management should get involved at the start to ensure that they are not only cognizant of ongoing activities but are also involved to the degree necessary to thoroughly understand the process. Policies implemented and support demonstrated by senior management provide the driving force to ensure that training programs receive the attention that is imperative, if facility training programs are to be successful.

1.2 Development of this Handbook

This Handbook has been designed to assist facilities/sites/offices in their efforts to develop training programs based on the systematic approach to training (SAT) model. Information in this Handbook has been compiled from a number of sources: The Institute of Nuclear Power Operations, Principles of Training System Development; DOE Guidelines for Job and Task Analysis for Department of Energy Nuclear Facilities; and selected DOE contractor training manuals and procedures. In addition, personnel representing DOE contractors and private industry contributed significantly to the development of this process.

1.3 Handbook Description

This Handbook contains a narrative discussion on the various phases of the systematic approach to training process. The phases can be modified and incorporated as appropriate when developing detailed local procedures. Each phase is organized such that the major steps necessary to adequately complete it are clear. Figures, attachments, and illustrations are added for clarification and may be reproduced as desired.

The processes described in this Handbook represent only one of the possible approaches for the development of training programs using the systematic approach to training model. Other approaches may work equally well if they are based on a systematic method

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of determining and implementing training that is directly related to the needs and requirements of the job.

This Handbook was written on the assumption that a facility/site/office is currently not using the systematic approach to training model for their training programs. However, many facilities/sites/offices do have effective training programs in place that contain many performance-based characteristics. Existing programs should not be discarded, rather systematic methods should be used to validate and supplement the content where necessary. The systematic approach also helps refine the methods of managing and implementing these programs.

This Handbook is organized into a series of sections, each section representing one of the phases of the SAT model. An overview of each of the phases follows.

1.3.1 Analysis. This section addresses three methods of identifying training/performance requirements: needs analysis, job analysis, and task analysis. The major outputs of the analysis phases are a task list for each position, and a task-to-training matrix.

The task-to-training matrix identifies the training disposition of the tasks identified in the task list and lists the existing materials that support task performance. Participation of subject matter experts and facility personnel is emphasized throughout the processes.

1.3.2 Design. The design phase uses the information collected during the analysis phase to provide a “blueprint” for developing training programs based upon the SAT model. This section of the Handbook addresses methods for writing learning objectives, setting training standards, designing tests, and preparing training plans. The major outputs of the design phase are learning objectives and test items. For existing programs, contractors are encouraged to determine if their learning objectives are appropriate, cover all required content, and include appropriate criteria and conditions.

1.3.3 Development. Development incorporates the results of the design activities. The major outputs of the development phase are the completed lesson plans and training aids.

1.3.4 Implementation. Implementation encompasses taking the results of the development phase into the training setting and conducting the training. The major output of the implementation phase is trained personnel.

1.3.5 Evaluation. Evaluation consists of a periodic review of the training materials and methods of soliciting feedback from former trainees and their supervisors on the effectiveness of training. The major outputs of evaluation are the decisions made to improve the training program during all phases.

1.4 Management of the Training Program

This Handbook does not contain all the material or information necessary to make a training program work. Overall policies and procedures that each organization determines necessary to develop and administer performance-based training programs are also required. These policies and procedures may be called Training Program Manuals, Training Procedures Manuals, Training Management Manuals, Training Plans, etc. Whatever its name, the document should contain procedures that govern the way the facility/site/office conducts training. For purposes of discussion in this Handbook, this document will be referred to as the *Training Management Manual*.

1.4.1 The *Training Management Manual* should formalize facility policies and procedures for training. Examples of sections that should be included in the manual follow.

1. Introduction and Organization
 - Purpose and scope of the manual;
 - Manual compliance requirements;
 - Training program purpose and goals; and
 - Organizational relationships and reporting structure.

2. Qualification and Training Program Descriptions
 - Overview of qualification and training programs;
 - New employee orientation or indoctrination;
 - Visitor indoctrination;
 - Subcontractor indoctrination and training;
 - Descriptions of all training programs (individually or by groups);
 - Instructor training and qualification;
 - Continuing training;
 - Proficiency requirements; and
 - Requalification (periodic, following disqualification, lapsed qualification, etc.).

3. Training Program Material Development and Administration
 - Training/Evaluation Standards;
 - Checklists or qualification cards;
 - Lesson plans, on-the-job-training (OJT) guides, lab guides, etc.; and
 - Training aids and reference material.

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4. Training Program Standards and Policies

- Academic standards;
- Examinations;
- OJT (conduct and evaluation);
- Lectures, seminars, training exercises, etc.;
- Drills;
- Signature requirements;
- Student conduct and controls;
- Disqualification procedures and policies; and
- Exceptions, extensions, and waivers.

5. Administration

- Training and qualification records;
- Selection and qualification of instructors;
- Training program development/change requests;
- Audits (internal and external);
- Evaluating training program effectiveness; and
- Control of subcontracted training.

2.1 ANALYSIS

The process descriptions contained in this section describe a systematic approach to identifying and documenting performance-based training requirements. The types of analysis used for identifying training requirements include needs analysis, job analysis, and task analysis. These analyses will provide assurance that training is the appropriate solution to performance problems and identify requirements that serve as the basis for the design and development of performance-based training programs. The process descriptions in this section will assist users:

2.2 Determine Training Needs

Training needs are initially identified by reviewing regulatory requirements and existing training programs, and/or conducting a needs analysis. These activities enable facilities/sites/offices to determine training needs originating from performance problems, regulatory requirements, and in some cases, requests for additional training or changes to existing training.

2.2.1 Further in-depth analysis need not be conducted for training requirements originating from a regulatory source [DOE Order, Occupational Safety and Health Act (OSHA), etc.], since in essence the needs analysis has already been done. These requirements are simply included and addressed in the design and development phases of the training program. Likewise, additional detailed needs analyses are not necessary for training programs that are in place and are producing the desired results. However, needs analyses are appropriate when a discrepancy exists in the performance of the job. A needs analysis should also be performed whenever changes to training or requests for new training courses are received. The analysis provides assurance that training is appropriate and ensures that it is not included elsewhere in the training program.

2.2.2 A needs analysis can identify solutions to job performance discrepancies. Substandard performance may be related to faulty equipment, inadequate procedures, attitude of the workforce, etc. Prior to developing new courses or modifying existing training programs, a needs analysis should be conducted to determine that training is the appropriate solution. Proper conduct of the analysis identifies the root cause(s) and serves as a basis for future plans to correct identified performance discrepancies. The following questions should be evaluated as part of this analysis.

1. Do performance deficiencies exist?
2. Are employees capable of performing their jobs?
3. Do they perform the job frequently?

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4. Have previous employees been able to perform these jobs?
5. Are operating procedures adequate or have they changed significantly?
6. Are identified deficiencies training-related?

2.2.3 An effective needs analysis involves subject matter experts (SMEs) such as job incumbents and supervisors who are knowledgeable of the job requirements and standards of performance. Job data collected from these sources provide insight into performance problems and valuable input into actions planned to correct them. Analysis of performance problems should follow a logical sequence and continue until the root cause is established. In general, the following sequence should be followed.

1. Identify specific symptoms of the problem clearly.
2. List possible alternative causes to the problem.
3. Investigate each alternative cause until it can be eliminated or confirmed as a contributor.

2.2.4 Circumstances generally having training-related implications may include the following.

1. Performance-based training programs for key positions are not in place.
2. The facility has a shortage of qualified personnel.
3. Major changes in job scope have occurred.
4. Changes to requirements have occurred.
5. Plant or equipment modifications are not routinely incorporated into training programs.

2.2.5 Any actions taken and decisions made during the needs analysis should be documented. This documentation provides an important element that supports and validates the training program since a critical part of the training program records is the rationale that supports related decisions. A form similar to the "Training Needs Analysis Report" (Attachment 1) may be used to document findings and recommendations. These records should be maintained throughout the life of the training program to substantiate development efforts and subsequent modifications.

2.2.6 If a valid task list exists for a training program and a needs analysis results in the identification of additional tasks for a program, the tasks should be added to the task list. If the analysis does not result in identification of new tasks, the task list for the program should be reviewed to determine if the task titles need to be revised, or if any task needs to be changed to train or no-train (refer to Section 2.3.3 of this Handbook). If a valid task list for the program does not exist, a needs analysis may result in the development of a specific course that satisfies a training need for a specific task. This task should then be included in the task list when a job analysis when it is performed.

2.3 Develop a Valid Task List

A job analysis is conducted to develop a detailed list of duty areas and tasks for a specific job or position. It can also supply information to develop a job/position description, if desired. Job analyses also allow comparison of existing training programs to established requirements and identify deficiencies in the adequacy of program content. For existing programs, the job analysis provides reasonable assurance that all tasks essential to safe and efficient operation are addressed by the training program. It also identifies parts of the training program that are unnecessary, thus resulting in a more effective training program and more efficient utilization of resources. For facilities/sites/offices developing new programs, the job analysis provides the information necessary to identify tasks associated with the job. Training design and development activities can then be based on actual needs, as opposed to perceived needs.

All pertinent information regarding position-specific job analyses should be documented in a job analysis report, which becomes part of the training program file for each specified position. This report describes the process/methodology used to conduct the job analysis, the names and positions of individuals conducting the analysis, and the results of the analysis. The following sections provide general guidance pertaining to performing job analyses.

2.3.1 **Review Available Job Information.** The first step in job analysis is a review of available job information. This review provides input to an initial list of tasks and duty areas, and serves as the starting point for further analysis. The following are examples of the types of documents that should be reviewed.

1. Standard Operating Procedures (SOPs);
2. Group, Department, and/or Division Procedures;
3. Standing Directives (SDs), Standard Practices (Sps);

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4. Technical Safety Requirements (TSR)/Standards;
5. Occurrence Reports (Ors);
6. Job Questionnaires/Job Descriptions;
7. Equipment/System Operating Manuals;
8. Existing Qualification Documents; and
9. Studies employing job or task analyses of similar jobs (e.g., DOE, Edison Electric Institute, Institute of Nuclear Power Operations, Nuclear Regulatory Commission).

Information gained from observation of job incumbents performing the tasks should be used in the review, as should any data that has been collected related to extremely effective or ineffective performance.

This review is conducted for the following reasons.

1. It enables the person conducting the analysis to better understand the nature of the job;
2. It identifies how much, if any, of the job analysis work has already been completed; and
3. It yields information to write a job description if one does not already exist.

2.3.2 **Select and Train Job Analysts.** Personnel selected to conduct the job analysis should include SMEs, supervisors for the job or position undergoing analysis, and representation from departments involved in the decision-making process. These departments may include Operations, Training, and Human Resources. Representation from these groups promotes better cooperation and understanding during and after the analysis. The persons selected should be supportive of the job analysis activity and trained in the process.

Training for those participating in the job analysis is necessary because the participants are much more likely to be knowledgeable in the details of the job being analyzed than they are in the process by which the analysis is conducted. A short course is recommended to explain the purpose, value, and methodology for collecting job analysis data.

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2.3.3 **Develop the Task Listing.** In addition to the information obtained from the document review, SMEs from the prospective user group are consulted for compilation of the task lists. A task list is developed using the following general process.

1. The job is broken down into duty areas that are part of the job responsibilities;
2. Initial task lists are developed; and
3. Task statements are written to describe individual tasks.

Duty areas are groups of tasks that constitute a major subdivision of a job. They integrate specific knowledge, skills, and abilities required by the job. An example of a duty area for a reactor operator may be "the emergency core cooling system;" for a cascade operator, "the cascade compressor lubricating oil system;" and for a hot cell operator, "the cell ventilation system." Examples of tasks for the above duty areas are "Start up the emergency core cooling pump;" "Shift, inspect, and clean the lubricating oil strainers;" and "Align the ventilation system for negative cell pressure," respectively.

Task statements should be written such that they are clear, complete, concise, relevant, and stated at a consistent level. "Guidelines for Writing Task Statements" (Attachment 2) is a guide for preparing task statements and provides examples of "dos" and "don'ts" for task statement development.

2.3.4 **Validate the Task Listing.** Validation of the initial task list can be accomplished in numerous ways. A tabletop discussion using three or four SMEs, job-qualified employees, and supervisors can provide reasonable assurance that the initial task listing is accurate. Interviewing a limited number of job incumbents may also be an appropriate method. The primary concerns of the validation process are to ensure that:

1. All tasks performed are included on the task list;
2. The task statements accurately describe the tasks; and
3. Only those tasks associated with the job are included on the task list.

2.3.5 **Prepare the Survey Questionnaire.** Questionnaires are prepared for distribution to job incumbents. They are used to verify the accuracy and validity of the initial task list and identify which tasks will be selected for training. Each questionnaire includes appropriate instructions for filling out the form; a section for

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demographic information (personnel data); task listings appropriately grouped by functional duty areas; rating scales designed to gather information regarding the characteristics of each task; and a listing of the tools, equipment, and references for task performance. The job incumbent is asked during the survey to assign ratings in the following categories: Task Importance, Task Difficulty, and Task Frequency. The rating system is based on the criteria contained in "Task Rating System" (Attachment 3). Clear, complete instructions should be included on the questionnaire. Attachment 4 is a questionnaire example that may be used.

2.3.6 Select the Survey Sample and Conduct the Survey. Questionnaires should be administered to a representative sample of the overall group, division, or department to ensure validity of response information. Considerations to be made concerning number and types of survey respondents include experience of the job incumbents, availability, and restrictions imposed by operational or production requirements. Qualified supervisors should be included in the survey. The survey sample size should be as large as possible to assure a representative sample of the prospective work group population.

2.3.7 Analyze the Survey Results. Survey results are compiled and analyzed by the training organization. As a minimum, the reported results should contain the following.

1. Frequency of task performance;
2. Importance (consequences of inadequate performance);
3. Difficulty of task performance; and
4. All additional tasks identified by survey respondents that were not included in the initial survey.

Any differences between supervisor responses and job incumbent responses are resolved during the analysis of the data. Differences may occur because of the different perspectives of the respondents and the emphasis each group places on individual tasks. Large deviations in numerical responses to individual tasks should also be investigated during this analysis. It is helpful to compile the results of the questionnaires on a form similar to "Job Analysis Tabulation" (Attachment 5). Data entered on this form are the numerical averages from all returned questionnaires (excluding supervisors). Data from the averages of the supervisor questionnaires are used to help determine the validity of the survey.

Survey results can be compiled by hand or by use of a computerized database management system. Several software systems are readily available if a computer system is used. Before the responses are entered into the data base, each returned questionnaire should be checked to identify any problems that might invalidate

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responses. Upon completion of data entry, the survey data can be analyzed as desired for the overall ratings of each scale for each task. These results can then be used to determine which tasks, if any, are selected for detailed analysis.

2.4 Select Tasks for Training

2.4.1 Develop Numerical Averaging Criteria. After analyzing the survey results the numerical averages of the responses are used to identify which tasks will be selected for training. Tasks are selected or deselected for training using a systematic process similar to the one illustrated in Figure 1. This process involves the establishment of criteria for each category that represents tasks according to their average numeric position on the questionnaire scales (e.g., Difficulty: very, moderate, not). The numeric cutoff points should be based on consideration of the relative impact of the category on the operation concerned. Figure 1 contains example ranges for each of the categories. Normally, Task Importance and Task Difficulty have a greater impact than Task Frequency, and the outcome of the decision tree reflects this.

2.4.2 Apply Responses to the Decision Tree. After the criteria developed in Section 2.3.1 have been established, the numerical average of each of the tasks is inserted into the decision tree (Figure 1) and the proper path is chosen. Tasks should then be sorted into groups according to similar combinations of average difficulty, importance, and frequency ratings as shown in Figure 1. The decisions arrived at using this procedure result in a grouping of tasks along a scale so that one end of the scale contains difficult, important, and frequently performed tasks; the other end of the scale contains the easy, less important, and infrequently performed tasks. Tasks that are identified as No Train should be reviewed by subject matter experts and supervision to assure that no formal training is needed.

2.4.3 Develop a Train/No Train/Overtrain List. Each group of tasks, in turn, is associated with a recommendation to train, not to train, or to overtrain as follows:

TRAIN. Provide a combination of formal training (e.g., classroom, on-the-job, drills, simulators, etc.).

NO TRAIN. No Train is not to be interpreted to mean that no training at all is required. It means that no formal training (refer to Train above) is necessary; the task can be learned on the job.

OVERTRAIN. Provide a combination of formal training plus periodic practice of the task (retraining).

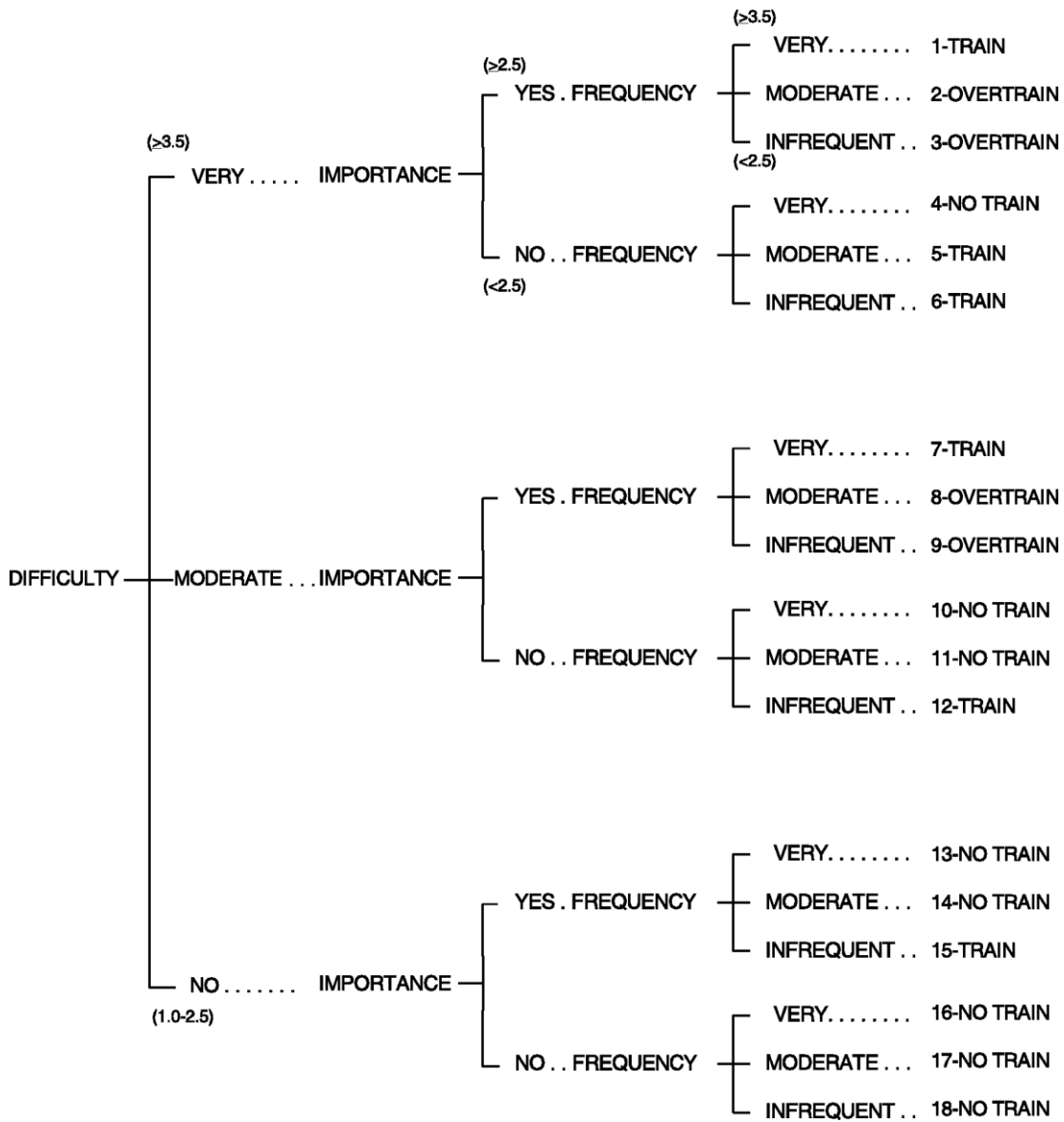


Figure-1. Criteria for Selecting Tasks for Training

2.4.4 **Validate the Lists.** At this point, the Train/No Train/Overtrain lists should be reviewed by a committee. This review is intended to provide concurrence and/or refinement to the list of tasks identified for training. The committee should consist of representatives from training, SMEs, and management since decisions will be made at this point that will determine the amount of time and resources that will be dedicated to subsequent activities.

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Selection or deselection of tasks for training should be based primarily on the results of the job analysis. Care should be taken to ensure that training needs are considered and training requirements, originating from regulatory sources, are included.

2.5 Prepare a Task-to-Training Matrix

The purpose of a Task-to-Training Matrix (TTM) is to provide one document that can be used to guide the maintenance of a training program. It provides a ready reference for evaluating the impact of procedure changes, criteria for selecting tasks for training, updated technical information, revised learning objectives, etc. The matrix should contain information for all tasks, whether selected for training or not. All related training and reference material should be included for the tasks selected for training. Tasks not selected for training should be listed in a separate section of the matrix and should include only related reference material. For new training programs, the matrix should be initiated following collection of job analysis data. As the later phases of the SAT are completed, additional information should be identified for inclusion into the matrix. For existing training programs, the TTM should be completed for all applicable training material (initial and continuing) and related references. This information provides the basis for analysis of existing training materials. Attachment 6, "Task-to-Training Matrix" provides an example.

2.6 Conduct an Analysis of Existing Training Material

At this point in the analysis phase, a comparison of existing training materials should be conducted. This is best accomplished using a committee made up of at least three SMEs and one or two knowledgeable people from the training organization. Existing lesson plans, lesson guides, OJT guides, and test questions, etc., should be compared to the criteria included in the process discussed in Section 3 of this Handbook to ascertain whether the existing materials are adequate.

2.6.1 Using the list of tasks selected for training, and the applicable operating procedures, review existing training materials for the following:

1. Training material exists that addresses the tasks identified for training;
2. Terminal objectives are included and are accurate and consistent with the task statement;
3. Standards for qualification are consistent with the terminal objectives;

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4. Enabling objectives are included and sequenced such that they accurately reflect the knowledge, skills, and abilities necessary to perform the task elements contained in the applicable procedure; and
5. Test items (questions) accurately measure the performance under the conditions and standards required by the objectives and the procedure.

2.6.2 The outcome of this analysis places the tasks selected for training in one of three categories: training for the task is adequate, training for the task exists and requires changes, or training for the task does not exist.

2.7 Conduct a Task Analysis

Although included in this process for consistency, in actual practice, task analyses, design, and development activities normally occur concurrently for most tasks. As training is designed and developed for the tasks selected for training, each task should be analyzed to determine the knowledge, skills, and abilities required for satisfactory accomplishment of the task. Task analysts should be selected and further trained in the process.

2.7.1 Task analysis data collection forms should be developed to meet specific division/department needs. Task information to be collected includes:

1. Initial **conditions** (prerequisites) required for task performance;
2. **Standards** (criteria) for acceptable task performance (e.g., limits, ranges, time requirements);
3. Critical **elements** (steps) that must be performed to accomplish the task properly; and
4. Associated knowledge, skill, and ability statements required to perform particular elements of the task or the overall task.

2.7.2 Procedures for conditions, standards, and elements associated with a task may be referenced if the information is adequately addressed in the procedure.

2.7.3 Task analysis information may be collected by one or more of the following methods:

1. Incumbent/subject matter expert interviews using guidelines or previous task analyses;
2. In-depth procedural review; and

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3. Subject matter expert consensus group meetings.

The particular method(s) used will be dependent upon manpower availability, plant production/operation requirements, and budgetary restraints.

2.7.4 When a task is large or complex, compiling key data on some type of analysis form can ensure that the required knowledge and skills are not overlooked. "Task Analysis Data Collection Form" (Attachment 7) and "Task Worksheet" form (Attachment 8) are examples of typical task analysis data collection forms.

2.7.5 Documentation collected during task analysis should be retained as part of the training course file and updated periodically as required by procedural changes, equipment/system modifications, management policy changes, and/or job restructuring.

2.8 Application of Job or Task Analysis Information

Information collected during the analysis is translated into training program requirements. Analysis data are also used to validate training program content and ensure that training reflects actual job requirements for both existing and newly developed material. The process contained in Section 3 describes the application of analysis data in the design of training programs.

2.9 Training Development/Changes

As additional training requirements are identified by user groups, requests for the development of new training materials and/or modifications of existing materials should be made. "Training Development/Change Request" (Attachment 9) is an example of a form that could be used.

2.10 Analysis Checklist

For ease in tracking activities during the analysis phase, use of a checklist is encouraged. This will allow individuals involved in the process to better plan and coordinate their activities. An example of an analysis checklist is given in "Analysis Checklist" (Attachment 10).

2.11 Key Considerations

The following key considerations should be emphasized when performing and evaluating activities of the analysis process:

1. A systematic process involving both training and facility personnel is used to analyze training needs.

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2. Alternative solutions to performance problems, including training and other management initiatives, are considered thoroughly before committing resources.
3. Job performance requirements are identified through reviews of existing job data and/or surveys of workers and are confirmed by subject matter experts.
4. Clear standards and uniform methods are used to collect, analyze, and review job and task data.
5. A panel of subject matter experts is used to assist training personnel when selecting tasks for analysis and training.
6. Tasks are identified for initial and/or continuing training.

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3.1 DESIGN

The approach described in this section outlines the basic processes used to design training programs that are based upon the job-related/performance-based information (i.e., training needs, task lists, tasks selected for training) collected during analysis. This section is organized into the major headings of the design process.

3.2 Write Terminal Objectives

Terminal learning objectives (TLOs) are learning objectives that clearly state the measurable performance the trainee will be able to demonstrate at the conclusion of training, including conditions and standards of performance. They are translated directly from the task statement, and provide the framework for the development of training/evaluation standards, enabling objectives, and lesson plans. Care should be taken when developing and writing learning objectives. Trainees either clearly understand them, or they are of limited use. Related terminal objectives are then written for each task statement before any other design work is begun. Refer to Attachment 11, "Guidelines for Writing Learning Objectives."

3.2.1 Determine Appropriate Training Setting. When writing a terminal objective, consider the training setting since it has to be balanced against available resources and facility constraints. The training setting is the environment in which training is conducted and should be consistent with the task. Training settings include:

1. **Self-Paced Instruction.** This is any form of instruction that does not require the presence of an instructor at the training setting. However, feedback should be provided. Self-paced instruction can be in printed form, in audiovisual form, in the form of a kit that can be assembled or manipulated, or in the form of a computer-assisted instruction program. Training that meets the following conditions can be considered for self-paced instruction:
 - Training for the task does not require close supervision. Unsupervised training is not likely to result in injury to employees or damage to plant equipment. In addition, immediate feedback from a supervisor is not required for the trainee to achieve mastery.
 - New personnel are not required to perform the tasks immediately.
 - All conditions can either be provided in the training materials or made available in the facility when needed by the trainee. Tasks that require special facilities, conditions, or equipment not readily available in the facility should be considered for another training setting.

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- The task does not require extended periods to achieve mastery. Tasks that are very difficult or extremely difficult suggest lengthy training durations and are more suited to settings that provide supervision and immediate feedback.
2. **On-the-Job Training (OJT).** OJT is formal training that is conducted and evaluated in the work environment. If the job permits the assignment of tasks to OJT, and a system is in place to handle the administration and testing involved in OJT, tasks can be considered for assignment to this setting. OJT has the advantage of providing continuous training on tasks that are of immediate need to the trainee. Further, OJT can continue for whatever length of time is necessary for the trainee to achieve mastery. OJT is limited to those situations where it is administratively possible to conduct the training and where OJT can be conducted without interference to ongoing facility operations. Training that meets the following conditions can be considered for OJT:
- Assignment of trainees can be made in small groups and spread over a sufficiently long period of time.
 - There are no critical resource (manpower, material, facility availability) constraints in the plant, and multiple training conditions can be provided in the job environment.
 - Qualified personnel are available to conduct OJT.
 - If the tasks meet all the guidelines listed above, they should be considered for OJT. If one or more of the guidelines are not met, the tasks should be considered for assignment to the remaining settings.
 - It should be noted that for each job position there may be certain "must perform" items. The OJT setting is a preferable setting to adequately train and assess performance.
3. **Simulator.** Training that is conducted in or on a device that duplicates the physical appearance; operating conditions during normal, abnormal, and emergency conditions; and indications associated with the actual work environment. This setting, though expensive, is suited for training tasks requiring a high degree of trainee-system interaction, but for which OJT is not appropriate. For example, some of these tasks are performed

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infrequently and would not be encountered normally in the course of OJT. Tasks that meet the following conditions can be considered for simulator training:

- Similarity to the actual task is required for the trainee to achieve mastery.
- Problem diagnosis under stressful situations is an integral part of performance.
- Teamwork is an important part of the task.
- Training of the tasks in the OJT setting would interfere with ongoing facility operations, would introduce unnecessary safety hazards, or would not be encountered in the course of normal job operations.
- A simulator exists or can be obtained that sufficiently resembles the physical and operational characteristics of the facility.
- The physical performance skills and system interaction components of the tasks are sufficiently great to require a fair amount of repetitious practice.

4. **Laboratory/Workshop.** Training that emphasizes hands-on practical experience in a controlled environment, but which is not necessarily conducted at the actual job site. Laboratory/workshop training should be considered if multiple job conditions (environment, system, equipment, etc.) are required for task performance. Laboratories and workshops permit application of course material by the trainees in a hands-on environment. They are particularly effective when used to train basic skills that support task performance. Training that meets the following conditions can be considered for laboratory/workshop instruction:

- Tasks, elements, and skills require hands-on practice to achieve mastery.
- Constraints exist that make OJT impractical.

5. **Classroom.** Training presented to groups of various sizes, typified by stand-up lecture, seminar, or group interaction. Classroom instruction works well for presentation of fundamental and basic theoretical knowledge. Because a classroom training setting does not replicate on-the-job conditions, it is recommended that a combination of classroom and

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other settings be used in the course of instruction. Training that meets the following conditions can be considered for classroom training:

- Large quantities of information will be presented during training.
- A large group of trainees will be scheduled for training at a given time.
- Other training settings are not suitable or available.
- There are no critical resource constraints. (Everything required for training can be provided at the classroom facility.)

When evaluating the design of an existing training program or addressing a performance deficiency, determine if the current training setting for the task is the best instructional choice. If it is not, it may be necessary to select another training setting and/or modify the learning objectives and lesson material to incorporate the setting selected. For new programs, evaluate each setting and select the setting most consistent with the task, taking into account available resources and facility constraints. Write the terminal objective based on the task and the setting.

3.2.2 Sequence the Terminal Objectives. All terminal objectives for tasks identified for inclusion in the training program should now be sequenced and organized into instructional areas. Objectives are normally sequenced from simple to complex. The sequence should allow each terminal objective to build upon and provide information necessary to support the next terminal objective within that instructional area. They should be sequenced in a logical progression which takes into account the level of learning necessary to build to the next objective. This will ensure the entire training program is sequenced correctly.

3.3 Develop Training/Evaluation Standards (TESs)

After the terminal objectives have been written, it is necessary to ensure that when training materials are developed they are directly linked to the objectives. The development of a Training/Evaluation Standard (TES) can help to ensure that this vital link is maintained. The purpose of the TES is to provide the basis for the development of objective-based training materials and to maintain consistency in the evaluation of student performance. Each TES is directly related to a specific job task (or group of very similar tasks) identified during job analysis.

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The TES contains two sections; Training and Evaluation.

1. The Training section contains the task title and number, the terminal and enabling objectives, and the applicable references. The information contained in this section will form the basis for the training development activities that follow.
2. The Evaluation section contains a performance test that includes prerequisites, amplifying conditions and standards, and instructions to the trainee and the evaluator. This performance test is used to measure the adequacy of a trainee's performance on a particular job-related task. There are several names used for the evaluation section of this standard, each varying in format and degree of documentation (e.g., job performance measures, qualification standards, and OJT checklists). The evaluation section of the TES can also be used to evaluate the performance of existing job incumbents. Incumbents may not have had the opportunity to participate in the newly developed performance-- based training program. By evaluating their performance using the performance test in the TES, the merit of prior training can be assessed, and appropriate remedial training can be assigned if necessary.

It is during the development of the TES that the majority of task analysis occurs, since many of the knowledge and skill requirements for task elements are identified while writing these standards. The advantage of performing task analysis at this point is twofold.

1. It reduces unproductive data gathering by providing early determination of entry-level requirements and course prerequisites. This results in the generation of a set of enabling objectives that can be provided to a training developer.
2. A document is generated that establishes the performance requirements necessary to evaluate trainee task performance.

Placing task analysis data into a computer data base will greatly facilitate the construction of a TES. A computer program could easily sort the data and print it out in the desired TES format. Also, the data base could be utilized to sort and organize the knowledge, skill and abilities (KSAs) and objectives to identify areas of commonality, and to group-related KSAs or objectives for ease of sequencing.

The TES can be formatted several ways, but should include the following components at a minimum:

1. **Task Number and Title** - Unique number and task statement from the Task-to-Training Matrix;

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2. **Terminal Objective** - Derived from the task statement;
3. **Enabling Objectives** - Derived from the knowledge and skills identified during task analysis;
4. **References** - Applicable procedures, technical safety requirements, etc., related to task performance;
5. **Performance Test** - Designed to measure mastery of the terminal objective;
6. **Prerequisites** - List of qualifications, courses of instruction, etc., that have to be completed prior to administration of the performance test;
7. **Amplifying Conditions and Criteria** - Provide clarification or amplification of the conditions and standards stated in the objectives;
8. **Instructions** - Clear instructions to the trainee and the evaluator on how to use the standard; and
9. **Approval Signature** - Appropriate signature and the date the performance test is approved.

Each TES can either stand alone or be incorporated into a larger document for ease of reference, recordkeeping, and training program description. An example of this type of document, for a single task, is found in Attachment 12, "Sample Training/Evaluation Standard (TES)."

The following steps are performed when developing the TES:

- 3.2.1 **Determine Testing Limitations.** The first step is to review the task and terminal objective to determine potential testing constraints. The testing reflects the stated terminal objective. Constraints include availability of time, limited work force or equipment, and inadequate resources. If performance of an entire task would impose unreasonable demands on facilities or equipment, develop the evaluation portion of the TES using a sample of the task elements.

If actual task performance is not feasible due to limitations, simulation of the task should be considered. It is important to recognize that a "best approximation" for a standard of performance is not always adequate. Key portions of a task should be "perform" items whenever existing facility conditions permit.

- 3.2.2 **Determine Elements of the Task to be Tested.** Step two is where task analysis begins. The process of task analysis has often been an invisible activity that is

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performed by an instructor. In many cases, this method of analysis is adequate and has resulted in enabling objectives and appropriate training content. However, visible task analysis information can help to ensure that key information will not be overlooked when developing training or performance tests. To aid in this endeavor, forms on which to compile task analysis information can be very useful when tasks are complex, lengthy, or unfamiliar to an instructional developer. There are a variety of forms available that will satisfy the user's needs. Attachment 13, "TES Development Worksheet" is a form that will not only provide space to collect key elements and KSAs but also provides space to identify KSAs as entry-level and write enabling objectives.

Begin by listing all of the task elements on Attachment 13. If an adequate procedure exists for the task, it may not be necessary to list the element description on the worksheet. In this case, it would be appropriate to list the element number from the procedure. If it is determined that, due to testing constraints, complete duplication of the task in the TES performance test is unrealistic, then the elements of the task should be examined. Elements that include important decision points can be used to measure successful performance of the entire task. Those key elements would then be listed on the worksheet.

- 3.2.3 **Identify Knowledge, Skills, and Abilities (KSAs).** Using the list of all task elements, it is now necessary identify the KSAs required to perform those elements. Attachment 15, "Completed TES Development Worksheet" provides an example of how the TES Worksheet may be used to record this information.
- 3.2.4 **Determine Entry-Level Requirements.** In every training program, the entry-level KSAs of the trainee should be considered. By properly establishing the entry-level requirements, new learning will be based upon what the trainees already know, and the trainees will not be wasting time on objectives they have already mastered.

The entry-level requirements should be based on a familiarity with the general level of KSAs of the trainees, and by a careful review of documents such as job descriptions, position descriptions, or personnel qualification requirements. The entry-level requirement should be set at a point where most trainees have the required KSAs. Any required KSAs that the trainees do not possess upon entry will have to be taught as part of the overall training program. Remedial lessons may be necessary for those trainees who do not meet the entry-level requirements.

One way to determine entry-level is to develop and administer an entry-level test. This test can determine if personnel meet the entry-level requirements, and serves to focus the training at the appropriate level. This can be especially helpful when

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evaluating an existing program since it allows comparison of existing job incumbent training level to the desired level.

It should be noted that entry-level testing is optional and can be affected by contractual agreement. It is essential, however, that a system be in place to enable verification that trainees meet the established entry-level requirements. The system should include a course of action for those personnel who fail to meet the requirements.

- 3.2.5 **Determine Amplifying Conditions and Standards.** The conditions and standards stated in the terminal objective may need further clarification to allow proper evaluation of task performance. For this reason, any additional conditions or standards that serve to amplify the terminal objective or individual task elements should be listed in the TES. Care should be exercised to ensure that the additional conditions and standards do not change the intention of the terminal objective.

Ideally, the conditions and standards applied during training and testing should be identical to those existing during actual task performance. However, if some testing constraints were determined to exist, the conditions and standards used during training will be a compromise. Although a compromise, the conditions and standards applied during training and testing should be designed to be the best possible assessment of the trainee's ability to perform the task under actual conditions.

- 3.2.6 **Write Enabling Objectives.** Enabling objectives are learning objectives that support the terminal objective. They include the critical components of performance, conditions, and standards. Enabling objectives should be written directly from the KSAs required for element performance. Any identified KSAs that are not included in the entry-level requirements should be incorporated into an enabling objective. See Attachment 11, "Guidelines for Writing Learning Objectives," for information on how to write learning objectives.

Enabling objectives should be sequenced logically, moving from simple to complex, and from lower to higher levels of learning. Often, the required sequence will drive the outline and content of the lesson plan and other training material. If TESs are developed for all tasks identified for a particular training program, enabling objectives that are common to several tasks may be grouped into one lesson of instruction. This grouping can increase the efficiency and cost effectiveness of a training program by reducing duplication. For this reason, a computerized system that can sort by enabling objective title can be invaluable.

When evaluating an existing program or a performance deficiency, identify which enabling objective(s) support each terminal objective. Each should then be evaluated for correct standards and conditions of performance, for clarity and conciseness, and for support of the terminal objective.

- 3.2.7 **Determine Scoring Methods.** Scoring methods are determined when constructing the evaluation section of the TES. In some evaluation standards, referenced procedures may provide detailed, step-by-step descriptions of required performance, and therefore provide an effective scoring method. Another method is to prepare a performance checklist that incorporates the action steps or elements of task performance. The trainee is required to follow each step, usually without deviation. See Attachment 12. For other tasks, where strict adherence to procedural sequence may not be required, the product of performance (i.e., a tangible result) can provide a measurement of successful task completion. When developing the TES, scorable items should be clearly defined to distinguish between satisfactory and unsatisfactory performance.

After completion of the TES development, a review of the TES should be done to ensure that it includes the desired characteristics. For an example, see Attachment 14, "TES Review Checklist."

3.3 Develop Test Items

Test items are developed to be consistent with the learning objectives. The purpose of the test item is to measure trainee performance against the criteria stated in the learning objective. The test item development sequence is as follows:

- 3.3.1 **Determine Test Item Format.** Test items are developed from the learning objectives to measure trainee skills, recall, and/or application of information. Test item formats that are preferred in a performance-based system include performance, completions/short answer, multiple choice, matching, alternate choice, and drawing/labeling. Other test item formats may have applications in specific situations.

Selection of test item format is guided by action verbs of the learning objectives. Action verbs of the learning objectives suggest one format to be more appropriate for use in testing than others.

1. Skill action verbs suggest a performance test format, and knowledge action verbs suggest one or more of the written formats. For example, "start" and "shut down" are skill actions verbs that suggest a performance test format.

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2. Completion/short-answer format is appropriate for many knowledge actions verbs, including "recall," "identify," and "list."
3. Action verbs such as "discriminate" and "select" should be tested using a multiple choice format.
4. Learning objectives that require the student to "classify" or "relate" should be tested in the matching format. See "Test Item Formats" (Attachment 16) for guidelines of test characteristics.

3.3.2 **Determine the Number of Test Items to be Developed.** The appropriate number of test items for each learning objective depends on a number of factors. Although at least one test item should be developed for each learning objective, certain considerations justify development of more than one test item for a given learning objective. For example, tasks used to develop the learning objectives that were rated at or near the maximum scale of importance and/or difficulty would suggest a larger number of test items than those tasks rated near the minimum scale.

3.3.3 **Develop Skill and Knowledge Test Items.** Test items should be written after the format is selected and the number of test items is determined. Test items should have answer keys written at this time.

3.3.4 **Validate Contents of Test Items.** Content validation is the process by which test items are determined to be sound and incontestable as to meaning and correct answer. Each test item should be reviewed by at least three subject matter experts. Each should agree on what the test item is asking and the correct response. These validation reviews should be documented.

3.3.5 **Incorporate Items into Test Bank for Future Use.** A test item bank should be developed and maintained current. The items in the test bank will be used in the future to construct entry-level tests, pre-instruction tests, progress tests, or after instruction tests. A tracking system should be developed to correlate test items to the corresponding learning objective.

3.4 Construct Tests

The construction of tests at this time is optional. However, tests are needed prior to implementing the training program. Tests are a form of evaluation that instructors can use to measure the results or effectiveness of their stated objectives. Test items should be constructed and scored in an objective, rather than subjective, manner. An objective test can be scored without the exercise of personal opinion. The length of a test should not exceed the number of test items which could be answered in two hours by the average

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trainee. This may require assembling several tests for a given instructional area. The following steps are involved in the development of tests:

- 3.4.1 **Develop Test Specifications.** Learning objective levels are broken down into three levels: knowledge of facts, terms, and symbols; comprehension of principles and concepts; and application of information, principles, and concepts. Tests should have the appropriate number and mix of test items based on the importance of each area being tested and the level of learning objective. For example, if 50% of the learning objectives are written at the comprehension of principles level, and the majority of test items used are knowledge of facts, terms, and symbols, then the test is not representative of the learning required. Learning objectives that are more difficult to master and critical to job performance should have more test items represented on the test. The test specification is developed so that these concerns are addressed. See "Sample Test Specification Form for 50-Item General Employee Test" (Attachment 17).

The completed test specification should be reviewed by subject matter experts and facility management. This review can help to ensure that a sufficient number of learning objectives are tested to predict performance.

- 3.4.2 **Assemble the Test.** Tests are assembled using the following general guidelines:
1. Select the appropriate test items based on the test specifications;
 2. Group test items with the same format together;
 3. Group items of similar content together to help the concentration of the test taker;
 4. Design the format of the test to have a place for the trainee's name, clearly marked page numbers, sufficient space between the questions, and clear distinctions between the different sections;
 5. The test key should be prepared when the test is constructed. This is especially important for essay and short-answer questions;
 6. Test directions should be written clearly and included on the test. A model answer may help to clarify directions;
 7. Point allocations for each answer should be indicated and consistent with importance of the learning objective that the test item is testing; and

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8. The content of the tests should be changed from one exam to the next so they are not compromised.

3.5 Write Training Development and Administrative Guide

A Training Development and Administrative Guide should not be confused with the facility's *Training Management Manual* (see Introduction) which outlines the facility training policies and procedures that guide the development of all training. A Training Development and Administrative Guide is a management tool for the administration of an individual training program. It is used to gain management approval of the program and guide development and implementation efforts. Though not part of this guide, additional specifications may be developed to clarify and detail the required characteristics of individual courses or lessons. Approval should include training management and the management of the organization for which the training is being developed. An example of this guide is in the Sample Training Development and Administrative Guide (Attachment 18).

The Training Development and Administrative Guide is not intended to be a large document. However, inclusion of the course outline could require several pages. The example outlined in Attachment 18 is just a few pages from each section of an outline, which is 21 pages in length. The rest of the document should only be a few pages in length. It should have appropriate signatures indicated for review and approval.

The following discussion outlines the major steps in developing procedures for the guide.

3.5.1 **Determine the Training Organization and Administrative Responsibilities.**

Each contractor should have training responsibilities established as a guide for personnel that are responsible for various portions of the program. Typical questions to be answered are:

1. Who will develop the lesson material?
2. Who will perform reviews of material and when?
3. Who will present the material and document it?
4. What are the interfaces between the training personnel and the referent organization?

3.5.2 **Determine Course Loading and Scheduling Requirements.** These are determined by using training requirements identified during the analysis phase and the projected availability of new and existing facility employees who will require training. Course loading and scheduling should be based on the

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availability of qualified instructors, capacity of facilities, and availability of equipment.

3.5.3 **Establish Trainee Evaluation Guidelines.** Evaluation criteria should provide for testing, placement, recycling, remedial training, and follow-up evaluation during on-the-job performance. Trainee evaluation guidelines should address the following:

1. Basis and method for exception from parts of the training program;
2. Evaluation method of trainee performance throughout the program;
3. Guidelines for disposition of trainees whose performance is unsatisfactory;
4. Provisions for counseling and remedial instruction, recycling to earlier segments of training, or removal from the program when appropriate; and
5. Evaluation of trainee comprehension and retention of material (i.e., using a post test).

It should be noted that several of the items above may be addressed in the facility *Training Management Manual*. Therefore, they would not have to be included in the guide, but should be referenced.

3.5.4 **Specify Required Instructor Qualifications.** Determine instructors' qualifications based on the training program needs. Qualified trainers, subject matter experts, job incumbents, or others should be utilized as appropriate. See the Guide to Good Practice for Training and Qualification of Instructors, DOE-HDBK-1001-96.

3.5.5 **Determine Required Training Resources and Facilities.** To ensure that facilities and resources are available to support training activities, the guide should address physical facilities, equipment, and reference materials.

1. Physical facilities and equipment include the following:
 - Classroom facilities;
 - Laboratories and workshop facilities;
 - Simulators;
 - Audiovisual aids and equipment;
 - Tools and equipment; and

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- Office space and furnishings.
2. Technical reference material should cover topics at a level appropriate for the program, instructor, and trainee; should be applicable to facility systems and equipment; and should be current with facility modifications.

3.5.6 **Prescribe Test Administration Guidelines.** These guidelines should include the following:

1. Security, including accountability of test items to avoid compromise during reproduction, storage, use, and evaluation;
2. Prior notification to trainees of materials needed for the test and the procedure to be followed during the test;
3. Testing instructions to the trainee that include purpose of the test, importance of following test item instructions, time limitations, and special instructions for the answer sheet;
4. Development and use of answer keys;
5. Evaluation of test results using training standards established during test item development;
6. Disposition of test results, including review with and counseling of trainees; and
7. Provisions to vary the content of tests to prevent compromise.

3.5.7 **Establish Supplemental Training Record Requirements.** This should include retention periods and entry and retrieval procedures to provide the following:

1. Records relating to training programs that permit review of content, schedule, and results of past and current programs; and
2. Individual trainee records that include a history of trainee performance and permit verification of required qualifications.

3.5.8 **Develop the Course Curriculum Outline.** This outline serves as a guide for development of course material. It outlines, by training setting, the learning objectives in the prescribed sequence.

3.5.9 Prepare the Development and Implementation Schedule. Course, unit, and lesson objectives should be organized and scheduled. A schedule should be prepared to define the milestones for development and implementation activities. A simple milestone bar chart (e.g., Gantt Chart) to indicate major activities is sufficient.

3.6 Key Considerations

The following are key considerations that should be emphasized when performing and evaluating activities of the design process:

1. Training/evaluation standards contain job-related data for measuring task performance;
2. Selection of training settings considers task, instructional, resource, and logistical constraints;
3. Learning objectives are used to identify training content and satisfactory trainee performance;
4. Learning objectives identify observable and measurable trainee action or behavior;
5. Test items are appropriate for the learning objectives;
6. Learning objectives are compatible with expected entry-level skills and knowledge of trainees;
7. Learning objectives are sequenced to assist trainees in making the transitions from one skill or knowledge level to another;
8. Pretests are developed to determine trainees' entry qualifications and to identify remedial training and exception requirements as applicable;
9. Progress tests are developed to evaluate trainee performance and determine the need for additional assistance;
10. Post-tests are developed to measure trainees' satisfactory completion of training; and
11. Training standards for evaluating trainee test performance are established.

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4.1 DEVELOPMENT

This section describes the processes used to develop training programs that are based upon job-related performance-based information (i.e., training needs, task lists, tasks selected for training) collected during the analysis phase and the work accomplished (learning objectives, tests, Training Development and Administration Guide) during the design phase. The development process includes the following.

4.2 Select Training Methods

Training methods selected should be based on the objectives and settings for the course. Training methods are techniques of communicating instructional material to trainees. They include lecture, demonstration/practice, discussion/facilitation, oral questioning, role playing, walk-through, and self-pacing. Characteristics of each of these methods are found in "Training Methods" (Attachment 19).

Although discussion and oral questioning have general application in all training settings, other methods are more effective in certain training settings. For example:

- Lecture generally is considered more appropriate for the classroom;
- Demonstration and practice applies primarily to on-the-job training (OJT) and laboratory and simulator training, although it can also be used in the classroom;
- Role playing is particularly effective during simulator drills and exercises that involve team training;
- Walk-throughs serve to enhance training that is conducted in training settings where the job environment is simulated; and
- Self-pacing is a method generally reserved for self-study.

4.3 Develop Lesson Plans

Lesson plans are detailed expansions of the curriculum outline that ensure consistency in the delivery of training from instructor to instructor and from student to student. They are used by the instructor as the primary training tool to guide the learning process and utilization of training materials. Lesson plans identify the learning objectives, content, learning activities, training equipment, and training materials needed for training and provide guidance for their use. In addition, properly developed lesson plans perform the following functions:

- Provide a degree of standardization of instruction;

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- Present a logical, sequential listing of content;
- Prevent over— as well as under-emphasis of selected content;
- Force instructors to analyze content prior to presentation;
- Offer a ready format for revision;
- Provide a record of contents presented;
- List aids, equipment, and references used; and
- Provide continuity between the lessons presented within a specific course, especially when several instructors are involved.

4.3.1 **Develop Lesson Plan Format.** The first step in lesson plan development is the determination of format. Instructor and trainee activities should be planned so they occur at the proper stages in the learning process. Once a standard format has been established, it should be used for all lesson plans. This standard format should be specified in the facility *Training Management Manual*, discussed in Section 1.0 of this Handbook. See the forms "Sample Lesson Plan Format—Classroom," "Sample Lesson Plan Format—OJT," "Sample Lesson Plan Format—Simulator" (Attachments 20 through 22, respectively) for sample lesson plan formats. While the printed design or format of a lesson plan may differ, the lesson plan should include the following:

1. Cover Page

- Labeling Information
 - Course Title and Number - A title and a number unique to that lesson plan
 - Lesson Title - A title descriptive of the content
 - Lesson Time - Approximate duration of the lesson
 - Author - Individual who wrote or last revised the lesson plan
 - Review and Approval Signatures
 - Date - Date lesson plan was approved or last revised
 - Revision Number - Current revision number;
- Terminal and Enabling Objectives - The learning objectives for the lesson;

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- Training Aids and Material Used - A list of all support material and tests used during instruction with this lesson plan;
- References - All pertinent references used to support the content of the lesson plan (inclusion of page and paragraph for text material is helpful); and
- Prerequisites - Any courses, classes, qualifications, etc., required prior to beginning this instruction.

2. Historical Record Form

- A section which includes documentation of the changes made to a lesson plan, why they were made, and who made and approved them. See "Training Materials Historical Record" (Attachment 23).

3. Presentation Content

- Introduction - A section which includes the purpose of the lesson, the training session conduct and administration (i.e., breaks, smoking policy, outline of activities), and a statement of the learning objectives;
- Body - The lesson content, trainee, and instructor activities; and
- Summary - A highlight of important points and review of learning objectives.

4.3.2 **Write Content and Specify Learning Activities.** The second step of lesson plan development is the writing of content and learning activities. Although writing the content of the lesson plan and specifying the learning activities can be classified as separate activities, they occur concurrently when developing a lesson plan. Instructor and trainee activities should be planned so that they occur at the proper stages in the learning process. To ensure this proper timing, content can appear on one half of the page and activities on the other. Guidance for instructor activities is provided in "Instructor Activities" (Attachment 24) for the following items:

1. Gaining and maintaining attention and motivating the trainee;
2. Informing the trainee of the learning objectives;
3. Electing recall of prerequisite knowledge;
4. Presenting the training material;
5. Providing learning guidance;

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6. Electing mastery of the learning objectives;
7. Electing performance feedback;
8. Evaluating trainee performance; and
9. Enhancing retention and transfer of training material.

The content of the lesson material is derived from the elements of the enabling objectives. Developers should use the training standard portion of the Training Evaluation Standard that was developed during the design phase as a rough outline for the development of this content. The sequenced enabling objectives can be used as the content headings in the body of the lesson. Using enabling objectives this way will aid in review, approval, and auditing of the lesson plan. However, a simple outline of the material is not considered adequate for instructional content because an outline is too brief and leads to subjective instruction which does not assure need-to-know information will be covered. Therefore, the outline should be developed in sufficient depth to assure mastery of the learning objectives and coverage of all test items being used for trainee evaluation. Some enabling objectives or portions of enabling objectives require activities to make the content more easily understood. "Instructor Activities" (Attachment 24) provides appropriate instructor activities for the introduction, body, and summary sections of the lesson. Trainee activities should be selected from methods listed in "Training Methods" (Attachment 19). The methods should be selected based on the characteristics described in the attachment, the learning needs of the students, and the learning objectives.

When revising an existing training program each lesson plan should be evaluated to assure proper format, instructional continuity, and depth of content. Existing lesson plans should not be discarded or considered inadequate until they are thoroughly reviewed. See "Lesson Plan Checklist" (Attachment 25) for a checklist to be used when reviewing lesson plans.

4.4 Develop Training Support Material

Training support materials refer to training equipment, audiovisual media, and printed material. When selecting or developing training support materials, the type of material is influenced by the learning objectives and method of instruction. Materials should support the learning objectives and emphasize job-related information and situations. The lesson specifies what training materials are required and when. A guideline for incorporating training material into the lesson is found in "Training Media" (Attachment 26). The following steps are performed when developing training materials.

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- 4.4.1 **Specify Use of Audiovisual Media.** The use of audiovisual media in presenting course material can help maintain trainee interest, motivation, and improve training efficiency and effectiveness. Media to be considered include simulation, computer-aided instruction, film or videotape, sound slide or film strip, audio recorder, transparencies, and written handouts.

The characteristics of a learning activity may suggest that a medium with certain audiovisual capabilities will be more effective in displaying or transmitting the desired information to the trainees. These characteristics (visual, visual movement, exact scale, audio) are summarized in "Learning Activity Characteristics " (Attachment 27). Each learning activity should be analyzed to determine which of the characteristics should be reflected in the audiovisual capabilities of the medium. These four characteristics are not independent and combinations of them may be needed to display or transmit the information effectively.

The media selected should be evaluated in terms of cost and practicality of use in the training program. Factors to be considered in these evaluations include:

1. Projected life-cycle costs of the selected media;
2. Budgetary resources available, particularly if the media requires a substantial capital investment;
3. Appropriateness of the media for the number of trainees to be trained at a given time;
4. Frequency of changes to media;
5. Compatibility with existing programs; and
6. Lead time required to produce the media.

- 4.4.2 **Review and Select from Existing Materials.** Developing effective training material requires creativity and is both costly and time-consuming. Adopting or modifying existing material can reduce training development costs. Existing course materials should be collected and reviewed to determine if they meet in whole or in part the needs of the training program. Review criteria for existing materials is found in "Existing Material Review Criteria" (Attachment 28). Material selection should be based on an evaluation of existing material against the following criteria:

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1. Is it appropriate to expected trainee entry-level skills and knowledge?
2. Does it cover the learning objectives?
3. Is it consistent with learning activities?
4. Is it compatible with the Training Development and Administration Guide for the program?

The review and analysis of existing course material will identify materials to be rejected, materials to be accepted without revision, and materials to be revised. The materials that are suitable without revision should be incorporated into the development process. Material needing revision should be modified as described in the following section.

4.4.3 Modify Existing Training Materials. Modifying existing training materials can minimize development time and conserve resources. The modification process can involve two approaches: revision of existing training materials that are free of copyright restrictions, or preparation of supplementary material for training materials under copyright restrictions. Modification should be considered when existing materials are incomplete or minor changes are needed. For example:

1. Additional information is needed to meet the requirements of the learning objectives and learning activities;
2. Minor modifications to facility systems, equipment, and/or procedures require an update or change;
3. Minor changes in regulations require an update or change;
4. Industry operating and maintenance experiences necessitate a minor update or change; and

Existing materials that are incomplete or require minor modification should be modified using the following guidelines:

1. The style and reading level of the modification should be consistent with the existing materials;
2. Modifications should be inserted into existing material where needed; and
3. Some redundancy may be necessary to provide continuity between the modifications and the existing materials.

- 4.4.4 **Develop New Materials.** Development of new training materials should be consistent with the learning objectives and should reflect the learning activities to ensure that the trainees progress through training in an organized and efficient manner. Training materials should be developed using guidelines that are intended to promote learning.

The guidelines include formatting that will ensure ease in trainee use. For example, charts, graphs, tables, and other illustrations that are effective in emphasizing key points should be located on a separate page and in close proximity to related information.

The reading level of training materials should be consistent with the expected entry-level skills and knowledge of the trainees. Essential information should be located in the materials, and the trainees should not be referred to other places for that information.

More than one representation of key or complex information should be included in the materials. Relating the information in a job context is an effective way to promote learning. This should include a description of the job environment, how the information will be applied on the job, and the reasons why it is important for the trainee to learn the information.

4.5 Conduct Training Tryouts

During a training program tryout, data is compiled and evaluated to correct faults and improve the effectiveness of the lesson plan and training materials. A training program tryout includes evaluation of training material for technical accuracy as well as instructional effectiveness. The following steps are performed when conducting a tryout of the training material:

- 4.5.1 **Select, Train, and Evaluate Instructors.** Instructor qualifications were identified during the design phase. In addition to technical competence, instructor qualifications should provide oral and written communication abilities, interpersonal skills, and instructional capabilities. Instructors who do not meet these established qualifications should be trained in advance.

A continuing training program to upgrade and improve the technical and instructional capabilities of instructors should be established. Continuing training and development should be based on periodic evaluation of instructor performance. Evaluation should include direct observation by a qualified evaluator during training sessions and should address technical competence,

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instructional skills, and overall effectiveness in achieving the learning objectives. Examples for the evaluation of instructors are contained in "Sample Instructor Evaluation Form" and "Instructor/Supervisor Evaluation Example" (Attachments 29 and 30, respectively). Instructors should remain current with job requirements, facility changes, operating experiences, and technical specifications in the facility.

The use of both announced and unannounced evaluations can improve the overall effectiveness of instructor performance. Guidelines to be followed by the evaluator should include the following.

1. Establish a relationship with the instructor based on mutual respect and trust;
2. Review the lesson plan and other course material prior to the training session in which the evaluation will occur;
3. Recognize that the primary purpose of instructor evaluation is to improve the quality of training;
4. Refrain from making comments or participating in training activities;
5. Schedule and conduct a critique of the evaluation with the instructor;
6. Provide a completed copy of the evaluation to the instructor; and
7. Assist the instructor in developing a plan for correcting any deficiencies noted.

4.5.2 **Confirm Availability of Trainees.** Selection of trainees should be coordinated between the training and referent organizations to ensure that course loading and scheduling requirements are met. Trainees selected should possess the required entry-level skills and knowledge of the scheduled program. Trainees should be selected sufficiently in advance to permit adjustments in scheduled training (e.g., remedial training) that may be required.

4.5.3 **Confirm Availability of Training Facilities and Resources.** The availability of training facilities and resources identified in the Training Development and Administrative Guide should be verified. Conflicts in scheduling or availability should be resolved to ensure that required facilities and resources are available when training begins. The following guidelines assist in this effort.

1. Confirm that the allocated training facility is adequate and appropriate for the number of trainees, learning activities, media, and the numbers and types of training equipment to be used;
2. Check the facility and correct any unsafe conditions;

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3. Check equipment operability, including spare parts and maintenance support;
4. Verify that the facility is properly heated, cooled, and lighted, and is reasonably free of distractions; and
5. Confirm that sufficient training materials for the course are available (plant procedures, drawings/schematics, texts, handouts, audiovisual aids, tests, tools, consumables, etc.).

4.5.4 **Perform Technical Review.** The technical review is performed to ensure the training materials are technically accurate, current, and consistent with facility systems, equipment, and procedures. The review should be conducted by a subject-matter expert who provides feedback to the material developer. All materials should be reviewed, and identified deficiencies should be corrected. This review should be coordinated as materials are being developed.

4.5.5 **Conduct Small-Group Evaluation.** After revisions from the technical review have been made, a tryout of the materials should be conducted on a small group of trainees. The trainees should possess the entry-level skills and knowledge expected of future trainees. Although a minimum of one trainee is necessary, additional trainees should be used when personnel availability permits.

During the tryout the training setting should be simulated as closely as possible. The lessons are presented, and all appropriate tests are administered and scored. Effective small-group evaluation includes the following activities.

1. Trainees are monitored to determine if the presentation of material and directions for study are clear and easily understood.
2. Presentations and directions that require modification or clarification are documented.
3. Questions asked by the trainees that relate to effectiveness of training are recorded;
4. The length of time taken by trainees to complete training segments and tests is recorded;
5. Test items answered or performed incorrectly by the trainees are identified; and
6. Trainee comments that address the following are obtained:

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- Difficulty of the material
- Length of the training
- Amount of material covered
- Clarity of the material
- Terminology used in the material
- Pace of the training
- Structure of the material and sequence of training
- Quantity and quality of practice exercises
- Quality of the media
- Relevance of the training to job performance.

For courses of lengthy duration it is not always feasible to conduct a small-group evaluation. An alternative is to conduct small-group evaluations on the most important segments of the course. Courses or segments of courses not submitted to small-group evaluation should receive increased monitoring and emphasis during the first run. See "Indicators of Potential Training Program Weaknesses," "Post-training Questionnaire," and "Post-training Interview" (Attachments 31 through 33, respectively) for examples of a checklist, questionnaire, and interview form that can be used to collect data during the small-group evaluation and the first run.

- 4.5.6 **Conduct First Run.** The first run verifies the usability of the training material under intended conditions and confirms the revisions made to the material during the technical review and small-group evaluation. Prior to conducting the first run, material should receive formal approval by the training and referent organization management. During the first run, learning and administrative problems are noted and trainee comments on the training are obtained. Techniques for data collection are the same as for small-group evaluation. After collection, the data should be analyzed to improve applicable training materials. If problems are identified during the tryout, retraining of the trainees involved may have to occur once the materials are corrected.
- 4.5.7 **Evaluate Data and Revise Material.** Data collected during the small-group evaluation and tryout is translated into findings, and decisions are made for revising the training materials. Progress and post-test scores should be collected and analyzed to determine if the intended learning outcome is reflected in the learning objectives and their associated test items. If the training does not produce the intended learning outcomes, revision of training materials should be considered. It should be noted that faulty test items may not accurately measure the intended learning outcome of the trainees. Those test items consistently missed by trainees should be analyzed for faulty construction. Supporting training

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materials should also be analyzed for clarity, completeness, and technical accuracy.

Trainee evaluations should be reviewed to detect errors in the presentation, materials, or media that may or may not be apparent to the program developer or instructor. Final materials should be approved by the cognizant training and referent organization management.

4.6 Key Considerations

The following are key considerations that should be emphasized when performing and evaluating activities of the development process:

1. Training methods are appropriate to the training setting and learning activities;
2. Training events define the structure and sequence of learning;
3. Learning activities are derived from the learning objectives;
4. Lesson plans provide a structured approach for conducting consistent training;
5. The learning objectives guide the evaluation of existing training material;
6. Development of new training materials is guided by the learning objectives, the learning activities, and the expected trainee entry-level skills and knowledge; and
7. Data, acquired during tryout of the training materials, are used to determine technical accuracy and training effectiveness, and guide any needed revisions.

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5.1 IMPLEMENTATION

The implementation activities described in this chapter should be applied based on the status of an existing program. Some activities are performed only once during implementation of a training program while others are repeated each time the program is conducted. Activities of implementation are:

5.2 Conduct Training

If specified in the Training Development and Administrative Guide, trainees should be pretested to ensure that they are adequately prepared. Trainee performance should be monitored and evaluated during training. This evaluation should provide for recognizing successful performance and areas in need of improvement. The following steps are performed when conducting training:

5. 1.1 **Pretest Trainees.** Testing of (prospective) trainees should be done if so specified in the Training Development and Administrative Guide. The type of testing done is dependent on the design of the program and the needs of the organization receiving the training.

Entry-level testing is used to determine whether prospective trainees have the fundamental skills and knowledge needed to participate in the training program. Such tests are based on the entry level requirements identified in the analysis and design phases. Passing the entry-level exam indicates a probability of successful completion of the training. Failing the entry-level exam indicates that a potential trainee needs remedial training to acquire the fundamental skills or knowledge for successful completion of the training.

Pretests measure the trainees' mastery of the objectives that are addressed via the course content. Pretests should be given sufficiently in advance of training to allow for adjustments to course direction and scope. Pretest results can be used for the following reasons:

1. Accelerate or except from segments of training those trainees who exhibit mastery of specific learning objectives;
2. Identify overall training program emphasis based on common strengths and weaknesses of the group of trainees; and
3. Preview course content and trainee performance requirements.

- 5.2.2 **Prepare for Training.** Instructors should prepare sufficiently to ensure consistent and effective delivery of lessons. Lesson plans should be reviewed to ensure familiarity with lesson content, equipment and tools, and the use of media, text

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material, references, and tests. Technical errors should be identified and corrected during this review. The schedule and emphasis should be modified based on trainee pretest results.

Instructor preparation should include a review of all procedures that address training implementation. Additionally, the instructor should:

1. Check the assigned training facility to ensure it is appropriate for the number of scheduled trainees, learning activities, equipment, and media to be used;
2. Verify his/her ability to operate equipment and use tools effectively;
3. Ensure that sufficient supplies of training materials (e.g. consumables, text material, handouts, workbooks, tests, procedures, etc.) are available and up-to-date;
4. Verify that the training facility is heated, cooled, and lighted properly and is reasonably free of distractions;
5. Review procedures for monitoring progress, evaluating performance, and counseling trainees; and
6. Review test administration procedures for test storage, retrieval, reproduction, and instructions during and after testing.

5.2.3 **Deliver Lessons.** Lesson plans outline instructor and trainee activities and the resources necessary to support training. Effective training presentation requires general adherence to the lesson plan and an understanding of the learning process.

Instructors can guide trainee progress more effectively if they have a working knowledge of the learning process. Trainee motivation can be enhanced by providing an effective training environment, by identifying a clear indication of what will be learned, and by presenting the materials in an organized, concise, and factual manner. Techniques that instructors can use to contribute to trainee motivation include the following:

- Assisting trainees in setting specific, attainable goals and identifying the means for achievement;
- Actively involving the trainees in the learning process, including hands-on application (e.g., equipment, tools);
- Using rewards to recognize achievement (e.g., certificates, promotions keyed to training progression); and

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- Interjecting competition with self or others (e.g., accelerated pace, added skills an employee can use, new equipment the employee can operate/maintain, peer group recognition).

An effective training environment also requires that the trainee exercise good listening habits. The instructor should use the following methods to improve students' listening habits:

- Directing attention to the material being presented and eliminate distractions;
- Relating material being presented in personal terms and to personal experiences of the instructor or the students;
- Using learning objectives to organize ideas; and
- Reviewing and summarizing the main idea(s).

Meanwhile, students should be:

- Evaluating the material only after the facts have been presented; and
- Asking questions when they are uncertain or confused.

5.2.4 Evaluate Trainee Performance. Trainee performance should be evaluated regularly during and at the completion of the training program. Evaluation measures trainee progress and provides performance feedback to the instructor and the trainees that serves to reward success and identify needed improvement in trainee performance. Trainee performance is also used to evaluate the effectiveness of the training program.

Pre-tests, progress tests, and post-tests are administered as scheduled in the lesson plan to evaluate trainee performance. The following guidelines should be used in administering tests:

1. Security of tests and answer keys should be maintained during storage, reproduction, and testing of trainees to prevent compromise;
2. Trainees should be given prior notification of scheduled tests and materials needed (i.e., calculators);
3. Instructions to the trainees should include the purpose of the test, the importance of following instructions, and time limitations;

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4. Equipment and tools used during performance tests should be available and in operational condition;
5. Written tests should be corrected, graded, and reviewed with the trainees in a timely manner to enhance benefits derived from the test; and
6. In performance tests, deficiencies should be identified, a grade given, and the trainee advised of the results promptly.

Trainee performance and progress toward achieving mastery of the learning objectives should be monitored closely. Monitoring should identify satisfactory performance and trends that may indicate potential problems. Trainees should be counseled periodically to review progress and at any time when deficiencies occur. Counseling should address trainee performance strengths and/or deficiencies and include a plan for improvement, if needed. The trainees' supervisor(s) should be kept informed of trainee progress and be involved in counseling when performance problems warrant.

Standards for evaluating trainee performance should be applied consistently. Trainees should not be permitted to complete the training program or progress to another segment of training until deficiencies have been corrected and the training standards met. A program of remedial training or recycling to previous segments of training can be beneficial in correcting trainee performance deficiencies. Remedial training is a cost-effective alternative to removal from training.

5.3 Conduct In-Training Evaluation

During training, data should be collected for subsequent use in evaluating and improving training program effectiveness. Evaluation information is collected from test performance data, instructor critiques and trainee critiques. Evaluation of the training program is addressed in the process. If the above data sources indicate recurring problems or suggest the need for improvement, follow the analysis and revision process outlined in Section 6.0 of this Handbook.

5.2.1 Collect Test Performance Data. Trainee test scores should be used to assess trainee progress and improve training and testing effectiveness. If a large number of trainees experience difficulty with a training segment, as reflected in their test scores, the training material or test items may be faulty and in need of revision. An exception analysis (see Evaluation Section 6.2.2, Conduct Exception Analysis) should be conducted to evaluate test data before revisions are made. Progress test and post-test scores should be compiled routinely during training. After the test scores are tabulated in a usable form, an analysis should be

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conducted and interpretations made. Analysis may indicate changes or modifications needed to the training material.

- 5.2.2 **Perform Instructor Critiques of Training.** Instructors are a unique source of evaluation data. They can identify problems involving technical accuracy, completeness, pace, sequence, and level of difficulty of the training materials. A procedure for recording these problems when they occur should be established. Problems noted and suggestions for improvement should be reported in training critiques. The critique should be submitted by the instructor at the completion of training segments or at any time a problem of significance is identified. Evaluations should be performed in each training setting the instructor functions. "Instructor Lesson Rating Form" (Attachment 34) is an example of this type of critique.

Although instructor training critiques are a valid source of evaluation data, recommended changes should be analyzed along with the training supervisor's performance evaluation of the instructor and the success of trainees in completing the segment of training.

- 5.2.3 **Obtain Trainee Critiques of Training.** Trainees can provide useful feedback for improving presentation of course material. A questionnaire completed by trainees after major segments of training should focus on course effectiveness and ways in which training can be improved. It should address the pace of training, clarity of the material, and the quality of the media.

Trainee critiques of training should be used by the instructors to improve their performance and can be helpful when used in conjunction with instructor performance evaluations. See "Sample Course Critique" and "Example Employee Training Evaluation" (Attachments 35 and 36, respectively) for evaluation instruments to be completed by trainees. See "Revision Critique Summary" (Attachment 37) as an aid to improving the training program through the use of trainee critiques.

5.3 Document Training

The documentation of training includes preparing, distributing, storing, controlling, and retrieving records and reports that address the training program and trainee participation. These records and reports assist management in monitoring the effectiveness of the training program. They also provide a historical reference of changes that have occurred within a program due to evaluations. When documenting a training program, the training program and trainee records are maintained and reports prepared, as indicated by the recommended steps below.

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5.3.1 **Maintain Training Program Records.** Training program records should be maintained to permit review of content, schedules, and current and past program results. These records should be classified according to type and retention period. They should be located, organized, and indexed for ease of retrieval. Training program records should include the following.

1. Most recent job and task analysis data used in training program development;
2. Course schedules;
3. Lesson plans and tests;
4. Trainee attendance summaries (name, course, dates, and test results);
5. Instructor evaluations; and
6. Reports of program audits and evaluations.

5.3.2 **Maintain Trainee Records.** Records of the training and qualification of facility employees should be maintained. Records should be current and organized to permit efficient but controlled retrieval. A trainee's record should contain the individual's training history and the identification of required training that has not been completed. Specifically, trainee records should include the following.

1. A summary of the individual's education, training, experience, and qualifications at the time of hire;
2. A summary sheet indicating the individual's current and previous positions with the company, training received, qualifications achieved, and continuing training required;
3. A record of training completed, including course title, attendance dates, test performance, and certifications of successful course completion;
4. A record of training attended but not successfully completed, including course title, attendance dates, and test performance evaluations; and
5. A record of waivers or exceptions granted, including course titles and statements of justification.

5.3.3 **Prepare Training Reports.** The training organization should report periodically to appropriate levels of management on the status and effectiveness of training activities. Significant training events or problems should be identified and reported when they occur. Although specific aspects will vary with individual contractors, the reports should address the following.

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1. Completion of training programs, including course title, dates, and summary of trainees' performance;
2. Attrition of individual trainees, including a summary of performance problems, remedial actions, and final disposition;
3. Evaluations and audits of training program effectiveness, use of training manpower and resources, and achievement of goals and objectives;
4. Recommendations for improving course scheduling; and
5. Action plans for completing program improvements.

5.4 Key Considerations

The following are key considerations that should be emphasized when performing and evaluating activities of the implementation phase.

1. Procedures are developed and used to implement the Training Development and Administrative Guide;
2. Technical and instructional qualifications are based on job performance requirements;
3. Trainees meet the training program prerequisites;
4. Training facilities and resources are available and appropriate for training;
5. Pretests are administered to trainees prior to training;
6. Instructors make all necessary preparations prior to training;
7. Instructors ensure they are using the most current procedures and lessons;
8. Instructors adhere to lesson plans;
9. Instructor performance is evaluated on a regular basis;
10. Trainee performance is evaluated regularly and upon completion of training, using established performance standards;
11. Security of tests and answer keys is maintained to prevent compromise;
12. Instructor and trainee critiques of training and trainee test scores are used in evaluating training program effectiveness; and

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13. Trainee and training program records are maintained for evaluating training program effectiveness.

6.1 EVALUATION

The evaluation phase of performance-based training takes place in order to determine the effectiveness of the training program. Evaluation is the quality assurance component of the performance-based training model. There are three major activities involved in evaluation: monitoring of indicators, analyzing information, and initiating corrective actions.

6.2 Monitor Indicators

Data should be collected for each indicator that provides the best indication of training effectiveness. While this data collection should be continuous in many cases, it is a "batch" process. In these cases, the frequency for which these items are reviewed should be determined based on the frequency management feels is necessary to ensure the currency of the training program. The following indicators can be monitored to determine training program effectiveness.

6.2.1 Monitor Facility Operating, Maintenance, and Industrial Safety Experiences.

Facility operating, maintenance, and industrial safety experiences should be monitored to identify employee performance problems caused by improper training. Facility events and industrial accident reports can identify tasks for which inadequate training may be contributing to equipment damage, excessive unavailability, unscheduled maintenance, rework, unsafe practices, or lack of adherence to approved procedures. This information should be supplemented with interviews. Training personnel should monitor the frequency of personnel errors, and review accident and event reports for training implications using the following questions.

1. Did the employee fail to follow prescribed procedures?
2. Did the employee improperly diagnose the situation?
3. Was the employee misinformed or unaware of the correct procedure?
4. What was the specific sequence of events?
5. Has this problem or a similar problem occurred in the past?
6. Was an individual injured?
7. Was equipment damaged?
8. Was a significant amount of work time lost?
9. Was a technical safety requirement or standard violated?

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10. Does the report describe a new or unusual situation?
11. Was the employee newly assigned to this position?
12. Are job performance standards different from those used in training?

6.2.2 Collect Employee and Supervisor Feedback. Employee, supervisor, and instructor feedback is gathered to identify program strengths and weaknesses. Instructor and student critiques completed during implementation should be included in this data. This feedback can be gathered using checklists, numerical rating scales, questionnaires, and interviews. Regardless of the material, process, or program being evaluated, there are general principles that should be followed to construct an evaluation instrument.

Checklist Format. A checklist is used to observe a process or assess a product to judge whether the actions or results meet predetermined standards. Examples of checklist evaluation forms are "Lesson Plan Review Criteria Checklist," "Instructor Observation Checklist—Classroom," and "Training Development Recommendation Checklist" (Attachments 38 through 40, respectively). Checklists might be used to determine if a lesson plan is complete and ready for instructor use, if a trainee's job performance was satisfactory after training, or if an instructional session was conducted properly. The following guidance may be helpful when constructing a checklist.

1. Identify all actions or key points to be evaluated. Each should be important, observable, and measurable;
2. Identify the most frequent problems found in the activity to be evaluated;
3. Convert these problems (negative statements) into positive statements that describe satisfactory performance or describe satisfactory products; and
4. If possible, have a model or samples of acceptable materials to help the user judge whether standards of accuracy and quality are met.

Numerical Rating Scale Format. The use of a numerical rating scale helps control the subjectivity of the evaluator and provides better discrimination than a simple pass/fail or satisfactory/unsatisfactory choice. Numerical rating scales should include written descriptions of typical performance to help guide evaluators in rating performance. A numerical rating scale can be used to evaluate a trainee's performance on many tasks, evaluate group interactions, or collect feedback from facility management on trainee performance. For example, numerical scales might be used to collect post-training feedback from trainees and

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supervisors, and to conduct instructional setting evaluations. "Laboratory Instructor Evaluation," "Instructor Performance Assessment Instrument," "Supervisor's Post-Training Feedback," "Simulator Instructor Observation," and "Trainee Post-Training Evaluation" (Attachments 41 through 45, respectively) are examples of numerical rating scale evaluation measures. Numerical rating scales also help reduce common rating errors such as:

1. Under- or over-rating specific performances because of a general or overall impression;
2. The tendency to rate most performances as average (avoiding highs and lows); and
3. The tendency to give similar ratings to two or more performances, related in the mind of the evaluator.

The following guidance may be helpful when constructing numerical rating scales:

1. Select the performance to be evaluated. It should be important, observable, and measurable;
2. Decide if the scale will contain an even or odd number of possible responses and how many possible responses will be supplied per item. Once this is determined all the selected performances being evaluated should have the same number of possible responses. Keep the scale simple for ease of use; and
3. Two different weighting systems could be used. One system assigns a low-to-high rating across the range of numbers. Two examples are low-medium-high and poor-good-excellent. A preferred system adds written descriptions of typical performances that describe what the ratings mean. Write the descriptions so they are balanced and accurate.

Questionnaire Format. A questionnaire is used to elicit opinions, obtain information, and collect feedback about the work or training environment. "Trainee Cumulative Feedback Evaluation," "End-of-Course Training Evaluation," and "Program Evaluation" (Attachments 46 through 48) questionnaires should be administered to individuals or groups as appropriate. Data collected in a group setting tends to be more reliable than mailed questionnaires. If mailed questionnaires are used, they should include a letter from a senior company official that explains the purpose of the questionnaire, solicits the individual's help, and thanks the respondents for their time.

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Questionnaires distributed without addressing these topics usually have very poor results. Questionnaires can also be completed in an interview. If interviews are used they should be held in a controlled environment, free of noise or disruption. Responses should be recorded. The following guidance may be used when developing a questionnaire.

1. Define the purpose of the questionnaire. This can be done by asking the following questions: "What do we want to find out?", "Why do we want to find that out?", "When do we need the information?", "How can we best get the information we need?", "Where should we gather information?", and "Who is the information for and from whom should we collect the information?"
2. Select evaluation questions to be used in the questionnaire. There are generally three sources for these questions. These include managers and users of the information to be collected; previously collected data, interviews, and fieldwork with people in the environment; and other questionnaires that have been used for similar purposes.
3. Determine the types of questions required. Generally, three types are used.
 - **Performance Questions** - This type of question usually asks what has actually been performed. These questions are aimed at descriptions of actual experiences, activities, or actions and corresponding performance that would have been observable had the evaluator been present to observe the actions;
 - **Opinion Questions** - This type of question can help identify problem causes and suggest possible solutions. These questions are aimed at finding out what people think about something. Opinion questions reflect people's goals, intentions, desires, and values; and
 - **Knowledge Questions** - These questions assess what factual information the person has. The assumption is that certain facts are prerequisites for effective performance.
4. Focus each question on a specific point. Provide cues or a point of reference to help the respondent. For example, "What problems have you had in calibrating the transmitter since you were trained?", or "Based on what you know about the new modification procedures, what should be changed in this course?", or "In your opinion, should the fundamentals section of operator training be resequenced in the course?"

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5. Specify the type of comparison or judgment to be made. Provide specific, appropriate bases from which comparisons or judgments can be made. Do not mix performance-based with other types of scales within the same response.

When gathering feedback from employees the following questions should be considered:

1. What additional training have you received since being assigned to your job?
2. What unexpected difficulties or problems in job performance have you experienced?
3. Has your supervisor given you instructions different from those you learned during training? What were they?
4. Have you noticed other differences between the training you received and what is expected of you now?
5. Have changes occurred in your job since you were assigned?
6. How were you prepared to handle these changes?
7. Which tasks do you find easiest?
8. Which tasks do you find especially challenging?
9. Looking back, what specific training benefitted you most?
10. What kinds of errors have been committed on the job?
11. What suggestions would you make to improve training?
12. What additional training do you need for your job?

Supervisors should be interviewed to determine how well training is preparing new employees to perform their jobs and what training is needed for current employees. The following types of questions can be used to collect supervisors' responses.

1. How well do employees (both newly-trained and experienced) perform on the job?
2. What tasks were newly-trained employees best prepared to perform?

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3. For what tasks were they inadequately prepared?
4. Are employees able to diagnose conditions and identify alternate solutions for accomplishing a task?
5. What kinds of errors have employees committed?
6. Which tasks require excessive time for employees to complete?
7. How do newly-trained employees compare to those who received earlier training?
8. What additional training have they received since they were assigned job responsibilities?
9. Have employee errors caused equipment damage or failure?
10. Has rework by maintenance personnel been required due to personnel errors or lack of adequate training?
11. Have increases in rework, unscheduled maintenance, or overtime occurred in jobs performed by newly-trained employees?
12. Have employees been commended or warned for unusually good or bad job performances?
13. Have you observed unexpected results from training?
14. Has training created any new problems?
15. What suggestions would you make to improve initial or continuing training?
16. Do you expect any changes in job assignments or equipment that will require additional training or changes in current training?
17. What current training do you consider to be excessive or unnecessary?

6.2.3 Review Facility Inspection and Evaluation Reports. Facility and corporate inspection and evaluation reports (including quality assurance audits) should be reviewed for indications of training-related weaknesses. The following questions should be answered by this review.

1. How effectively is training preparing employees to conform to plant procedures?
2. To what extent do training activities conform to established procedures?

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3. In what areas of training are improvement needed?

Review facility evaluations and audits reports for recommendations for improvement in the following areas:

1. Organization and management of the training system;
2. Trainee selection;
3. Development and qualification of training staff;
4. Support of training with facilities, equipment, and materials;
5. Conduct of job analysis and identification tasks for training;
6. Establishment of training program content;
7. Development of learning objectives as the basis for training;
8. Organization of instruction using lesson plans and other training guides;
9. Conduct of classroom and individualized instruction;
10. Conduct of on-the-job training;
11. Conduct of simulator training;
12. Conduct of laboratory training;
13. Examinations and evaluations leading to qualification/certification; and
14. Systematic evaluation of training effectiveness.

6.2.4 **Review Facility Modifications and Procedure Changes.** Facility modifications may require special training, changes in existing training, or additions to continuing training. Design changes, facility modifications, and procedure changes should be reviewed and tracked for training implications and considered for incorporation into existing training programs.

6.2.5 **Review Industry Operating and Maintenance Experiences.** Industry operating and maintenance experiences should be reviewed for applicability and possible incorporation in facility training programs. This information can be obtained from several sources such as Unusual Occurrences and DOE investigations. Incorporating industry operating experience into facility training enables contractors to benefit from each other's experiences. Industry operating and

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maintenance experience reports should be screened to answer the following questions.

1. How unique is the event?
2. Do similar conditions exist at this facility?
3. What is the potential for the event to occur here?
4. What consequences to personnel or equipment will result if the event occurs?
5. Is there evidence that this event may be part of a trend?
6. What specific training should be provided to prevent the occurrence or mitigate the consequences of such an event at this facility?

6.2.6 **Regulatory Developments.** Training personnel should monitor DOE and Nuclear Regulatory Commission orders, regulations, special reports, etc., for information and changes in requirements affecting training. The impact of regulatory changes can be evaluated using the following questions.

1. What conditions do the changes address?
2. Do those conditions exist at this plant?
3. Will changes influence the way our personnel perform their tasks?
4. What specific effects will this change have on training?
5. Does the condition require an immediate response?

6.3 Analyze Information

Program evaluation information should be analyzed before it is used to make changes in training. The simplest method of analysis that will yield the information required should be used. Analysis methods include exception analysis and content analysis. Some types of data should be organized and tabulated using frequency distributions prior to analysis. Verify apparent performance discrepancies through discussions with appropriate personnel. The following activities are used to analyze data: frequency distributions, exception analysis, content analysis, and root cause identification.

6.3.1 **Frequency Distributions.** Frequency distributions should be used for organizing, summarizing, and displaying data. They can be constructed using simple counting, averaging, and graphing procedures that show how often particular

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events have occurred. They are normally used as the first step in analyzing responses to surveys and trainee progress test results.

After all data from the indicators is collected, responses are tabulated. Totals are then entered into the corresponding spaces on a blank survey. The average (mean) response for each item is calculated and displayed on a bar chart. The bar chart presents survey information in a simple visual form. It highlights high and low values and permits easy comparison with acceptable performance standards or sets of previous data.

- 6.3.2 **Exception Analysis.** Exception analysis is used for reviewing data to detect unacceptable variations from a predefined standard. Facility operating, maintenance, and industrial safety experience should be analyzed using this method. Increases in the frequency of accidents, injuries, personnel errors, rework or unscheduled maintenance, or increases in overtime above normal levels may indicate a need to provide additional training or improve existing training. Acceptable levels should be established for each of these parameters as criteria for comparison. If any observed value deviates from the criteria, the cause should be investigated.

Feedback from employees and employee exams, supervisors, and instructor and trainee critiques should be analyzed to indicate if any training problem needs to be investigated.

- 6.3.3 **Content Analysis.** Content analysis depends primarily on the expertise and professional judgment of the individuals performing it. Content analysis should be considered for use with all types of information and may be used in conjunction with exception analysis. Interview responses should be analyzed using content analysis. The following guidelines should be used when performing content analysis:

1. Look for agreement. If respondents provide the same or similar answers, these answers are more likely to be valid;
2. Do not disregard responses. Do not attempt to "second-guess" employees, supervisors, or subject matter experts. If a response appears erroneous or exaggerated, follow up with observations and additional discussion; and
3. Focus the analysis on discovering specific tasks or subject areas in which training refinements seem necessary.

- 6.3.4 **Root Cause Identification.** Identification of the root cause should lead to determination of the appropriate corrective action. Utilize training and facility personnel in the identification of root causes and the determination of appropriate

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solutions. In general, root causes are identified by first identifying specific symptoms of the problem. Then alternative causes are generated and investigated until they are confirmed or eliminated.

Identification of root causes may be aided by the use of evaluation standards produced during the design phase. When facility events or feedback from employees or their supervisors indicate that workers have difficulty with specific tasks, administering applicable evaluation standards to a group of workers may disclose the nature of the problem and its cause.

6.4 Initiate Corrective Actions

If a performance discrepancy or potential problem is discovered and analysis confirms that training can contribute to a solution, action should be initiated to correct the existing or potential problem. Training modifications initiated because of existing deficiencies in personnel performance and those resulting from changing needs should be processed in a similar manner. Improvements and changes to training should be initiated and tracked systematically. Analysis results should be retained to document evaluation activities and indicators should continue to be monitored.

Because of the amount of work and cost involved, any decision to modify training should be carefully considered. Each facility should establish a procedure for deciding whether or not training should be changed, how it should be changed, and to whom the new or modified training should be provided.

Improvements or revisions involving any phase of the training process (analysis, design, development, implementation, or evaluation) should be completed in a timely manner. Since some performance deficiencies can be eliminated by better implementation of an existing program, with no changes in the program itself, this should be considered.

6.5 Key Considerations

The following considerations should be emphasized when performing and evaluating activities during the evaluation phase.

1. Responsibility for monitoring indicators, analyzing data, and approving revisions is clearly defined;
2. The training department is alerted to facility operating, maintenance, and industrial safety experiences;
3. Communication on training effectiveness occurs between plant supervisors and the training department;

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4. Employee opinion of the quality and effectiveness of training is collected periodically;
5. The training department is alerted to employee performance errors;
6. The training department meets with maintenance and operations, supervisors and engineers to determine potential training problems;
7. Training uses facility inspection and evaluation reports to guide program revisions;
8. Facility modifications and procedure changes are monitored for training consequences;
9. Training monitors industry operating and maintenance experiences for program impacts;
10. Regulatory changes are reviewed for training consequences;
11. Program performance data is analyzed;
12. Proposed changes are reviewed by appropriate facility and training personnel; and
13. Training changes are tracked.

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