PRINCIPLES OF TRAINING SYSTEM DEVELOPMENT SUPPLEMENT

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Plant Area: Training and Qualification

Key Words: Analysis, Design, Development, Implementation, and Evaluation

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

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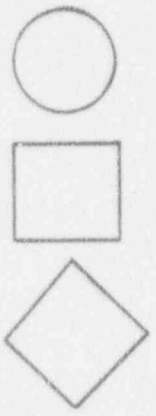
Flowchart symbols such as the following will be used throughout the manual.

Legend



Input/Output

Process

Decision

THE FIVE PHASES ARE

Analysis provides a method of responding to changes in human resource requirements, solving job performance problems, and learning from operating experience. It begins by gathering the facts needed to make informed training development decisions. This is necessary to make sure that apparent concerns can be resolved through training. If the facts confirm a valid training need, job analysis uses existing job data and incumbent employees to identify and rate job tasks. Tasks rated difficult and important are selected for training. Their exact methods of correct performance and underlying competencies are then determined through task analysis. Completing this process reveals reliable information on safe work practices. The knowledge, skills, and attitudes identified provide a task-specific content reference for both new and existing programs.

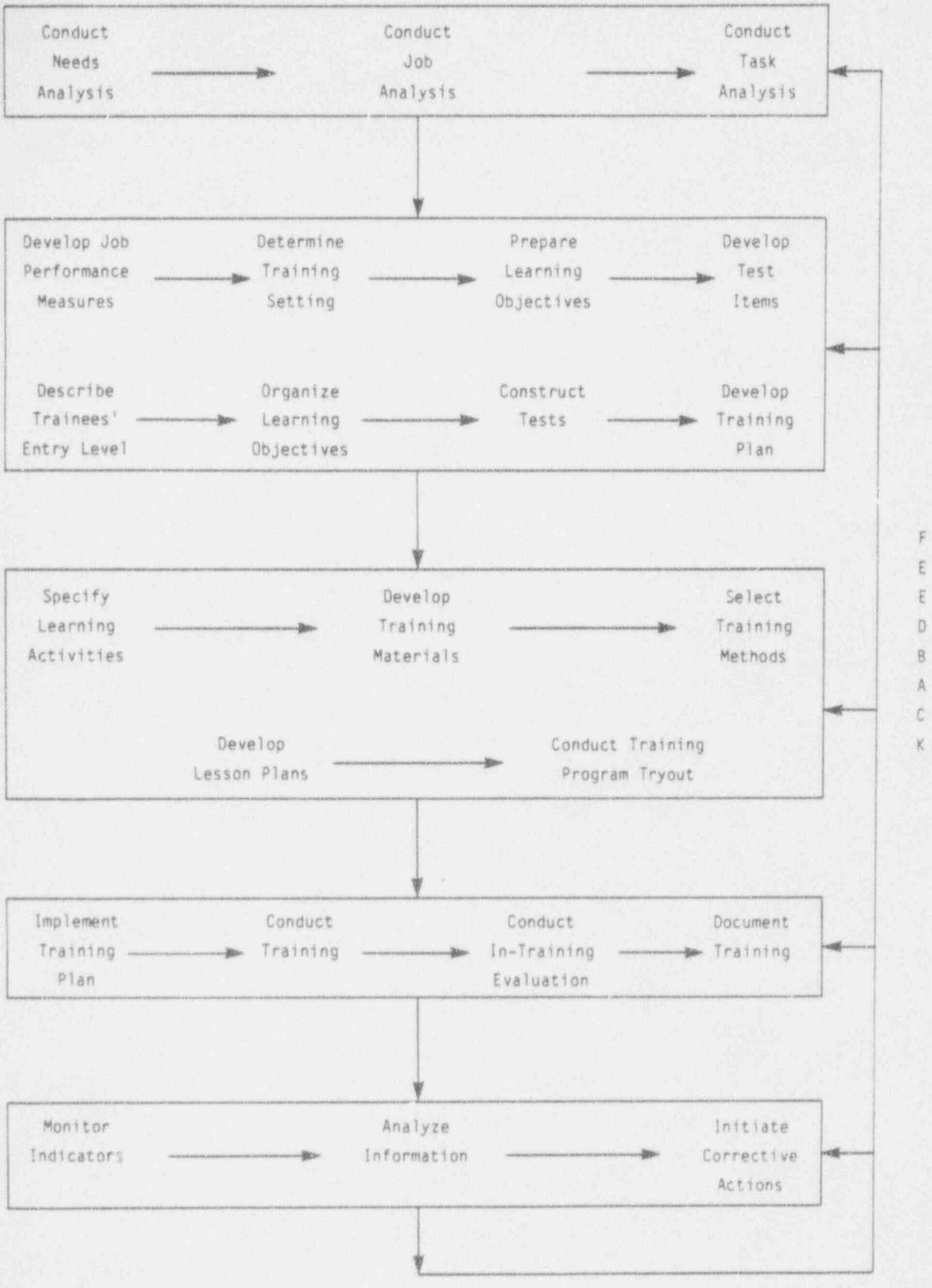
Design uses the task performance information collected during analysis to specify, in measurable terms, the knowledge, skills, and attitudes that training will develop in the learner. Job performance measures are prepared for each task. By defining how individual tasks are performed, they focus training development efforts and support in-plant training and qualification. Learning objectives are developed for groups of task-related knowledge and skills. These written statements define exactly when, what, and how well the trainee must perform during training. Tests are produced to ensure that these competencies are reliably evaluated. Together, these measures of observable employee behavior serve as the program design basis. Decisions on the training setting, trainee entry qualifications, and organization of learning objectives are also made. Design concludes with development of a training plan.

Development organizes the instructional materials needed for trainees to achieve the learning objectives. Emphasis is on maximizing the use of existing materials and resources. Instructor and trainee activities are defined using the job performance measures, learning objectives, and tests produced in design. These activities describe how the instructor and trainees will perform during training to achieve the learning objectives. Existing, suitable training materials and lesson plans are selected and new ones produced as required. Resulting training materials are reviewed for technical accuracy, tried out with a group of trainees, and revised as necessary. Performance-based training materials are the products of this phase.

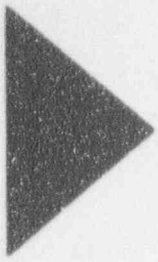
Implementation is the process of putting training programs into operation. It begins by activating the training plan. Instructors are selected and trained, and the availability of trainees, facilities, and resources is confirmed. Training is delivered as planned, and trainee and instructor performance is evaluated. These evaluations serve two purposes. First, they verify that trainees have achieved the learning objectives. Second, instructor performance problems can be detected and solved. Key records are maintained to support management information needs and to document the performance both of trainees and instructors.

Evaluation ensures training's continuing ability to produce qualified employees. By monitoring such indicators as employee job performance, plant and procedure changes, and operating experience, it helps maintain and improve the training program. It is the dynamic process of assessing performance, identifying concerns, and initiating corrective actions. The program feedback it yields enables training to respond adaptively to unforeseen problems or changing conditions. Completing evaluation steps produces the performance data and feedback vital to any training system.

THE ACTIVITIES IN EACH PHASE ARE

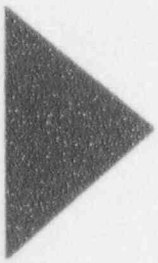


THE OUTCOMES OF THE ACTIVITIES ARE



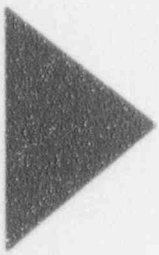
TRAINING REQUIREMENTS

- Training Needs
- Tasks Selected for Training
- Skill, Knowledge and Attitude Requirements



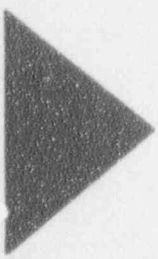
TRAINING SPECIFICATIONS

- Job Performance Measures
- Training Setting Decisions
- Learning Objectives
- Test Items
- Grouped Learning Objectives
- Tests
- Training Plan



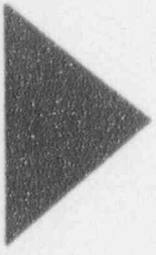
TRAINING PROGRAM

- Learning Activities
- Training Materials
- Methods
- Lesson Plans
- Tryout Results/Revisions



TRAINED EMPLOYEES

- Accountable Training
- Trained Personnel
- In-Training Evaluation Data
- Training Records



TRAINING CHANGES

- Training Program Evaluation Recommendations

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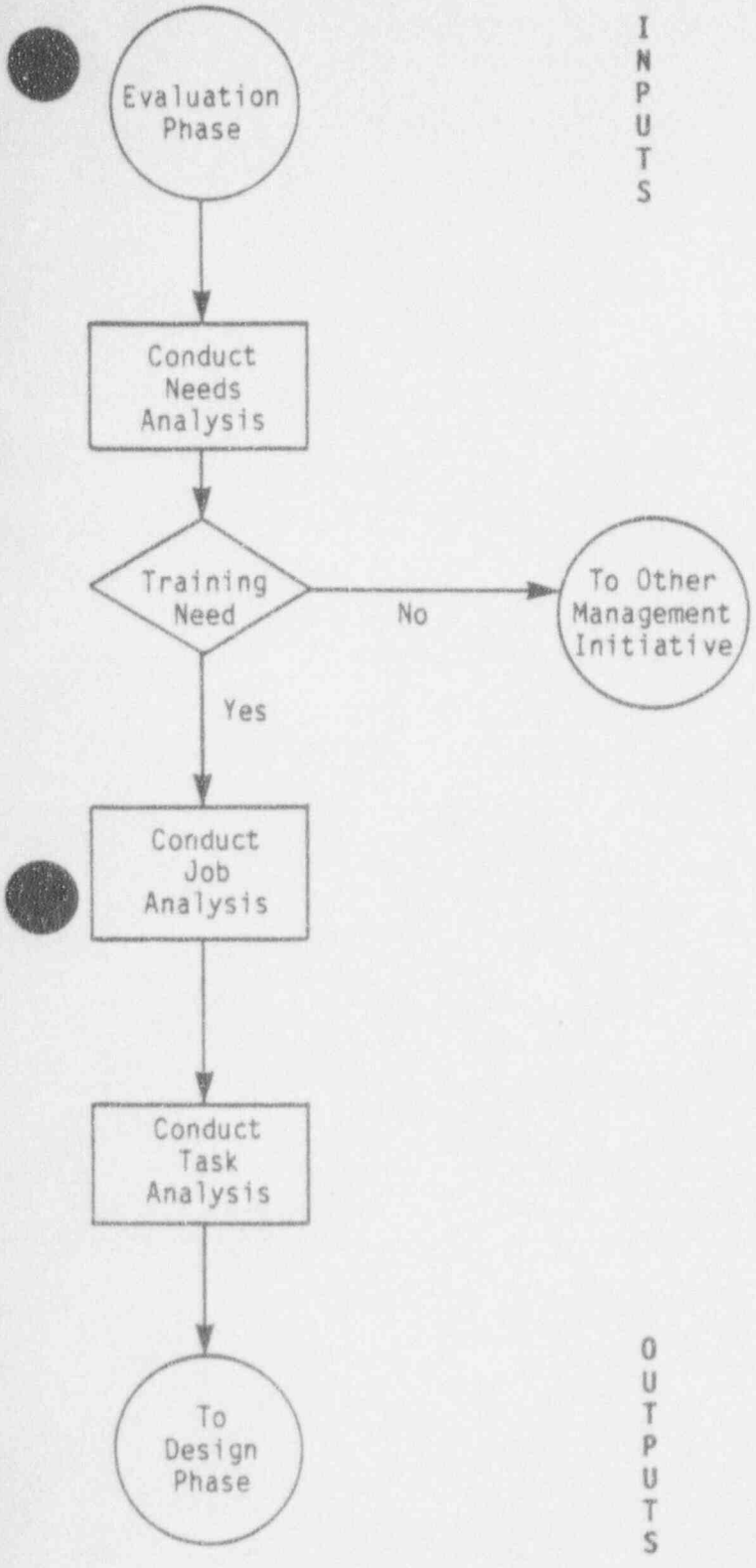
TRAINING SYSTEM ANALYSIS



INPUTS

- o Potential Human Resource Changes
- o Job Performance Problems
- o Training Program Evaluation Recommendation(s)

Respond to anticipated human resource requirements, apparent job performance problems, or training evaluation data by gathering the facts necessary to make informed development decisions

Use some combination of reviewing existing job data, conducting interviews, administering job survey questionnaires, or conducting consensus meetings to identify those job tasks and attitudes requiring training.

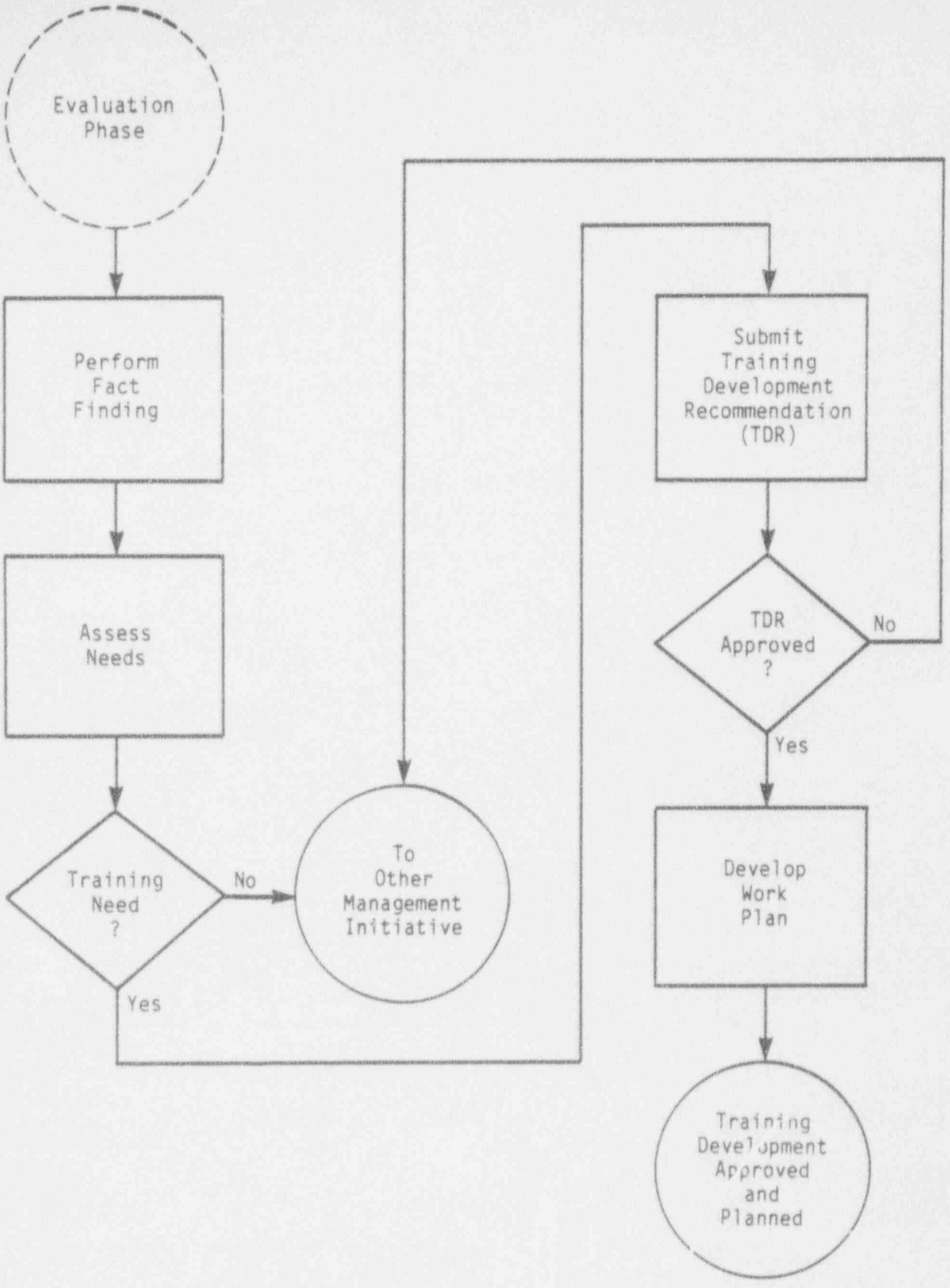
Work with subject matter experts and management to define the exact methods of proper task performance and their underlying skill, knowledge and attitude.

OUTPUTS

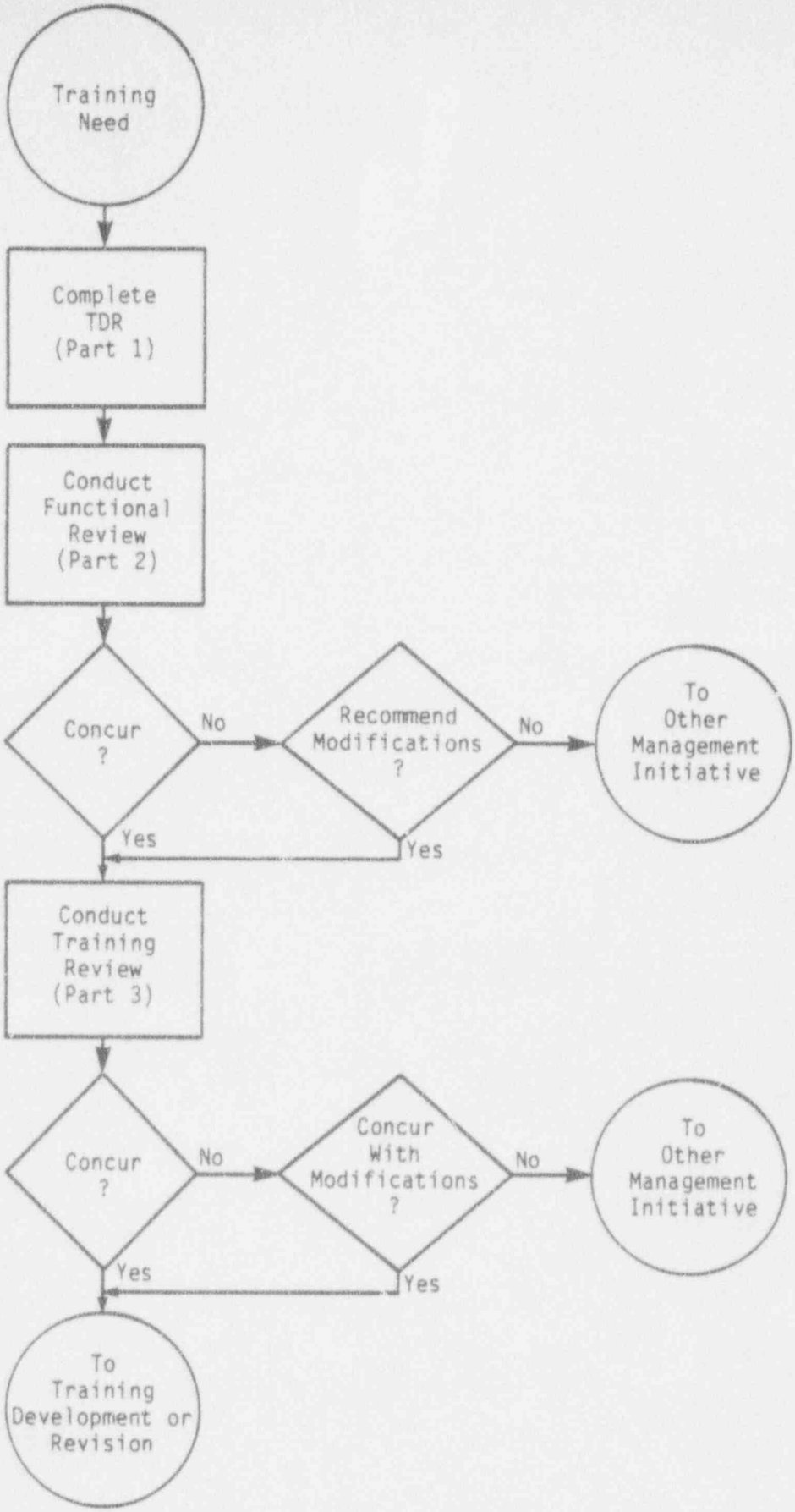
- o Training Needs
- o Job Tasks
- o Tasks Selected for Training
- o Skill, Knowledge, and Attitude Requirements

Training System Analysis: Inputs, Processes, and Outputs

CONDUCT NEEDS ANALYSIS



Conduct of Needs Analysis



Training Development Recommendation Procedure

TRAINING DEVELOPMENT RECOMMENDATION FORM

TRAINING DEVELOPMENT RECOMMENDATION

PART 1

ORIGINATOR: _____ TDR NO.: _____

TYPE: NEW DEVELOPMENT _____ REVISION _____ RELATED TDR NO.: _____

1. Identify the problem: _____

_____

_____

_____

2. Does the problem impact on the safe operations of the plant?
Yes _____ No _____

3. What job classification is affected?
_____ Control room operator
_____ Senior control room operator
_____ Shift supervisor
_____ Plant equipment operator
_____ Shift technical advisor
_____ Electrician
_____ Mechanical maintenance
_____ Instrument and control technician
_____ Radiation protection technician
_____ Chemistry technician
_____ Managers and technical staff
_____ Other _____

4. What kind of task is involved?
_____ Normal operations
_____ Maintenance and surveillance
_____ Administrative
_____ Abnormal
_____ Emergency
_____ Team evolution
_____ Other _____

5. How important is this situation?
_____ Negligible
_____ Undesirable
_____ Serious
_____ Severe
_____ Extremely severe

6. Does the situation require urgent consideration? _____ Yes _____ No

7. How difficult is this task to perform?
_____ Very easy
_____ Somewhat easy
_____ Moderately difficult
_____ Very difficult
_____ Extremely difficult

8. What is the frequency of this requirement or proolem?
_____ Rarely (about once a year)
_____ Seldom (about 3 or 4 times a year)
_____ Occasionally (about once a month)
_____ Often (about once a week)
_____ Very often (daily)

9. What is the source of the requirement or problem?
_____ Lack of training
_____ Insufficient training emphasis
_____ Lack of practice during training
_____ Incorrect training materials
_____ Conflict between training and job requirements
_____ Regulatory requirement
_____ Not applicable

10. How can this recommendation benefit plant operations?
_____ Correct unsafe practices
_____ Improve plant availability
_____ Eliminate equipment misuse/damage
_____ Reduce reworks
_____ Reduce unscheduled maintenance
_____ Improve employee performance
_____ Accelerate qualification
_____ Avert anticipated problem
_____ Respond to regulatory requirement/ change
_____ Maintain job qualifications

11. How do you suggest training be
_____ revised or _____ developed?
(In the space below, identify the root cause of the problem and how it should be corrected.)

_____ _____
Signature Date

PART 2
FUNCTIONAL REVIEW

Part 1 Disposition Action:

Approved _____ Approved with Modifications _____ Disapproved _____

Modifications and comments: (Note: approved with modifications and disapproved require comment)

_____ _____
Signature, Title Date

PART 3
TRAINING REVIEW

Disposition Action:	Approved	Approved with Modifications	Disapproved	Defer
Part 1	_____	_____	_____	_____
Part 2	_____	_____	_____	_____

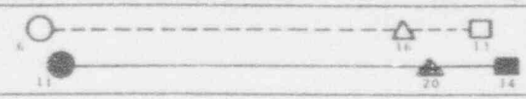
Modifications and comments: (Note: approved with modifications, disapproved, and defer require comment)

_____ _____
Signature, Title Date

PLANNING WORKSHEET

PLANNING WORKSHEET

COURSE TITLE:

EVENT/ACTIVITY	J F M A M J J A S O N D
ANALYSIS:	(NOTE) 
Conduct Job Analysis	
Conduct Task Analysis	
DESIGN:	
Develop Job Performance Measures	
Determine Training Setting	
Prepare Learning Objectives	
Develop Test Items	
Structure and Sequence Learning Objectives	
Describe Trainee Expected Entry-Level Skills and Knowledges	
Construct Tests	
Develop Training Plan	

NOTE: EXAMPLE USE OF SYMBOLS

- LEGEND -

○ = planned commencement date	● = actual commencement date
--- = planned development time	—— = actual development time
△ = planned completion date	▲ = actual completion date
□ = planned management approval of completed event/activity	■ = actual management approval of completed event/activity

PLANNING WORKSHEET

EVENT/ACTIVITY	COURSE TITLE: J F M A M J J A S O N D
DEVELOPMENT:	
Specify Learning Activities	
Develop Training Materials	
Select Training Methods	
Develop Lesson Plans	
Conduct Training Program Tryout	
IMPLEMENTATION:	
Implement Training Plan	
Conduct Training	

NOTE: EXAMPLE USE OF SYMBOLS

- LEGEND -

○ = planned commencement date
--- = planned development time
△ = planned completion date
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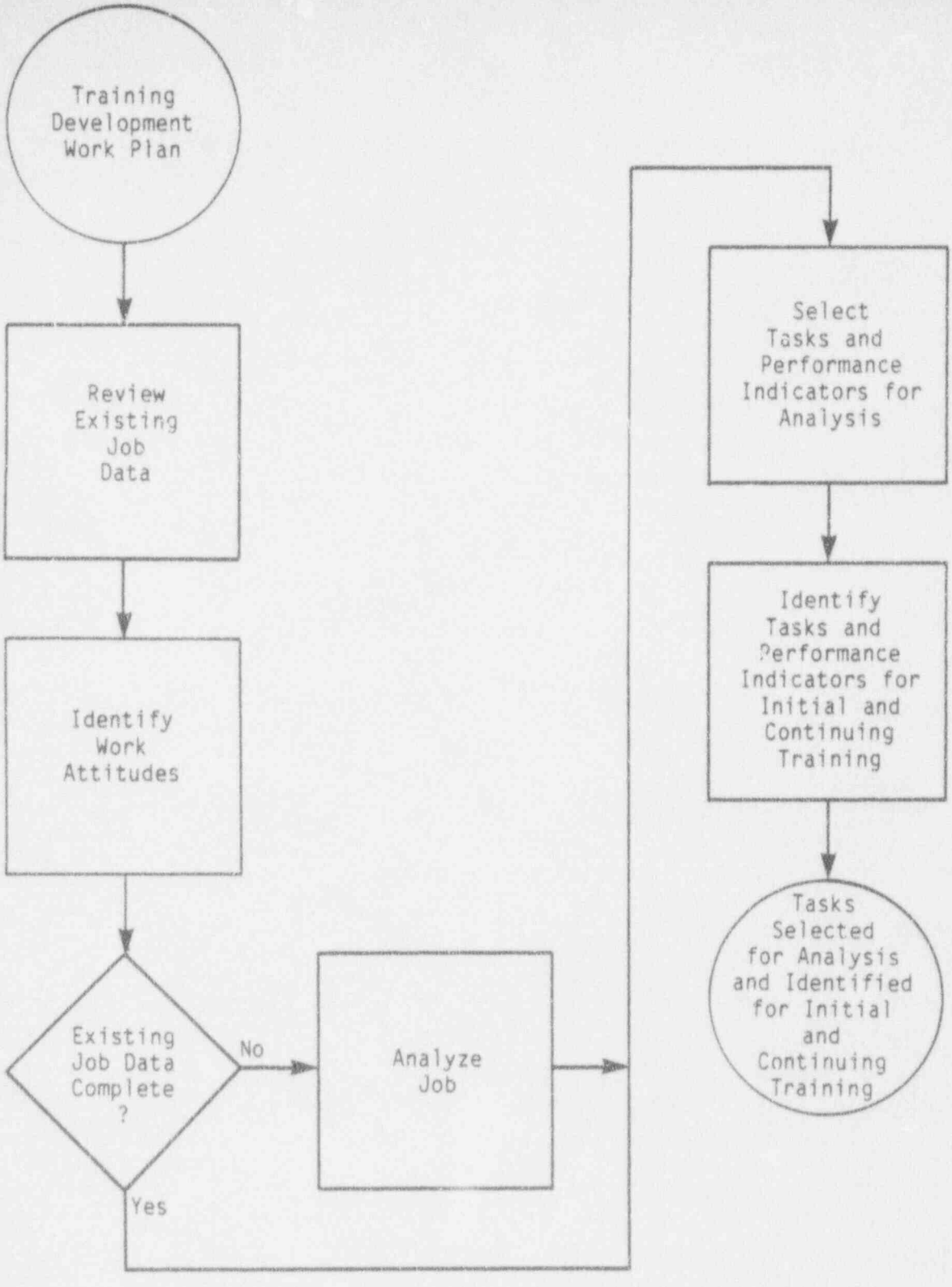
CONDUCT JOB ANALYSIS



Conduct of Job Analysis

TASK STATEMENT REVIEW GUIDELINES

REQUIREMENT	TASK STATEMENT	EXAMPLE
rity	Use wording that is easily understood.	"Compare written description to actual performance." But Not "Relate results to needs of field."
	Be precise so words mean the same thing to all personnel in the job clasification.	Use words such as "check, coordinate, assist" with caution--they are vague.
	Write separate, specific statements for each task. Avoid combining vague items of skill, knowledge, or responsibility.	"Supervise files." "Maintain files." But Not "Have responsibility for maintaining files."
Completeness	Use abbreviations only after spelling out the term.	"Closed Cycle Cooling System" (CCCS) may be followed by "Start up the CCCS."
	Include both form and title number when the task is to complete a standard form, unless all that is needed is the general type of form.	"Complete Task Description Worksheet (Form No. XXX)."
Conciseness	Be brief. Short phrases are preferred to long expressions.	"Write production and control reports." But Not "Accomplish necessary reports involved in the process of maintaining production and control procedures."
	Begin with a present-tense action word (subject "I" or "you" is understood).	"Clean" or "Write."
	Indicate an object of the action to be performed.	"Clean engine." "Write report."
	Use terminology that is currently used on the job.	"Use most recent NRC documentation."
Consistency	Avoid stating a person's qualifications, such as intelligence, experience, or education.	"Load computer tape." But Not "Has one year computer training."
	Omit items on receiving instruction, unless actual work is performed during training.	"Give instruction." But Not "Attend lecture."

Table 2-1. Task Statement Review Guidelines

DATA COLLECTION METHODS

Job analysis data collection methods include interviews, consensus meetings, and questionnaire surveys. Each of these methods has guidelines that should be followed to ensure that consistent and reliable data is collected. These are addressed in the following paragraphs.

Interviews

An interview is a meeting (usually one-on-one) between the individual collecting the data (interviewer) and the employee (job incumbent). The following guidelines apply to preparing, opening, steering, and closing an interview.

Preparing for the Interview

- Review worker-related information prior to interview.

- Build the employee's interest in advance through well-prepared announcements. Advise the employee's supervisor in advance of arrangements for the interview.

- Select facilities that will ensure a distraction-free, comfortable environment.

- Avoid any implication that the interviewer has a higher status than the employee.

- Assemble necessary forms, references, and questions.

Opening the Interview

- Find out the employee's name in advance, introduce yourself, and discuss general topics until you have established a rapport and the worker is comfortable.

- State the purpose of the interview. Explain why it was scheduled, what should be accomplished, and how the employee's cooperation can help produce a useful survey.

- Relate the interview to goals the employee believes are important.

- Be courteous, use eye contact, and show a sincere interest in the employee and the topic being discussed.

Steering the Interview

- Discuss topics according to the logical sequence of duties performed.
- Keep the conversation active by using silence or pauses; brief, assenting comments, neutral questions; or by summarizing key points.
- Allow the worker time to think about and answer each question. Ask only one question at a time.
- Use closed questions for workers who tend to be verbose and open questions for workers who tend to be reserved or unresponsive.
- Avoid leading questions (i.e., answer implied in the question).
- Use simple language.
- Show a sincere interest in the worker and the topic being discussed.
- Do not be distracting, condescending, or authoritative.
- Keep a steady, consistent pace and avoid interrupting.
- Secure specific and complete information pertaining to each type of question. Follow up leads that may be pertinent to the question.
- Consider the organizational relationship of the job under analysis to other jobs in the department.
- Control the time of the interview. When the worker strays from the subject, summarize data collected and ask the next related question.
- Take legible notes and avoid laborious, time-consuming written observations.

Closing the Interview

- Emphasize closed questions when indicating the end of the interview is approaching.
- Summarize the worker's statements, indicating major duties and key details concerning those duties.
- Conclude by explaining the value of the information the worker has provided.
- Close the interview on a friendly note. Thank the worker for his/her help and cooperation.

Consensus Meeting

In a consensus meeting, a panel of subject matter experts compiles the data through a collective decision process. The following guidelines address preparing, controlling, and summarizing a consensus meeting involving a panel of experts.

Preparing for the Meeting

- o Outline an agenda for the meeting, including purpose, goals, schedule, and procedures.
- o Define the problem to be resolved (e.g., outline the tasks of an apprentice electrician).
- o Specify alternative organizational approaches (e.g., list tasks by duty area, equipment, or engineering system).
- o Identify consequences of each alternative (e.g., electricians identify easily with duty areas but are organized by speciality [equipment] area).
- o If possible, draft a task list based on review of existing data prior to the meeting.

Conducting the Meeting

- o Convene a panel of six to eight subject matter experts (SMEs).
- o Stress that participants were selected because of their qualifications.
- o State that the meeting has management support. Ensure that the leader's role is one of problem solver, facilitator, and problem clarifier.
- o Have the group review the task list and related documentation. Correct any deficiencies or inaccuracies.
- o Use non-threatening, participative discussion techniques. Do not permit one member to dominate the discussion.
- o Raise one duty area at a time, resolve its contents, rate the tasks, and move to the next duty area.
- o If disagreement results, discuss the problem thoroughly; if agreement cannot be reached, record the majority opinion.
- o Compile SME ratings outside of the meeting.

Summarizing the Meeting

- o Summarize and review results of composite ratings.
- o Set a follow-up meeting date to verify agreements and priorities for task analysis. A final review of the results also may be conducted.
- o Acknowledge individual contributions by thanking each member of the group.

Questionnaire Survey

A questionnaire survey is a data collection form with job-related information and questions that is distributed to the employees for completion. The following guidelines address planning, developing, and administering a questionnaire survey.

Planning the Questionnaire Survey

- Specify the purpose of the questionnaire in 25 words or less. Ascertain who needs the information and what decisions are going to be made on the basis of the data.

- Identify characteristics and availability of the population being surveyed (e.g., reading level, experience, location).

- Outline general areas that must be addressed in the questionnaire (e.g., task list, references, tools, and equipment).

- Identify data analysis needs (e.g., coding, statistics, reports).

- Use closed question format whenever possible. (Closed questions require a brief and succinct answer.)

- Schedule distribution, administration, and return of the questionnaire.

Developing the Questionnaire Survey

- Include an introduction that states the purpose of the questionnaire, sponsoring organization, amount of time required, reasons for participating, and ways in which the data will benefit the individual being surveyed.

- Ensure respondents of the data's confidentiality.

- Allow for a limited range of responses. Use a scale with positive and negative options to avoid influencing responses in one direction. Explain response options.

- Ask only one question in each item. Write simple, brief, clear, obvious questions.

- Sequence questions in a logical order from easy to difficult. Put important questions at the beginning of the survey.

- Avoid leading questions (i.e., only one answer is possible), emotional words, and negative phrases.

- Try out the questionnaire on typical members of the job being surveyed to ensure items are clear and concise.

- Examine each question carefully. If the answer to this question is not pertinent, omit the question.

Administering the Questionnaire Survey

- Develop directions for survey administrator/coordinator that describe general administration, collection, and processing procedures.

- Specify any sampling requirements that must be met for the survey.

- Schedule distribution and return of the survey.

- Conduct any follow-up measures that may be necessary.

JOB ANALYSIS DATA

Discussions of job analysis require use of the following key terms: job, duty, activity, and task. The interrelationships among these terms are shown in the control room operator example on page 2-3-22. The job comprises duty or responsibility areas and tasks performed by an employee. It is a group of positions identical in their major tasks and work scope. An activity refers to the conditions under which jobs are performed (e.g., normal, abnormal, and emergency). A duty is a major subdivision of work performed by an employee in a job. Duty areas are used to categorize groups of similar tasks. A task is the lowest level of employee behavior that describes performance of a meaningful function in the job. Tasks possess the following characteristics:

- o a statement of a specific action
- o a defined beginning and end
- o an action that can be performed in a relatively short period of time (i.e., seconds, minutes, or hours)
- o an action that is observable and measurable
- o an action that is independent of other actions

Most jobs are composed of many tasks; some are performed simply and quickly, while others may be complex and time-consuming. For this reason, it is useful to organize tasks into categories for job analysis. Categorizing tasks permits application of simplified measures to the job analysis process. For example, during the INPO-sponsored PWR control room operator job analysis, task types were categorized as (1) system operation, (2) maintenance and surveillance, (3) administrative, (4) abnormal, (5) emergency, and (6) supervisory.

During job analysis surveys, factors of difficulty, importance, and frequency of performance of each task are rated by employees. These factors are defined in the following paragraphs.

Difficulty

Difficulty refers to mental and physical effort required by a worker to achieve proficiency in task performance. Some tasks are easy or familiar and require no training prior to performance. More difficult tasks can be mastered

by most employees with proper training, while others require physical skill or intellectual ability that relatively few employees are capable of achieving. Use of difficulty ratings can ensure that complicated tasks are trained formally. The following is an example of a scale that can be used by employees to rate task difficulty.

Minimum: 1. "Very easy" to perform
2. "Somewhat easy" to perform
3. "Moderately difficult" to perform
4. "Very difficult" to perform
Maximum: 5. "Extremely difficult" to perform

Importance (Criticality)

Tasks have varying degrees of importance in job performance. Some tasks are vital to job performance, while others may be of relatively minor consequence. Task importance is rated in terms of consequences of inadequate performance (e.g., injury to personnel, damage to equipment, etc.). Importance ratings ensure that tasks essential to job performance are identified and that personnel are trained for them. The following is an example of the scale that can be used by employees to rate task importance:

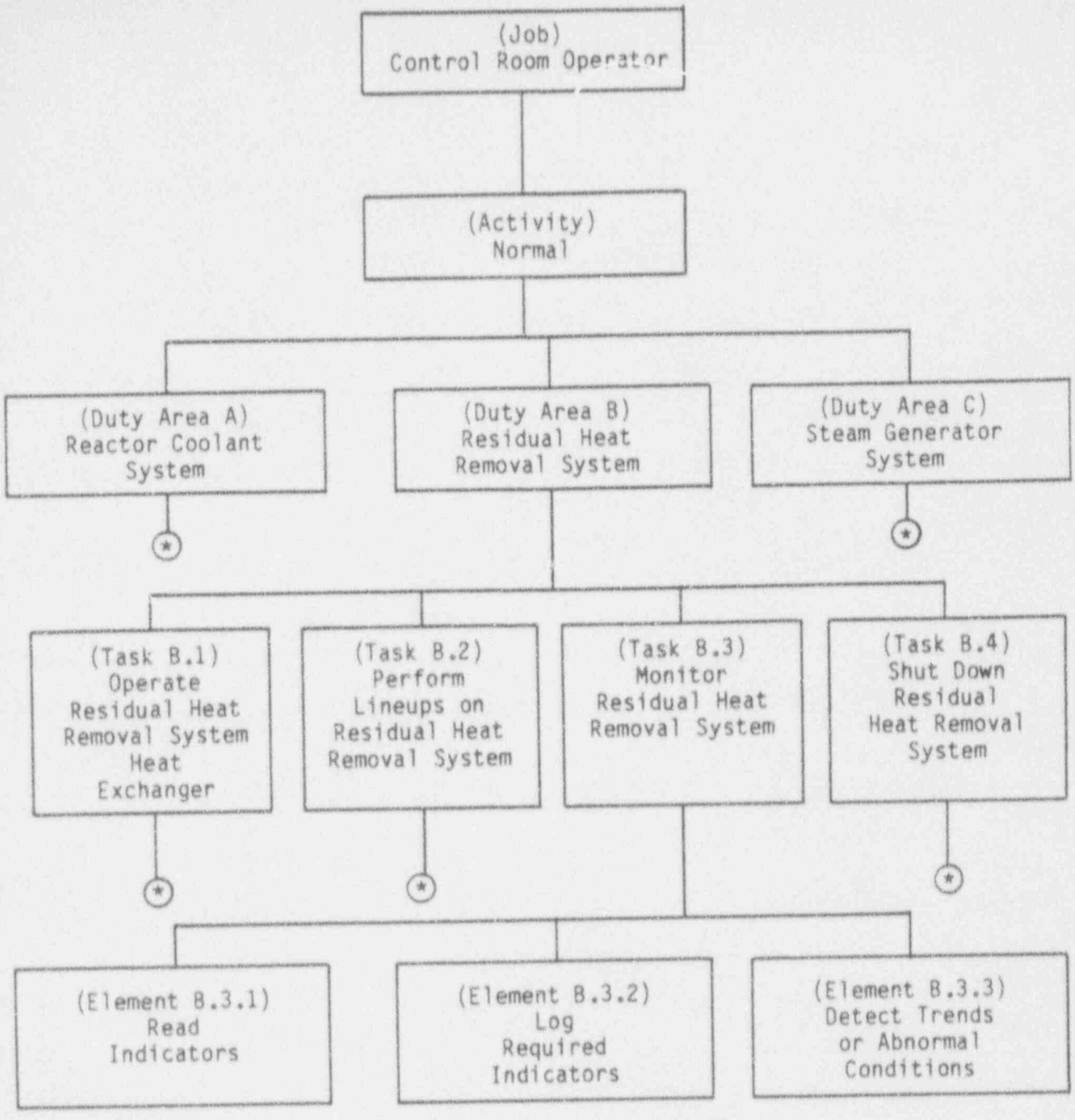
Minimum: 1. Consequences of improper performance are "negligible."
2. Consequences of improper performance are "low."
3. Consequences of improper performance are "about average."
4. Consequences of improper performance are "high."
Maximum: 5. Consequences of improper performance are "extremely high."

Frequency of Performance

Frequency of performance measures how often a task is performed by an employee. A frequently performed task is a more likely candidate for training, as the need for proficient performance is relatively continuous.

A task performed infrequently (once in several years) usually is not suitable for training. These tasks could be covered by drills or exercises on the job or used to develop detailed procedures (i.e., job performance aids). Frequency of performance can be used to determine the need for initial and/or continuing training. It also can affect training setting selection. The following is an example of a scale that can be used by employees to rate task frequency of performance:

	0.	Never
Minimum	1.	Rarely (about once a year)
	2.	Seldom (about three or four times a year)
	3.	Occasionally (about once a month)
	4.	Often (about once a week)
Maximum	5.	Very often (daily)



*To simplify this example, continuation of these items has been omitted.

(NOTE: Although task elements are identified during task analysis, they are displayed here to show their relationship to job, duties, activities, and tasks.)

Interrelationships of Job, Activities, Duties, Tasks and Elements

TASI: SELECTION FACTORS

TASK SELECTION FACTORS

Selection of tasks using the factors of difficulty and importance begins by computing the mean (average) of the numerical score (rating) assigned to each factor by employees during data collection.

The mean (average) value of each factor is used in a review process. For example, decision points are given a range of values for each factor mean score, as indicated below:

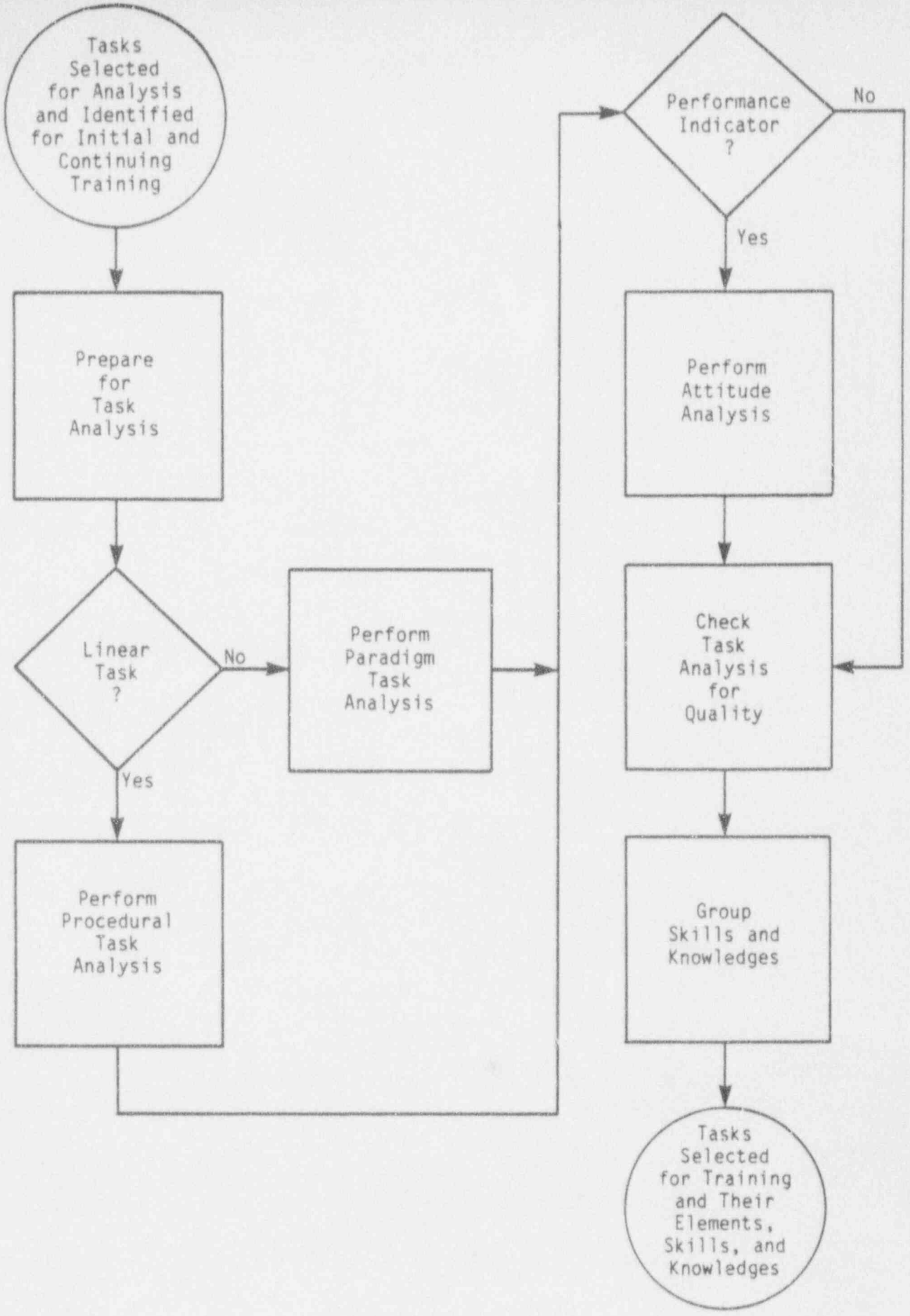
Decision Factor	Point	Value Range
Difficulty	Very	Mean score $\geq$ 3
	Average	Mean score $>$ 2 and $<$ 3
	Easy	Mean score $\leq$ 2
Importance	Yes	Mean score $\geq$ 3
	No	Mean score $<$ 3

The difficulty and importance mean scores are used to determine the appropriate category for each task. After each task goes through this process, the tasks that reflect a composite rating of difficulty and importance are produced. These groups of tasks are submitted to the panel of experts and training personnel for review.

The panel determines which tasks do not require training or would not use training resources effectively. The following are examples of criteria that may be used to exclude tasks from analysis and training:

- The task can be learned easily on the job without adverse impact on plant operations.
- The task has low difficulty and importance ratings, indicating that training resources should not be expended on that task during formal training.
- The task requires skills and knowledges that should have been acquired at lower job classifications.

CONDUCT TASK ANALYSIS



Conduct of Task Analysis

TASK ANALYSIS DATA

During task analysis, tasks are analyzed by job incumbents and training personnel to identify elements and other related data that support task performance. These performance-related data are discussed in the following paragraphs.

Conditions

Conditions are on-the-job situations that influence task performance. Conditions also refer to information and resources available to the employee that aid in performance of a task or element. The following categories should be considered:

- o plant operating mode
- o equipment and equipment status
- o tools and supplies
- o environmental conditions (e.g., temperature, noise, ventilation, humidity)

Cues

Cues refer to events or occurrences that signal the beginning (initiation) or end (termination) of a task or task element.

Standards

A standard specifies the level of acceptable performance of the task. It should contain a statement of observable and measurable performance. Satisfactory performance can be defined by acceptable output of performance (products) or by following step-by-step procedures (process) or a combination of both.

Product standards generally are described in terms of quantity (number) or quality (accuracy, completeness, reliability, precision, etc.). Process standards outline steps of a procedure (sequence, time spent, directions followed, timeliness, order, etc.).

For many tasks, both process and product standards are appropriate and should be used. Examples of standards include "complete and accurate," "submitted on

time," or "properly assembled." It is acceptable to identify standards by referencing existing, readily accessible criteria (e.g., must meet 10 CFR 57). When there is no written criteria, such as in "subject to supervisor's approval," it is necessary to specify what constitutes supervisory support (i.e., time, accuracy, quantity of product, etc.).

Elements

A sequential listing of task action steps is required. These steps or elements define the worker's actions during performance of a specific task. Elements begin with action verbs (e.g., "operate," "calculate," "adjust") and should be listed in their correct sequence.

Skills and Knowledges

Skill and knowledge statements describe what a worker needs to know to be able to perform a task or task element. Skills and knowledges should not address general understandings. For example, a good skill/knowledge statement would be "derivation of heat absorption by addition and subtraction of heat/work inputs and outputs." In contrast, a general statement, "understand general math principles," would be ambiguous and open to interpretation. Skill and knowledge statements should be written in specific terms. However, they must be kept at a practical level.

Consequences of Inadequate Task Performance

Potential results of incorrectly performing the task also are listed. This category identifies potential safety problems and the importance of proper task performance.

Related Tasks

Establishing a relationship among tasks is useful. One process categorizes tasks by plant system and by activity, using a number coding system. This coding identifies the relationship between abnormal tasks and their "parent" normal tasks.

References

References should be identified because of their importance in nuclear power plant operations. These include procedures, technical manuals, and technical specifications.

Task Output

Task output is the final result of satisfactory task performance. Task output should be the logical end result of task performance. Output is implied by the task statement. Each task output must be stated in measurable terms.

Human Interfaces

All personnel with whom the worker interacts during performance of the task are listed under human interfaces. In many cases, worker interaction is a critical factor in task performance and can influence training requirements.

Personnel Safety Considerations

Possible hazards that could cause accidents during task performance are listed under this heading. Some examples of personnel safety considerations are radiation exposure, high temperatures, toxic fumes, ladders, scaffolds, and other industrial safety aspects.

OUTLINE OF SAMPLE TOPICS FOR SKILLS AND KNOWLEDGES

1. SYSTEM

A. Residual heat removal system
B. Engineered safety features actuation system
C. Steam generator system
D. Area radiation monitoring system
E. Chlorination system
F. Nuclear instrumentation system
G. Main turbine generator

2. COMPONENT

A. Pumps
B. Valves
C. Heat exchangers/condensers
D. Chemicals
E. Radiation monitoring equipment
F. Test equipment
G. Sensors/detectors

3. ACADEMIC

A. Mathematics
B. Chemistry
C. Classical physics
D. Reactor theory
E. Instrumentation and control
F. Materials
G. Management/supervisory

REFERENCES

REFERENCES

The following references correspond to activities in the Analysis Section. They are provided as sources of additional study for the interested reader. The list is not intended to be all-inclusive or an endorsement of the author's view. Additional references or information may be obtained by contacting the Training and Education Division, Institute of Nuclear Power Operations.

Section 2.1: Conduct Needs Analysis

Kaufman, R. and English, F. Needs Assessment. Englewood Cliffs, N. J.: Educational Technology Publications, Inc., 1979. (Chapters 3 and 4)

Mager, R. F. and Pipe, P. Analyzing Performance Problems. Belmont, Ca.: Pitman Learning, Inc., 1970.

Section 2.2: Conduct Job Analysis

McCormick, E. J. Job Analysis: Methods and Applications. New York, N. Y.: AMACOM., 1979. (Chapter 4)

Zemke, R. and Kramlinger, T. Figuring Things Out - A Guide to Needs and Task Analysis. Reading, Ma.: Addison-Wesley Publishing Co., 1982. (Chapter 4, 8, 9, 12, and 13)

Mager, R. F. Goal Analysis. Belmont, Ca.: Fearon Pitman Publishers, Inc., 1972.

Section 2.3: Conduct Task Analysis

Institute of Nuclear Power Operations. Task Analysis Procedure (83-009). Atlanta, Ga., 1983.

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TRAINING SYSTEM DESIGN

INPUTS

- o Training Needs
- o Job Tasks
- o Tasks Selected for Training
- o Skill, Knowledge, Attitudes

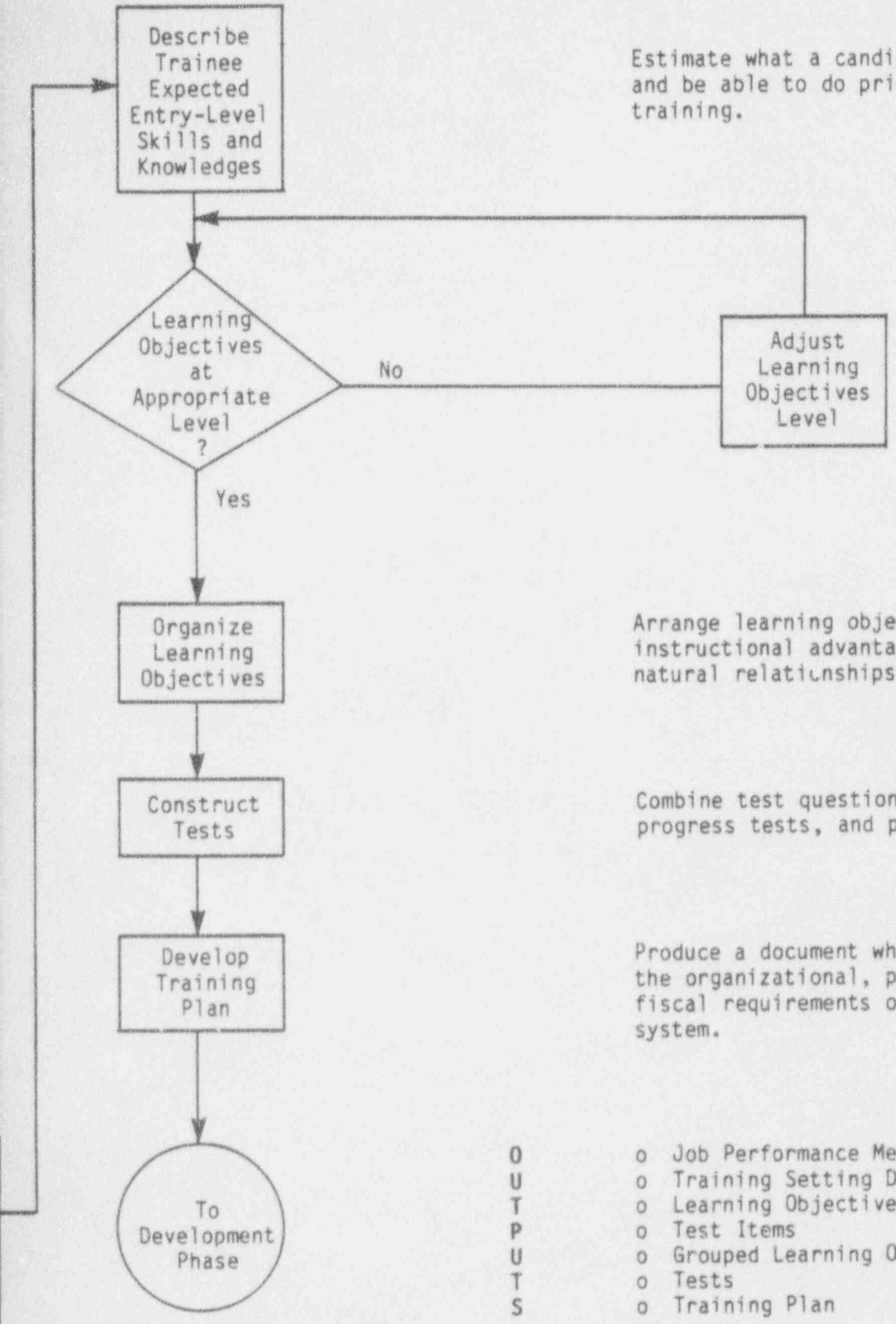
Construct tests to observe and measure trainee perfromance on each job task selected for training.

Select the training environment most appropriate to the tasks to be learned.

Develop written statements identifying exactly what, when, and how well the trainee must perform after training.

Produce test questions to measure objectively how well trainees fulfill learning objectives.

Training System Design: Inputs, Processes, and Outputs



Estimate what a candidate should know and be able to do prior to entering training.

Arrange learning objectives to take instructional advantage of their natural relationships to each other.

Combine test questions into pre-tests, progress tests, and post-tests.

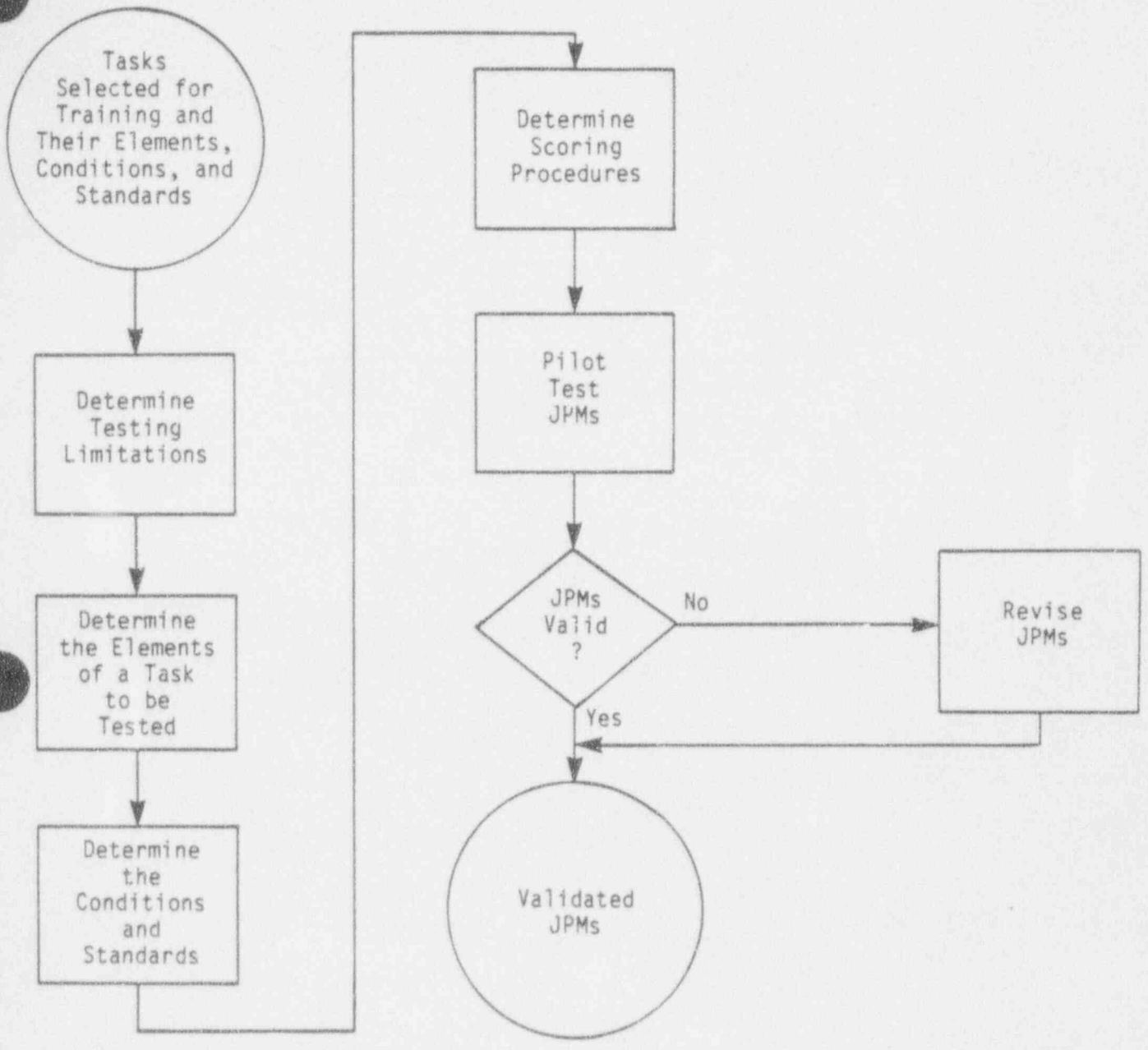
Produce a document which describes the organizational, personnel, and fiscal requirements of the training system.

OUTPUTS

- o Job Performance Measures
- o Training Setting Decisions
- o Learning Objectives
- o Test Items
- o Grouped Learning Objectives
- o Tests
- o Training Plan

Training System Design: Inputs, Processes, and Outputs (cont)

DEVELOP JOB PERFORMANCE MEASURES



Develop Job Performance Measures

JOB PERFORMANCE MEASURE WORK SHEET

JOB CLASSIFICATION: Control Room Operator JPM FOR TASK NO: 0590050101

TASK TITLE: Operate the feedwater regulating system in manual and automatic modes.

DIRECTIONS TO TRAINEE: When I tell you to begin, you are to OPERATE THE FEEDWATER REGULATING SYSTEM IN MANUAL AND AUTOMATIC MODES. I will describe general conditions and provide tools to perform this task. Before starting, I will state task standards(s) and initiating cues and answer any questions you have. If you perform a critical step improperly or do a step out of sequence, you will fail this job performance measure.

A. GENERAL CONDITIONS:

1. Plant mode(s)--reactor at power
2. Feedwater system operating
3. Condensate system operating
4. Instrument air system operating
5. Power available to feedwater regulating valves

B. GENERAL TOOLS AND EQUIPMENT:

1. Plant paging system
2. Plant telephone

C. GENERAL REFERENCES:

1. Main feedwater system operating procedure
2. Reactor operator log
3. Station directives

D. TASK STANDARDS:

1. Steam generator level must be maintained in normal operating range.

E. INITIATING CUE(S):

1. Receive direction from shift supervisor to perform task.
2. Plant procedure requires performance of task.

F. PERFORMANCE CHECKLIST:

		Task Elements	Standards	Initials
1.	S/C	Select manual mode with feedwater regulating valve for affected steam generator.	without error	_____

F. PERFORMANCE CHECKLIST: (continued)

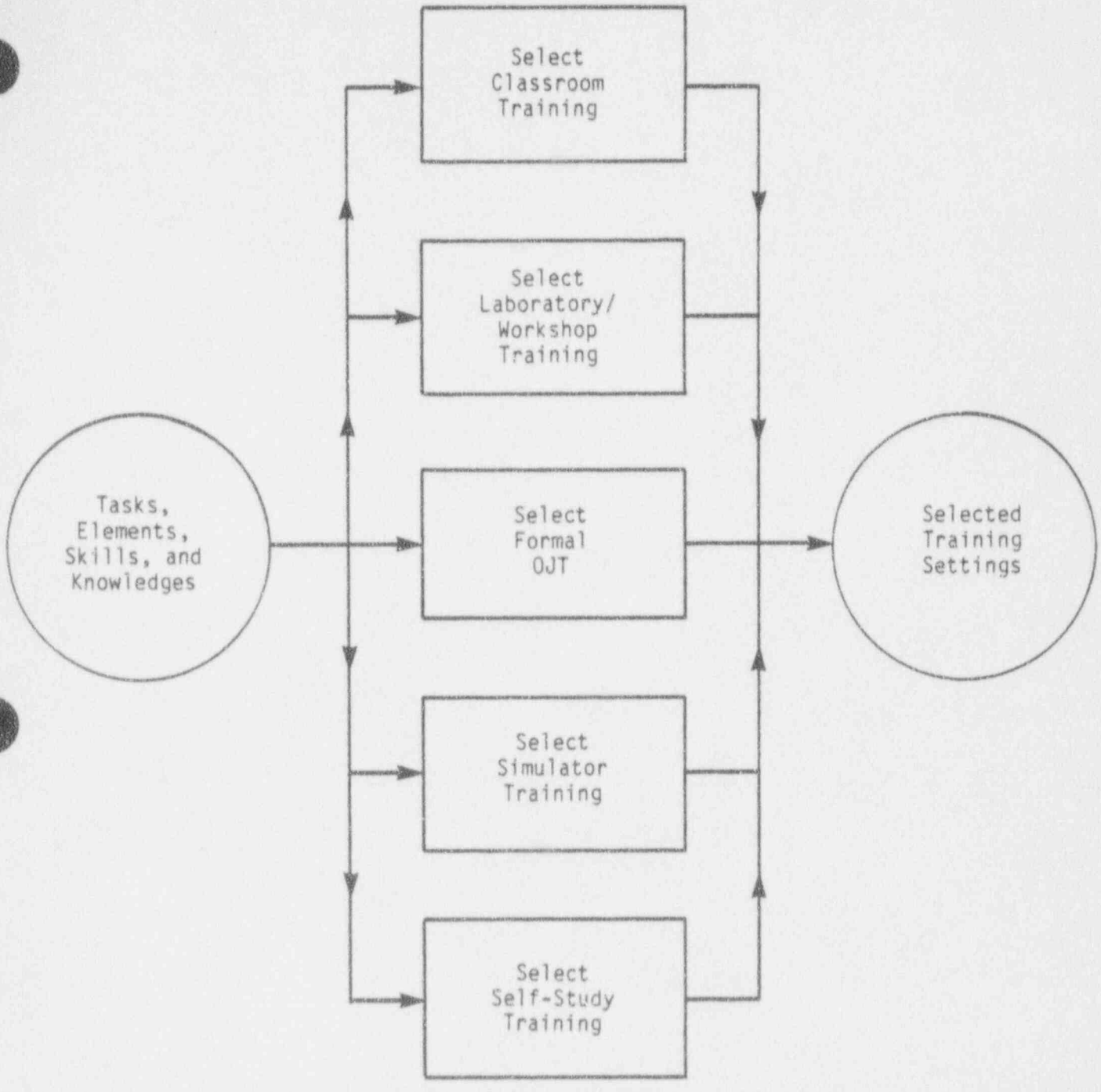
		Task Elements	Standards	Initials
2.	S/C	Adjust feedwater regulating valve controller to maintain specified steam generator level.	Steam generator level maintained at program level ± 20%.	_____
3.	S/C	Verify steam generator level is in normal operating band.	Steam generator level maintained at program level ± 20%.	_____
4.	S/C	Adjust feedwater regulating valve controller to programmed steam generator level.	Steam generator level maintained at program level ± 20%.	_____
5.	S/C	Verify feedwater flow and steam flow matched.	Feedwater flow within 5 million lbs. mass per hour of steam flow.	_____
6.	S/C	Select automatic mode on affected feedwater regulating valve controller.	without error	_____
7.	S/C	Monitor feedwater regulating valve demand position indicator.	without error	_____
8.	S/C	Verify steam generator level is in normal operating band.	Steam generator level maintained at program level ± 20%.	_____
9.	S	Inform shift supervisor of task completion.	without error	_____
10.	S	Log task completion.	without error	_____

Codes: (S) Sequence is important. This step must be performed only after the preceding step(s).

(C) Critical step. Failure to meet standards for this item constitutes failure of the JPM.

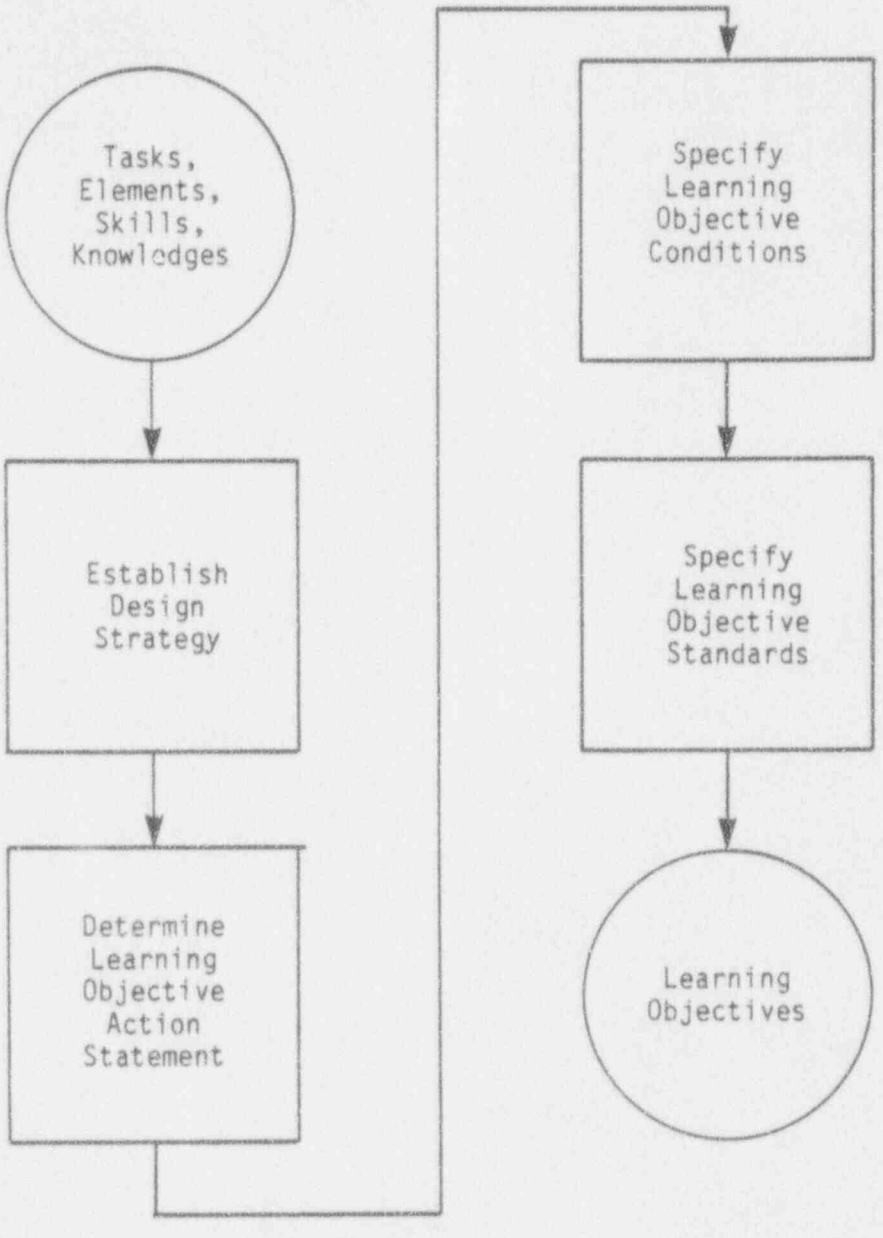
Comments:

DETERMINE TRAINING SETTINGS



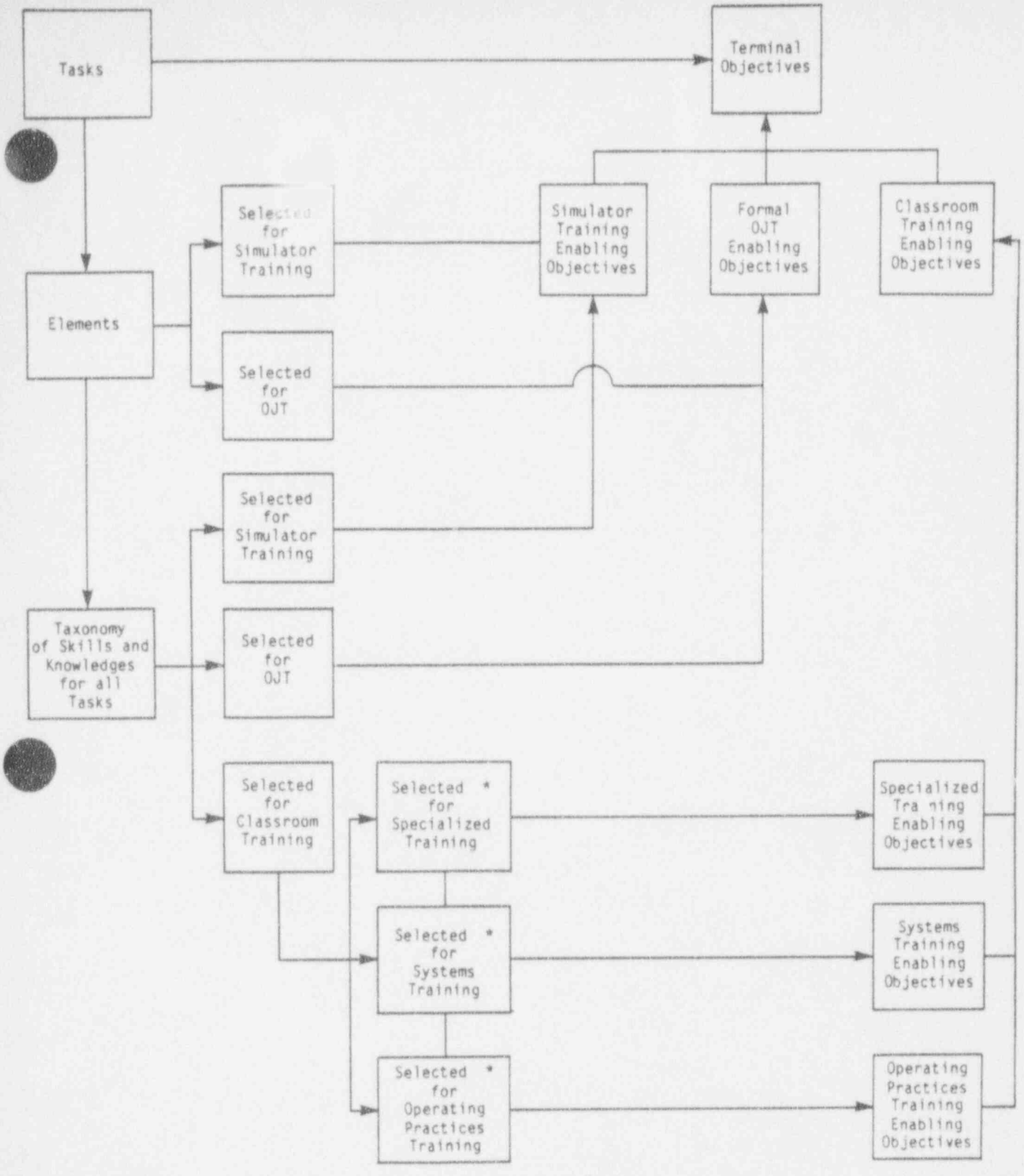
Determine Training Settings

PREPARE LEARNING OBJECTIVES



Prepare Learning Objectives

SAMPLE CONTROL ROOM OPERATOR DESIGN STRATEGY



See the INPO guideline 83-022, PWR Control Room Operator, Senior Control Room Operator, and Shift Supervisor Qualification

Sample Control Room Operator Design Strategy

SAMPLE LIST OF ACTION VERBS

SKILL	KNOWLEDGE
Check	Define
Close	Identify
Fill	Label
Locate	List
Open	Name
Start	Recall
Stop	Recite
Turn	Relate
Trip	State
Vent	Tell
Adjust	Calculate
Calibrate	Classify
Communicate	Compare
Inspect	Detect
Operate	Derive
Remove	Discriminate
Repair	Explain
Replace	Evaluate
Set	Interpret
Throttle	Plan
	Prove
	Rate
	Solve
	Summarize
	Verify

Sample List of Action Verbs

LEARNING OBJECTIVES CONDITIONS

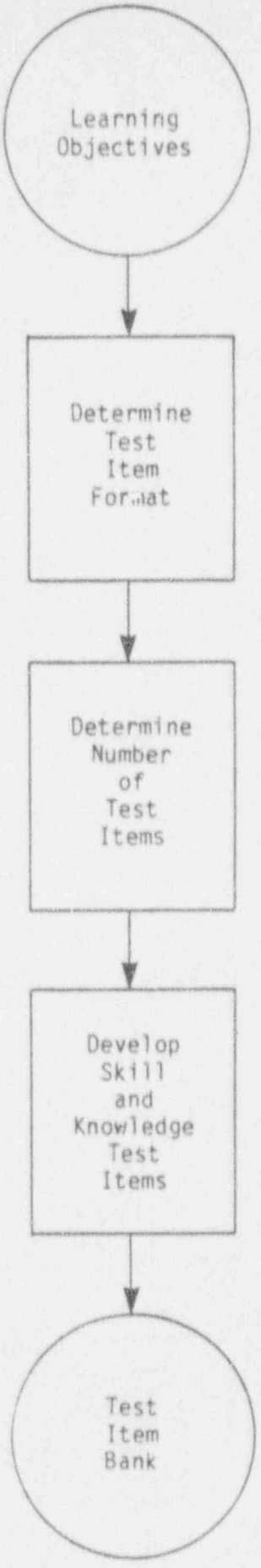
TYPE OF CONDITION	EXAMPLE
OJT Setting Plant operating mode; equipment and equipment status	Given the reactor plant at full power, the secondary equipment closed cycle cooling water system running with one heat exchanger in service and one heat exchanger in standby, and the secondary equipment closed cycle cooling water pump aligned with one pump running and one pump in standby, operate the secondary equipment closed cycle cooling system within system temperature limits.
Laboratory Setting Equipment; materials	Given a feedwater sample, laboratory equipment, and reagents, analyze a feedwater sample for pH in accordance with prescribed plant procedures.
Classroom Setting References	Given a manual on fire prevention, state the most effective extinguishing agent for a Class "C" fire.
Simulator Setting Problem situations or contingencies	Given a malfunction in the main feedwater pump, select the correct plant procedure for troubleshooting the malfunction in the main feedwater pump.
Workshop Setting Equipment; tools; references	Given the disassembled parts of a three-phase electric motor, proper tools, and a technical manual, assemble parts of the three-phase electric motor in correct sequence.
Classroom Setting Safety considerations	Given a complete set of protective clothing, don the clothing in the correct sequence.

Learning Objective Conditions

LEARNING OBJECTIVES STANDARDS

CRITERIA FOR GOOD STANDARDS	WHAT IS SPECIFIED	EXAMPLE
Completeness	o precise nature of the output; number of features output must contain; minimum acceptable level of performance	Using a calculator, multiply two three-digit numbers and write the answer to the nearest tenth.
	o number of steps or sequence of steps that must be covered; reference to a plant operating procedure	Given a feedwater sample, laboratory equipment, and reagents, analyze a feedwater sample for pH. The steps will be performed in correct sequence and comply with plant procedures.
Accuracy	o implying the standard of NO ERROR; how exact the performance must be; correct numbers reflecting tolerances	Given the reactor plant at power, the feedwater regulating system in manual mode, a wide range steam generator level reading, and a steam generator system description, calculate the steam generator narrow range level to ± 5% of wide range level.
	o value of dimensions that acceptable answer/performance can assume (these may be qualitative)	Given a misadjusted carburetor and the necessary tools, adjust the carburetor so the engine idles at its smoothest point.
Speed	o how many days, hours, minutes, or seconds are allowed for performance	Given a 200-word rough draft, type a letter without error at a minimum speed of 40 words per minute. Given a disassembled globe valve, rags, gasket material, tools, and a technical manual, reassemble the globe valve in 30 minutes.

DEVELOP TEST ITEMS



Develop Test Items

TEST ITEM FORMATS

Test Item Format	Characteristics	Guidelines for Use
Performance	o a direct translation of a skill learning objective into a test item the trainee is required to perform; an overt (hands-on) action or series of actions	o Performance (action) of the learning objective must be matched in the test item. o Conditions and standards of the learning objective must be matched in the test item. o Item directions to the trainee should be clear and concise. o Actions should be observable, and measurable process items (i.e., step-by-step procedures) should be listed in the order in which they are performed. o Standards for results to be achieved (i.e., accuracy or completeness) should include an indication of competence (e.g., ± 5% of program level, within two degrees).
Completion/Short answer	o an item that requires the trainee to complete the sentence or write the answer to a question in a few words o series of well-constructed completion/short answer items can measure knowledge with more consistency and objectivity than essay test items	o The item must be stated simply without extensive qualification so that the test is not unintentionally a reading test. o The answer called for must be clear to the informed trainee. o For completion items, the main idea should precede the blank. o The item should be constructed so that only one correct, brief answer is possible.

Test Item Format	Characteristics	Guidelines for Use
Alternate choice (true-false)	o a two-choice item in which only one of the responses is absolutely correct	o The item must be true or false, without qualification. o The item should not be long or overly complex with many qualifying phrases. o The item should not be lifted directly from printed sources due to the potential for lack of clarity or accuracy when taken out of context.
Multiple choice	o an item with three or more responses, one of which clearly provides the "best answer"	o The item can contain either a direct question or incomplete statement (to be filled in with the correct response). o Words should be included in the item that otherwise would be repeated in each response. o The correct answer should be clearly the best of the responses. o Responses should be plausible for the test item. o Responses should be within trainee's comprehension. o Responses should not overlap or include other responses. o Responses should be arranged in some logical order. o "None of the above" and "all of the above" should be avoided as responses. o Position of the correct answer should be varied. o The item and responses should not measure trainee opinion.

Test Item Format	Characteristics	Guidelines for Use
Matching	o a list of conditions, responses, and directions for matching the conditions to the responses	o Conditions and responses should be relatively homogeneous so that they have a plausible relationship to each other. o The number of responses should be less than or more than the number of conditions to avoid the simplicity of a one-to-one relationship. o Directions to the trainee should explain the basis for matching clearly.
Drawing/Labeling	o an item that requires the trainee to sketch the flowpath of a given system/circuit, or label a drawing provided	o The item should be clear and contain specific instructions. o The system/circuit to be sketched should have only one correct flowpath. o The drawing (test item) should identify the items to be labeled clearly. o There should be only one correct term for each item to be labeled in the drawing.

SKILL AND KNOWLEDGE TEST ITEMS

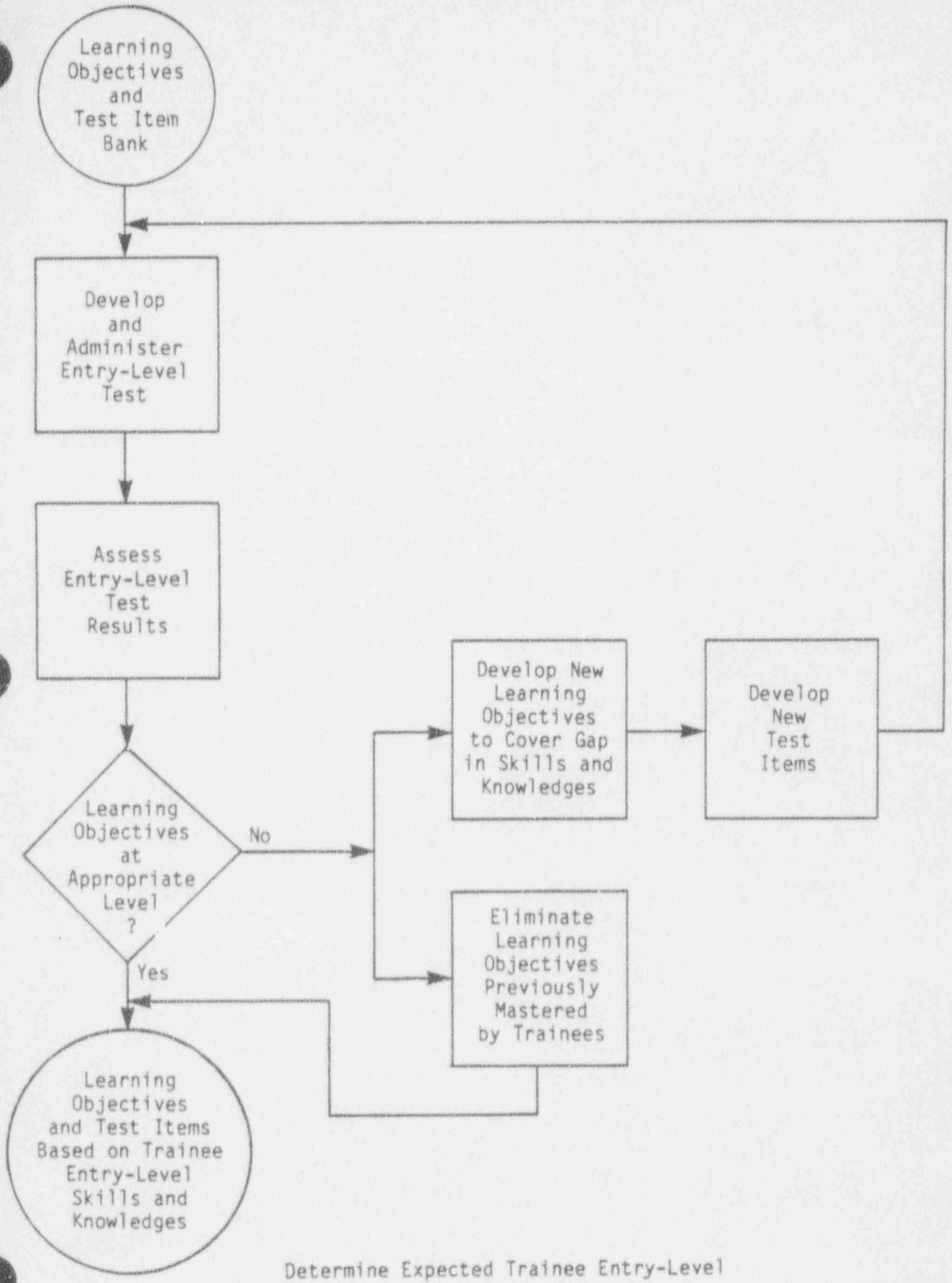
Learning Objective	Category of Learning	Test Format	Test Item
Simulator Setting Given the reactor at power, feedwater and condensate systems operating, feedwater regulating valve in manual mode, and a copy of the main feedwater system operating procedure, adjust the feedwater regulating valve controller to maintain steam generator level within normal operating range.	Skill	Performance	Adjust the feedwater regulating valve controller as required to maintain steam generator level within the normal operating range prescribed in the main feedwater system operating procedure. The trainee must be able to perform this task according to the job performance measure.
OJT Setting Given a portable radio, communicate with the control room, using proper communications procedures in a nonemergency situation.	Skill	Performance	Using the portable radio, communicate with the control room operator advising that the containment sump pump is ready for start-up. Nonemergency communications procedures will be followed.
Classroom Setting Given a case study involving an employee performance appraisal, conduct a performance evaluation according to the company policy manual.	Skill	Performance	Using the case study "Troublesome Tom" and a trainee to play Tom's role, conduct a performance appraisal according to the company policy manual. Your performance will be rated by the class and the instructor using the performance appraisal checklist.

Learning Objective	Category of Learning	Test Format	Test Item
Classroom Setting List the five functions of the reactor vessel and internals.	Knowledge	Completion/Short answer	Three of the reactor vessel functions are: 1. _____ 2. _____ 3. _____
		Completion/Short answer	One function of the reactor vessel internals is to support the (_____ _____).
Laboratory/Workshop Setting Given a circuit diagram, decade box setting, galvanometer reading on a Wheatstone resistance bridge, calculate the internal DC resistance of the electrical circuit.	Knowledge	Completion/Short answer	In the circuit diagram, the resistance bridge is a Wheatstone-type. Calculate the circuit's internal DC resistance if the decade box is set on 300 ohms, the galvanometer reads zero, and Rx = 350 ohms.
Classroom Setting Given a plant drawing and pictures of various engineering symbols, select the symbol for various types of valves and actuators.	Knowledge	Matching	Using the portion of a plant drawing that contains numerous symbols, select the correct symbol for o check valve o gate valve o globe valve
		Multiple Choice	The engineering symbol  refers to a device used to open and close a valve a. by a pneumatic operator b. by an electric operator c. by a hydraulic operator d. manually

Learning Objective	Category of Learning	Test Format	Test Item
Simulator Setting Given indication of abnormal control rod drive flow conditions, relate abnormal control rod drive flow conditions to causes of the abnormal conditions.	Knowledge	Matching	Match abnormal control rod drive flow conditions with the cause (response): Conditions — Responses A. High flow — air problem B. Low flow — directional solenoid problem C. Zero flow
Classroom Setting Given a schematic of a two-pass condenser, label the eight major components of a two-pass condenser.	Knowledge	Drawing/labeling	Label each of the eight components (indicated by an arrow) of the two-pass condenser illustrated in the schematic.

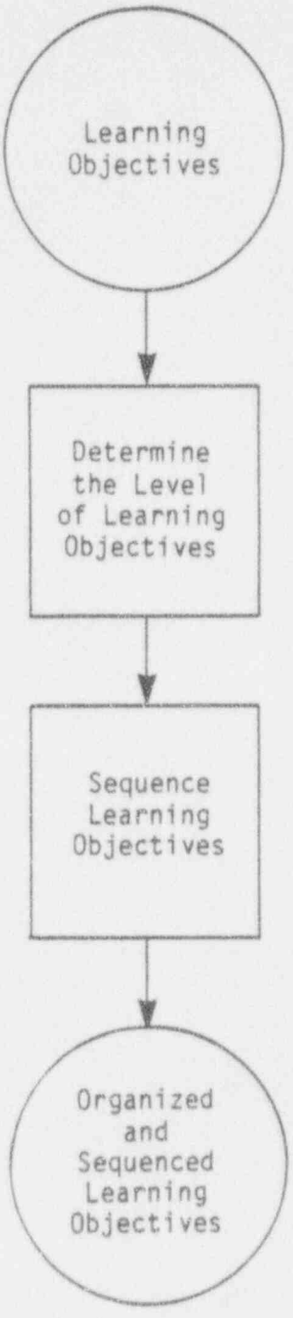
Skill and Knowledge Test Items (cont)

DETERMINE EXPECTED ENTRY-LEVEL SKILLS AND KNOWLEDGES



Determine Expected Trainee Entry-Level Skills and Knowledges

ORGANIZE LEARNING OBJECTIVES



Organize Learning Objectives

RELATIONSHIPS AMONG LEARNING OBJECTIVES

	DEPENDENT	SUPPORTIVE	COMMON FACTOR	INDEPENDENT
Definition:	Skills and knowledges in one learning objective are related closely to those in another learning objective.	Skills and knowledges in one learning objective have some relationship to those in other learning objectives.	Learning objectives have the same action verb and similar objects or contain basic information or skills.	Skills and knowledges in one learning objective are not related to those in other learning objectives.
Clarification:	To master one of the learning objectives, it is first necessary to master the other.	The learning involved in mastery of one learning objective transfers to the other, making learning involved in the mastery of the other easier.	Includes nomenclature and use of basic equipment and tools and educational subjects such as mathematics and science.	Mastering one of the learning objectives does not simplify mastering the other.
Examples:	1. To learn multiplication, addition must be learned first.	1. "To assemble a rotary pump" is supportive of "to disassemble a rotary pump."	1. In the learning objectives "desolder capacitor" and "desolder transformer," desolding techniques could be trained for early, with the unique aspects addressed during training on electrical circuit maintenance.	1. "To describe the operation of an AC generator" is independent of "to solve for inductance in a circuit schematic."
	2. To troubleshoot a pump, the normal operation of the pump must be learned first.	2. "To troubleshoot a centifugal pump" is supportive of "to troubleshoot a rotary pump."	2. In the learning objectives "identify capacitor" and "identify transformer," an identification of electrical components (capacitors and transformers) could be sequenced before training in capacitor and transformer maintenance is conducted.	2. "To adjust the fuel jets in a diesel engine" is independent of "to replace the fuel pump."
Relationship Sequencing:	The learning objectives should be arranged in the sequence indicated by the above hierarchy. The learning objectives should be placed closely together in the sequence to permit effective transfer of learning from one learning objective to another.	The learning objectives should be grouped together and sequenced early in training to improve learning effectiveness.	In general, the learning objectives can be arranged in any sequence without loss of learning effectiveness.	

Relationships Among Learning Objectives

CONSTRUCT TESTS

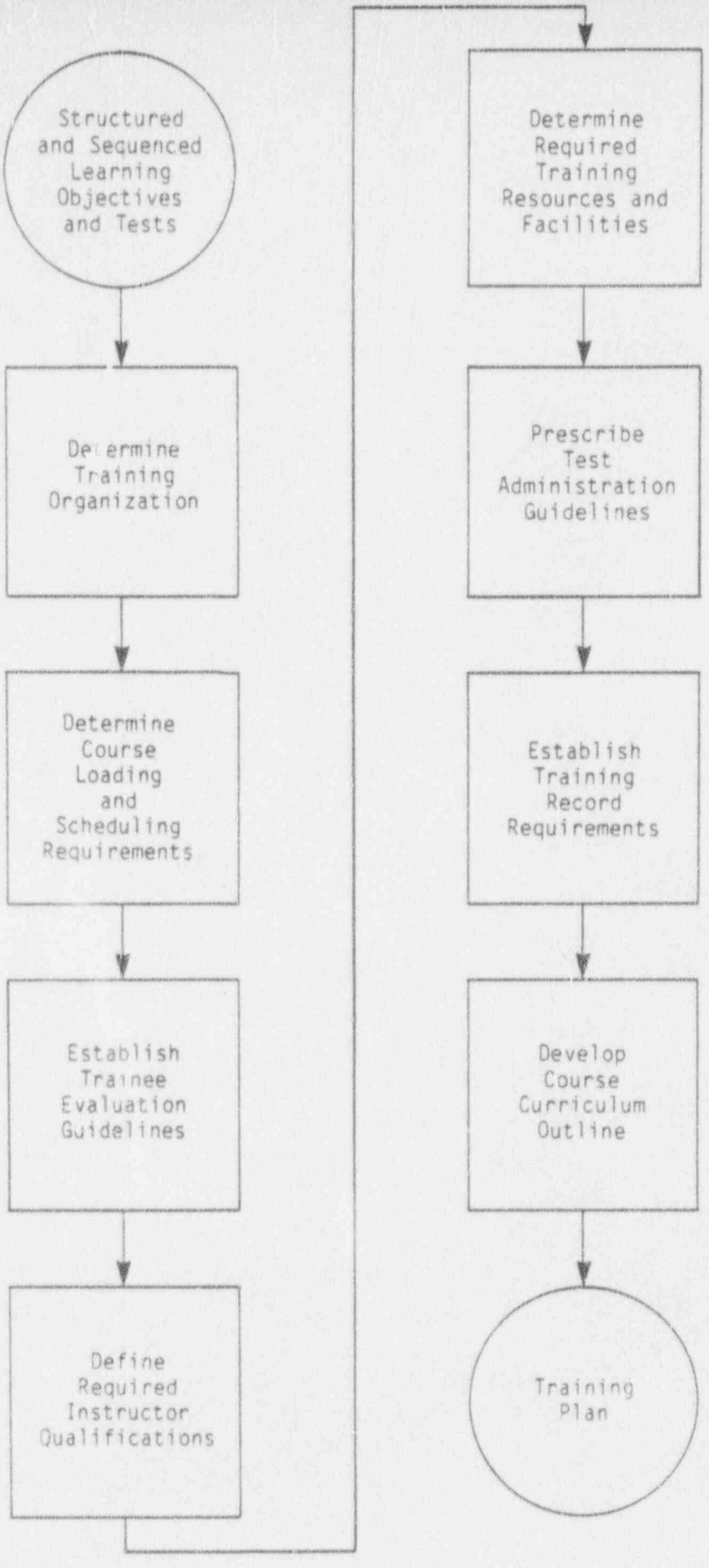
Construct Tests

TABLE OF SPECIFICATIONS FOR A 50-ITEM
GENERAL EMPLOYEE TRAINING PRE/POST TEST

Content Area \ Level of Learning Objectives	Knowledge of Facts, Terms, Symbols	Comprehension of Principles, Concepts	Application of Information, Principles, Concepts	Total Number of Questions
1. Fundamentals	1	1	0	2
2. Biological Effects	0	2	0	2
3. Administration	2	2	1	5
4. Exposure Control	2	5	4	11
5. Contamination Control	2	5	3	10
6. Monitoring	1	3	1	5
7. Access Control	3	3	1	7
8. Unusual Incidents/ Emergencies	1	2	3	6
9. Protective Clothing and Respiratory Equipment	1	1	0	2
TOTAL NUMBER OF QUESTIONS	13	24	13	50

Table of Specifications for a 50-Item General Employee Training Pre/Post-Test

DEVELOP TRAINING PLAN



Develop Training Plan

TRAINING PLAN PROCEDURES

TRAINING PLAN PROCEDURES

The following information outlines the major procedures of the training plan. These procedures include the following:

- o determine the training organization
- o determine course loading and scheduling requirements
- o establish trainee evaluation guidelines
- o specify required instructor qualifications
- o determine required training resources and facilities
- o prescribe test administration guidelines
- o establish training record requirements
- o develop the course curriculum outline

1. Determine the Training Organization

   The organization for administering the training program will vary in size and structure, depending upon the individual utility. The authority of the training organization and its relationship to the remainder of the plant and corporate structure should be established clearly. It should include an adequate number of qualified personnel for effective training management, supervision, development, and delivery.

   Responsibilities of the training organization should be based on job requirements and developed systematically. Goals and objectives should be established to coordinate and guide training functions. These functions should address course scheduling, administration of trainees, supervision and evaluation of instructors, evaluation and revision of training materials, purchase of course consumables, maintenance of training documentation, and preparation of reports on training program progress and effectiveness.

2. Determine Course Loading and Scheduling Requirements

   The training plan should address trainee loading and scheduling requirements of the course. These are determined by using training requirements

identified during needs analysis and the projected availability of new and existing plant employees who will require training. Course loading and scheduling also are affected by the availability of qualified instructors, capacity of facilities, and availability of equipment.

3. Establish Trainee Evaluation Guidelines

The training plan should include trainee evaluation criteria. The 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:

- Evaluate pretest results along with previous training or experience. Remedial training or exemption from all or parts of the training based on pretest results could be considered in this evaluation process.

- Evaluate trainee performance regularly throughout the course, using progress tests. Guidelines should provide for disposition of trainees whose course performance is unsatisfactory. They also should include provisions for counseling and remedial instruction, recycling to earlier segments of training, or removal from the course when appropriate.

- Evaluate trainee comprehension and retention of course material, using a course post-test.

4. Specify Required Instructor Qualifications

Determination of instructor qualifications is important to any training program and is an integral part of the training plan. Instructors' qualifications should be determined systematically and based on job requirements. INPO guideline Technical Instructor Training and Qualification (INPO 82-026) provides guidance for determining instructor qualifications.

5. Determine Required Training Resources and Facilities

To ensure that facilities and resources are available to support training activities, the training plan should address physical facilities, equipment, and reference materials. Physical facilities and equipment would include the following:

- o classroom facilities
- o laboratories and workshop facilities appropriately equipped to provide hands-on training
- o a real-time, full-scope control room simulator for providing hands-on training in recognition and control of normal, abnormal, and emergency plant conditions (when a plant-referenced simulator is not available, the utility should determine the most appropriate simulator available for training)
- o office space and furnishings adequate to accommodate needs of training personnel
- o audiovisual aids and equipment
- o tools and equipment for use in training similar to those used on the job by the trainees

Technical reference material should cover topics at a level appropriate for the program, instructor, and trainee; should be applicable to plant systems and equipment; and should be current with plant modifications. Examples include the following:

- o plant-specific documents (procedures, drawings, technical manuals, etc.)
- o materials describing significant industry events
- o training-related regulatory guides, industry standards, bulletins, and guidelines
- o nuclear power plant technology texts
- o academic texts
- o trade, technical, and engineering journals

- o technical regulations, guides, codes, and standards
- o power plant equipment technology texts and training materials
- o engineering handbooks
- o reference materials on instructional technology, industrial training, and related topics

6. Prescribe Test Administration Guidelines

The training plan also provides guidelines for test administration and includes the following:

- o security, including accountability of test items to avoid compromise during reproduction, storage, use, and evaluation
- o prior notification to trainees of materials needed for the test and the procedure to be followed during the test
- o 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
- o development and use of answer keys
- o evaluation of test results, using training standards established during test item development
- o disposition of test results, including counseling of trainees

7. Establish Training Record Requirements

Training record requirements should be established in the training plan and should include retention periods and entry and retrieval procedures to provide the following:

- o records relating to training programs that permit review of content, schedule, and results of past and current programs
- o individual trainee records that include a history of trainee performance and permit verification of required qualifications

8. Develop Course Curriculum Outline

The course curriculum outline is the final element of the training management plan and serves as a guide for development of course material. It outlines by training setting the learning objectives in the prescribed sequence. Program, course, unit, and lessons objectives should be organized and scheduled. Progress tests also should be scheduled at appropriate intervals.

REFERENCES

REFERENCES

The following references are for activities in the Design Section. They are provided as sources of additional study for the interested reader. The list is not intended to be all-inclusive or an endorsement of an author's view. Additional references or information may be obtained by contacting the Training and Education Division, Institute of Nuclear Power Operations.

Section 3.1: Develop Job Performance Measures

Department of the Army. Interservice Procedures for Instructional System Development (Phase I Analysis, TRADOC Pamphlet 350-30). Washington, D.C.: Department of the Army, 1975. Block I.3.

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Section 3.2: Determine Training Setting

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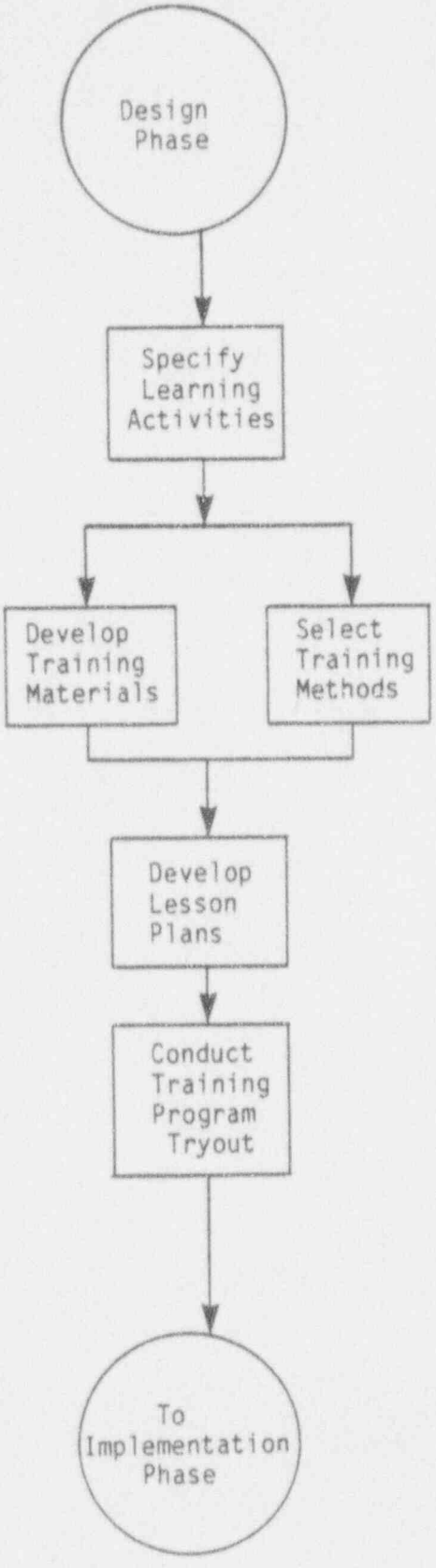
TRAINING SYSTEM DEVELOPMENT



INPUTS

- o Job Performance Measures
- o Training Setting Decision
- o Learning Objectives
- o Test Items
- o Grouped Learning Objectives
- o Tests
- o Training Plan

Identify what instructional events will occur during training and how they will contribute to achieving the learning objectives.

Select Existing Usable Training Materials and Produce Original Ones As Required

Match training strategies to appropriate settings and learning objectives.

Produce instructor lesson plans for all training.

Perform a technical review of training and test its effectiveness using a typical instructor and group of employees for whom it is intended.

OUTPUTS

- o Training Materials
- o Lesson Plans
- o Tryout Results/ Revisions

Training System Development: Inputs, Processes, and Outputs

SPECIFY LEARNING ACTIVITIES

TRAINING EVENT DEVELOPMENT GUIDELINES FOR THE SKILL CATEGORY OF LEARNING

Training Event	Skill Development Guideline
1. Gaining and maintaining attention and motivating the trainee	o appeal to interests the trainee is known to have o relate the instruction to near- and long-term goals of the trainee and the training program o change the media and schedule break periods during lengthy segments of training o allow sufficient flexibility to permit the instructor to exercise change during unanticipated instructional developments
2. Informing the trainee of the learning objectives	o address the learning objectives in clear and concise language o illustrate the learning objectives in a variety of ways both for emphasis and to clarify any misunderstanding o explain the objectives and how they relate to mastery of the task o relate the value of the learning objectives to job performance
3. Eliciting recall of prerequisite knowledge	o stimulate the recall of previously learned component knowledge
4. Presenting the training material	o use appropriate media to provide a visual demonstration of the physical skill o provide proper timing and sequence within and between skill events, and break the events down into manageable steps o ensure cues needed for performance are realistic and available, and emphasize the action and reaction that must be performed by the trainee o emphasize actions and reactions required of trainee within varying job conditions

*Adapted from Briggs, L. J. and W. W. Wager. Handbook of Procedures for the Design of Instruction. Englewood Cliffs, N.J.: Educational Technology Publications, 1981.

Training Event Development Guidelines
for the Skill Category of Learning*

Training Event	Skill Development Guideline
5. Providing learning guidance	o identify each skill step, its performance, and its relationship to the overall skill event
6. Eliciting mastery of the learning objectives	o ask the trainee to perform the skill event in part or whole o monitor trainee progress
7. Providing performance feedback	o provide knowledge of results and reward promptly and frequently during early training and occasionally during later training stages
8. Evaluating trainee performance	o ask the trainee to perform the whole skill event in accordance with the standards of performance
9. Enhancing retention and transfer of training material	o provide periodic practice for infrequently used skills

*Ibid.

Training Event Development Guidelines for the Skill Category of Learning* (cont)

TRAINING EVENT DEVELOPMENT GUIDELINES
FOR THE KNOWLEDGE CATEGORY OF LEARNING

Training Event	Knowledge Development Guideline
1. Gaining and maintaining attention and motivating the trainee	o appeal to interests the trainee is known to have o relate the instruction to near- and long-term goals of the trainee and the training program o change the media and schedule break periods during lengthy segments of training o allow sufficient flexibility to permit the instructor to exercise change during unanticipated instructional developments
2. Informing the trainee of the learning objectives	o address the learning objectives in clear and concise language o relate the value of the learning objectives to job performance o explain the objectives and how they relate to mastery of the task o illustrate the learning objectives in a variety of ways both for emphasis and to clarify any misunderstanding
3. Eliciting recall of prerequisite knowledge	o stimulate recall of information related to the new information, concept, or rule
4. Presenting the training material	o use appropriate media to provide a visual demonstration of the information, concept, or rule o present statements of new information in a meaningful context and logical sequence o present the concept or rule, when it applies, and when it does not o provide examples and periodic reviews or summaries o emphasize actions and reactions required of trainee within varying job conditions

*Ibid.

Training Event Development Guidelines
for the Knowledge Category of Learning*

Training Event	Knowledge Development Guideline
5. Providing learning guidance	o provide features of the job environment that will aid in retention of the information, concept, or rule o provide opportunity for the trainee to apply the concept or rule in a variety of new situations
6. Eliciting mastery of the learning objectives	o ask the trainee to state or write the information, concept, or rule o ask the trainee to apply the rule or concept in an unfamiliar situation o monitor trainee progress
7. Providing performance feedback	o identify to the trainee what is wrong or omitted from the statement of information, concept, or rule o identify to the trainee what is wrong with the application of the rule or concept to the unfamiliar situation o provide immediate and positive knowledge of results and reward early in training; provide knowledge of results and reward toward the end of training that are comparable to the job environment
8. Evaluating trainee performance	o ask the trainee to restate the information, rule, or concept o ask the trainee to originate a situation and apply the rule or concept
9. Enhancing retention and transfer of training material	o provide time for repetition and rehearsal of the information, rule, or concept o provide the opportunity for application of the rule or concept to a variety of job situations

*Ibid.

Training Event Development Guidelines for
the Knowledge Category of Learning* (cont)

EXAMPLE LEARNING OBJECTIVE WITH
TRAINING EVENT AND LEARNING
ACTIVITY FOR CLASSROOM SETTING

Learning Objective: Given a picture of the steam generator indication section of the main control board, identify the location of system indication for main feedwater flow and steam generator level without error.

Training Event	Learning Activity
GAIN ATTENTION	Display two meters that appear to be identical and ask trainees, "What's the difference?"
STATE OBJECTIVE	Introduce learning objective and relate it to task of operating feedwater regulating system in manual and automatic modes.
RECALL PREREQUISITE	Review the location of the steam generator indication section in the control room.
PRESENT MATERIAL	Explain exact location of feedwater flow and steam generator level indication.
PROVIDE GUIDANCE	Describe color coding stripe around general groups of indication dealing with a particular steam generator loop.
ELICIT PERFORMANCE	Question trainees on location of indications using a transparency of steam generator indication position without indications labelled.
PROVIDE FEEDBACK	Show transparency with feedwater flow and level indications labelled.
EVALUATE PERFORMANCE	Administer written quiz with a diagram of the steam generator indication section.
ENHANCE RETENTION	Review steam generator flow and level indication when calculating narrow and wide range level.

Example Learning Objective with
Training Event and Learning Activity
for Classroom Setting

EXAMPLE LEARNING OBJECTIVE WITH
TRAINING EVENT AND LEARNING ACTIVITY
FOR SIMULATOR SETTING

Enabling Objective: Given a main feedwater system operating procedure, reactor at power, feedwater system, condensate system, and instrument air system operating, power available to the feedwater regulating valves, and feedwater regulating valve in manual mode adjust the steam generator level within ± 5% of programmed level. (Task: 0590050101)

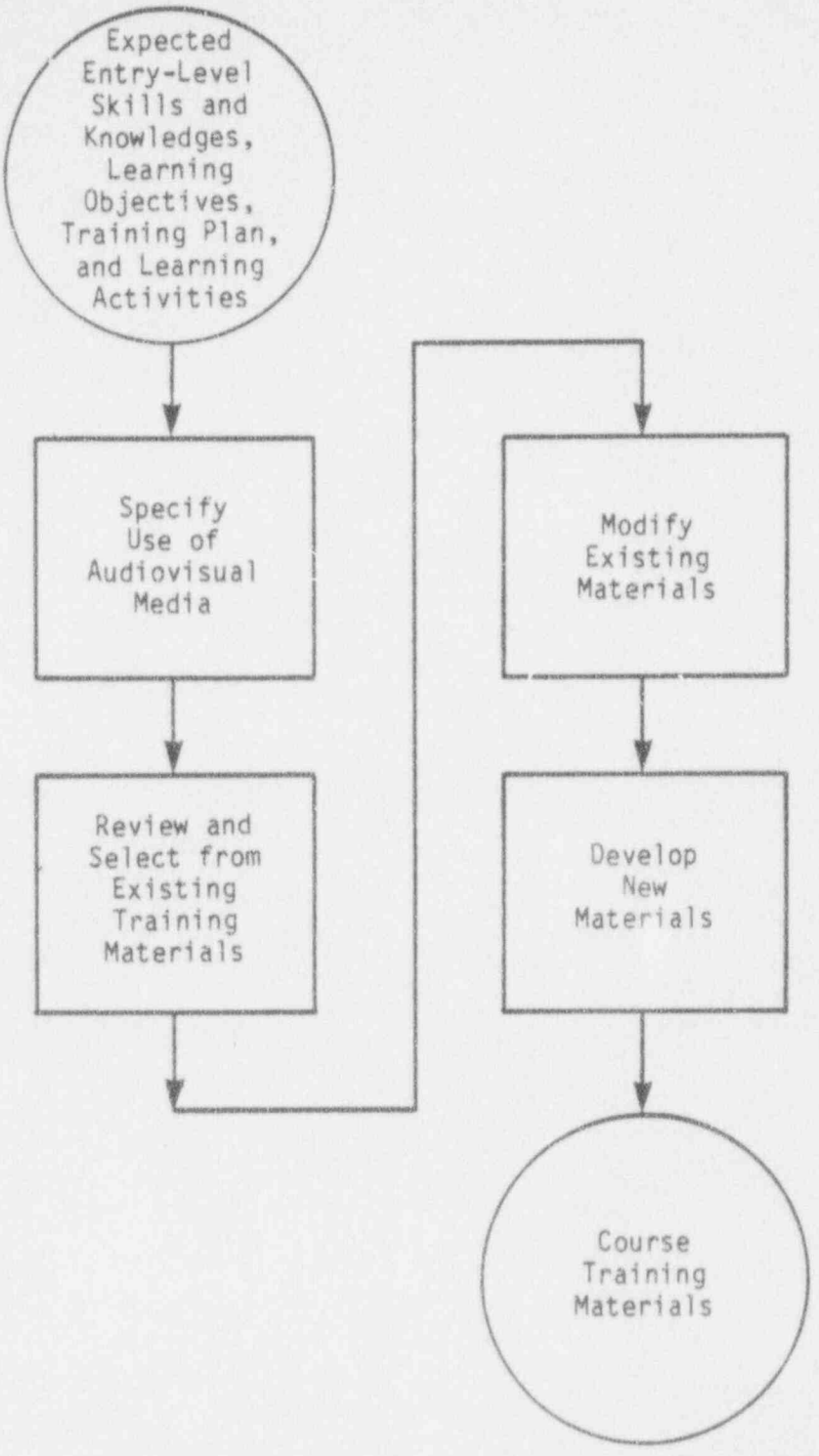
Training Event	Learning Activity
GAIN ATTENTION	State that many LERs concerning reactor trips are due to the operator's inability to maintain steam generator level in manual feedwater control during transient conditions.
STATE OBJECTIVE	Introduce learning objective.
RECALL PREREQUISITE	Review the location of controls and indications for feedwater and steam generator. Review location of main feedwater system operating procedure in the control room. Review the operation of the feedwater control system.
PRESENT MATERIAL	Use the simulator and main feedwater system operating procedure to demonstrate proper steam generator level control in manual under the following conditions: reactor at power, feedwater system, condensate system, and instrument air system operating. Power is available to feedwater regulating valves.
PROVIDE GUIDANCE	Explain possible level control problems (e.g., shrink, swell, indications) which cause trips to occur.
ELICIT PERFORMANCE	Trainees control steam generator level in manual within the programmed band during varying steam flow conditions.

Example Learning Objective with
Training Event and Learning Activity
for Simulator Setting

Training Event	Learning Activity
PROVIDE FEEDBACK	Review trainee's actions. Ask trainee to identify any problems and discuss potential solutions.
EVALUATE PERFORMANCE	Setup the simulator for turbine start-up. Let each trainee control the steam generator level in manual within ± 5% of programmed level until the generator is on the line. Retest as necessary.
HANCE RETENTION	Discuss feedwater control system failures and review maintaining steam generator level in manual control. (Task: 0590190401)

Example Learning Objective with
Training Event and Learning Activity
for Simulator Setting (cont)

DEVELOP TRAINING MATERIALS



Develop Training Materials

MEDIA ALTERNATIVES BY SETTING AND
LEARNING ACTIVITY CHARACTERISTICS

Media Alternatives by Setting and Learning Activity Characteristics

EXTERNAL SOURCES OF EXISTING TRAINING MATERIAL

EXTERNAL SOURCES OF EXISTING TRAINING MATERIAL

1. Industry-Related Agencies
   - -- Electric Power Research Institute (Resource Handbook for Power Plant Training Programs is a composite listing of training material available)
   - -- American Nuclear Society
   - -- Oak Ridge Associated University
   - -- Department of Energy Laboratories (Oak Ridge National Laboratory, EG&G Idaho, Sandia, Brookhaven, and Battelle)

2. Vocational and Technical Education Agencies
   - -- National Center for Research and Vocational Education, Ohio State University (Vocational Education Curricula Material is a composite listing of training material available)
   - -- National Projects Branch, Office of Vocational and Adult Education, Department of Education (Curricula Materials for Vocational Education is a composite listing of training material available)

3. Nuclear Power Training Vendors

4. Military Departments
   - -- Catalog of Navy Training Courses (NAVEDTRA 10500), prepared by the Department of the Navy (See Note.)
   - -- Formal Schools Catalog (DA Pamphlet 351-4), prepared by the Department of the Army (See Note.)
   - -- USAF Formal Schools Catalog (AF Manual 50-5), prepared by the Department of the Air Force (See Note.)

5. NSSS Vendors

   -- Westinghouse Electric Corporation
   -- General Electric Company
   -- Combustion Engineering, Inc.
   -- Babcock & Wilcox Co.

6. Vocational and Technical Schools and Universities in the Geographical Area of the Plant

NOTE: These publications, as well as related course materials, generally are free of copyright restrictions and may be ordered through the following sources:

National Technical Information Service
Department of Commerce
Springfield, VA 22151
-or-
Government Printing Office
Washington, DC 20402

REVIEW OF EXISTING TRAINING MATERIAL

Criteria Category	Criteria Clarification	Criteria Application
1. Appropriateness to expected trainee entry-level skills and knowledge	o Are the materials prepared at a level of skills and knowledges appropriate to the trainees?	o Determine if material content can be related to expected entry-level skills and knowledges, including appropriate reading level of the trainees.
	o Are the materials clearly written and presented so the trainee can complete the required learning activities?	o Determine if selected trainees can use the materials and complete the learning activities.
2. Coverage of learning objectives	o Do the materials reflect the learning objectives of the desired program?	o Assess the material, comparing the learning objectives to those of the desired program, and determine which learning objectives are not covered adequately.
	o Will the use of the materials be consistent with other materials in the training program or the mastery of the learning objectives?	o Analyze sets of materials to determine if they are supportive and provide an effective progression of learning.
3. Consistency with learning activities	Do the materials conform to the learning activities of the desired program?	Analyze the material, comparing the learning activities to that of the desired program. Identify any deficiencies.
4. Compatibility with the training plan	Are the materials practical for use in the given plant situation, as specified in the training plan?	Determine if the materials can be used in plant facilities with available equipment, time, space, and with the number of trainees planned.

SELECT TRAINING METHODS

Method	Characteristics
Lecture	o a public speaking type presentation o effective and efficient with large groups of trainees o typically used in classroom setting o body of information should be well-organized, condensed, and presented in logical steps o presentation should provide periodic pauses for answering direct questions from the trainees o conclusion should provide a summary of key points
Demonstration/ Practice	o a presentation in which the exact procedures (skills) are shown in step-by-step sequence by the instructor o more effective with small groups of trainees o limited to laboratory/workshop, formal OJT, and simulator training when use of equipment is involved o the performance of each step and its relationship to the overall procedure is emphasized by the instructor o the trainee performs the step-by-step procedure under instructor supervision until proficiency is achieved
Discussion	o guided conversation between trainees with direction from the instructor or group leader o more effective with small groups of trainees o typically used in classroom setting o a discussion leader should be appointed for each group

Method	Characteristics
Discussion (continued)	o provides opportunity for trainees to observe, listen, and participate actively in the learning activity
Oral Questioning	o instructor asks specific questions of different trainees (not always those who volunteer the answer) to increase interaction and control the pace of the training o permits direct interaction between the instructor and trainees o appropriate to all settings o samples trainee comprehension of the material
Role Playing	o trainees assume roles (responsibilities) in a real or simulated job environment o develops an understanding of roles and the importance they play in the job environment o permits instructor observation of trainee attitudes, philosophies, and personality traits o appropriate to all settings except self-study o effective in learning team member functions and team response coordination o particularly effective during exercises and drills
Walk-Through	o trainees experience actual job environment o used to facilitate trainees' transition from learning in a simulated environment to application in the job environment o limited to a discussion of action steps within the actual job environment

Method	Characteristics
Walk-Through (continued)	o emphasizes physical plant layouts, spatial relationships, equipment location, and observation of trained employees performing their jobs o places the course learning objectives in a job context that increases trainee motivation and allows active participation o permits a sampling of trainee comprehension of the learning activity
Self-Pacing	o the pace of training is controlled by the trainee (i.e., a lesson stops when a trainee fails to respond and remains stopped until the trainee responds) o used in conjunction with self-study o frequently used during remedial training

DEVELOP LESSON PLANS

CLASSROOM LESSON PLANS

Classroom Lesson Plans

In the classroom, group training is led by an instructor. Lectures should be alternated with active instructor/trainee discussion, study sessions, and trainee practice of the material being learned. Trainees should be given assignments that reinforce the acquired knowledge or permit practice of the required skill.

Lesson plans for classroom training should include the following information:

- o training description
  - -- title, purpose, and scope of the training
  - -- terminal objective(s)
  - -- duration of training
  - -- references for additional instructor research

- o expected trainee entry-level skills and knowledges

- o classroom presentation outline that provides an introduction, body, and summary that addresses the following:
  - -- enabling objectives, learning activities, and training method(s)
  - -- text material and reference assignments
  - -- audiovisual media scheduling and use
  - -- trainee handouts
  - -- trainee study assignments

- o classroom workbook assignments (when applicable)
  - -- schedule and application
  - -- questions to be answered and/or projects to be completed by the trainees to apply the knowledge or skill acquired during the classroom presentation
  - -- references available to the trainee that aid in answering the questions or completing the project
  - -- safety considerations

- o progress test and post-test administration
  - -- scheduling and use
  - -- training standards for evaluating trainee performance
  - -- instructions for providing feedback to the trainees

LABORATORY WORKSHOP LESSON PLANS

Laboratory/Workshop Lesson Plans

Laboratory and workshop training is appropriate when the conditions of job performance may be simulated. This permits application of course material by the trainees in a hands-on environment. Laboratory or workshop training should be structured to ensure maximum trainee benefit from the practical experience. This should include repetition to build trainee skills and emphasis on industrial safety.

Lesson plans for laboratory and workshop training should include the following information:

- o training description
  - -- title, purpose, and scope of training
  - -- terminal objective(s)
  - -- duration of training
  - -- references for additional instructor research

- o expected trainee entry-level skills and knowledges

- o laboratory/workshop guide
  - -- enabling objectives, learning activities, and training method(s)
  - -- equipment/tool scheduling and use
  - -- text material and reference assignments

- o progress test and post-test administration
  - -- scheduling and use
  - -- training standards for evaluating trainee performance
  - -- instructions for providing feedback to the trainees

FORMAL OJT LESSON PLANS (OJT GUIDES)

Formal OJT Lesson Plans (OJT Guides)

In formal OJT, training in the learning objectives is provided in the actual job environment. Although training at the work station is emphasized, classroom and/or self-study can be used to complement formal OJT. This can include theory and principles of operation of systems and equipment and an introduction to related manuals, procedures, charts, diagrams, and other similar materials.

The lesson plan for a formal OJT program frequently consist of a series of OJT guides. These guides provide direction and structure during training at the work station. They also are used as a qualification guide or check-off when evaluating an employee's proficiency in performing a task or series of tasks during job performance.

Lesson plans for formal OJT should include the following information:

- o training description
  - -- title, purpose, and scope of the training
  - -- terminal objective(s)
  - -- duration of training
  - -- references for additional instructor research

- o expected trainee entry-level skills and knowledge (i.e., prerequisite classroom or self-study training)

- o formal OJT guide
  - -- enabling objectives, learning activities, and training method(s)
  - -- equipment scheduling and use
  - -- safety considerations
  - -- reference assignments

- o progress test and post-test administration
  - -- scheduling and use
  - -- training standards for evaluating trainee performance
  - -- instructions for providing feedback to the trainee

SIMULATOR LESSON PLANS (EXERCISE GUIDES)

Simulator Lesson Plans (Exercise Guides)

Simulator training provides instruction in normal, abnormal, and emergency operating conditions and procedures in a real-time and realistic setting. Simulator training can include classroom instruction and a preview in addition to the exercise conducted on the simulator. In the classroom, training is provided in selected knowledge learning objectives that are dependent or supportive of the learning objectives that will be included in the exercise. A preview can consist of a walk-through of the exercise or operation of the simulator at real-time and freezing the simulator when appropriate to emphasize operating principles and the basis for actions taken. (See the INPO guideline, Simulator Training, INPO 82-005, for further details.)

Lesson plans for simulator training should include the following information:

- o training description
  - -- title, purpose, and scope of the training
  - -- terminal objective(s)
  - -- duration of training
  - -- references for additional instructor research

- o expected trainee entry-level skills and knowledge

- o preview outline
  - -- enabling objectives, learning activities, and training method(s)
  - -- reference assignments

- o exercise guide, enabling objectives, and learning activities
  - -- initial plant conditions
  - -- shift turnover information to be established and provided to the trainees (e.g., malfunctions, overrides, remote operations)
  - -- materials and references
  - -- system or equipment operating symptoms to be recognized (when applicable)
  - -- correct operator response to the exercise
  - -- malfunctions that may be inserted during the exercise
  - -- plant conditions expected at the end of the exercise

- progress test and post-test administration
  - -- training standards for evaluating trainee performance
  - -- instructions for providing feedback to the trainees

SELF-STUDY LESSON PLANS

Self-Study Lesson Plans

Self-study consists of individualized, self-paced or program-paced training. The conditions of the learning objectives are contained in the training materials or made available in the plant when needed by the trainee. In the absence of a full-time instructor, it is necessary that self-study materials be organized and presented clearly. The reading level and level of detail in the materials should be consistent with the expected entry-level qualifications of the trainee. Self-administered and self-check exercises at frequent intervals are needed for feedback on trainee progress. Tests should be administered, scored, and retained by qualified plant personnel with the trainee advised and counseled regarding test results.

Lesson plans for self-study training should include the following information:

- o training description
  - -- title, purpose, and scope of the training
  - -- terminal objective(s)
  - -- duration of training

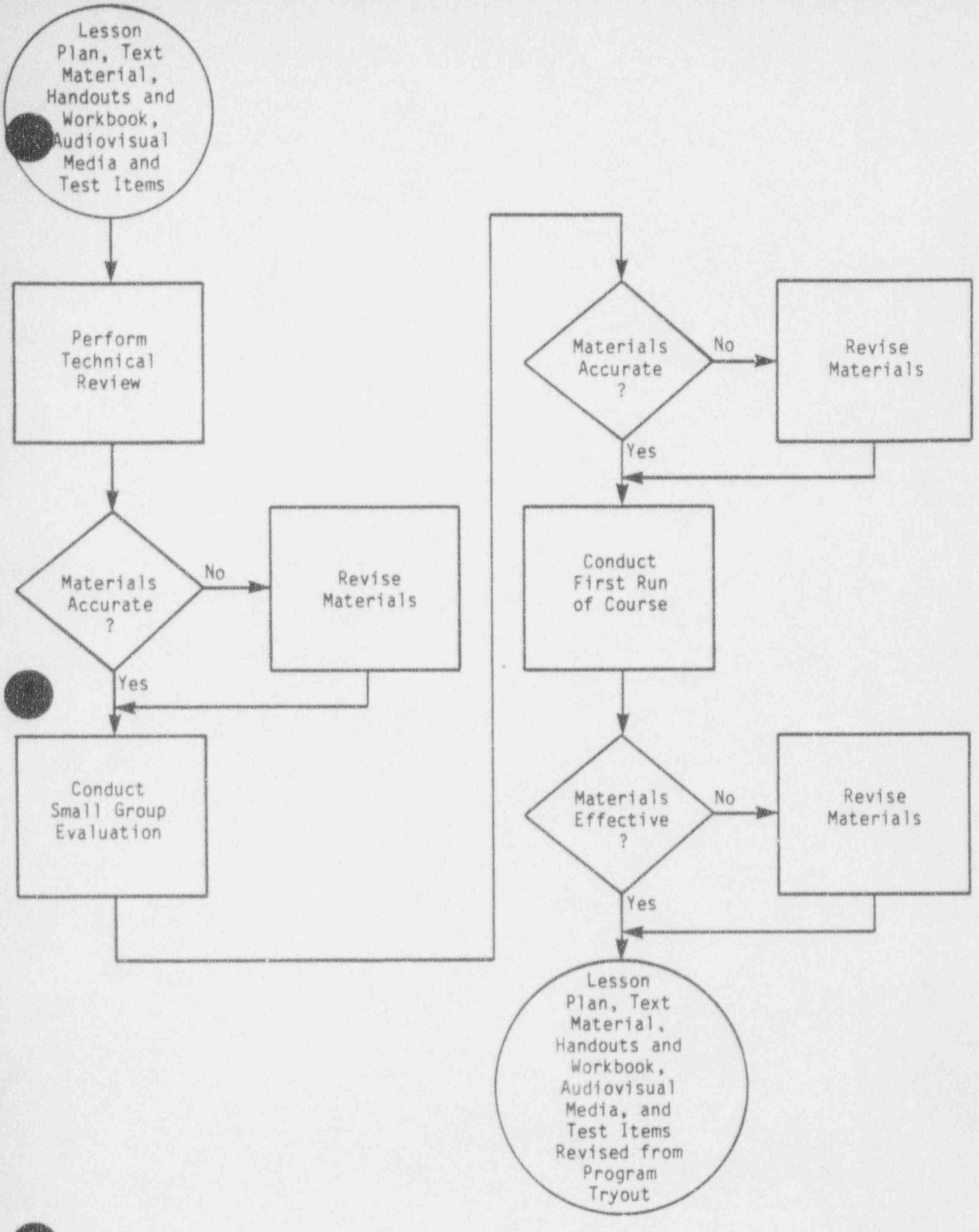
- o expected trainee entry-level skills and knowledges

- o instructions to the trainee
  - -- self-paced or program-paced
  - -- studying the material
  - -- use of audiovisual media (when appropriate)
  - -- use of practice exercises

- o self-study resources
  - -- enabling objectives and learning activities
  - -- text material assignments
  - -- equipment scheduling and use (to be provided in the self-study package or scheduled in the plant)
  - -- audiovisual media scheduling and use (when appropriate)

- o progress test and post-test administration
  - -- scheduling and use
  - -- test administrator
  - -- training standards for evaluating trainee performance

CONDUCT TRAINING PROGRAM TRYOUT



Conduct Training Program Tryout

CHECKLIST FOR EVALUATING THE TECHNICAL ACCURACY OF TRAINING MATERIALS

The following checklist was designed to evaluate the adequacy of technical training materials.

Check the items "Yes" or "No" as appropriate.

Technical Materials	Yes	No
1. Content of the material is accurate technically.	____	____
2. Terminology is appropriate to the job.	____	____
3. Material emphasizes appropriate safety aspects.	____	____
4. Material reflects the current status of plant systems and equipment.	____	____
5. Material reflects current plant operating procedures.	____	____
6. Complexity and level of detail are appropriate to the intended trainees.	____	____
7. Illustrations (e.g., charts, graphs, etc.) are clear and explain key and complex points.	____	____
8. Examples are relevant to the job.	____	____
9. Practice exercises and test items are accurate technically.	____	____
10. Information is complete in relation to scope of learning objectives.	____	____

Checklist for Evaluating the Technical Accuracy of Training Materials

POST-TRAINING QUESTIONNAIRE

Please circle the response you consider appropriate for each question and provide comments where appropriate.

1a. How difficult was the instruction?

Too Easy Average Too Difficult

b. Where and why was it too easy or too difficult? _____

_____

2a. How was the length of the instruction?

Too Short Okay Too Long

b. Where and why was it too short or too long? _____

_____

3. How was the amount of information?

Too little at one time Okay Too much at one time

4a. How was the information?

Clear Average Confusing

b. Where and why was it confusing? _____

_____

5. How was the vocabulary in the lesson?

Too Simple Okay Too Complicated

6a. How were the directions?

Clear Average Confusing

b. Where were the directions confusing? _____

_____

7. How was the amount of practice exercises?

Too Few About Right Too Many

8. How were the practice exercises?

Interesting Okay Boring

9. How was the lesson's pace?

Too Slow Okay Too Fast

10. How was the content structured?

Logically Okay Randomly

11. Any other general comments? Write them below. Thanks.

POST-TRAINING INTERVIEW

The individual participants will be asked the following questions. Their responses should be indicated in the spaces provided.

1. How difficult was the instruction?

2. How was the length of the instruction?

3. How was the amount of information?

4. Was the information clear or confusing?

5. How was the vocabulary in the lesson?

6. Were the directions clear or confusing?

7. How were the practice exercises? Were they helpful?

8. How was the lesson's pace?

9. How were the illustrations?

10. Any other general comments?

Post-Training Interview

INDICATORS OF POTENTIAL
TRAINING PROGRAM WEAKNESSES

Check the indicators that were observed during small group evaluations and the first run of the course.

_____ Learning objectives are not compatible with the entry-level skills and knowledges of the trainees.

_____ Learning objectives are not sequenced for effective learning.

_____ Learning activities do not support effective accomplishment of the learning objectives.

_____ Learning activities do not specify adequately the behavioral activities of the instructor and trainees.

_____ Text material and references are inconsistent with expected trainee entry-level skills and knowledges.

_____ Materials contain terminology not used in a nuclear power plant.

_____ Pacing of material is too slow or too rapid.

_____ Audiovisual media used is inappropriate or ineffective.

_____ Practice exercises are not similar to test items.

_____ Test items do not measure mastery of the learning objectives adequately.

REFERENCES

REFERENCES

The following references correspond to activities in the Development Section. They are provided as sources of additional study by the interested reader. The list is not intended to be all inclusive or an endorsement of the author's view. Additional references or information may be obtained by contacting the Training and Education Division, Institute of Nuclear Power Operations.

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Section 4.5: Conduct Training Program Tryout

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Department of the Navy. Interservice Procedures for Instructional System Development. (Phase III, Develop, NAVEDTRA 106A). Washington, D. C.:

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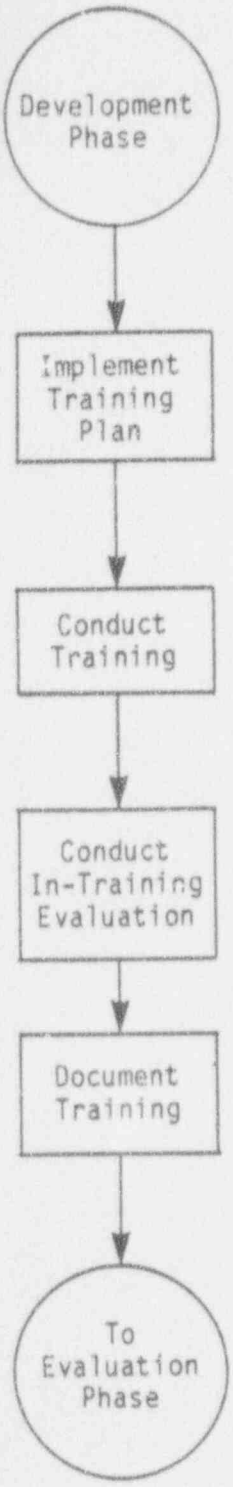
TRAINING SYSTEM IMPLEMENTATION



INPUTS

- Training Materials
- Lesson Plans
- Tryout Results/Revisions
- Training Plan

Activate the training plan. Develop implementation procedures, and confirm the availability of trainees, instructors, facilities and resources.

Deliver training as specified in the training plan, procedures, materials, and lesson plans.

Monitor trainee, materials, and instructor performance.

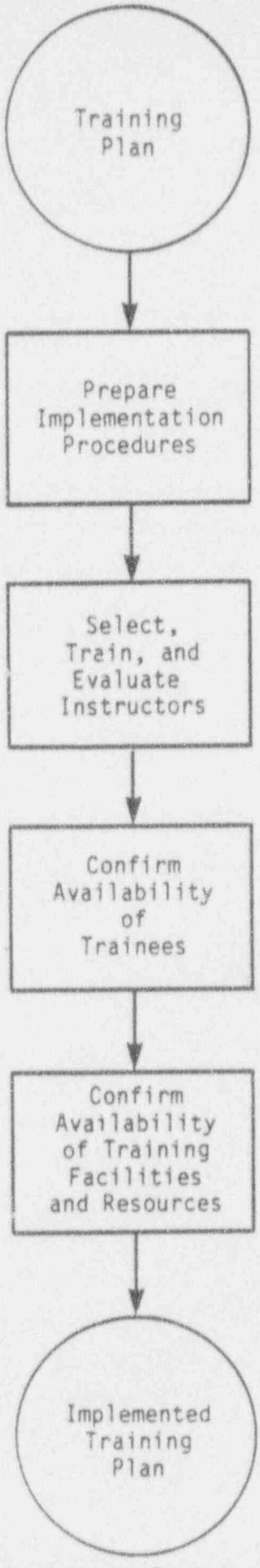
Maintain trainee, instructor, and program records.

OUTPUTS

- Trained Personnel
- In-Training Evaluation Data
- Training Records

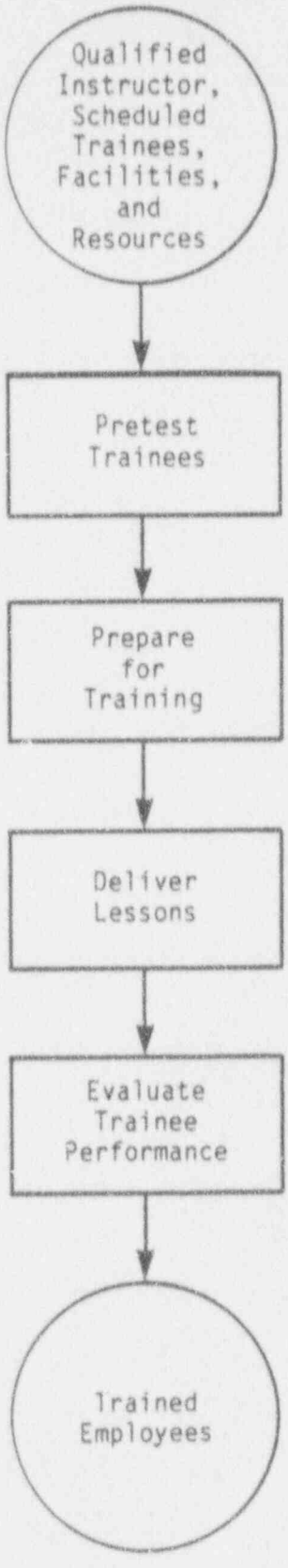
Training System Implementation: Inputs, Processes, and Outputs

IMPLEMENT THE TRAINING PLAN



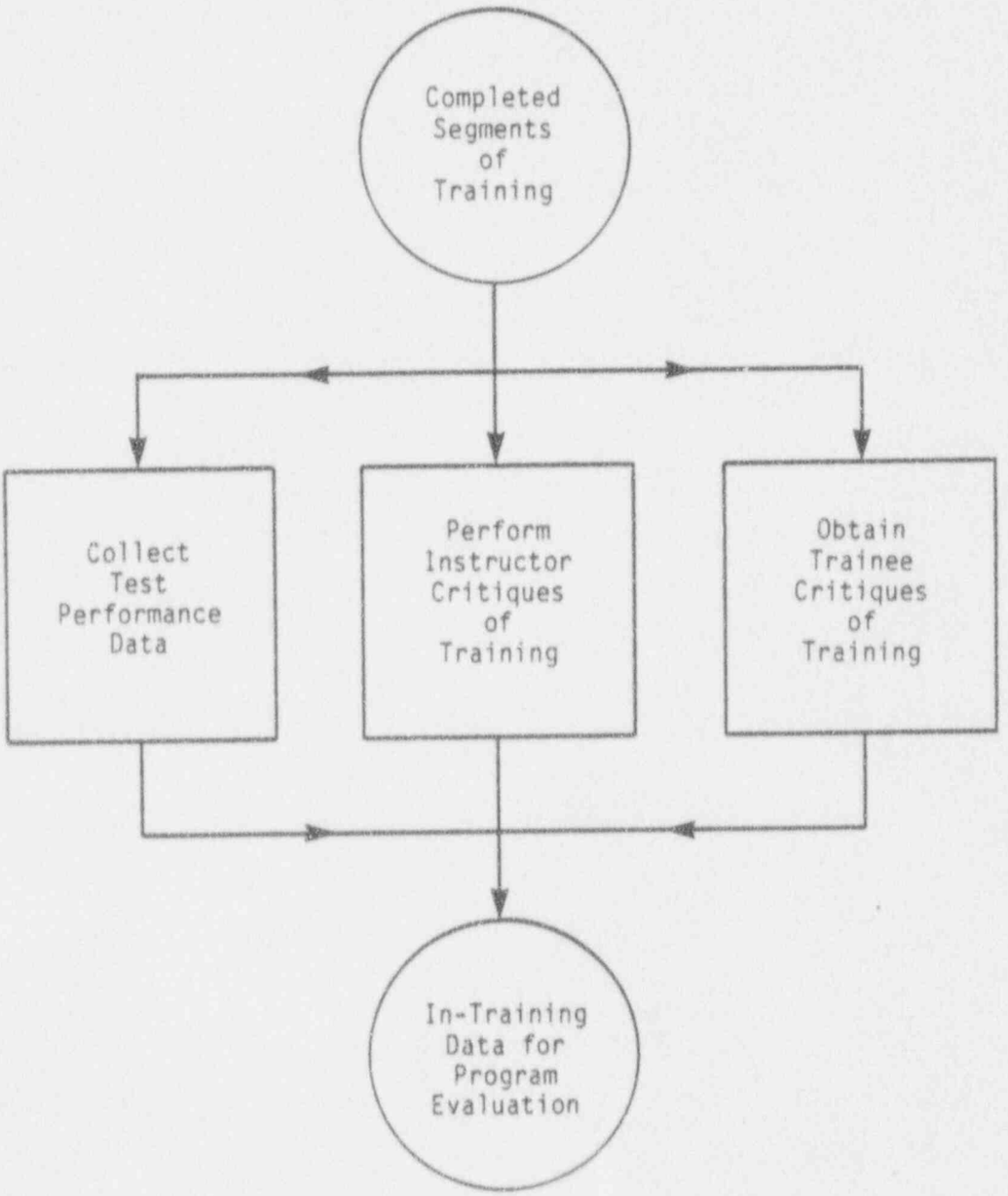
Implement the Training Plan

CONDUCT TRAINING



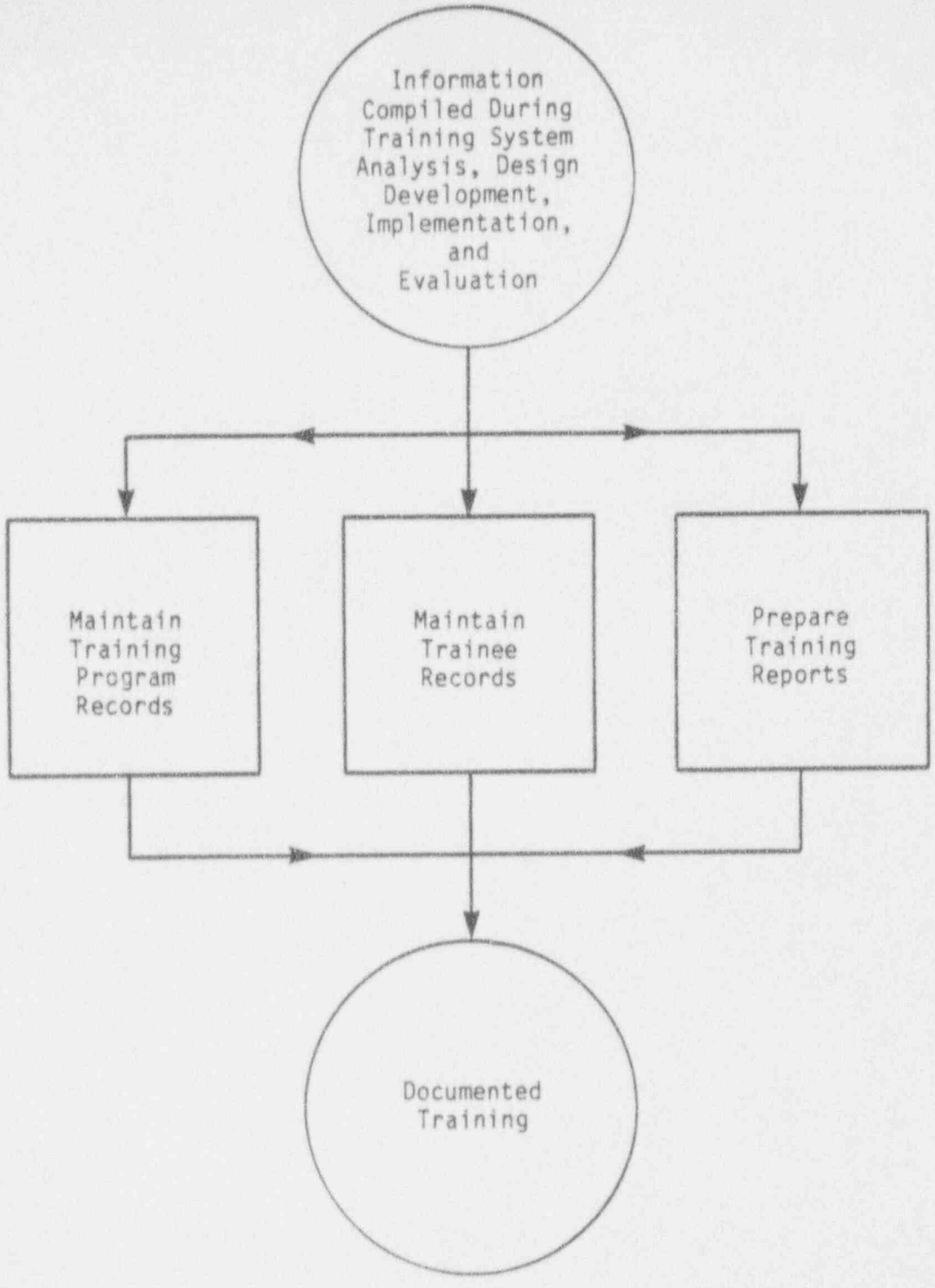
Conduct Training

CONDUCT IN-TRAINING EVALUATION



Conduct In-Training Evaluation

DOCUMENT TRAINING



Document Training

REFERENCES

REFERENCES

The following references correspond to activities in the Implementation Section. They are provided as sources of additional study for the interested reader. The list is not intended to be all-inclusive or an endorsement of an author's view. Additional references or information may be obtained through the Training and Education Division, Institute of Nuclear Power Operations.

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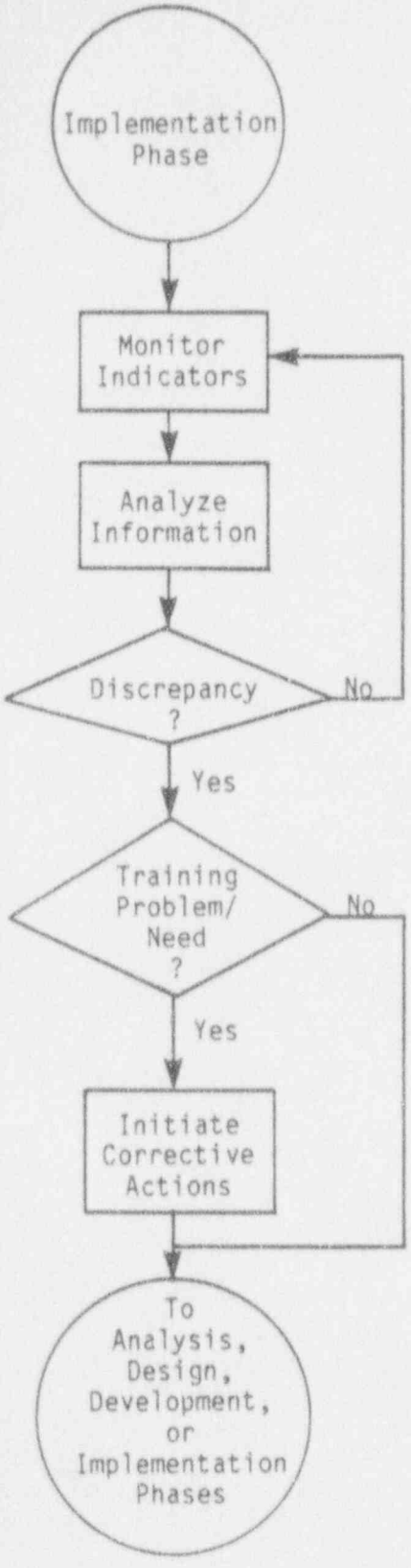
TRAINING SYSTEM EVALUATION



INPUTS

- o Trained Personnel
- o In-Training Evaluation Data
- o Training Records

Identify and review measures of training system performance.

Convert training system performance data into reliable program information.

Review the apparent training problem or need.

Process a training development recommendation.

OUTPUTS

- o Training Program Evaluation Recommendation(s)

Training System Evaluation: Inputs, Processes, and Outputs

MONITOR INDICATORS

Directions: This survey is designed is to obtain your feedback on the quality of licensed operator training. Based on what you now know about your job, please rate the quality of the training you received as to how well it prepared you to perform the tasks listed below. (If you have not performed a particular task yet, leave it blank.)

RATING: Excellent 5, Good 4, Average 3, Fair 2, Poor 1

1.	Establish initial conditions at operator panel for a reactor start-up	___	___	___	___	___
2.	Perform control rod exercises	___	___	___	___	___
3.	Perform boron concentration change calculations	___	___	___	___	___
4.	Start up rod drive motor generator sets	___	___	___	___	___
5.	Fill the boron injection tank	___	___	___	___	___
6.	Perform shutdown margin calculations	___	___	___	___	___
7.	Perform hydrogen purge and establish hydrogen over pressure (VCT)	___	___	___	___	___
8.	Perform lineups of containment purge system	___	___	___	___	___
9.	Perform lineups of component cooling system	___	___	___	___	___
10.	Manually make up to the volume control tank	___	___	___	___	___
11.	Operate the steam dump/turbine bypass control system	___	___	___	___	___
12.	Manually operate the condensate hotwell makeup and dump system	___	___	___	___	___
13.	Perform a moisture separator/reheater hot start	___	___	___	___	___
14.	Deenergize a control rod drive mechanism	___	___	___	___	___
15.	Perform a discharge/release from a waste monitor tank	___	___	___	___	___

ANALYZE INFORMATION

ANALYSIS METHOD SELECTION

Indicator	Information Required	Type of Information	Analysis Methods
Plant Operating and Industrial Safety Experience	Has employee error caused any operational problems or personnel injuries?	Reports	Exception analysis Content analysis
Plant Maintenance Experience	Have rework, unscheduled maintenance, or overtime increased?	Interviews	Exception analysis Content analysis
Feedback from Employees and Supervisors	How do employees and supervisors rate training in preparing workers to do their jobs? What job activities need more or less training?	Interviews Surveys	Exception analysis Content analysis
Plant Inspections, Evaluations, and Accreditation Activities	Do findings and recommendations indicate training problems?	Reports	Content analysis
Plant Modifications and Procedure Changes	Do plant modifications or procedure changes affect training?	Reports	Content analysis
Industry Operating and Maintenance Experience	Do industry events indicate need for training changes or additions?	Reports	Content analysis
Regulatory Developments	Do regulatory changes affect plant training?	Reports	Content analysis
Trainee Test Performance	In what areas is trainee performance inadequate?	Test Scores	Exception analysis
Trainee Critiques of Training	What problems do trainees perceive?	Surveys	Exception analysis Content analysis
Instructor Critiques of Training	What changes do instructors recommend?	Reports	Content analysis

POST-TRAINING SURVEY RESULTS

Job Position: Control Room Operator

Survey Date: _____

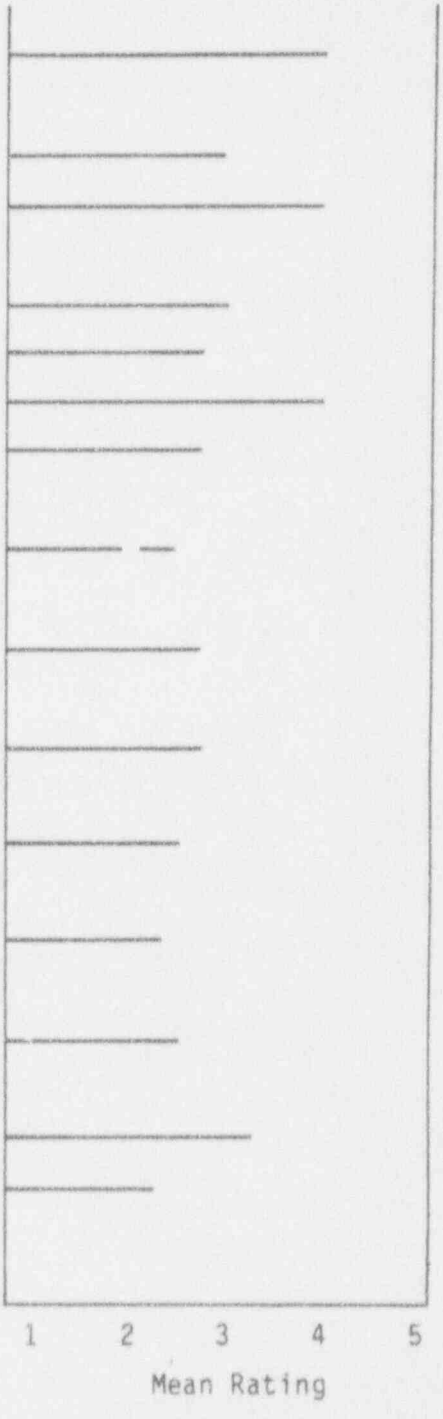
Number of Respondents: _____

		Mean	Poor 1	Fair 2	Average 3	Good 4	Excellent 5
		RATING:					
1.	Establish initial conditions at operator panel for a reactor start-up	3.90	0	2	4	8	6
2.	Perform control rod exercises	3.20	1	2	9	8	0
3.	Perform boron concentration change calculations	3.95	0	1	5	8	6
4.	Start up rod drive motor generator sets	3.15	1	1	12	6	0
5.	Fill the boron injection tank	2.75	2	6	8	3	1
6.	Perform shutdown margin calculations	3.90	0	0	6	10	4
7.	Perform hydrogen purge and establish hydrogen over pressure (VCT)	2.85	3	4	7	5	1
8.	Perform lineups of containment purge system	2.50	2	9	7	1	1
9.	Perform lineups of component cooling system	2.75	1	7	8	4	0
10.	Manually make up to the volume control tank	2.85	2	5	7	6	0
11.	Operate the steam dump/turbine bypass control system	2.45	3	7	8	2	0
12.	Manually operate the condensate hotwell makeup and dump system	2.30	3	9	7	1	0
13.	Perform a moisture separator/reheater hot start	2.45	4	6	8	1	1
14.	Deenergize a control rod drive mechanism	3.20	1	2	9	8	0
15.	Perform a discharge/release from a waste monitor tank	2.10	6	8	4	2	0

Frequency Distribution for Post-Training Employee Survey Results

BAR CHART OF POST-TRAINING EMPLOYEE
SURVEY RESULTS

1. Establish initial conditions at operator panel for a reactor start-up
2. Perform control rod exercises
3. Perform boron concentration change calculations
4. Start up rod drive motor generator sets
5. Fill the boron injection tank
6. Perform shutdown margin calculations
7. Perform hydrogen purge and establish hydrogen over pressure (VCT)
8. Perform lineups of containment purge system
9. Perform lineups of component cooling system
10. Manually make up to the volume control tank
11. Operate the steam dump/turbine bypass control system
12. Manually operate the condensate hotwell makeup and dump system
13. Perform a moisture separator/reheater hot start
14. Deenergize a control rod drive mechanism
15. Perform a discharge/release from a waste monitor tank



Bar Chart of Post-Training Employee Survey Results

REFERENCES

REFERENCES

The following references correspond to activities in the Evaluation Section. They are provided as sources of additional study for the interested reader. The list is not intended to be all-inclusive or an endorsement of an author's view. Additional references or information may be obtained by contacting the Training and Education Division, Institute of Nuclear Power Operations.

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TRAINING SYSTEM DEVELOPMENT GLOSSARY

TRAINING SYSTEM DEVELOPMENT GLOSSARY

Abnormal Task - a task performed during alarm or off-normal plant conditions.

Academic Knowledge - understanding of facts, definitions, principles, rules, or theories (e.g., mathematics, electricity, communications, heat transfer, reactor physics, fluid flow).

Accreditation - A process to formally recognize and approve nuclear utility training as meeting established criteria.

Action Step (Element) - a discrete action or step executed during the performance of a task.

Action Verbs - verbs identifying behaviors that are observable and measurable.

Analysis - the training system development phase that assesses performance requirements or deficiencies, determines the needs that are best satisfied through training, and produces task performance data that serves as the foundation for training program design, development, and implementation.

Behavior - the actions of a person in response to the environment.

Certification - formal recognition of successful completion of training by a trainee.

Chain - a series of actions (operants) performed in a linear sequence; the response of one operant produces the stimulus for the following operant.

Classroom Training - a training setting in which lectures, demonstrations, and discussions are conducted.

Clustering - the grouping of common skills and knowledges into areas (e.g., academic, component, system) to reduce redundancy and provide a more organized and efficient approach to program development.

Component Knowledge - understanding of the characteristics, functions, construction, or operation of a specific class of equipment (e.g., characteristics of a valve, pump, controller, or sensor; construction of a check valve, centrifugal pump, level sensor).

Condition - the circumstances existing prior to task performance.

Configuration Group - a group of nuclear power plants with similar systems and design characteristics.

Consequences of Inadequate Performance - environmental, system, or component effects that could result from improper task execution.

Criteria - the standards used to compare and evaluate any performance, product, or process.

Critical Action Step (Critical Element) - an essential element that must be performed to complete a task successfully; an action step from which serious consequences may occur.

Curriculum Outline - an outline of training used for development of course material that organizes the terminal and enabling objectives into sequenced units or modules of training.

Demonstration - a training method in which a procedure is shown in a step-by-step sequence.

Design - the training system development phase in which products of job and task analysis are used to develop specifications for training program development and implementation; includes developing job performance measures, selecting training settings, developing learning objectives and tests, determining expected trainee entry-level skills and knowledges, and formulating the training plan.

Development - the training system development phase that involves establishment of learning activities, selection of media and methods, review and selection of existing course material, development of new material, and the tryout and revision of course material.

Discrimination - the process of recognizing that two or more related stimuli require different responses.

Discussion - a training method involving guided conversation between trainees that encourages constructive thinking and interaction within the group.

Duty Area - a logical grouping of tasks comprising a major subdivision of a job.

Element (Action Step) - a discrete action or step executed during the performance of a task.

Emergency Task - a task performed during emergency or unforeseen conditions in the plant; a task that involves the use of emergency plans or emergency operating procedures.

Enabling Objective - one of a set of objectives that supports the attainment of a terminal objective.

Entry-Level Test - a test derived from learning objectives that is used to measure trainee entry-level skills and knowledges.

Evaluation - the training system development phase in which indicators (e.g., operating experiences, employee performance, job requirements, etc.) are monitored, assessed, and used to maintain and improve the performance of a training program.

Fact Finding - an aspect of needs analysis in which representatives from functional departments, personnel, and training collect data on past and present problems and future plans that may affect job performance.

Formal On-the-Job Training - a training setting in which plant employees achieve learning objectives through training conducted in the job environment.

Frequency Distribution - the number of times that various ratings or responses appear during a survey or test.

Generalization - the process of recognizing that two or more different stimuli require a similar response.

Human Interfaces - personnel who interact with a worker during task execution.

Implementation - the training system development phase in which the training program is put into operation; includes implementing the training plan, preparing for and conducting training, conducting in-training evaluation, and documenting training.

Initiating Cue - the first prompt or signal that causes a worker to perform a specific task.

Instructional Technologist (IT) - a person who interviews a worker and records task analysis data on a task analysis data collection form. The IT identifies and translates pertinent information into a standardized format.

Job - the duties and tasks performed by a single worker.

Job Analysis - a method used in obtaining a detailed listing of the duties and tasks of a specific job. Job analysis is the first step in obtaining data required for task analysis.

Job Performance Measure (JPM) - tests used to evaluate a worker's proficiency on a specific job task.

Knowledge - understanding of facts, principles, or concepts. Knowledge includes cognitive (mental) processes necessary for applying information.

Laboratory/Workshop - a training setting in which the conditions of job performance are simulated to permit hands-on application of course material by the trainees.

Learning Activities - activities of instructors and trainees during training events.

Learning Analysis - a process used to identify the enabling objectives that must be mastered by a trainee before a terminal objective can be achieved.

Learning Category - a type of learning behavior. All learning may be classified into knowledge or skill categories.

Learning Objective - a statement that specifies measurable behavior that a trainee should exhibit after instruction, including the conditions and standards for performance.

Lecture - a training method characterized by a public speaking-type presentation that is organized and presented in logical steps.

Lesson Plan - an instructor's primary training document that outlines instructor and trainee activities and the resources necessary for the conduct of training.

Media - the materials used to transmit information to trainees. Includes computer-assisted instruction, simulation, and audio and/or visual presentations.

Method - a strategy by which the trainees achieve the learning objectives. Includes lecture demonstration/practice, discussion, oral questioning, role playing, walk through, and self pacing.

Module - a single unit of self-contained instruction.

Needs Analysis - a process of identifying potential or existing training needs by examining gaps between performance requirements and existing or expected performance.

Normal Task - a task performed using plant operating procedures during normal or routine plant conditions.

Operant - a basic unit of behavior; a description of the specific stimulus (S) and specific response (R).

Oral Questioning - a training method involving interaction between instructors and trainees that provides a sampling of trainee comprehension of the material.

Output - the result of completing a task.

Paradigm (Logic Diagram) - a graphic representation of task actions and cues using stimulus-response (operant) formats.

Paradigm Task Analysis - a reasoning process that involves the identification of a specific stimulus-response sequence required to perform a task. This reasoning process is used to investigate tasks that require decisions.

Parent Task - the original, normal task from which problem assessment tasks are derived.

Performance-Based Training - a systematic program of instruction designed around tasks and the related knowledges and skills required for competent job performance.

Personnel Safety Considerations - personnel dangers encountered during task performance.

Plant Mode - the operating status of a nuclear power generating plant. The following six modes are used:

- o normal (at power)
- o start-up
- o hot standby
- o hot shutdown
- o cold shutdown
- o refueling

Post-test - a course-comprehensive test administered to all trainees at the end of the course to measure trainee mastery of the learning objectives.

Pretest - a test administered to all trainees before beginning a course to confirm individual trainee qualification for entering training; it also is used to identify remedial training requirements and to exempt trainees from all or portions of training.

Preview - an aspect of simulator training that can consist of a walk-through of the simulator exercise or operation of the simulator at real-time (freezing the simulator when appropriate to emphasize operating principles and the basis for actions taken).

Problem Assessment - the identification of abnormal conditions that may occur during the performance of a normal task element.

Problem Resolution - one remedy for an identified abnormal condition.

Procedural Task Analysis - a task analysis method used to identify the elements of a task and their sequence.

Progress Test - a test used to evaluate trainee progress in mastering learning objectives during a training program.

Qualifications - the combination of an individual's physical attributes and technical, academic, and supervisory knowledges and skills developed via training, education, and demonstrated on-the-job performance.

Q.C. Checklist - the document used by the Subject Matter Expert/Instructional Technologist (SME/IT) team when reviewing the task analysis data collection form.

References - the documents, procedures, instructions, and/or guidelines used by a worker during the performance of a task.

Reliability - the capability of an instrument or process to yield consistent results.

Remedial Training (remediation) - supplementary training designed to correct trainee performance deficiencies.

Response - mental or physical action taken in response to a stimulus.

Role Playing - a training method in which the trainee assumes a role in a real or simulated job environment or situation.

Self-Pacing - a type of self-study technique or strategy in which the pace of training is controlled by the trainee.

Self-Study - a training setting without a full-time instructor in which the conditions are provided in the training materials or in the plant when needed by the trainee.

Simulator Training - a training setting using a training device that simulates a plant or a portion of a plant to develop trainee operating skills and to provide knowledge of plant behavior during normal, abnormal, and emergency conditions.

Skill - the ability of a worker to perform an action requiring coordination of body movements.

Standard - measurable requirements, either quantitative or qualitative, by which performance is evaluated.

Standard Deviation - a measure of dispersion from the mean.

Stimulus - the prompt or signal that causes a worker to respond with a particular action.

Subject Matter Expert (SME) - a worker qualified and experienced in performing a particular task.

System Knowledge - understanding of information on a specific system and its major component locations, interrelationships, indications, controls, alarms, or power supplies (e.g., purpose of letdown flow control valve is to control CVCS letdown; location of charging pump running indicators).

Task - a well-defined unit of work having an identifiable beginning and end and two or more elements.

Task Analysis - the systematic process of examining a task by interviewing job incumbents to identify conditions, standards, elements, and required skills or knowledges.

Task Analysis Data Collection Form - the document used by the IT-SME team for gathering task performance data.

Task Identification Number - an INPO number that includes a system reference, task reference, activity reference, and job title reference that distinguishes a task from all others.

Task Inventory - a survey instrument that lists the tasks performed and the tools, equipment, and references used by a worker.

Task Standard - a statement that defines a measurable criterion or acceptable standard of task performance. The criteria may be stated as time requirements, degree of accuracy, or allowable number of errors.

Task Title - a statement of highly specific action that has a verb, an object, and possibly a qualifier (e.g., start-up reactor coolant pump).

Taxonomy - a listing of skill and knowledge statements in component, system, and academic categories.

Taxonomy Code - the system of numbering each skill and knowledge statement identified during the task analysis process.

Team Evolutions - those actions involving a series of interrelated tasks performed by several workers that comprise one large, coordinated operation (e.g., start-up plant from cold shutdown).

Technical Review - a review conducted by a subject matter expert to verify completeness and accuracy of data collected or materials produced during the training system development process.

Terminal Objective - a statement describing a trainee's expected performance after training. Terminal objectives contain job-related conditions, actions, and standards and are supported by a set of enabling objectives.

Terminating Cue - the prompt or signal that informs the worker that the task is completed.

Test - a device or technique used to measure trainee mastery of the learning objectives.

Test Specification - a guide for the development of a test (pretest, progress test, or post-test) that describes the intended scope and emphasis of the test.

Training Methods - techniques or strategies used during training that assist the trainees in mastering the learning objectives (including lecture, demonstration, discussion, oral questioning, role playing, walk-through, and self-pacing).

Training Plan - a plan that describes course management organization, course loading and scheduling requirements, trainee management and evaluation guidelines, instructor qualifications and responsibilities, course facility and equipment requirements, test administration guidelines, training record requirements, and course curriculum outline.

Training Setting - the environment in which training is conducted and learning occurs. Training settings include classroom, laboratory and workshop, formal OJT, simulator, and self-study.

Training System Development - a set of interrelated activities used to systematically establish and maintain performance-based training. It includes analysis, design, development, implementation, and evaluation.

Validity - the capability of an instrument or process to yield accurate results.

Walk-through - a training method that facilitates trainee transition from learning in a simulated environment to application in the actual job environment; includes plant visits that emphasize physical layouts and observation of trained employees performing their jobs.

Work Plan - a method for planning training system development activities and the schedule for completing those activities.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

April 19, 1994

MEMORANDUM FOR: Darlene Huyer
Anstec, Inc.

FROM: Tremaine Donnell, INPO Coordinator
Records and Archives Services Section
Information and Records Management Branch
Office of Information Resources Management

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Enclosure: As stated

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