

FFTF IMPLEMENTATION OF TRAINING
REQUIREMENTS FOR GOVERNMENT
OWNED FACILITIES

MASTER

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3rd Symposium on the Training
of Nuclear Facility Personnel

April 29, 1978

Gatlinburg, Tn.

EB

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FFTF IMPLEMENTATION OF TRAINING REQUIREMENTS
FOR GOVERNMENT AND COMMERCIALY OWNED FACILITIES

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ABSTRACT

The Fast Flux Test Facility (FFTF) is a liquid metal cooled, fast flux reactor plant. It is owned by the Department of Energy (DOE) and is operated by the Hanford Engineering Development Laboratory (HEDL) under a DOE contract with Westinghouse Hanford Company. The FFTF is presently undergoing acceptance testing of sodium systems in preparation for initial criticality in August 1979. It will be used to test fuels and materials, to develop associated components and to gain operating experience for future LMFBR's.

The FFTF Training Program is a specific example of how training guidelines provided by NRC can be implemented in principle in a DOE owned reactor. The DOE requirements for government owned facilities and the NRC requirements for commercially owned facilities are compared to components of the FFTF Training program. These components will be described, actual status provided and evaluated as to meeting requirements. "Cold Plant Qualification" (equivalent to NRC Cold Plant Licensing) is the next major milestone for FFTF Operator training. Additional requirements or constraints such as operator time utilization, recruiting and turnover, plant availability and startup testing greatly affect the ability to meet this milestone. These constraints and requirements and the resulting compromises will be evaluated relative to meeting DOE requirements.

INTRODUCTION

The Fast Flux Test Facility (FFTF) is a liquid metal cooled, 400 megawatt fast flux reactor plant. It is owned by the Department of Energy (DOE) and is operated by Westinghouse Hanford Company under contract with DOE. The FFTF is presently undergoing acceptance testing of sodium systems in preparation for initial criticality in August, 1979. It will be used to test fuels and materials to develop associated components and to gain operating experience for future LMFBR's.

The FFTF Training Program is a specific example of how training requirements for government owned facilities can be implemented in a DOE owned reactor. The DOE requirements for government owned facilities are compared to components of the FFTF Training Program. These components will be described, actual status provided and evaluated as to meeting requirements. Cold Plant Qualification is the next major milestone for FFTF Operator training. Additional requirements or constraints such as operator time utilization, recruiting and turnover, plant availability and startup testing greatly affect the ability to meet this milestone. These constraints and requirements and the resulting compromises will be evaluated relative to meeting DOE requirements.

Training requirements for FFTF operators are based upon requirements of DOE Manual Appendix 8401 II, Immediate Action Directive (IAD) 8401-6 and other draft and proposed DOE manuals. Appendix 8401 II, May 7, 1965 suggests factors which Field Office Managers should consider in determining the adequacy of selection, training and certification programs for operators and supervisors of DOE owned reactors. IAD 8401-6, April 22, 1970, establishes the requirements for reactor operator and supervisor retraining, reexamination and requalification programs. Other draft DOE proposals set forth the DOE required qualification of reactor staff and establish requirements in the areas of selection, training, examination and certification of Operations personnel. Although these other draft DOE manuals are yet to be approved, the FFTF Operator Training Program is designed to be in compliance with the proposals.

SELECTION CRITERIA

Requirement

Candidates for reactor operator and supervisor training should possess high school diplomas and college degrees, respectively, with satisfactory achievement in technical courses. Experience and education may be substituted, interchangeably, as appropriate.

FFTF Implementation

The FFTF Training Plan requires that technician (reactor operator) candidates have a high school diploma or equivalent and at least two years of college or equivalent.

Candidates are divided into two categories: experienced by virtue of actual power reactor operation and non-experienced. Approximately half of the technicians have 6 to 8 years prior reactor experience from the military which is deemed appropriate experience to substitute for the two years of college education. The past four years of experience in recruiting and training of non-experienced candidates has further refined our selection criteria to require college level courses in math up to calculus and physical science courses. For the first class consisting of 12 non-experienced candidates in 1975, college level math and physical science was not required. The high attrition rate (8 of 12) in that class is thought to be due, in part, to lack of academic preparation. Since the incorporation of the math and physical science requirement in 1976, only 4 of 63 non-experienced have dropped out of the program due to academic problems.

The FFTF Training Plan requires that all Operations Engineers (supervisor) will have a minimum of four years of nuclear plant experience. A maximum of two years of this experience can be fulfilled by academic or related technical training on a one-for-one basis. The recruiting of Operations Engineers has been directed at degreed (B.S.) in engineering or scientific areas. With only one exception, all Operations Engineer candidates have had Bachelor degrees.

The following matrix demonstrates the effectiveness of meeting this requirement.

	<u>High School Diploma</u>	<u>2 yrs College</u>	<u>Experience⁽¹⁾</u>
Reactor Operators	128 of 128	63 of 128	65 of 128
	<u>College Degrees⁽²⁾</u>	<u>Experience</u>	
Supervisors	51 of 52	1 of 52	

- Note:
- (1) Of the 65 experienced reactor operator candidates, about half also have two years of college.
 - (2) Of the 51 supervisor candidates over half also have reactor operating experience.

Recently, six of the high performance, experienced reactor technicians were qualified as Operations Engineers. They are non-degreed but have over 8 years reactor operator experience.

Requirement

Contractor management shall specify the demands on health, coordination, and manual dexterity required to perform both routine and emergency functions. A health examination shall be given to establish the candidate's fitness to perform his proposed job tasks.

FFTF Implementation

The Hanford Environmental Health Foundation (HEHF) is the contractor established to perform health appraisals of all Westinghouse Hanford Company employes. Discussions with the HEHF physicians and psychologists were conducted to determine what medical examinations were appropriate to meet the above specification. The discussion included a tour of the FFTF and presentation of operator responsibilities.

In mid 1978, HEHF recommended and Westinghouse Hanford Company then established the requirements for FFTF operators. The requirements do meet NRC Regulatory Guide 1.134, dated September 1977 and ANSI Standard N546-1976. After the successful completion of the annual or initial health appraisal, a certificate from HEHF is placed in operator's personnel file. It is planned that all operators and supervisors will be certified by HEHF prior to cold plant certification.

Requirement

The contractor's selection program should include personal interviews and careful review of the candidates employment history and may include appropriate physical and aptitude tests.

FFTF Implementation

Westinghouse Hanford Company employment practices require management interviews, as well as reference, prior employment and education investigation as part of the selection process. The appropriate physical and aptitude tests are part of the pre-employment health appraisal discussed above and its successful completion is a condition of employment.

As demonstrated by the hiring of over 180 operators and supervisors, Westinghouse Hanford Company has considerable experience in hiring operators. The selection process uses the following activities to finally hire a candidate: screening, interviewing, site tour, personnel relations interview, reference and education checks, security checks, and health appraisal. The FFTF Training Manager is responsible for the recruiting of operators.

The screening process is done in several ways. The resumes submitted by applicants are reviewed by the Training Manager to identify qualified applicants. This amounted to over 1,000 resumes in 1978. The applicants that meet minimum qualifications are then interviewed by phone to check availability, interest, and recheck qualifications. If everything is positive, the candidate is invited in for an on-site interview.

Another method of screening is the conduct of off-site interviews in the Northwest's major cities. After a week of advertising, a recruiting center is established for face-to-face interviews. This has been very effective in producing non-experienced candidates. Screening interviews are also conducted at off-site locations through personnel agencies and this has been a good source of experienced candidates.

The on-site interview is a requirement and is the most important part of the process. FFTF Operations uses at least two managers to evaluate each candidate. At least one manager is operations experienced. A tour of FFTF is provided to not only give a candidate a view of his/her work environment, but to demonstrate to non-experienced candidates what operator responsibilities actually are. The ability of the candidate to understand technical concepts, system interrelationship, and physical mobility can also be evaluated during the site tour.

The primary purpose of the personnel relations interview is to make a final check of interest. If a candidate meets all other criteria, he/she will succeed in the program and stay with it only if there is a high degree of interest. The exit interview is conducted by the Personnel Relations employment specialist away from the FFTF site after the on-site interview. This exit interview also provides an independent assessment of the candidate by a skilled specialist in Personnel Relations.

After the on-site interview and all people involved in the interviewing process agree an offer should be made and management approvals are obtained, a detailed check of references and education is conducted by Personnel Relations' specialists. If everything still checks out, an offer is made contingent on health appraisal and security requirements being met.

The process is long, complicated and is specifically designed to ensure only high quality operators are selected. Because the quality is high, the success of the FFTF Project, and more importantly, the safe operation of FFTF is greatly enhanced.

TRAINING

Requirement

The qualification of personnel shall be documented in a form amenable to internal and external audit.

FFTF Implementation

Each trainee completes detailed qualification cards which include the following requirements:

- a. Oral checkouts on the theoretical background.
- b. Oral checkouts on each plant system.
- c. Oral checkouts on selected plant system procedures and reactor procedures.
- d. Performance of selected plant procedures (normal, infrequent, recovery and emergency procedures).

Each watchstation at FFTF has a separate qualification card which consists of an outline of the requirements and provides a signature space to indicate the fulfillment of each requirement. The qualification card is thus a record of qualification for the trainee.

Watchstation qualification cards are organized according to the following format:

	<u>Area</u>	<u>Authorized Signature</u>
A.	Prerequisites	Training Manager
B.	Theory	Qualified Operator*
C.	Operating Station Basics	Qualified Operator*
D.	Specific Component Knowledge	Qualified Operator*
E.	Equipment Operation	Qualified Operator*
F.	System Operating Procedures	Qualified Operator*
G.	Plant Operating Procedures	Qualified Operator*
H.	Recommended for Qualification	Qualified Operator*
I.	Final Written Examination	Training Manager
J.	Final Oral Examination	Shift Operations Manager
K.	Certification of Qualification	Shift Operations Manager

*Operator must be qualified on the watchstation concerned.

In addition to watchstations, the FFTF Qualification program includes three qualification levels.

1. Operation Technician

An individual completing this qualification may be assigned to any roving watchstation outside the control room having completed all watchstation and Operations Technician level qualification requirements. He/she can also be assigned as lead watchstander on those watchstations where more than one watchstander is required.

2. Reactor Technician

An individual completing this qualification may be assigned to any of the reactor operating watchstations inside and outside the control room with the exception of the supervisory watchstation.

3. Operations Engineer

An individual completing this qualification may be assigned to any watchstation including the supervisory watchstations called the Chief Operator and Refueling Engineer.

The following table identifies the watchstations which personnel will be assigned during normal operations. To adequately staff these positions and provide on crew training time for replacement operator training, each crew will consist of 21 personnel.

<u>POSITION</u>	<u>NUMBER ASSIGNED</u>
Shift Operations Manager	1
Operations Engineer	1
Control Room	
Chief Operator	1
Reactor Operator	1
Closed Loop Systems Operator	1
DHX Operator	1
Control Room Auxiliaries Operator	1
Outside Control Room	
Containment Operator	2
Service Systems Operator	3
Heat Transport Systems Operator	4
Refueling Personnel	2
Relief Operator	1
Trainees	2
TOTAL	<u>21</u>

Qualification level cards (Operations Technician, Reactor Technician and Operations Engineer) are organized according to the following format:

<u>Area</u>	<u>Authorized Signature</u>
A. Prerequisites	Training Manager
B. Overall System Knowledge	Qualified Operator*
C. Required Operating Stations	Training Manager
D. Recommendation for Qualification	Shift Operations Manager
E. Final Written Examination	Training Manager
F. Final Oral Examination	Operations Manager
G. Certification of Qualification	Operations Manager

*Operator must be qualified at the level concerned.

In addition to the qualification card, a qualification guide is provided which closely parallels the qualification card in format and stipulates the requirements and level of knowledge for each signature. The qualification guide helps ensure the same minimum level of competence for all operators who qualify.

The format of the qualification card does provide an easily auditable form. Internal audits are conducted by Training Staff personnel at the time of the written examination and periodic internal audits are conducted by other groups. External audits are periodically conducted by DOE.

Requirement

Principles of reactor operation, features of facility design, general operating characteristics, instruments and controls, safety and emergency systems, standard and emergency operating procedures, and radiation control and safety are the categories that shall be covered.

Training topics shall include but not be limited to physics and chemistry; core, primary and auxiliary system design; operating characteristics and limitations; control mechanism and instrumentation; safety reserve and emergency systems; shielding; engineered safeguards; operating and abnormal conditions; radiological and emergency procedures; radiation monitoring systems and survey equipment; radiological safety principles; effects of experiments; technical specification limits and requirement; fuel handling; and manipulation of reactivity controls.

FFTF Implementation

Classroom training is provided all trainees. The approximate in-class durations are as follows:

<u>Subject</u>	<u>First Class All Engineers</u>	<u>Subsequent Classes Engineers and Technicians</u>
Mathematics	24	36
Reactor Physics	57	58
Electricity and Electronics	10	37
Radiological Controls	18	18
Industrial Safety	10	12
Sodium Technology	37	19
Reactor Safety	26	14
Heat Transfer and Fluid Flow	10	20
FFTF Systems	107	120
	<hr/> 299 hours	<hr/> 334 hours

The above courses were presented over a 20 week period. This resulted in a pace of about 4 hours a day in class with remainder devoted to study, examinations and examination review. Each topic was covered by written exams and an overall written examination was given at the end of the course.

The comparison below shows how each of the required topics are covered by FFTF academic training.

<u>Requirement Topic</u>	<u>FFTF Topic</u>
Principles of Reactor Operation	Reactor Physics
Features of Facility Design	FFTF Systems
General Operating Characteristics	Reactor Physics, FFTF Systems
Instruments and Controls	Electricity and electronics, FFTF Systems.
Safety and Emergency Systems	FFTF Systems-Reactor Safety
Standard and Emergency Operating Procedures	FFTF Systems - Reactor Safety
Radiation Control and Safety	Radiation Control Industrial Safety
Physics	Reactor Physics
Chemistry	Sodium Technology

<u>Requirement Topic</u>	<u>FFTF Topic</u>
Core, Primary and Auxiliary System Design	FFTF Systems
Operating Characteristics and Limitations	Reactor Physics-FFTF Systems
Control Mechanism and Instrumentation	FFTF Systems
Safety Reserve and Emergency Systems	Reactor Safety - FFTF Systems
Shielding	Radiological Controls
Engineered Safeguards	Reactor Safety
Operating and Abnormal conditions	FFTF Systems
Radiological and Emergency Procedures	Radiological Controls
Radiation Monitoring Systems and Survey Equipment	FFTF Systems - Radiological Controls
Radiological Safety Principles	Radiological Controls
Effects of Experiments	Reactor Physics
Technical Specifications Limits and Requirements	Reactor Safety - FFTF Systems
Fuel Handling	FFTF Systems - Reactor Physics
Manipulation of Reactivity Controls	Reactor Physics

Replacement Operators are being provided with the above training divided into two 9 week periods. The initial period covers operations technician topics and the second period covers reactor technician and Operations Engineer topics.

Requirement

The reactor supervisor training program shall include the categories and topics specified above, but with increased depth to reflect the added responsibilities of the supervisor. In addition, emphasis shall be placed on design and operating limitations; bases for technical specifications; radiation hazards; reactivity effects during experimental and maintenance activities; fuel handling, structure, burnup and reactivity worth; alterations in core configuration; and administrative responsibilities, controls and procedures.

FFTF Implementation

The first training class was directed at the supervisor level operator with increased depth in all areas. The subsequent classes were similar to the first but the treatment of theoretical courses was less mathematically rigorous. Graduate engineers in subsequent classes complete a mathematically oriented supplement which is identical to that presented in the first class.

The qualification cards and qualification guides for the supervisory positions (OE) includes theory checkouts on the following topics:

1. Fast Reactor Physics
 - a. Reactor Kinetics
 - b. Reactivity Changes and Reactor Dynamics
 - c. Reactor Experiments
 - d. Reactor Control
2. Heat Transfer and Fluid Flow
3. Sodium Safety
4. Radiological Controls
 - a. Radioactive Material Handling
 - b. Radioactive Waste Management
5. Reactor Safety
 - a. Accident Assessment
 - b. Operator Responsibilities
 - c. Emergency Plan
 - d. Criticality Safety
6. Overall Fuel Cycle
7. Overall Irradiations Test Program
8. Detailed Core and Vessel Construction
9. Detailed Core Component Construction
 - a. Fuel Assemblies
 - b. Control Assemblies
 - c. Reflector Assemblies
 - d. Test Assemblies
 - e. Closed Loop In Reactor Assemblies
10. Industrial Safety
 - a. Hoist and Crane Safety
 - b. Oxygen Deficient Atmosphere
 - c. Accident Analysis and Reporting

The Chief Operator card requires checkouts on the plant procedures. This includes discussion of design and operating limitations and bases for technical specifications.

Requirement

The program shall include on-the-job training for operators and supervisors to assure their familiarity with all aspects of reactor operations. Where construction precludes on-the-job training, practical experience at similar reactors, training on simulators, and other appropriate training are acceptable.

On The Job training should include:

- a. *Location, function and operating characteristics of all facility components important to safety.*
- b. *Reactor startup and shutdown.*
- c. *Reactor console and control room manipulations.*
- d. *Reactor and auxiliary equipment operation.*
- e. *Instrumentation.*
- f. *Safety system testing and operation.*
- g. *Reactor maintenance and fueling operations.*
- h. *Operation of experimental facilities.*
- i. *Radiation protection practices.*

FFTF Implementation

The FFTF Qualification card requires actual performance of normal evolutions under supervision of qualified operators. Where the evolution cannot be performed, the evolution is simulated and actions walked through under supervision of a qualified watchstander. In addition, a prescribed number of training watches are also called for on the qualification card. The qualification cards when completed thus assure that operators are familiar with all aspects of the watchstation.

During the construction and startup of FFTF, many of the normal evolutions are precluded by incomplete systems and a cadre of qualified operators were not available. The initial FFTF Qualification program was separated into Qualification for Sodium Fill and FFTF Cold Plant Qualification.

The emphasis of sodium fill qualification is sodium characteristics and operation of sodium and auxiliary systems. Those qualification card requirements pertaining to sodium fill were specified in writing. Each operator was then given the qualification cards and worked to complete sodium fill qualification using the cards and the required sodium fill signature list. Since there was not a cadre of qualified operators, "system experts" were used to sign the qualification cards. Personnel are assigned one or more systems to learn in detail those areas. Certification as "system expert" occurs after completion of an oral board examination. The evaluation board consists of two members of Operations Management and the cognizant design engineers of the system. A list of certified system experts is maintained. At least one system expert per crew is desired for all shift coverage.

Practical experience at EBR-II and HTSF were used to gain sodium operating experience for selected members of the operating staff. At EBR-II, the trainees were assigned to rotating crews and completed training cards patterned after EBR-II qualification cards. Four areas were covered:

1. Coolant Systems
2. Reactor Control Console
3. Fuel Handling
4. Maintenance

24 members of the first training class and selected members of the second and third training class participated at EBR-II. Although this experience has been greatly diluted (only 12 members of the operating crews with EBR-II experience remain due to attrition), the experience was extremely valuable in the preparation of operating and administrative procedures. The majority of the initial system experts were EBR-II experienced which also provided an increased experience level to the qualification program. With availability of hands on experience at FFTF and at the FFTF Operator Training Simulator, these off-site programs were discontinued in 1977.

The High Temperature Sodium Facility (HTSF) was used to provide sodium experience by direct loan of operators for two year assignments and a formal training program for selected members of the first training class.

The FFTF Operator Training Simulator provided valuable training for all Operations Engineers and Reactor Technicians qualifying for sodium fill. This training consisted of 72 hours actual simulator time with emphasis on operating characteristics, instrumentation, control of the plant and procedures. This initial training also included reactor startups and shutdowns, response to casualty conditions, and several simulator examinations.

The Sodium Fill qualification phase is now over. Sodium fill commenced July 1978 and a few words are appropriate in retrospect of the sodium fill qualification process. Several factors greatly affected the eventual implementation of the program. The first factor is attrition. The initial plan called for four classes to provide 105 operators. However, the initial plan was based on an initial criticality date in 1975. The attrition is shown by the fact that over 180 hirees started the classes since 1974 and we started our eighth class this month. Some of the attrition was planned as the support staffs were established. Promotions are inevitable if recruiting is effective in getting top people and it is as shown by the fact that 23 personnel have been promoted since 1974. 42 people who have left the crews are still with the FFTF Project so the training and experience gained in the operator training program is still being utilized for the good of FFTF. The lesson learned here is that excessive attrition should be expected if plant delays are encountered.

The second factor is demands on operator time. As can be seen in Figure 1, the demands are varying and much dependent on construction completion of systems. In 1975 thru 1977, procedures and qualification were major

time consumers. In 1977 to 1978, the testing and site support requirements ramped up rapidly while procedure preparation and qualification ramped down. This is to be expected, but the graph points out that the demands on the operator time did not leave excess time and the buildup of operators was appropriately timed.

Cold Plant Qualification builds on the Sodium Fill Qualification and emphasizes principles of reactor operation, the performance of evolutions and procedures that could not be performed before initial sodium fill, and control room training in the Operator Training Simulator. Refresher courses in radiation safety and criticality control are being provided prior to the fuel load. Control room operators and supervisors will receive additional simulator training which emphasizes the procedures to be used on the FFTF fuel load and approach to criticality. The next section will go into detail about the final certification process for cold plant qualification.

Requirement

The reactor operators training shall be sufficiently comprehensive to cover all areas which are applicable to the candidates job descriptions.

FFTF Implementation

The FFTF Qualification card was written from the start to cover most of the normal, infrequent and off-normal conditions encountered by the watchstander. The qualification card is directly applicable to all areas of the candidate's job description. The overall training program described above support the qualification requirements by virtue of a comprehensive academic class which is the base for a detailed "hands-on" training in each of the areas designated on the qualification program. The estimated hours to qualify at the different levels are:

Operating Technician	800 manhours
Reactor Technician (Reactor Operator)	1100 manhours
Operating Engineer (Supervisor)	1300 manhours

These are approximate hours and do not include classroom time of over 300 manhours.

FFTF OPERATOR UTILIZATION

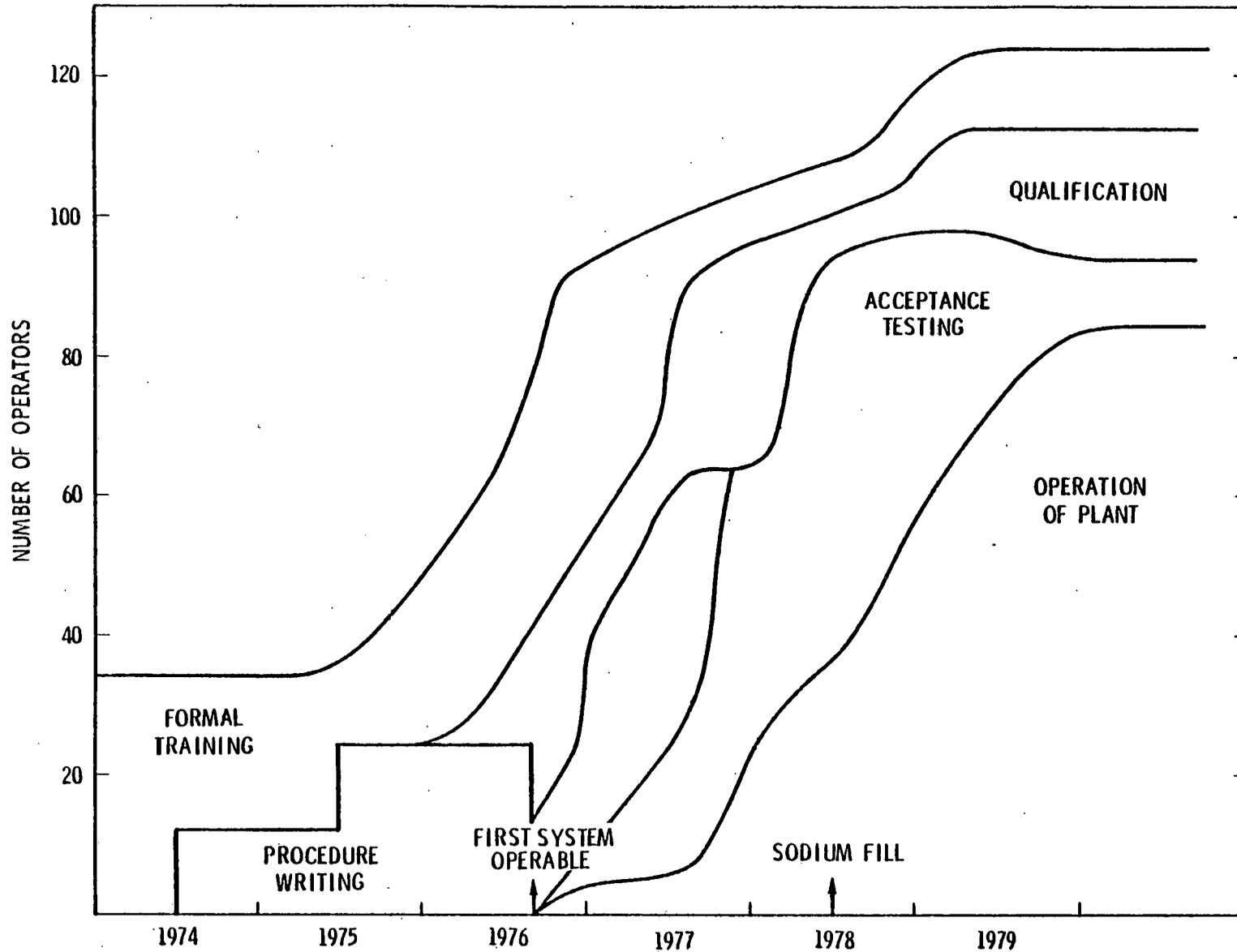


Figure 1

CERTIFICATION

Requirement

Written procedures for certification by management of qualified reactor operators and supervisors shall be developed and implemented. Certification shall be made either by senior line management or by a committee designated by management.

FFTF Implementation

This is being accomplished for initial certification of operators with the Cold Plant Qualification Plan. The plan describes the Cold Plant qualification examination sequence (i.e., certification examinations to be administered prior to the initial fuel loading and startup). The Cold Plant qualification requirements are particularly stringent as a result of the plant's complexity and uniqueness. Only certified persons shall operate the reactor or operate auxiliary systems which significantly affect reactor safety (this shall not exclude operation by trainees or other designated persons under the supervision of a qualified operator).

Certification shall be made by the manager of FFTF Testing and Operations or the manager of Operations based on the recommendation of a board convened to examine the individual orally and to monitor the operational examination performed at the Operations Training Simulator (OTS). The board composition for the two levels is:

1) Supervisor Certification

- . The Manager of Testing and Operations (for Shift Operations Managers boards only) or Operations Manager
- . An FFTF Project Manager
- . A qualified cross-crew Shift Operations Manager (except for Shift Operations Managers boards)

2) Reactor Operator

- . The Manager of FFTF Operations
- . A qualified cross-crew Shift Operations Manager
- . A qualified cross-crew Operations Engineer or an Operations Services Engineer

Requirement

Neither reactor operators nor supervisors may be certified by his/her immediate supervisor.

A line manager or supervisor may administer the examination if the contractor does not have expertise from which to draw. However, if the employe who administers the examination is also to be certified or recertified, he shall not be examined by those persons whom he examines nor can examine himself.

FFTF Implementation

The immediate Shift Operations Manager recommends, but does not certify an operator or supervisor. Upon completion of all prerequisites, the Training Manager informs the FFTF Testing and Operations Manager or the FFTF Operations Manager and recommends the certification of the operator. The FFTF Testing and Operations Manager is responsible for certifying Shift Operations Managers. The Operations Manager is responsible for certifying all others. If the appropriate manager concurs with the findings of all examinations and all recommendations, he endorses the accompanying letter, certifying the operator as qualified. Oral examination boards for final certification include appropriate managers from other groups as discussed above. OTS Training Engineers administer portions of the operational examination and the written examination.

Requirement

Certification should be based on successful completion of written, oral, and manipulative examinations in subjects covered in the Training Program Description.

FFTF Implementation

Written, Oral and Operational Examinations are required for certification of reactor operators. Both written and oral examinations are a part of the training program discussed earlier.

The operational examination to be administered at the OTS provides determination of the qualification of a Reactor Technician to perform control room reactor operations. An in-plant walkthrough is not required because all control room operators must have previously qualified on all watchstations outside the control room.

Requirement

Certification shall be made only after assuring that all the requirements of training and examinations (including written, operating, oral and medical) have been satisfied and management has assured that the reactor operator and supervisor are capable of performing satisfactorily all of the functions of the assigned tasks.

FFTF Implementation

The training requirements established for certification as an operator at the Fast Flux Test Facility include successful completion of a combination of academic, Operations Training Simulator, and experience requirements as established in the FFTF Training Plan. These requirements are appropriate to the level of qualification.

All operators must receive and satisfy the criteria of a medical examination that is given by HEHF to reveal health problems that could interfere with operating assignments.

The operator demonstrates completion of in-plant qualification at the appropriate level by completion of Qualification Cards. Verification is performed by the operator's Shift Operations Manager. For Shift Operations Managers, the verification is performed by the Operations Manager.

The Shift Operations Manager determines to his satisfaction that an operator is qualified and capable of safely operating all systems appropriate to his qualification goal prior to recommending that operator for written, operational and oral examinations.

The successful completion of all operational, written, and oral examinations is a prerequisite for certification. Certification is made only after assuring that all the requirements of training and the examinations have been satisfied and management has assured that the operator is capable of performing satisfactorily all of the functions of the operator's appropriate level. The certification is valid for a period of two years.

Requirements

The documentation for each candidate shall include:

- a) Education, experience, employment history, and health evaluation.*
- b) Training programs completed.*
- c) Records of written examinations consisting of the candidates answers and examiners evaluation.*
- d) Records of oral and operational demonstration examinations including either a listing of the basic questions asked and tasks performed or a general summary of each area covered, an evaluation of the operator's/supervisor's response and a general summary of oral examination by the examiner which includes but is not limited to an evaluation of the knowledge, ability, and performance of the operator/supervisor.*
- e) Records of initial certification and the most recent recertification with dates and approval signatures.*

FFTF Implementation

The documentation for personnel qualified for operation of the Fast Flux Test Facility is maintained in a form amenable to internal and external audit. All records related directly to qualification are maintained for a period of at least ten years. Records include:

- . Education, experience, employment history, the HEHF health evaluation and appraisals of performance.
- . Training program completion records including lesson plans, video-tape summaries, examination, and class standings.

REQUALIFICATION

Requirement

A retraining program shall be established to provide training on changes to plant procedures, areas in which the candidate shows deficiency, areas in which the candidate is not routinely exposed and other areas necessary to keep the operator/supervisor proficient. The retraining program shall include:

- a) Continuous refresher training*
- b) In-depth retraining at least annually in abnormal plant procedures and emergencies*
- c) Immediate retraining in identifiable weak areas*

FFTF Implementation

The FFTF requalification program is designed so that an operator remains qualified on his most senior qualification level and also maintains proficiency on stations encompassed by that qualification level. The requalification program defines the requalification requirements for each qualification level and the manner in which these requirements are met and evaluated. It includes an annual written examination, a preplanned lecture series, reactivity control manipulations, system operation, demonstration of applicable procedures, cognizance of changes to facility design, and review of infrequent and recovery procedures. For those operating stations involved in Control Room operation, substantial use of the OTS will be made.

A preplanned lecture series has been established to review seldom used but safety related procedures, systems and basic fundamentals to help insure that operator proficiency is maintained. The general topics covered in this lecture series are:

1. Theory and Principles of Reactor Operations
2. General and Specific Plant Operating Characteristics
3. Plant Instrumentation and Control Systems
4. Plant Protection Systems
5. Engineered Safety Systems
6. Normal, Infrequent and Recovery Operating Procedures
7. Radiation Control and Safety
8. Technical Specifications

The program consists of 64 hours of lecture divided amongst the eight topics. Each topic is administered in two portions. The first is a general discussion of the subject, and the second considers the specific application to FFTF systems or problems. An example as applied to theory of reactor operation would be:

General: Discussion of the fission process, neutron multiplication process and reactivity insertion mechanisms.

Specific: Discussion of FFTF reactivity coefficients, reactor kinetics, dynamics and inherent safety concepts.

Supervisors and Reactor Operations are required to attend both portions of each topic (unless exempted by previous examination) while a balance of plant operator is required to attend only the general portion.

The eight topics which make up the lecture series are grouped into four groups of two. Following the completion of each group, an examination of about two hours duration is administered. Thus, over a span of one year, all topics are presented and four examinations are given. Each individual examination is divided into a general and specific part for each topic and thus can be given to all personnel involved in the lecture series.

If an operator receives a failing grade on the examination for any topic, he is considered to be uncertified and must review the material and be reexamined until he can achieve a passing grade on the reexamination. A remedial program is established to ensure timely review and coverage of all necessary material.

Requirement

The contractor's operator and supervisor training and examination system shall provide for:

- a) Training on a continuous basis*
- b) Refresher training prior to examination*
- c) Sufficient company time for training*
- d) Reexamination at least annually in all procedures for handling abnormal plant conditions and emergencies, and biennial reexamination on all other subjects.*
- e) Retraining and reexamination in any other weak areas discovered.*

FFTF Implementation

A long term schedule has been developed and is being computerized to allow periodic flagging and review of training requirements. This will not only be utilized to monitor Reactor Operations requirements, but also Hanford Engineering Development Laboratory requirements for periodic safety meetings, emergency equipment training, emergency response team training and others.

Refresher Training is provided by the preplanned lecture series.

A five crew rotation has been established to ensure adequate time is available for training. The rotation has a period of 35 days, and a crew would have four days available from each 35 for training purposes.

The requirement for annual and biennial reexamination is covered by utilizing quarterly examinations. This method ensures an annual examination on recovery and emergency procedures.

Remedial action in identified weak areas consists of a formal review by the individual's Shift Operations Manager, followed by the establishment of a formal remedial program. This program requires concurrence of the Training Manager and must be completed before the individual is allowed to repeat any examinations.

Requirement

The reexamination shall include written, oral and operational testing (the time between examinations on each category is not greater than two years on the average and the maximum time interval between qualification on any category does not exceed 27 months).

FFTF Implementation

In order to evaluate an individual for requalification, several tools are used.

1. The annual written examination series discussed in the previous section in conjunction with the lecture series is administered.
2. Periodic short written or oral examinations on procedures and design changes are administered while on shift by the Operations Engineer and reported to the Training Manager.
3. Periodic OTS refresher training provides for the evaluation of the operator's performance and competency. The report documents drills performed and includes an evaluation of the operator's action.
4. A semi-annual operator proficiency evaluation by Operation's Management on performance of watchstanding abilities.

An operator will be disqualified for failure to satisfactorily complete any of the above.

Requirement

The contractor has the following options:

- a) *Giving one examination biennially which covers all topics.*
- b) *Giving examinations on selected topics throughout the two year period.*
- c) *In lieu of training prior to examinations, give a comprehensive examination prior to retraining (written and oral) in each category, as well as an operational examination, to determine weak areas in which the operator/ supervisor shall be retrained and retested.*

FFTF Implementation

The four examinations administered during a year are collectively considered to be the annual and biennial examinations required. Administering the annual examination in four parts has several advantages:

1. Operators with academic deficiencies are identified earlier and can be given special help.

2. Scheduling two hour examinations for shift personnel is easier than scheduling an eight hour examination.
3. The operator is much more capable of studying effectively for several short examinations than for one long examination.

This method helps minimize the probability that an operator will have an unsatisfactory examination performance which reduces the need to remove operators from watchstanding responsibilities and helps to provide a consistent level of understanding of all operators.

The results of the examination series are used to evaluate the effectiveness of the series, plan the next years series, and identify any operators who may be exempted from the next lecture series. If an operator receives a grade of greater than 90% on the examination for any topic, he is exempted from the next year's lecture on that topic. However, he must take the next years examination on that topic. As long as he scores above 90% he will continue to be exempted from mandatory lecture attendance.

Requirement

Examination - Written, operational, and oral examinations shall be prepared and administered by the contractor to satisfactorily demonstrate the required knowledge of reactor operators and supervisors. These examinations shall include questions on all categories listed above. DOE shall concur in the type, depth, and breadth of the examinations for initial certification. Administration of examinations of reactor operators and supervisors shall be by those personnel sufficiently knowledgeable to ascertain candidate deficiencies. The examination contents, administration, and evaluation of the examination shall be reviewed by personnel other than the candidate or his immediate supervisor.

FFTF Implementation

Examinations will satisfactorily demonstrate the required knowledge for FFTF Operations. The content of these examinations and their administration has been discussed in the previous section. DOE concurrence was obtained for Sodium Fill Qualification and will be for Cold and Hot Plant Certification. Examination administrators are selected because of extensive qualifications or capabilities in a specific area, or, for management personnel, because of significant program familiarity. Shift Operations members of boards (including Shift Operations Managers) must be certified prior to acting as a board member. Training engineers have an aggregate of seven years of simulator experience including participation in NRC examination administration.

Examinations are reviewed for content and administration by the FFTF Training Manager. The evaluation for oral, written and operational examinations is prepared by members of the appropriate board or of the Training Staff and reviewed by the Training Manager who is not an immediate supervisor for the candidates. It is again reviewed by the Operations Manager (or Testing and Operations Manager for Shift Operations Managers reporting to the Operations Manager) prior to certification.

Requirement

The candidate shall not be allowed to function as a certified operator/supervisor if he has not completed all of the requalification program within two years of the previous certification. If a certified operator fails a required portion of a recertification examination or shows serious deficiencies which indicate he may operate in an unsafe manner, then he is to be considered uncertified even though the time of his previous certification has not expired. In addition, the recertification of previously certified operators/supervisors shall be based on:

- a) Operating records and experiences during the past certification period.*
- b) Successful completion of appropriate portions of the retraining and retesting program.*
- c) Review by and concurrence of designated official(s) independent of the facility management.*
- d) Experience. If an operator or supervisor has been away from reactor operations for a period of up to 12 months, selected retraining and oral and/or written and operative examinations shall be given as deemed necessary. However, if the absence is greater than 12 months, appropriate comprehensive written, oral, and operating examinations (as required of initial qualifying candidates) shall be given to determine weak areas. Retraining and retesting shall be required in areas of weakness.*

FFTF Implementation

The requalification requirements as previously discussed include a formal lecture program and a reexamination series to be completed annually. In addition, the requalification program requires performance of specific evolutions. The on-the-job portion of the requalification program is to ensure that all operators maintain their operating proficiency on plant equipment and stay abreast of design or procedure changes. On a regular basis, operators must demonstrate their:

1. Skill with Reactivity Control Systems
2. Understanding of the operation of equipment according to procedure
3. Cognizance of facility design changes and procedure changes
4. Review of infrequent and recovery procedures

To ensure that all supervisors and operators maintain their skill in manipulating reactivity control systems, it is required that each operator perform a minimum of five reactivity manipulations every year. Supervisors can meet this requirement by a combination of actual performance and direction of manipulation as long as he actually performs at least three manipulations. This reactivity control experience may be performed on the actual Reactor Control Panel during normal operation, on the OTS during training sessions, or by using fuel transfer equipment to move fuel drivers or control rods within the core during refueling.

The specific reactivity manipulations which satisfy this requirement include:

1. Startup from refueling conditions to power standby
2. Power ascent from power standby to power state
3. Power descent to hot standby
4. Cooldown from hot standby
5. Power change greater than 10% of full power
6. Removal of fuel assembly from the core lattice
7. Insertion of fuel assembly into the core lattice
8. Removal of control rod assembly from the core lattice
9. Insertion of control rod assembly into the core lattice
10. Removal of a test assembly from the core lattice
11. Insertion of a test assembly into the core lattice

The operator must perform a variety of these manipulations and in satisfying the reactivity manipulation requirement can only count one of each toward the five manipulations per year.

In addition to being used to help satisfy the reactivity manipulation requirement, the OTS is used for extensive operator simulation retraining. The retraining consists of normal reactor evolutions.

As the OTS is operated throughout the various normal operating routines, infrequent and recovery conditions are initiated without prior warning. In this manner, the operators are exposed to actual plant operating conditions and allowed to react to several sets of abnormal situations.

The intent of this training is to provide the operator with substantial experience in nonequilibrium and casualty events during approximately 50 hours of simulation yearly. This gives the best possible assurance that he maintains his proficiency in executing all infrequent and normal FFTF operating procedures.

Operators must demonstrate their understanding of the operation of equipment according to procedure. This is accomplished by requiring that an operator periodically be assigned as the operator on all operating stations which he immediately supervises. To prevent an operator from being away from any station for a prolonged period, he normally operates each station at least once every six months. Also, all qualified Reactor Operators, In-Vessel Fuel Handlers, Supervisors and Refueling Engineers

are evaluated during the performance of their duties at least once every six months. This evaluation is conducted by the Operations Manager, Shift Operations Manager, or Training Manager for the Chief Operator and Refueling Engineer and by the Shift Operations Manager, Operations Engineer or Training Manager for the Reactor Operator and Refueling Technician.

Acceptable methods for performing this evaluation include observation:

- 1) during actual operation for at least a four hour period, or
- 2) during a simulated walkthrough of the procedural steps required to operate the pertinent equipment.

Requalification requires concurrence of the Training Manager and an FFTF Project Manager not reporting to the Testing and Operations Manager. In the event that an operator or supervisor has not operated for a period of up to 12 months, then all missed examinations, OTS training and on-the-job training must be made up. In addition the Shift Operations Manager, with the concurrence of the Training Manager, will prepare a remedial program to provide assurance that safe operating is not compromised. An operator/supervisor who has not been involved in operations for a period in excess of one year will be required to requalify.

Failure of any written examination, serious misperformance of any evaluation, or failure of any OTS examination shall result in lapsing of certification. Certification shall not be restored until a remedial program is completed.

Conclusion

The FFTF is unusual in that no comparable facility exists and thus no existing training package can be easily modified to meet Operator Training needs. This has resulted in the evolution of an in-house training program and has brought out the accompanying development pains. Identification of the applicable requirements and surveying established programs to build an experience base of acceptable solutions is vital to establishment of a viable training program. The FFTF Training Program is designed to be in compliance with the present DOE requirements and to be in compliance with presently proposed DOE manuals when they are implemented; and provides a sample of an acceptable program for others to utilize in their program development.