



KANSAS GAS AND ELECTRIC COMPANY

GLENN L. KOESTER
VICE PRESIDENT - NUCLEAR

February 25, 1982

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555



KMLNRC 82-165
Re: Docket No. STN 50-492
Subj: NRC Management Structure and Technical Resources
Review Team Commitments

Dear Mr. Denton:

The NRC's Management Structure and Technical Resources Review Team visited KG&E offices in Wichita and at the Wolf Creek Site during the week of January 18, 1982. During the visit KG&E committed to revise or clarify several items in the Wolf Creek FSAR and to provide some additional information.

The attachments document KG&E's resolution of the meeting's commitments, except for those related to our training described in FSAR Section 13.2. A complete revision of FSAR Section 13.2 will be forwarded to the NRC by March 5, 1982 to document our revised training commitments.

Attachment I provides revised FSAR pages which include:

1. A description of the Wolf Creek Plant Safety Review Committee's (PSRC) review of major and minor designated procedures (Section 13.5.1.2).
2. A description of how the PSRC and Joint Test Group review pre-operational test procedures and results (Sections 13.4.1.1, 14.2.3.2.1).
3. Wolf Creek Fire Plan revisions to document annual hands-on training for fire brigade members (WCGS Fire Protection Program Section 2.1).
4. An amplified description of KG&E's program to 1) upgrade the academic qualifications of our Senior Reactor Operator and

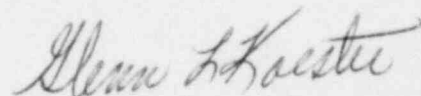
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- Shift Supervisor personnel, 2) review the Wolf Creek Control Room to make information and controls more useful to operators, 3) provide shift consultants with operating experience, and 4) use of a WCGS specific simulator for training. These sections describe KG&E's present and long-term solution to the issue of a shift technical advisor in the control room. As described in the FSAR change, it is KG&E's strongly held opinion that the augmented training program for our operators better serves public safety than does adding a separate shift technical advisor (Sections 18.1.1.2, 18.1.1.3).
5. Contingent upon the acceptability of 4) above, KG&E's commitment to an operating shift crew compliment of 10 personnel including an individual trained in chemistry procedures (Radiological Emergency Response Plan Table 1.1-1).
 6. An updated resume for the plant Maintenance Supervisor which describes his experience and training. In addition, KG&E commits to sending the Maintenance Supervisor for additional training on ASME Code Sections III and XI to expand his previous code knowledge. This training will be complete at least six months prior to fuel load (Section 13.1.3.2).

The revised FSAR material will be formally incorporated into the Wolf Creek Generating Station, Unit No. 1, Final Safety Analysis Report in Revision 9. The information herein is hereby incorporated into the Wolf Creek Generating Station, Unit No. 1, Operating License Application.

Yours very truly,



GLK:bb
Attach

cc: Mr. J.B. Hopkins (2)
Division of Project Management
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. Thomas Vandell
Resident NRC Inspector
P.O. Box 311
Burlington, Kansas 66839

Mr. Eric Johnson
U.S. Nuclear Regulatory Commission, Region IV
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011

OATH OF AFFIRMATION

STATE OF KANSAS)
) SS:
COUNTY OF SEDGWICK)

I, Glenn L. Koester, of lawful age, being duly sworn upon oath, do depose, state and affirm that I am Vice President - Nuclear of Kansas Gas and Electric Company, Wichita, Kansas, that I have signed the foregoing letter of transmittal, know the contents thereof, and that all statements contained therein are true.

KANSAS GAS AND ELECTRIC COMPANY

ATTEST:

W.B. Walker

W.B. Walker, Secretary

By *Glenn L. Koester*
Glenn L. Koester
Vice President - Nuclear

STATE OF KANSAS)
) SS:
COUNTY OF SEDGWICK)

BE IT REMEMBERED that on this 25th day of February, 1982, before me, Evelyn L. Fry, a Notary, personally appeared Glenn L. Koester, Vice President - Nuclear of Kansas Gas and Electric Company, Wichita, Kansas, who is personally known to me and who executed the foregoing instrument, and he duly acknowledged the execution of the same for and on behalf of and as the act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal the date and year above written.



Evelyn L. Fry
Evelyn L. Fry, Notary

Commission expires on August 15, 1984.

SNUPPS-WC

procedures for that activity. The actual preparation of procedures may be performed by other KG&E personnel or by outside contractors, but the final responsibility lies with the designated responsible position.

Temporary changes can be made to approved procedures. Temporary changes must be approved by a cognizant Group Leader and the responsible Section Supervisor. At least one of these members shall have a Senior Reactor Operator license for all procedures affecting plant operation.

Procedures are classified by the Plant Safety Review Committee (PSRC) as Safety-Related (SR) or Non-Nuclear Safety-Related (NNSR). The SR procedures are further subdivided into Major and Minor procedures. All procedures are reviewed and the reviews documented by qualified personnel. All major SR procedures shall be reviewed by at least one individual other than the preparer, by the Plant Safety Review Committee (PSRC), and by the Plant Superintendent. Review by the PSRC may be conducted and documented by individual members outside of formal meetings.

Temporary changes to major procedures which do not change the intent of the approved procedure revision may be made provided such changes are approved by the Cognizant Group Leader and one of the Duty and Call Supervisors. At least one of these members shall have a Senior Reactor Operator license for all procedure affecting plant operation. These changes shall subsequently be reviewed by the Plant Safety Review Committee (PSRC) and approved by the Plant Superintendent and shall then become permanent changes if appropriate. Permanent changes to major procedures will be reviewed and approved as per the previous revision.

All temporary and permanent changes to minor SR procedures shall be approved by a cognizant group leader and reviewed and approved by the PSRC or an assigned subcommittee of the PSRC. All temporary and permanent changes to NNSR procedures will be approved by a cognizant group leader and reviewed and approved by the responsible section supervisor.

13.5.1.3 Procedures

The Plant Superintendent will develop and implement station administrative procedures that provide a clear understanding of operating philosophy and management policies. As stated in 13.5.1.2, administrative procedures will be implemented that provide methods for preparation, review and approval of all other station procedures including permanent procedures, temporary procedures or any procedures that might be of a transient or self-cancelling nature.

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13.4 REVIEW AND AUDIT

A program for review and audit of activities affecting station safety during the operational phase has been established. The program provides a system to insure that these activities are performed in accordance with company policy and rules, approved procedures and license provisions. This program will provide review of safety-related plant changes, tests, and procedures.

13.4.1 ONSITE REVIEW

Proposed physical changes to nuclear-safety-related systems, changes to nuclear-safety-related procedures, any new or modified tests or experiments involving nuclear-safety-related systems, and unplanned events that have operational nuclear-safety significance will be reviewed by the Plant Safety Review Committee.

13.4.1.1 Plant Safety Review Committee (PSRC)

The PSRC is composed of certain supervisory and technical personnel as described in the Administrative Controls Section of the Technical Specifications. The PSRC is charged with reviewing those nuclear-safety-related activities described in the Technical Specifications and with advising the Plant Superintendent on the disposition of those items reviewed. The PSRC may also review other nuclear-safety-related activities as deemed appropriate by the Plant Superintendent.

A subcommittee of the PSRC, the Joint Test Group (JTG) is established for the review of preoperational test procedures in accordance with Section 14.2.3.2.

13.4.2 INDEPENDENT REVIEW

Activities affecting station safety occurring during the operational phase will be independently reviewed by the Nuclear Safety Review Committee.

13.4.2.1 Nuclear Safety Review Committee (NSRC)

The NSRC will function as an independent body to review safety-related station matters. It shall report its findings and recommendations to the Vice President - Nuclear. The membership of the NSRC and the subject matter to be reviewed is detailed in the Administrative Controls Section of the Technical Specifications. The NSRC may also review other safety-related activities as deemed appropriate by the Vice President - Nuclear.

14.2.2.6 Qualifications of Key Personnel

The qualifications for key plant operating personnel are described in Chapter 13.0.

The qualification requirements for startup personnel involved in the WCGS startup program conform to capability levels per ANSI N45.2.6 and Regulatory Guide 1.8 recommendations.

All test personnel will be indoctrinated in the startup administrative procedures, methods and controls.

14.2.3 TEST PROCEDURES

14.2.3.2 Procedure Review and Approval

14.2.3.2.1 Joint Test Group (JTG)

A subcommittee of the PSRC, the JTG will be organized by KG&E to review preoperational test procedures and preoperational test results.

The primary JTG functions will be to:

1. Review preoperational test procedures and recommend their approval by the Plant Superintendent and the Startup Manager.
2. Evaluate and authorize changes to preoperational test procedures as detailed in the Startup Administrative Manual.
3. Evaluate preoperational test procedure results and present those results to the PSRC for its approval.
4. Recommend that the Startup Manager and the Plant Superintendent approve for system turnover purposes the preliminary preoperational test results. By his approval of the preliminary test results, the Plant Superintendent accepts turnover of the tested system from Startup.

Membership in the JTG will include the following personnel or their designated representatives:

- c. The toxic characteristics of expected products of combustion.
- d. Identification of the location of fire fighting equipment for each fire area and familiarization with the layout of the plant, including access and egress routes to each area.
- e. The proper use of available fire fighting equipment and the correct method of fighting each type of fire. The types of fires in cables and cable trays, hydrogen fires, fires involving flammable and combustible liquids or hazardous process chemicals, construction fires, and record file fires.
- f. The proper use of communication, lighting, ventilation, and emergency breathing equipment.
- g. The proper method for fighting fires inside buildings and confined spaces.
- h. The direction and coordination of the fire fighting activities (Fire Brigade Leaders only).

NOTE: Fire Brigade Leaders and all other operations personnel, assigned to Fire Brigade duty, will also receive training in the following areas:

- i. Detailed review of fire fighting strategies and procedures.
- j. Review of the latest plant modifications and corresponding changes in fire fighting plans.

2.1.3 Practice Sessions

All Fire Brigade members will participate in training exercises designed to provide experience in actual fire extinguishment and the use of emergency breathing apparatus under strenuous conditions, as those which may be encountered in fire fighting. These exercises will be included in each Fire Brigade member's initial training. Practice sessions will be provided on an annual basis for all Fire Brigade members.

2.1.4 Assignment to Fire Brigade Duty

Upon the completion of the training outlined in Section 2.1.2 and 2.1.3 the individual's name will be placed on the

Fire Brigade roster. He may then be assigned to Fire Brigade duty as needs require.

2.1.5 Complete Training for Fire Brigade Members

Over a two year period following initial qualification, Brigade members will receive periodic refresher training such that all areas of Section 2.1.2 are covered within the two year period. The training may consist of a combination of classroom work and drills as described in Section 2.6. Training sessions will be conducted at least once every three months. To maintain active status on the Fire Brigade Roster, each member must complete all of the refresher training, practice sessions and must participate in at least two fire drills per year.

2.2 Training for Personnel Authorized Unescorted Access to WCGS

18.1.1.2 KG&E ResponseGeneral

As stated in NUREG-0737 and the above position statement, the requirement for an STA qualified person in the power plant in addition to an SRO licensed Shift Supervisor is a temporary requirement until the qualifications of the Shift Supervisor are upgraded and control boards are reviewed and modified to make information and controls more useful to the operators. This is consistent with the industry consensus established by INPO standard GPG-01, "Nuclear Power Plant Shift Technical Advisor Position Description Qualifications, Education and Training" which refers to the fact of this position being "eliminated" when certain additional actions are completed and the December 17, 1981 approved copy of ANSI/ANS 3.1 which also referred to this position as "interim." Two members of the NRC staff participated in the preparation and approval of ANSI/ANS 3.1.

Control Room Review

The SNUPPS plants have retained a consultant to conduct control board "human factors" reviews. Results of these reviews have already partially been submitted to the USNRC. Four significant actions have been undertaken and will be completed by fuel load to improve the operator-control board interface and the decision making process by the Shift Supervisor.

1. Extensive rearrangement of switches, recorders and indicators is being undertaken to improve location relationship of equipment controls and associated indications.
2. The location of all annunciators have been reviewed and an extensive hierarchical prioritization arrangement has been developed to assist the operator in recognizing independently significant and dependent annunciator alarms.
3. Panels of status and permissive lights have been rearranged into functional groups and methods of designating different plant safeguards modes have been considered to improve the operator's ability to understand and respond to these indications.
4. The SNUPPS utilities, in conjunction with the Westinghouse Owner's Group, have developed an extensive Safety Parameter Display System with an ability to display critical parameters, both quantitatively and graphically. The Senior Reactor Operators in the control room will have these Safety Parameter Display Systems available to

them to monitor plant conditions during any incident.

The original SNUPPS control board design had significant Prairie Island and Ginna plant operating experience input from Northern States and Rochester Gas and Electric during the initial design phases and had more extensive mimicking than most nuclear plant control boards. The above modifications are improving upon one of the better pre-TMI control board designs and should result in the control board supplying relevant, easy to comprehend information to all control room personnel.

College Program

KG&E is conducting an extensive college education program to upgrade the academic qualifications of its SRO candidates. If the 60 semester credit hours of college level courses in mathematics, reactor physics, chemistry, materials, reactor thermodynamics, fluid mechanics, heat transfer, electrical and reactor control theory are necessary for nuclear power plant control room operations, it is the strongly held opinion of KG&E that this training should be invested in one or more personnel responsible for the shift operations as opposed to adding a technical advisor position. KG&E is of the opinion that the public safety is much better served if appropriate personnel responsible for safe operation of the plant have all the prerequisite knowledge for plant operations and safety, rather than having to rely on an advisor. The placement of increased knowledge in line supervisory personnel is far more effective in the decision making process than a separate "advisor" who has specialized technical training but far less, if any, operating experience than any of the individuals that he is "advising." Human engineering dictates a solution based on utilization of line management.

KG&E engaged the services of the faculty of Emporia State University and Kansas State University to conduct college level courses for college level credit in the following subjects (semester credit hours in parentheses):

- College Algebra (3)
- Trigonometry (2)
- Calculus I and Calculus II (6)
- Applied Differential Equations (3)
- Chemistry I and Chemistry II with labs (8)
- Physics I and Physics II with labs (8)
- Statics (3)
- Properties of Engineering Materials (2)
- Electrical Circuit Technology with lab (4)
- Energy Conversion Technology (Thermodynamics) (3)
- Mechanics of Fluids (3)
- Materials of Reactor Systems (2)

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Radiation Detection and Monitoring with lab (3)
Nuclear Reactor Technology I and II (neutron physics,
reactor theory, control theory) (6)
Nuclear Reactor Thermal Technology (reactor fluid
systems and heat transfer) (3)
Radiation Protection (2)

The above classes are part of the Kansas State University curriculum to obtain a Bachelor of Science in Engineering Technology, Nuclear Reactor Technology option, degree. This program is accredited by the ABET/ECPD (Accreditation Bureau for Engineering and Technology of the Engineering Council of Professional Development). This program has been submitted to INPO and certified in writing by INPO as meeting all the college level academic requirements for the Shift Technical Advisor. This program addresses every topic in the December 17, 1981 ANSI 3.1 standard for Shift Supervisor academic training. This program provides college level training in every topical requirement of any proposed 10CFR55 draft revision that has come to public view. The Kansas State-Emporia State University program provides training in every topic proposed to date and should more than satisfy any final requirements for college level training.

As of February 1, 1982, 28 credit hours of the college level program have been completed. The remainder of the program will be taught in four more 8-week segments to be completed by January, 1983. KG&E has 16 personnel participating in this program full time and seven others participating part time depending on previous college experience. These personnel are all shift supervisors, supervising operators, or control room operator candidates. Additional plant staff engineers will participate in many of the nuclear courses. Academic results to date have been excellent, and this program should provide a significant pool of personnel with appropriate academic qualifications on shift.

In recognition that a program to provide college level training to future operators will be required, KG&E has contracted Emporia State University and Kansas State University to provide continuing services in the future. All the lectures by faculty members have been videotaped and these will be edited and supported with workbooks that reference the videotapes, textbooks and examples to reduce the onsite professorial participation in the future. However, Emporia State University and Kansas State University will continue to administer examinations, teach a reduced number of lectures and provide counseling for the conduct of these courses for future SRO candidates.

Shift Consultants

KG&E has committed to augmenting each on-shift crew during plant startup and the first year of operation with personnel who have previously held an SRO or RO license on a large commercial PWR. These personnel will be consultants to the Shift Supervisor and will provide advice and recommendations to him based upon their previous operating experience.

Simulator Training

KG&E has purchased a WCGS specific simulator which is planned to be installed at the plant and tested in 1982 with operator training utilizing this simulator to commence in 1983. The simulator design contains standard SNUPPS power block systems and WCGS site specific systems. KG&E is committed to Regulatory Guide 1.149 (ANSI 3.5 - 1979) which provides that the simulator be continuously updated to keep it within eighteen months of the WCGS plant control. All human factors modifications to the WCGS control board will be included in a timely manner into the simulator control board. At the completion of the preoperational test program, data that is appropriate to the simulator will be reviewed and included in the simulator data base.

Prior to the availability of the WCGS simulator, WCGS operator training utilizes SNUPPS simulators operated by Westinghouse. These simulators duplicate the pre-human factors reviewed control room for WCGS's sister plant Callaway.

Therefore, WCGS operator training and retraining involving a simulator has been or will be accomplished utilizing a simulator which duplicates or very closely duplicates the control room environment and design characteristics of WCGS. This provides valuable exposure of the WCGS operator to simulated situations which are nearly identical to those he may experience in the WCGS control room and, therefore, gain valuable knowledge for diagnosing and properly responding to actual control room situations.

In the event that a shift crew does not contain one SRO who fulfills the educational guidelines established by the above training program, the Technical Specifications will require that the crew will be supported onshift by a Duty/Call Technical Advisor (DCTA).

These DCTAs will serve as assistants to the Shift Supervisor. The DCTA will be present on all shifts when required and available to report to the control room within 10 minutes of notification of an "off normal" event. The DCTAs will be designated from the engineering and scientific personnel at the Wolf Creek Generating Station (WCGS). The DCTA will not

have the authority to perform or direct plant control manipulation, unless, the DCTA is a licensed SRO and is authorized by the Shift Supervisor to do so.

Specific responsibilities of the DCTAs will be delineated in administrative procedures and emergency plan implementing procedures. Specific personnel available as DCTAs will be designated in call lists also presented in procedures. Because the DCTAs are selected from the normal facility operating organization, they report to their regularly assigned supervisors during normal operations when not on duty assignment. In an emergency situation, the DCTA reports initially to the Shift Supervisor and the Duty/Call Superintendent when the latter arrives onsite to assume responsibility as Duty Emergency Director. (See the WCGS Radiological Emergency Response Plan.)

DCTAs will possess fundamental knowledge of reactor physics, chemistry, materials, fluid mechanics, heat transfer, and specific knowledge of safety analyses, transient analyses, and plant response as applicable to WCGS. DCTAs will be familiar with plant design; plant layout; and operating, emergency operating, and emergency plan implementing procedures. DCTAs will possess a bachelor's degree in engineering or science. Because the DCTAs will be members of the regular plant operating organization, they will be involved in activities associated with normal plant operation, including review and evaluation of operating experience.

18.1.1.3 Conclusion

KG&E's commitments to:

- a. human factors review of the WCGS control room,
- b. providing the educational background necessary for a more effective control room decision making process in shift supervisory personnel,
- c. temporary use of shift consultants, and
- d. extensive use of WCGS control room simulators in the operator training program

is consistent with the intent and specifics of the long-term solution to item I.A.1.1 of NUREG-0737.

TABLE 1.1-1

MINIMUM STAFFING REQUIREMENTS FOR WCGS
FOR NUCLEAR POWER PLANT EMERGENCIES

Major Functional Area	Major Tasks	Position Title or Expertise	On Shift	Capability for 1 hour	Additions 2 hours
Plant Operations and Assessment of Operational Aspects		Shift Supervisor (SRO)	1	-	-
		Supervising Operator (SRO)	1	-	-
		Reactor Operator (RO)	2	-	-
		Nuclear Station Operator	4	-	-
Emergency Direction and Control*		Duty Emergency Director (Shift Supervisor until relieved)	1**	-	-
Notification/Communication	Notify licensee, State local and Federal personnel and maintain communication	Emergency Communicator	1**	2	1
Radiological Accident Assessment and Support of Operational Accident Assessment	Emergency Operations Facility (EOF) Director	EOF Coordinator (until relieved by Duty Emergency Manager)	-	1	2***
	Offsite Dose Assessment	Sr Health Physics (HP) Expertise	-	1	-
	Offsite Surveys		-	2	2
	Onsite (out-of-plant)		-	1	1
	In-plant surveys	HP Personnel	1	1	1
Chemistry/Radio- chemistry	Chem Personnel	1	-	1	
Plant System Engineering, Repair and Corrective Actions	Technical Support	Shift Technical Advisor	1**	-	-
		Core/Thermal Hydraulics	-	1	-
		Electrical	-	-	1
		Mechanical	-	-	1

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Cooled Fast Breeder reactor where decommissioning, decontamination and fast breeder health physics experience was obtained.

Reactor Engineering Supervisor

W. B. Norton, Reactor Engineering Supervisor, has been employed by Kansas Gas and Electric Company since June, 1979. He obtained a Bachelor of Science degree in Nuclear Engineering from Kansas State University in 1979. Mr. Norton has three years of experience in the nuclear field. He has attended and received certification from the Westinghouse Station Nuclear Engineer Course and has also attended various computer software courses at Westinghouse. Mr. Norton gained refueling and startup experience at the Trojan Nuclear Plant outage of 1981. Plans are being made for him to gain additional experience during the initial core loading and startup testing at the V. C. Summer Nuclear Station. In his three years with KG&E, he has been involved with review of preoperational tests, startup tests, Technical Specifications and preparation of operating procedures.

Maintenance Supervisor

M. D. Rich, Maintenance Supervisor, has been employed by Kansas Gas and Electric Company since June, 1964. He obtained a Bachelor of Science degree in Electrical Engineering from Wichita State University in 1964. Mr. Rich has seventeen years of engineering experience. He has served in various positions with KG&E including Results Engineer, Coordinating Engineer-Central Maintenance, Plant Maintenance Engineer, and Mechanical Supervisor-Central Maintenance. His responsibilities included performance of tests; evaluation of test results; maintenance scheduling; supervision of maintenance crews on major maintenance jobs such as turbine generator overhauls, major boiler modification/repair; and responsible for the total mechanical and electrical maintenance program at a fossil plant.

Mr. Rich has been working in KG&E's Nuclear Department since February, 1976. From February, 1976 until the present, he has served as KG&E's representative on the SNUPPS Spare Parts Group and served as Chairman of that group from 1977 until 1981. As KG&E's representative on the Spare Parts Group he had the responsibility of selecting and ordering all of the operational spare parts for the WCGS. As a part of this process, he became heavily involved in specifying and reviewing the Engineering and QA requirements for the spare parts. Considerable time has been spent by Mr. Rich in studying the ASME Section II code as well as associated Regulatory Guides, ANSI and IEEE Standards in order to perform his job. Mr. Rich was already familiar with the ASME Section VIII code as well as having a good working knowledge of NDE techniques from his years of maintenance experience in KG&E's fossil plants.

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Mr. Rich has served as the Maintenance Supervisor at the site since March, 1979. In this capacity, he has been responsible for establishing the Maintenance Program at the plant. All maintenance on equipment turned over to the Startup Organization is under the Operations Maintenance organization, therefore, the Maintenance Supervisor is responsible for maintenance on equipment starting at initial turnover from Construction to Startup.

In addition to the above, Mr. Rich has participated in a complete refueling outage at Point Beach Nuclear Plant in the Spring of 1981. During this outage, Mr. Rich worked very closely with the Maintenance Superintendent at Point Beach.

The following is a list of related training which Mr. Rich has completed:

Reactor Engineering	Nuclear engineering course taught by Kansas State University - NE 580
PWR Information Course	2 weeks
IRD Vibration Analysis	2-day seminar
Qualification of Safety-Related Equipment for Nuclear Power Generation Stations	3-day seminar
Maintenance and Operation of Centrifugal Pumps	1-week seminar - Pacific
Executive Introduction to Nuclear Power Plant Operations Simulator Courses - Pittsburg SNUPPS Simulator	3 days - 20 hours contact with SNUPPS simulator

Plant Support Supervisor

D. R. Smith, Plant Support Supervisor, has been employed by Kansas Gas and Electric Company since July, 1981. He obtained a Bachelor of Science degree in Electrical Engineering from the University of Kansas in 1964 and a Master of Business Administration from the University of Washington in 1980. Mr. Smith has 15 years experience in the nuclear field. He served 20 years in the U.S. Navy, receiving a commission in 1964 and retiring in 1975. His duties/positions have included reactor operator, Electrical Officer, Reactor Control Officer, Engineering Officer of the Watch and Command Duty Officer during shipyard nuclear power plant