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NUCLEAR REGULATORY COMMISSION

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NUCLEAR REGULATORY COMMISSION

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BRIEFING ON OPERATOR TRAINING

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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Monday, March 6, 1989

The Commission met in open session, pursuant to notice, at 10:00 a.m., Lando W. Zech, Jr., Chairman, presiding.

COMMISSIONERS PRESENT:

LANDO W. ZECH, JR.
THOMAS M. ROBERTS
KENNETH M. CARR
KENNETH C. ROGERS
JAMES R. CURTISS

STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

SAMUEL J. CHILK, Secretary
JOSEPH SCINTO, Office of the General Counsel
JOE COLVIN, NUMARC
DR. TERRY WILLIAMS, Virginia Power
LEE WILLIAMS, Alabama Power
CHARLES SCHROCK, Wisconsin Public Service Corp.
WALTER COAKLEY, INPO

P-R-O-C-E-E-D-I-N-G-S

10:00 a.m.

CHAIRMAN ZECH: Good morning, ladies and gentlemen.

On behalf of the Commission, I'd like to welcome the representatives here today from the Nuclear Management and Resource Council, NUMARC, the Institute of Nuclear Power Operations, INPO, and a number of utilities, including Alabama Power, Virginia Power and Wisconsin Public Service Corporation. So, welcome, gentlemen.

This is an information briefing this morning in which representatives from the nuclear industry will describe for the Commission the responsibilities of the operation staff at nuclear power reactors, the knowledge needed to fill those responsibilities and the training being provided to the operating staff.

In the interest of fairness to all commentators and commentors, I believe that it would be inappropriate to discuss matters regarding the proposed rule on the education experience requirements of senior reactor operators at this meeting.

Copies of the meeting slides, I understand, are available at the entrance to the meeting room.

Do any of my fellow Commissioners have any

opening comments before we begin?

If not, Mr. Colvin, welcome. You may begin.

MR. COLVIN: Good morning, Mr. Chairman. Gentlemen, good morning.

I'm Joe Colvin, Executive Vice President and Chief Operating Officer of NUMARC. I want to thank you for this opportunity to appear before you today on the topic of operator training.

Our purpose this morning is to provide you with an actual overview of industry practices and techniques relating to operator training and shift operations. The presenters with me here at the table are the managers who are responsible for those activities at their utilities. Their presentations are focused on the methods and expectations of these programs as they are implemented at their respective utilities. I think you'll see that there are some differences. However, we believe that they are generally representative of the industry as a whole.

Before I introduce the presenters, I want to briefly mention the NUMARC Operators' Issues Working Group. The working group comprised of 18 utility professionals with broad expertise in operations and training was established to help NUMARC resolve important regulatory issues affecting operating

personnel and their training.

The working group was the focal point for industry efforts on the operator requalification issue and has worked successfully with the NRC staff to bring that important issue to proper resolution. The working group is now assisting us in developing comprehensive industry response to the proposed rule on the educational experience requirements of senior operators.

Mr. Don Schnell, Senior Vice President of Union Electric Company is the Chairman of that group but was unable to be with us today because of a prior commitment.

Two of today's presenters, however, are members of the working group. Doctor Terry Williams, on my right, and Mr. Lee Williams, on my left, are both members of the working group, and as well Mr. Coakley or other senior NUMARC representatives participate in those activities.

Mr. Chairman, with your concurrence, I would like to change the agenda order that we previously provided to you and have Doctor Terry Williams first. With your concurrence we'll do that.

CHAIRMAN ZECH: Certainly.

MR. COLVIN: And I'd like to introduce the

presenters and then turn them over to you.

CHAIRMAN ZECH: Fine.

MR. COLVIN: Turn the presentations over to them.

CHAIRMAN ZECH: Good.

MR. COLVIN: Doctor Terry Williams is the Manager of Nuclear Training at Virginia Power and will talk to you on the academic-oriented components of operator training. He has a Bachelor of Science degree in Secondary Education from Old Dominion University, a Master of Education from Virginia Commonwealth and a Doctorate degree from Ohio State.

Doctor Williams has been with Virginia Power since 1981. He has held a succession of supervisory and management positions in power operations and training, has had line responsibility for nuclear training since 1983.

Prior to his employment at Virginia Power, he worked as an Assistant Professor at Penn State University and then as an Assistant Professor at Virginia Commonwealth University.

He's a member of the Academy Council of the National Academy for Nuclear Training and is currently President of the Electric Utility Instructor Training Consortium and was Chairman of the Southeastern States

Nuclear Training Association from 1987 to 1988.

Mr. Williams?

CHAIRMAN ZECH: Thank you. You may proceed.

DOCTOR WILLIAMS: Thank you. Good morning. I've been asked to provide an overview of the academics and engineering fundamentals as presented in operator training programs.

With me today is Mike Crist who is the Supervisor of Training at the North Anna Power Station. Depending on the questions, I'd like to defer to Mike for more detailed responses.

I also have provided you a packet and in the packet is a copy of the slides that I'm going to be presenting, as well as a series of handouts to help provide some detail to some of the areas that I'm going to cover this morning. I'll try to be clear about where I am in both the slide package as well as the handouts.

The presentation objectives that I've set up today are to provide a scope and depth of operator training in the basic science and technology area, as well as to show the relationship of academics to technical training and, lastly, to emphasize performance-based nature of our curriculum development.

Virginia Power is the third largest U.S. investor-owed nuclear power supplier. We have four units, three loop Westinghouse PWRs; two at Surry, for a total of 1562 megawatts, two at North Anna, for 1830 megawatts. Unit 2 at North Anna just experienced a run of over one year.

The nuclear contribution to the energy mix at Virginia Power was 32 percent in 1987 and 34 percent in 1988.

CHAIRMAN ZECH: That means the energy mix in the state?

DOCTOR WILLIAMS: For our service area.

CHAIRMAN ZECH: For your service area?

DOCTOR WILLIAMS: Yes, sir.

CHAIRMAN ZECH: All right.

DOCTOR WILLIAMS: The training facilities at Virginia Power are modern. They have technical training libraries. We have NRC-certified control room simulators. We have shops, labs, ample classrooms and a new addition is the see-thru reactor model. The see-thru reactor model is used, for example, to train mitigated core damage.

We have a training staff that includes the two nuclear sites as well as a corporate group of 139 persons. All of our instructors at the sites are

plant qualified and a good practice in the operations area is to maintain -- for them to continue to maintain their active SR license, which is a commitment to excellence in that it requires seven days on shift each quarter for them to do that, as well as the license operator requal. program.

We have training specialists at each site which provide a blend between the technical and the instructional world, the academic world. There are four training specialists at the site and 15 in corporate. The corporate training group is an evaluation group as well as development and we also have a pretty extensive graphic support, which I should thank for this presentation. They did a nice job.

The operator training target audience is typically either a high school graduate -- we find that they come from the upper half of the graduating class, that they have strong science and math backgrounds -- or the Navy Nuclear Program where we have found that they have proven aptitudes with strong fundamentals.

Our initial training is represented by three phases. I will review those very quickly. The first phase is called Nuclear Foundations Training. The

second phase of the initial training is the Nuclear Control Room Operator Development Program, and the third phase is the RO/SRO license class. I credit the INPO accreditation requirements for a vast improvement in operator training. I think you'll see this as I walk through this curriculum.

In the Nuclear Foundation Training Program, this is a six month, pre-employment course where we identify high school graduates with the proper aptitude. They are tested for math and science aptitudes. They are screened to enter this foundation program, four months of the program. And if you would refer to handout number 1-1, it gives you the layout and the flow chart of the curriculum I'm referring to.

The first 17 weeks is known as a common track where both operators and health physics technicians are in the program combined. You can see by reviewing this handout that we cover the mathematics, physics, chemistry, electricity, D.C. and nuclear physics.

CHAIRMAN ZECH: Where are we on this slide?

DOCTOR WILLIAMS: Okay. It's handout 1-1. It's on the right-hand side of the package. There's a series of handouts.

COMMISSIONER ROBERTS: Excuse me. I want to

understand. I'm not picking at nits, but you said pre-employment.

DOCTOR WILLIAMS: Yes, sir.

COMMISSIONER ROBERTS: These people are not on the payroll?

DOCTOR WILLIAMS: We do offer employees the option to go in, but the program is designed for non-employees that we identify. If they're successful in this program, we then offer them employment. But we do have both hourly and salary personnel who are allowed to enter as a benefit, but it's not -- again, we accommodate both, but it's not designed that way.

Okay. Is everybody with me on the handout?

CHAIRMAN ZECH: Not yet.

DOCTOR WILLIAMS: If you go into the large package --

CHAIRMAN ZECH: Briefing materials for Commissioners it says, 1-1.

DOCTOR WILLIAMS: Yes, sir.

CHAIRMAN ZECH: Okay.

DOCTOR WILLIAMS: Okay. And I'm referring to the first block called "Common Track: 17 Weeks." Again, I'm trying to give a feel for the science and the math that's covered during that period.

COMMISSIONER ROGERS: Could I just ask a

question on that?

CHAIRMAN ZECH: Sure. Go right ahead.

COMMISSIONER ROGERS: In this program, are there homework assignments?

DOCTOR WILLIAMS: Yes, sir, and labs. Yes, sir. As you'll see as I go through here, this program has been reviewed by John Tyler Community College and the two instructors that we have on staff are members of their adjunct faculty and we do get 46 semester credit hours for this program. This program was designed after we had completed the RO and SRO job task analysis. We felt that there was a need in the knowledge area for these fundamental science and math areas.

Again, the program is designed for the upper half high school graduate with three years of science and math. The entire program reviews and reinforces and builds student understanding of the scientific principles and the curriculum design relates academics to nuclear plant technology by illustration, problems, and plant tours.

The curriculum, as I've indicated, is recognized by the Virginia Community College system for 46 semester hours of credit.

CHAIRMAN ZECH: Do you give them

examinations?

DOCTOR WILLIAMS: Yes, sir, we give them both interim course exams and a comprehensive final exam for each phase of the program.

CHAIRMAN ZECH: All right.

DOCTOR WILLIAMS: The students earn, after completing the first 17 weeks, a nuclear foundation technology career certificate with a transcript of 29 semester hours. Then, when they finish their specialty tracks in the operator case, which I'm focusing on today, for nine additional weeks study, they receive 17 credit hours. The courses that are covered there would be represented under the specialty operator track, thermal dynamics, heat flow, transfer fluid flow, reactor theory, electricity, A.C., instrument and control, and electric mechanics I.

CHAIRMAN ZECH: What percentage pass the course and what percentage fail?

DOCTOR WILLIAMS: About -- I'd say 95 percent pass the course and again I think it has to do with our strict pre-screening process. Again, we give aptitude tests, we evaluate their transcripts and they are interviewed by the station Superintendent of Ops. or our Superintendent of Health Physics.

CHAIRMAN ZECH: All right. Thank you.

COMMISSIONER ROGERS: In that specialized operator track, that's supposed to last nine weeks.

DOCTOR WILLIAMS: Yes, sir.

COMMISSIONER ROGERS: Except they all add up to ten weeks. What goes?

DOCTOR WILLIAMS: They just rounded it off. It's a nine week program.

COMMISSIONER ROGERS: So they're not two weeks then, each segment?

DOCTOR WILLIAMS: No. Some of them are probably short a day here or there and it comes out --

COMMISSIONER ROGERS: I see.

CHAIRMAN ZECH: All right.

DOCTOR WILLIAMS: All right.

CHAIRMAN ZECH: All right. Let's proceed.

DOCTOR WILLIAMS: Okay. In your package, if you would refer to handouts 1-2 and 1-3, I tried to summarize out of the John Tyler catalog just the generic course descriptions that cross reference to the curriculum that I showed you in 1-1. 1-3, on the next page, indicates some of the selected college-type level texts that are used in this program. In Virginia anyway, these are pretty standard type texts for freshmen-type level courses.

The second phase of the program is -- and I'm back on my viewgraphs -- is the Nuclear Control Room Operator Development Program. Now, this is a 39 month combination on-the-job qualification and self-study program which is performance based and leads to performance based task qualification. The trainee progresses through the watchstations of increasing complexity.

COMMISSIONER ROBERTS: Excuse me. At this point they're on the payroll.

DOCTOR WILLIAMS: Yes, sir.

COMMISSIONER ROBERTS: What percentage of those who successfully complete, your 95 percent completion, join the company and continue on in this step?

DOCTOR WILLIAMS: Well, because of the investment, we've always offered those successful graduates employment. We just, for obvious reasons in terms of attitudes and things of this sort, don't make an employment offer for the foundation program. We have found -- this program is a carryover from a program that used to exist at Memphis State. Basically, it's a similar type program that we just do internally in the company. And we have found that those people have succeeded well in sitting for the

NRC RO exams.

COMMISSIONER CARR: But there's a recognition when they enroll in that basic course that if they complete it satisfactorily they'll be offered a job, I assume.

DOCTOR WILLIAMS: That's implied.

COMMISSIONER CARR: Yes, okay.

DOCTOR WILLIAMS: Yes, sir.

CHAIRMAN ZECH: All right. Let's proceed.

DOCTOR WILLIAMS: In handout -- back to the handout package -- Tab 2-1 and 2-2, I tried to give you an overview of what this 39 month program would look like. We use a career development approach and it is broken up into what is called steps. The steps are related to watchstation qualifications and systems make up those watchstations.

The requirements to complete a step include completing all job performance measures on the systems, completing the watchstation qualifications, passing an end of step test, a cognitive test, and an appraisal of performance which is considered satisfactory.

The four weeks at the beginning of the course is called Basic Nuclear Power Plant Technology and Engineering Mechanics II. In handouts 2-3 and 2-

4, I have given you overviews of those courses of instruction. We find that by blending the theoretical knowledge with the hands-on proficiency, that we get proficient operators.

Continuing training is also provided to reemphasize the application of the scientific principles. That is not, as you'll see shortly in my summary, reflected in the 39 months. That's additional to the 39 month self-study. I'll try to make that clear in about three slides.

The third phase of training is the RO/SRO license course.

CHAIRMAN ZECH: This is after 39 months?

DOCTOR WILLIAMS: Yes, sir.

CHAIRMAN ZECH: All right.

DOCTOR WILLIAMS: And it is not common for them to go directly from the 39 month program into that course. The waiting periods range from one to two to three years.

CHAIRMAN ZECH: What do they do in the meantime?

DOCTOR WILLIAMS: They would be considered qualified, non-licensed operators to work assigned watchstations.

CHAIRMAN ZECH: Like equipment operator,

something like that?

DOCTOR WILLIAMS: It could be an equipment operator, yes, sir.

CHAIRMAN ZECH: All right. But they're working in the plant. On shifts, generally?

DOCTOR WILLIAMS: Yes, sir. They're working on some shift.

CHAIRMAN ZECH: Yes, they're not in the control room yet, but they're working -- before they go to your RO/SRO licensing course, they're working on the plant, on shifts, in kind of --

DOCTOR WILLIAMS: Right.

CHAIRMAN ZECH: -- what you might call indoctrinational training?

DOCTOR WILLIAMS: Well, they've completed their initial training. What they're doing is they are qualified to work the various watchstations.

CHAIRMAN ZECH: I see.

DOCTOR WILLIAMS: So they are assigned on that shift to work the appropriate watchstations.

CHAIRMAN ZECH: I see.

COMMISSIONER CARR: So, some of them may not go on to RO/SRO, maybe just be satisfied to be an operator?

DOCTOR WILLIAMS: We just recently allowed

that to occur. It used to be an up or out approach where if they could not successfully pass the RO, we would terminate them or put them in an area that was non-operator based. We just recently allowed permanent NLOs, non-licensed operators to stay on, but it's done very selectively and it is monitored by the Vice President of Nuclear Operators on how many we allow to do that. That's changed within the last year and a half.

CHAIRMAN ZECH: Can you give us an example of the type of individual that you'd permit to do that?

DOCTOR WILLIAMS: It's judged based on his degree of qualifications, his attitude and, again, congruent work assignments being available for us to do that. We found in the past that some of the people would go into a health physics area or a QA area or some other area and be retrained for those areas. So, again, we've only got two at one site, at North Anna, and four at Surry that are in that category. They must maintain their watchstation qualifications through the continuing training program.

CHAIRMAN ZECH: Yes. All right. My experience is that some program like that can be a good program if it's properly supervised and

monitored, because there are some people who've gone through all the things you give us and even though they passed all the 39 months of training so far, you do have a considerable investment in them --

DOCTOR WILLIAMS: Yes.

CHAIRMAN ZECH: If they have shown that they can do that, but they can't pass the RO and SRO license for some reason or another, it would seem to me that there are some people who just aren't good at taking big exams. For some reason or other they just don't do that well. They might have shown you beforehand that they have the capability of handling certain jobs, but they might not be able to pass that difficult RO exam. I understand that. But I think if you --

COMMISSIONER ROBERTS: Or not choose to.

CHAIRMAN ZECH: I suppose that's true too in some cases. But my point is here, even if they do choose to and they don't pass it, I can understand what you're doing because there are some people who simply have that difficulty. But those you do keep, it would be very important, in my judgment, to be able to justify why you're keeping them, very solidly, and I think you can do that.

DOCTOR WILLIAMS: Yes.

CHAIRMAN ZECH: But I think it's important to monitor those individuals. Some can be very valuable and, as Commissioner Roberts pointed out, they may not have, for some reason or other, the desire. Maybe they like to work as an equipment operator. There are people who have that desire and that gives them tremendous satisfaction, rather than go into the operational field. So, I think that should be monitored carefully, but I would agree that it can be a useful -- to use people who are trained and who would impress you with their aptitude as well as their attitude and their competence, but they might not go into the other area.

So, I think that's a good thing to do, except I would say monitoring and careful use of that program is important.

DOCTOR WILLIAMS: Yes. And again, as a part of a nuclear standard, the station manager makes the decision. It's overseen by the Vice President of Nuclear on numbers and on a monthly indicator report, we indicate how many are in that classification. So, it's --

CHAIRMAN ZECH: Good.

DOCTOR WILLIAMS: -- it's viewed monthly. The person also, I might point out, doesn't get that

option until he has been unsuccessful in the RO class twice, which is again a tremendous commitment on our part because it's a year course.

CHAIRMAN ZECH: All right. Let's proceed.

DOCTOR WILLIAMS: Okay. Phase III of the operator training, the RO/SRO license course, is again an attempt at reviewing basic science and technology knowledge with expanded -- and providing additional academics which provide the underpinnings for technical license training. Understanding of engineering technology fundamentals is essential for the "whys" of proper plant operation and off-normal transient analysis.

The trainees routinely evaluate or are evaluated on basic scientific principles. If I could refer you to handout 3-1, I think you can see in an overview fashion some of the principal areas that are covered and I have a list of the math, the physics, chemistry, material science. And again, I gave you an example of what those courses were previously. If you follow through, you can see that in the license course segments, it is repeatedly reviewed from the different appropriate angles.

Handouts 3-2 and 3-3 provide you an overview of the lesson plans which exist for these licensed

courses. Again, a little more detail about the math and the electrical theory, chemistry, and I won't-- my intent was not to review all that, but to provide you that background.

The engineering fundamentals are not taught in isolation. However, they're incorporated into integrated plant operations. Operator requalification programs are based on both INPO and NRC job and task analysis. Special emphasis is in the teamwork and diagnostic skills training, which in handout 4-1 I provide you again an overview of that curriculum and the 56 hours of instruction that's provided on that subject.

In summary, the three segments and phases of operator training represents 273 weeks or five and a quarter years. I do want to point out that in Phase II, some of that time is on-the-job self-study. However, Phase I and III are all classroom, simulator, or guided in plant.

The total hours does not include continuing training for the non-licensed operator, which is this year -- I gave you an average of 127 on the handout. However, for this year, we've scheduled 192 hours. It does not included the continuing training requalification requirements of ROs and SROs once

they're licensed. Again, I gave you an average of 250 hours. This year it's 288 hours.

Other differences that I wanted to point out was that the Virginia Power Nuclear Foundation Training Program is 34 semester hours short of an Associate of Science degree and it's based on mostly liberal arts courses and a mathematics course at the college level calculus. The training program, however, is performance based, not generic degree.

Additional differences between our total training program, this would include all three phases, and a four year general engineering technology degree are that there are only selected engineering technology subjects, such as dynamics and statistics, that are not represented in the program, that the total operator training educational experience would be equivalent to 45 percent of a nuclear engineering technology four year degree, in our opinion.

Curriculum development has provided us the ability to provide this type of training. We have followed both the INPO and NRC recognized methodologies of job task analysis. As a matter of fact, we actually probably went beyond that in terms of identifying the basic foundational knowledge which represents our foundation program.

The knowledge is necessary for integrated operations. Normal, off-normal, emergency is presented appropriately in each training segment. Subject matter experts validate the academic content with the realistic applications for reinforcement. Again, I've tried to demonstrate that in my presentation this morning.

Continuing training reinforces operator knowledge and skills. We've used sound educational principles and practices of going from the simple to the complex. The appropriate learning setting has been reviewed and these programs are continuously validated and checked for reliability.

The shift technical advisors are assigned to each shift, and we do have five shifts. We have found that a best practice is to have all STAs with SRO licenses and degrees. That is a long-range goal of ours. This provides an effective crew mix of engineering ability, the STA and the operating experience. The engineers, in some cases, are not always the best suited supervisors.

That concludes my presentation. I'd like to thank you for your time.

CHAIRMAN ZECH: All right. Thank you very much.

Any questions from my fellow Commissioners?

Commissioner Roberts?

Commissioner Carr?

COMMISSIONER CARR: No.

CHAIRMAN ZECH: Commissioner Rogers?

COMMISSIONER ROGERS: Well, there's a lot that I could ask, but I don't want to delay us too much.

How do you do your validity reliability checks that you just mentioned a moment ago? What constitutes those?

DOCTOR WILLIAMS: Okay. The validity is done through job task analysis where we trace the knowledge and skills related to the objectives which relate to the evaluation that we perform, both performance, job performance measures and cognitive. That provides us very good content validity.

We then also have a pretty extensive evaluation system in place to do follow-up from the trainees and the supervisors on how well people are performing to identify degraded job performance in frequently performed tasks. So there's a whole system designed as a part of our training systems approach to address that particular aspect.

COMMISSIONER ROGERS: What about the

instructors? How are they selected and what is their performance --

DOCTOR WILLIAMS: Okay. The instructors maintain both technical qualifications and we have an extensive professional qualification program. For example, the professional skills are taught in a seven day workshop within six months of assignment to training. They then must complete an 18 unit instructor training program which covers anywhere from developing objectives to performing evaluation.

As a matter of fact, one of the current efforts I have is to develop on a national basis those 18 units. We're using the National Center for Vocational Education out of part of Ohio State, affiliated with Ohio State, to do those 18 units over again. So, we're going to be upgrading that. That's the professional part.

The technical part is based on the type of license and what they're assigned to teach. If they have to teach integrated plant response, they're required to have an SRO license. Again, I've already stated we require our SROs to maintain an active license as opposed to going inactive or -- it's the preferred method. We do have a few certified instructors and we do have a few for medical reasons

who have dropped licenses, but they all typically are SRO trained.

In the cases where we're teaching some of the more advanced subjects, we hire and have hired personnel with advanced degrees. So, for example, in the foundation they have Master's degrees. One of them is a graduate of the Naval Academy. We have, at North Anna, an instructor who has a Master's degree in Nuclear Engineering, who teaches the thermal and nuclear physics courses.

COMMISSIONER ROGERS: What's your classroom monitoring?

DOCTOR WILLIAMS: We require that twice a year the instructors be evaluated at least once by the supervisor and once by training specialists. Plus, we collect end of course critiques from all sessions which, of course, the shift supervisors aren't shy about telling us what we're doing right or wrong. So, we keep a very close connection with the plant in terms of are we delivering the services that they require.

COMMISSIONER ROGERS: Thank you.

CHAIRMAN ZECH: Commissioner Curtiss?

COMMISSIONER CURTISS: No questions.

CHAIRMAN ZECH: I don't have any questions

either. Perhaps, because we have so many presenters this morning, I'll ask the rest of our presenters to go through and finish their presentations and we'll hold our questions until we're all finished, if that's all right with my colleagues.

So, Mr. Colvin, who is next?

MR. COLVIN: Yes, sir. Let me go ahead and complete the introductions then. That will make it proceed faster.

CHAIRMAN ZECH: We need to move along because we have a lot on our schedule today. I'd like to kind of stick as close as we can to our 11:30 completion date. So, I know we've taken more time on this one perhaps, but the Commissioners will say that's because of our questions. But we would ask you to help us to try to keep on schedule.

MR. COLVIN: Yes, sir, I'll certainly try. With your concurrence then, let me make the rest of the introductions and then I'll turn it over to the particular presenter.

CHAIRMAN ZECH: Thank you.

MR. COLVIN: The next presenter will be Mr. Lee Williams. He's the Training Manager at Alabama Power Company, holds a Bachelor of Science degree in Nuclear Science Management from Troy State University,

has over 22 years of combined Navy and commercial nuclear experience. He's been employed with Alabama Power Company since 1975 and holds an active SRO license. He's been a peer evaluator on the INPO accreditation team visits and is an evaluator on the International Atomic Energy Agency's Operational Safety and Review Team, OSART, visits.

Mr. Williams will discuss the topic of shift operating training practices at Farley, principally from an operational perspective.

The third presenter this morning will be Mr. Charles Schrock, Assistant Manager of Plant Operations at Wisconsin Public Service Corporation's Kewaunee Plant. He'll discuss plant management's expectations of the operating staff.

He holds a Bachelor of Science degree and a Master of Science degree in Nuclear Engineering from University of Michigan. He's been with Wisconsin Public Service for ten years, and prior to his current position of Assistant Manager of Plant Operations, has held positions of Superintendent, Licensing Assistance, and Assistant Manager Nuclear Engineering. He holds an SRO license from the NRC for a nuclear research reactor and presently holds an SRO license for Kewaunee.

The fourth gentleman at the table with us today is Mr. Walt Coakley, Group Vice President of Education and Training at INPO, is not scheduled to make a presentation, but is here to respond to any questions you might have relative to INPO's role in operator training or the accreditation process.

With that, I'll turn it over to Mr. Lee Williams.

CHAIRMAN ZECH: Thank you very much.

You may proceed.

MR. WILLIAMS: Thank you for the opportunity to make this presentation today.

First of all, I'd like to start just by talking through, if you will, the growing process or the building of how we train our operators.

As Doctor Williams has already indicated, we start with the basic fundamentals, move from there into systems, which is just training the individuals in facts, individual facts related to individual systems. As we continue up the ladder or the hierarchy, we get into integrated plant operations, which is putting the pieces of the systems together. Moving from there into the utilization of procedures in making the plant work, in controlling the unit, both in normal, abnormal and emergency situations.

Again, we're utilizing the pieces and the fundamental knowledge that the individuals have gained in the training program.

Finally, all this is brought together, if you will, in the simulator training portion of the program where the individual applies all of the fundamentals that he's developed with time, the facts of the systems, the integrated plant operations and procedure uses. I'd like to stop here just a minute and talk about that.

Probably the most significant improvement in the operation, and I believe also in the training of our individual team members, has been in the area, the improved area of procedures, in their human factors design, in their technical content and to the depth and scope that they go beyond the basic design of the plant, which is important, I think, as far as the training. Also, the background information that goes with the procedures answers the question, why is this here and why are you doing this? So, I think that's a tremendous improvement.

In this setting on the simulator, one of the important things that we do with the individuals is point out their part of the team in operating the unit. They do not stand alone. They are not working

in isolation. Part of this is in the psychological realm, if you will, or the individual personal profile. How do I fit in with this team? How do I react under stress and how do I reactor when someone challenges me? How do I resolve conflict within the team and within myself? What's my role and responsibility and how can I improve on the operation of the unit through my communication? How can I make sure that my lack of communication doesn't threaten the unit?

Part of the role of the team is the STA, the shift technical advisor. In our organization, he is a member of the operating team, rotates with a fixed shift. There are five shifts in our operation. He is an advisor to the shift supervisor. In our facility, he is a degreed engineer who has been through the exact training program of the SRO. He may or may not have a license or hold a license. That decision is made on his ability at the end of the training program if we believe he has the capability to go on and complete the examination successfully. Not all engineers are able to do that first time through the training program.

In the 15 years I've been with Alabama Power Company, talking from memory, I have two engineers out

of many who have completed the program first time through and have been successful in obtaining their license. Most require the second time through the program. That's not a disparaging comment. Don't take it that way, but usually it's the lack of the operating experience that keeps them from being able to progress. Academically they do fine, but when you get into managing the resources available to them, it's where their shortcoming develops and that's due to a lack of experience.

The shift technical advisory --

CHAIRMAN ZECH: How many will pass the second exam?

MR. WILLIAMS: Yes.

CHAIRMAN ZECH: How many?

MR. WILLIAMS: To my knowledge, and I'm talking off the cuff here, they have all passed the exam, but not all have been allowed to go on. For instance, I know of several in our organization we felt did not possess the capability to go on the second time and we've placed them in other positions in the organization.

CHAIRMAN ZECH: I see.

MR. WILLIAMS: The STA provides an independent assessment of the performance, the thermal

hydraulic performance of the core, makes his recommendations to the shift supervisor. He is available to the shift supervisor, first of all, by procedure any time there is an abnormal or emergency transient that takes place. Also, and additionally by our procedures, any time he believes there's a need or when the shift supervisor wants to call on him, that's when he's available. Those are the off-normal situations.

He also performs an important function during routine day-to-day operations and he is the clearing authority or the processing individual for placing components in systems into and out of service. He prepares the necessary paperwork, checks technical specifications, makes sure that things can be worked as they're being requested, presents that information to the shift supervisor for his concurrence and approval, and he is integrated into our operation on a routine basis in that method.

But that's one member of the team that I spoke about previously and that's how we use the STA in our organization.

One of the most important parts, or another important part in our training program as we develop these senior operators is the utilization -- and this

is something that comes out in the simulator training -- of the resources that are available to him around the clock. Our training program emphasizes that first of all in looking at the resources that are available on the crew.

One of the early problems we identify with new people in the training is that they try to conquer the world by themselves. A problem exists in the control room and here's a three man, four man team, and they're oblivious to calling for help. We work very hard in trying to dispel that, making them realize that the entire world is at the end of that telephone, regardless of the time of the day or night.

That's an important operational aspect of how we run our units. Management routinely comes in and says, in our morning briefings, "Yes, I got that call last night at midnight or 2:00 o'clock in the morning. Yes, I know about this." That's how we run our plants. They're constantly in communication on a rotational basis.

So, not only is there the crew that is on call, which includes 19 people in the operations department, plus around-the-clock coverage in chemistry, health physics, all three maintenance disciplines and others, the on-call operations team,

if you will, of plant personnel, there's 17 people on a three week rotation, most of which are on beepers, immediately available by practice and by procedure. If it's your on-call week, you must be available to the plant. I'm on that rotation in an emergency position and every third week I have to keep myself within phone touch of the plant. If I change, I have to get approval of the on-call emergency director.

In addition to that, we have the corporate personnel who are on call. There's seven in that rotation on, again, a three week rotation. To show you the depth of background of these individuals, they're all degreed engineers and six of them are present SRO licenses. Two have completed SRO training in the past. Two additional ones are in our organization, but not directly working for Plant Farley. They're in the Vogtle project.

In addition, the Vice President and the Senior Vice President have both previously held SRO licenses on our plant and have moved up through the organization. Those people are also on call and available.

In addition then we have the vast array of vendor personnel who include those that, for instance, just the local vendor as part of our on-call response

and our emergency procedures for help in just getting routine matters solved, local vendors such as those who provide hydrogen and nitrogen, oxygen gases to the plant. It also includes our NSSS vendor. They too are set up on a rotation to where they're constantly available to us by phone.

And then obviously another one that you know about are those individuals directed by the emergency plan, such as the fire department, the hospitals, ambulance personnel, et cetera. These are the individuals that we -- when we're emphasizing what management expects of the shift supervisor is that he recognizes these resources are available to him and uses them and utilizes them effectively.

I'd like to quote from one of our procedures that says, "During his shift, the responsibility and authority of the shift supervisor shall be to maintain a broad perspective of operational conditions affecting the safety of his unit as a matter of highest priority." Our shift supervisors, that's how we train them. That's management's expectation. That's also training's expectation. Utilize the resources immediately available to you, whether it's in engineering, whether it's the NSSS vendor or whether it's the local vendor in town who can provide

a service to you.

In closing, I'd like to say thank you again for being able to make this presentation. I look forward to answering any questions at the end.

CHAIRMAN ZECH: Thank you very much.

MR. COLVIN: Mr. Schrock.

CHAIRMAN ZECH: Proceed, Mr. Schrock. Welcome.

MR. SCHROCK: I thank you very much for the opportunity to discuss this with you. I've been asked to talk about the operation at Kewaunee, maybe give a little bit of a different perspective from an Ops. Manager on how we perceive the training and how the plant is operated.

I would like to briefly talk about the plant itself and the organizational structure and then get into the operations group.

The Kewaunee Plant is a two loop Westinghouse pressurized water reactor. It is owned jointly by Wisconsin Public Service, Wisconsin Power and Light and Madison Gas and Electric. It's rated for 560 megawatts of electric gross and 1,650 megawatts thermal.

(Slide) The next slide shows that our performance statistics for 1988, Kewaunee had an

availability factor of 87.4 percent, a capacity factor of 83.3 percent and a forced outage rate of 1.7 percent.

Since going commercial in June of 1974, Kewaunee has had an availability of 84.37 percent, a capacity factor of 81.46 percent and a forced outage rate of 2.76 percent. We are currently in our 14th refueling outage, getting ready for our 15th cycle of operation.

(Slide) Our typical total man-rem exposure, shown on the next visual, averages around 220 man-rem per year and our low-level waste generation is about 70 cubic meters per year. Needless to say, we are proud of all of these statistics. We think the Kewaunee plant has been a good performer.

(Slide) The next visual does show the overview of the entire nuclear organization. Our Senior Vice President of Power Production has reporting to him the Manager of Nuclear Power and the Manager of Nuclear Power has a corporate staff in the plant itself.

(Slide) The next slide shows the corporate staff. There are 77 total people on the corporate staff. That includes nuclear engineering, training, a new group that we formed recently in Safety System

Engineering for doing safety system functional inspections, and the emergency preparedness group and administrative group.

(Slide) The plant is shown on the next slide. The plant staff itself has five basic groups. There are 72 in maintenance, 45 in the quality control warehouse and administrative area, 39 in health physics and chemistry, 17 in our technical support group. We have a contract security force of about 65 people, and our operations group has 52 people in it.

(Slide) The next slide does show the organization for the operations group. Reporting to me, I have an operations engineer and an operations superintendent. The operations superintendent has come up through the ranks. He started as a nuclear auxiliary operator when the plant was under construction and progressed through control room operator, shift supervisor and then finally to operations superintendent.

We operate with a six shift rotation. Each shift has six shift supervisors, six control room supervisors. Excuse me. There are six shift supervisors, one on each shift. Then there are two nuclear control operators, two non-licensed operators on each shift.

(Slide) The next slide shows the shift organization. We do have an STA. Kewaunee uses the STA a little differently than the other two gentlemen here have described. We use an on-call duty rotation. We have about 15 STAs that have gone through an STA training program and they each rotate on a 24 hour basis. We do have living facilities at the plant, in the plant boundary for them. We have required the STAs to be closely involved with the operation by attending two of the three shift turnovers everyday and by making frequent tours through the control room.

From an operations perspective, I require my shift supervisors to keep the STA informed on everything. If the plant changes, if we're taking safety systems out of service or if we have some kind of an instrument failure, the STA gets notified immediately. So he is always kept apprised of the situation.

I would add that we've had positive feedback. The STA does provide a fresh perspective since he is not part of the crew, and although he does train with the crew of occasion, generally the training is separate from the crew. Many of the shift supervisors have told me that it is a different perspective and it does help.

CHAIRMAN ZECH: What's the qualification of the STA?

MR. SCHROCK: The STA does have a Bachelor's degree in Engineering and he goes through an abbreviated SRO program.

CHAIRMAN ZECH: Does he have a license?

MR. SCHROCK: No, he does not have a license. We patterned the STA training program right after the Senior Reactor Operator Program. The one major distinction is we don't require the 520 hours on shift doing an --

CHAIRMAN ZECH: Do you permit them to get a license if they request the opportunity?

MR. SCHROCK: We don't have the manpower right now to allow that. Speaking for management, ideally we would like to start a program where we can get as many engineers SROs as we can. In the past, we haven't been able to support that.

CHAIRMAN ZECH: All right. Let's proceed.

MR. SCHROCK: I'd like to discuss a little bit the typical experience and background of our operators.

(Slide) The next visual does show a short summary. About 40 percent of our operators have Navy nuclear experience and about 30 percent have come into

the plant with a two year Associate degree. Those two groups are generally mutually exclusive. The third number I have here, 25 percent active in a baccalaureate program, these are made up of all of the above. Twenty five percent of our entire operations staff is currently enrolled in a plant program that we brought to the site, the University of Maryland program. The result of that program would be a Bachelor of Science degree in Nuclear Science and engineering.

Currently there are two individuals in the operations organization that do have both an SRO and an Engineering degree. That is myself and my operations engineer.

COMMISSIONER CARR: A University of Maryland program on-site?

MR. SCHROCK: Yes, sir. It's a combination of computer-aided study. For some courses we do bring professors to the site and then there is self-study programs.

(Slide) As far as the experience level of our operations staff, the next slide does show the average years of experience. Our shift supervisors have 14 and a half years average experience. That ranges -- one shift supervisor has about 22 years

experience with the Wisconsin Public Service, down to a minimum of about nine years experience. Our control room supervisors have an average of 12 and a half years nuclear experience and our nuclear control operators have an average of about 11 years nuclear experience.

I'd like to take a minute and just discuss the flow paths of individuals that come into the company. The typical progression, we'll hire an individual in the nuclear auxiliary operator position, which includes two basic qualifications. There's the equipment operator qualifications and the auxiliary operator qualifications. The EO qualifications come first. It's about a three month program before an individual is qualified as an equipment operator. At that point, he can stand that watch by himself and typically will do so for around six months to a year.

The next step would be to go to the auxiliary operator position and he'll stand that watch after about a three month qualification period for another six months to a year. So, our typical individual will start an RO training program after having worked for about three years at the plant. In addition to that, he has the Associate degree background or the nuclear Navy background.

The RO training program is about a 22 month program and it is similar to the programs that have been described already. It does include the basic fundamentals, systems training, simulator training and accident transient diagnostics. After that 22 month program, if successful, the individual will get a license. At that point in time, he'll have been with the company about five years.

Since our nuclear control room operator position is a vacancy driven position, an individual with a license will continue to work in the non-licensed areas with the license until an opening opens up in the control room. That typically is another one to two years.

That's the typical progression through to the control room operator phase. After that, we do provide all of our senior nuclear control room operators the chance to get an SRO. That's another nine month training program very similar to the RO training program, but abbreviated because they've had it all before. After having received the SRO, the individuals are promoted based on merit into the supervisory position of control room supervisor.

(Slide) The next slide that I have does show a comparison between the reactor operator

training program from 1980 to now. As you can see, the basic program is the same. The fundamentals course has grown from a 12 week course to a 16 week course. The systems course has also grown from a 12 week to a 16 week course, and the on-shift time has increased only slightly.

The biggest change that we've had is in the simulator time. In the 1980 time frame, we would use a non-specific simulator. In our case, we would use other Westinghouse type of plants, but at different locations for two weeks during that whole program. Now we use our own site-specific simulator for about eight weeks during the course of that program and we continue to use the research reactor at the University of Wisconsin for much of our theoretical training.

(Slide) The next slide shows some of the significant improvements in the training program. As I mentioned, the site specific simulator has been a very big boon. Another change that we've made, and I've brought along an example of it, is we worked with a professor from the University of Wisconsin, who is Doctor Saiid Abdel-Khalik, to create a plant-specific accident transient course. Doctor Saiid is an expert in the thermohydraulics area and he wrote the book for Kewaunee using Kewaunee data and Kewaunee transient

analysis, emphasizing the thermohydraulic side of it.

We've had very good feedback from this course. We developed it to be taught in a two week time frame. We've been experimenting with the time frame for our recall people. This is used in the new operator training program, but we have given it to our reactor operators in the recall.

Another change that we've made is we've added the team skills and diagnostic training program similar to what Lee described. And finally, we've also added the emergency response guidelines. And again, these have helped a lot, not only because the guidelines themselves have improved significantly, but along with the one volume set of the guidelines is a four volume set of background documents which explains the fundamentals behind the guidelines, the plant transients that were analyzed and why you're doing the steps that you're doing.

One other area that we have done, but I haven't indicated on the slide, is we've increased our staff size to allow for the six shift rotation. In 1980 we were still on a five shift rotation. By going to six shifts, we've provided that much more time for the training. So we now have a dedicated shift for training. In addition to that, we've increased our

staff size in the training area significantly to support all the new requirements in training.

(Slide) The next slide shows the operations group attrition. This is another area that we're pretty proud of at Kewaunee. I went back five years for the purpose of this discussion, just to get a feel for where we're at.

In the last five years, we've had 22 people leave the operations group. On the surface, it seems like a lot. However, the reasons for the attrition explain what is going on. We've had three people that have actually terminated employment, quit for a variety of reasons. Two of our people retired, and one, unfortunately, was killed in a car accident.

But the last statistic is the one that's important to me. We've had 16 of our operations people that have been promoted or transferred into the organization. I reviewed our current organization supervisory staff and looked at the number of people that have ROs or SROs or have held ROs or SROs. About 15 percent of our supervisory staff in the nuclear organization, excluding operations, are people that came out of the operations group or have held the SRO. That includes our current Manager of Nuclear Power who was the Manager of Operations and then the Plant

Manager and held an SRO. Our current plant manager was the Manager of Operations, held the SRO, and our current Senior Vice President was a plant manager.

Many of the groups that we've got are actually headed by people with the SRO or have held the SRO.

COMMISSIONER CARR: Have any data on what percentage of that 15 percent are degreed?

MR. SCHROCK: Very few.

The last area that I would like to talk about is the general expectations that we have for the plant, for the crews, how they run the plant. Very briefly I can talk about the normal day shift operations and then the back shift operations.

During the day shift, the shift's complement is as I have described. We have a shift supervisor, a control room supervisor, the two control room operators and the two non-licensed operators. The interface with management is continuous and direct. Typically we have morning meetings to discuss the day's plans. There will be constant communication back and forth as surveillance is done or various operational duties have to be performed. None of that is unexpected.

On the back shift, however, we do provide

the shift supervisor and the crews with as much help as we can give them. I guess I would add that we have every confidence in our shift supervisors, that they will make the right decision. But I would say we demand that when they have time they communicate with management. In order to do that, informally between myself and my day staff people, we make sure that one of us is always around so that the shift supervisor knows who he can call if he has a question or would like to report on the plant.

In addition to that, we've developed a rotation among both the plant staff management and the corporate management so that the shift supervisor knows he can always reach by pager or by telephone one of those individuals.

We also have a Westinghouse site representative that is available by pager, and we have contacts with our nuclear steam supply -- or the architect engineer who is on our floor -- that we maintain. We have always been able to contact these people at any hour of the day or night.

I would like to close with just a couple of examples of how the plant does respond to off-normal events.

The first example happened just recently.

It was at the beginning of February. We had an icing problem in our fore bay which is the area that draws the water out of Lake Michigan and cools the condenser. With the icing, the fore bay level drops and there is a point at which the circulating water pumps, which are drawing the water through, trips.

Well, at 4:00 o'clock in the morning, the shift supervisor got the first alarm that the fore bay level was decreasing. He knew what he had to do. He needed to decrease plant power so that he could minimize flow through the condenser and hopefully stabilize the fore bay level. But he immediately called my operations superintendent and me and on the phone the three of us talked about it briefly. He told us what his plans were. We said it was a good plan and he started on it.

We both then left for the plant. Within a half an hour, my ops. manager or superintendent was there and I was there a few minutes later, followed by the plant manager. In that time frame we had four maintenance people there. The team then got together and we averted a plant trip by appropriate throttling of valves and reducing plant power. So, the shift supervisor knew what to do, but the plant had the resources available to get them there.

Another example, also recently we developed a steam generator tube leak at the end of this current operating cycle. This was a little bit different because it was a slow moving event. However, what I'd like to point out is that the plant management and corporate management, right up to the Senior Vice President of Power Production, spent the weekend at the site following the onset of the minor leakage on a Friday, to make sure that the shift supervisor and the rest of the plant staff knew the plant status and knew what we were going to do if the condition continued to degrade.

By the time Sunday night following the Friday that the tube leakage started occurred, we had our game plan, if you will, well put together and the shift supervisor knew exactly what to do and took the plant off-line without any problems.

The last comment I would make is under emergency operations. We have fortunately never had to get into the operations, but if we do, I brought one last example. The shift supervisor is the emergency director on the back shifts and the senior manager at the plant. When you have a plant reactor trip or an emergency safeguard actuation, the first thing that the operators do and the control room

supervisor is pull out the emergency response guidelines. These take him through the initial stages of any accident.

The shift supervisor does two things in parallel. He makes sure the plant is being controlled and he makes sure the emergency plan is being implemented. Those are the ways that we get the resources available to the plant.

That concludes my prepared presentation. I'll be happy to take any questions. I appreciate the opportunity to discuss it with you.

CHAIRMAN ZECH: Thank you very much.

Mr. Colvin?

MR. COLVIN: Mr. Chairman and gentlemen, that concludes our prepared presentation. We thank you for allowing us the time to speak to you this morning. In closing, I just wanted to reiterate that the presentations today and the presenters were speaking from their own experience at their utilities. We do believe, however, that those are generally representative across the industry.

With that, we'd welcome any questions or comments you might have and are ready to respond to same.

CHAIRMAN ZECH: All right. Thank you very

much. Before I ask my colleagues for questions, as far as the Kewaunee organization is concerned, Mr. Schrock, I notice in the last SALP that you got category one in all functional areas and I congratulate you for that. I think Region 3 has told us that you're the first utility in Region 3 to achieve those very high marks. Those are the best marks that are given, as we all know. But I congratulate you for that performance and say once you've reached that level, you're challenge now is to keep it up.

COMMISSIONER CARR: No place to go but down.

CHAIRMAN ZECH: We'll be watching to see that you keep it up now. But I congratulate you for what you've done.

MR. SCHROCK: Thank you very much. We accept the challenge.

CHAIRMAN ZECH: Good.

Commissioner Roberts?

COMMISSIONER ROBERTS: I don't have any questions, just a comment. I guess I'd be surprised or disappointed if you didn't put your best foot forward and this has been a very impressive presentation. I certainly hope what you said -- I hope all of our licensed panel reactors could

demonstrate a similar commitment to training as these entities.

That's all I have.

CHAIRMAN ZECH: Commissioner Carr?

Commissioner Rogers?

COMMISSIONER ROGERS: Well, I just really wanted to know how realistic that statement is. You've got a very large number of people at power plants and these are excellent training programs. They certainly are impressive. The question is, what's the low end of the scale? This is the upper end of the scale, I'm sure. How confident are we --

COMMISSIONER ROBERTS: There's a no win for you.

COMMISSIONER ROGERS: How confident are we of what the quality at the low end is?

MR. COLVIN: I think with that I'd like to pass the buck, as the saying goes, and turn over to Mr. Coakley, principally because in the accreditation process I think that's one of its basic premises, is to establish that level of training throughout the industry.

CHAIRMAN ZECH: Mr. Coakley?

MR. COAKLEY: Gentlemen, this description of these programs reflects very closely our guideline for

the Senior Reactor Operator Shift Supervisor Training Program to meet accreditation standards. I believe that except for a few of the extras that you've heard this morning, this is very typical. The guideline and what they've described is on the order of 600 contact hours, 40 equivalent hours of training in all the thermodynamics for the mechanics, these are required to have the program accredited. The University of Wisconsin accident transient analysis course is something that's not, of course, present in every program.

But beyond the fundamentals courses in the classroom that you've all heard about, there's an awful lot of this that carries on into the simulator for accident and transient analysis which they haven't really discussed. The case studies, the diagnostics, the mitigating core damage training, which may or may not have been mentioned by every person. But I believe that they represent perhaps the high end, but I think everybody's within 90 or 95 percent of that quality and content.

COMMISSIONER ROGERS: Well, of course, one can make a general observation, and that is that in looking at course descriptions and course content lists and so on and so forth, there really isn't an

awful lot of difference from a well presented course and one that isn't well presented. They both look about the same on paper very often. The difference, of course, is the quality of the instructor and how well that quality is being maintained.

It seems to me that's something that I'd like to know a little bit more about certainly as time goes on because very often what looks to be a very fine course on paper doesn't really do the job. All the elements are there in the course description, but I myself have sat in on courses, without saying where, but in recent months, which I found that basically the instructor was leading the class. He asked a question, he didn't get an answer and then he'd supply the question and everybody would say yes, and then he'd say fine. I didn't hear the answers coming back from the students the way I would have liked them.

So, one has to be very mindful of quality assurance in this business. You can set up a very good program, it can look very good on paper, but then it has to be monitored very closely in terms of instructor performance. So, I would like to hear all the time as to how that's being done, because quite often it isn't done quite as well as people think it's being done.

MR. COAKLEY: We agree. I think you focus on a very key issue. We are attacking this in several areas throughout the industry, both through the National Academy for Nuclear Training, which is sponsoring quite a bit of professional development for instructors and instructor workshops.

But more along the evaluation line, renewal of accreditation is focusing very, very much on the delivery and the execution of training. We do find those problems. We find classes that do not have the right kind of participation. We now monitor training as a part of our accreditation visits, the actual delivery of training, all of our plant evaluations that go back to an accredited training programs. The training evaluator monitors as much of the classroom and on-the-job training and simulator training as he can.

I think we probably have a bottom line test in the case of performance in that we look at every crew -- we look at two crews at every plant evaluation for a day each, running through several off-normal events. We only look at abnormal, off-normal accident situations. That's pretty tough looks given by very competent peers as to how the people actually handle it, build their background into their performance.

But I think it's something that you focused on. We worry about it. I talk about it with all the Academy activities. Instructors have to deliver a quality product or people will not keep their ears open and learn.

COMMISSIONER ROGERS: Well, one of the dilemmas in this kind of instruction and education is to match up the people who really know, from operating experience point of view, with the ability, the pedagogic ability to work well in teaching it. It's one thing to be able to do it yourself -- that's very important, of course -- but the other thing is then to work with a group of students and to try to transfer that effectively to them and at the same time challenge them and test them.

Those abilities, just as you pointed out that engineers don't always make the best supervisors, high quality operators may not make the best teachers. And so, one has to be mindful of that and to find that very happy situation where you have a person who can do both very well. It's a big challenge. That's the challenge that I think the industry faces in trying to do this, because there are always a limited number of people that have those skills and abilities. You have to try to use them most effectively.

I wonder if there are any thoughts about industry-wide sharing of the very best teachers and instructors for some of these things and giving them an opportunity to work in this kind of capacity in a short time with different utility training programs, the really super ones.

MR. COAKLEY: I know of no programs that actually exchange instructors, if that's what you're thinking of, sir, but I think Terry has probably has some experience with Ohio State's program for getting instructors together, teachers together.

The Middle Atlantic Nuclear Training Group and the Northeast Training Association both have annual workshops, a week long, on enhancing teaching skills. We're pushing facilitating as opposed to didactic teaching is a training area that we're going to be -- that we're working on within the Academy now as new and much more effective learning methods.

COMMISSIONER ROGERS: Is it possible to get a little bit more of an idea of really what you're talking about when you're talking engineering fundamentals that are required here for shift supervisor training programs? What are we really talking about when you get down to the nitty-gritty of engineering? How is that approached?

MR. COAKLEY: I think some of it is included in Doctor Williams' lesson plan outline there, but in our guideline for controller and operator --

COMMISSIONER ROGERS: Well, I see the topic areas, but you know it's that step below that.

MR. COAKLEY: He had some lesson plan formats in there. We found a course that we could not focus --

COMMISSIONER ROGERS: Well, I don't want to take everybody's time up with it, but I would like-- and I'm sure if you could send me something I'm sure the other Commissioners would like to see it. But I'd like to see something a little bit more than just the list of topics, a little bit more of what kind of problems are dealt with and how they're dealt with. And if there are homework assignments of some sort, I'd like to see what they are, just to get a little feeling about that.

MR. COAKLEY: But lesson plans which are fairly thorough, detailed lesson plans?

COMMISSIONER ROGERS: No, just one or two of them.

CHAIRMAN ZECH: Just an example of lesson plans.

MR. COLVIN: That's fine with me. We can do

that.

COMMISSIONER ROGERS: Good. Who has done the academic review of the INPO programs? What kind of people have you brought in? Tell us a little bit more about who they are.

MR. COAKLEY: The original job and task analysis for reactor operator and senior reactor operator produced a taxonomy of knowledge and skills which is like that thick. That was sent to deans of engineering at -- I don't remember the exact facts in this -- five or six, seven universities. One of them was Bill Kimel from University of Missouri, Dean of Engineering there. The group reviewed everything that we were asking be put into this training program as a result of the analysis.

Their conclusions were that they didn't-- they didn't look at it from the point of view of what wasn't there. They looked at it from the point of view of what this consisted of in terms of what their academic courses were. They found that the skills and knowledge as required by this taxonomy were covered from everywhere from the lower half to upper half of undergraduate programs on into graduate school. They commented that most of them could be taught without calculus. This is probably the one essential

difference between the programs that are being taught at the plant sites and the universities is that it's done on mathematics below the calculus level, apparently successfully.

COMMISSIONER ROGERS: No, I think it can be done without calculus. It takes a little more pedagogical skill, but I think it can be done.

MR. COAKLEY: No one identified anything they felt was missing from the body of knowledge.

COMMISSIONER ROGERS: Thank you.

CHAIRMAN ZECH: Thank you.

Commissioner Curtiss?

COMMISSIONER CURTISS: No questions.

CHAIRMAN ZECH: Mr. Coakley, you talked to us a little bit about the INPO accreditation program. And the involvement of INPO we know has been very significant in training and, as far as I'm concerned, my observations of training at the utilities has certainly improved in the past few years. There's no question about it. It's become much more professional and much more helpful I think to the operators, much more realistic and has certainly raised the level of operational safety, in my judgment, at our nuclear power plants.

I do think that the three companies that

have given us presentations here today have excellent programs. I would hope all the rest of them have programs that good. I'm not so sure. But I would hope that they do, or at least if they don't have that they'd try to achieve them to the extent that these three utilities have.

But I'd like to ask Mr. Coakley, how do you make sure that each utility maintains an appropriate level of competence in their training programs? We've talked on it very briefly and I don't want any detailed answer, but could you give us a little bit more about how INPO involves themselves in giving the assurance that training truly is improving? I know you've got an accreditation program. That's commendable, but what I really mean is the on-site visits. Do you do that? How do you satisfy yourselves that training truly is improving?

MR. COAKLEY: In the renewal of accreditation that's taking place every four years, that gives us a very thorough look at the programmatic parts of it. Approximately every 16 to 18 months we have a plant evaluation team go on-site and look at all aspects of the plant operations.

CHAIRMAN ZECH: Is that part of the whole program, every 16 to 18 months an on-site review?

MR. COAKLEY: That's by our evaluation and assistance teams that do the operational evaluations of the plant, sir.

CHAIRMAN ZECH: But that includes training?

MR. COAKLEY: Yes, sir, it includes training. Each of the area evaluators looks for evidence of under-performance, lack of skill, lack of knowledge. He feeds anything he observes in that area back to the training member of that team who then examines the training program to see whether or not it was taught, whether or not it was taught completely, whether or not it was examined and whether or not that individual went to the training. Now, that's a sampling process, but it does give us a very good insight into whether or not there are results coming out of the training.

They also interview the supervisors in the departments to find out their opinion of whether or not the training program is providing them the talent that they need when they send them over from the training department, or the people they send over for refresher training. They also interview the trainers. They observe on-the-job training taking place against some pretty tough criteria for whether or not the people who conduct that OJT and the qualification

checkouts are instructed and certified to do that job. Besides that, they observe laboratory, simulator and classroom training taking place.

We try to do this as randomly as we can so that we get an objective look of what's actually taking place.

CHAIRMAN ZECH: Well, I kind of agree with Commissioner Rogers that that's a very important part of your program, those checks to see -- sitting in the classroom by observers to see how it is coming across and to see how it's conducted and so forth. So, that kind of -- you know the program is good, the plan is excellent, no question about it, but the execution is where you really have to put your efforts, in my judgment.

MR. COAKLEY: May I add that --

CHAIRMAN ZECH: Go right ahead.

MR. COAKLEY: We have a pretty formal tracking system for problems we find. We judge the degree of falling away from the criteria objectives. In the case of one program, set of programs that were accredited, we sent a follow-up team out. After we saw a hint of problems, we had that utility come back to the accrediting board. The accrediting board put their programs on probation for 120 days. They went

back and fixed the problems, came back and had performance restored.

CHAIRMAN ZECH: Those kind of things are necessary when you see it's appropriate to do so.

One last question. Can you tell us about the status of the INPO activities to accredit an 11th training area on continuing training of licensed personnel?

MR. COAKLEY: Yes, sir. In our renewal of accreditation, we have asked that the continuing training program be broken out as a separate description of the course so we can put appropriate focus on that. We feel like that's so important to maintain proficiency. We have looked at approximately a quarter of the operator training programs and I'd say something like 50 or 60 of those have been back to the board for renewal. We have seen some late starts in upgrading, but everybody has brought the operator programs up to a higher level than they were at initial accreditation.

Our biggest problem is in the other training areas. Operations training has been accepted as a good thing as well as a necessity by the operators for quite some time. Our biggest problem in the follow-up area is in the non-operator training. We really have

to --

CHAIRMAN ZECH: Good. Well, I agree with that and I hope you're focusing on maintenance training.

Well, let me thank you, gentlemen, for a very informative briefing this morning.

I would note that on October of 1988 the staff briefed the Commission on their views on the status of training and qualification of nuclear operations personnel and the Commission was told at that time that the staff believes the INPO accreditation program is effective in insuring nuclear power plant personnel have the qualifications commensurate with the performance requirements of their job and that was an important assessment from the staff to the Commission.

We were pleased, of course, to hear that. And at that time, I should point out, the Commission directed the staff to continue to closely monitor-- our staff as well as INPO -- to closely monitor the training in the industry and the utilities to assure that they are implementing their training programs in accordance with the NRC-endorsed INPO accreditation program. We also asked the staff to report back to the Commission as appropriate with this kind of

assessment.

So we will be following your training programs as well as INPO is following them.

I'd like to thank all of you again for this informative presentation, Mr. Colvin and NUMARC supervisory role in this regard.

INPO is playing a very direct and important role in training and, Mr. Coakley, we welcome you back to the table again.

The three of you from the utilities, Virginia Power, Alabama Power Company, and Wisconsin Public Service, we thank you for being with us today. We commend you for the programs you have in place.

My only challenge to all of you would be to make sure they're implemented as good as they've been planned and programmed. I think implementation of the program is fundamental and I would hope that you would insure that you have feedback systems and monitoring systems of your programs because once we've put these excellent programs in place -- no question about their excellence in my judgment -- then the challenge is constantly monitoring, upgrading them when you can. You'll keep constantly learning. But mainly to check and make sure that the training is being accomplished in accordance with your own desires and with our

desires.

That's what we've charged our people to do on the staff and that's what we charge INPO to do, and certainly that's what we charge all of you to do. So, please focus on the implementation once you have the program in place.

Are there any other questions from my fellow Commissioners?

If not, I thank you very much for your willingness to stay on schedule with us too. We do have a busy day.

Thank you very much. We stand adjourned.

(Whereupon, at 11:26 a.m., the hearing was concluded.)

CERTIFICATE OF TRANSCRIBER

This is to certify that the attached events of a meeting of the United States Nuclear Regulatory Commission entitled:

TITLE OF MEETING: BRIEFING ON OPERATOR TRAINING

PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: MARCH 6, 1989

were transcribed by me. I further certify that said transcription is accurate and complete, to the best of my ability, and that the transcript is a true and accurate record of the foregoing events.

Carol Lynch

Reporter's name: Peter Lynch

VIRGINIA POWER

DR. TERRY M. WILLIAMS
MANAGER - NUCLEAR TRAINING

AN OVERVIEW

ACADEMICS/ENGINEERING FUNDAMENTALS AS PRESENTED IN OPERATOR TRAINING PROGRAMS

VIRGINIA POWER

PRESENTATION OBJECTIVES

VIRGINIA POWER

- Present Scope and Depth of Operator Training in Basic Science and Technology.
- Show Relationship of Academics to Technical Training.
- Emphasize Performance - Based Nature of Curriculum Development.

INTRODUCTION

VIRGINIA POWER

- 3rd Largest U. S. Investor-Owned Nuclear Power Supplier
- 4 Nuclear Units -
  Surry (1562 MW)
  North Anna (1830 MW)
- Nuclear Contribution to Energy Mix -
  32% In 1987, 34% In 1988

TRAINING FACILITIES

VIRGINIA POWER

- Modern Facilities At Each Site:
  - Technical Training Libraries
  - Certified Control Room Simulators
  - Shops and Labs
  - Ample Classrooms
  - "See-Thru" Reactor Model
- Training Staff (139 Approved Manning)
  - Plant-Qualified Instructors
  - Training Specialists
- Corporate Training/Graphics Support

OPERATIONS TRAINING TARGET AUDIENCE

VIRGINIA POWER

- High School Graduate
  - Upper Half
  - Strong Science, Math
- Navy Nuclear Program
  - Proven Aptitude
  - Strong Fundamentals

VIRGINIA POWER

Science and Technology - Three Major Segments

I. Nuclear Foundations Training Program

II. Nuclear Control Room Operator Development Program

III. RO/SRO License Class

I. Nuclear Foundations Training Program (6 Months)

- Designed For Upper Half High School Graduates With Three Years Each of Science and Mathematics Required.
- Entire Program Reviews, Reinforces and Builds Student Understanding of Scientific Fundamentals.
- Curriculum Design Relates Academics to Nuclear Plant Technology By Illustration, Problems, Plant Tours, Etc.
- Curriculum Recognized By Virginia Community College System (Total of 46 Semester-Hour Credits Awarded).
  - Nuclear Foundations Technology Career Studies Certificate (29 Semester Hours.)
  - Nuclear Control Room Operator Career Studies Certificate (17 Semester Hours.)
  - Nuclear Health Physics Career Studies Certificate (17 Semester Hours.)

VIRGINIA POWER

II. Nuclear Control Room Operator Development Program

- 39-Month, Resulting In Performance-Based Task Qualification.
- Trainee Progresses Through Watchstation Qualification of Increasing Complexity.
- 4 Weeks At Beginning Is Basic Nuclear Power Plant Technology and Engineering Mechanics.
- Theoretical Knowledge Becomes “Hands-On” Proficiency.
- Continuing Training Reinforces Application of Scientific Principles.

VIRGINIA POWER

III. RO/SRO License Course

- Basic Science and Technology Knowledge Is Reviewed and Expanded, Providing Academic Underpinnings For Technical License Training.
- Understanding of Engineering Technology Fundamentals Essential For the "Why's" of Proper Plant Operation and Off-Normal Transient Analysis.
- Trainee Routinely Evaluated On Basic Scientific Principles.
- Engineering Fundamentals Are Not Taught In Isolation - Incorporated Into Integrated Operations.
- Operator Requalification Program Based on INPO/NRC Job/Task Analysis.
- Develop Teamwork and Diagnostic Skills.

SUMMARY

VIRGINIA POWER

	Segment of Operator Training	Length of Segment
I.	Nuclear Foundations Training Program	26 Weeks
II.	Nuclear Control Room Operator Development Program	189 Weeks (1)
III.	RO/SRO License Course	58 Weeks (2)
	Total Training	273 Weeks (5 1/4 Years)

(1) Does Not Include Continuing Training Throughout This Segment (127 Hrs/Yr).

(2) Does Not Include Continuing Requalification Training for Licensed Operators (250 Hrs/Yr), Which Include Written and Simulator Examinations.

SUMMARY

VIRGINIA POWER

Difference Between Virginia Power Foundation Program and Two-Year Associate of Science Degree Program

- Liberal Arts Courses (E.G., History, Sociology, Psychology, Etc.) (34 Semester Hours.)
- Mathematics to College-Level Calculus
- Training Program Is More Performance Based Than Generic Degree Program

Additional Difference Between Total Training Program and Four-Year General Engineering Technology Degree

- Selected Engineering Technology Subjects (Dynamics, Statistics, Etc.)
- Total Operator Training Equivalent to 45% of Nuclear Engineering Technology 4-Yr. Degree

CURRICULUM DEVELOPMENT

VIRGINIA POWER

- Follows INPO/NRC Recognized Methodology of Job/Task Analysis.
- Knowledge Necessary For Integrated Operations (Normal, Off-Normal, Emergency) is Presented Appropriately In Training Segments.
- Subject Matter Experts Validate Academic Content With Realistic Applications For Reinforcement.
- Continuing Training Reinforces Operator Knowledge and Skills.
- Sound Educational Principles and Practices Applied.
  - Simple-To-Complex
  - Appropriate Learning Settings
  - Validity/Reliability Checks

SHIFT TECHNICAL ADVISORS

VIRGINIA POWER

- STA Assigned to Each Shift.
- Best Practice to Have All STA's With SRO Licenses and Degrees.
- Provides Effective Crew Mix of Engineering Ability and Operational Experience.
- Engineers Are Not Necessarily the Best Shift Supervisors.

BRIEFING MATERIAL

FOR

NRC COMMISSIONERS

MARCH 6, 1989

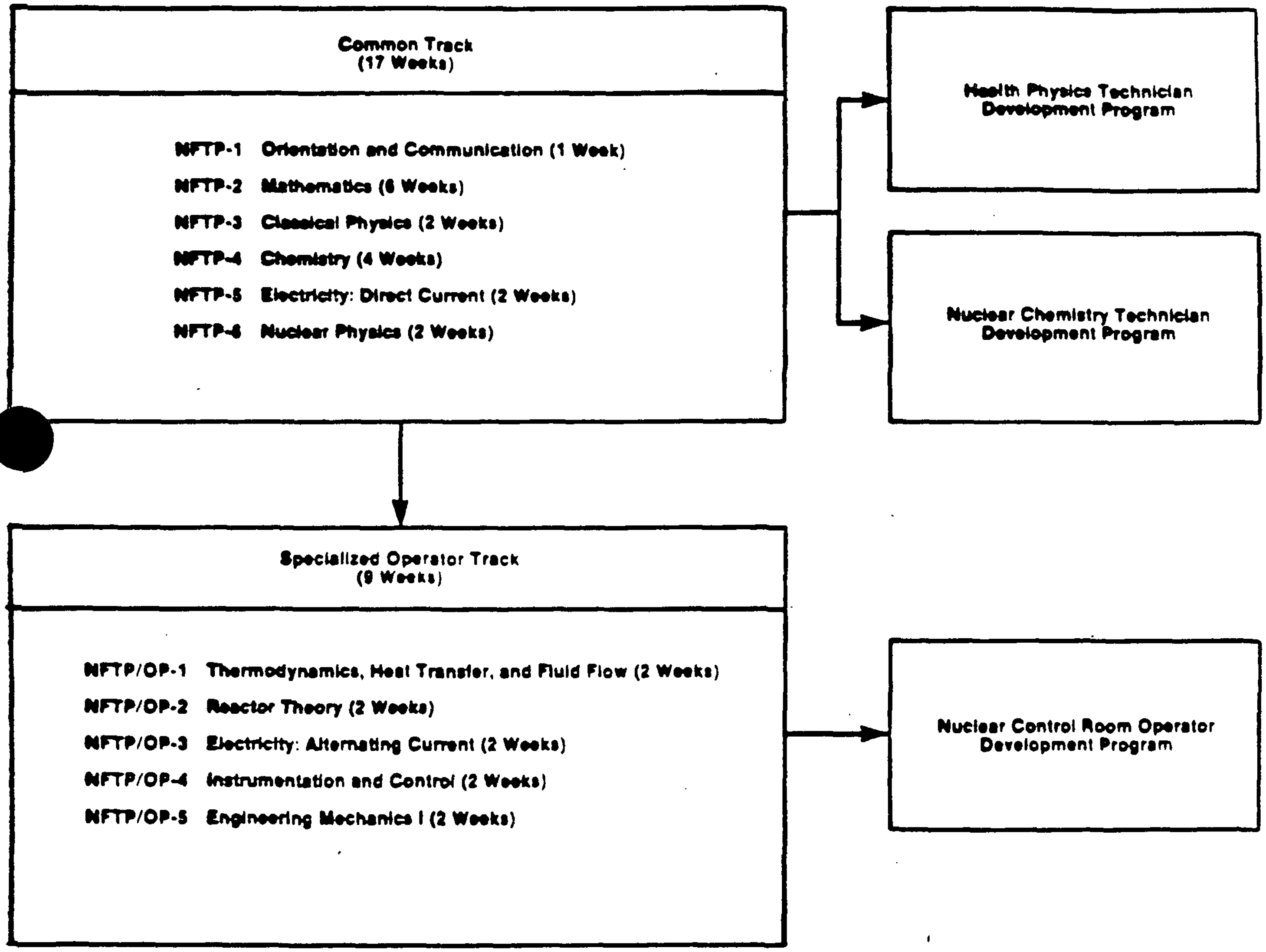
CONTENTS

BRIEFING PRESENTED UNDER AUSPICES
OF
NUCLEAR MANAGEMENT
AND
RESOURCE COUNCIL

TAB 1 NUCLEAR FOUNDATIONS TRAINING PROGRAM

NUCLEAR FOUNDATIONS TRAINING PROGRAM

Training Flow Chart



(excerpt from NFTP Program Guide)

JOHN TYLER COMMUNITY COLLEGE

Examples of Catalogue Course Descriptions Corresponding to Nuclear Foundations Training Program Modules.

NFTP 4 CHEMISTRY

> **CHM 111-112 College Chemistry I-II (4 Cr.) (4 Cr.)**
> Explores the fundamental laws, theories, and mathematical concepts of chemistry. Designed primarily for science and engineering majors. Requires a strong background in mathematics. Lecture 3 hours per week. Laboratory 3 hours per week.

NFTP 3 PHYSICS

> PHY 201-202 General College Physics I-II (4 Cr.) (4 Cr.)
> Teaches fundamental principles of physics. Covers mechanics, thermodynamics, wave phenomena, electricity and magnetism, and selected topics in modern physics. Prerequisite MTH 165 or equivalent. Lecture 3 hours per week. Laboratory 3 hours per week.

NFTP 2 MATHEMATICS

> MTH 171-172 Pre-Calculus Mathematics I-II (3 Cr.) (3 Cr.)
> Presents the concepts and methods necessary for the study of calculus including algebra, analytical geometry, and the study of algebraic, exponential, logarithmic, and trigonometric functions. Prerequisites satisfactory score on an appropriate proficiency examination and MTH 04 and MTH 06 or equivalent. Lecture 3 hours per week.

SELECTED COLLEGE-LEVEL STUDENT TEXTS USED IN THE NUCLEAR FOUNDATIONS TRAINING PROGRAM

Area — Textbook

Communication and Orientation

The Gregg Reference Manual, William A. Sabin

Mathematics

Essentials of Mathematics, Russell V. Person

Precalculus, Functions and Graphs, Munum and Yizze General Physics - Vol. #1

Classical Physics

Applied Physics, Tippens, G.P. - Vol. #2

Chemistry

Fundamentals of Chemistry, Brady and Holum, G.P. - Vol. #4

Electricity: DC

Basic Electricity, Volumes 1 through 5, Van Valkenburgh, Nooger: Neville, Inc.

Nuclear Physics

Chart of the Nuclids, General Electric, G.P. Vol. #IV

Reactor Theory

Academic Program for Nuclear Power Plant Personnel, Vol. III, Nuclear Power Plant Technology

Thermodynamics

Elements of Applied Thermodynamics, Johnston, Brockett, Bock, Keating

Heat Transfer, Thermodynamics and Fluid Flows Fundamentals, General Physics Corporation

Electricity: AC

Basic Electricity, Volumes 1 through 5, Van Valkenburgh, Nooger: Neville, Inc.

Instrumentation

Academic Program for Nuclear Power Plant Personnel, Vol. IV Nuclear Instrumentation

Engineering Mechanics, General Physics Corp. Series, Vol. IV

TAB 2 NUCLEAR CONTROL ROOM OPERATOR DEVELOPMENT PROGRAM

2-1 NORTH ANNA SEQUENCE OF INSTRUCTION
2-2 SURRY SEQUENCE OF INSTRUCTION
2-3 EXAMPLE CURRICULUM OUTLINE: BASIC NUCLEAR POWER PLANT TECHNOLOGY
2-4 EXAMPLE CURRICULUM OUTLINE: ENGINEERING MECHANICS II

NUCLEAR CONTROL ROOM OPERATOR DEVELOPMENT PROGRAM
SEQUENCE OF INSTRUCTIONAL UNITS BY PROGRAM STEP

NORTH ANNA WATCHSTATIONS/STEPS

Step 1: General Watchstation (5 months)

	Instructor Guide #	Hours
Basic Nuclear Power Plant Technology	4	80
Watchstanding Techniques	1	28
Power Station Safety	2	4
Engineering Mechanics II	5	60
Power Station Communications	3	4

	System Module #
Fuel Oil System	8
Fire Protection System	6
Domestic Water Systems	7

Step 2: Outside Watchstation (4 months)

Circulating Water System	12
Service Water System	13
Vacuum Priming System	14
Basic Electrical Distribution System	18
Heat Tracing System	22
Compressed Gas System	20
Compressed Air System	17
Auxiliary Boiler System	11
Auxiliary Steam System	10
Waste Oil Collection System	9

Step 3: Turbine Building Watchstation (6 months)

Main Condensate System	25
Water Treatment System	16
Main Steam System	23
Main Feedwater System	26
Secondary Sampling System	34
Extraction Steam System	27
Secondary Drains System	28
Turbine Lube Oil System	29
Gland Seal System	30
Electro-Hydraulic Fluid System	31
Main Generator and Exciter System	32
Bearing Cooling System	33
Main Turbine System	24
Secondary Plant Ventilation Systems	36
Chilled Water System	15

		System Module #
Step 4:	**Auxiliary Building Watchstation (6 months)**	
	Reactor Coolant System	38
	Reactor Vessel and Core Components System	39
	Residual Heat Removal System	40
	Chemical and Volume Control System	41
	Steam Generator Blowdown System	37
	Liquid Waste System	43
	Gaseous Waste Disposal System	45
	Radiation Monitoring System	46
	Primary Ventilation System	47
	Reactor Cavity Purification System	50
	Component Cooling System	51
	Primary Grade Water System	21
	Spent Fuel Pit Cooling System	49
	Boron Recovery System	42
	Safety Injection System	52
Step 5:	Safeguards Building Watchstation (6 months)	
	Primary Sampling System	56
	Containment Vacuum and Leakage Monitoring System	57
	Auxiliary Feedwater System	26
	Primary Vents and Drains System	59
	Decontamination Systems	44
	Emergency and Vital Electrical Distribution System	35
	Emergency Diesel Generator System	55
	Containment Depressurization System	53/54
	Containment Isolation System	67
	Containment Atmospheric Cleanup System	58
	Neutron Shield Tank System	60
	Rod Control System	65
Step 6:	Backboards Watchstation (6 months)	
	Containment Structure	66
	Vibration and Loose Parts Monitoring System	70
	Ambient Temperature Monitoring System	71
	Ex-Core Nuclear Instrumentation System	62
	In-Core Nuclear Instrumentation System	63
	Core Cooling Monitoring System	64
	Meteorological Monitoring System	68
	Annunciator and Event Recorder System	69
	Seismic Monitoring System	72
	Plant Computer	73

Step 7: Control and Protection Watchstation (6 months)

	System Module #
Pressurizer Pressure Protection and Control System	74
Main Turbine Generator Control and Protection System	75/76
Reactor Protection System	77
Fuel Handling System	48
_T/Tavg Control & Protection System	77
Pressurizer Level Control and Protection	74
Steam Dump Control System	23
S/G Level Control and Protection System	26
S/G Recirc, Transfer and Wet Layup System	37

NUCLEAR CONTROL ROOM OPERATOR DEVELOPMENT PROGRAM
SEQUENCE OF INSTRUCTIONAL UNITS BY PROGRAM STEP

SURRY WATCHSTATION/STEPS

Step 1: General Watchstation (5 months)

	Instructor Guide #	Hours	System Module #
Basic Nuclear Power Plant Technology	4	80	
Watchstanding Techniques	1	40	
Power Station Safety	2	24	
Engineering Mechanics II	5	40	
Power Station Communications	3	16	
Fuel Oil System			8
Fire Protection System			6
Domestic Water Systems			7

Step 2: Outside Watchstation (4 months)

Circulating Water System	12
Service Water System	13
Vacuum Priming System	14
Basic Electrical Distribution System	18
Heat Tracing System	22
Compressed Gas System	20
Gas Turbine System	19
Meteorological Monitoring System	68

Step 3: Condensate Polishing Building Watchstation (6 months)

Auxiliary Boiler System	11
Compressed Air System	17
Main Condensate System	25
Flash Evaporator/Water Treatment System	16
Main Feedwater System	26
Secondary Sampling System	34
Steam Generator Blowdown System	37
Condensate Polishing System	61

		System Module #
Step 4:	Turbine Building Watchstation (6 months)	
	Main Steam System	23
	Extraction Steam System	27
	Secondary Drains System	28
	Turbine Lube Oil System	29
	Gland Seal System	30
	Electro-hydraulic Fluid System	31
	Main Generator and Exciter System	32
	Bearing Cooling System	33
	Turbine/Service Building Ventilation System	36
	Chilled Water System	15
	Auxiliary Steam System	10
	Waste Oil Collection System	9
	Main Turbine System	24
Step 5:	Auxiliary Building Watchstation (6 months)	
	Reactor Coolant System	38
	Reactor Vessel and Core Components System	39
	Residual Heat Removal System	40
	Chemical and Volume Control System	41
	Liquid Waste System	43
	Gaseous Waste System	45
	Radiation Monitoring System	46
	Primary Ventilation System	47
	Reactor Cavity Purification System	50
	Component Cooling System	51
	Primary Grade Water System	21
	Spent Fuel Pit Cooling System	49
	Boron Recovery System	42
	Safety Injection System	52
	Primary Sampling System	56
	Containment Vacuum and Leakage Monitoring System	57
	Primary Vents and Drains System	59
	Containment Structure System	66
Step 6:	Service Building Watchstation (6 months)	
	Technical Support Center	78
	Emergency and Vital Electrical Distribution System	35
	Emergency Diesel Generator System	55
	Containment Spray System	53
	Recirculation Spray System	54
	Containment Isolation System	67
	Neutron Shield Tank System	60
	Containment Atmospheric Cleanup System	58
	Vibration and Loose Parts Monitoring System	70
	Fuel Handling System	48
	Seismic Monitoring System	72

System Module #

Step 7: (6 months)

Ambient Temperature Monitoring System	71
Ex-Core Nuclear Instrumentation System	62
In-Core Nuclear Instrumentation System	63
Core Cooling Monitoring System	64
Rod Control System	65
Annunciator and Event Recorder System	69
Plant Computer	73
Pressurizer Pressure Protection and Control System	74
Main Turbine Control and Protection System	75
Main Generator Control and Protection System	76
Reactor Protection System	77

Unit Number: NCRODP-4

Unit Title: Basic Nuclear Power Plant Technology

Program: Nuclear Control Room Operator Development Program

Unit Description: This unit introduces the trainee to the basic concepts underlying the operation of a nuclear power plant, Surry Power Station Layout, and the basic systems and their functions at Surry Power Station.

Subject Matter:

I. Basic Nuclear Plant Cycle

II. Basic Thermodynamic Concepts

III. Station Layout

IV. Nuclear Steam Supply Systems Introduction

V. Reactor Coolant System

VI. Reactor Control

VII. Nuclear Instrumentation System

VIII. Chemical and Volume Control System

IX. Reactor Trip System

X. Residual Heat Removal System

XI. Introduction to Main Steam and Feed Systems

XII. Main Steam System

XIII. Main Turbine and Associated Systems

XIV. Main Condenser and Air Ejectors

XV. Circulating Water and Vacuum Priming Systems

XVI. Main Condensate and Feedwater Systems

XVII. Extraction Steam and Secondary Drain Systems

XVIII. Introduction to Corrosion Control

XIX. Condensate Polishing and Chemical Addition

XX. Steam Generator Blowdown and Associated Systems

XXI. Secondary Makeup Systems

XXII. Main Generator and Support Systems

XXIII. Electrical Systems Introduction

XXIV. Station Service Electrical Distribution

XXV. Emergency Electrical Distribution

XXVI. Introduction to Emergency Systems

XXVII. Safety Injection System

XXVIII. Auxiliary Feedwater System

XXIX. Containment and Containment Support Systems

XXX. Containment Spray System

Unit Number: NCRODP-5

Unit Title: Engineering Mechanics II

Program: Nuclear Control Room Operator Development Program

Unit Description: This unit introduces the reading of drawings and prints; basic circuitry control and protection devices; and the operating characteristics and inspection checks associated with pumps, valves, heat exchangers, and steam traps with which the operator should be familiar.

Subject Matter:

I. Reading Drawings

II. Electrical Equipment

III. Pumps

IV. Valves

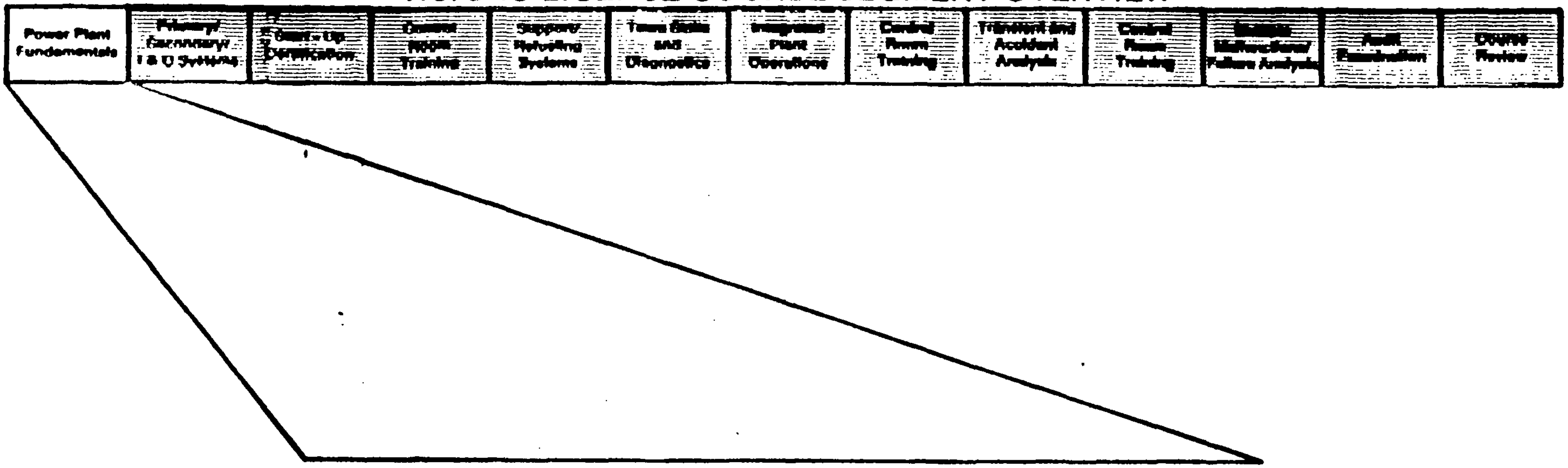
V. Heat Exchanger Malfunctions

VI. Steam Traps and Strainers

TAB 3 RO/SRO LICENSE COURSE

3-1 COURSE OVERVIEW
3-2 SURRY LESSON PLAN OVERVIEW
3-3 NORTH ANNA LESSON PLAN OVERVIEW

RO/SRO LICENSE COURSE SEGMENT OVERVIEW



- 13 Weeks
- Principle areas covered:
  - Mathematics
  - Physics
  - Chemistry
  - Material Science
  - Engineering Mechanics
  - Electrical Theory
  - Thermodynamics
  - Reactor Theory
  - Health Physics (Advanced Radiation Worker Training may be substituted)
- Approximately 10 tests will be administered. An overall average of at least 80% is required at the conclusion of this segment.
- Formal classroom lecture is the major method of instruction in this segment. Classroom problem solving sessions occur in those subjects which require mathematical manipulations. A simulator learning activity demonstrating subcritical multiplication, criticality, and reactivity feedback is conducted during the Reactor Theory Segment.

RO/SRO LICENSE TRAINING PROGRAM

LESSON PLAN OVERVIEWS

SURRY POWER STATION

NCRODP-79 MATHEMATICS

1. Axioms, Decimals, Fractions, and Percentages
2. Exponents, Powers and Roots
3. Logarithms
4. Essentials of Algebra
5. Dimentional Analysis
6. Graphing and Graph Reading
7. Geometry
8. Trigonometry and Vectors

NCRODP-80 ELECTRICAL THEORY

1. Introduction to Electricity
2. DC Circuit Analysis
3. Magnetism
4. Electromagnetism
5. Alternating Voltage and Current
6. Generator Theory
7. Alternating Current Motors
8. Transformers
9. Resistance in AC Circuits
10. Inductance in AC Circuits
11. Capacitance in AC Circuits
12. Electrical Power Generation
13. Batteries
14. Electrical Print Reading
15. Circuit Breakers

NCRODP-81.1 CHEMISTRY

1. General Chemistry Concepts
2. Corrosion
3. Makeup Water and Secondary Coolant Processing
4. Secondary Chemistry Specifications
5. Primary Chemistry Specifications

NCRODP-8.2 HEALTH PHYSICS

1. Radiation and Its Effects
2. Radiation Detection
3. External Exposure Control
4. Respiratory Protection
5. Radioactive Releases

NCRODP-82 PHYSICS

1. Introduction to Physics
2. Application of Physics

NCRODP-83 THERMO, FLUID FLOW, HEAT TRANSFER

1. Mechanical and Thermal Energy; Work and Heat
2. General Energy Equation and Continuity Equation
3. Thermodynamic Terminology and Behavior of Water
4. The Second Law of Thermodynamics
5. Steam Tables (Mollier Diagram)
6. Thermodynamic Cycle Analysis
7. Basic Fluid Flow Phenomena
8. Applications of Fluid Flow Phenomena
9. Basic Heat Transfer
10. Heat Exchangers

NCRODP-84 MATERIAL SCIENCE

1. Itroduction to Material Science
2. Operator's Curve and Pressurized Thermal Shock
3. Engineering Structural Materials

NCRODP-85 ENGINEERING MECHANICS

1. Pumps
2. Turbines
3. Bearings and Lubrication
4. Fans and Compressors
5. Heat Exchangers
6. Metals, Piping and Miscellaneous Equipment
7. Valves

NCRODP-86.1 REACTOR PHYSICS

1. Atomic and Nuclear Fundamentals
2. Mass and Energy Equivalence
3. Neutron Induced Reactions
4. Quantifying Neutron Interactions
5. Neutron Moderation
6. Neutron Multiplication and Reactivity
7. Fission Neutrons
8. Reactor Power Equations
9. In-Hour Equation and Neutron Flux Transients

NCRODP-86.2 REACTOR OPERATION PRINCIPLES

1. Fuel Temperature Coefficient and Defect
2. Moderator Temperature Coefficient and Defect
3. Power Defect
4. Fission Product Poisions
5. Reactivity Controls Part I: Kexcess and Chemical Shim
6. Reactivity Controls Part II: Control Rods and Burnable Poision Rods
7. Reactor Start-up
8. Power Operations
9. Reactor Shutdown

NCRODP-86.3 REACTOR ENERGY REMOVAL

1. Reactor Fuel Heat Transfer
2. Boiling Heat Transfer
3. Reactor Thermal Limits
4. Natural Circulation

NCRODP-88 PRIMARY SYSTEMS

NCRODP-88.1 Reactor Coolant System

1. Reactor Coolant System Overview
2. Reactor Vessel and Internals
3. Pressurizer and Pressurizer Relief Tank
4. Steam Generators
5. Steam Generator Operating Characteristics
6. Reactor Coolant Pumps
7. Valves, Piping, and Instrumentation
8. General System Operation
9. Technical Specifications - An Overview
10. RCS Technical Specifications

NCRODP-88.2 Residual Heat Removal System

1. Residual Heat Removal System
2. Operations of the RHR System

NCRODP-88.3 Chemical and Volume Control System

1. CVCS Overview
2. Charging and Letdown Subsystem
3. Seal Injection and Return Subsystem
4. Other Minor Functions of CVCS
5. Charging Pumps
6. Charging Pump Cooling Subsystem

7. Boric Acid Transfer and Storage Subsystem
8. Primary Grade Water Subsystem
9. Blender Control Subsystem
10. CVCS Operations

NCRODP-88.4 Containment

1. Containment Systems Overview
2. Containment Vessel
3. Subsurface Drain system
4. Containment Penetrations
5. Containment Vacuum System
6. Containment Ventilation
7. Containment Airlocks
8. Hydrogen Recombiners
9. Neutron Shield Tank

NCRODP-88.5 Component Cooling Water System

1. Component Cooling System
2. Chilled CC System

NCRODP-89 SECONDARY SYSTEMS

NCRODP-89.1 Steam Systems

1. Secondary Plant Overview
2. Main Steam System
3. Reheat Steam System
4. Steam Dump System
5. Extraction steam System
6. Auxiliary Steam System
7. Auxiliary Boilers

NCRODP-89.2 Main Turbine and Support Systems

1. Main Turbine
2. Turbine Lube Oil Systems
3. Lube Oil Storage and Conditioning
4. Turning Gear
5. Gland Seal and Exhaust System
6. Electro-Hydraulic Control Fluid System
7. Turbine Control
8. Turbine Protection
9. Turbine Supervisory Panel

NCRODP-89.3 Condensate and Feed

1. Main Condenser
2. Main Condensate System
3. Main Feed System
4. Auxiliary Feed System
5. Secondary Drains System

NCRODP-89.4 Secondary Plant Makeup and Purification Control Systems

1. Condensate Polishing System
2. Flash Evaporator/Water Treatment
3. Steam Generator Blowdown
4. S/G Recirculation and Transfer System
5. Secondary Sampling System

NCRODP-89.5 Secondary Plant Cooling Systems

1. Circulating Water System
2. Service Water System
3. Bearing Cooling Water System
4. Vacuum Priming Systems
5. Chilled Water Systems

NCRODP-90 ELECTRICAL SYSTEMS

NCRODP-90.1 Main Generator

1. Main Generator Component Parts
2. Isolated Phase Bus Duct System
3. Main Generator Cooling System
4. Hydrogen Seal Oil System
5. Main Transformer
6. Main Generator Voltage Regulator
7. Generator Protection and Control

NCRODP-90.2 Basic Electrical Distribution

1. Switchyard
2. Station Service Distribution
3. Screenwall Distribution
4. Lighting
5. Semi-Vital Distribution
6. Station Service Protection and Control

NCRODP-90.3 Emergency and Vital Electrical Distribution

1. Emergency Diesel Generator - Mechanical
2. Emergency Diesel Generator - Electrical
3. Emergency 4160 V Distribution
4. Emergency 480 V Distribution
5. Vital Bus Distribution
6. 125 V Distribution
7. Emergency Distribution Protection and Control
8. Emergency Distribution System Operation

NCRODP-91 ENGINEERED SAFETY FEATURES SYSTEM

1. Engineered Safeguards Functions
2. Safety Injection System
3. SI System Operations
4. Consequence Limiting Safeguards
5. Containment Spray System
6. Recirculation Spray Systems

NCRODP-92 SUPPORT SYSTEMS

NCRODP-92.1 Compressed Air Systems

1. Service Air System
2. Instrument Air System
3. Blue Compressor Outage Air System
4. Condensate Polishing Air System
5. Containment Instrument Air System

NCRODP-92.2 Fire Protection Systems

1. Fire and Domestic Water Systems
2. Low Pressure Cardox System
3. High Pressure Cardox System
4. Halon System
5. Fire Detection Systems

NCRODP-92.3 Ventilation Systems

1. Turbine Building Ventilation
2. Service Building Ventilation
3. Control Room / Relay Room Ventilation
4. Auxiliary Ventilation Systems
5. Technical Support Center Ventilation

NCRODP-92.4 Radioactive Fluid Support Systems

1. Boron Recovery System
2. Gaseous Waste System
3. Vents and Drains System
4. Liquid Waste System
5. Primary Sampling System
6. Post-Accident Sampling System

NCRODP-92.5 Refueling Support Systems

1. Unit Refueling Overview
2. Refueling Technical Specifications
3. Fuel Handling Tools
4. Fuel Transfer System
5. Reactor Cavity Purification System
6. Spent Fuel Pit and Support Systems
7. Refueling Abnormal Procedures

NCRODP-92.6 Independent Spent Fuel Storage Installation (ISFSI)

1. ISFSI Facility Design
2. ISFSI Safety Analysis
3. ISFSI License

NCRODP-93 INSTRUMENTATION AND CONTROL

NCRODP-93.1 Basic Measurement Devices and Control Systems

1. Measurement Devices
2. Control Systems

NCRODP-93.2 Nuclear Instrumentation Systems

1. Basic Detector Theory
2. Source Range NIS
3. Intermediate Range NIS
4. Power Range NIS
5. Excore Fission Chamber System
6. DELETED
7. Incore Flux Thimble Thermocouple System
8. Incore Flux Detector System

NCRODP-93.3 Process Protection and Control

1. Characteristics of Tavg Control System
2. Delta T/Tavg Instrumentation System
3. Rod Control System
4. Rod Position Indication System
5. Pressurizer Pressure Control System
6. Overpressure Level Control System
7. Pressurizer Level Control System
8. S/G Water Level Control System
9. Steam Dump Control System
10. Reactor Protection - General
11. Reactor Coolant System Flow Protection
12. Reactor Coolant System Pressure Protection
13. Pressurizer Level Protection
14. Overpower/Overtemperature dT Protection
15. Technical Specifications - Reactor Protection
16. Permissive/Bypass Status Light

NCRODP-93.4 Accident and Event Monitoring and Control Systems

1. Plant Computer System (P-250)
2. ERF Computer System/Safety Parameters Display System

3. Inadequate Core Cooling Monitor System
4. Post-Accident Monitoring System
5. Auxiliary Shutdown Panel
6. Remote Monitoring Panels
7. Loose Parts Monitoring Panels
8. Seismic Monitoring
9. Meterological Monitoring Panel

NCRODP-93.5 Radiation Monitoring Systems

1. Victoreen Area Monitoring System
2. Victoreen Process Monitoring System
3. VRC Steam Monitoring System
4. Kaman Process Monitoring System
5. Containment Monitoring Panel

NCRODP-93.6 Instrumentation Failure Analysis

1. Instrumentation System Failures

NCRODP-95 TRANSIENT AND ACCIDENT ANALYSIS

NCRODP-95.1 Condition I and II Events

1. Event Classifications
2. Condition 1 Events
3. Partial Loss of RCS Flow
4. Loss of Main Feedwater
5. Dropped/Misaligned Rod Recovery
6. Loss of Containment Vacuum
7. Loss of Vital Bus
8. Loss of Offsite Power
9. Loss of Instrument Air
10. Dilution Accident

11. Anticipated Transient Without Trip (ATWT)
12. Main Steam Trip Valve Closure
13. Stuck Open Pressurizer Spray Valve

NCRODP-95.2 Condition III and IV Events

1. Radioactive Gas Release Accident
2. Rod Withdrawal Accident
3. Secondary Breaks
4. Complete Loss of RCS Flow
5. Loss of All Feedwater Accident
6. S/G Tube Rupture
7. Loss of Coolant Accident
8. Loss of All AC Power
9. RCP Locked Rotor
10. Rod Ejection Accident
11. Fuel Handling Accident
12. Loss of RHR Events

NCRODP-95.3 Emergency Response Guidelines

1. Overview of ERGs
2. Emergency Procedure Writer's Format
3. EP-1.00 Rx Trip/Safety Injection
4. EP-1.01 Rx Trip Recovery
5. EP-1.02A Natural Circ Cooldown
6. EP-1.02B Natural Circ Cooldown With Void
7. EP-2.00 Loss of Primary/Secondary Coolant
8. EP-2.01 SI Termination
9. EP-2.02 Post-LOCA Cooldowon and Depressureization
10. EP-2.03 Transfer to Cold Leg Recirculation
11. EP-2.04 Transfer to Hot Leg Recirculation
12. EP-3.00 Faulted S/G Isolation
13. EP-4.00 S/G Tube Rupture
14. EP-4.01 Post-SGTR Cooldown (Backfill Method)

15. EP-4.02 Post-SGTR Cooldown (Blowdown Method)
16. EP-4.03 Post-SGTR Cooldown (Steam Dump Method)
17. ECA-1.00 Loss of All AC Power
18. ECA-1.01 Loss of All AC Recovery Without SI
19. ECA-1.02 Loss of All AC Recovery With SI
20. ECA-2.01 Loss of Emergency Coolant Recirculation
21. ECA-2.02 LOCA Outside Containment
22. ECA-3.01 Uncontrolled Depressurization of All S/Gs
23. ECA-4.01 SGTR With LOCA (Subcooled Recovery Method
24. ECA-4.02 SGTR With LOCA (Saturated Recovery Method
25. ECA-4.03 SGTR Without Pressurizer Pressure Control
26. CSF Status Trees
27. FRPs - Subcriticality
28. FRPs - Core Cooling
29. FRPs - Heat Sink
30. FRPs - Integrity
31. FRPs - Containment
32. FRPs - Inventory
33. EP-0.01 Rediagnosis

NCRODP-95.4 LOCA and LOCA Mitigation

1. Post-Accidetn Cooling
2. Vital Process Instrumentation
3. Instrument Accident Response
4. Assessment Methodology
5. Radiological Aspects
6. Class 9 Events

NCRODP-95.5 Emergency Plan and Implementation Procedures

1. Emergency Plan Overview
2. Station Emergency Manager Training
3. Emergency Communicator Training

NCRODP-95.6 Fire Contingency Plans

1. Appendix "R" Overview
2. FCA 1.00
3. FCA 1.01 (With Attachmetns from FCA-1.00)
4. FCA 1.02 through 1.09

NCRODP-96 Teamwork and Diagnostic Skills

1. Team Development
2. Personality Types
3. Communications
4. Leadership
5. Conflict Resolution
6. Managing Stress
7. Control Room Team Roles and Responsibilities
8. Decision Making
9. Problem Solving
10. Diagnostic Principles
11. Applying Diagnostics To Procedure Use

NCRODP-100 ADMINISTRATIVE PROCEDURES

1. SUADM-0-03 Post-Trip Review
2. SUADM-ADM-01 Station Organization
3. SUADM-0-07 Ops Organization
4. SUADM-0-08 Ops Administrative
5. SUADM-0-09 Ops Logs and Records
6. SUADM-0-10 Ops Procedures
7. SUADM-0-11 Function Bypass and Temporary Modifications
8. SUADM-0-12 Ops Notifications

9. SUADM-0-13 Ops Maintainence and Tagging
10. SUADM-0-19 Containment Entry
11. SUADM-ENG-05 Equipment Classifications
12. SUADM-ENG-04 Setpoint Changes
13. SUADM-SP-01 Environmental Qualification Program

RO/SRO LICENSE TRAINING PROGRAM

LESSON PLAN OVERVIEWS

NORTH ANNA POWER STATION

NCRODP-79 Mathematics

NCRODP-80 Electrical Theory

1. Electrical Theory
2. Introduction to Elec.
3. Magnetism
4. Direct Current Circuit Analysis
5. Generator Theory
6. Alternating Voltage and Current
7. Transformers
8. Alternation Current Motors
9. Resistance in Parallel AC Circuits
10. Inductance in AC Parallel Circuits
11. Capacitance in Parallel AC Circuits
12. Parallel AC Circuit Analysis
13. RLC Effect on Electrical Power Generation
14. NAPS Main Generator Basic Operation

NCRODP-81 Chemistry and Health Physics

1. Corrosion
2. Primary Chemistry
3. Secondary Chemistry
4. Make-up Water

NCRODP-82 Classical Physics

1. Systems of Units and Unit Conversion
2. Forces and Motion
3. Work, Energy, and Power
4. Momentum and Collisions
5. Temperature and Ideal Gas Behavior

NCRODP-83 Thermodynamics, Fluid Flow, and Heat Transfer

1. Mechanical & Thermal Energy, Work, and Heat
2. General Energy Equation & Continuity Equation
3. Thermo Terminology & the Behavior of Water
4. The Second Law of Thermo
5. Mollier Diagram and Steam Tables
6. Thermo Cycle Analysis
7. Basic Fluid Flow Phenomena
8. Applications of Fluid Flow Phenomena
9. Basic Heat Transfer
10. Heat Exchangers

NCRODP-84 Material Science

1. Intro to Material Science
2. Operation's Curve
3. Pressurized Thermal Shock

NCRODP-85 Engineering Mechanics

1. Pumps
2. Turbines
3. Bearings & Lubrication
4. Fans & Compressors
5. Heat Exchangers
6. Metals, Piping & Misc. Equipment
7. Valves

NCRODP-86 Reactor Theory

NCRODP-86.1 Reactor Physics

1. Atomic & Nuclear Fundamentals
2. Mass & Energy Equivalence
3. Neutron Induced Reactions
4. Quantifying Neutron Interactions

5. Neutron Moderations
6. Neutron Multiplication & Reactivity
7. Fission Neutron
8. Reactor Power Equations
9. Inhour Equation & Neutron Flux Transients

NCRODP-86.2 Reactor Operator Principles

1. Fuel Temp. Coefficient & Defect
2. Moduator Temp. Coefficient & Defect
3. Power Defect
4. Fission Product Poisons
5. Reactivity Controls Part 1 K Excess & Chemical Shim
6. Reactivity Controls Part 2 Control Rods & Burnable Poison Rods
7. Reactor Startup
8. Power Operations
9. Reactor Shutdown

NCRODP-86.3 Reactor Energy Removal

1. Reactor Fuel Heat Transfer
2. Boiling Heat Transfer
3. Reactor Thermal Limits
4. Natural Circulation

NCRODP-87 Control Room Training (not applicable)

NCRODP-88 Primary Systems

NCRODP-88.1 Reactor Coolant System

1. Reactor Vessel & Core Construction
2. Pressurizer & Pressure Relief
3. Reactor Coolant Pumps
4. Steam Generators

5. RCS Piping
6. Instrumentation & Controls

NCRODP-88.2 Residual Heat Removal System

1. RHR System Description
2. RHR System Operation

NCRODP-88.3 Chemical Volume and Control System

1. Charging & Letdown
2. Makeup System

NCRODP-88.4 Neutron Shield Tank

1. Neutron Biological Shields
2. Neutron Shield System

NCRODP-88.5 Technical Specifications

1. Use of Tech Specs
2. Tech Specs Required Information

NCRODP-89 Secondary Systems

NCRODP-89.1 Main Steam System

1. Main Steam

NCRODP-89.2 Main Turbine Construction and Operation, and Turbine Lube Oil

1. Main Turbine Construction & Operation
2. Lube Oil System

NCRODP-89.3 Main Condensate and Air Ejectors

1. Main Condensate System

NCRODP-89.4 Feedwater Systems

1. Main Feed System
2. Aux. Feedwater System

NCRODP-89.5 EHC/Turbine Control and Protection

1. Electro Hydraulic Fluid System
2. Turbine Control & Protection

NCRODP-89.6 Extraction Steam System

1. System Description

NCRODP-89.7 Secondary Drains System

1. Secondary Drains System

NCRODP-90 Electrical Systems

NCRODP-90.1 Basic Electrical Distribution

1. Switchyard Electrical Distribution System
2. Station Service Electrical Distribution

NCRODP-90.3 Vital and Emergency Distribution

1. Vital Electrical Distribution
2. Emergency Electrical Distribution

NCRODP-90.4 Emergency Diesel Generators

1. Diesel Construction
2. Emergency Diesel Operations

NCRODP-90.5 Security Uninterrupted Power Supply

1. Tech. Support Center Distribution

NCRODP-91 Engineered Safety Features

NCRODP-91.1 ESF

1. ESF
2. SI or ECCS as Subset of the ESF System
3. Quench Spray System
4. Recirculating Spray System

NCRODP-91.2 Containment and Containment Systems

1. Cont. and Cont. Systems

NCRODP-92 Support Systems

NCRODP-92.1 Fire Protection

1. Fire Protection System Construction, Operation & Procedures

NCRODP-92.2 Service Water

1. Service Water

NCRODP-92.3 Liquid Waste

1. System Description
2. Instrumentation & Controls
3. General System Operation

NCRODP-92.4 Gaseous Waste

1. Water Gas Disposal System

NCRODP-92.5 Circulating Water System

1. Circ. Water

NCRODP-92.6 Component Cooling Water

1. System Description
2. Instrumentation & Controls
3. General Operation

NCRODP-92.8 Water Treatment

1. Makeup Water
2. Flash Evaporator
3. Demineralizer

NCRODP-92.9 Fuel Handling and Refueling Operations

1. Fuel Handling & Refueling Operations
2. Core Components
3. Fuel Handling Equipment
4. Refueling Operations

NCRODP-92.10 Compressed Air System

1. Service Air Objectives

NCRODP-92.11 Main Generator Seal Oil System

1. Hydrogen Side Seal Oil System
2. Air Side System

NCRODP-92.12 Sampling Systems

1. High Rad. Sampling System

NCRODP-92.13 Appendix R Monitoring

1. App. Monitoring in Fuel Building

NCRODP-92.14 Boron Recovery System

1. System Description

NCRODP-92.15 Ventilation System

1. Primary Ventilation System
2. Control Room Ventilation
3. App. R. Modification to Ventilation

NCRODP-92.16 Bearing Cooling System

1. Bearing Cooling System

NCRODP-92.17 Vacuum Priming System

1. Vacuum Priming System

NCRODP-93 Instrumentation and Control

NCRODP-93.1 Radiation Monitoring

1. Westinghouse Radiation Monitoring
2. Hi Range Radiation Monitoring System

NCRODP-93.2 Excore NIS

1. Detector Operation
2. Instrument Operation
3. Excore Monitoring System

NCRODP-93.3 Incore NIS

1. Incore Detection System
2. Incore Instrumentation System

NCRODP-93.4 Core Cooling Monitoring

1. Instrumentation & Control

NCRODP-93.5 Rod Control & Rod Position Indication

1. Rod Control Drive Mechanism
2. Rod Control System
3. Rod Position Indication System

NCRODP-93.6 Meteorological Monitoring

1. Meteorological Monitoring

NCRODP-93.7 Seismic Monitoring

1. Seismic Monitoring

NCRODP-93.8 Pressurizer Pressure and Level Control and Protection

1. Pressurizer Level Control & Protection
2. Pressurizer Pressure Control & Protection

NCRODP-93.9 Main Generator Control and Protection

1. Main Generator Control & Protection
2. Main Generator Breaker Control

NCRODP-93.10 Reactor Protection

1. Instrumentation & Control
2. Operation of the Reactor Protection System

NCRODP-93.11 Steam Dumps

1. Steam Dumps

NCRODP-93.12 SGWLC and Protection

1. Steam Generator Water Level Control & Protection System

NCRODP-93.13 RVLIS

1. Reactor Vessel Level Indication System

NCRODP-93.14 Basic I and C

1. Intro.
2. Sensing Elements
3. Controller & Control Actions
4. Final Elements
5. Control Systems

NCRODP-93.15 Auxiliary Shutdown Panel

1. Aux. S/D Panel

NCRODP-93.16 P-250 Plant Computer

1. Plant Computer

NCRODP-93.17 Vibration and Loose Parts Monitoring

1. Vibration & Loose Parts Monitoring System
2. Loose Parts Monitoring Subsystem

NCRODP-93.18 Instrument Failures

1. I&C System Failure Analysis

NCRODP-93.19 Inadequate Core Cooling Monitor

1. Inadequate Core Cooling Monitor

NCRODP-94 Startup Certification (not applicable)

NCRODP-95 Transient Response and Mitigating Core Damage

NCRODP-95.1 Transient and Accident Analysis

1. Transient and Accident Analysis

NCRODP-95.2 Mitigating Core Damage

1. Mitigating Core Damage
2. Potentially Damaging Operating Conditions
3. Accident Response to Incore Instrumentation
4. Accident Response of Excore Instrumentation
5. Post Accident Core Damage Assessments
6. Rad. Aspects of Core Damage
7. ATWS

NCRODP-95.3 Emergency Response Guidelines

1. Emergency Op. Procedures, Emerg. Supplement, Emerg. Contingency Actions
2. Critical Safety Functions

NCRODP-96 Teamwork and Diagnostic Skills

1. Team Development
2. Personality Types
3. Communications
4. Leadership
5. Conflict Resolution
6. Managing Stress
7. Control Room Team Roles and Responsibilities
8. Decision Making
9. Problem Solving
10. Diagnostic Principles
11. Applying Diagnostics To Procedure Use

NCRODP-97 Station Modifications and Operations Experience (not applicable)

NCRODP-98 Audit Examinations (not applicable)

NCRODP-99 NRC Examination Preparation (not applicable)

NCRODP-100 Administrative Procedures

TAB 4 TEAMWORK AND DIAGNOSTIC SKILLS

4-1 CURRICULUM OUTLINE

TEAMWORK AND DIAGNOSTIC SKILLS

CURRICULUM OUTLINE

I. TEAM DEVELOPMENT

A. Introduction: Why We Emphasize Team Skills
B. Team Characteristics
C. The Advantages of Teamwork
D. Teamwork Process Model
E. Basic Team Behaviors
F. The Four Stages of Team Development
G. Techniques for Improving Teamwork on the Job

II. PERSONALITY TYPES

A. The Myers-Briggs Type Indicator
B. Interpretation of MBTI Styles
C. Applying MBTI Information To Our Jobs and Teamwork

III. COMMUNICATIONS

A. Introduction: The Importance of Successful Communication
B. The Communication Process
C. Communication Barriers
D. Techniques for Overcoming Barriers
E. One-Way Vs. Two-Way Communication
F. Types of Communication
G. Listening
H. Feedback
I. Questioning Techniques
J. Giving Instructions
K. Communication Standards for Operations

IV. LEADERSHIP

A. Leadership Theories
B. Situational Leadership Styles
C. Selecting the Appropriate Leadership Style
D. Influencing: An Important Leadership Skill
E. Conflict Resolution Skills

V. CONFLICT RESOLUTION

A. Introduction
B. Causes of Conflict
C. Types of Conflict: Destructive or Constructive
D. Conflict Resolution Style
E. Conflict Resolution Skills

VI. MANAGING STRESS

A. Introduction
B. Awareness: Knowing the Causes and Effects of Stress
C. Relaxation
D. Positive Attitude and Lifestyle
E. Reducing the Impact of Stress in the Control Room

VII. CONTROL ROOM TEAM ROLES AND RESPONSIBILITIES

A. Functions of the Control Room Team
B. Breakdowns in Teamwork
C. Sources of Established Control Room Team Roles and Responsibilities
D. Unwritten Roles and Responsibilities
E. Roles and Responsibilities of the Control Room Team

VIII. DECISION MAKING

A. Effective Decisions
B. Types of Decisions
C. Individual Vs. Team Decisions
D. The Decision-Making Process

IX. PROBLEM SOLVING

A. Types of Problem-Solving Situations
B. Problem-Solving Styles
C. Information - Collecting Styles
D. The Problem-Solving Process
E. Problem-Solving Techniques

X. DIAGNOSTIC PRINCIPLES

A. The Three Major Steps of the Diagnostic Process
B. Monitoring
C. Maintaining Awareness
D. Detecting Trends
E. Identifying Problems
F. Barriers to Effective Monitoring
G. Interpretation
H. Intervention
I. Human Performance Problems Related to Diagnostics
J. Diagnosing Plant Problems

XI. APPLYING DIAGNOSTICS TO PROCEDURE USE

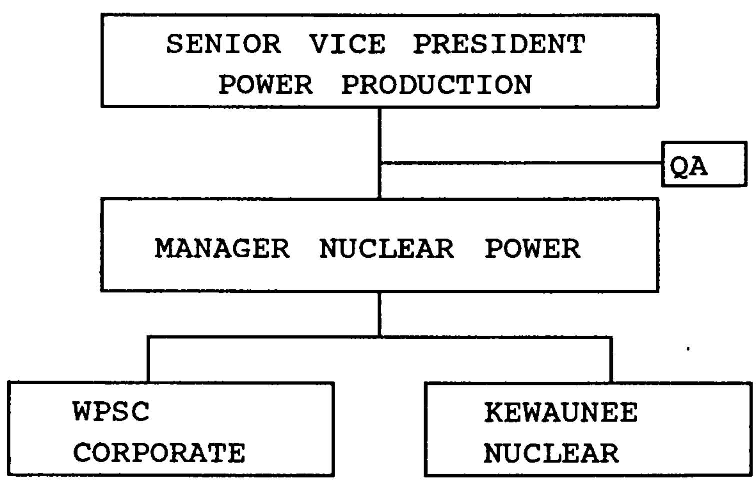
A. Introduction
B. Procedural Compliance
C. Procedure Limitations
D. Deviating From Procedure

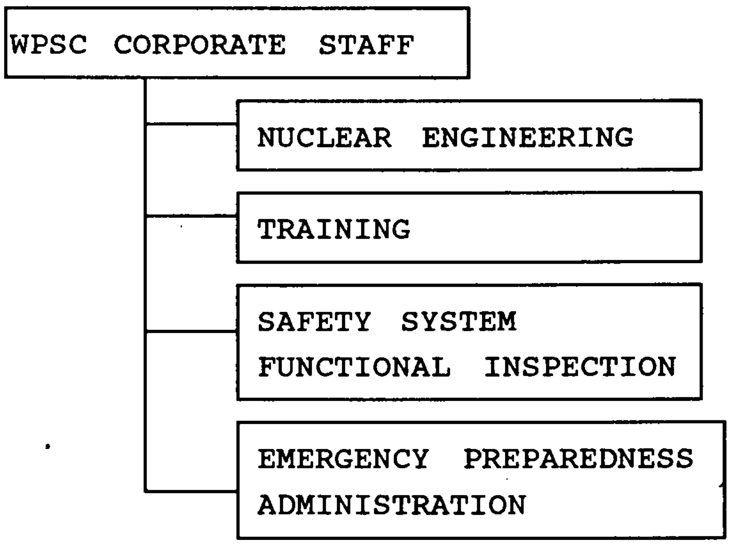
PERFORMANCE STATISTICS 1988

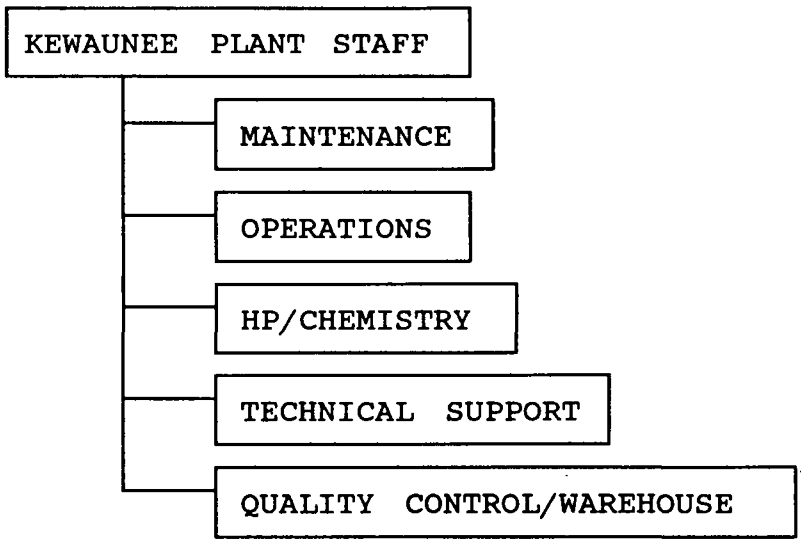
	Kewaunee	Industry Ave.
Availability Factor	87.4	69.8
Capacity Factor	83.3	63.6
Forced Outage Rate	1.7	10.2

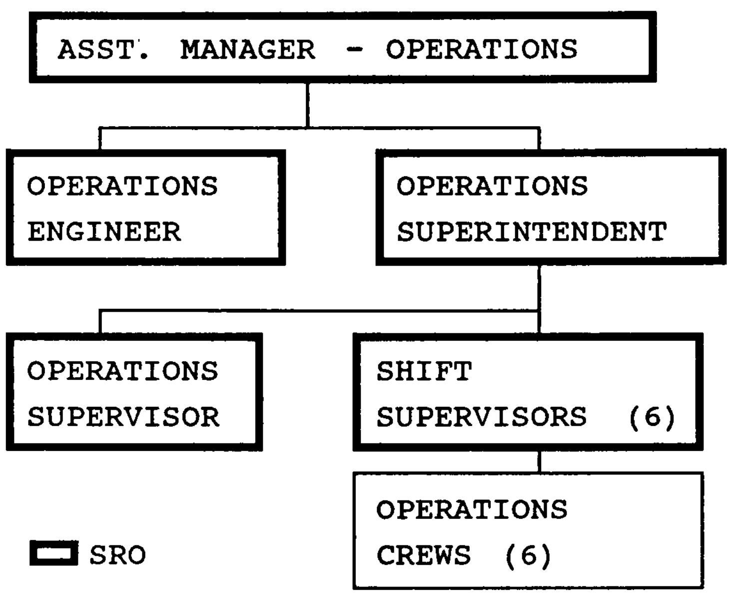
<u>RADIOLOGICAL MANAGEMENT - 1987</u>

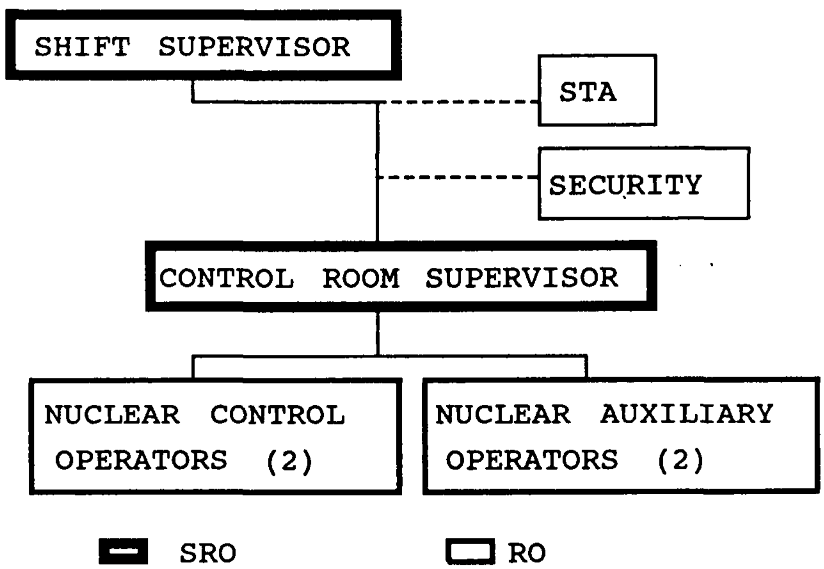
	Kewaunee	Industry Average
Personnel Exposure (Man-Rem)	226	368
Low Level Radwaste (Cubic Meters)	70	194


SENIOR VICE PRESIDENT
POWER PRODUCTION
QA
MANAGER NUCLEAR POWER
WPSC
CORPORATE
KEWAUNEE
NUCLEAR


WPSC CORPORATE STAFF
NUCLEAR ENGINEERING
TRAINING
SAFETY SYSTEM FUNCTIONAL INSPECTION
EMERGENCY PREPAREDNESS ADMINISTRATION


KEWAUNEE PLANT STAFF
MAINTENANCE
OPERATIONS
HP/CHEMISTRY
TECHNICAL SUPPORT
QUALITY CONTROL/WAREHOUSE


ASST. MANAGER - OPERATIONS
OPERATIONS ENGINEER
OPERATIONS SUPERINTENDENT
OPERATIONS SUPERVISOR
SHIFT SUPERVISORS (6)
OPERATIONS CREWS (6)
SRO


SHIFT SUPERVISOR
STA
SECURITY
CONTROL ROOM SUPERVISOR
NUCLEAR CONTROL OPERATORS (2)
NUCLEAR AUXILIARY OPERATORS (2)
SRO
RO

OPERATIONS GROUP PROFILE

- 40% Have Nuclear Navy Experience
- 30% Have 2 Year Associate Degree
- 25% Active in Baccalaureate Program

OPERATIONS GROUP PROFILE

	Ave. Yrs Experience
Shift Supervisor	14.5
Control Room Supervisor	12.5
Nuclear Control Operator	11.0

REACTOR OPERATOR
TRAINING PROGRAM COMPARISON

	1980	Present
Fundamentals	12	16
Systems	12	16
On-Shift Time	500 hrs	520 hrs
Simulator Time	2 weeks	8 weeks
Training Reactor	2 weeks	2 weeks

REACTOR OPERATOR TRAINING PROGRAM

SIGNIFICANT IMPROVEMENTS

- Site-Specific Simulator
- Site Specific Accident/Transient Analysis
- Team Skills/Diagnostic Training
- Emergency Response Guidelines

OPERATIONS GROUP ATTRITION

1984 - 1988

- 3 Terminated Employment
- 3 Retired or Deceased
- 16 Promoted or Transferred
  - * 15% of Supervisors Have Operations Background

RESOURCES AVAILABLE TO OPERATIONS CREW

- Plant Staff Immediately Available By Telephone
- Plant Staff Can Respond To Site In 30-60 Minutes
- NSSS/Architect-Engineer By Phone In 1 Hour