



KNOWLEDGE RETENTION & TRANSFER

TVA's Approach to Retaining Critical Knowledge in an Aging Workforce

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TVA's Approach to Retaining Critical Knowledge in an Aging Workforce



Agenda

Background and Overview

- TVA's Attrition Challenge
- Integrated Staffing Plan
- Retaining Critical Knowledge
 - Knowledge Retention Initiative
 - Application of KR at Sequoyah Nuclear Plant
 - Lessons Learned

Application of Knowledge Retention

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Who is TVA?



- America's largest public power producer
- Through a network of 158 municipal and cooperative power distributors
- 8 million customers; 7 states
- 12,800 Employees
- Capacity – 31,000 MW
 - 3 nuclear plants
 - Five units; 5,683 megawatts
 - 11 coal-fired plants
 - 29 hydroelectric dams
 - 1 pump storage facility



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The Attrition Challenge



Significant downsizing 1988 – 1997

- ❖ From 28,000 to Less Than 12,800 Employees
- ❖ TVA Nuclear from 13,900 to Less Than 2,900
- ❖ Very Limited Entry Level Recruiting
- ❖ Various Retirement Incentives to Aid Downsizing

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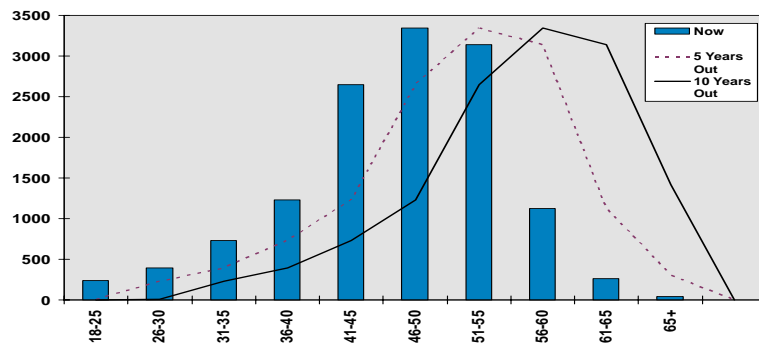
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The Attrition Challenge



- Average Age – approximately 47
- 1/3 can retire within next 5 years
- Timing Replacements???????
- Manage Labor Cost



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Integrated Staffing Plan



Developed in 1998, TVA's Integrated approach to Staffing includes:

- ❖ Work Force Planning
- ❖ Recruiting Initiatives
- ❖ Training Pipeline
- ❖ Key Leadership/Succession Planning
- ➔ **Knowledge Retention**

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Recruiting Initiatives



- College Recruiting
 - Eight Targeted Universities
 - In Valley Recruiting (helps retention)
- Maintenance and Operations Pipeline
 - Majority entry level trainees – 2 year degree required in technical area – EEI Testing
 - Supplement Maintenance with experience/journey level as needed
 - Navy Nuclear as available in Ops
- Professional/Experienced Recruitment to Ensure Adequate Bench strength

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Training Pipeline



The role of pipeline training and multi-skilling in knowledge transfer

Currently 142 trainees in Pipeline Training Programs

- 133 Skilled Craft
- 9 Engineers/Technical

- Increased entry-level requirements and shorter training programs (2.5 vs 4 years) - Most require 2 year Technical Degree & EEI Test
- Use craft instructors/subject matter experts (SMEs)
- Use benchmarking to improve programs - *faster to work*
- Cross train incumbent employees- *Multi-skilling*
- Use of retirees as instructors and SMEs

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Knowledge Retention Initiative

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Knowledge Retention

8 Knowledge Management Strategies

- External Best Practice Sharing
- Internal Best Practice Sharing
- Competitive Intelligence (CI)
- Knowledge of Customers
- Innovation & Creation of New Knowledge
- Intellectual Capital and CI Protection
- Avoidance of Knowledge Loss Through Attrition
- KM Information Technology Tools

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Knowledge Retention



Process Focus

- Focusing on the critical positions where knowledge loss is the greatest threat
- Identifying and prioritizing the specific knowledge and skills at risk
- Developing concrete, actionable responses to mitigate this loss.

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Knowledge Retention



TVA's Knowledge Retention Process -
Retaining Critical Knowledge

Three main subprocesses/activities:

- Step 1.** Conduct a ***Knowledge Loss Risk Assessment***
- Step 2.** ***Determine Approach*** to Capture Critical Knowledge
- Step 3.** ***Monitor*** and ***Evaluate***

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Knowledge Retention

Step 1 Step 2 Step 3



"Knowledge Loss Risk Assessment"

- The "Knowledge Loss Risk Assessment" is designed to identify positions/people where the potential knowledge loss is greatest and most imminent.
- Includes Ratings based on two factors:
 - Time until Retirement
 - Position Criticality
- Provides focus - Identifies positions where steps to mitigate knowledge loss may be needed.

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Knowledge Retention

Step 1 Step 2 Step 3



"Knowledge Loss Risk Assessment"

$$\text{Retirement Factor} \times \text{Position Risk Factor} = \text{Total Attrition Factor}$$

Retirement Factor -- The projected retirement dates in the work force planning system (whether based upon employee estimates or calculated based on age and tenure data) will be assigned a retirement factor as follows:

- 5 - Projected retirement date within current or next fiscal year
- 4 - Projected retirement date within 3rd fiscal year
- 3 - Projected retirement date within 4th fiscal year
- 2 - Projected retirement date within 5th fiscal year
- 1 - Projected retirement date within or greater than 6th fiscal year

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Knowledge Retention



Step 1 Step 2 Step 3

"Knowledge Loss Risk Assessment"

$$\text{Retirement Factor} \times \text{Position Risk Factor} = \text{Total Attrition Factor}$$

Position Risk Factor -- An estimate of the difficulty or level of effort required to replace the position incumbent. Managers/supervisors are responsible for making these ratings based upon the following criteria:

- 5 - Critical and unique knowledge and skills. Mission-critical knowledge/skills with the potential for significant reliability or safety impacts. TVA- or site-specific knowledge. Knowledge undocumented. Requires 3-5 years of training and experience. No ready replacements available.
- 4 - Critical knowledge and skills. Mission-critical knowledge/skills. Some limited duplication exists at other plans/sites and/or some documentation exists. Requires 2-4 years of focused training and experience.
- 3 - Important, systematized knowledge and skills. Documentation exists and/or other personnel on-site possess the knowledge/skills. Recruits generally available and can be trained in 1 to 2 years.
- 2 - Proceduralized or non-mission critical knowledge and skills. Clear, up-to-date procedures exist. Training programs are current and effective and can be completed in less than one year.
- 1 - Common knowledge and skills. External hires possessing the knowledge/skill are readily available and require little additional training.

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Knowledge Retention



Step 1 Step 2 Step 3

"Knowledge Loss Risk Assessment"

$$\text{Retirement Factor} \times \text{Position Risk Factor} = \text{Total Attrition Factor}$$

Total Attrition Factor -- An estimate of the effort and urgency necessary to effectively manage the attrition.

- 20-25 High Priority - Immediate action needed. Specific replacement action plans with due dates will be developed to include: method of replacement, knowledge management assessment, specific training required, on-the-job training/shadowing with incumbent.
- 16-19 Priority - Staffing plans should be established to address method and timing of replacement, recruitment efforts, training, shadowing with current incumbent.
- 10-15 High Importance- Look ahead on how the position will be filled/ work be accomplished. College recruiting, training programs, process improvements, reinvestment
- 1-9 Important - Recognize the functions of the position and determine the replacement need.

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Knowledge Retention

Step 1 Step 2 Step 3

“Determine Approach to Capture Critical Knowledge”

- Conduct Interview to ID potential knowledge loss areas
- Assess consequences of loss using interview results and organization specific critical skills inventories
- Prioritize and ID options to retain or mitigate
- Develop and implement action plans

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Knowledge Retention

Step 1 Step 2 Step 3

Conduct Interview to ID potential Knowledge Loss Areas

Interview Questionnaire

- General questions
- Task questions (how...)
- Fact or information questions (what...who...)
- Pattern recognition / lessons-learned questions

C. Questions About Facts or Information

A. General Questions

Questionnaire

Identifying At-Risk Knowledge

Instructions

The purpose of this questionnaire is to help you identify your critical skills and knowledge, especially those unique knowledge items and skills that might be lost when you leave TVA.

Some things to think about as you work through these questions:

- Knowledge or skill can mean several different things. We want to use a very broad definition that could include anything that new employees would need to know to do a job like yours (except for the exclusions noted below).
- Do not include standard skills that are common to your particular job or that are assumed for a particular certification or degree (e.g., journeyman electricians are expected to be able to read a blueprint, etc.). If you're not sure it is common, include it here.
- Some of the questions will appear to ask the same thing several different ways. We do this on purpose to make sure we do not miss valuable information. When the answer is something you have already discussed, simply say so rather than repeat the information again.
- When we ask you to describe or list things, give us a general description and not a detailed description. Don't try to tell us how to do something. We will come back and gather this level of detail later. For now we are just trying to build lists to evaluate and prioritize.
- For each major piece of knowledge, try to give us some sense of how important it is and how much trouble we may be in due to attrition. Tell us if the knowledge is written down somewhere or not, who knows it besides you, what would likely happen if no one knew this, how long it takes someone to learn it, etc.
- The questions under section D will produce lists. In many cases these lists will already exist in job descriptions, training programs, PM procedures, and/or in various databases. If so, simply refer to the appropriate source or list and tell us how to find it. In other words, there is no need to try to rewrite the list in the spreadsheet.

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Knowledge Retention

Step 1 Step 2 Step 3

Monitor and Evaluate Knowledge Retention Plans

- ✓ Review updated Work Force Planning Attrition Data - *Annually during Business Planning*
 - Review previous Knowledge Retention Plans
 - ID areas that need to be reassessed (*Repeat Conduct Knowledge Loss Risk Assessment - Step 1*)
- ✓ Quarterly Work Force Reviews (Succession Planning Meeting)
- ✓ Bi-Annual Leadership Review Meetings

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End Overview

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Implementation of TVA's Knowledge Retention Process at Sequoyah Nuclear Plant

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Sequoyah Nuclear Plant – Quick Facts

- 2-Units / 2320MW
- 4-loop, Westinghouse designed PWR with Ice Condenser Containment
- Commercial Operation, 1981 (Unit 1)
- 852 Employees
- Contractors for security, etc . . .

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Sequoyah KR Demographics



Status/Results of Assessments:

- All employees have been assessed and have a “Score” (851 current employees)
- 10 “High Priority” KR Action Plans initially developed
- 4 “High Priority” KR Action Plans currently being monitored

Breakdown of Assessments:

- 4 “High Priority”
- 12 “Priority”
- 136 “High Important”
- 699 “Important”

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Sequoyah Nuclear Plant: KR Update *Background/History*



- First KR assessment November, 2003 - initially identified 10 “High Priority” candidates
- Internal consultant conducted interviews with all 10 candidates – Develop Action Plans
- Of 10 initially identified as “High Priority” 4 are still considered as “High Priority” today
- Disposition of the other 6:
 - Employee 1, Civil Engineer: Moved retirement date 2 years out, which moved score to a less priority
 - Employee 2, Rad. Chemist: Moved retirement date 4 years out, which moved score to a less priority
 - Employee 3, Ops Specialist: Moved retirement date 4 years out, which moved score to a less priority
 - Employee 4, Maintenance Specialist: Retired after knowledge loss was captured through Action Plan
 - Employee 5, Electrical Design Engineer: Retired after knowledge loss was captured through Action Plan
 - Employee 6, Mech Maintenance Engineer: Moved retirement date, which moved score to a less priority

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Sequoyah Nuclear Plant: KR Update *Current State*



- 4 “High Priority” candidates. Plans last reviewed in March 2005:
 - Employee A, Periodic Test Program Specialist: Replacement person hired from outside with turnover in progress. Retire in August.
 - Employee B, System Engineer (Pumps, Valves): Knowledge captured through this process and turnover to in-house personnel. Retirement Dec.
 - Employee C, System Engineer (Primary water side): Knowledge captured through this process and turnover to in-house personnel. Retirement early 2006.
 - Employee D, Electrical Design Engineer: Knowledge captured through this process and turnover to in-house personnel. Retirement in August.
- Sequoyah recently updated attrition information on all employees, surfaced 5 additional names to the potential “High Priority” status. After evaluations and review by the team, determined they were not in the “High Priority” category - Action Plans not needed.
- **Immediate Next Steps**
- Develop KR Action Plans for the 5 employees on site with a position risk factor of “Critical”
- Continually evaluate the effectiveness of the program

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Sample KR Plan – Sequoyah Engineer



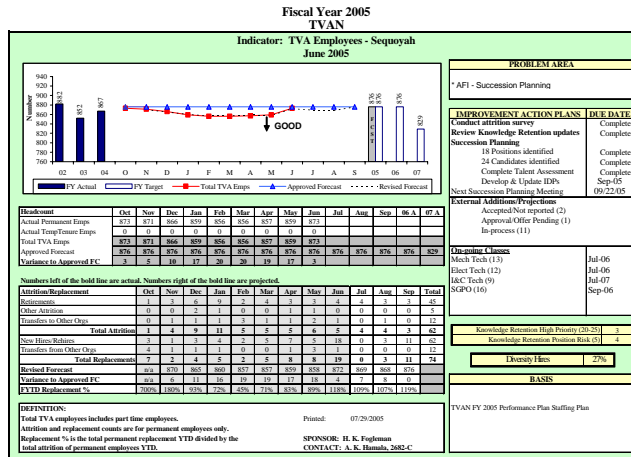
KNOWLEDGE RETENTION PLAN				
Employee:	Position: Engr. Mech. General (NUC)	Position Risk Factor: 4 Retirement Factor: 5	Total Attrition Factor: 20	
Summary and Situation Assessment:				
<p>The incumbent has in depth knowledge of and expertise in piping analysis with emphasis on use of the T Pipe software. This software is unique to SQN and little duplication of knowledge exists. Though a replacement person with an engineering degree could become proficient in the use of this software in about six months, at least two years on-the-job training is needed to respond quickly to urgent questions related to piping analysis. In addition to the T Pipe system, there must be extensive knowledge of the Class II computer system, SDP – NEDP9, and SQN LDC 13.1 and 24.2. Though a person with a two year degree may be knowledgeable, it is preferable to have someone with a four year degree in either Civil or Mechanical Engineering.</p> <p>Currently <u>Employee A</u> is being cross-trained on the T Pipe system. <u>Employee B</u> also works with this system and has significant knowledge. <u>Employee C</u> and <u>Employee D</u> work in the Chattanooga TVAN Corporate office and also have knowledge of the system.</p> <p>Because the T Pipe system is unique to SQN there is no external training on its use. However ASME does provide training on piping analysis and code requirements.</p>				
Knowledge or Skill	Criticality (1-5)	Actions (Required of Criticality 4-5) List steps which can and will be taken to retain this critical knowledge/skill and/or minimize the impact of its loss)	Target Date(s) for Completion	Status and Issues
Rigorous and alternate piping analysis, component qualification of code components and pipe rupture analysis skills	5	<ul style="list-style-type: none"> • Identify a replacement person for the critical skills • Replacement person complete ASME courses in piping analysis and code requirements • Replacement person develop a working knowledge of T-Pipe Code, ASME Code, procedures and criteria through reading and mentoring of _____ and _____ 	Dec 2004 Sept 2005 Sept 2005	<u>Employee A</u> and <u>Employee B</u> are being cross-trained in T-Pipe. Will send both to ASME Course when offered by TVA Training. Both being Mentored
Development Plans	5	<ul style="list-style-type: none"> • Supervisor assign replacement person “trail tasks” under the direction of _____ and/or _____ • Replacement complete qualification card under mentor sponsorship • Include mentoring in _____ and _____ PR&D and developmental goals in replacement individual • Recruit/hire person to replace replacement person 	March 2005 Dec 2005 Sept 2004 Oct 2005	On going replacements are _____
Documentation	5	Incumbent to develop a piping analysis, component qualification and pipe rupture reference library of handbooks, procedures, criteria and process in conjunction with replacement person.	Sept 2004	On going will be completed by Sept.
Knowledge Retention Plan Prepared by: <u>OE Consultant</u>		Date: November 6, 2003		
Last Update: <u>7/22/04; Manager</u>				

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Sequoyah Nuclear Plant: KR Update Monthly Report



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Examples of KR Options Used



Codification

- Incumbent, in conjunction with the replacement, developed reference library of handbooks, procedures, criteria, and processes for the key knowledge area.

Engineer it Out

- While not purely KR issue, a side benefit/example of this could include redesign/replacement of problematic controllers, which are maintenance intensive and difficult to operate (case where expertise to operate and maintain equipment limited to a few).

Alternative Resources

- In the case of Mechanical Engineer alternate resources were identified in Corporate Office that possessed a portion of this knowledge / expertise.

Education and Training

- Elec Engr Design. w/ expertise in Protective relaying, Switch Gear, breakers, etc. – selected a replacement, then used mentoring, formal training, and OJT to develop the replacement.
- Routinely, utilize subject matter experts as instructors in Technical Training classes to pass on / share critical knowledge items.

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Lessons Learned



- Less at-risk knowledge than suspected
- Risk greatest in specialized technical positions and in problem solving strategies
- Range of options to mitigate knowledge loss
- Current procedures may be weak; rely on experienced personnel rather than strong processes and detailed plans
- Self Assessment Areas for Improvement
 - Program ownership at TVA level
 - Closer alignment w/Succession Planning and Key Leadership
 - Sharing of KR info among organizations
 - Inclusion of collateral duties when assessing criticality
 - Implementation and follow through/periodic reviews

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Questions?







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End Sequoyah Demo.

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KNOWLEDGE RETENTION PLAN

Directions:
 Knowledge Retention Plans should be developed for knowledge and skills identified as most critical. Plans may include both methods to retain the critical knowledge and skills and actions necessary to mitigate the negative impact of losing the knowledge and skills.

Options
 A variety of alternatives can be used to address impending loss of critical knowledge and skill. These include:

Staffing <ul style="list-style-type: none"> ✓ New hire or transfer ✓ Current employee to assume responsibilities 	Documentation and Codification <ul style="list-style-type: none"> ✓ New or Revised Procedures ✓ Checklists, Inventories, etc. ✓ Performance Support Systems ✓ Shared Folders, Intranet, Job Aids ✓ Videotaped Instructions & Demonstrations ✓ Photographic Record ✓ Concept Maps 	Process Re-engineering <ul style="list-style-type: none"> ✓ Process Improvement ✓ Update Equipment ✓ "Smart" tools and technology ✓ Eliminate task, product or service
Education & Coaching <ul style="list-style-type: none"> ✓ Classroom and Simulator Training ✓ CBT, Video-based, and alternative delivery ✓ Directed Self-Study ✓ OJT and Qual Cards ✓ Targeted Work Assignments ✓ Coaching, Shadowing and Mentoring ✓ Apprenticeship Programs 		Alternative or Shared Resources <ul style="list-style-type: none"> ✓ Agency/interdepartment expert ✓ Rotational or "Visiting" Staff ✓ Multi-skilling, Cross-training, Collateral Duties ✓ Contractors, part-timers, retirees

Coordination:
 Some actions included on KR Plans need to be coordinated with other groups in order to be completed. In other instances, a potential knowledge loss issue at one site or within one group may suggest a more widespread threat. To complete the KR Plan or to address broader issues, coordination should occur with such groups as:

• Site training	• Peer Teams	• Process and Methods
• Other Sites	• Recruiting	• TVAN Corporate
• Key Leadership & Succession Planning	• Employee Technical Training & Organizational Effectiveness	

This coordination should be addressed as part of developing the KR Plan. As needed, senior management addresses coordination or implementation issues which cross major sites or divisions.

Example

At-Risk Knowledge or Skill	Actions	Assigned To:	Target Date(s) for Completion	Status and Issues
Mary is designer of -- and expert on -- client database (in Microsoft Access)	<ul style="list-style-type: none"> • Develop up-to-date documentation of database. • Complete MS Access training • Mary cross-train Mike on database. • All --Include these activities in PR&D 	Mary Mike Mary and Mike Mike, Mary, & supervisor	July 30 July 30 Sept. 30 By quarterly review	

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KNOWLEDGE RETENTION PLAN

Employee: Employee X Position: Program Manager/Elect Install & Cable Position Risk Factor: 25

Summary and Situation Assessment:

The incumbent has a great deal of critical knowledge and experience related to wiring and cable at all TVAAN sites. For example, the incumbent is the only one at TVA performing failure analysis on anything dealing with wire and cable. At present, his analysis can't be checked since he is the only one who knows how to do the analysis. The incumbent has become known in the industry as an expert dealing with wiring and cable and receives inquiries from other TVA groups (esp. FPG and Hydro) and from outside TVA.

The incumbent has designed, developed and facilitated training at all sites in an effort to establish some site expertise in this area. As a result of this training, there are pockets of knowledge at each site to handle day-to-day issues. The incumbent maintains more strategic responsibilities (monitoring TVA-wide patterns, identifying emerging issues, following industry developments, etc.), lab work, and consulting with the sites. He maintains a number of guides, journal, lists of industry experts and vendor contacts, an internal web site and other resources.

The incumbent represents TVA on IEEE's Insulated Conductors committee and in other industry and professional forums.

There is no formal higher level institute who provides knowledge and skill training in this area. The incumbent has basically self taught through using industry experts, OJT, and by controlled lab work.

At-Risk Knowledge or Skill	Actions	Assigned To:	Target Date(s) for Completion	Status and Issues
Expertise on generation-related wiring and cables TVA-wide	Steps which will be taken to retain this critical knowledge skill and/or minimize the impact of its loss. <ul style="list-style-type: none"> Recruit, hire and develop and additional wiring and cable expert(s). 	Manager Y	Sept. 1, 05	With approval, position will be advertised internally and externally.
	<ul style="list-style-type: none"> Prepare and implement development plan for an additional wiring and cable specialist. 	Employee X	Sept. 1 05	Begin development simultaneous to position advertisement.
	<ul style="list-style-type: none"> Continue development and maintenance of wiring and cable-related documentation (installation & design guides, lab procedures/processes, etc.) 	Employee X	Ongoing	Review progress and priorities quarterly

The incumbent also noted that the industry-wide cable/wiring professional network has the same knowledge retention issues surrounding this field as does TVA.

¹ Since explicit knowledge is not available off the street, then TVA will have to develop in-house. This could take 2 to 3 years. New expert should be a degreed engineer with training and/or experience in electrical, mechanical, chemical, and/or materials/electrics.