Kentucky Power Company

REQUEST

Refer to the Company's response to Staff 2-71c OH page 1 of 4. Provide this same information for the most recent five years.

RESPONSE

Information is only available for the four most recent tax years. See attached pages.

2002 was the first year that KPC filed an Ohio Franchise tax return, due to a change in the Ohio tax law on Apirl 30, 2000. (see attached document for a copy of Ohio Revised Code Sec. 5727.30).

WITNESS – Sandra Keller

Kentucky Power - Ohio Apportionment
As Last Filed - 2005 Tax Year

PROPERTY FACTOR			
TOTAL	OH AMOUNT	OH %	OH % @ 20%
1,387,574,154	0	0.000000	0.000000

PAYROLL FACTOR			
TOTAL	OH AMOUNT	OH %	OH % @ 20%
27,466,957	0	0.000000	0.000000

SALES FACTOR			
TOTAL	OH AMOUNT	OH %	OH % @ 60%
1,052,490,950	254,641,864	0.241942	0.145165

TOTAL OF FACTORS
0.145165

Kentucky Power - Ohio Apportionment
As Last Filed - 2004 Tax Year

PROPERTY FACTOR

TOTAL	OH AMOUNT	OH %	OH % @ 20%
1,286,014,271	0	0.000000	0.000000

PAYROLL FACTOR

TOTAL	OH AMOUNT	OH %	OH % @ 20%
29,177,440	0	0.000000	0.000000

SALES FACTOR

TOTAL	OH AMOUNT	OH %	OH % @ 60%
1,274,590,130	161,188,108	0.126463	0.075878

TOTAL OF FACTORS
0.075878

Kentucky Power - Ohio Apportionment
As Last Filed - 2003 Tax Year

PROPERTY FACTOR			
TOTAL	OH AMOUNT	OH %	OH % @ 20%
1,184,103,706	0	0.000000	0.000000

PAYROLL FACTOR			
TOTAL	OH AMOUNT	OH %	OH % @ 20%
28,884,526	0	0.000000	0.000000

SALES FACTOR			
TOTAL	OH AMOUNT	OH %	OH % @ 60%
2,092,607,897	218,091,070	0.104220	0.062532

TOTAL OF FACTORS
0.062532

Kentucky Power - Ohio Apportionment
As Last Filed - 2002 Tax Year

PROPERTY FACTOR			
TOTAL	OH AMOUNT	OH %	OH % @ 20%
1,145,963,498	854,152	0.000745	0.000149

PAYROLL FACTOR			
TOTAL	OH AMOUNT	OH %	OH % @ 20%
28,828,520	0	0.000000	0.000000

SALES FACTOR			
TOTAL	OH AMOUNT	OH %	OH % @ 60%
2,263,283,042	252,972,906	0.111773	0.067064

TOTAL OF FACTORS
0.067213

STATE-LAW, OH-TAXRPTR ¶139-375, Sec. 5727.30. Utilities subject to excise tax; lien. –

[Ohio Revised Code], TITLE LVII TAXATION, CHAPTER 5727 PUBLIC UTILITIES, TAX ON NATURAL GAS COMPANY OR COMBINED ELECTRIC AND GAS COMPANY.

Sec. 5727.30. –

(A) Except as provided in divisions (B), (C), and (D) of this section, each public utility, except railroad companies, shall be subject to an annual excise tax, as provided by sections 5727.31 to 5727.62 of the Revised Code, for the privilege of owning property in this state or doing business in this state during the twelve-month period next succeeding the period upon which the tax is based. The tax shall be imposed against each such public utility that, on the first day of such twelve-month period, owns property in this state or is doing business in this state, and the lien for the tax, including any penalties and interest accruing thereon, shall attach on such day to the property of the public utility in this state.

(B) An electric company's or a rural electric company's gross receipts received after April 30, 2001, are not subject to the annual excise tax imposed by this section.

(C) A natural gas company's gross receipts received after April 30, 2000, are not subject to the annual excise tax imposed by this section.

(D) A telephone company's gross receipts derived from amounts billed to customers after June 30, 2004, are not subject to the annual excise tax imposed by this section. Notwithstanding any other provision of law, gross receipts derived from amounts billed by a telephone company to customers prior to July 1, 2004, shall be included in the telephone company's annual statement filed on or before August 1, 2004, which shall be the last statement or report filed under section 5727.31 of the Revised Code by a telephone company. A telephone company shall not deduct from its gross receipts included in that last statement any receipts it was unable to collect from its customers for the period of July 1, 2003, to June 30, 2004.

(As enacted by H.B. 794, Laws 1984; as amended by S.B. 156, Laws 1989; H.B. 904, Laws 1992; H.B. 283 and S.B. 3, Laws 1999; H.B. 640, Laws 2000; H.B. 95, Laws 2003, effective June 26, 2003.)

KPSC Case No. 2005-00341
KIUC 2nd Set Data Requests
Item No. 11
Page 6 of 6

Kentucky Power Company

REQUEST

Refer to the Company's response to Staff 2-71c OH page 1 of 4. Please describe what the $161 million represents. Does it represent KPC's MLR share of total AEP off-system sales revenues?

RESPONSE

The $161,188,108 represents KPC's MLR share of Ohio sales, as well as other Ohio operating revenue that is specifically attributable to KPC.

WITNESS – Sandra Keller

Kentucky Power Company

REQUEST

Does the Company reflect the Ohio franchise tax in the System Sales Clause computations? If so, please describe how it does so.

RESPONSE

No. Nor does it reflect other tax.

WITNESS – Errol K. Wagner

Kentucky Power Company

REQUEST

Refer to Section V Workpaper S-2 page 2 of 3. Provide the Company's workpapers supporting the apportionment factors for Ohio and West Virginia.

RESPONSE

See attachment in response to KIUC 2nd Set No. 11, on the tab titled "OH 2004" for the Ohio apportionment factor support workpaper.

See attachment in response to KIUC 2nd Set No. 10, on the tab titled "WV 2003" for the West Virginia apportionment factor support workpaper.

WITNESS – Sandra Keller

Kentucky Power Company

REQUEST

Refer to the Company's response to KIUC 1-15. There were no workpapers and source documents referenced in support of Section V of the Company's filing. Please confirm that there were none or provide the information requested in this question for Section V of the filing.

RESPONSE

The source documents for Section V of the Company's filing consist primarily of the Company's financial statements. They previously have been provided in the Company's Response to Data Request No. 23, AG First Set. In addition, the results of a line loss study were used. A copy of those results is attached.

WITNESS – Errol K. Wagner

KPCo Losses based on Test Year ending December 31, 2004

Loss Factors by System	% Demand	% Energy
System	**Loss**	**Loss**
Transmission	3.55%	2.87%
Subtransmission	1.78%	1.30%
Olive Hill - 4 kV (Transf #1)	0.74%	0.79%
Olive Hill - 12 kV (Transf #2)	0.84%	0.65%

Composite Loss Factors (Compounded)

System	Loss		Loss	
Transmission	**3.55%**	**Schedule 18**	**2.87%**	**Schedule 19**
Subtransmission	5.39%		4.21%	
Olive Hill - 4 kV (Transf #1)	**6.17%**		**5.03%**	
Olive Hill - 12 kV (Transf #2)	**6.27%**		**4.88%**	

Note: Composite Loss Factors are applicable to load metered at

respective system voltage to determine losses back to the generator.

Kentucky Power Company
City of Olive Hill
Energy and Demand Loss Calculation
Twelve Months Ended 06/30/2005

			Demand			Energy		
Line No.	**Month**	**Year**	**4 kw Billing**	**12 kw Billing**	**Total Billing**	**4 kw Billing**	**12 kw Billing**	**Total Billing**
1	July	2004	2,973.60	2,255.40	5,229.00	1,339,200.00	1,033,200.00	2,372,400.00
2	August	2004	3,007.20	2,242.80	5,250.00	1,195,200.00	921,600.00	2,116,800.00
3	September	2004	2,880.00	1,854.00	4,734.00	1,264,800.00	997,200.00	2,262,000.00
4	October	2004	2,056.80	1,558.80	3,615.60	981,600.00	694,800.00	1,676,400.00
5	November	2004	2,443.20	1,857.60	4,300.80	1,094,400.00	795,600.00	1,890,000.00
6	December	2004	3,494.40	2,471.40	5,965.80	1,824,000.00	1,285,200.00	3,109,200.00
7	January	2005	3,619.20	2,604.60	6,223.80	1,557,600.00	1,074,600.00	2,632,200.00
8	February	2005	2,913.60	2,329.20	5,242.80	1,605,600.00	1,116,000.00	2,721,600.00
9	March	2005	3,278.40	2,327.40	5,605.80	1,478,400.00	1,036,800.00	2,515,200.00
10	April	2005	2,275.20	1,643.40	3,918.60	1,036,800.00	772,200.00	1,809,000.00
11	May	2005	2,241.60	1,749.60	3,991.20	993,600.00	768,600.00	1,762,200.00
12	June	2005	2,913.60	2,203.20	5,116.80	1,332,000.00	119,800.00	1,451,800.00
			---------------	---------------	---------------	-------------------	-------------------	-------------------
13	Total		34,096.80	25,097.40	59,194.20	15,703,200.00	10,615,600.00	26,318,800.00
14	% of Total		57.60%	42.40%	100.00%	59.67%	40.33%	100.00%
15	Composite Loss		6.17%	6.27%		5.03%	4.88%	
16	Loss Factor		3.55%	2.66%		3.00%	1.97%	
17	Amounts on Sch 18 & 19				**6.21%**			**4.97%**
					=======			========
					Schedule 18			**Schedule 19**
18	4 kV Account No.		038-510-006-9					
19	12 kV Account No.		031-893-911-0					

Kentucky Power Company

REQUEST

Refer to the last paragraph on page 2 of the Company's response to KIUC 1-23. Please provide an electronic version, with formulas intact, of the Company's most recent cash flow forecast based on its most recent Financial Forecast. Identify and describe all assumptions on the timing of receipts and disbursements reflected in this cash forecast.

RESPONSE

The assumptions and timing of receipts and disbursements related to American Electric Power Company, Inc.'s financial forecast were provided in its Response to KIUC First Set of Data Request, Item No. 23. Attached is the electronic version, with formulas intact, of the most recent Financial Forecast.

WITNESS – Errol K. Wagner

Kentucky Power Company

REQUEST

Refer to the Company's response to Staff 2-60. Please describe why the cyclic vegetation management approach is superior to the performance based approach. Address why the performance based approach is not more cost cost-effective than the cyclic approach.

RESPONSE

The performance-based emphasis allows foresters to address circuits based on time elapsed since a circuit's last trim, reliability performance, criticality, and workforce input. The greater reliance on cyclic techniques that is being proposed initially is more costly than continuing with the current performance based approach; however, once fully established and consistently maintained, Kentucky Power expects continuing maintenance dollars to be reduced and ultimately providing a higher level of reliability.

Kentucky Power believes that the emphasis in its vegetation management on performance-based techniques is providing a high-level of overall tree related reliability performance. However, KPCo also understands that maintaining and meeting customers' growing demands for better reliability dictates the need to enhance the vegetation management program. A cyclic approach to managing our rights-of-way, based in large part on tree growth rates and time since previously maintained, should meet these expectations.

The performance based maintenance program, as currently practiced in Kentucky Power, uses historic reliability data as a primary input. By nature, these inputs target areas where vegetation has matured enough to interfere with the delivery of electricity. Due to safety considerations, reclearing vegetation that is close enough to contact energized conductors is more costly than maintaining vegetation that is outside the conductor zone.

Additionally, matured trees contain larger volumes of bio-mass that must be removed; which is more costly than handling brush and limbs with less growing time. At the current funding rate, a performance-based program is more cost effective than the investment needed to establish a cycle. However, the current level of funding for the performance based approach does not take the reliability "to the next level" that tomorrow's customer expects.

WITNESS – Everett G Phillips

Kentucky Power Company

REQUEST

Please describe when and why the Company switched to a performance based vegetation management approach.

RESPONSE

Beginning in the mid to late 1990s KPCO evolved its vegetation management practices to include more inputs into its tree trimming approach then just circuit criticality considerations and time continuum basis. The additional inputs include but are not limited to; reliability performance indicators/measures and work force input to look at portions of circuits that may pose a reliability threat. These additional inputs help prioritize and direct tree trimming resources. Vegetation management practices which take into consideration all of these inputs is known in the industry as a "performance-based" approach or in some cases an "asset management" approach.

The approach that is being proposed in Witness Phillips direct testimony is the next step in the vegetation management evolutionary process. The approach being recommended takes into consideration all the variables in the performance-based approach in addition to the Company conducting a complete system vegetation inventory for each of its circuits. In the proposed approach every circuit on KPCO's system will be cleared over a four year period and vegetation growth rates will be recorded to place each circuit on it's own unique cycle.

This approach, although initially more expensive to achieve, is expected to cost less to maintain and ultimately provide a higher level of reliability.

WITNESS – Everett G Phillips

Kentucky Power Company

REQUEST

Please provide a copy of all studies, analyses, and correspondence that addressed the economics and/or cost-effectiveness of the performance based versus cyclic vegetation management approach previously relied on by the Company to determine that a performance based approach was superior and should be adopted.

RESPONSE

As explained in the Company's response to KIUC-2nd Set, Item No. 18, the performance-based approach is an evolutionary process, therefore no specific studies or analyses are available for review. However, the performance-based approach is discussed in length in the 2003 Management Audit. Chapter 5 of the Management Audit is attached for your review.

WITNESS – Everett G Phillips

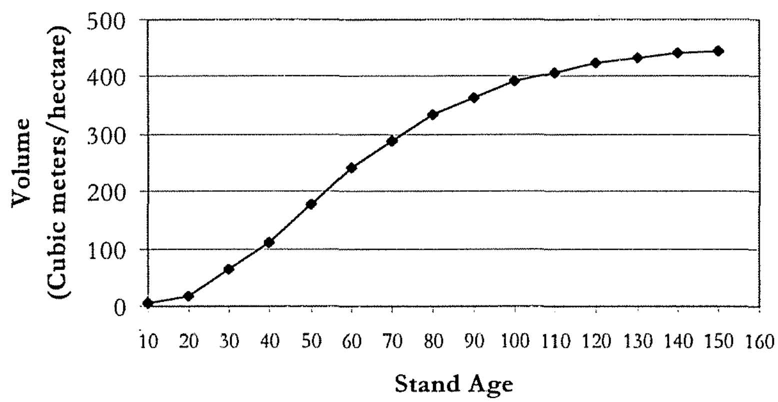
V. Vegetation Management and Animal Protection

This chapter addresses American Electric Power (AEP)/Kentucky's vegetation management and animal protection activities. Vegetation management is critical in providing reliable service to the customer. Tree-conductor contacts are the largest cause of unplanned service interruptions. AEP/Kentucky electric lines have a high exposure to trees. Animal-caused service interruptions, while not substantial, erode the quality of electric service and necessitate the installation of protective equipment.

A. Vegetation Management Concepts and Principles

The inventory of all trees that either have the potential to grow into a power line or on failure (breakage) to strike a conductor will be referred to as the utility forest. The utility forest has the same characteristics as any forest. The same patterns of biomass addition (tree growth) and tree mortality apply. Both of these are significant factors in power line security and both can be mathematically represented by geometric progressions, as illustrated in *Exhibit V-1*.

Exhibit V-1
Forest Biomass Addition
Timber Production
Spruce on Good Site



Adapted from: Freedman, Bill and Todd Keith, 1995. Planting Trees for Carbon Credits. Tree Canada Foundation.
1 cubic meter = 35.3 cubic feet.; 1 hectare = 2.47 acres

From a utility perspective, trees represent a liability in both the legal and financial sense. The fact that the utility forest changes by geometric progression is significant. It means the tree liability, if not managed, will grow exponentially.

Trees cause service interruptions by growing into energized conductors and establishing either a phase-to-phase or phase-to-ground fault. Trees also disrupt service when trees or branches fail, striking the line causing phase-to-phase faults, phase-to-ground faults or breaking the continuity of the circuit. As it is the two factors responsible for vegetation-related service interruptions, tree growth (biomass addition) and tree mortality, change by geometric progressions, the progression of tree-related outages is exponential. Failure to manage the tree liability leads to both exponentially expanding future costs and tree-related outages. Conversely, it is possible to simultaneously minimize vegetation management costs and tree-related outages.

It is not possible to totally eliminate the tree liability because the process of succession is a constant force for the re-establishment of trees from whence they were removed. The tree liability then, is like a debt that can never be completely paid. Under such circumstances, the best economy is found in maintaining the debt at the minimum level, thereby minimizing the annual accrued interest. However, irrespective of cost, minimizing the size of the tree liability or utility forest is rarely an option for utilities due to multiple stakeholders with an interest in the trees. What can be achieved, however, is equilibrium. The tree liability can be held constant at a point by annually addressing the workload increment. To continue the debt analogy, a debt is stabilized when the annual payments equal the interest that accrues through the year. The interest equivalent in the utility forest is comprised of annual tree growth and mortality. Actions that parallel the reduction in the debt principal are actions that actually decrease the number of trees in the utility forest. Such actions include removal of trees and brush by cutting or herbicide use.

When the pruning cycle removes the annual growth increment and the danger tree program removes trees as they become decadent, tree-related outages are stabilized. The residual level of tree-related outages reflects the interaction of several characteristics, including the size of the utility forest, chosen maintenance standards (such clear width), tree-conductor clearance, and tree species characteristics (such as mode of failure and decay). An expression of a managed tree liability, one where the annual workload increment is removed, is stable tree-related outages. Reducing tree-related outages below an achieved equilibrium necessitates actions that decrease the size of the utility forest. Actions are not limited to vegetation management. For example, increasing conductor height reduces the size of the utility forest as it reduces the number of trees capable of striking the line.

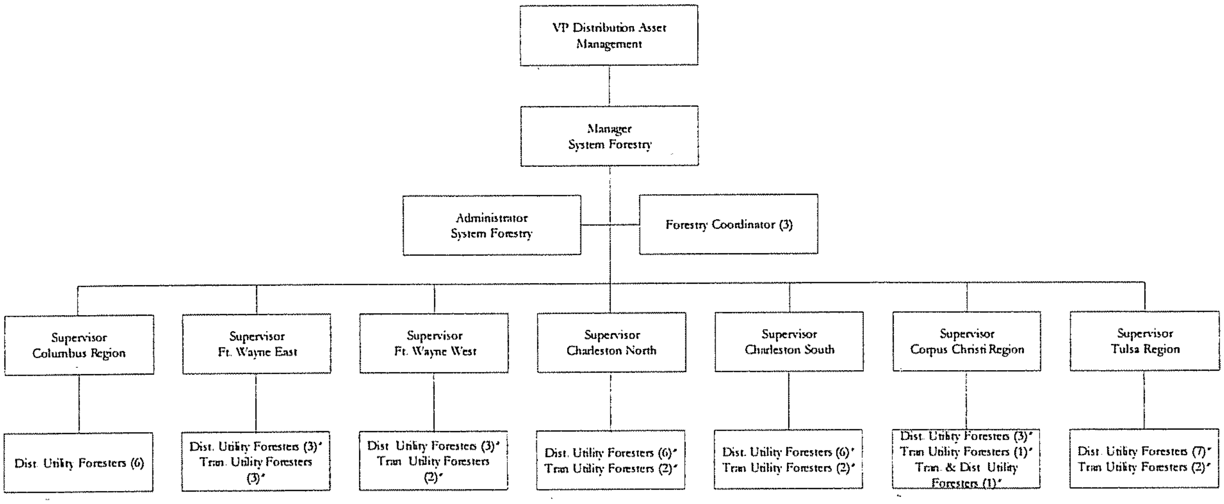
B. Background and Perspective

Organization

AEP's System Forestry (AEP Forestry) organization, which reports to the VP Distribution Asset Management, holds responsibility for vegetation management. Two foresters provide vegetation management services in the Hazard Service Area, one for the distribution system (Distribution Utility Forester) and another for the transmission system (Transmission Utility Forester). The Regional

Forester in the Charleston North Region supervises these foresters. The organization is shown in *Exhibit V-2*.

Exhibit V-2
AEP System Forestry Organization



* Resources located across each region

The System Forestry group was centralized in a 2000 reorganization stemming from a company merger.

Facilities

The distribution system is comprised of lines operated at 12 kV and 34.5 kV. The transmission voltages in the Hazard Service Area are 69 kV, 138 kV and 161 kV. Target easements are 40 feet for 12 kV lines, 50 feet for 34.5 kV lines and generally, 100 feet for the 69 kV, 138 kV, and 161 kV transmission lines. The target easements are not always achieved for distribution lines.

Clearance Standards

Trees that require pruning are cut to provide a minimum of 10 feet of clearance between conductors and the nearest tree part. Overhangs, however, are not tolerated regardless of clearance. Re-clearing is done to re-establish the original right-of-way. Where a transition from brush to large trees is evident, it is assumed that the large trees delineate the easement. Where no clear transition exists, vegetation management work planners and AEP Forestry staff assume the general easement widths, unless there is a known history with the landowner indicating otherwise. There is no set clear width (side clearance from tree boles at the right-of-way edge to the nearest conductor). There is no set distance for danger trees (trees outside the right-of-way that are diseased, cracked, leaning, subject to uprooting, or because of structural defects pose a threat to the power line). Identification of and removal of danger trees is based on whether or not they could strike the line on failure.

The right-of-way width and the conductor the furthest from the right-of-way centerline generally determine the clear width. For example, the clear width on 34.5 kV can be calculated as 21 feet (50 feet/2 – 8 feet (cross arm)/2 = 21 feet).

The clear width is considered when lines traverse slopes. The line may be installed off-center to provide a greater width on the uphill side. The clear width may be increased where the incidence of disease forces the labeling of an entire stand as danger trees. AEP/Kentucky is currently faced with increased pine mortality due to a bark beetle infestation.

Work Planning

The Distribution Utility Forester compiles the "wish list" of work for the following year considering:

- Follow up required such as herbicide on areas recently cleared
- Forecast of trim and re-clear based on history, visual field inspection, concerns expressed regarding reliability, and the number of customers on the circuit
- The list is prioritized based on engineering and operations input
- The Regional Forester checks to ensure the proposed work addresses lines that have the lowest reliability

The work plan may be modified through the year by input from operations, which is obtained on a weekly basis via the Complaints Database teleconference. Operations is another point of input regarding reliability. Other factors that may necessitate modifying the work plan include:

- New capital work projects
- The lack of availability or availability of specific crew types may alter the timing of work plan elements (i.e. aerial saw; aerial spray crew)
- Response to the Kentucky Public Service Commission (KPSC)
- Strikes
- Unusual events like 9/11, which prevented any flying, grounding the aerial work crews
- Hotspotting (where trees are in contact with conductors or the evidence of recent contact exists; addressing unplanned work as the need arises) done in response to Operations requests

Planning of the actual field work is done through contract work planners. The work planners are Asplundh Tree Expert Company (Asplundh) employees. The work planner position falls between a crew foreman and a general foreman.

In urban areas the work planner identifies the work to be done and notifies the landowner. Where the work is cross-country, the work planner notifies the landowners and the crew foreman determines the work to be done based on clearance requirements and general guidelines. The work planners mark the work on "pole maps." Upon completion of the work, the maps are returned to the Utility Forester. The circuits are then marked as completed in Right of Way Management (RWM), a web-based invoicing and record keeping database. There is no vegetation management layer in the Small World. As a result, records that tie work completed to geographic locations exist on paper only.

Utility Foresters audit the work for compliance with guidelines, completeness, quality, and accuracy of work units reported. All levels of AEP's Forestry group have specific audit frequency targets. When Forestry staff is particularly busy, the targeted amount of audits may not be met.

Hotspotting

Utilities commonly handle hotspot (where trees are making conductor contact) locations with a work effort separate from routine maintenance work. Such off-cycle work is generally referred to as hotspotting. There is a focused effort to minimize hotspotting due to associated higher unit costs. That hotspotting costs are frequently more than 100% higher than routine cycle pruning costs is illustrated in the Circuit Cost Summary report provided through AEP's RWM system. To facilitate the management of the amount of off-cycle work, hotspotting is listed as a separate line item in the budget and such work is tracked separately in RWM. *Exhibit V-3* provides the history of hotspotting in the Hazard Service Area.

Exhibit V-3
Hazard Service Area Hotspot History
(Distribution Only)

Year	Staff Hours	Cost
1997	25,103	$420,000
1998	8,673	$150,000
1999	14,104	$283,699
2000	21,250	$432,983
2001	6,311	$158,211
2002	NA	$120,462

Maintenance Cycles

Pruning cycles vary between two to three years in urban areas and three to eight years in rural areas. The pruning cycle is derived from the combination of the local Utility Forester's expertise, budget available, and emerging priorities. No growth studies have been undertaken by AEP/Kentucky to guide the derivation of maintenance cycles.

Pruning, tree and brush removal, and the identification and removal of danger trees are generally done in the same maintenance action. Exceptions occur for operations such as aerial pruning and danger tree removals in response to pest infestations. Aerial pruning is a discrete operation because the equipment requirements are completely different from that used for manual pruning and re-clearing. The Hazard Service Area is currently facing a Southern pine bark beetle epidemic that has resulted in stands of dead or decadent pines necessitating a more immediate, separate danger tree response.

Generally, within any utility pruning program, there are locations where trees will contact conductors before the next maintenance operation. Within the Hazard Service Area, locations where trees exist that grow considerably faster than the average (referred to as cycle busters), are targeted for tree replacement. Cycle buster species in the Hazard Service Area are silver maple (*Acer saccharinum*) and box elder (*Acer negundo*).

The herbicide program is planned as a follow up to cutting treatment, one to two years after re-clearing. While the first herbicide application following re-clearing is perceived to greatly diminish the stem count of incompatible species, subsequent herbicide applications are planned on a three-year cycle. The need for the herbicide application is monitored and the timing may be adjusted as required. AEP/Kentucky foresters indicated it is their experience that after multiple herbicide applications the cycle length is extended due to biological competition from low-growing power line compatible vegetation.

Tree Removals

AEP's *System Forestry Goals, Procedures & Guidelines for Distribution and Transmission Line Clearance Operations* document establishes a focus on tree removals unless the cost of such removals exceeds the cost of three pruning events. The guideline derives from financial analysis performed by Oklahoma Public Service.

The utility foresters exert influence on the work planners to ensure a strong focus on obtaining tree removals. *Exhibit V-4* provides the percent of total trees handled that are removed. The information is provided for the Hazard Service Area and AEP/Kentucky.

Exhibit V-4
Trees Removed of Trees Handled (Distribution Only)

	Hazard Service Area			AEP/Kentucky		
Year	**Tree Trimming**	**Tree Removal**	**% Removals**	**Tree Trimming**	**Tree Removal**	**% Removals**
1998	6,642	19,629	75%	53,078	63,959	55%
1999	9,630	33,658	78%	25,824	43,370	63%
2000	18,447*	33,622	65%	38,708	66,050	63%
2001	9,770	24,803	72%	23,579	47,988	67%
2002	7,035	16,894	71%	15,257	42,489	74%

* Aerial saw accounted for 10,880 trims

AEP Forestry has a tree replacement program that focuses on obtaining landowner agreement to remove cycle buster trees and replace them with low-growing, power line compatible tree species. Tree replacement is a separate line item in the budget. A financial analysis was undertaken to establish the merits of a tree replacement program.

Contracting

AEP has entered into an alliance agreement with Asplundh Tree Expert Company. The contract is essentially a sole source agreement with the exclusion of work performed from aircraft.

This contract that American Electric Power has entered into with Asplundh was piloted in American Electric Power's Charleston region. The agreement guarantees American Electric Power a specific minimum cost saving. At a certain percentage gain in productivity a pool of savings is triggered. In AEP/Kentucky the minimum guaranteed saving is 1% and the incentive pool begins to accumulate when productivity gains exceed 3%. The contractor is rewarded from the accumulated pool of savings based on key performance indicators, including productivity, safety, reliability, and mileage completed. In so far as the contractor fails to meet the conditions for the maximum incentive payment, the residual pool funds comprise further savings for American Electric Power.

Under the Alliance, AEP shares reports and information with Asplundh, and Asplundh has shared information with AEP. The Regional Forester believes the contractor has been more responsive under this contract. The contractor is free to adjust crew staffing and equipment because they need to meet certain productivity goals. The Regional Forester perceives specific benefits to arise from the Alliance. There is more stability in the work force because of the duration of the contract. This results in crew personnel being more experienced and familiar with the geographic area.

Productivity

Most of the vegetation management contract work is done on an hourly rate basis. Unit costs are derived from the RWM database/reporting system. Under the Alliance contract productivity information is shared with the contractor to focus improvement efforts that benefit both parties.

Budget

The budget determines the amount of tree work that can be completed. Local forestry staff develops a work plan based on their assessment of the work required in the following year. Funding is never sufficient to cover the locally perceived needs. A process of prioritizing what work will be done with the allocated resources is initiated by consulting the local Operations group and the Regional Forester. The Regional Forester has some flexibility in shifting funds to areas that have a particular need requiring resolution.

Exhibit V-5 provides a 6-year history of vegetation management funding both for the Hazard Service Area and AEP/Kentucky as a whole. The Hazard Service Area, since 1997, has received an increased share of the total AEP/Kentucky vegetation management budget.

Exhibit V-5
Vegetation Management Funding

Year	Hazard Whitesburg	% Change Relative to 1997	AEP/Kentucky	% Change Relative to 1997	Hazard Share of Total KY VM Budget
1997	S1,147,818		S4,099,999		28.00%
1998	S1,286,226	12.06%	S3,962,200	-3.36%	32.46%
1999	S1,367,653	19.15%	S3,088,468	-24.67%	44.28%
2000	S1,199,005	4.46%	S2,985,748	-27.18%	40.16%
2001	S1,109,587	-3.33%	S2,846,632	-30.57%	38.98%
2002	S1,152,638	0.42%	S3,202,100	-21.90%	36.00%

Decision Support

There is no inventory of the vegetation management work that needs to be done on an annual basis. Nor are there growth studies to guide the derivation of average pruning cycle lengths based on established clearance and tree re-growth rates.

Asset management approaches are used to prioritize where the largest return in reliability can be obtained for the dollar invested.

Productivity and mileage completed are key performance indicators in the Alliance contract. These are tracked in RWM, which provides both standardized reports and offers the flexibility for ad hoc reports. RWM provides unit costs, work units, herbicide usage, etc. from the foreman and circuit level up to the system level.

Animal Control

Birds and animals accounted for about 1% of unplanned outages in the Hazard Service Area over 1999-2001.

Targeting locations identified as experiencing animal caused outages, animal guards are installed on the primary bushings of overhead line transformers and other line equipment. In 2002 the installation of 217 animal guards at a cost of $3,348 is planned for the Hazard Service Area.

C. Findings and Conclusions

Finding V-1 Tree-caused outages are a distribution issue not a transmission issue.

The transmission system is not tree-free and some outages attributable to trees do occur, however, the number is very small. As shown in *Exhibit V-6*, the number of tree-caused outage incidents on distribution lines is substantially higher than those experienced on the transmission system.

Exhibit V-6
Tree-Related Outage Incidents - Hazard and Whitesburg

Cause Code	Years	Distribution Interruptions	Transmission Interruptions
Tree Inside ROW	1997-2001	1515	6
Tree Out of ROW	1997-2001	1806	0
Tree Removal	1997-2001	293	1
Total		3614	7

Finding V-2 Vegetation management methods, as employed, minimize both current and future vegetation management costs.

The vegetation management program as understood at the regional and local level has the potential to minimize both current and future maintenance costs. There is a strong, successful focus on tree removals. The rate of tree removal for AEP/Kentucky is much higher than is typical in the utility vegetation management industry. The high removal rate is particularly true for the Hazard Service Area (*Exhibit V-4*). From 1998 to present, in the Hazard Service Area, 71% of all trees handled were removed. This industry leading result will reduce future costs by avoiding the repetitive costs of pruning. The exceptional removal rate record is, however, marred. It is not known to what extent the high removal rate is an artifact of not handling the pruned trees often enough.

Some of the high removal rate may be attributable to the fact that the AEP/Kentucky service area is heavily treed and, under such conditions of tree abundance instead of scarcity, landowners may place less value on trees. Regardless, tree removals are not obtained without a focused effort to address the issue with landowners.

Pruning quality in the Hazard Service Area is very good. Pruning quality has a major impact on the rate of regrowth and, thereby, on the pruning maintenance cycle length and costs. Pruning quality is so good that there is no opportunity to further increase cycle length or suppress regrowth.

Herbicides are widely and effectively used in the AEP/Kentucky vegetation management program. Timely herbicide applications reduce current maintenance costs but, more significantly, by reducing the stem density of incompatible species while fostering a power line compatible vegetation community, substantially reduce future maintenance costs. Acceptance of herbicide use by landowners is high with only about a 3% refusal rate.

AEP/Kentucky's use of aerial spraying and aerial pruning are effective and serve to reduce maintenance costs.

AEP's prescriptive approach to vegetation management generally demonstrates a high level of professional skill and produces excellent results. This is particularly true for timely right-of-way interventions.

Finding V-3 The sole source Vegetation Management Alliance Agreement guarantees immediate savings benefits but sacrifices the ability to ascertain whether productivity and costs are competitive.

While the structure of the Alliance Agreement benefits American Electric Power, in entering into a sole source supplier agreement American Electric Power gives up the possibility of competitive contractor comparisons. If such comparisons were made in advance of entering into the Alliance Agreement and were the basis for selecting the contractor, then the process of ongoing monitoring of productivity is both informative and adequate.

Finding V-4 Maintenance cycles are too long and the timing of vegetation management activities is too late to avoid service interruptions from right-of-way trees.

Field examination of circuits where work is being done in the current (2002) year and where work is planned for next (2003) year revealed numerous locations where trees were either in the conductors or burning on the vegetation indicated that tree branches had made conductor contact. While no quantitative measure of the number of hotspots was undertaken, Schumaker & Company consultants found it not uncommon to encounter as many as five or six hotspots per mile of line.
Schumaker & Company consultants also found that work planned for 2004 includes locations where the clearance between trees and conductors is inadequate to avoid burners occurring prior to pruning service delivery.

While it is agreed that a two to three year pruning cycle in urban areas might be expected to prevent trees from growing into conductors, there was insufficient detail in the AEP/Kentucky data records to definitively assess whether the two to three year cycle is being met. Based on the total 2499 miles of distribution line in the Hazard Service Area, a three year pruning cycle necessitates covering 833 miles per year. The AEP *Forestry 2002 Distribution Work Plan – Pikeville/Hazard* shows 233 miles of cutting work planned for the Hazard Service Area. The planned miles fall substantially short of the 833 miles required to achieve a 3 year pruning cycle.

There is one standard clearance obtained when pruning. It is 10 feet. Hence, there should be no difference in the length of the pruning cycle for urban and rural areas, unless tree species are vastly different or no tall-maturing trees are tolerated on the right-of-way in rural areas. It was observed by Schumaker & Company consultants that planted landscape trees did introduce some non-native species but most trees were naturally occurring, volunteer species. If tall-maturing trees were not tolerated in the right-of-way, then all growth requiring pruning would arise from lateral growth. A pruning cycle of three to eight years for lateral growth would be adequate to avoid conductor contact. AEP/Kentucky is quite successful in obtaining tree removals, concentrating trees requiring pruning to the vicinity of residences. In the Hazard Service Area, however, a large portion of the residences is in rural areas. Because people value trees, they resist removal of trees around residences. This has the effect of interjecting a shorter pruning cycle (two to three years) into the three to eight year rural maintenance cycle.

Other than the fact of different vertical and lateral growth rates, one might justify the different cycle lengths between urban and rural settings on the basis of human exposure to electrical hazards potential but not from a reliability perspective.

The implications of the high number of burners evident in current and next year planned work areas are that either AEP/Kentucky will need to use more costly hotspotting or customers must endure service interruptions.

Schumaker & Company consultants observed an herbicide application being made to dense and tall brush, ranging up to 25 feet in height. It was estimated by local forestry staff that the area had been cleared six years ago. However, this estimate suggests in excess of four feet of growth per year on yellow poplar (*Liriodendron tulipifera*). Both the density and height of the brush serve to drive up maintenance costs. Generally, the ideal timing for the herbicide application that both minimizes costs and optimizes efficacy of effecting a right-of-way species shift to power line compatible species will be one or two years after brush cutting.

Finding V-5 Because maintenance cycles are too long, the need for hotspotting is great, yet the use of hotspotting to maintain uninterrupted service is being constrained.

The extent of the need for hotspotting to maintain safe, reliable service is a reflection on the adequacy of the maintenance cycle.

AEP/Kentucky's use of hotspotting has been variable over the years of 1997 through 2002 (*Exhibit V-3*). Expenditures on hotspotting appear to be substantially higher than average every third year. Both the number of hotspots witnessed during the field tours and the increasing number of service interruptions arising from right-of-way trees (*Exhibit V-8*) indicates that, unless maintenance cycles are adjusted, there will be a need for a large expenditure hotspotting program in 2003.

From a financial perspective there is merit to minimizing hotspotting. This is recognized by AEP Forestry and hence, hotspotting is minimized. The recognition and intent are positive. However, the purpose of a hotspotting program is to address the safety and reliability problems associated with tree-conductor contacts arising between maintenance cycles. The product of overly long pruning cycles is the increased need for hotspotting. The way to minimize hotspotting without increasing unit costs or tree-related outages is via a pruning cycle based on standard clearance and tree growth rates. The combination of overly long pruning cycles and the minimization of hotspotting expenditures finds expression in higher rates of tree-caused service interruptions.

Finding V-6 Use of industry standard practices inadequately address the reliability risks associated with the very high extent of tree exposure.

AEP/Kentucky's service area has an extremely high concentration of trees. Much of the area is rural and the topography mountainous. As a result power lines run not alongside roads but cross-country, doubling the amount of tree exposure.

The extent of tree exposure and remote, rugged terrain impose a serious challenge to managing service reliability. Vegetation management practices used are typical of the utility vegetation management industry and, thereby, fail to recognize the abnormally high degree of tree risk.

Specifically, AEP/Kentucky's practices regarding the identification and removal of danger trees are typical of the utility vegetation management industry. With the exception of trees affected by a pest or pathogen, trees susceptible to failure and interfering with electrical service (danger trees) are generally identified and removed only during the routine maintenance cycle. The inadequacy of this approach is illustrated by the fact that failure of off right-of-way trees accounts for about 35% of the total hours of unplanned distribution service interruptions (*Exhibit V-9*).

AEP/Kentucky has a very high tree removal rate. While this record bodes well for reducing off right-of-way tree-caused outages, the benefits are obscured by the negative effects of an overly long maintenance cycle. However, while a reduced cycle length would contribute to improved service reliability, off right-of-way tree-caused outages will remain relatively high being positively correlated to the extent of tree exposure. The practices and strategies applied are designed to identify and mitigate against tree hazards but not to limit the extent of tree exposure.

The observed vegetation management practices and articulated strategies do not reflect recognition of the rates of, and influence of, innate tree mortality.

Finding V-7 The vegetation management workload, comprised of the inventory of trees, tree growth, and mortality rates, has not been quantified and is unknown.

The first requirement to successfully managing tree-conductor conflicts is to quantify the magnitude of the problem. AEP/Kentucky has not done so.

Determining the size of the tree liability requires an assessment of the size of the utility forest (all trees capable of contacting conductors) and its rate of change. Through a count of trees categorized by work type (i.e. trims or removals), a measure of brush and total tree exposure, determination of average annual growth and mortality rates, the annual amount of work necessary to hold the tree liability steady is derived. Without a measure of the annual vegetation management workload increment required to sustain the tree liability at equilibrium, the probability of successfully managing tree-related outages is virtually nonexistent.

Finding V-8 The vegetation management budget is not based on the annual work required to avoid service interruptions.

While it was stated by AEP management that vegetation management funding has been relatively stable, actual expenditures show a downward bias lacking cost of living increases (*Exhibit V-5*). The trend for decreasing maintenance spending is apparent in the AEP/Kentucky vegetation management budget, which was reduced by 30% in 2001 from 1997 levels. The Hazard and Whitesburg operating areas have to an extent been buffered from this decrease by receiving an increasing share of decreasing vegetation management funding for AEP/Kentucky as a whole. In the context of a shrinking funding allotment the Hazard Service Area cannot continue to receive an increasing share of these funds unless the need for vegetation management funds in the rest of the AEP/Kentucky service area is rapidly shrinking. If this is the case, then evidence for it should exist in substantial reductions in tree-related outages for the rest of AEP/Kentucky. Without evidence of a decreasing need for vegetation management outside the Hazard Service Area, one would expect over time the historical average share of funding to be reestablished. In the return to the average, the Hazard Service Area would have to absorb its share of vegetation management budget reductions.

AEP/Kentucky's funding of vegetation management is not based on any measure of tree workload. Successful long-term vegetation management requires funding that permits removal of, as a minimum, the annual workload increment. Failing that, tree-related outages increase.

The pruning cycle afforded by the current budget is disconnected from the biological facts. It is easy to ignore these facts in the absence of scientifically sound, established tree growth rates.

Any approach to budgeting for vegetation management that is based not first and foremost on actual tree volumes and conditions, lacks the logical underpinnings for effective long-term management.

Finding V-9 Applying asset management strategies to prioritize maintenance reduces maintenance costs but does not ensure improved electric system reliability.

Asset management strategies are useful for prioritizing where to allocate resources for the maximum reliability benefit. These strategies are separate from the total resources allocated and, therefore, do not ensure the delivery of any specific standard of service.

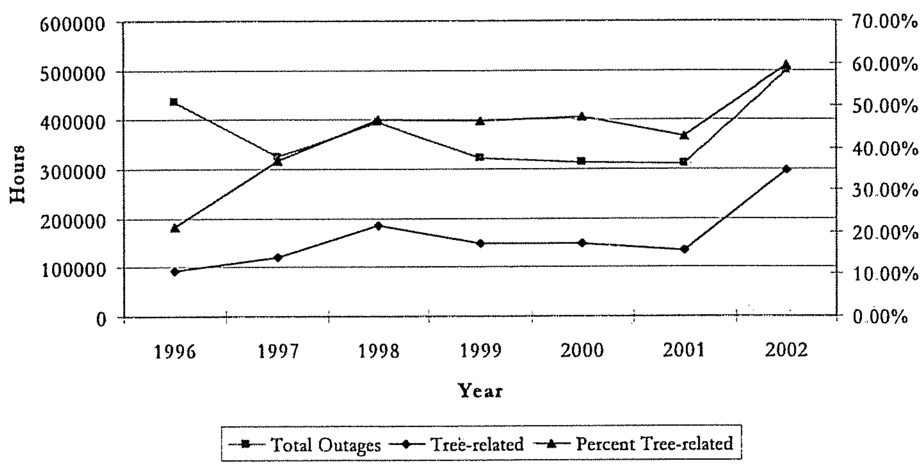
Asset management strategies as applied to vegetation management assure the optimum benefit for the dollar expensed and that may include getting more work done within the budget. For the approach to effectively address reliability problems there must be enough funds to complete as a minimum, the annual workload increment. That level of work completion would hold tree-related outages steady.

When funding for vegetation management is constrained such that the annual workload increment cannot be completed, system reliability will deteriorate. Asset management approaches may ameliorate the rate of deterioration but not the overall trend.

Finding V-10 Tree-related outages, the largest cause of unplanned service interruptions, are on an increasing trend that is not being addressed.

In the Hazard Service Area, tree-related outages are the single largest cause of unplanned outages. Over the period of 1998 to 2001 tree-related outages have accounted for 40% to 50% of all outages (*Exhibit V-7*) on a customer hour basis. Pro-rating the 2002 experience produces a jump to 60% of all outages.

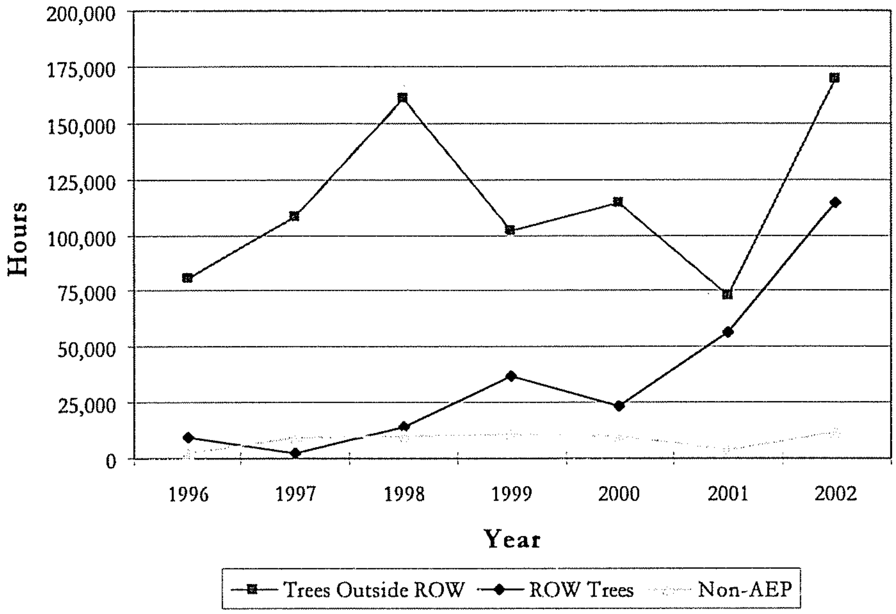
Exhibit V-7
Hazard Service Area
Unplanned Distribution Outages
(Major Storms Excluded)



* 2002 pro-rated

The outage history indicates that customers have been enduring more hours of service disruptions arising from on right-of-way of trees, which are trees requiring pruning. Within right of way tree-caused outages have been increasing essentially exponentially since 1997 (*Exhibit V-8*).

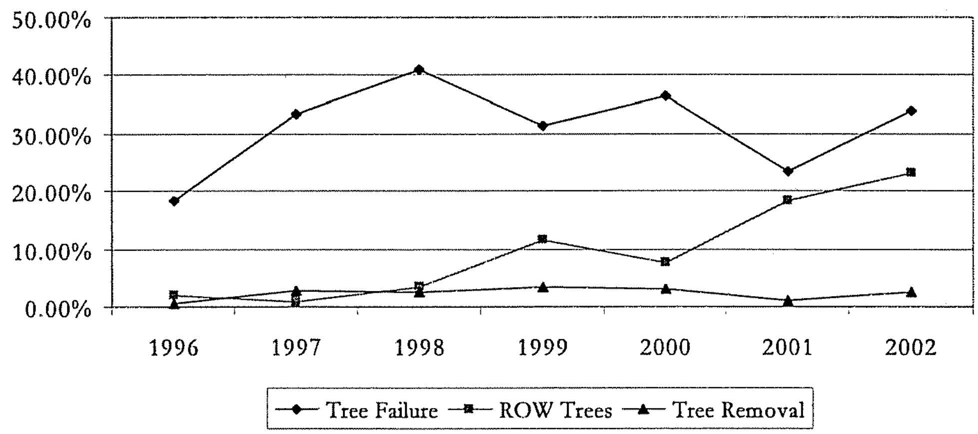
Exhibit V-8
Tree-Related Outages
by Tree Cause Code (Distribution)



* 2002 pro-rated

Right-of-way trees, which in 1997 accounted for less than 1% of unplanned outage hours, are predicted to account for more than 23% in 2002 (*Exhibit V-9*). Tree-caused outages due to non-AEP contractors have been fairly level. Tree failure of off right-of-way trees is the largest cause of service interruptions, ranging between 25% and 40% of all outages (*Exhibit V-9*). Tree removals in the Hazard Service Area were lower in 2001 than the preceding two years (*Exhibit V-4*). While data for 2002 is incomplete, prorating the trend found in the first 8 months suggests off right-of-way tree-related outages are increasing (*Exhibit V-8* and *Exhibit V-9*).

Exhibit V-9
Tree-related Outage Hours as a % of Total Unplanned Outages
(ROW Trees An Expanding Problem)

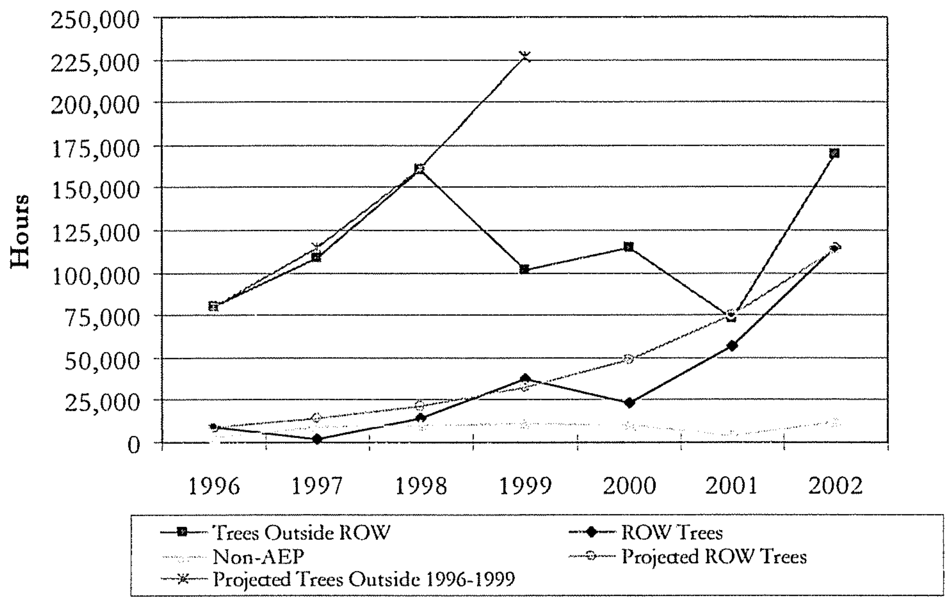


* 2002 pro-rated

The possibility exists that the influence of trees on reliability is not fully represented by the tree-caused outage codes. According to AEP/Kentucky documents another 6% of outages are ascribed to weather. AEP/Kentucky indicates that weather-related outages are mostly related to high wind and probably vegetation.

Tree-related outages caused by within right-of-way trees have been increasing exponentially since 1997 (*Exhibit V-10*). There is nothing in the vegetation management plan that would suggest this trend would change. The budget has not been increased to achieve a shorter pruning cycle and constrained hotspotting will contribute to perpetuate the established trend.

Exhibit V-10
Exponential Increase in ROW Tree-Caused Outages



* 2002 pro-rated

The focus on removals appears to have resulted in slight improvement in outages arising from off right-of-way trees until the current year. Both the (pro-rated) increase from 2001 to 2002 and the rate of increase from 1996 through 1998 show trees outside the right-of-way have the potential to add quickly and significantly to outages (*Exhibit V-10*).

To illustrate the potential for a rapid increase in tree-related outages from trees outside the right of way an algorithm was used to predict what those outages would have been for 1999 (Projected Trees Outside 1996-1999 in *Exhibit V-10*). The fact that the projected outages did not occur may be due to a lower frequency or intensity of minor storms and/or some action that proved to be an intervention. The intervention most probably was the over 70% increase in the rate of tree removals from 1998 to 1999 (*Exhibit V-4*). The nature of tree workload and tree-caused outage progression was revealed at the start of this section in *Vegetation Management Concepts and Principles* and illustrated in *Exhibit V-1*. Obtaining the best fit of such a geometric progression to the outage statistics for the years 1996 through 1998, the progression was extended for another year to forecast 1999 trees outside the right of way caused outages. While the projected level of outages did not occur, the projected curve (Projected Trees Outside 1996-1999 in *Exhibit V-10*) is revealing. Given we know the overall shape of the progression (as in *Exhibit V-1*), the projected outages segment reveals:

1) Work volume is well out to the right side of the graphic representation of the progression (see Exhibit V-1) where the exponential effects are large. This is to be expected because of the high degree of tree exposure for lines in the Hazard Service Area.
2) The rate of compounding is large as indicated by steepness of the slope for Projected Trees Outside 1996-1999. The steep slope is reflection of the degree of tree exposure but also provides information about tree failure rates, suggesting either high tree mortality or decadence and/or poor root support.

In a nutshell, what the Projected Trees Outside 1996-1999 curve reveals is trees outside the right of way caused outages are volatile, with a potential to significantly negatively impact overall reliability if there is not a focused management effort to contain them. Conversely, they are also very responsive to certain management actions (see sharp drop in Trees Outside ROW from 1998 to 1999 in *Exhibit V-10*).

There is no strategy specific neither to containing trees outside the right of way caused outages nor to making substantial outage reductions, in spite of the fact off right-of-way trees are the largest single contributor to service interruptions (*Exhibit V-9*). Rather there may be a tendency to discount outages from off right-of-way as beyond the control of the utility. This is not untypical in the utility industry as many utilities label such outages as non-preventable. However, to the customer experiencing a loss of service the relative location of the tree interrupting the service is immaterial.

Finding V-11 The articulated strategies for decreasing the impact of tree-conductor conflicts on reliability of service are inadequate.

Clear width has not been explored as a factor in improving reliability, other than accounting for the influence of slope where lines run across the slope. Outage statistics indicate tree failures outside the right-of-way account for about 35% of unplanned service interruptions (*Exhibit V-9*). No initiatives that specifically recognize and seek to address this substantial source of service interruptions were revealed.

Asset management strategies designed to improve SAIFI and SAIDI appear to focus on the circuit level. Focusing on the circuit level misses opportunities for improving reliability.

There are two factors that need to be examined in tree-related outages, those being controlling incidents and duration. While the asset management approach considers the number of customers affected by an interruption and, thereby, improving SAIDI, it does so only on the basis of the AEP Forestry standards. AEP/Kentucky Forestry has not extended the use of prescriptive treatments to address the specific areas (line segments) that have the greatest potential to negatively impact SAIDI. Application of a uniform standard fails to consider there may be portions of a circuit where a tree-related outage will take more time to locate and mitigate. If there is a probability that an outage incident on a particular portion of a circuit will have an above average negative affect on SAIDI, alternate, specific mitigation strategies are warranted.

Finding V-12 Animal protection practices are adequate.

Animal caused outages are a minor cause of unplanned service interruptions. AEP/Kentucky's approach to installing protective devices in response to emergent animal caused reliability problems is reasonable.

D. Recommendations

Recommendation V-1 Determine the annual vegetation management workload increment. (Refer to *Finding V-7*).

Trees represent a liability to utilities. Because vegetation is dynamic, there is an annual change in the tree workload inventory. To hold tree-related outages constant, the volume of annual vegetation management work completed must match the annual change in the tree workload inventory. Any portion of the annual work increment not completed enlarges by geometric progression. Failure to remove the annual workload increment results in both deteriorating reliability and increased future costs.

To prevent the escalation of costs and deteriorating reliability, the amount of annual vegetation management required (annual workload increment) must be quantified. It is a specific amount of work, representing a specific cost. Without quantification, there are only guesses.

Determining the annual workload increment necessitates a static snap shot of all current trims, removals, brush, and spray areas. In addition to this inventory, the rate of change needs to be quantified. It typically includes tree growth rates. The average rate of tree mortality over the utility forest should also be determined. As AEP/Kentucky has very high tree exposure, off right-of-way trees comprising 35% of unplanned distribution outages, tree mortality will figure prominently in managing tree-related outages.

Once this workload is determined, it would be useful to represent this information in a vegetation management layer in the Small World. This would provide a more useful representation of the information and eliminate the need to record the information on paper maps only.

Recommendation V-2 Establish pruning cycles based on measured average tree growth. (Refer to *Finding V-4*).

The field review suggests that current pruning cycles are one to two years behind. This observation is supported by the history of tree-related outages arising from trees within the right-of-way. Yet, AEP/Kentucky's experience shows it is feasible to reduce tree-related outages from within right-of-way trees to just a few percent of unplanned outages.

The present pruning cycle does not avoid tree-conductor contacts. Avoiding tree-conductor contacts should, however, be an objective of the pruning program for both safety and reliability reasons. A pruning cycle based on an inventory of trees requiring pruning and tree growth rates minimizes the number of tree-conductor contacts. Reducing outages from vegetation within the right-of-way to zero is not feasible for AEP/Kentucky because of the extremely fast growth rate of kudzu (Pueraria montana var. lobata). Typically within a maintained circuit there will be locations with exceptional growth that will require off-cycle pruning to avoid tree-conductor contacts. Such locations usually contain planted, introduced species. These locations require hotspotting and are the same ones targeted in the tree replacement program.

There are two possible ways to minimize within right-of-way tree-caused outages. The first is to establish a pruning cycle based on average tree growth. Flexibility is required to adjust the cycles up or down based on exceptional local conditions such as drought. The second approach is to substantially increase the use of hotspotting to prevent trees growing into conductors. The hotspotting approach escalates maintenance costs and is reactive. That is, hotspotting does not constitute management of the tree workload.

Recommendation V-3 **Budget for vegetation management based on the annual workload increment. (Refer to *Finding V-8* and *Finding V-9*).**

Successful vegetation management that manages tree-related outages can only derive from funding based on actual tree conditions. Funding based on any other premise is bound to fail the objective of providing safe, reliable, economic service. Paradoxically, because the tree workload expands exponentially, budgeting based on the actual tree workload is the path to simultaneously minimizing tree-related outages and costs.

Recommendation V-4 **Use hotspotting to minimize tree-related outages until the system is on a sustainable pruning cycle. (Refer to *Finding V-5*).**

Until the pruning cycle based on average tree growth is established across the entire Hazard Service Area, tree-conductor contacts will remain high. It may take a number of years to work across the whole Hazard Service Area establishing the shorter pruning cycle. In the interim, if tree-related outages are to be avoided, hotspotting must be substantially increased to prevent burners. The alternative is to maintain hotspotting at current levels, recognizing that while tree-caused outages will remain high, they will begin decreasing as more of the area is completed and maintained on the proper pruning cycle.

In areas where the new pruning cycle has been introduced, hotspotting should be used to maintain clearance at all cycle buster locations. The amount of hotspotting must be determined by the actual need in the field, unlike the current practice of ignoring hotspots because they occur in the next year's work plan. As the need for hotspotting cannot be entirely avoided, a target for the maximum amount of hotspotting should be set. However, the cap must be set based on real need. A cap of 2% to 5% is suggested as achievable with a proper pruning cycle.

Recommendation V-5 **Develop and implement practices designed to manage tree-caused outages. (Refer to *Finding V-6*, *Finding V-10*, and *Finding V-11*).**

The examination of tree-related outage history leads to a number of observations (*Exhibit V-9*).

- Within right-of-way trees account for about 20% of unplanned outages
- Within right-of-way tree-related outages have been increasing since 1997
- Reducing within right-of-way tree-related outages to less than 5% of the total is achievable
- Off right-of-way trees account for about 35% of unplanned outages

Reducing and managing within right-of-way tree-related outages could be achieved by the use of a growth-driven pruning cycle. The potential exists to reduce within right-of-way tree-related outages to below 5% of all unplanned outages.

Off right-of-way tree-related outages constitute an opportunity to substantially improve service reliability. Doing so will necessitate identification of portions of circuits where tree-related outages have above average negative effects on service reliability. Actions designed to address the location specific tree risks will need to be implemented.

An example is provided to illustrate that the potential for reducing off right-of-way tree-related outages does exist. To illustrate this potential for improving reliability, an analysis of the influence of right-of-way width follows. Assume a 34.5 kV line with the standard 50-foot right-of-way, as well as the following conditions:

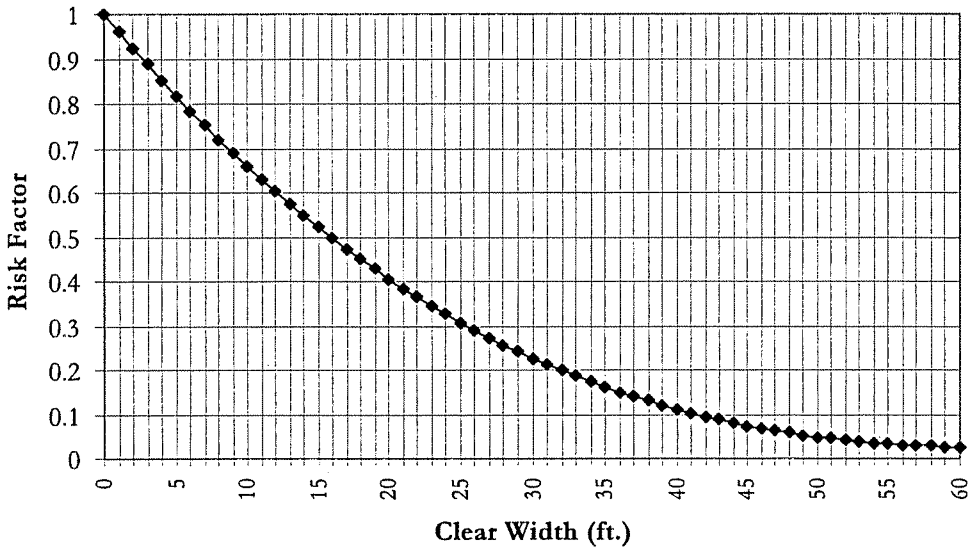
- Adjacent trees are 90 feet in height
- Average line height is 27 feet
- Tree density of adjacent trees is 220 trees/acre
- Cross arm length is 8 feet
- Tree removal costs average $50/tree

The current clear width is 21 feet (50 ft ROW/2 – 8 ft cross arm/2).

What would be the benefit and cost of increasing the right-of-way to 75 feet?

Exhibit V-11 shows the change in tree risk over a range of clear widths. There is a diminishing return in line security for the dollar invested in increasing clear width. At the current clear width of 21 feet, the tree risk factor is 0.385. Increasing the right-of-way width to 75 feet increases the clear width 33.5 feet. The risk factor associated with a 33 foot clear width is 0.186.

Exhibit V-11
Tree Risk Assessment
(Line Strike Probability for 90-foot Trees
Line Height at 27 Feet)



To facilitate assessment of the change in line security and the associated costs, information has been entered into a spreadsheet (*Exhibit V-12*). Increasing the right-of-way to 75 feet, under the assumed conditions, would reduce off right-of-way tree-related outages 52%.

Exhibit V-12
Change in Line Security
Cost Benefit Analysis

Line Segment Specific:		Acre/Mile	Trees/Mile	Cost/Mile	Line Security Improvement
Line Height	27				
Tree Height	90				
Trees/Acre	220				
Current Clear Width	21				
Current Risk Factor	0.385				
Increase Width	12.5	1.52	333		
New Risk Factor	0.186				52%
Removal Cost/Tree *	S8.00			S2,666.67	
Removal Cost/Tree **	S50.00			S16,666.67	

* Using feller bunches
** Chainsaw removals

The cost based on the assumed unit cost would be $16,667 per mile of right-of-way side. Where trees border both sides of the line, the cost will double. The cost of obtaining additional right-of-way has not been included.

While increasing the right-of-way width from 50 feet to 75 feet would produce a substantial reduction in tree-related outages, the cost is also substantial. Obviously, there would be merit in applying such an approach selectively to trouble spots that have a large influence on total customer minutes of outages.

Recommendation V-6 Introduce contractor agreements that ensure effective costs are competitive. (Refer to *Finding V-3*).

Consider means of assuring that contractor rates are competitive. It may require contracting with a minimum of two contractors for AEP's system.

The basis of competitive comparisons should be on the basis of effective costs, not merely on the basis of hourly labor and equipment rates offered. A measure of productivity needs to be applied as a modifier to hourly rates. AEP's RWM system can provide such a measure of productivity.