Before the
Pennsylvania Public Utility Commission

LYCOMING – CLINTON #2 LINE RE-TERMINATION

ATTACHMENTS IN SUPPORT OF THE

Letter of Notification

Application Docket No.____________

Submitted by: PPL Electric Utilities Corporation

SUMMARY

This filing is submitted by PPL Electric Utilities Corporation (PPL Electric) pursuant to the Pennsylvania Public Utility Commission's (PUC or the Commission) regulations at 52 Pa. Code §§ 57.71 through 57.77 for PUC approval to re-terminate the existing 16.4 mile long Clinton – Lycoming #2 138/69 kV Transmission Tie Line (Project) into a new bay in the existing Clinton Substation. The Clinton - Lycoming #2 138/69kV Transmission Tie Line is currently tied to the 4 mile long Lycoming #2 – Muncy 138/69 kV Transmission Tie Line, and they terminate into the Clinton Substation together into one bay. With Commission approval, the Clinton-Lycoming #2 Transmission Tie Line will be detached from the existing Lycoming #2 – Muncy 138/69 kV Transmission Tie Line and re-terminated in the Clinton Substation via a new 1,200 foot segment of transmission line into a new bay. The new segment of transmission line will be constructed entirely on land owned by PPL Electric in fee.

Together this 20.4 mile transmission line has experienced repeated outages and cannot be relied upon to continue to provide reliable service into the future. This proposed Project will separate the two transmission lines into two separate transmission lines for their entire lengths to reduce the line exposure. The estimated cost to design and replace the transmission line is approximately $3 million. Construction is scheduled to begin upon receipt of Commission approval to meet an in service date of July 2013.

This document, which describes the need for the Project and discusses the engineering and environmental analysis for the proposed construction, includes the following attachments:

Attachment 1	Necessity Statement
Attachment 2	Engineering Description
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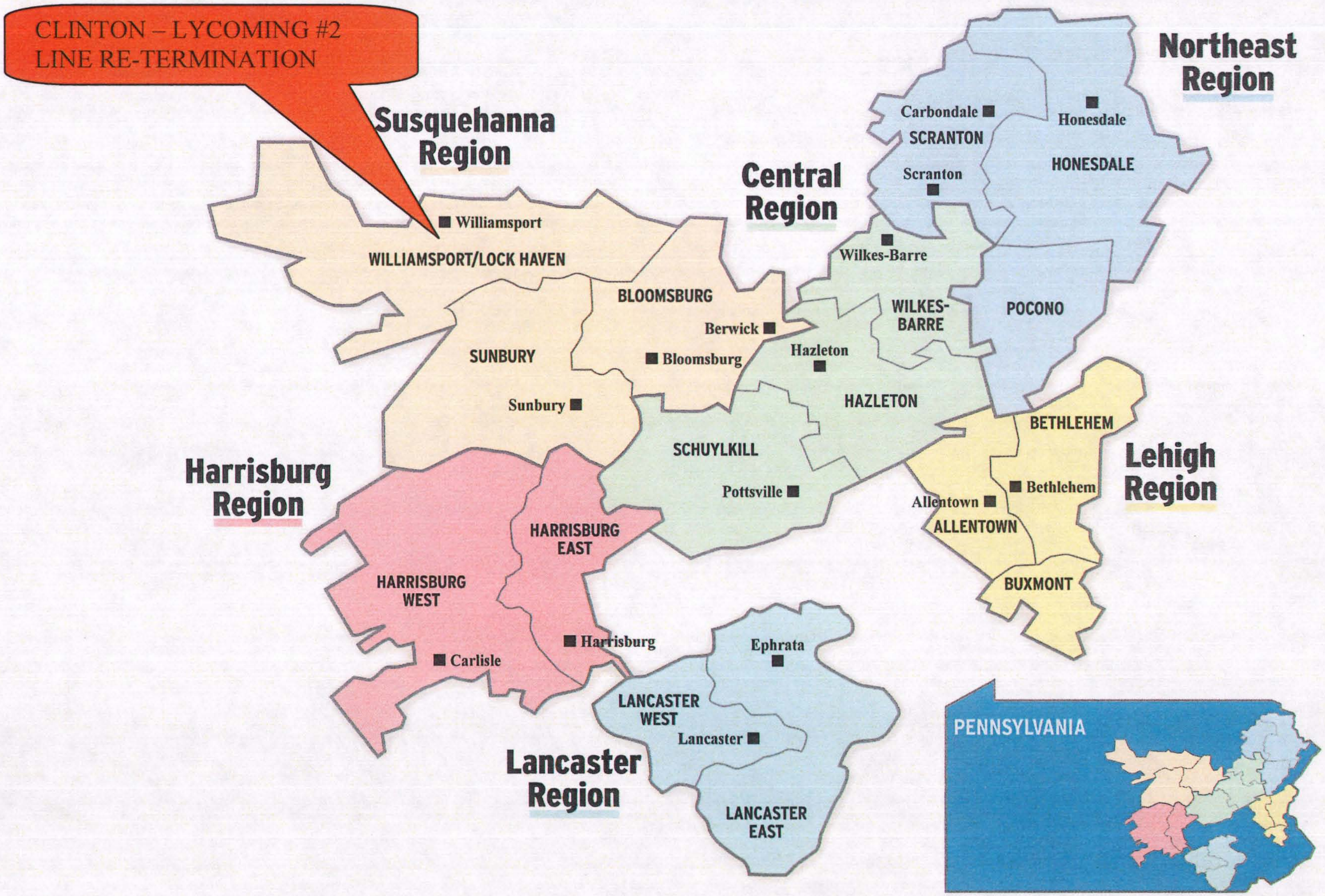
Attachment 4	PPL Design Criteria and Safety Practices
Attachment 5	PPL Electric Magnetic Field Management Program
Attachment 6	List of Owners of Property Within the Right-of-Way
Attachment 7	List of Involved Governmental Agencies, Municipalities and Other Public Entities

PPL ELECTRIC UTILITIES SERVICE TERRITORY



Attachment 1

ATTACHMENT 1
CLINTON-LYCOMING #2 & LYCOMING #2-MUNCY 138/69 kV LINES
NECESSITY STATEMENT

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ATTACHMENT 1
CLINTON-LYCOMING #2 & LYCOMING #2-MUNCY 138/69 kV LINES
NECESSITY STATEMENT

A. INTRODUCTION

With Commission approval, PPL Electric Utilities (PPL Electric) plans to break the existing 16.4 mile long Clinton – Lycoming #2 138/69 kV Line from the existing 4.0 mile long Lycoming #2 – Muncy 138/69 kV Line and re-terminate it into the existing Clinton 230-69 kV Substation. Currently the Clinton – Lycoming #2 and the Lycoming #2 – Muncy Transmission Lines are both connected to the same bay in the Clinton substation via a short joint tap. As presently configured, an outage on either of these transmission lines will also interrupt the other transmission line because they share the same line termination point at Clinton Substation. For example, a lightning strike on the 16.4 mile long Clinton – Lycoming #2 line will also cause an interruption to the Lycoming #2-Muncy Line. Breaking the Clinton – Lycoming #2 line from the Lycoming #2 – Muncy line and re-terminating it in a new bay at the Clinton Substation will reduce the total transmission line mileage of each line, thereby reducing customer exposure to interruptions. The 4.0 mile long Lycoming #2 – Muncy 138/69 kV Transmission Tie Line that already terminates into the Clinton 230 – 69 kV Substation would not be modified.

This Project is located in Clinton Township, Lycoming County. The proposed transmission upgrades are needed to improve the reliability of service to customers served from the existing 20.4 mile long Clinton – Lycoming #2 and Lycoming #2 – Muncy 138/69 kV Lines.

B. EXISTING SYSTEM

The existing transmission circuit that is the subject of this filing includes two sections; a 16.4 mile long Clinton – Lycoming #2 138/69 kV Line and a 4.0 mile long Lycoming #2 – Muncy 138/69 kV Line. The transmission circuit was built in these two sections between approximately 1975 and 1994. The Clinton – Lycoming #2 Line is double circuit for approximately 16.4 miles with the Clinton-Lycoming #1 Line. At a three terminal junction in the vicinity of Clinton Substation, the Clinton-Lycoming #2 Line taps off as the Lycoming #2 –

Muncy 138/69 kV 138/69 kV Line. The Lycoming #2 – Muncy 138/69 kV Line is a double circuit Line for approximately 4.0 miles with the Clinton-Muncy 138/69 kV Line.

The Clinton – Lycoming #2 138/69 kV Line and the Lycoming #2 – Muncy 138/69 kV Line currently operate in a networked configuration between the Clinton and Lycoming 230-69 kV Substations. Electrical power normally flows from both the Clinton and Lycoming Substations along these lines to PPL Electric's Faxon, Kenmar, Montoursville, Hughesville, and Muncy 69-12 kV distribution substations, which serve local customer loads, and to the substation owned by Atlantic Refining, a transmission service customer. In total, approximately 17,118 customers are served from the substations supplied by the Clinton-Lycoming #2 & the Lycoming #2 – Muncy 138/69 kV transmission Lines. The load forecast indicates that for the summer of 2013 the Clinton – Lycoming #2 & Lycoming #2 – Muncy 138/69 kV Lines will be supplying approximately 50 MW of customer load.

See Figure 1 on page 4 for the existing transmission system configuration.

C. DEFINITION OF THE PROBLEM

This Project aims to resolve problems related to the performance, reliability and safety of PPL Electric's Clinton – Lycoming #2 & Lycoming #2 – Muncy 138/69 kV transmission Lines. According to PPL Electric's Reliability Principles and Practices (RP&P), a load serving line should not exceed 2 outages per year per 20-mile circuit (or 0.1 outages/mile) for both momentary and permanent outages. This is equivalent to 2.04 interruptions per year for this 20.4 mile long line. A momentary outage is defined as an interruption that is less than 5 minutes in duration. A permanent outage is defined as an interruption that is greater than 5 minutes. In recent years, outage rates of the Clinton – Lycoming #2 & Lycoming #2 – Muncy 138/69 kV Lines have exceeded the line performance standards set by PPL Electric's RP&P with 4 outages in 2011, 7 outages in 2012, and 3 outages to date in 2013.

These interruptions have not only interrupted area residential customers but have also disrupted plant operations to Kellogg's, ADS and Charlotte Pipe. Such interruptions have proven to be costly to these industrial customers who require a high level of reliable service to sustain their businesses.

With the intention of improving the reliability of service to all customers served from the Clinton – Lycoming #2 and Lycoming #2 – Muncy 138/69 kV Lines, PPL Electric proposes to begin work on this Transmission Line Project immediately upon Commission approval to reduce the number of customers affected by a line interruption and thereby improve the reliability of service in the future.

D. PROPOSED SOLUTION

In order to reduce the probability that a customer served from the Clinton – Lycoming #2 & Lycoming #2 – Muncy 138/69 kV Lines will experience an outage, PPL Electric proposes to reduce the line mileage exposure. This reduction can be accomplished by detaching the Clinton – Lycoming #2 138/69 kV Line from the Lycoming #2 – Muncy 138/69 kV Line, at the three-terminal junction in the vicinity of the Clinton Substation and re-terminating the Clinton – Lycoming #2 138/69 kV Line into a new 69 kV line bay at the Clinton Substation. The Lycoming #2 – Muncy 138/69 kV Line will remain terminated in its existing bay. Once the Clinton – Lycoming #2 Line is terminated into the new Clinton 69 kV line bay, the Lycoming #2 – Muncy 138/69 kV Line will be renamed the Clinton – Muncy #1 138/69 kV Line.

The customers served from the re-named Clinton – Muncy #1 138/69 kV Line (previously referred to as the Lycoming #2 – Muncy Line) will see an immediate improvement in service and reliability after this Project is completed because it will shorten the overall length of the Line serving PPL Electric's Muncy and Hughesville substations, from 20.4 miles to 4.0 miles. The proposed upgrade will reduce the number of lightning strikes impacting the new Clinton-Muncy #1 138/69 kV transmission line by 80 percent.

The customers served from the Clinton – Lycoming #2 138/69 kV line will also see an improvement in service and reliability. The proposed plan will shorten the overall length of the 138/69 kV transmission Line serving PPL Electric's Faxon, Kenmar, and Montoursville Substations and Atlantic Refining's Substation, from 20.4 miles to 16.4 miles.

Circuit performance during lightning or other momentary outage-causing events associated with the re-named 4.0 mile long Clinton-Muncy #1 transmission Line and the 16.4 mile long Clinton-Lycoming #2 transmission Line will be addressed in the near future. PPL Electric is developing plans to improve the lightning performance of these circuits and also intends on rebuilding a portion of the Clinton-Muncy #1 138/69 kV Line. This work will be the subject of a future filing or filings before the Commission.

The proposed system upgrades identified will improve the reliability for the customers served by these lines. All work proposed in this Letter of Notification will be completed entirely on property owned in fee by PPL Electric.

The total estimated cost of this Project is $3.0 million. The proposed transmission line work is scheduled to begin immediately upon Commission's approval to support a scheduled in-service date of July, 2013.

E. <u>FUNCTIONAL ALTERNATIVES</u>

No other reasonably economical functional alternatives were identified that would resolve the problems outlined above. The Line modifications and Line improvements are a part of PPL Electric's long range plan to improve service reliability to its customers.

Attachment 2

ATTACHMENT 2
CLINTON - LYCOMING 138/69 kV LINE RE-TERMINATION
ENGINEERING DESCRIPTION

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MAP

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ATTACHMENT "2"
CLINTON - LYCOMING 138/69 kV LINE RE-TERMINATION
ENGINEERING DESCRIPTION

A. PROPOSED LINE DESIGN

PPL Electric Utilities (PPL Electric) proposes to detach the existing 20.9 mile long Clinton – Lycoming #2 138/69 kV Line from the existing 3 mile long Lycoming #2 – Muncy 138/69 kV Line and re-terminate it into the existing Lycoming 230-69 kV Substation. Currently the Clinton – Lycoming and the Lycoming #2 – Muncy Transmission Lines are both connected to the same bay in the Lycoming substation. As presently configured, an outage on either transmission line will take the other out of service.

Detaching the Clinton – Lycoming #2 line from the Lycoming #2 – Muncy line and re-terminating it in a new bay at the Clinton Substation will reduce the total line exposure. The 3 mile long Lycoming #2 – Muncy 138/69 kV circuit that already terminates into the Clinton 230 – 69 kV substation would not be modified.

The Clinton – Lycoming #2 Transmission Tie Line is presently supported by approximately of 111 structures. These structures are a mix of wood poles which range in height from 60 to 130 feet and steel monopoles which range in height from 60 to 130 feet. Wood poles were installed on a portion of the line constructed in 1975 and steel poles on portions constructed 1994. In order to re-terminate the Clinton – Lycoming #2 line in the new bay at the Clinton Substation approximately 1,200 feet of new 138/69/ kV Transmission Line will be constructed.

The new portion of the Clinton – Lycoming transmission line will consist of three 795.0 kcmil[1], 30/19, stranding, ACSR[2] power conductors and two 3/8 inch diameter Overhead Ground Wires (OHGW) that will provide lightning protection. The conductors and OHGWs will be supported by single or double shaft weathering steel monopoles equipped with

[1] Kcmil stands for thousand circular mils. Kcmil wire size is the equivalent cross sectional area in thousands of circular mils. A circular mil is the area of a circle with a diameter of one thousandth (.001) of an inch.
[2] ACSR stands for aluminum conductor steel reinforced.

upswept weathering steel arms and glass 138 kV insulator assemblies. The new steel structures will average 76 feet in height. Average span length for the new section of line will be 203 ft. Drawings of structures similar to the ones that will be installed for the proposed line reconstruction are shown on pages 5 – 8 at the end of Attachment 2.

To facilitate the placement of the new portion of the Clinton – Lycoming #2 transmission line, one pole on the existing Clinton – Milton 138/69 kV and Clinton – Lycoming 138/69 kV double circuit line will be replaced with a higher structure. Additionally, two spans of the existing Clinton – Lycoming #2 line will be removed as part of this Project.

Then new 138/69 kV line will be designed according to and will generally surpass minimum National Electrical Safety Code (NESC) standards. Additional design criteria and safety rules practiced by PPL Electric are included in Attachment 4. The minimum conductor to ground clearance will be 30.0 feet which occurs at a maximum conductor temperature of 125°C. The design minimum conductor ground clearances and conductor thermal ratings are shown in Table 1 and Table 2 below.

TABLE 1
DESIGN MINIMUM CONDUCTOR CLEARANCES
FOR 795.0 KCMIL 30/19 STRANDING ACSR*

Condition	Double-Circuit Design Clearance-to-Ground
Normal load, average weather (16° C, 60° F)	32.0 Feet
Predicted extreme thermal load (125° C, 257° F conductor temperature)	30.0 Feet
Predicted NESC extreme wind load (25 lbs. wind, 16° C, 60° F)	32.3 Feet
Predicted extreme weather conditions (1-inch ice, 4 lbs. wind, -18° C, 0° F)	32.0 Feet

*Clearances based on a maximum tension of 5,500 lbs. and a ruling span of 291 feet.

TABLE 2
CONDUCTOR THERMAL RATING
795.0 KCMIL 30/19 STRANDING ACSR
(257°F) 125°C MAXIMUM CONDUCTOR TERMPERATURE

Condition	Ambient Temperature °C	Wind Speed Knots	Ampacity Amps
Summer Normal	35	0	1068
Winter Normal	10	0	1214
Summer Emergency	35	1.5	1333
Winter Emergency	10	1.5	1490

B. MAGNETIC FIELD MANAGEMENT

PPL Electric's Magnetic Field Management Program is summarized in Attachment 5 and applied to reconstruction and new line projects. In order to lower magnetic field exposures, the program generally prescribes the use of line design that provides 5 feet higher ground clearances and reverse phasing new double-circuit lines where it is feasible to do so at low or no cost. The implementation of additional modifications will be considered, provided those modifications can be made at low or no cost.

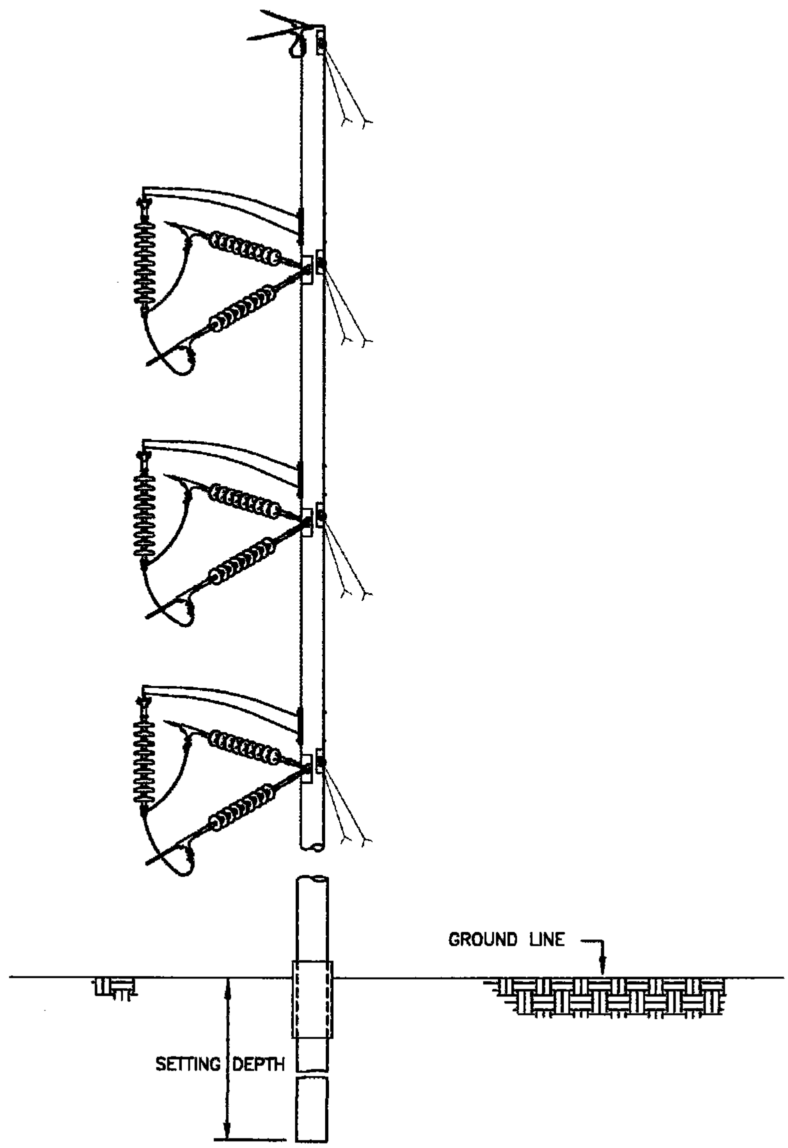
For this Project, reverse phasing cannot be utilized to reduce magnetic field levels because only one circuit is being constructed. However, some reduction in magnetic fields will be realized through the use of higher ground clearances.

C. RIGHT-OF WAY STATUS

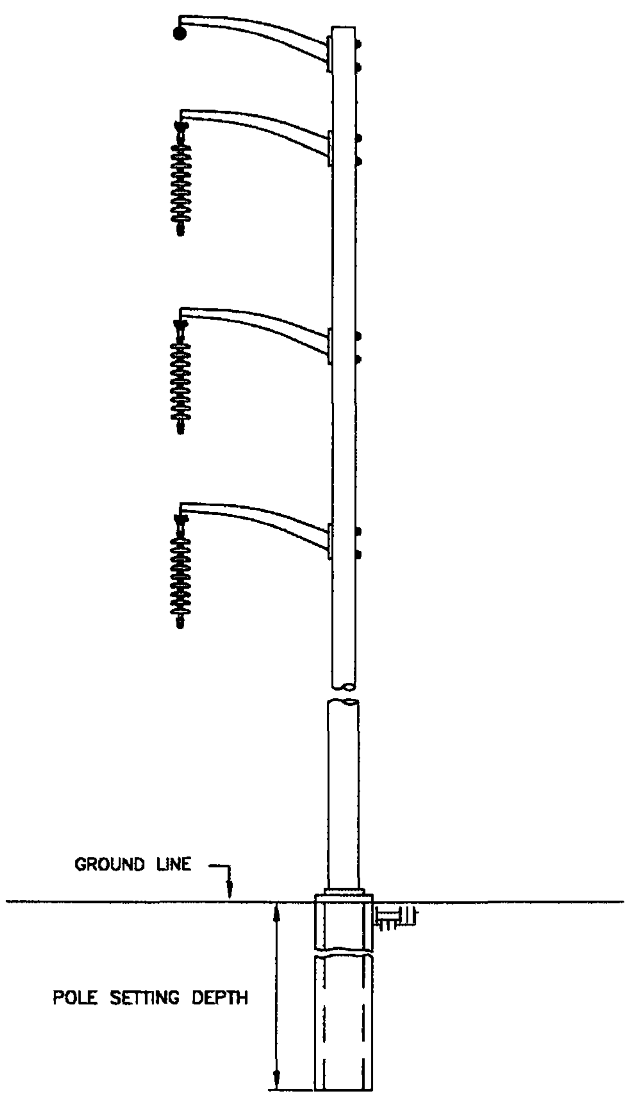
The proposed Clinton - Lycoming 138/69kV Transmission Line termination will be constructed completely on tracts of land owned in fee by PPL Electric. No additional right-of-way is required for this Project.

The Aerial Exhibit at the end of Attachment 2 shows the existing line route, proposed re-termination and portion of the existing line that will be de-energized.

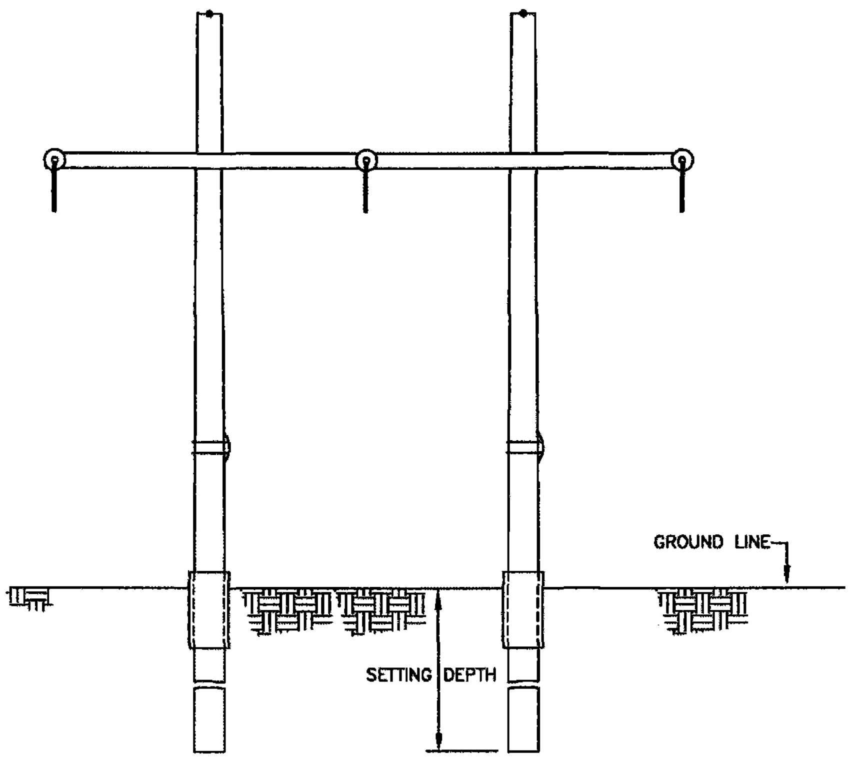
SINGLE CIRCUIT ANGLE TENSION STRUCTURE



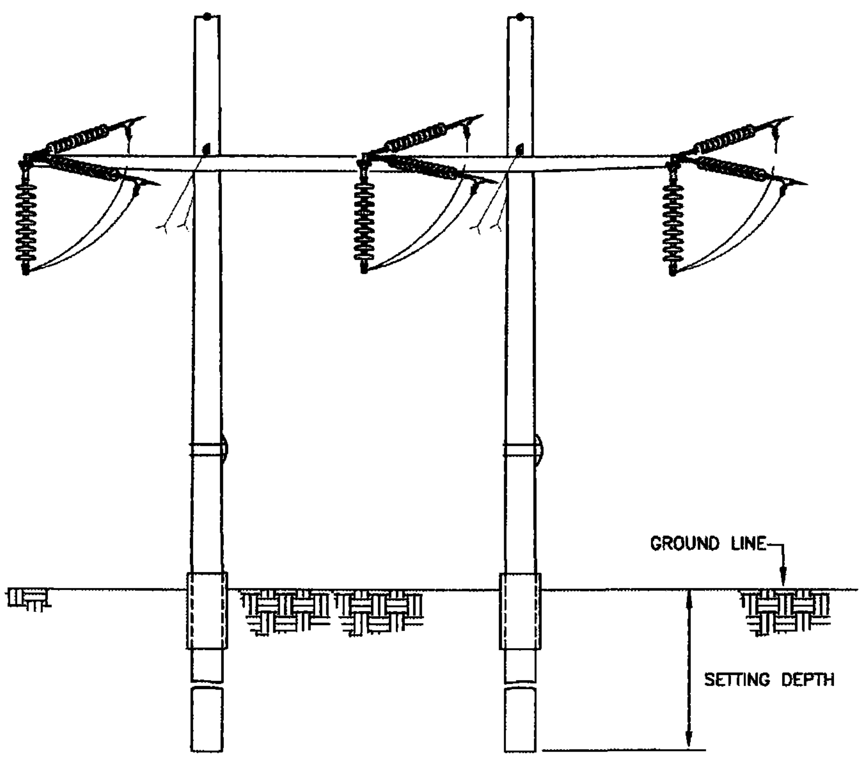
SINGLE CIRCUIT SUSPENSION STRUCTURE



SINGLE CIRCUIT TWO POLE TANGENT TENSION STRUCTURE



SINGLE CIRCUIT TWO POLE ANGLE TENSION STRUCTURE



Attachment 3

ATTACHMENT "3"
CLINTON - LYCOMING 138/69 kV LINE RE-TERMINATION
ENVIRONMENTAL ASSESSMENT

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CLINTON - LYCOMING 138/69 kV LINE RE-TERMINATION
ENVIRONMENTAL ASSESSMENT

A. INTRODUCTION

PPL Electric proposes to re-terminate the existing Clinton – Lycoming #2 138/69 kV transmission line into a new bay in the existing Clinton 230 – 69 kV Substation. To accomplish this, the Clinton – Lycoming Line will be detached from the existing Lycoming #2 – Muncy Transmission Line. Two spans of the Clinton – Lycoming #2 Line will be deactivated, and approximately 1,200 feet of new 138/69 kV transmission line will be installed between the break point and the new bay in the Clinton Substation. The new section of 138/69 kV transmission line will be supported by single-shaft steel poles placed on property owned in fee by PPL Electric.

The proposed Project was reviewed with Clinton Township and with Lycoming County. Neither the Township nor the County had any objections. A list of involved governmental agencies, municipalities and other public entities is presented in Appendix D.

B. LAND USE

The proposed line reconstruction will result in little, if any, environmental or social impacts as the new line section will be constructed entirely on property owned in fee by PPL Electric that already hosts substantial other electric transmission facilities. The new line section will be constructed adjacent to existing transmission lines, including a double circuit 230 kV transmission line, the Clinton – Milton 138/69 kV Transmission Line, the Clinton – Lycoming #1 138/69 kV Transmission Line, the Clinton – Muncy 138/69 kV Transmission Line and the Lycoming #2 – Muncy 138/69 kV Transmission Line. The entire Project area is substantially cleared of large mature trees and is crisscrossed with unpaved access roads. The Project area is primarily surrounded by undeveloped wooded parcels. Due to the transmission facilities already existing in the area and the limited size of this Project, the incremental visual impacts of the Project will be minimal.

No nearby communication towers, pipelines, or other utilities will be affected by the proposed Project. Additionally, no airports are located within 2 miles of the Project area. The nearest airport is Hackenburg-Penny Hill Airport, a private airport, is located approximately 2.9 miles to the southwest of the Project site. Impacts to this airport are not expected due to the distance from the airport, the layout of the approach path and the presence of similar sized structures already present at the site. Nonetheless, PPL Electric will file the appropriate notifications with the Federal Aviation Administration and the PennDOT Bureau of Aviation to confirm that the new line segment will not be a hazard to the airport's flight operations.

CULTURAL RESOURCES

The Project was submitted to the Pennsylvania Historical and Museum Commission (PHMC) to request identification of potential impacts to both historic and archaeological resources. A response from PHMC has not been received. PPL Electric anticipates that no archaeological resources are located at the Project site because PPL Electric already has constructed substantial facilities at the Project site and does not anticipate finding historic or archaeological resources. Should PHMC identify the potential for historic or archaeological resources, however, PPL Electric will work with PHMC to resolve any issues prior to the initiation of construction.

C. NATURAL FEATURES

The Project will not affect any unique geological, scenic, or natural areas. The recreational area located closest to the Project site is Tiadaghton State Forest, which is located approximately 0.5 miles to the north. The western portion of the existing Clinton – Lycoming #2 Transmission Line located to the west of the Project site runs through Tiadaghton State Forest. There are no anticipated impacts to this area due to the relatively small size of the Project compared to the existing electrical facilities already located adjacent to and near the Project area, the distance from these features to the Project area, and the existing mature forests surrounding the Project area which provide a vegetative buffer.

It is not anticipated that significant tree clearing or brush removal will be required as part of this Project since the Project area is located on property that already has been substantially cleared of mature trees because it is traversed by multiple transmission lines. However, some minor tree clearing and brush removal will be required, PPL Electric will apply its "Specifications for Initial Clearing and Control of Vegetation on or Adjacent to Electric Right-of-Way Through Use of Herbicides, Mechanical, and Hand Clearing Techniques" while performing the tree clearing to minimize impacts from vegetation clearing.

The proposed transmission tap will not cross any wetlands or areas designated as "Waters of the U.S." or "Waters of the Commonwealth." It is anticipated that less than one acre of soil will be disturbed during the completion of this Project. As such, soil erosion and sedimentation permits will not be required. However, PPL Electric will prepare and abide by a site specific soil erosion and sedimentation control plan, a copy of which will be maintained on site. Due to the area of disturbance being less than one acre, the erosion and sedimentation control plan does not need to be submitted to the County Conservation District.

E. THREATENED AND ENDANGERED SPECIES

PPL Electric has coordinated with different state and federal agencies to obtain information regarding threatened and endangered species in close proximity to the Project area. A review of the Pennsylvania Natural Diversity Inventory (PNDI) records indicates that there are no anticipated impacts to threatened and endangered species and/or special concern species and resources (PNDI Search ID: 20130508403309).

Attachment 4

ATTACHMENT 4
CLINTON - LYCOMING 138/69 kV LINE RE-TERMINATION
PPL ELECTRIC DESIGN CRITERIA AND SAFETY PRACTICES

The National Electric safety Code (NESC) is a set of rules to safeguard people during the installation, operation, and maintenance of electric power lines. The NESC contains the basic provisions considered necessary for the safety of employees and the public. Although it is not intended as a design specification, its provisions establish minimum design requirements. PPL Electric has developed design specifications and safety rules which meet or surpass all requirements specified by the NESC.

Engineering Design Criteria and Parameters

The NESC includes loading requirements and clearances for the design, construction, and operation of power lines. The "loads" on conductors and supporting structures are the mechanical forces that develop from the weight of the conductors, the weight of ice on the conductors, plus wind pressure on the conductors and supporting structures. Loading requirements are the loads on the conductors and structures that are anticipated assuming certain ice and wind conditions. Loading requirements always contain "safety factors" to allow for unknown or unanticipated contingencies. The clearances and loading requirements contained in the NESC were developed to ensure public safety and welfare.

PPL Electric transmission line design standards meet or surpass the NESC standards. For example, the relative order of grades of construction for conductors and supporting structures is B, C, and N; Grade B being the highest. According to the NESC standards, construction Grades B, C, or N may be used for transmission lines (except at crossings of railroad tracks and limited access highways where Grade B construction is specified). However, PPL Electric designs all of its transmission lines for Grade B construction. The use of Grade B design and construction specifies enhancements such as larger-minimum crossarm dimensions, larger-minimum conductor size, and increased safety factors.

Another example is the design parameters utilized to account for ice and wind loadings on the overhead ground wire (OHGW) and power conductors. The NESC standard ice and wind design magnitudes for the PPL Electric territory are 0.5 inch thickness of radial ice combined with four pounds per square foot horizontal wind pressure (equivalent to 40-mile per hour wind velocity). The conductor sags and tensions used in line designs are the result of various ice and wind combinations, depending on the elevation at the line location and line design voltage. The conductor sags and tensions used in the design of all PPL Electric transmission lines are at least 0.5-inch ice combined with eight pounds wind pressure (equivalent to 57 miles per hour wind velocity). This means that PPL Electric lines are designed to operate safely and reliably during inclement weather even more severe than assumed by the NESC. In addition, PPL Electric transmission lines are designed with more clearance to the ground than required by the NESC. The tables below compare PPL Electric and NESC ground clearances for lines of various voltages.

138 kV

	Vertical Clearance to Ground	
Surface Underneath Conductors	NESC Standard	PPL Electric Design
Roads, streets, alleys	21 Ft.	30 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	21 Ft.	30 Ft.
Spaces accessible to pedestrians only	17 Ft.	30 Ft.
Railroad tracks	31 Ft.	36 Ft.

230 kV

Surface Underneath Conductors	Vertical Clearance to Ground: NESC Standard	Vertical Clearance to Ground: PPL Electric Design
Roads, streets, alleys	23 Ft.	32 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	23 Ft.	32 Ft.
Spaces accessible to pedestrians only	19 Ft.	32 Ft.
Railroad tracks	31 Ft.	36 Ft.

500 kV

Surface Underneath Conductors	Vertical Clearance to Ground: NESC Standard	Vertical Clearance to Ground: PPL Electric Design
Roads, streets, alleys	28 Ft.	53 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	28 Ft.	53 Ft.
Spaces accessible to pedestrians only	24 Ft.	53 Ft.
Railroad tracks	38 Ft.	53 Ft.

A relay protection system is used to protect the public safety and welfare as well as equipment and the transmission system. Relay protection is installed for all transmission lines to automatically de-energize the line in the unlikely event that the line or supporting structure fails and the line contacts the ground.

Periodic Maintenance Program on All Transmission Lines

To ensure continued public safety and integrity of service, a periodic maintenance and inspection program is implemented for every transmission line. The program is administered through the use of helicopter patrols, with supplemental foot and structure climbing patrols. A number of helicopter patrols are performed on all lines annually. The two-man helicopter crew flies parallel, to the left, and above the line so that the observer can look for signs of line damage or deterioration and observe clearances between vegetation and conductors. The observations are included in a report that is forwarded to the appropriate department for corrective action.

Foot and structure climbing patrol programs for a transmission line begin approximately three to five years after the line is energized, unless a helicopter patrol reports a need for earlier action. The frequency of foot patrols varies from once every year to once every several years depending on line type and age.

An assigned foot patroller checks right-of-way conditions, including access roads, bridges, pole washouts, tower footers, vegetation height and clearance to conductors, pole and tower deterioration and, with the use of binoculars, insulators, and condition of hardware. Identified problems are included in a report that is forwarded to the appropriate department for corrective action.

A scheduled line outage is required to perform an overhead patrol because of "hands-on" inspection of hardware. Overhead patrols are conducted on a schedule determined by line age, operating record, and observed general condition. The necessary repairs are also done during the inspection outage.

Personnel Safety Rules

The following are a few of the PPL Electric safety rules that demonstrate the Company's concern for employee safety:

- Work procedures have been developed to allow work to be performed on energized facilities in a safe manner. When lines or apparatus are removed from service to be worked on, the Energy Control Process system is applied. This system provides that a red tag must be physically placed on the control handle of the de-energized equipment. The red tag may be removed only after proper authorization to energize the equipment. Various other tags are used for limited operations and informational purposes. Employees will not apply or remove a tag or change the status of tagged equipment unless authorized.

- Temporary safety grounds are used on de-energized facilities for employee safety during maintenance, construction, or reconstruction work. Safety grounds are wires connecting the de-energized facility to an electrical ground. If the facility should be energized, the safety grounds will divert the current directly to ground and reduce the likelihood of personal injury. The conductor size and attachment clamps of temporary safety grounds must be capable of conducting anticipated fault currents. Rubber gloves, rubber sleeves, and additional rubber protective equipment are used as required when applying or removing temporary safety grounds to or from the lines or apparatus to be grounded. An approved nonconductive working stick of sufficient length to allow workers to maintain the following required minimum clearances is used to test that the line has been de-energized and to apply temporary safety grounds:

Voltage-kV	Minimum Clearance
138	3'-7"
230	5'-3"
500	11'-3"

Before applying grounds, a test is done to confirm that the line is de-energized. The voltage test device is checked before and after use to assure reliability. When ground pins are used to establish proper ground points, they are driven to a depth of not less than four feet as near vertical as possible.

- Poles or structures are inspected and examined for structural integrity before climbing. If there is any reason to believe that a pole is unsafe, it is stabilized before work is performed. Appropriate safety gear in the form of body belts, safety straps, hard hats, gloves, etc., is worn by linemen during line work activity.

Attachment 5

MAGNETIC FIELD MANAGEMENT

PPL Electric Utilities Corporation

DECEMBER 2004

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INTRODUCTION

At PPL Electric Utilities Corp. (PPL EU), magnetic field management means investigating and implementing methods at low or no cost to reduce magnetic fields in new or rebuilt transmission and distribution lines. This document explains PPL EU's Magnetic Field Management Program, which is part of PPL EU's larger Electric and Magnetic Fields (EMF) policy.

PPL EU's View

Some people are worried that electric and magnetic fields are harming their health. Others think the scientific research does not show a problem at all, and still others believe there's just too much scientific uncertainty to draw any conclusions.

Here's what we do know now. Various panels of scientists that have reviewed the EMF research generally have drawn two main conclusions. First, the large body of evidence does not demonstrate that EMF are harmful. Second, additional research is recommended to explore questions raised in some studies.

Given these conclusions, PPL EU is taking a reasoned approach in responding to the EMF issue. PPL EU's approach to the EMF issue consists of five elements:

- Providing EMF information to customers and employees
- Providing magnetic field measurements
- Establishing and implementing a magnetic field management program to reduce magnetic fields in new or rebuilt facilities when it can be done at no, or low, cost
- Integrating EMF in the public involvement process that PPL EU undertakes in the siting of transmission lines
- Have supported additional research

EMF Are All Around Us

Electric and magnetic fields occur in nature and in all living things. The earth, for instance, has a magnetic field, which makes the needle on a compass point north.

Electric fields and magnetic fields of a different type also surround every wire that carries electricity. In everyday life, these EMF arise from several basic sources, including power lines, electrical appliances, home and building wiring, other utility lines and cables, and currents flowing on water pipes. Though they often occur together, EMF are made up of two separate components:

Electric Fields

Electric fields are produced by the voltage—or electrical pressure—on a wire. The higher the voltage, the higher the electric field. As long as a wire is energized—has voltage present—an electric field is present (see Figure 1). In other words, an appliance, or an electric power line, doesn't actually have to be turned on to create an electric field. It just has to be plugged in. Electric fields diminish with distance and can be blocked or partially shielded by objects such as trees and houses.

Magnetic Fields

Magnetic fields are created by the current or flow of electricity through a wire. Generally speaking, the higher the current, the higher the magnetic field. Because they only occur when current is flowing, magnetic fields are present only when the power is turned on (see Figure 1). Magnetic fields also diminish with distance, but—unlike electric fields—are not blocked by common objects. In recent years, public and scientific interest has turned toward the magnetic field component of EMF because of some scientific studies regarding these fields.

Figure 1

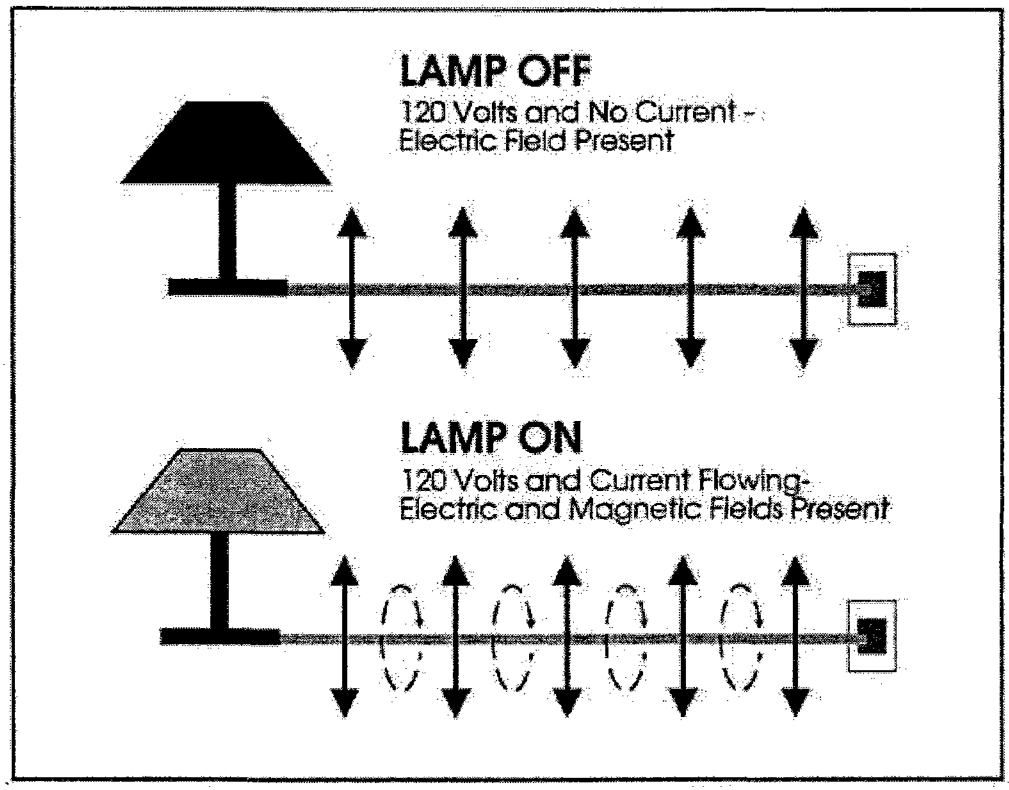

LAMP OFF
120 Volts and No Current -
Electric Field Present
LAMP ON
120 Volts and Current Flowing-
Electric and Magnetic Fields Present

Figure 2

Magnetic field strengths decrease with distance Magnetic fields are measured in milligauss	Source: "EMF In Your Environment", U.S. Environmental Protection Agency 1992 At 6 inches	At 1 foot	At 2 feet
Clothes dryer	2 to 10	* to 3	*
Microwave oven	100 to 300	1 to 200	1 to 30
Toaster	5 to 20	* to 7	*
Power drill	100 to 200	20 to 40	3 to 6
Can opener	500 to 1500	40 to 300	3 to 30
Mixer	30 to 600	5 to 100	* to 10
Hair dryer	1 to 700	* to 70	* to 10
Color television	Data not available	* to 20	* to 8

FIGURE 2 * The magnetic field measurement at this distance from the operating appliance could not be distinguished from background measurements taken before the appliance had been turned on.

Measuring Magnetic Fields

Magnetic fields usually are measured in a unit called a milligauss. Magnetic field levels found in the living areas of homes typically range from less than 1 milligauss to about 4 milligauss according to the U.S. Environmental Protection Agency. They can be higher in some cases. The levels next to appliances can exceed 1,000 milligauss (1 gauss). Figures 2 and 3 show how the strength of the field falls off as you move away from the source, just as the heat of a campfire grows weaker as you walk away from it. For overhead power lines, the strength of the magnetic fields is dependent upon a number of factors that will be explained later. Those factors produce a magnetic field that drops off rapidly as you move away from the power line.

Figure 3

Sample Magnetic Field Levels in Milligauss

Type of Overhead Power Line	Distance from the line			
	Under the line	50 ft.	100 ft.	200 ft.
220 kV and 500 kV	5-400	5-250	1-75	0.5-20
69 kV and 138 kV	3-80	0.5-2.5	0.1-10	0.1-3
12 kV and below	0.4-20	0.1-1	-	-

The magnetic field values provided in this table represent a general range of values associated with the types of overhead power lines listed and are provided for illustration. There will be circumstances in which there will be magnetic field levels above or below the range of values provided due to variations in such factors as height of the wires, current flow and so on.

DEVELOPMENT OF PPL EU's MAGNETIC FIELD MANAGEMENT PROGRAM

One element of our response to EMF concerns expressed by some of our customers is PPL EU's Magnetic Field Management Program. The program was initiated in March 1991 because PPL EU believes it makes good sense, as a matter of policy, to respond to the concerns expressed by some of our customers and to reduce magnetic fields in new and rebuilt facilities where it can be done with either no-cost or low-cost design changes.

This document updates the original program which has been revised several times since 1991. These guidelines were developed by PPL EU's EMF Working Group.

VARIABLES THAT AFFECT MAGNETIC FIELDS

Magnetic fields from transmission and distribution lines are a function of a number of design variables. The following parameters affect the magnetic field levels produced by transmission and distribution lines:

- Current
- Height of conductors above ground
- Configuration of conductors
- Distance from the line

EFFECT OF PHASE CURRENT ON MAGNETIC FIELDS

At power frequencies (i.e., 60 hertz), the magnetic field level is a function of the current or flow of electricity through a wire. Keeping all other parameters the same, the magnetic field is proportional to the current. Hence, if the current increases by 25 percent, the resulting magnetic field level will increase by 25 percent.

The overall load current on any line varies with the demand for power. It's usually highest during daytime hours and lowest at night. There also are weekly, monthly, seasonal and yearly variations.

The difference in the currents between each phase in a multiphase line also can affect the magnetic field. This difference is called phase unbalance. For a constant load, a statistical analysis of this phase unbalance can be made to determine its effect on the magnetic field. Close to the line, there is very little effect. However, the phase unbalance slows the rate at which the magnetic field decreases with distance from the line.

EFFECT OF CONDUCTOR CONFIGURATION ON MAGNETIC FIELDS

In the transmission and distribution of power, utilities like PPL EU presently use both three-phase and single-phase lines. Each phase on a three-phase power line has either a single conductor or a bundle of two or more conductors. In a three-phase system, the ground-level magnetic field is a result of the fields produced by the currents in each of the phases. Placing the three phases as close together as possible (compaction) creates some field cancellation, and the ground-level magnetic field is reduced. However, appropriate phase separation is required for the reliable operation of the line. In addition, the arrangement of the phases can create some; field cancellation and reduction of the ground-level magnetic field.

EFFECT OF DISTANCE FROM THE MAGNETIC FIELD SOURCE

Magnetic field strength diminishes with the vertical and lateral distances from the magnetic field source. Increasing the height of the conductors above ground is useful for magnetic field reduction at ground level, but may result in increased structure costs and increased aesthetic impact of the structures. Another possible method of increasing the distance to the magnetic field source is to increase the right-of-way requirements. By keeping buildings off increased rights of way, thereby requiring the public to live and work further away from lines, exposure to magnetic fields produced by the lines can be reduced. Increases in right of way are not always practical and may increase costs significantly, however.

SUMMARY OF PPL EU's MAGNETIC FIELD MANAGEMENT PROGRAM

Under its Magnetic Field Management Program, PPL EU has changed the way it builds and rebuilds some of its transmission and distribution lines. These design changes reduce magnetic field levels (assuming balanced circuit loadings and phase currents) by up to 69 percent in most of the company's new transmission lines. These guidelines now are being applied to new and reconstructed transmission facilities, based on this program.

The distribution component of the program focuses on 12 kV lines, the company's standard distribution voltage. It concentrates on the three-phase, primary 12 kV lines, since these are the most heavily loaded facilities and often are located in densely populated areas. The guidelines in this program are being applied to these three-phase, primary 12 kV lines.

A maximum 3-5 percent change in estimated cost was used as the limit for the guidelines since this value is consistent with low cost, is within estimating accuracy and is likely to have little impact on overall line costs.

The magnetic field calculations used in this document for the design of PPL EU's overall magnetic field management plan assume balanced load conditions among the phases and a fixed level of current, not necessarily representative of specific transmission or distribution lines. These levels were calculated using the Electric Power Research Institute's ENVIRO computer program. Under actual operating conditions, the magnetic field levels that result may vary due to such things as actual load per circuit, overall current on each phase conductor and the electrical configuration and operation of each line.

MAGNETIC FIELD MANAGEMENT PROGRAM GUIDELINES

The guidelines for magnetic field management are noted below, with discussion points for each.

OVERHEAD LINES

NEW OR REBUILT TRANSMISSION LINES

1. **Balance transmission circuit loads and phase currents as much as possible.**
    - PPL EU should continue to make every effort to balance loadings between the two circuits of a double circuit line when planning new or rebuilt facilities to maximize the effects of reverse phasing.
    - PPL EU should continue the practice of balancing single-phase loads across the three phases of the distribution system. (Unbalanced phase currents on the distribution system are reflected through to the transmission system.)
        - Unbalanced phase currents result in higher magnetic fields that do not drop off as quickly with distance as do the fields resulting from balanced phase currents.
        - For a 5 percent phase current unbalance, the magnetic field 50 feet from the centerline of a single circuit 138 kV line could be more than twice the value than if the same line had balanced phase circuits.
    - Balanced phase currents on each three-phase distribution circuit also reduce magnetic fields from the distribution circuits themselves. In addition, they reduce magnetic fields on the transmission system from which the distribution system circuits are supplied and connected through substations.
    - Apart from magnetic field considerations, balanced phase currents on each three-phase distribution circuit also reduce line losses and improve the system voltage.

2. **Continue with the present practice of using long-span construction as the PPL EU 138/69 kV standard**

- Structure designs for short-span and long-span construction are illustrated on Charts I and II, respectively.
  - Short-span design does not significantly reduce magnetic fields when compared to long-span design even though it is more compact than long-span design. Comparison of the magnetic field values from Chart III indicates essentially the same values. Therefore, short-span design should not be used solely to reduce magnetic fields.
  - PPL EU will continue to use long-span construction for 138/69 kV double-circuit lines and for single-circuit/future-double-circuit lines.
  - For single-circuit/future-double-circuit lines, PPL EU will continue to install two conductors on the top positions and one in the middle position as shown in Chart IV.
    - This arrangement minimizes magnetic fields as shown in Chart V by placing the three initial conductors higher on the structure, which increases the ground clearances, and by placing the conductors in a triangular configuration.

3. **Compact design structures are not a low-cost alternative and should be used for magnetic field reduction only in special applications.**

Chart VI illustrates the compact design structure.

- The compact design increases the initial installation costs by 79 percent when compared to the long-span design but reduces the magnetic field from 9 mG to 3 mG (about 67 percent) at the edge of the 100-foot-wide right of way as shown on Chart III.

4. **Reverse phase new or rebuilt double-circuit transmission lines for all voltage levels.**

- Reverse phasing was adopted by PPL EU in March 1991 for double-circuit 138/69 kV transmission lines and in April 1992 for all other double circuit transmission lines. Reverse phasing is shown in Chart VII. Reverse phasing will reduce the magnetic fields when the current flow on both circuits is in the same direction. Calculated values contained here are based on balanced and equal phase currents on both circuits.

- Reverse phasing reduces the magnetic field of a double circuit 138 kV single pole transmission line from 29 mG to 9 mG (about 69 percent) at the edge of the 100-foot-wide right of way as shown on Chart III.
- Reverse phasing reduces the magnetic field of a double circuit 230 kV single pole transmission line from 49 mG to 16 mG (about 67 percent) at the edge of the 150-foot-wide right of way as shown on Chart VIII.
- Reverse phasing reduces the magnetic field of a double-circuit 500 kV single pole transmission line from 37 mG to 21 mG (about 43 percent) at the edge of the 200-foot-wide right of way as shown on Chart IX.

• When new or rebuilt double-circuit lines require tapping existing double-circuit lines, PPL EU will review the existing lines to determine if reverse phasing can be provided at low cost.

• Computer modeling is required to develop the optimum phasing and overall conductor arrangements for lines added to, or rebuilt in, multiple-line corridors.

- Merely adding a reverse-phase double-circuit line to an existing transmission line corridor or reverse phasing a rebuilt line in the multiple-line corridor will not necessarily produce lower magnetic field levels at the edge of the corridor right of way.
- The corridor must be computer modeled with all the lines, existing phase conductor locations and currents. Then, magnetic field calculations must be made varying the phase arrangements of the new or reconstructed line to determine the appropriate phasing arrangement.
- Current flow direction on a line also must be considered. For example, a reverse-phased line should have the current flowing in the same direction on both circuits. If the current flow is in the opposite direction for one circuit, reverse phasing will not produce the lowest magnetic field and another phase arrangement that produces lower fields may need to be utilized.

5. **Increase the minimum ground clearance for all new transmission lines.**

138/69 kV Transmission Lines

- Increasing the minimum line design ground clearance from 25 feet to 30 feet may add up to about 5 percent to the installed cost of a new double-circuit single pole 138/69 kV line. For a given project, such cost may be substantially less, however. In fact, PPL EU frequently uses higher-than-minimum ground clearances due to such features as road crossings, line crossings and site-specific terrain. With long-span reverse-phase design, the, magnetic field is reduced from 9 mG to 7 mG (about 22 percent) at the edge of a 100-foot-wide right of way as shown in Chart X.
  - In the actual design of transmission lines to include higher minimum ground clearances, there may be limited segments (such as highway crossings, severe slopes and transmission line crossing locations) where National Electrical Safety Code (NESC) minimum ground clearances may need to be used. The NESC minimum ground clearances are less than the increased ground clearance discussed previously.

230 kV Transmission Lines

- Increasing the minimum line design ground clearances from 27 feet to 32 feet may add up to about 5 percent to the cost of a single-circuit single-pole line (current standard). For a given project, such cost may be substantially less, however. In fact, PPL EU frequently uses higher-than-minimum ground clearances due to such features as road crossings, line crossings and site-specific terrain. By increasing the clearances, the magnetic field is reduced from 30 mG to 28 mG (about 7 percent) at the edge of a 150-foot-wide right of way.
- Increasing clearances from 27 feet to 32 feet could theoretically add up to about 2.8 percent to the cost of a double-circuit single-pole line (current standard) and reduce the magnetic field of a reverse-phase line from 16 mG to 15 mG (about 6 percent) at the edge of a 150-foot-wide right of way. Chart XI is a summary of this data.
- Studies are required for each new 230 kV line to determine optimum structure types, ground clearances, configurations and designs to reduce field levels. Such

studies could include analysis of reduction measures such as additional minimum ground clearances, increasing conductor tensions, using reduced phase spacing (a "Delta" configuration on a single-circuit line), installing the second circuit initially, and/or adding a second set of conductors that are reverse phased and operated in parallel with the first set (bundled/split phase).

500 kV Transmission Lines

- Increasing ground clearances from 33 feet to 53 feet may add up to about 4.5 percent to the cost of a single-circuit "H-frame" line (current standard). For a given project, such cost may be substantially less, however. In fact, PPL EU frequently uses higher-than-minimum ground clearances due to such features as road crossings, line crossings and site-specific terrain. By increasing the clearances, the magnetic field is reduced from 42 mG to 35 mG (about 17 percent) at the edge of a 200-foot-wide right of way.
- Increasing ground clearances from 33 feet to 53 feet could theoretically add up to 2.8 percent to the cost of a double-circuit "H-frame" line (current standard) and reduces the magnetic field of a reverse-phase line from 21 mG to 16 mG (about 24 percent) at the edge of a 200-foot-wide right of way. Chart XII is a summary of this data.
- Studies are required for each new 500 kV line to determine optimum structure types, ground clearances, configurations and designs to reduce field levels. Such studies could include analysis of reduction measures such as additional minimum ground clearances, increasing conductor tensions, using reduced-phase spacing (a "Delta" configuration on a single circuit line), installing the second circuit initially, and/or adding a second set of conductors that are reverse phased and operated in parallel with the first set (bundled/split phase).

RECONDUCTORING OR ADDING ADDITIONAL CIRCUITS TO EXISTING TRANSMISSION LINES

When reconductoring or adding additional circuits to existing transmission lines, PPL EU will evaluate low-cost or no-cost options for magnetic field management on a case-by-case basis.

When reconductoring existing transmission lines or adding additional circuits, low-cost alternatives may not exist; however, the following steps will be taken:

- For a single-circuit line, the use of a Delta arrangement or other modifications on the existing structure, with reduced-phase spacing, will be evaluated.
- For double-circuit lines, application of reverse phasing may reduce the magnetic field under the line and within the right of way and will be evaluated.
- For single- and double-circuit lines, evaluate using higher conductor tensions that can increase the minimum line design ground clearance.

DISTRIBUTION LINES

At the 12 kV distribution level, new main three-phase lines will continue to be constructed with five feet of additional ground clearance.

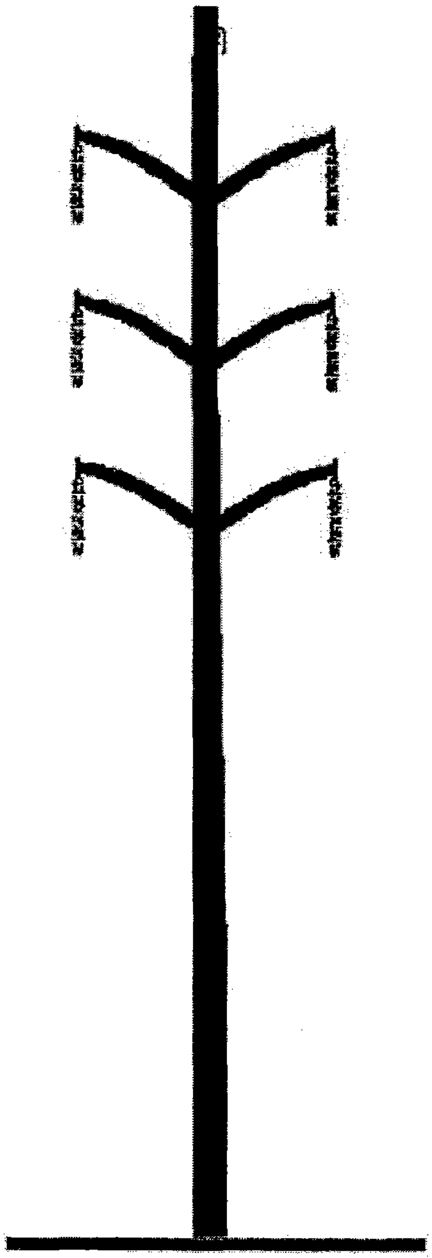
- Main lines are the most heavily loaded sections of a distribution line and therefore have the highest magnetic fields associated with them.
- Increasing the ground clearance by five feet reduces the magnetic field under the line from 14 mG to 11 mG using the standard eight-foot crossarm design. These values are based on increasing pole heights from 45 feet to 50 feet and a typical operating current of 300 amps per phase.
- Chart XIII is a summary of this data. Increasing ground clearance by five feet could theoretically add about 5 percent to the cost of a typical distribution line.

UNDERGROUND TRANSMISSION LINES

Underground transmission lines are required due to environmental or land use factors or restrictions on available clearances, PPL EU will evaluate options for magnetic field management techniques on a case-by-case basis.

- The phase arrangement that produces the lowest field will be determined.
- The depth of burial of the line will be determined considering the cost of excavation and the location of other buried utilities in the area.
- The use of steel pipe ferromagnetic shielding that reduces magnetic fields will be evaluated.

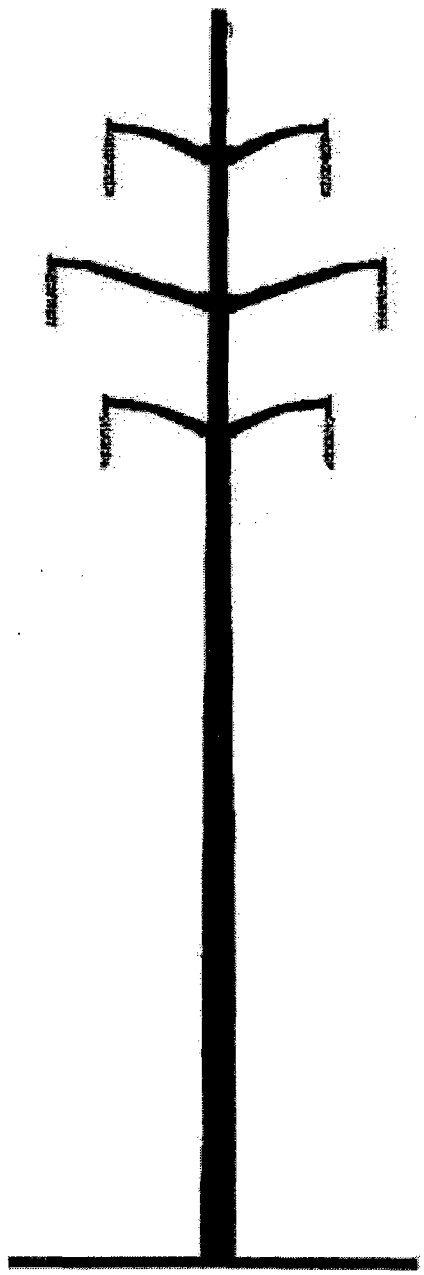
Short-Span Construction



- **More compact design**
- **Should not be used solely to reduce magnetic fields**
- **Typical conductor data:**

1 3/8" HS steel overhead ground wire - 7.3 feet sag
6-556.5 KCMIL 24/7 ACSR power conductors - (PARAKEET) 10.0 feet sag
Average span - 400 feet

Long-Span Construction Remains PPL EU 138 kV Standard



- Lower cost alternative
- Reduces magnetic fields due to higher structures
- Typical conductor data:

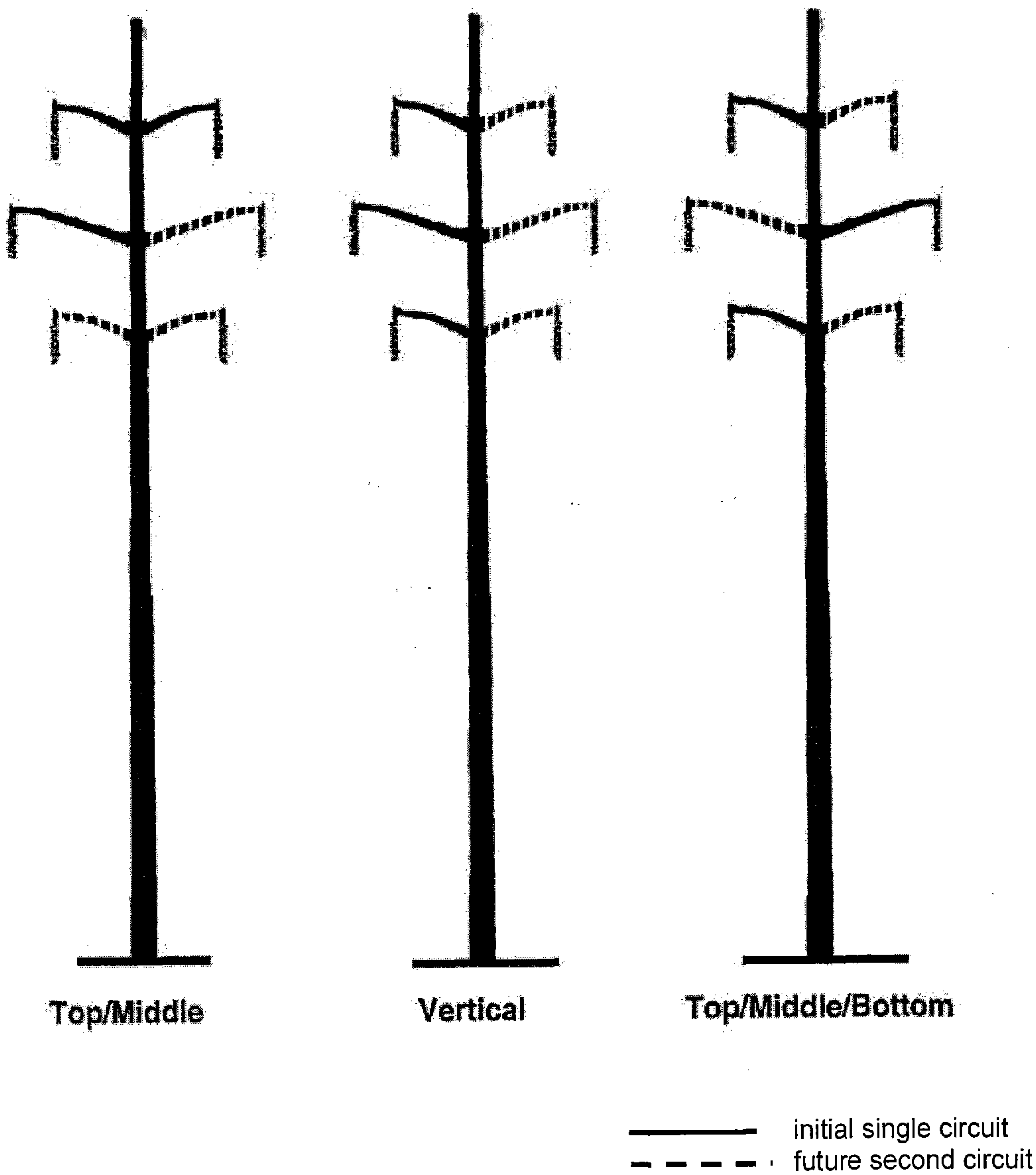
1 3/8" HS steel overhead ground wire -
17.3 feet sag
6-556.5 KCMIL 24/7 ACSR power
conductors - (PARAKEET) 23.0 feet sag
Average span - 600 feet

138/69 kV REVERSE-PHASE TRANSMISSION LINES CALCULATED MAGNETIC FIELDS AT 400 AMPERES

TYPE CONSTRUCTION	MAGNETIC FIELD IN MILLLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
SHORT SPAN (CHART I)	30
SHORT SPAN (REVERSE PHASE)	8
LONG SPAN (CHART II)	29
LONG SPAN (REVERSE PHASE)	9
COMPACT (CHART VI)	14
COMPACT (REVERSE PHASE)	3

The edge of right of way is 50 feet from the line centerline.
The 400 ampere phase current is balanced between phases.
Calculations are based on a minimum ground clearance of 25 feet.
LONG SPAN, SHORT SPAN and COMPACT are double-circuit lines.

Typical Single-Circuit Structure Designs

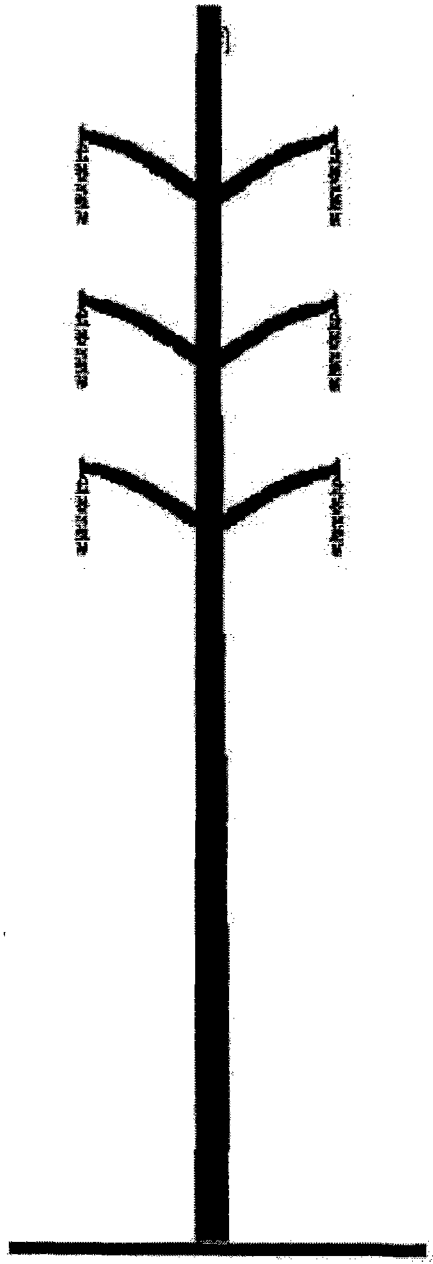


138/69 kV SINGLE CIRCUIT TRANSMISSION LINES CALCULATED MAGNETIC FIELDS AT 400 AMPERES

TYPE CONSTRUCTION	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
TOP/MIDDLE/BOTTOM	20
VERTICAL	17
TOP/MIDDLE	12

The edge of right of way is 50 feet from the line centerline.
The 400 ampere phase current is balanced between phases.
Calculations are based on a minimum ground clearance of 25 feet.

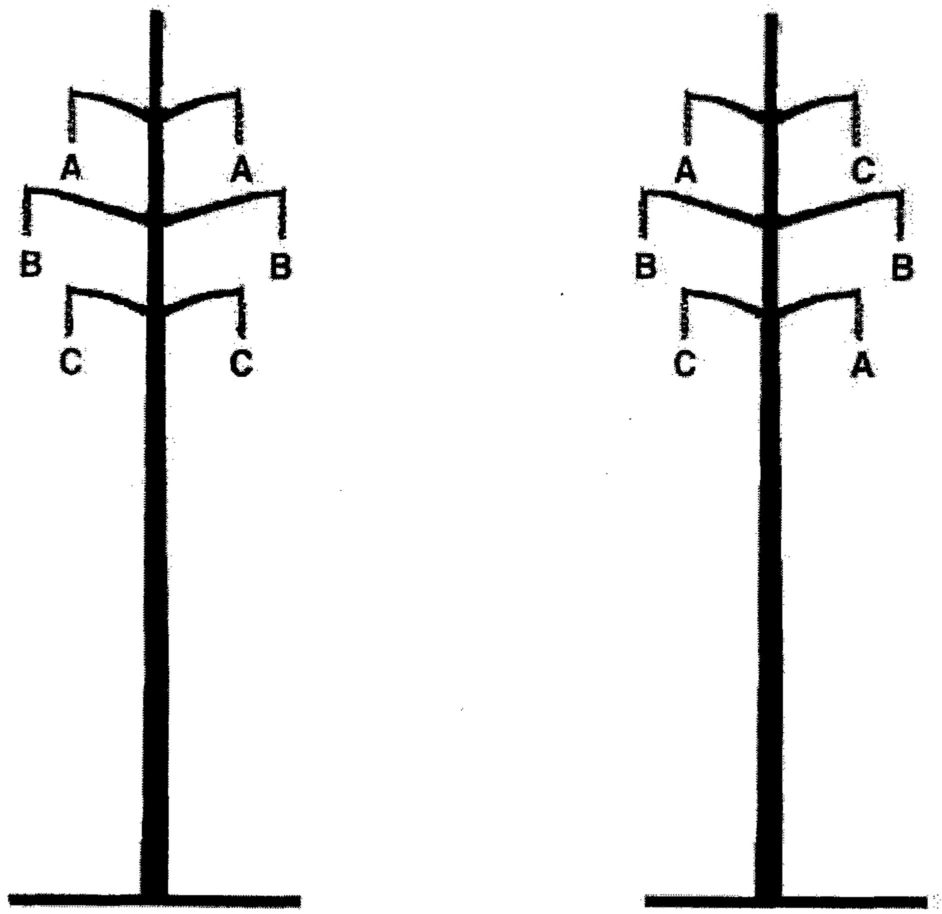
Compact Design Structure



- **Minimize magnetic fields due to compact design**
- **Not a low-cost alternative**
- **Typical conductor data:**

1 3/8" HS steel overhead ground wire - 9.0 feet sag
6-556.5 KCMIL 24/7 ACSR power conductors - (PARAKEET) 9.0 feet sag
Average span - 300 feet

Reverse Phasing of Double-Circuit Transmission Lines



From: ⟶ ⟶ ⟶ ⟶ To:

Reverse phasing also can be one of the following phase arrangements:

A	B		B	A		B	C		C	A		C	B
C	C	or	C	C	or	A	A	or	B	B	or	A	A
B	A		A	B		C	B		A	C		B	C

CHART VIII

230 kV REVERSE-PHASE TRANSMISSION LINES
CALCULATED MAGNETIC FIELDS AT 800 AMPERES

TYPE CONSTRUCTION	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
DOUBLE CIRCUIT POLE	49
DOUBLE CIRCUIT POLE (REVERSE-PHASE)	16

The edge of right of way is 75 feet from the line centerline.
The 800 ampere phase current is balanced between phases.
Calculations are based on a minimum ground clearance of 27 feet.

CHART IX

500 kV REVERSE-PHASE TRANSMISSION LINES
CALCULATED MAGNETIC FIELDS AT 1100 AMPERES

TYPE CONSTRUCTION	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
DOUBLE CIRCUIT POLE	37
DOUBLE CIRCUIT POLE (REVERSE PHASE)	21

The edge of right of way is 100 feet from the line centerline.
The 1,100 ampere phase current is balanced between phases.
Calculations are based on a minimum ground clearance of 33 feet.

INCREASED 138/69 kV MINIMUM GROUND CLEARANCE CALCULATED MAGNETIC FIELDS AT 400 AMPERES

TYPE CONSTRUCTION	MINIMUM GROUND CLEARANCE FEET	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
SINGLE CIRCUIT TOP/MIDDLE	25	12
SINGLE CIRCUIT TOP/MIDDLE	30	10
LONG SPAN	25	29
LONG SPAN	30	26
LONG SPAN (REVERSE PHASE)	25	9
LONG SPAN (REVERSE PHASE)	30	7

The edge of right of way is 50 feet from the line centerline.
The 400 ampere phase current is balanced between phases.

INCREASED 230 kV MINIMUM GROUND CLEARANCE
CALCULATED MAGNETIC FIELDS AT 800 AMPERES

TYPE CONSTRUCTION	MINIMUM GROUND CLEARANCE FEET	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
SINGLE CIRCUIT TOP/MIDDLE	27	30
SINGLE CIRCUIT TOP/MIDDLE	32	28
DOUBLE CIRCUIT POLE	27	49
DOUBLE CIRCUIT POLE	32	46
DOUBLE CIRCUIT POLE (REVERSE PHASE)	27	16
DOUBLE CIRCUIT POLE (REVERSE PHASE)	32	15

The edge of right of way is 75 feet from the line centerline.
The 800 ampere phase current is balanced between phases.

INCREASED 500 kV MINIMUM GROUND CLEARANCE CALCULATED MAGNETIC FIELDS AT 1,100 AMPERES

TYPE CONSTRUCTION	MINIMUM GROUND CLEARANCE FEET	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
SINGLE CIRCUIT "H" STRUCTURE	33	42
SINGLE CIRCUIT "H" STRUCTURE	53	35
DOUBLE CIRCUIT POLE	33	37
DOUBLE CIRCUIT POLE	53	31
DOUBLE CIRCUIT POLE (REVERSE PHASE)	33	21
DOUBLE CIRCUIT POLE (REVERSE PHASE)	53	16

The edge of right of way is 100 feet from the line centerline.
The 1,100 ampere phase current is balanced between phases.

12 kV DISTRIBUTION LINES
CALCULATED MAGNETIC FIELDS AT 300 AMPERES

TYPE CONSTRUCTION	POLE HEIGHT FEET	MAGNETIC FIELD IN MILLIGAUSS*	
		AT CENTERLINE	AT 30 FEET FROM CENTERLINE
STANDARD CROSSARM	45	14	7
STANDARD CROSSARM	50	11	6

* Field level under the line at mid-span based on 300 amps, balanced loading, one meter above ground level.

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Attachment 6

ATTACHMENT 6
CLINTON - LYCOMING 138/69 kV LINE RE-TERMINATIONLIST OF
OWNERS OF PROPERTY WITHIN THE RIGHT-OF-WAY

Property Owner/Address	Parcel Number
PPL Electric Utilities Corp.	1 & 2

Attachment 7

ATTACHMENT 7
CLINTON - LYCOMING 138/69 kV LINE RE-TERMINATION
LIST OF INVOLVED GOVERNMENTAL AGENCIES, MUNICIPALITIES AND OTHER PUBLIC ENTITIES RECEIVING APPLICATIONS

1. Pennsylvania Historical and Museum Commission
   Bureau for Historic Preservation
   Commonwealth Keystone Building, Second Floor
   400 North Street
   Harrisburg, Pennsylvania 17120-0053
   Attn: Mr. Douglas C. McLearen, Chief

2. Pennsylvania Department of Transportation
   Honorable Barry Schoch, P.E., Secretary
   c/o Office of Chief Counsel
   Commonwealth Keystone Building
   400 North Street, 9th Floor
   Harrisburg, PA 17120
   Attn: William J. Cressler

3. Department of Environmental Protection
   P.O. Box 2063
   Market Street State Office Building
   Harrisburg, Pennsylvania 17105-2063
   Attn: Office of Field Operations

4. Lycoming County Commissioners
   48 West Third Street
   Williamsport, PA 17701
   Attn: Jeff C. Wheeland, Chairman

5. Lycoming County Planning Commission
   48 W. Third Street
   Williamsport, PA 17701
   Atn: George Logue, Jr., Chairman

6. Clinton Township Board of Supervisors
   2106 State Route 54
   Montgomery, PA 17752
   Attn: Ed Shrimp, Chairman

7. Clinton Township Planning Commission
   2106 State Route 54
   Montgomery, PA 17752
   Attn: Chris Miller, Chairman