SUMMARY OF ITEMS OF ENGINEERING INTEREST

JULY 1999

Viewing Instructions

There are both bookmarks and links imbedded in this file.

Browsing with bookmarks

Bookmarks mark parts of a document for quick access.

To jump to a topic by using its bookmark:

1. The bookmarks are shown on the left side of the screen. If a triangle appears to the left of the bookmark, click the triangle to show or hide subordinate bookmarks.

2. To go to the destination specified by a bookmark, click the bookmark text or double-click the page icon to the left of the bookmark name.

Following links

The various indices in this bulletin use links to allow the user to quickly go to the desired article.

To follow a link:

1. Move the pointer over a linked area. The pointer changes to a pointing finger when positioned over a link.

2. Click to follow the link.

General information:

You can use the buttons at the top of the screen for going from page to page. Also, by right-clicking your mouse, you will see a navigation box. For details, please see the Acrobat Reader help screens.

UNITED STATES

DEPARTMENT OF AGRICULTURE

RURAL UTILITIES

SERVICE

SUMMARY OF

ITEMS OF ENGINEERING INTEREST

JULY 1999

THIS PAGE IS INTENTIONALLY BLANK

TABLE OF CONTENTS

ITEM **PAGE**

ENGINEERING and DESIGN

MATERIAL and PROCUREMENT

OPERATIONS AND ENVIRONMENTAL

ADMINISTRATIVE and OTHER

ABBREVIATIONS

AMR	Automatic Meter Reading
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
BER	Borrower's Environmental Report
BIL	Basic Impulse Level
CEQ	Council on Environmental Quality
CFC	National Rural Utilities Cooperative Finance Corporation
CFR	Code of Federal Regulations
CWP	Construction Work Plan
EA	Environmental Analysis
EIS	Environmental Impact Statement
ER	Environmental Report
ESD	Electric Staff Division
EVAL	Applicant's Environmental Analysis
FONSI	Finding of No Significant Impact
GFR	RUS General Field Representative
HPS	High Pressure Sodium
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IOU	Investor Owned Utility
kV	Kilovolt
M&E	Mechanical and Electrical
MW	Megawatt
NEHRP	National Earthquake Hazard Reduction Program
NESC	National Electrical Safety Code
NRECA	National Rural Electric Cooperative Association
OLF	Overload Factor
PSD	Power Supply Division
REA	Rural Electrification Administration
RTB	Rural Telephone Bank
RUS	Rural Utilities Service
RUS List of Materials	RUS Informational Publication 202-1, "List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers"
T&D	Transmission & Distribution
UBC	Uniform Building Code
WWD	Water And Waste Disposal
Y2K	Year 2000

ENGINEERING and DESIGN

Revision of the 1997 National Electrical Safety Code

Work on the revision of the 1997 NESC National Electrical Safety Code (NESC) (to create the 2002 NESC) has been ongoing for the past year. The seven NESC subcommittees have completed their meetings and review of proposed changes. The preprint of the Code Revisions developed by the subcommittees will be published September 1, 1999, and will include a request for input from the public concerning the proposed changes. Of major concern to cooperatives and consultants are the changes being considered for Sections 25 and 26, Safety Rules for Overhead Lines - Loadings for Grades B and C and Strength Requirements, respectively.

Some of these proposed changes are summarized below:

1. In Rule 250C, the subcommittee may remove the 60-foot (18 m) height limit. The present code requires one to consider extreme winds for structures over 60 feet (18 m). NESC Subcommittee 5 is considering removal of this exclusion, thus requiring designers to consider extreme winds for all structures regardless of their height. If this proposal passes, distribution lines may have to be the same strength as transmission lines if extreme winds control the design.

2. A new combined ice and wind 50 year map may be included in section 25, Loadings for Grades B and C. The subcommittee is proposing to allow utilities to meet current requirements of Light, Medium, or Heavy Loading District loads or to meet the new combined ice and wind map.

3. The current 50-year extreme wind map will be replaced with the new ASCE 7, 50-year wind map based on a 3-second gust wind speed. Initially this may appear as a rather benign change. However, use of this wind information involves equations to calculate the wind pressure on an overhead line which are fairly cumbersome.

4. Fiber reinforced composite structures and crossarms are being added to the strengths and loading sections.

5. One proposal concerns the Grade C transverse overload factor on steel or prestressed concrete structures. The proposal is to change the overload factor from 2.2 to 1.75.

6. Subcommittee 5 is also considering a complete rewrite of sections 24, 25, and 26. This proposal eliminates light, medium, and heavy loading district loads and replaces these loads with construction, extreme wind, and extreme wind and ice loads.

This summary is not an attempt to detail all proposed changes as there are many others being proposed. Individuals involved in the design of transmission and distribution lines should closely review the preprint when it is issued on September 1, 1999, and make their opinions known by submitting comments by May 1, 2000, to:

Secretary
National Electrical Safety Code
IEEE Standards Department
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331

NESC Subcommittee 5 will also be holding a session to briefly explain proposed changes and to entertain questions at the winter meeting of the Tower, Poles, and Conductor subcommittee of the IEEE Transmission and Distribution Committee at Las Vegas (early February, 2000), and perhaps at other events as well.

If you would like more information or have any questions, please call Don Heald, Structural Engineer, Transmission Branch, at (202) 720-9102.

Bulletin 1728F-803 Implementation

Questions and concerns from some Rural Utilities Service (RUS) borrowers prompted us to investigate the unusual problems that are being encountered in implementing new Bulletin 1728F-803, "Specifications and Drawings for 24.9/14.4 kV Line Construction." We contacted some borrowers in person and others by telephone who told us about the disturbing impact the new assembly numbers were causing for their staffs and their computer programs.

We have learned that a number of borrowers utilize some very sophisticated and extensive computer software to aid them in their line staking. Additionally, these computer programs are closely linked together in a system that calculates, and sometimes controls, materials, inventory, cost estimating, retirement, and various other accounting functions. Some of these computer systems were developed in-house and some were purchased from specialized software vendors. Quite frankly, until our recent investigation, we were not aware that these software systems were so extensive, so closely linked together, and so difficult to make changes and additions. Also, when we delayed the effective date of the new bulletin, it did not occur to us that the date we picked, December 31, 1999, was the day before "Y2K"! We were advised that our timing on this bulletin could not have been worse because many borrowers are changing their entire data processing systems in an effort to be Y2K compatible. Dealing with entirely new processing systems while also having to deal with drawing number changes was more than anyone needed.

We were aware that line workers and engineers would need to become accustomed to a new set of assembly unit numbers and new drawings. We also anticipated that this would not be a popular change. The change in the construction assemblies themselves and their associated material is

actually very minor as discussed below. Some of the borrowers we talked with told us that the change in the numbers and drawings would not be so difficult if they had more transition time to familiarize themselves with the numbers and drawings before they would actually be used.

Based on what we have learned, we are planning to delay the effective date of new Bulletin 1728F-803 such that borrowers may continue to use old Bulletin 50-5 (D-803), "Specifications and Drawings for 24.9/14.4 kV Line Construction," until July 1, 2001, or may use new Bulletin 1728F-803 immediately. When approved, this postponement will:

- Allow borrowers to delay transition work until after the "Y2K" event;
- Allow sufficient time to make orderly and required changes in their computer systems;
- Allow users of the new bulletin adequate time to get use to the new numbers and drawings before they are to be used; and,
- Allow RUS time to provide borrowers with conversion tables (*i.e.*, the new number of the old assembly) and other data and information borrowers might find useful.

We have developed a table converting RUS Bulletin 1728F-803 construction units to retirement units. This conversion table is similar to the existing tables in the appendices of Bulletin 1767B-2, "Work Order Procedure (Electric)." This information should be available to borrowers shortly.

We have also compiled a conversion table that compares the new assembly numbers with the old numbers with annotated comments on what changes are involved. This table is attached as Exhibit 1. After reviewing this table one will see that the new numbering system is more orderly, and more importantly, one will see that the actual construction assembly units have not changed drastically.

Changes needed to be made to computer systems (because of RUS Bulletin 1728F-803 drawings) are not as drastic as they might first seem if the following is considered:

Several assemblies were deleted because they are no longer used or useful to borrowers. Many of these deleted units were "guide drawings." Unlike construction assembly units, "guide drawings" do not have any material associated with them. The new bulletin has several new guide drawings (with no material) that need not be entered in computer programs.

There are many new drawings depicting optional use of post type insulators. These types of drawings were not in the old bulletin. If a borrower does not use or plan to use post type insulators, then there is no need to enter them in the computer. On the other hand, if post type insulators are used, then the new drawings should be very helpful to engineers and line workers.

Many of the new deadend type drawings now show the optional use of three, 4 ¼ inch (10.8 cm) suspension insulators instead of two 6 inch (15.2 cm) suspension insulators. Some borrowers prefer to use a single polymer deadend insulator. Borrowers may continue to use the same deadend insulators that they have in the past. The 4 ¼ inch (10.8 cm) suspension insulator drawings involve drawing changes only and do not require a change in computer programs. This

option is explained in detail in the "General Construction Specifications" section of the new bulletin.

Considering all of the above, the vast majority of the required changes only require the addition or changing of washers! A lot of borrowers consider washers to be truck stock and don't even list them on their material sheets. However, we do realize that with each unit some borrowers probably include more material, such as armor rods, ties, and bolt lengths that are not shown on the RUS drawings. An assembly number conversion table should allow borrowers, in many cases, simply to replace the old number with a new number for identical or similar construction assemblies.

The following are a few "tricks" that borrowers could employ:

- Distribute some copies of the new bulletin in the engineering office and line shop several weeks before training and implementation to peak interest and help acclimatize key personnel.

- When and where possible, insert a new column in computerized forms with the new assembly numbers next to the old ones. Retain both columns before a conversion is made and as long afterward as may be useful.

- On staking sheet drawings (and staking sheets when feasible), put the new assembly number in parenthesis next to the old one for several weeks before the conversion. For some period after the conversion, reverse the process. (This is the process that has been used by the NESC to convert from English to metric units.)

For more information on the changes in Bulletin 1728F-803, see Bulletin 1728F-800, "Assembly Unit Numbers and Standard Format." This bulletin explains the new numbering format and the reasons why we made the changes.

If you have any information or questions, please call Jim Bohlk, Electrical Engineer, Distribution Branch, at (202) 720-1967.

Errata and Comments to Bulletin 1728F-803

Recently, RUS published Bulletin 1728F-803, Specifications and Drawings for 24.9/14.4 kV Line Construction. We have identified several errors in the first printing of 1728F-803, and we have received some comments that are addressed below.

<u>Errata to Bulletin 1728F-803</u>

TABLE VII, Maximum Line Angles on Spool Insulator Assemblies, at the beginning of Section "N", has the wrong value (*1,500 lbs./conductor*) entered for the designated maximum transverse load for ANSI Class 53-4 spool insulators. The correct value is 2,250 lbs./conductor, which is fifty percent of the mechanical and electrical (M&E) strength for this class of insulators.

Thus, all of the line angles are incorrect; they are smaller than they need to be. The attached table (Exhibit 2) has the correct designated maximum transverse load value entered and the resulting calculated line angles (which are greater), and are now correct. Please make copies of the attached table and replace TABLE VII in each copy of Bulletin 1728F-803.

Assembly "VC2.51" should have 2 (two) pin type, 15 kV white insulators (item "a") listed in the QTY (quantity) column instead of 1 (one) as shown.

The drawings of Assembly "VD1.81L" should show the outside clamp type crossarm pins (item "f") 8 inches (20 cm) from the end of the arm. On Assembly "VD1.83L," the clamp type crossarm pins should be arranged the same as shown on the "VD2.91L" assembly drawing.

There may be other errors in the first printing of this bulletin. Please contact us if you find errors or have questions or comments. RUS plans to publish an errata sheet to this bulletin later this year.

Comments on Bulletin 1728F-803

The drawings for the transformer banks "VG2.1," "VG3.1," etc., show cutouts (item "af") and arresters (item "ae") mounted next to each other on a crossarm. The drawings in old Bulletin 50-5 show the use of a combination cutout/arrester (item "ax"). Either method may be used. Also, either method may be used for single-phase, conventional pole type transformers. However, RUS strongly recommends that surge arresters be mounted directly on the transformer, thus shortening the arrester lead length and providing maximum protection to the transformer.

Table 232-2 in the 1997 edition of the NESC requires 13.0 feet (3.96 m) minimum ground clearance to platforms and equipment cases. This dimension is shown for the platform mounted voltage regulators of assembly "VY1.3" in new Bulletin 1728F-803. However, a 10.0 foot minimum (3.05 m) ground clearance is shown for similar assemblies "VM7-1" and "VM7-3" in old Bulletin 50-5 and "M7-11" in Bulletin 50-3, "Specifications and Drawings for 12.5/7.2 kV line Construction." RUS requires that all new construction comply with the most restrictive provisions of the most recent edition of the NESC, RUS specifications, or other local regulating governmental authorities. Thus, for these assemblies, the NESC clearance of 13.0 feet (3.96 m) minimum must be used because it is more restrictive than the clearance shown in Bulletins 50–5 and 50-3. Please note, however, that the requirements of the NESC are not retroactive and only apply to new construction.

If you have any information or questions, please call Jim Bohlk, Electrical Engineer, Distribution Branch, at (202) 720-1967.

Guidelines for RUS Approval to Use Steel Distribution Poles

In the August 1997 issue of the Items of Engineering Interest, RUS summarized information that borrowers need to include with their requests for RUS approval to use steel distribution poles. These guidelines have been slightly revised and are provided below.

In order to assist the RUS staff in considering requests to use steel distribution poles, borrowers should adequately address in writing items 1 through 8 below. Currently, approval to use steel distribution poles is only being granted on a case-by-case trial basis to gain experience.

Information to include in requests to use steel distribution poles:

1. Because approval is only being considered for site specific projects, define the project and where the steel poles will be installed.

2. State the maximum number of steel poles to be used.

3. Furnish reasons for using steel poles. If favorable cost is the main reason, then include an engineering economic analysis of the cost of using steel poles compared with standard RUS construction with wood poles. This analysis should include the additional cost (if any) for equipment and material needed to compare both structure types as equivalent in mechanical strength, raptor protection, and quality of service such as blinking lights due to lightning flashovers.

4. Provide a description of the proposed steel poles and the method(s) of corrosion protection to be utilized when manufactured, when placed in service and for future maintenance.

5. RUS regulations require that all assembly units must be built according to RUS construction standards. If nonstandard assembly top construction is being proposed, then furnish sufficient dimensioned drawings and other technical information for RUS' evaluation of the design.

6. Except for various miscellaneous material items, RUS regulations require that borrowers use materials that RUS has accepted or technically accepted. A compilation of accepted materials may be found in Informational Publication 202-1, "List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers." Contact the Chair, Technical Standards Committee "A" (Electric) for information on technically accepted items. If the proposed design uses materials that do not fall into the any of the acceptance categories above, then furnish RUS sufficient information, data and test results of all such materials for evaluation and approval determinations.

7. Indicate that the steel poles to be used have been selected based on engineering calculations considering the expected duty and conditions to which they will be exposed. (See also "Wood Equivalent Steel and Concrete Poles" in this issue.)

8. Provide a statement regarding the anticipated impact that the pole-top assembly design of the steel pole may have on the possible electrocution of raptors. Also state the mitigation measures that will be incorporated in the design to minimize such possibilities.

The following design information should also be considered but does not have to be submitted to RUS:

RUS strongly advocates a minimum lightning impulse withstand strength (often incorrectly and simply referred to as a BIL level) of 300 kV for distribution pole top assemblies. A minimum of 300 kV withstand needs to be maintained at dead-end assemblies. Withstand strengths of less than 300 kV will usually facilitate flashovers of lightning strikes to or proximate to distribution lines. A recloser operation, which will cause lights to flicker, is usually required to clear the resulting arc. Thus, a minimum of 300 kV withstand is required to maintain a reasonable quality of service. Standard RUS pole type assemblies, with wood poles, have a minimum withstand strength of 350 to 400 kV. If the steel pole design has a withstand strength of less than 300 kV, borrowers should consider what additional measures, such as the installation of surge arresters, might be used to minimize flashovers, or, what impact a design with a withstand strength of less than 300 kV might have on the quality of service.

A steel pole may be used as a grounding conductor if the pole meets the sufficient conductivity and low impedance requirements of the NESC and RUS specifications. However, a directly embedded steel pole is not recognized in the NESC as a grounding electrode. Thus, the NESC and RUS requires that separate driven ground rods or grounding electrodes be used for all equipment, surge arresters and other required system grounds, including grounding the poles themselves, if needed to provide adequate grounding. (See NESC Rule 215.C.1.)

Borrowers should use stainless steel or galvanized steel ground rods and non-copper ground wire in the soil on steel pole lines to mitigate the corrosive effects of buried dissimilar metals in close proximity.

The design of unguyed angle and dead-end steel pole structures should consider pole deflection and the possible need for greater embedment depths.

For NESC Grade C construction, there should not be a direct substitution of wood poles with steel poles of the same designation. Engineers should calculate the design load and select the standard class steel pole based on these calculations. Extreme ice conditions and appropriate high winds should be considered in the design loads. (See also “Wood Equivalent Steel and Concrete Poles” in this issue.) For steel poles on distribution lines, RUS advocates the use of NESC Grade B overload factors for angle and deadend (guyed or unguyed) structures.

The information requested above is needed to insure a safe, reliable, and economical distribution line when using steel poles. Considerations such as these plus many other design considerations are incorporated into all RUS standard designs for overhead distribution lines. RUS is developing a guide specification for steel distribution poles which, when finalized, borrowers could use to purchase and use steel distribution poles without further RUS approval.

If you would like further information or have any questions, please call Harvey Bowles, Chief, Distribution Branch, at (202) 720-5082, or Bob Lash, Chief, Transmission, at (202) 720-0486.

Wood Equivalent Steel and Concrete Poles

Borrowers are cautioned that there should not be a direct substitution of wood poles with steel poles or concrete poles if the original line design was based on Grade C construction. Most manufacturers standardize on steel or concrete poles such that the poles have a wood pole equivalency based on Grade B requirements in the NESC. Table 1 below summarizes the loads used to design poles:

Table 1

Pole Class	Wood Pole Tip Loads (lbs.)	Steel or Concrete Pole 'Equivalent' Load (lbs.)
1	4500	2800[1]
2	3700	2300
3	3000	1900
4	2400	1500
5	1900	1200
6	1500	950

An example will be used to demonstrate the confusion when using standard class steel or concrete poles in distribution lines.

Example:

A cooperative wishes to build a distribution line meeting Grade C construction. The design calls for 40-4 wood poles but decides in one section to use steel distribution poles. The transverse working load (load without overload factors, [OLF]) is 1200 lbs. two feet (.6 m) from the top of the wood pole.[2] The common practice is to substitute a standard class steel pole, designated as a 40-4, for the wood pole. From Table 1, the ultimate load for the equivalent steel pole would be 1500 lbs.

But, this is where the problem occurs. The 'ultimate' load, to which the steel pole needs to be designed, should be: 1200 lbs. (working load) x 2.2 (OLF[3]) = 2640 lbs.

In the table above, the 2640 lbs. 'ultimate' load corresponds to a 'class 1' steel pole.

If a 40-4 steel pole with a tip load of 1500 lbs. were selected, it would be under the required NESC strength by approximately 75 percent. This is where the potential confusion comes into play.

If you would like more information or have any questions, please call H. Robert Lash, Chief, Transmission Branch, at (202) 720-0486 or Harvey Bowles, Chief, Distribution Branch, at

[1] Ratio of Grade B steel OLF 2.5 to wood OLF 4.
[2] Class 4 tip load of 2400 lbs. divided by Grade C wood OLF 2.0.
[3] Overload factor for steel poles not at a crossing, Grade C construction.

(202) 720-1979.

Engineer's Checklist for the Design of Substations

Increased electrical demand in areas served by RUS borrowers indicates more need for the construction of substation facilities now and in the future. Therefore, it's important that the engineer take a closer look at the construction techniques available in RUS publications and other resources to utilize in the construction of substation facilities. We recommend that engineers use the following construction drawings list and the checklists as a quick aid in helping in the substation design process.

Drawings to be submitted by the engineer for RUS review:

- One line diagram (relaying systems; ratings for breakers, transformers, switches, etc.)
- Three line diagram (PT's, CT's, phasing, etc.)
- Plot plan (Plan View)
- Grading plan (Site Plan, fence layout and details)
- Foundation plan and details
- Elevation plan and details
- Grounding plan and details
- Control house plan, elevations and details
- Material lists

One & Three Line Diagrams Checklist:

- ❑ All spare CT's are shorted and properly grounded at the cabinets
- ❑ Station service transformers are internally or externally fused
- ❑ Surge arresters are used on all high and low sides
- ❑ Voltage and current ratings included for all equipment
- ❑ All existing and future equipment properly identified
- ❑ Underground cables are clearly identified at the termination points
- ❑ Reflects plan view of equipment arrangement
- ❑ All conductors are identified as to size, material and number per phase
- ❑ Legend, revision notes with date, and reference drawings and equipment notes are added

Plan View - Drawing Checklist:

- ❑ Access roads, culverts and other drainage surfacing provided
- ❑ Fence and gate locations selected properly and shown on scale
- ❑ Allowance for maintenance crew accesses for removal and installation of equipment
- ❑ Allowance for future expansion and mobile substation connections
- ❑ Electrical clearances (phase to phase and phase to ground) are clearly shown
- ❑ North arrow properly positioned
- ❑ Landscaping is architect to meet local requirements

Grading - Drawings Checklist:

- ❑ Elevation of the finished subgrade and existing contours
- ❑ Cross-sectional views indicating slopes for cut and fill areas

Foundations - Drawings Checklist:

- ❑ Steel reinforcement bar size, spacing, and location
- ❑ Thickness of concrete pads between 8” (20 cm) and 24” (61 cm)
- ❑ Top of concrete elevations
- ❑ Construction notes including reinforcing bar chart, footings, anchor bolts with tolerance tables, and all foundation details

Grounding Plan and Details Checklist:

- ❑ Ground grid buried a minimum of 1 foot 6 inches (0.5 m) below grade
- ❑ Adequate grounding conductor buried to allow for expansion due to temperature changes and future construction additions
- ❑ Below ground connections by exothermic weld process
- ❑ Ground grid extended minimum of 2 feet (0.6 m) (3 feet [.9 m] is recommended) outside of the fence and gate bypass extending a minimum of 1 foot 6 inches (0.5 m) beyond open gates
- ❑ Above ground connections by compression or bolted
- ❑ All structures connected to ground grid
- ❑ Two or more ground paths for surge arresters, transformers and all other electrical equipment
- ❑ Disconnect switch handles grounded adequately to the ground grid and to the grounding mats according to the grounding detail drawings
- ❑ Chain link fence and gate grounded
- ❑ Reinforcing bars not used for grounding electrodes
- ❑ Adjoining metal fence (farm fence, etc.) not connected directly to substation fence
- ❑ Grounding conductors including grounding rods
- ❑ Shall meet the applicable standards and RUS acceptable materials
- ❑ The entire area inside the fence and including a minimum of 3.3 feet (1 m) (4.9 feet [1.5 m] recommended) outside the fence shall be covered with minimum of 4 inches (10 cm) of crushed rock possessing a minimum resistivity of 3,000 ohm-meters wet or dry

Elevation Plan and Details Checklist:

- ❑ Material Size and Shape
- ❑ Expansion Provisions
- ❑ Weep Holes
- ❑ Precautions for aluminum-to-copper connections
- ❑ Welding procedures notes (inert gas shielding for aluminum bus)
- ❑ Corona Bells (above 161 kV)
- ❑ Bus adequately supported, with provisions for mounting surge arresters

- Use of damping cable to minimize vibration
- Lightning protection shield angle less than 45 degrees, or use of "Rolling Sphere Methods" (refer to the "Lightning Protection for Substations" article in the 1998 Items of Engineering Interest)
- Surge arresters lead length short as possible, surge arresters not used as bus supports
- Proper length and BIL of suspension and post insulators
- Adequate construction details to construct
- Provisions for construction notes, legend, future expansion, and mobile substation connection

If you would like more information or have any questions, please call Ted V. Pejman, Electrical Engineer, Transmission Branch, at (202) 720-0999.

MATERIAL and PROCUREMENT

RUS Plans for Improving the List of Materials

For many years, RUS has published Informational Publication 202-1, "List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers" (List of Materials). We are constantly trying to improve this publication. The following is a summary of the initiatives RUS has started recently and initiatives we plan to undertake to improve the List of Materials.

Already Initiated

1. T&D Materials Subcommittee. NRECA's Transmission and Distribution (T&D) Committee has established a new Materials Subcommittee to identify needed improvements in the RUS List of Materials. The Materials Subcommittee has met some three times since formation and has completed a thorough review of the RUS List of Materials and has already provided RUS with valuable feedback.

   The subcommittee has identified a number of product categories included in the List of Materials that are outdated and no longer needed RUS is currently considering removal of the items identified as outdated. The subcommittee has also identified a number of new item categories that should be added.

   Some of the new items identified by the subcommittee include such materials as fiberglass crossarms, motor-operated switches, more types of anchors, and Automatic Meter Reading (AMR) equipment. The RUS staff is currently evaluating some of these items for possible listing. This evaluation involves developing requirements under which Technical Standards Committee "A" would consider prospective manufacturers' products. As soon as these requirements are developed and Technical Standards Committee "A" agrees, RUS staff will begin inviting manufacturers known to produce these products to submit applications for RUS acceptance consideration.

The Materials Subcommittee also advised that it was requesting that NRECA establish a WEB site repository whereby NRECA members could post requests for information about various products and, conversely, provide feedback on the performance of various products. This new tool would also allow the Materials Subcommittee and the other T&D Subcommittees to pass subcommittee minutes, action item notices, and enable them to function faster and more effectively. RUS believes that the WEB site will be invaluable in helping identify new categories of products of significant and growing interest to borrowers.

2. RUS WEB Listing. RUS has included the List of Materials on the RUS WEB site at:

http://www.usda.gov/rus/electric/listof.htm

Currently a borrower can connect to this site and download the entire list as an Adobe Acrobat "PDF" file. We are currently updating this listing on a biweekly basis after each meeting of Technical Standards Committee "A." This initiative offers borrowers the most up-to-date listing possible.

New Initiatives

In addition to responding to applicable recommendations from the Materials Subcommittee, RUS also plans to vigorously pursue the following actions to improve both the quality and usefulness of the List of Materials:

1. Consider More Choices in Specific Product Listings. Our current regulations in 7 CFR 1728 specifically limit acceptance of one product per manufacturer per product category in the List of Materials (dual listing prohibition). We know that some RUS borrowers would like to see more than one of a manufacturer's products in the same categories because, in some instances, the sole product accepted for the manufacturer does not satisfy the borrower's needs for a specific application. We believe that there may be a number of categories where a multiple listings of manufacturers' products are justified on the basis of functionality and there is no conflict with the dual listing prohibition. One example is in the “anchor” category. We believe that in addition to anchors already included, a more rugged anchor could also be listed and provide borrowers added utility for installing anchors in extremely hard soil.

   We plan to initiate a review of categories to see if there are product categories where we can offer more choices like the anchor listing example. After identifying such listing, we will then invite all the listed manufactures to submit applications to have appropriate products considered by Technical Standards Committee “A.”

2. Addition of New Product Categories. We are currently working or expect to begin work on establishment of the following new product categories:

   a. Meters with AMR Capabilities – We are currently investigating and preparing a requirements sheet for possible inclusion of a new category of watthour meters which

have AMR capabilities. When we complete this preliminary phase we plan to send letters to all known manufacturers of such products and invite them to submit applications for RUS acceptance consideration of their products.

b. Wood, Steel, and Concrete Poles - We are currently working with the NRECA Transmission Subcommittee to prepare guide specifications for steel and concrete poles. When this task is completed, we will consider using the documents produced, along with RUS' Wood pole specifications, as a possible basis for listing and acceptance of all three pole types; and

c. Wood and Fiberglass Crossarms - We hope to initiate the same actions as cited in item "a" above in the near future.

3. Data Base List. We are planning to move the List of Materials from its present word processing format into a data base format. We believe that in data base format borrowers will be able to better utilize the listings and run queries and compare products with greater ease. This project will be a high priority of the new Chair of Technical Standards Committee "A."

4. Revision of 7 CFR 1728. We are currently evaluating the regulation which controls the RUS listing and acceptance process. We are hoping to introduce new provisions which will allow us to maintain the list more effectively. As an example, we hope to make obsolete listing a thing of the past through periodic relisting of accepted products.

We are very excited about these initiatives and the improved impact they are expected to have on the List of Materials. However, these initiatives will involve significant resources to accomplish and therefore will take some time to complete.

If you would like more information or have any questions, please call Don Heald, Acting Chair, Technical Standards Committee "A" (Electric), at (202) 720-0980.

Distribution Line Anchor Coatings and Galvanizing

RUS has received some requests from manufacturers of anchors to consider allowing RUS borrowers to use bare steel (ungalvanized or uncoated) anchors in distribution line construction. Manufacturers advised that use of bare steel anchors would allow them to achieve production economies that could be passed on to borrowers. These requests prompted RUS to review anchors and RUS' requirements related to coatings.

At the present time, RUS requires non-power-installed anchors to be:

1. Galvanized in accordance with American Society for Testing and Materials (ASTM) Standard A153, "Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware", or

2. Coated with a coal tar asphalt.

There are a number of reasons for galvanized or asphalt coated anchors. These manufacturing processes help to preserve the anchors and prevent users from having to deal with messy, rusting, stain-producing pieces of steel in warehouses, storage yards, and the back of line-crew trucks. However, the more important reason for the RUS requirement is to help minimize corrosion of the anchor rods to which the anchors are attached while in service. Corrosion of anchor rods can cause the anchor rods to fail and can result in possible catastrophic structure failure of the power line in the anchor's vicinity. Such failures cannot be tolerated, especially in today's utility market when customers are expecting and demanding highly reliable electric service.

Galvanizing, which is essentially the application of zinc on the surface of steel, is a form of cathodic corrosion protection. When placed in an electrolyte such as soil and interconnected with steel, zinc forms a galvanic corrosion cell. Electrochemically, zinc is more reactive than steel and, thus, the zinc becomes the anode of the cell and corrodes. Steel, being less reactive electrochemically, becomes the cathode of the cell and is protected from corrosion. If there is much less zinc exposed to the electrolyte than steel, the zinc will be completely consumed and the steel would no longer receive protection and eventually becomes susceptible to corrosion. (Galvanic corrosion cells will form between various locations on the steel and the anodic locations will corrode, eating away the metal.) If there is much more zinc exposed in the electrolyte than steel, zinc corrodes rapidly at first but the two metals gradually polarize and the galvanic corrosion cell process slows down providing long term corrosion protection with minimal loss of zinc. Hot dip galvanizing of steel anchors and anchor rods completely encases the two steel products and provides a high zinc-to-steel ratio exposure resulting in efficient corrosion protection for the anchor and anchor rod.

Asphalt coatings provide corrosion protection in a different manner. Coatings act as a barrier between a steel anchor and the soil, preventing the steel from coming in contact with soil. Connected to a galvanized steel anchor rod, an asphalt coated steel anchor causes less galvanic stress to the anchor rod than would be the case if the anchor was bare steel. In the latter case, a bare steel anchor would create a very reactive galvanic cell with a galvanized steel anchor rod. The anchor rod would soon loose all its zinc coating and expose the steel under it to eventual corrosion and possible loss of the rod's holding power. With a good asphalt covering on an anchor there would be much less galvanic stress on a connected anchor rod and the anchor rod would be protected from corrosion.

A perfect coating would not let any anchor steel contact soil and there would be no corrosion cell created between the anchor material and the anchor rod. Unfortunately, no coating is perfect as there are always voids or small holes in the coating which expose very small amounts of steel to the soil. During installation of an anchor there is always some degradation of the anchor's coating as well. However, the overall coverage of a properly coating anchor is still effective in providing adequate corrosion protection to the anchor rod and the anchor.

Anchor coatings need to be of the highest quality to provide the most reliable service possible. Coatings should have a high permeability to effectively insolate the anchor steel from contacting the soil. Coatings should also be relatively inert with respect to the soil to ensure they do not

deteriorate and otherwise will provide long service life. As can be imagined, coatings must also have good impact resistance to minimize damage during shipping, handling, and installation. A coating must also have excellent adherence characteristics so that it makes and maintains an effective bond to the anchor's steel. A coating should also have low water absorption properties to help keep moisture from coming into contact with the steel surface of the anchor.

RUS also requires that coatings be electrically conductive to minimize radio and television interference problems. The normal electrical field stresses existing near the high voltage phase conductors electrostatically couple to the anchor guy and anchor rod seeking a pathway to ground. With a galvanized anchor or an anchor with a conductive coating, these stresses are easily grounded and alleviate the stresses. The grounded anchor assembly also is much safer for line crews and the public. If an anchor is coated with a material that is electrically insulating, the coating and steel under it acts like a capacitor. The phase conductors' electrical stresses still couple onto the anchor guy and flow down through the anchor rod and then flow to ground through the coating's "capacitor" causing a voltage drop to appear across the anchor-soil interface. The anchor assembly now acts like a small low-power radio station with a 30 to 45 foot (9 to 14 meter) antenna which can generate a broad spectrum of the powerline's harmonic frequencies which include commercial radio and television frequencies. Commercial radio and television signals are usually weaker in rural areas making reception troublesome anyway. A noisy anchor assembly near a consumer's residence can wreck havoc with reception and make listening or watching or both impossible.

RUS' review of anchor manufacturer's request to use paint instead of asphalt coatings involved Electric Staff Division (ESD) visits to several anchor manufacturers and RUS borrowers. During visits to borrowers we learned that borrowers are quite satisfied with asphalt coated anchors and that there was no aversion to handling and installing them. During visits to anchor manufacturing plants, ESD discovered that various coating application methods and differing coating thickness are resulting on finished anchors.

RUS is currently in the process of developing an anchor coating specification which will be used to evaluate anchors for RUS acceptance. Such a specification will help to ensure that anchor coatings are consistently satisfactory.

If you would like more information or have any questions, please call George Keel, Equipment Specialist, Distribution Branch at (202) 690-0551.

Security Lights – High Pressure Sodium or Mercury Vapor?

Security lights have increased in popularity as more and more people move into rural areas. Mercury vapor lights were the standard for many years and have proved durable and satisfactory. High Pressure Sodium (HPS) lights were promoted primarily because they use considerably less energy. However, the experience with HPS lights installed by some electric cooperatives has been disappointing and frustrating. The perception of some consumers is that HPS lights do not provide enough light. In contrast to mercury vapor lights, which start out bright and gradually get

dimmer over the years, HPS lights actually get brighter over the years. Common voltage fluctuations, such as from window air conditioners, can cause HPS lights to cycle off. Problems with both the HPS fixture and the lamp, combined with the brightness and cycling issues, have resulted in numerous customer complaints. The extra trips to replace fixtures and lamps have increased maintenance costs, and although data is difficult to verify, it is believed that the increased maintenance costs may offset the energy savings. Preliminary data also indicates that the life expectancy of HPS lamps may be considerably less than mercury vapor lamps. As a result, many utilities suspect they are losing money on HPS lights and need to increase rates to avoid subsidizing this product.

The initial problems with HPS lights involved both the fixture and the lamp. Better quality fixtures are now available, but problems with HPS lights still persist. These problems are believed to be the result of improper installation of the fixture, inconsistent lamp manufacturing quality, or rough handling of the lamp. A large IOU found that lamp failures were greatly reduced following training which stressed proper handling and installation, including installing the lamp as the last step in the process. To reduce customer complaints and problems some utilities have switched back to mercury vapor and others are offering customers a choice. A survey by one cooperative indicates that customers prefer mercury vapor over HPS by a 4 to 1 margin, mostly because they prefer the white color of mercury vapor compared to the yellow color of HPS.

The energy savings potential make HPS lights a highly desirable choice. However, based on the limited experience discussed here, there is a need for greater improvement in HPS installation standards and lamp quality. RUS borrowers with similar HPS experience should let manufacturers know their concern and insist on improvements.

If you would like more information or have any questions, please call Mike Norman, General Field Representative (Kentucky), at (606) 253-4653, E-mail: mnorman@rus.usda.gov.

RUS Acceptance of AMR Capable Meters and Financing AMR Systems

RUS has decided to include Automatic Meter Reading (AMR) Capable Meters in RUS Informational Publication 202-1, “List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers.” RUS is currently in the process of developing a set of requirements for AMR Capable Meters. When this list of requirements is finalized, RUS will invite all known manufacturers of AMR capable meters to submit applications for RUS acceptance of their products.

In addition to RUS accepting AMR Capable Meters, RUS will now finance the costs associated with the purchase and installation of AMR systems. In developing a request for financing, either as part of a loan application or for the use of general funds subject to future reimbursement with RUS financing, borrowers should work with their RUS General Field Representative (GFR) in providing the following support documentation:

1. Cost/benefit analysis reflecting savings to be realized as a result of the installation of the AMR system. Intangible benefits should be identified, and will be considered, even though a dollar value may not be assigned.

2. Technical information on the proposed scope of the project and AMR system. This should include information on the type of system and communications medium proposed, and type of meters to be used.

3. A breakdown of estimated costs in four distinct categories: (1) master station, (2) injection/substation equipment, (2) any retrofit or additional meter costs to accept AMR devices and (4) all other costs associated with purchasing, installing and operating the specific AMR device.

RUS staff is currently developing specific procurement and cost accounting procedures and will make those available to borrowers as soon as they are completed.

If you would like more information or have any questions regarding AMR capable meters, please call Stephen Jones, Electrical Engineer, Distribution Branch, at (202) 720-1792. If you have any questions regarding the financing of AMR systems, please contact your GFR or Regional Office.

Cable Insulation Failures from Abnormal Soil Conditions

Recently, a cooperative from the Midwest experienced numerous outages on its underground circuits due to cable failures. The affected circuits are approximately 14 and 16 miles (23 and 26 km) long, and were installed around 1986. The cables are unjacketed, with 4/0 aluminum conductors, extruded semiconducting screens, 175 mil wall insulation, with bare copper concentric neutral wires. The initial major fault occurred in 1995. The next three faults were within an area of 40 square yards (33 square meters) and during summer seasons. Subsequent faults spread throughout these circuits.

The cooperative dug up affected cable sections and sent cable samples to the manufacturer and to independent labs for testing. One of the reports suggested the problem is associated with metal corrosion that may be caused by the presence of sulfate reducing bacteria. The most common physically visible problem identified in all of the test reports seems to be the presence of “spots” on insulation surfaces. None of the reports stated how these spots developed but several possible mechanisms of development were suggested. One such suggested mechanism was that moisture containing dissolved calcium carbonate is migrating into the cable. When the moisture attempts to migrate back out (driven by temperature gradients or capillary action), the calcium carbonate precipitates in localized regions under the insulation shield. This buildup of precipitate could cause the insulation shield to lose contact with the insulation in these regions, leading to partial discharge and eventual failure.

The soil environment in all effected areas has a higher concentration of calcium carbonate than a "normal" environment. In one area, the soil is 12-1/2 times more conductive than seawater. Of the five failures evaluated to date, four were located in a site some 3-1/2 feet (1.1 m) lower in elevation than the surrounding terrain while the fifth was near a small lake. It is probable that these locations are water drainage sites for the respective areas. The manufacturer believes that agriculture chemicals may be concentrating in these failure locations, and these chemicals, in turn, are being absorbed into this unjacketed cable, causing the observed "spots" in the insulation/screen interface and seriously affecting the integrity of the cable dielectric.

The manufacturer also theorizes that the failure could be from the limestone deposits that leached into the cable from the surrounding soil. The company further speculates that something happened to the cables after installation resulting in the loose insulation/insulation screen adhesion area.

Electrical and physical examinations to date show evidence of impulse damage to the cables and chemical attack from something in the service environment. Cable with thicker insulation and a jacket has been proposed as a solution to this highly localized electrical phenomenon. Chemical infusion and biological attack should be minimized by using a jacketed cable.

If you would like more information or have any questions, please call Trung Hiu, Electrical Engineer, Distribution Branch, at (202) 720-1877.

Keep Testing Your Underground Power Cable

In previous Items of Engineering Interest, we have discussed testing of new underground cable. The Underground Subcommittee of the NRECA's T&D Engineering Committee highly recommends that electric utility operators test underground cable they purchase. The Subcommittee recommends that the following tests be conducted at a minimum.

1. Dimensional analysis of all cable components;
2. Microscopic examination for voids, contaminants and protrusions; and
3. Insulation shield stripping test.

The Subcommittee also recommends that optional testing of Tree-Retardant Cross-Linked Polyethylene and Cross-Linked Polyethylene insulated cables include a Hot Oil Test. The Subcommittee does <u>not</u> recommend conductor shield and insulation shield resistivity tests because they consistently test well below maximum specifications.

Subcommittee recommended typical sampling rates are to test one sample, each, from the first and last reel on orders of 50,000 feet (15 km) or less and one sample for each additional 50,000 feet (15 km) of cable ordered.

The Subcommittee recommends that purchasers instruct manufacturers to cut samples and send them to the selected testing laboratory, or the purchaser can cut the samples upon arrival of the shipment. The Subcommittee further recommended that purchasers notify suppliers in advance

that cable testing will be conducted and purchasers should establish responsibilities and procedures in case of a failure, such as: Any evidence of noncompliance with the enclosed specifications shall be justification for:

1. Further testing at manufacturer's expense (each shipping reel);
2. Rejection of the tested reel and possibly the reels preceding and following in the manufacturing process; and
3. Rejection of the entire order, depending on the severity and frequency of noncompliance.

A partial list of possible independent testing laboratories provided by the Subcommittee includes:

Cable Technology Laboratories, Inc.
P.O. Box 708
690 Jersey Ave.
New Brunswick, NJ 08903
(201) 846-3220

Forster Electrical Engineering, Inc.
550 North Burr Oak Ave.
Oregon, WI 53575
(608) 835-9009

NEETRAC
62 Lake Mirror Road, Building 3
Forest Park, GA 30050
(800) 762-6522

All of these laboratories participate in the Cable Acceptance Testing Program promoted by NRECA's T&D Underground Subcommittee. The inclusion of a laboratory in this list does not imply endorsement by RUS. The testing laboratories listed above have voluntarily agreed to collect electric cooperative test data and provide it to the NRECA Underground Subcommittee annually for information and publication. To have your data included, note on your purchase order "INCLUDE IN COOPERATIVE DATA FILE." Cooperative names will not be published and participation is voluntary.

If you would like more information or have any questions, please call Trung Hiu, Electrical Engineer, Distribution Branch, at (202) 720-1877.

RUS is Planning to Revise its Contract Forms

RUS is planning to update, consolidate, and streamline the standard forms of contracts used for construction and procurement. The forms included in this effort are:

- Form 172, Certificate of Inspection, Contract Construction.
- Form 173, Materials Contract.

- Form 180, Construction Contract Amendment.
- Form 181, Certificate of Completion, Contract Construction for Buildings.
- Form 187, Certificate of Completion, Contract Construction.
- Form 198, Equipment Contract.
- Form 200, Construction Contract - Generating.
- Form 201, Right-of-Way Clearing Contract.
- Form 203, Transmission System Right-of-Way Clearing Contract.
- Form 238, Construction or Equipment Contract Amendment.
- Form 257, Contract to Construct Buildings.
- Form 274, Bidder's Qualifications.
- Form 282, Subcontract.
- Form 458, Materials Contract.
- Form 764, Substation and Switching Station Erection Contract.
- Form 786, Electric System Communications and Control Equipment Contract.
- Form 790, Distribution Line Extension Construction Contract (Labor and Materials).
- Form 792, Distribution Line Extension Construction Contract (Labor Only).
- Form 830, Electric System Construction Contract (Labor and Materials).
- Form 831, Electric Transmission Construction Contract (Labor and Materials).

Our plans for revising and updating these forms include:

1. Eliminate unneeded forms. This would include merging the Form 181 into the Form 187, merging the Form 180 into the Form 238, merging the Form 201, 203, and 764 into the Form 830, and eliminating Forms 181, 180, 201, 203, and 764. We are also considering eliminating infrequently used guidance forms (Forms 172, 173, 274, 282, and 458).

2. Make forms suitable for "subject to" or "not subject to" RUS approval. This would include merging the Form 831 into the Form 830 and eliminating Form 831.

3. Make construction contract forms suitable for "labor only" or "labor and material." This would include merging the Form 792 into the Form 790 and eliminating Form 792.

4. Standardize tables and information pages and incorporate them as separate attachments. We are planning to publish the "Construction Units" pages as a separate bulletin. This would allow the borrower to include in the bid package only those construction unit pages that are relevant to a particular project.

5. Maximize consistency among forms. This would include standardizing common provisions and terminology, and adding a "Notice and Instructions to Bidders" to forms not having one.

6. Include an estimated or base quantity provision in unit price contract forms.

7. Add a provision regarding assignment of the contract to RUS.

8. Update and clarify contract provisions as necessary. This would include:
    a. Clarifying that the contractor (not the owner or engineer) is solely responsible for the means and methods of construction and for the supervision of the contractor's employees.
    b. Deleting the reference to a "Supervisor" appointed by RUS.
    c. Delete the reference to the loan contract and owner's access to funding.
    d. Deleting the option for eliminating retainage after the contract is 50% complete.
    e. Updating the "Buy American" requirement.
    f. Eliminating gender specific terms (him, his, materialmen, etc.)

RUS welcomes comments from the users of these forms about our plans to update, consolidate, and streamline the standard forms of contracts. We are specifically interested in comments on the following questions:

- Are the guidance forms used often or should they be eliminated?
- Are there provisions in the contract forms that should be updated (in addition to the provisions indicated above)?
- Does the proposed revision/consolidation plan meet the needs of most borrowers?

If you have comments, please send them to: Fred J. Gatchell, Deputy Director, Electric Staff Division, Rural Utilities Service, U.S. Department of Agriculture, Stop 1569, 1400 Independence Ave., SW., Washington, DC 20250-1569. If you would like more information or have any questions, please call Fred Gatchell, Deputy Director, ESD, at (202) 720-1398.

OPERATIONS AND ENVIRONMENTAL

Substation Periodic Visual Inspections

Each substation and the individual items of equipment contained therein should be periodically inspected. The recommended frequency of these inspections is monthly.

Visual inspections should encompass the total substation area including the site, the control house and all equipment and structures. This inspection should be made with the substation energized. Therefore, all inspections should be made from ground level, to assure adequate safety clearances from energized parts. Binoculars should be used to view buses and other equipment located on structures.

Special care should be used when ground connections are checked, since a high voltage could develop across any gap created between a ground cable and a piece of equipment, particularly under fault conditions. For this reason, ground connections should not be removed for any reason while the substation is energized.

The following describes details of visual inspection:

Power Transformers

1. Inspect control cabinet, control relays, contactors, indicators, and the operating mechanism.

2. Look for loose, contaminated, or damaged bushings, loose terminals, and oil leaks.

3. Check oil levels in main tanks, tap changer compartment, and bushings.

4. Inspect inert gas system (where applicable) for leakage, proper pressure, etc.

5. Read and record operations counter indicator associated with load tap changer.

6. Observe oil temperature. The oil temperature should not exceed the sum of the maximum winding temperature as stated on the nameplate plus the ambient temperature (not to exceed 40°C) plus 10°C. Generally, oil temperature does not exceed 95° and 105°C for 55°C and 65°C winding temperature rise units, respectively, since the ambient temperature rarely exceeds 30°C for periods of time long enough to cause an oil temperature rise above these points.

Voltage Regulators

1. Perform the same inspections as listed for power transformers (as applicable).

2. Place regulator control in manual position and operate regulator over small range only.

3. Return control to automatic and verify that the regulator functions properly.

4. Read and record operations counter indicator.

Oil, Vacuum, SF_6 and Air Blast Circuit Breakers

1. Check for loose, contaminated, or damaged bushings, loose terminals, oil leaks, and proper gas pressures.

2. Check oil level in bushings and main tank (as applicable).

3. Check anti-condensation heaters.

4. Read and record the number of operations indicator. If breaker has not operated during the preceding year, bypass the breaker or otherwise remove the breaker from the circuit for testing. Test the breaker by simulating relay action by placing a jumper across the tripping contact studs on the back of the relay. Allow breaker to go through its sequence to check its operation.

5. Inspect contact areas on main plug-in assembly for signs of overheating or arcing.

6. Read and record compressor operating hours indicator.

Fuses

1. Observe condition of contact surface of fuse clips.

2. Check for broken or cracked supporting insulators and for contamination.

Surge Arresters

1. Check for cracked, contaminated or broken porcelain, loose connections to line or ground terminals and corrosion on the cap or base.

2. Check for pitted or blackened exhaust parts or other evidence of pressure relief.

3. If discharge counters are provided, check connections and record the number of operations.

Buses and Shield Wire

1. Inspect bus supports for damaged porcelain and loose bolts, clamps or connections.

2. Observe condition of flexible buses and shield wires.

3. Inspect suspension insulators for damaged porcelain (include line entrances).

Capacitors (Series and Shunt)

1. Observe condition of fuses.

2. Inspect for damaged tanks and bushings and for leakage of the dielectric.

Reactors (Oil Filled and Air Core)

1. Observe condition of paint and varnish.

2. Inspect bushings for cracks and contamination.

3. Check valves and gaskets for oil leaks (as applicable).

Disconnects and Other Switches

1. Check for cracked, contaminated, or broken porcelain, loose connections and corrosion to metal parts.

2. Observe condition of contact surfaces and area around them.

3. Observe condition of arcing horns on air break switches (where applicable).

4. Inspect operating mechanism.

5. Inspect all live parts for scarring, gouging, or sharp points that could contribute to radio noise or corona.

6. Inspect flexible braids or slip-ring contacts used for grounding for corrosion, wear or broken strands.

7. Check gearboxes for signs of moisture and corrosion.

8. Check corona balls and rings for damage.

Control and Metering Equipment

1. Check current and potential transformers for damage to cases, bushings, terminals, and fuses. Verify the integrity of the connections, both primary and secondary.

2. Observe the condition of control, transfer, and other switch contacts, indicating lamps, test blocks and other devices located in or on control cabinets, panels, switchgear, etc. Look for signs of condensation in these locations.

3. Examine meters and instruments externally to check for loose connections and damage to cases and covers. Note whether the instruments are reading or registering.

4. Open and close each potential switch on the test block to determine whether the speed of the meter disk is affected. Repeat the process with the current switches. Changes of speed should be approximately the same for each meter element.

5. Check status of relay targets (where applicable).

6. Make an external examination of relays, looking for damaged cases and covers or loose connections.

7. Check station battery for loose connections and the battery cells for low electrolyte level and low specific gravity of the electrolyte.

8. Inspect station battery charger. Check charging current and voltage. Observe ground detector lamps for an indication of an undesirable ground on the dc system.

9. Check annunciator panel lights.

Structures

1. Inspect all structures for loose or missing bolts and nuts.

2. Check for damaged paint, galvanizing, and signs of corrosion.

3. Inspect for deterioration, buckling, and cracking.

Grounding System

1. Check all above grade ground connections at equipment, structures, fences, switch operator's platforms (mats), etc.

2. Observe the condition of any flexible type connections.

Cable

1. Inspect exposed sections of cable for physical damage.

2. Inspect the insulation or jacket for signs of deterioration.

3. Check for cable displacement or movement.

4. Check for loose connections.

5. Inspect shield grounding (where applicable), cable support, and termination.

Foundations

1. Inspect for signs of settlement, cracks, spalling, honeycombing, exposed reinforcing steel, and anchor bolt corrosion.

Substation Area (General)

1. Verify existence of appropriate safety signs (*i.e.*, danger and warning signs, as applicable).

2. Check indoor and outdoor lighting systems for burned-out lamps or other component failures.

3. Verify that there is an adequate supply of spare parts and fuses.

4. Observe the condition of hook sticks.

5. Inspect the fire protection system and the provision for drainage in the event of leaking oil.

6. Check for bird nests or other foreign materials in the vicinity of energized equipment, buses, or fans.

7. Observe the general condition of the substation yard, noting the overall cleanliness and the existence of low spots that may have developed.

8. Observe the position of all circuit breakers in the auxiliary power system and verify the correctness of this position.

9. Inspect the area for weed growth, debris, and only minor material associated with the maintenance of the substation equipment stored in the yard.

Substation Fences

1. Check for minimal gap under the fence and gate. Normally the gap should not exceed 2 inches (5 cm) under the fence and 4 inches (10 cm) under the gate.

2. Check that the fence fabric is intact with no rust.

3. Check that the barbed wire is taut.

4. Check that the gate latches are operable.

5. Check that flexible braid type connections are intact.

6. Verify that no wire fences are tied directly to the substation fence.

If you would like more information or have any questions, please call Mike Eskandary, Electrical Engineer, Transmission Branch, at (202) 720-9098.

7 CFR Part 1794 - RUS Environmental Policies & Procedures

RUS is pleased to announce the publication of its final rule on "Environmental Policies and Procedures," 7 CFR Part 1794. The rule was published in the Federal Register on December 11, 1998, which is also the effective date of the final rule. The previous version of 7 CFR Part 1794, dated March 13, 1984, has been rescinded.

The Federal Register version of the final rule (7 CFR Part 1794) can be downloaded from the RUS web site at: www.usda.gov/rus/regs.shtml under Electric Program Regulations and Bulletins. The final rule exclusive of the preamble and responses to comments can be downloaded from the same web site.

Most of the changes to 7 CFR Part 1794 result from the addition of Water and Environmental Programs, that formerly belonged to the Farmers Home Administration, to RUS. Actions and procedures specific to that program are defined in separate subsections of the final rule.

The final rule contains a variety of substantive and procedural changes from the provisions of the previous rule that affect Electric Borrowers. Those changes are identified by section as follows:

Subpart A - General

§1794.3 Actions requiring environmental review

Only borrower actions that require the approval of financing assistance are subject to environmental review. Specifically excluded are approvals pursuant to loan contracts and security instruments (*e.g.*, approval of the use of general funds where no RUS reimbursement will be requested) and approvals of lien accommodations.

§1794.4 Metric units

Environmental documents prepared by or for an electric borrower should use non-metric equivalents (British system) followed by metric units in parentheses or a metric conversion table as an appendix. All numerical designations have been rounded to the nearest whole number. This is a reversal of previous policy.

§1794.6 Definitions

This is a new section that defines some of the terminology used in the regulation. Note that the environmental document submitted by electric borrowers for projects that are normally categorically excluded or require an environmental assessment without scoping is now called an Environmental Report (ER). In the previous rule the document was called a Borrower's Environmental Report (BER).

§1794.7 Guidance

The two environmental guide bulletins that were issued in November 1993 and April 1995, respectively, have been revised and updated to accompany the final rule. Both environmental guidance bulletins can be downloaded from the RUS web site under Electric Program Regulations and Bulletins. The two bulletins are now titled:

RUS Bulletin 1794A-600 – Guide for Preparing an Environmental Report for Categorically Excluded Projects.

RUS Bulletin 1794A-601 – Guide for Preparing the Environmental Report for Electric Projects Requiring an Environmental Assessment.

Subpart B – Implementation of the National Environmental Policy Act

§1794.11 Apply NEPA early in the planning process.

Where a proposed action normally requires the preparation of an Environmental Impact Statement (EIS), it is imperative that the borrower consults with RUS prior to obtaining the services of an environmental consultant. The Council on Environmental Quality

(CEQ) Regulations in §1506.5(c) stipulate when an EIS is to be prepared by a contractor, that contractor be chosen solely by the lead agency, with the cooperation of the cooperating agencies, or by a cooperating agency to avoid any conflict of interest.

It is also imperative that borrower's notify and consult with the appropriate Branch within the Power Supply Division (PSD) of RUS on all Environmental Analysis (EA) with Scoping and EIS projects. The Engineering and Environmental Staff needs authorization from PSD before staff can proceed with the environmental review for proposals in these two categories.

Subpart C – Classification of Proposals

§1794.21 Categorically excluded proposals without an ER.

(b) Electric and Telecommunications Programs

The following three actions were deleted in the new regulation and are no longer considered actions subject to environmental review:

(2) Routine approvals made pursuant to loan security documents (*e.g.,* contracts for bulk commodities, goods and services, capital credit retirements, and technical design or specifications).

(3) Agreements for transmission, wheeling, interconnection with, power purchases from, or sale to other utilities where no associated borrower construction or financing of construction is involved.

(6) Fuel or mineral contracts where the borrower does not have effective control over or responsibility to alter the development of the specific fuel or mineral source (*e.g.,* the mine).

The following five actions that previously required a BER, normally do not require an ER under the new regulation:

(14) Rebuilding of power lines or telecommunications cables where road or highway reconstruction requires the applicant to relocate the lines either within or immediately adjacent to the new road or highway easement or right-of-way.

(15) Phase or voltage conversions, reconductoring or upgrading of existing electric distribution lines, or telecommunication facilities.

(17) Participation by an applicant(s) in any proposed action where total applicant financial participation will be five percent or less.

(19) Additional bulk commodity storage (*e.g.,* coal, fuel oil, limestone) within existing generating station boundaries. A certification attesting to the current state

of compliance of the existing facilities and a description of the facilities to be added shall be provided to RUS.

(20) Proposals designed to reduce the amount of pollutants released into the environment (*e.g.*, precipitators, baghouse or scrubber installations, and coal washing equipment) which will have no other environmental impact outside the existing facility site.

The following six new actions have been added to this category:

(16) Construction of new power lines, substations, or telecommunications facilities on industrial or commercial sites, where the applicant has no control over the location of the new facilities. Related off-site facilities would be treated in their normal category.

(18) Construction of a battery energy storage system at an existing generating station or substation site.

(21) Construction of standby diesel electric generators (one megawatt or less total capacity) and associated facilities, for the primary purpose of providing emergency power, at an existing applicant headquarters or district office, telecommunications switching or multiplexing site, or at an industrial, commercial or agricultural facility served by the applicant.

(22) Construction of onsite facilities designed for the transfer of ash, scrubber wastes, and other byproducts from coal-fired electric generating stations for recycling or storage at an existing coal mine (surface or underground).

(23) Changes or additions to an existing water well system, including new water supply wells and associated pipelines within the boundaries of an existing well field or generating station site.

(24) Repowering or uprating of an existing unit(s) at a fossil-fueled generating station in order to improve the efficiency or the energy output of the facility. Repowering or uprating that results in increased fuel consumption or the substitution of one fuel combustion technology with another is excluded from this classification.

Note that a description of the facilities to be constructed shall be provided to RUS for Items (14), (15), (16), (18), (20), (21), (22), and (23).

§1794.22 Categorically excluded proposals requiring an ER.

(a) Electric and Telecommunications Programs

The following action that previously required an EA requires an ER under the final rule.

> (7) Construction of substations, switching stations, or telecommunications switching or multiplexing centers requiring no more than 5 acres (2 hectares) of new physically disturbed land or fenced property.

The following new actions have been added to this category:

> (5) Changes to existing transmission lines that involve less than 20 percent pole replacement, or the complete rebuilding of existing distribution lines within the same ROW. Changes to existing transmission lines that require 20 percent or greater pole replacement will be considered the same as new construction
>
> (8) Construction of diesel electric generating facilities of 5 megawatts (MW) (nameplate rating) or less either at an existing generation or substation sites. This category also applies to a diesel electric generating facility of 5 MW or less that is located at or adjacent to an existing landfill site and supplied with refuse derived fuel. All new associated facilities and related electric power lines shall be covered in the ER.
>
> (10) Construction of new water supply wells and associated pipelines not located within the boundaries of an existing well field or generating station site.

The acreage threshold for new headquarters (item #4) has been increased from 5 acres (2 hectares) to 10 acres (4 hectares).

The capacity thresholds for diesel generation facilities (item #8) have been modified and the capacity thresholds for hydroelectric proposals have been eliminated.

§1794.23 Proposals normally requiring an EA.

(c) Electric Program

The following new action has been added to this category:

> (4) Repowering or uprating of an existing unit(s) at a fossil-fueled generating station where the existing fuel combustion technology of the affected unit(s) is substituted for another (*e.g.* coal or oil-fired boiler is converted to a fluidized bed boiler or replaced with a combustion turbine unit).

The acreage threshold for new headquarters (item # 7) has been increased to greater than 10 acres (4 hectares).

The capacity thresholds for combustion turbine or diesel generation have been modified to differentiate between new sites (50 MW or less) and existing sites (100 MW or less).

Capacity thresholds for hydroelectric proposals have been eliminated.

§§1794.24 and 1794.25

Acreage and capacity threshold changes within §1794.24, and a capacity threshold change within §1794.25 reflect changes that have been made in §§1794.22(a), and 1794.23(c).

Other Procedural Changes

Subpart D - Procedure for Categorical Exclusions

Each project must be sufficiently described to ensure its proper environmental classification. Sufficient information for this purpose is normally provided in the project description included in the construction work plan. There are 13 actions in §1794.21(b) that require additional information. The purpose is to ensure that construction and operation of the facilities covered by these actions will not impact important resources.

Subpart E – Procedure for Environmental Assessments

The EA will be the subject document of the notice of availability requirements in §1794.42, where previously, the applicant's BER or the Environmental Analysis (EVAL) was the subject document. With this change, the notice requirements for all three programs will be consistent for both EA proposals and EA with scoping proposals. This change will encourage more public involvement by allowing public review of EA proposals prior to the issuance of a Finding of No Significant Impact (FONSI). Normally, there will be no comment period following the issuance of the FONSI as was required for scoping proposals under the previous regulation.

Subpart F – Procedure for Environmental Assessments with Scoping

The notice requirements for Electric program projects that require scoping have been changed. The timing of RUS *Federal Register* notice for public scoping meetings in §1794.52(b) has been reduced from 30 days to 14 days prior to the meeting. No appreciable benefit resulted from the earlier notice requirement.

Scoping documents must be made available to the public at least 10 days in advance of the meeting. The meeting format can be either the traditional (formal presentation) style or the open house style.

The previous rule allowed RUS to accept the applicant's BER as its EA but required RUS to prepare its own EA from the applicant's EVAL where a proposed action requires scoping. This requirement has been changed to allow RUS accept the EVAL as its EA. (See §1794.53.)

Subpart G – Procedure for Environmental Impact Statements

The policy regarding the use of a contractor prepared EIS has been modified. Under the previous rule, RUS was required to use agency funds if an independent contractor was chosen by RUS to prepare the EIS. In accordance with the provisions of 7 CFR Part 1789, "Use of Consultants Funded by Applicants" and Section 759A of the Federal Agriculture Improvement and Reform Act of 1996, preparation of a draft or final EIS by an independent contractor can be funded by the applicant, provided the consultant is selected by RUS.

A new requirement, publication of a notice of availability by RUS and the applicant for a Record of Decision, is established in §1794.63.

If you would like more information or have any questions, please call Larry Wolfe, Senior Environmental Protection Specialist, Engineering and Environmental Staff, at (202) 720-5093, E-mail: lwolfe@rus.usda.gov.

ADMINISTRATIVE and OTHER

Y2K Update

With less than 160 days remaining until January 1, 2000, it is imperative that everyone continue their hard work ensuring that all critical systems are Y2K compliant. It is important that all billing and business systems, as well as infrastructure and other date-sensitive systems, be ready for the transition to Y2K. To further ensure a smooth transition, you should consult with those companies whose systems interface with yours to determine their compliance status.

Regardless of how thoroughly you plan for Y2K compliance, last-minute surprises are inevitable. After you have finished the necessary steps of awareness, inventory, assessment, remediation, testing, and implementation, potential risks must be identified and managed. It may be impossible to correct 100 percent of the issues in time; therefore, problems with mission critical processes should be solved first. As you are aware, because of your interaction with a multitude of other entities, there are Y2K issues beyond your control that may affect you. One important way to be sufficiently prepared is through the development and application of a well-defined and executable contingency plan.

The RUS Y2K Home Page (www.usda.gov/rus/y2k/index.htm) has information on contingency planning and links to other sites with a wealth of information on the topic. Links are also included to sites that discuss all aspects of the Y2K problem including descriptions of the steps in correcting it.

We would like to thank all of the electric and telecommunications borrowers who responded to our Y2K Compliance survey. A copy of the latest summary of responses can also be found on the

RUS Y2K Home Page. We appreciate your continued interest and cooperation in this crucial matter.

If you have questions about general Y2K issues, please contact our Y2K Compliance Coordinator, John Schell, at (202) 720-0671, or by E-mail at jschell@rus.usda.gov. Your RUS General Field Representative is also available to provide assistance in helping you ensure Y2K compliance.

RUS 2000 Electric Engineering Seminar

RUS is planning to conduct a seminar on rural electric distribution and transmission system engineering and operations in March, 2000. The program will include presentations on various topics of interest to the rural electric engineering community.

In addition to the formal presentations, this seminar will provide an opportunity for the participants from around the country to share experiences and ideas of mutual interest. Distribution system managers, engineers, and line superintendents as well as personnel of consulting engineering firms are expected to attend this seminar. RUS is planning to hold this seminar in conjunction with NRECA's "TechAdvantage 2000."

If you would like more information or have any questions, please call Fred Gatchell, Deputy Director, ESD, at (202) 720-1398.

Seismic Safety

RUS is revising its existing regulations concerning seismic safety. The proposed revision to 7 CFR Part 1792, Subpart C, would update and simplify the seismic safety requirements for new building construction using RUS or RTB loan, grant or guaranteed funds or funds provided through lien accommodations or subordinations approved by RUS or RTB.

The proposed revision also changes the list of acceptable model codes and standards for which new buildings are to meet seismic provisions. According to a recent study commissioned by the Interagency Committee on Seismic Safety in Construction, the model codes and standards which are equivalent to the 1994 NEHRP Recommended Provisions are the 1997 ICBO Uniform Building Code (UBC) and the ASCE 7-95 Minimum Design Loads for Buildings and Other Structures.

If you would like more information or have any questions, please call Don Heald, Structural Engineer, Transmission Branch, at (202) 720-9102.

Water and Wastewater Roles for Rural Electric Systems

Over the last 30-plus years, many rural electric systems have assumed a variety of roles with water and sewer systems. The roles include:

- Ownership
- Management services
- Operation and maintenance services
- Financial assistance
- Building community support
- Assistance in developing new facilities
- Merger assistance

Involvement in other utilities like community water or wastewater systems will expand the rural electric system's relationship with its customers while providing a valuable community service. Some electric cooperatives that are involved in this program include Warren Rural Electric Cooperative Corporation in Bowling Green, Kentucky, and Southern Illinois Electric Cooperative in Dongola, Illinois.

RUS, through its Water and Environmental Programs, provides financing for water and waste disposal (WWD) facilities. WWD loans and grants are available to develop water and waste disposal (including solid waste disposal and storm drainage) systems in rural areas and towns with a population not in excess of 10,000. The funds are available to public entities such as municipalities, counties, special-purpose districts, Indian tribes, and corporations not operated for profit. RUS may also guarantee water and waste disposal loans made by banks and other eligible lenders. Grant funds may be used to reduce water and waste disposal costs to a reasonable level for rural users. Grants may be made for up to 75 percent of eligible project costs in some cases. More information may be obtained from any USDA Rural Development field office or via the Internet at:

http://www.usda.gov/rus/water/

During fiscal year 1998, 949 loans for $787 million and 752 grants for $469.5 million were made to construct or improve rural water and waste disposal facilities. Similar numbers are expected for fiscal year 1999.

In 1995, NRECA and the National Rural Utilities Cooperative Finance Corporation (CFC) jointly published *Community Involvement – Opportunities in Water-Wastewater Services, The Final Report of the NRECA/CFC Joint Member Task Force on Rural Water and Wastewater Infrastructure*. This is a very good resource for rural electric systems contemplating involvement in a water or wastewater system. More information may be obtained from NRECA, 4301 Wilson Boulevard, Arlington, Virginia 22203-1860. Telephone: (703) 907-5500.

If you would like more information or have any questions, please call Glen Deal, Acting Director, Engineering and Environmental Staff, at (202) 720-1582, E-mail: gdeal@rus.usda.gov.

RUS Technical Publications

RUS has issued a number of technical publications recently. These publications include:

RULES:

- **7 CFR 1710, Subpart E, "Load Forecasts and Market Analysis."** This proposed rule, published July 7, 1999, will change the existing load forecasting regulations. The proposed changes are intended to reduce the overall administrative burden of reporting load forecasts to RUS. The proposed changes will also allow RUS to accept less detailed analysis for smaller borrowers.

- **7 CFR 1724, "Electric Engineering, Architectural Services and Design Policies and Procedures."** This rule, published on June 29, 1998, contains RUS requirements on engineering and architectural services and system design. This rule simplifies RUS requirements relating to architectural and engineering services and the planning and design of electric distribution, transmission, and generation systems and facilities owned by RUS borrowers, and substantially reduces the number of engineering documents that must be submitted to RUS. These policies and procedures were contained in seven RUS bulletins, which have been rescinded.

- **Bulletin 1728F-803, "Specifications & Drawings for 24.9/14.4 kV Line Construction"** (incorporated by reference). The final rule covering the revision of this bulletin was published on December 31, 1998. The revision includes a new drawing assembly designation system as well as a number of clarifications, modifications, and updates to these drawings. This bulletin was formerly known as RUS Bulletin 50-3.

- **Bulletin 1728F-806, "Specifications & Drawings for Underground Electric Distribution"** (incorporated by reference). The proposed rule covering the revision of this bulletin was published on April 8. 1998. The proposed revision includes a number of clarifications, modifications, and updates to these drawings. Public comments on this proposed rule have been received and are now being incorporated into the final rule.

GUIDANCE DOCUMENTS:

- **Bulletin 1726C-115, "Checking Sag in a Conductor by the Return Wave Method,"** dated September 24, 1998. This bulletin presents a convenient and practical method for checking sag in a conductor regardless of span length, tension, size or type of conductor.

- **Bulletin 1728F-800, "Assembly Unit Numbers and Standard Format,"** dated December 16, 1998. This bulletin explains and documents the RUS construction unit numbering scheme and the new numbering format used in new and revised RUS construction drawings.

- **IP 202-1, "List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers,"** published in July 1999, and its quarterly supplements. This document

provides a convenient listing of the materials and equipment that have been accepted by RUS.

If you need any of these publications, please contact RUS' Program Development and Regulatory Analysis staff at (202) 720-8674. Many RUS publications are also available via the Internet at:

http://www.usda.gov/rus/regs.shtml

PUBLICATIONS IN PROGRESS

Timber Specifications: RUS is in the process of revising the following three bulletins that cover pressure treating poles and crossarms, and their respective quality control:

- **1728F-700, "RUS Specification for Wood Poles, Stubs and Anchor Logs,"**
- **1728H-701, "RUS Specification for Wood Crossarms (Solid and Laminated) Transmission Timbers and Pole Keys"** (7 CFR 1728.201), and
- **1728H-702, "RUS Specification for Quality Control and Inspection of Timber Products"** (7 CFR 1728.202).

Topics currently being considered for revision include:

1. Elimination of the requirement for borrowers to notify RUS of their timber product purchases during the previous year,
2. Reinstatement of the acceptance and listing of inspection agencies in the RUS List of Materials,
3. Requirement for a heat sterilization during kiln drying or steam conditioning of poles,
4. Requirement for inspection agencies to have their company designation branded or tagged on the pole face,
5. Elimination of the 10 percent allowance of preservative retention reduction after shipment to the borrower,
6. Requirement for all independent inspectors and plant quality control personnel to be trained and certified by x-ray fluorescence instrument manufacturer,
7. Requirement for treating plants and inspection agencies to maintain certain levels of liability insurance and errors and omission insurance, and
8. Include butt treating of cedar poles as an acceptable method of treatment for poles.

RUS is hereby soliciting input from electric borrowers and others as to necessary changes to the aforementioned bulletins. Comments or suggestions should be sent to H. Robert Lash,

Chief, Transmission Branch, RUS, Stop 1569, 1400 Independence Ave SW, Washington, DC 20250-1569, E-mail: blash@rus.usda.gov. All comments are welcome.

RUS is also working on the following publications:

- **7 CFR 1710, Subpart H, "Demand Side Management and Renewable Energy Systems."** This proposed rule will reflect the changes in the electric utility industry and provide borrowers with more flexibility in obtaining RUS financing for demand side management and renewable energy projects. Criteria for an integrated resource plan acceptable to RUS will also be reduced. For further information, please contact Georg Shultz at (202) 720-1920.

- **RUS Bulletin 1724D-101B, "System Planning Guide, Construction Work Plans."** This bulletin provides guidance to borrowers and engineers in the preparation of Construction Work Plans (CWP). This revision will update and simplify this document. For further information, please contact Jim Bohlk at (202) 720-1967.

- **RUS Bulletin 1724D-112, "The Application of Shunt Capacitors to** the Rural Electric System." This bulletin will examine the application of shunt capacitors on rural distribution systems and serve as a general guide for capacitor applications to RUS borrowers and others. The System Planning Subcommittee of NRECA's T&D Committee has been instrumental in the development of this bulletin. For further information, please contact Chris Tuttle at (202) 205-3655.

- **RUS Bulletin 1724D-114, "Voltage Regulator Application on Rural Distribution Systems." This bulletin will** examine the application of voltage regulators on rural distribution systems and serve as a general guide for voltage regulator applications to RUS borrowers and others. For further information, please contact Harvey Bowles at (202) 720-5082.

Transmission and Distribution Engineering Committee

In 1991, NRECA established its Transmission and Distribution Engineering Committee (T&D Committee) to work with REA (now RUS) in the development and maintenance of electric transmission and distribution standards and specifications, and the exchange of engineering information of mutual interest to rural electric utilities. The T&D Committee is composed of some of the most dedicated and talented individuals from NRECA and from electric cooperatives all across the United States. These individuals routinely donate several weekends and considerable amounts of other personal time each year to fulfill their commitments to the Committee.

We want to use this opportunity to thank these individuals and the organizations that sponsor their participation. See Appendix B for the T&D Committee Roster.

If you would like more information or have any questions, please call Don Heald, Acting Chair, Technical Standards Committee “A” (Electric), at (202) 720-0980.

Exhibit 1
Conversion Table of Assembly Numbers and Materials
Old Bulletin 50-5 to New Bulletin 1728F-803

OLD ASSEMBLY	NEW ASSEMBLY	REQUIRED MATERIAL CHANGES or (advisory comments)
VA1	VA1.1	(none)
VA1A	VA1.2	(none)
VA1-1		*(old assembly discontinued)*
VA1-1A		*(old assembly discontinued)*
VA1-2		*(old assembly discontinued)*
VA2	VA2.1	(brackets replaced with pole-top-pins)
VA2-3		*(old assembly discontinued)*
VA3	VA3.1	**Replace 2 Washers**
VA4	VA4.1	**Replace 4 Washers**
VA5	VA5.1	**Replace 2 Washers**
VA5-1		*(old assembly discontinued)*
VA5-2	VA5.2	**Replace 2 Washers**
VA5-2A		*(old assembly discontinued)*
VA5-3	VA5.3	(none)
VA5-4		*(old assembly discontinued)*
VA6	VA6.1	**Significant Changes**
VA7	VA5.21	(none)
VA7-1	VA5.31	(none)
VA8	VA6.21	(none)
VA9	VA2.21	**Add 2 Washers (under crossarm pins)**
VA9-1	VA1.11	**Add 1 Washer (under crossarm pin)**
VB1	VB1.11	(none)
VB1A	VB1.12	(none)

Exhibit 1
Conversion Table of Assembly Numbers and Materials
Old Bulletin 50-5 to New Bulletin 1728F-803

OLD ASSEMBLY	NEW ASSEMBLY	REQUIRED MATERIAL CHANGES or (advisory comments)
VB1-1		*(old assembly discontinued)*
VB1-1A		*(old assembly discontinued)*
VB2	VB2.21	(none)
VB3	VB3.1	**Replace 2 Washers**
VB3A		*(old assembly discontinued)*
VB4-1	VB4.1	**Replace 6 Washers**
VB4-1A		*(old assembly discontinued)*
VB5-1	VB5.1	**Replace 3 Washers**
VB5-1A		*(old assembly discontinued)*
VB7	VB5.21	(none)
VB7-1	VB5.31	(none)
VB8	VB6.21	(different crossarm braces)
VB9	VB2.22	**Add 2 Washers (under crossarm pins)**
VB9-2	VB2.51	**Add 2 Washers (under crossarm pins)**
VB9-1	VB1.14	**Add 1 Washer (under crossarm pin)**
VB9-3	VB1.41	**Add 1 Washer (under crossarm pin)**
VC1	VC1.11	(none)
VC1B	VC1.12	(none)
VC1-1		*(old assembly discontinued)*
VC1-1A		*(old assembly discontinued)*
VC1-2	VC1.11L	(none)
VC1-3	VC2.21L	(brackets replaced with pole-top-pins)
VC1-4	VC1.13L	(brackets replaced with pole-top-pins)
VC1-5		*(old assembly discontinued)*
VC2	VC2.21	(brackets replaced with pole-top-pins)

Exhibit 1
Conversion Table of Assembly Numbers and Materials
Old Bulletin 50-5 to New Bulletin 1728F-803

OLD ASSEMBLY	NEW ASSEMBLY	REQUIRED MATERIAL CHANGES or (advisory comments)
VC2-1	VC2.52	(none)
VC2-2	VC2.52L	(none)
VC3	VC3.1	**Replace 3 Washers**
VC3L		*(old assembly discontinued)*
VC3-1	VC3.2L	**Replace 8 Washers**
VC4-1	VC4.1	**Replace 8 Washers**
VC4-1L	VC4.2L	**Replace 8 Washers**
VC5-1	VC5.1	**Replace 4 Washers**
VC5-1L	VC5.2L	**Replace 4 Washers**
VC7	VC5.21	(none)
VC7-1	VC5.31	(none)
VC8	VC6.21	(different crossarm braces)
VC8-1	VC6.51	**Significant Changes**
VC8-2		*(old assembly discontinued)*
VC8-3		*(old assembly discontinued)*
VC9	VC2.51	**Add 2 Washers and Anti-split Bolt**
VC9-1	VC1.41	**Add 1 Washer (under crossarm pin)**
VC9-2	VC2.51L	**Replace 2 Insulator Pins**
VC9-3	VC1.41L	**Replace 1 Insulator Pin**
VDC-C1	VD1.81	(none)
VDC-C1B		*(old assembly discontinued)*
VDC-C1L	VD1.83L	(none)

Exhibit 1
Conversion Table of Assembly Numbers and Materials
Old Bulletin 50-5 to New Bulletin 1728F-803

OLD ASSEMBLY	NEW ASSEMBLY	REQUIRED MATERIAL CHANGES or (advisory comments)
VDC-C2-1	VD2.91	(none)
VDC-C2-1L	VD2.91L	(none)
VDC-C3		*(old assembly discontinued)*
VDC-C4-1		*(old assembly discontinued)*
VE1-1	E1.1	**Add Marker; Significant Changes**
VE1-2		*(old assembly discontinued)*
VE1-3	E2.1	**Add Marker; Significant Changes**
E2-1	E1.01	**Add Marker; Significant Changes**
E2-2		*(old assembly discontinued)*
E2-3	E1.02	**Add Marker; Significant Changes**
E3-2	E3.1	**Add Guy Marker**
E3-3		*(old assembly discontinued)*
E3-10		*(old assembly discontinued)*
E4-2		*(old assembly discontinued)*
E4-3		*(old assembly discontinued)*
VE5-1		*(old assembly discontinued)*
VE5-2		*(old assembly discontinued)*
VE6-2	*(E2.2G)*	*(old assembly discontinued - see E1.1)*
VE6-3	*(E2.2G)*	*(old assembly discontinued - see E2.1)*
VE7-2L	*(E2.3G)*	*(old assembly discontinued - see E1.1)*
VE7-3L	*(E2.3G)*	*(old assembly discontinued - see E2.1)*
VE8-2L	*(E2.4LG)*	*(old assembly discontinued - see E1.1)*
VE8-3L	*(E2.4LG)*	*(old assembly discontinued - see E4.1L)*
E11		*(old assembly discontinued)*
E12		*(old assembly discontinued)*

Exhibit 1
Conversion Table of Assembly Numbers and Materials
Old Bulletin 50-5 to New Bulletin 1728F-803

OLD ASSEMBLY	NEW ASSEMBLY	REQUIRED MATERIAL CHANGES or (advisory comments)
F1-1	F1.6	(none)
F1-2	F1.8	(none)
F1-3	F1.10	(none)
F1-4	F1.12	(none)
F1-1C		*(old assembly discontinued)*
F1-2C		*(old assembly discontinued)*
F1-3C		*(old assembly discontinued)*
F1-4C		*(old assembly discontinued)*
F1-1S	F2.6	(none)
F1-2S	F2.8	(none)
F1-3S	F2.10	(none)
F1-4S	F2.12	(none)
F1-1P	F3.6	(none)
F1-2P	F3.8	(none)
F1-3P	F3.10	(none)
F1-4P	F3.12	(none)
F2-1		*(old assembly discontinued)*
F2-2		*(old assembly discontinued)*
F2-3		*(old assembly discontinued)*
F2-4		*(old assembly discontinued)*
F4-1S	F4.2	(none)
F4-1E	F4.1	(none)
F5-1	F5.1	(none)
F5-2	F5.2	(none)
F5-3	F5.3	(none)
F6-1	F6.1	(none)
F6-2	F6.2	(none)
F6-3	F6.3	(none)
VG10	VG1.8	(none)
VG66		*(old assembly discontinued)*
VG106	VG1.3	(none)

Exhibit 1
Conversion Table of Assembly Numbers and Materials
Old Bulletin 50-5 to New Bulletin 1728F-803

OLD ASSEMBLY	NEW ASSEMBLY	REQUIRED MATERIAL CHANGES or (advisory comments)
VG19	VG1.7	(none)
VG65		*(old assembly discontinued)*
VG105	VG1.2	(none)
VG39	*VG1.7*	(none)
VG67		*(old assembly discontinued)*
VG136	*VG1.2*	(none)
G150	Y2.1	**Significant Changes**
VG150	VY2.1	**Significant Changes**
VG210	VG2.1	(none) (separate cutout & arrester)
VG310	VG3.1	(minor changes) (1 crossarm eliminated)
VG311	VG3.2	(minor changes) (1 crossarm eliminated)
VG312	VG3.3	(minor changes) (1 crossarm eliminated)
J5	J1.2	(none)
J6	J2.2	(none)
J7	J3.1	(none)
J7C	*J2.2*	(none)
J8	J1.1	(none)
J10	J2.1	(none)
J11	*J3.1*	(none)
J12	J4.1	(none)
K10	K1.1	(none)
K11	K1.3	(none)
K14	K1.4	(none)
K10C	K2.2	(none)
K10C	K2.3	(none)
K10L	K2.1	(none)
K11L	K1.3	(none)
K14L	K1.1	(none)

Exhibit 1
Conversion Table of Assembly Numbers and Materials
Old Bulletin 50-5 to New Bulletin 1728F-803

OLD ASSEMBLY	NEW ASSEMBLY	REQUIRED MATERIAL CHANGES or (advisory comments)
K11C	K1.4	(none)
K14C	K1.2	(none)
K15C	*J2.1*	(none)
K16C	K3.2	(none)
K17	K3.1	(none)
K17L	*K3.1*	(none)
VM2-11	H1.1	(none)
VM2-11A		*(old assembly discontinued)*
VM2-12	P2.1	(none)
M2-15	H4.1	(none)
VM2-12A	P2.2	(none)
VM2-12A2	P2.3	(none)
VM3-1A	VS1.1	(none)
VM3-4		*(old assembly discontinued)*
VM3-16	VS2.32	(minor changes) (Add 1 crossarm brace)
VM3-2	VS2.21	(minor changes) (number of bolts & washers)
VM3-3	VS2.31	(minor changes) (number of bolts & washers)
VM3-10A	VR1.1	(none)
VM3-19		*(old assembly discontinued)*
VM3-20		*(old assembly discontinued)*
VM3-19A	VR2.1	(none)
VM3-20A	VR3.1	(none)
VM3-23	VR1.2	**Significant Changes (arms replaced with bracket)**
VM3-24		*(old assembly discontinued)*
VM3-25		*(old assembly discontinued)*

Exhibit 1
Conversion Table of Assembly Numbers and Materials
Old Bulletin 50-5 to New Bulletin 1728F-803

OLD ASSEMBLY	NEW ASSEMBLY	REQUIRED MATERIAL CHANGES or (advisory comments)
VM3-24A	VR2.2	(none)
VM3-25A	VR3.2	(none)
VM5-1		*(old assembly discontinued)*
VM5-2	VA1.01	(none)
VM5-4		*(old assembly discontinued)*
VM5-5	VA1.011	(none)
VM5-6	VP1.01	(none)
VM5-7	VA1.011P	(none)
VM5-8	VA5.2	**Replace 1 Washer**
M5-9	VS1.01	(none)
M5-10	VS1.02	(none)
M5-11		*(old assembly discontinued)*
M5-12		*(old assembly discontinued)*
M5-13	W3.2	(none)
M5-14		*(old assembly discontinued)*
M5-15		*(old assembly discontinued)*
M5-16		*(old assembly discontinued)*
M5-17	W3.1	(none)
M5-18	VA1.10P	(none)
M5-19	N1.2	(none)
M5-20		*(old assembly discontinued)*
M5-21		*(old assembly discontinued)*
M5-22		*(old assembly discontinued)*
M5-23		*(old assembly discontinued)*
VM7-1	VY1.1	**Significant Changes** (crossarms, platform eliminated)
VM7-3	VY1.3	(minor changes) (number of bolts & washers)
M8	Q1.1	(minor changes) ("item number" of material)
M8-6	Q3.1	(minor changes) ("item number" of material)
M8-9	*K4.4G*	*(guide drawing - no material)*
M8-10	*K4.3G*	*(guide drawing - no material)*

Exhibit 1
Conversion Table of Assembly Numbers and Materials
Old Bulletin 50-5 to New Bulletin 1728F-803

OLD ASSEMBLY	NEW ASSEMBLY	REQUIRED MATERIAL CHANGES or (advisory comments)
M8-11	Q3.3	(minor changes) ("item number" of material)
M8-12	Q3.2	(minor changes) ("item number" of material)
VM10-14		*(old assembly discontinued)*
VM10-15		*(old assembly discontinued)*
M19	W2.1G	*(guide drawing - no material)*
M20	W1.1G	*(guide drawing - no material) (Note New Specifications)*
M21		*(guide drawing discontinued)*
M22-1		*(guide drawing discontinued)*
M22-2		*(guide drawing discontinued)*
M24	K4.1G	*(guide drawing - no material)*
M24-1		*(guide drawing discontinued)*
M24-10	K4.2G	*(guide drawing - no material)*
M26-5		*(guide drawing discontinued)*
M27		*(guide drawing discontinued - see G1.1G)*
M27-1		*(guide drawing discontinued - see G1.1G)*
M27-2		*(guide drawing discontinued)*
M28		*(guide drawing discontinued - see G1.1G)*
M29-1		*(guide drawing discontinued)*

Exhibit 1
Conversion Table of Assembly Numbers and Materials
Old Bulletin 50-5 to New Bulletin 1728F-803

OLD ASSEMBLY	NEW ASSEMBLY	REQUIRED MATERIAL CHANGES or (advisory comments)
VM33-1		*(old assembly discontinued)*
VM33-2		*(old assembly discontinued)*
VM33-3		*(old assembly discontinued)*
VM33-4		*(old assembly discontinued)*
VM33-5		*(old assembly discontinued)*
VM33-6		*(old assembly discontinued)*
M40-6		*(guide drawing discontinued)*
M40-1A		*(guide drawing discontinued)*
M40-1A2		*(guide drawing discontinued)*
M40-8		*(guide drawing discontinued)*
M40-10		*(guide drawing discontinued)*
M40-16		*(guide drawing discontinued)*
M40-19		*(guide drawing discontinued)*
M40-11		*(guide drawing discontinued)*
M40-12		*(guide drawing discontinued)*
M40-13		*(guide drawing discontinued)*
M40-17		*(guide drawing discontinued)*
M41-1		*(guide drawing discontinued - see new Section "L")*
M41-10		*(guide drawing discontinued - see new Section "L")*
M42-3		*(guide drawing discontinued - see new Section "L")*
M42-11		*(guide drawing discontinued - see new Section "L")*

Exhibit 1
Conversion Table of Assembly Numbers and Materials
Old Bulletin 50-5 to New Bulletin 1728F-803

OLD ASSEMBLY	NEW ASSEMBLY	REQUIRED MATERIAL CHANGES or (advisory comments)
M42-13		*(guide drawing discontinued - see new Section "L")*
M42-21		*(guide drawing discontinued - see new Section "L")*
M43-4		*(guide drawing discontinued - see new Section "L")*
M43-10		*(guide drawing discontinued)*
M45-20		*(guide drawing discontinued)*
M45-21		*(guide drawing discontinued)*
M45-22		*(guide drawing discontinued)*
M52-3		*(guide drawing discontinued)*
M52-4		*(guide drawing discontinued)*
R1	M1.30G	*(guide drawing - no material)*

GENERAL NOTES for CONVERSION TABLE

(Old Bulletin 50-5 to New Bulletin 1728F-803)

1. The old drawings of the primary deadend and suspension assemblies show two 10" (25 cm) suspension insulators; the new drawings show three, 4 1/4" (11 cm) suspension insulators. Any arrangement which uses materials from the "List of Materials" (Informational Publication 202-1) is acceptable. The material descriptions and quantities need to be changed accordingly. See the "General Construction Specifications" of Bulletin 1728F-803 for additional information.

2. The old drawings of the primary and neutral deadend and suspension assemblies specify "deadend assemblies" and "angle assemblies" (items "ca" through "ce") on the drawings and in the material lists. Old guide drawings "M41-1" through "M42-21" show construction details and materials for these various assemblies. The above construction details and materials are shown in the "Tying Guides" of

Exhibit 1
Conversion Table of Assembly Numbers and Materials
Old Bulletin 50-5 to New Bulletin 1728F-803

Section "L" of new Bulletin 1728F-803.

3. The new pole top assemblies of Bulletin 1728F-803 utilize the hole spacing of the new pole framing guide in drawing "W1.1G."

4. The drawings and specifications of new Bulletin 1728F-803 specify the use of a square, 3" (8 cm) curved washer for all primary and neutral deadend assemblies instead of the square, 2 1/4" (6 cm) flat washer specified in old Bulletin 50-5.

5. The drawings and specifications of new Bulletin 1728F-803 specify the use of an anti-split bolt assembly on all pole top assemblies with double pole top pins and insulators.

6. The drawings and specifications of new Bulletin 1728F-803 specify the use of a square, 2 1/4" (6 cm) flat washer beneath the shoulder of all 7.2 kV crossarm pins.

7. Generally, the allowable transverse loading of pole-top assemblies in new Bulletin 1728F-803 is the same as those in old Bulletin 50-5. However, the maximum line angles for the new assemblies are more restrictive (smaller) than those of the old assemblies. USE THE TABLES FOR MAXIMUM LINE ANGLES IN NEW BULLETIN 1728F-803.

Exhibit 2

TABLE VII

MAXIMUM LINE ANGLES ON SPOOL INSULATOR ASSEMBLIES

(ANSI Class 53-4 Spool Insulator)

Designated Maximum Transverse Load = 2,250 Lbs./Conductor

CONDUCTOR SIZE	WIND SPAN (feet) 150	200	250	300	350	400
LIGHT LOADING DISTRICT						
4 ACSR (7/1)	60	60	60	60	60	60
2 ACSR (6/1)	57	57	56	55	55	54
2 ACSR (7/1)	44	43	43	42	42	41
1/0 ACSR (6/1)	36	35	35	34	34	33
123.3 AAAC (7)	35	35	34	34	33	33
2/0 ACSR (6/1)	35	35	34	34	33	33
3/0 ACSR (6/1)	28	28	27	27	26	26
4/0 ACSR (6/1)	28	27	27	26	25	25
246.9 AAAC (7)	27	26	26	25	25	24
336.4 ACSR (18/1)	26	26	25	24	24	23
336.4 ACSR (26/7)	18	18	17	17	16	16
MEDIUM LOADING DISTRICT						
4 ACSR (7/1)	60	60	60	60	60	60
2 ACSR (6/1)	57	56	55	55	54	53
2 ACSR (7/1)	44	43	43	42	41	41
1/0 ACSR (6/1)	36	35	35	34	34	33
123.3 AAAC (7)	35	35	34	34	33	33
2/0 ACSR (6/1)	36	35	34	34	33	33
3/0 ACSR (6/1)	28	28	27	27	26	26
4/0 ACSR (6/1)	28	27	27	27	26	26
246.9 AAAC (7)	27	27	26	26	25	25
336.4 ACSR (18/1)	27	26	26	25	25	24
336.4 ACSR (26/7)	19	18	18	18	17	17
HEAVY LOADING DISTRICT						
4 ACSR (7/1)	60	60	60	60	60	60
2 ACSR (6/1)	56	54	53	52	51	49
2 ACSR (7/1)	43	42	41	40	39	38
1/0 ACSR (6/1)	35	34	34	33	32	31
123.3 AAAC (7)	34	34	33	32	31	31
2/0 ACSR (6/1)	35	34	33	32	31	31
3/0 ACSR (6/1)	28	27	26	26	25	24
4/0 ACSR (6/1)	27	27	26	25	25	24
246.9 AAAC (7)	27	26	25	25	24	23
336.4 ACSR (18/1)	26	25	25	24	23	22
336.4 ACSR (26/7)	18	18	17	17	16	16

Replace Table VII in RUS Bulletin 1728F-803, Specifications and Drawings for 24.9/14.4 kV Line Construction, with this table.

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX A

RURAL UTILITIES SERVICE ELECTRIC STAFF DIVISION

Office of the Director

George J. Bagnall Director
(202) 720-1900 gbagnall@rus.usda.gov

Donna B. Howdershelt Secretary
(202) 720-1900 dhowders@rus.usda.gov

Fred J. Gatchell Deputy Director
(202) 720-1398 fgatchel@rus.usda.gov

Vacant Chair, Technical Standards Committee "A"
(202) 720-0980 tscae@rus.usda.gov

Nona Johnson Technical Committee Assistant
(202) 720-0980 njohnson@rus.usda.gov

Marshall D. Duvall Staff Engineer
(202) 720-0096 mduvall@rus.usda.gov

Robin L. Meigel Finance Specialist
(202) 720-9452 rmeigel@rus.usda.gov

Energy Forecasting Branch

Georg A. Shultz Chief
(202) 720-1920 gshultz@rus.usda.gov

Carolyn Bliss Secretary
(202) 720-1920 cbliss@rus.usda.gov

Sharon E. Ashurst Public Utility Specialist
(202) 720-1925 sashurst@rus.usda.gov

Christopher L. Tuttle Economist
(202) 205-3655 ctuttle@rus.usda.gov

Distribution Branch

Harvey L. Bowles Chief
(202) 720-5082 hbowles@rus.usda.gov

Angel Winters Secretary
(202) 720-5082 awinters@rus.usda.gov

James L. Bohlk Electrical Engineer
(202) 720-1967 jbohlk@rus.usda.gov

Trung V. Hiu Electrical Engineer
(202) 720-1877 thiu@rus.usda.gov

George L. Keel Equipment Specialist
(202) 690-0551 gkeel@rus.usda.gov

Stephen Jones Electrical Engineer
(202) 720-1792 sjones@rus.usda.gov

Transmission Branch

H. Robert Lash Chief
(202) 720-0486 blash@rus.usda.gov

Betty Sharpe Secretary
(202) 720-0486 bsharpe@rus.usda.gov

Donald G. Heald Structural Engineer
(202) 720-9102 dheald@rus.usda.gov

Mike Eskandary Electrical Engineer
(202) 720-9098 meskanda@rus.usda.gov

Ted V. Pejman Electrical Engineer
(202) 720-0999 tpejman@rus.usda.gov

Norris Nicholson Electrical Engineer
(202) 720-1924 nnichols@rus.usda.gov

Updated July, 1999

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX B

NRECA TRANSMISSION & DISTRIBUTION ENGINEERING COMMITTEE

MEMBER	ORGANIZATION	LOCATION
Committee Chairman		
Overt L. Carroll	Clark RECC	Winchester, KY
NRECA Staff Coordinator		
Steve Lindenberg	NRECA	Arlington, VA
David Altman	Lumbee River EMC	Red Springs, NC
Dominic Ballard	East Kentucky Power Co-op	Winchester, KY
Alan Blackmon	Blue Ridge EC	Pickens, SC
Gregory Broussard	Jackson EMC	Jefferson, GA
John Burch	Florida Keys EC	Tavernier, FL
James Byrne	Poudre Valley REA	Fort Collins, CO
Jim Carter	NRECA – WQC	Spartanburg, SC
Steve Cress	Tipmont REMC	Linden, IN
Russ Dantzler	Mid-Carolina EC	Lexington, SC
Berl Davis	Palmetto EC	Hilton Head, SC
Bruce Dreyer	Middle Tennessee EMC	Murfreesboro, TN
Herman Dyal	Clay Electric Co-op	Keystone Heights, FL
Charles Emerson	Trico EC	Tucson, AZ
Doug Emmons	Hoosier Energy REC, Inc.	Bloomington, IN
Mark Evans	Volunteer Electric Co-op	Decatur, TN
Ronnie Frizzell	Arkansas EC Corp.	Little Rock, AR
David Garrison	East Central Oklahoma EC	Okmulgee, OK
David Gebhardt	LaPlata EA	Durango, CO
Phil Gelhorn	East Central EA	Braham, MN
Ed Giesler	Tri-County EC	Portland, MI
Allan Glidewell	Southwest Tennessee EMC	Brownsville, TN
Weldon Gray	Concho Valley EC	San Angelo, TX
Ron Gunnell	Randolph EMC	Asheboro, NC
Charlene Ham	Rusk County EC	Henderson, TX
Wayne Henson	East Mississippi EPA	Meridian, MS
Bill Hetherington	Lee County EC, Inc.	North Ft. Myers, FL

APPENDIX B

NRECA TRANSMISSION & DISTRIBUTION ENGINEERING COMMITTEE

MEMBER	ORGANIZATION	LOCATION
Vince Heuser	Nolin RECC	Elizabethtown, KY
Jon Hodge	Trinity Valley Electric Co-op	Athens, TX
Tom Hoffman	Agralite Electric Co-op	Benson, MN
Jerrod Howard	Central Electric Power Co-op, Inc.	Columbia, SC
Robert Johnson	Arkansas EC Corp.	Little Rock, AR
Joseph Joplin	Rutherford EMC	Forest City, NC
Wally Lang	Minnkota Power Co-op, Inc.	Grand Forks, ND
Terry Lee	South Mississippi EPA	Hattiesburg, MS
Carl Liles	Western Farmers EC	Anadarko, OK
Gregory Lindsly	Dixie EMC	Baton Rouge, LA
Troy Little	Four County EPA	Columbus, MS
Charles Lukkarila	Great River Energy	Elk River, MN
Bill Kahanek	Lower Colorado River Authority	Austin, TX
Ken Malone	Middle Tennessee EMC	Murfreesboro, TN
Charles (Bubba) McCall	Georgia Transmission Corp.	Tucker, GA
John Mitchell	Rappahannock EC	Fredericksburg, VA
Ken Murphy	Tallapoosa River EC	LaFayette, AL
William Murray	Berkeley EC	Moncks Corner, SC
Tom Myers	Berkeley EC	Moncks Corner, SC
Ace Necaise	Singing River EPA	Lucedale, MS
Jim Newberg	Missoula EC, Inc.	Missoula, MT
Rod Nikula	Wright-Hennepin CEA	Rockford, MN
David Obenshain	Piedmont EMC	Hillsborough, NC
David Moore	Johnson County EC	Cleburn, TX
Bob Oldham	Southern Maryland EC	Hughesville, MD
Michael Pehosh	Ozarks EC	Fayetteville, AR
Chris Perry	Nolin RECC	Elizabethtown, KY
Peter Platz	Coast Electric Power	Bay St. Louis, MS
John Rodgers	Nodak EC, Inc.	Grand Forks, ND
David Rudolph	Cass County Electric Co-op	Fargo, ND
Terry Rosenthal	Laclede EC	Lebanon, MO

APPENDIX B

NRECA TRANSMISSION & DISTRIBUTION ENGINEERING COMMITTEE

MEMBER	ORGANIZATION	LOCATION
Paul Rupard	East Kentucky Power Co-op	Winchester, KY
Glenn Sell	Union Rural EC	Marysville, OH
Lewis Shaw	Brunswick EMC	Shallotte, NC
Robert Siekas	Cherryland EC	Grawn, MI
Jim Skeen	Plumas-Sierra Rural EC	Portola, CA
Thomas Slusher	Union EMC	Monroe, NC
Michael Smith	Singing River EC	Lucedale, MS
Gary Stein	Wabash Valley Power Assn.	Indianapolis, IN
Blaine Strampe	Federated REA	Jackson, MN
Vernon W. Strickland	Intercounty ECA	Licking, MO
Tom Suggs	Natchez Trace EPA	Houston, MS
Kieth Thomason	Middle Tennessee EMC	Murfreesboro, TN
Brian Tomlinson	Denton County EC, Inc.	Corinth, TX
David Turner	Lower Colorado River Authority	Austin, TX
John Twitty	Alabama EC	Andalusia, AL
Scott Wehler	Adams Electric Co-op	Gettysburg, PA
John Westby	Verendrye EC, Inc.	Velva, ND
Kenneth Winder	Moon Lake Electric	Roosevelt, UT

APPENDIX B

NRECA TRANSMISSION & DISTRIBUTION ENGINEERING COMMITTEE

MEMBER	ORGANIZATION	LOCATION
CONSULTANT MEMBERS		
Jim Bardwell	SGS Witter, Inc.	Albuquerque, NM
Keith Bartels	Martin & Associates, Inc.	Mitchell, SD
George Chapman	Patterson & Dewar Engineers, Inc.	Decatur, GA
Peter Daly	Power System Engineering, Inc.	MADISON, WI
Bob Dew	Southern Engineering Company	Atlanta, GA
Don Gray	SGS Witter, Inc.	Albuquerque, NM
Joseph Jones	McCall-Thomas Engineering Co.	Orangeburg, SC
Joe Perry	Patterson & Dewar Engineers, Inc.	Decatur, GA
Art Smith	Patterson & Dewar Engineers, Inc.	Decatur, GA
Gene Smith	SGS Witter, Inc.	Lubbock, TX
Mike Smith	SGS Witter, Inc.	Albuquerque, NM
James Stewart	Stewart Engineering, Inc.	Anniston, AL
Ed Thomas	Utility Electrical Consultants	Raleigh, NC
Mike Waters	Utility Electrical Consultants	Raleigh, NC