BEFORE

THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of the Application of Duke Energy Ohio, Inc., for Approval to Modify Transmission and Distribution Programs Pursuant to Ohio Administrative Code 4901:1-10-27.	)))))	Case No. 19-1558-EL-ESS

APPLICATION OF DUKE ENERGY OHIO, INC.

Comes now Duke Energy Ohio, Inc., (Duke Energy Ohio or Company) and states as follows:

Duke Energy Ohio is an Ohio corporation engaged in the business of supplying electric transmission, and distribution service to more than 700,000 customers in southwestern Ohio, all of whom will be affected by this Application. Duke Energy Ohio is a public utility, as defined by Ohio Revised Code (R.C.) 4905.02, and an electric light company, as defined by R.C. 4905.03, and is subject to the jurisdiction of the Public Utilities Commission of Ohio (Commission).

Beginning in 2008, and pursuant to the Commission's new rules promulgated by the Commission in response to the enactment of Amended Substitute Senate Bill No.221, the Company filed its first application for approval of its programs and procedures.[1]

In May of 2012, the Company submitted an application to revise and amend its circuit inspection programs.[2]

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[1] *In the Matter of the Application of Duke Energy Ohio, Inc., for Approval of Proposed Programs for Inspection, Maintenance, Repair and Replacement of Distribution and Transmission Lines*, Case No.09-807-EL-ESS, Amended Application, (October 30, 2009).

[2] *In the Matter of the Application of Duke Energy Ohio, Inc., to Revise and Amend Its Circuit Inspection Program*, Case No.12-1679-EL-ESS, Application, (May 29, 2012).

In January of 2016, the Company submitted an application to revise one paragraph related to vegetation management.[3]

This Application is made pursuant to Ohio Administrative Code (O.A.C.) Rule 4901:1-10-27(E)(2) which provides that such applications shall be deemed approved on the forty-sixth day after filing if not otherwise acted upon by the commission.

This Application is, in part, submitted to comply with the Commission's directive in Case No.17-32-EL-AIR, *et al.*, to file an application to change the Company's distribution vegetation management trim-cycle from four years to five years. However, along with the change mentioned in paragraph 3, the Company is seeking other changes that streamline the document and assist with clarifying the differences between Transmission and Distribution practices and programs because this has caused some confusion in the recent past. The redlined version attached below contains notes embedded in the copy to assist with explaining the need for the changes.

The document also seeks to better describe existing programs and practices that are now possible due to the Company's deployment of smartgrid technology. Programs and procedures for vegetation management for both transmission and distribution are not being requested at this time. That portion of the application is proposed to remain as currently approved.

[3] *In the Matter of the Application of Duke Energy Ohio, Inc., for Approval to Revise Paragraph (F) of its Programs for Inspection, Maintenance, Repair and Replacement of Distribution and Transmission Lines*, Case No. 16-915-EL-ESS, Application, (January 21, 2016).

Respectfully submitted,

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Duke Energy Ohio Inspection, Maintenance, Repair and Replacement of Transmission and Distribution Facilities, Circuits and Equipment

4901:1-10-27 (E)(l) Inspection, maintenance, repair, and replacement of transmission and distribution facilities (circuits and equipment).

Distribution (<69 kV)

(a) Poles ~~and Towers~~

Duke Energy Ohio shall inspect all Duke Energy Ohio owned poles on a 10 year schedule and treat, repair or replace as needed. Poles and towers shall be visually inspected in compliance with inspection program 4901:1-10-27 (D)(l),(2)(a). The goal shall be to maintain adequate strength and integrity of poles and towers per the National Electrical Safety Code. Based on

the inspection results, repair work orders shall be prepared as needed and tracked until complete.

All equipment and hardware on poles shall be inspected as follows: Duke Energy shall check condition of base of the pole for rotting, termites, and other abnormalities. Poles involved with landslides or "wash outs", leaning for any reason; objects hanging on or near pole; burning pole, cross-arms, and/or braces; ground wire broken; cross-arms or broken braces; bird holes; and vehicular damage. Communities or municipalities often have permission to post/attach traffic control and similar signs on utility poles. Business, political, and yard sale or similar signs shall be removed.

~~Refer to Exhibit A for complete pole inspection specifications.~~

~~Towers shall be inspected as follows: Duke Energy Ohio will inspect for loose, bent, rusty, or missing steel; Duke Energy Ohio shall inspect numbers and "Danger Hi-Voltage" signs; base of tower rusted; involved with landslides or "wash outs"; objects hanging on or near tower; and flashings lights on tower (FAA).~~

(b) Circuit and Line Inspections

The distribution inspection program shall consist of a driving or walking visual inspection. All distribution circuits shall be inspected on a 5-year schedule as part of the distribution inspection program 4901:1-10-27(~~E~~D)(1)~~b),(2).~~. D2 Inspectors shall document physical defects or other potential hazards to the safe and reliable operation of the circuits. Based on the inspection results, those findings that are determined to be critical will be immediately reported for assessment and repair. Otherwise, repair work orders are prepared as needed and tracked until complete.

~~Refer to Exhibit B for LEVEL definitions and examples.~~

When ~~LEVEL 1 (Ll)Priority 10~~ defects that could reasonably be expected to endanger life or property ~~situations~~ are found, the inspector will contact the appropriate company employee~~district Work Coordinator~~ so it can be addressed immediately. ~~If there is no answer, the inspector will leave a message and contact the appropriate District Supervisor and provide complete, detailed and thorough as possible description of the situation found when entering details into eMaxMaximo. eMax Maximo is Duke Energy's computerized maintenance management system in which Duke Energy maintains centralized records of all equipment and maintenance performed on that equipment. This will assist Transmission & Distribution Construction personnel in evaluating the situation.~~

All remaining deficiencies shall be corrected by the end of the year following the completion of the inspection or testing that originally revealed such deficiencies.

Two-pole conditions are those where in the field, two poles sit side by side and where one pole is in the process of being removed/changed out. Duke Energy Ohio shall log two-pole

conditions ~~into eMax~~ Maximo when found in the field. Enter pole numbers, physical location, and attachments; type and number of attachments.

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~~attachments; type and number of attachments.~~

~~Deteriorated "Elephant Ear" cutouts, deteriorated "Fuzzy Barrel" fuse tubes, taped fuse tubes, and deteriorated, checked or cracked Durabute ("Chicken Wing") cutouts should be logged as a priority LEVEL 3 (L3).~~

(c) Primary enclosures (e.g., pad-mounted transformers and pad-mounted switch gear) and secondary enclosures (e.g., pedestals and hand holes)

The distribution inspection program shall consist of a visual inspection. All pad- mounted transformers, secondary pedestals, hands holes and primary switchgear shall be inspected on a 5-year schedule as part of the distribution inspection program 4901:1-10- 27(~~0~~)(~~1~~e1c). Inspectors shall document physical defects or other potential hazards to the operations of the transformers, switch gear, and secondary enclosures. This inspection shall identify exterior physical defects in equipment or potential hazards such as transformers that are rusted, leaking, oil-stained, have broken hinges, missing locks and/or bolts. Based on the inspection results, repair work orders shall be prepared as needed and tracked until complete.

~~Refer to Exhibit C for priority definitions.~~

~~In eMax~~Maximo~~, the term "TRANSFORMER" - "OTHER" shall be used to refer to damage(s) to box pads.~~

(d) Line reclosers

Electronic monitoring will replace the annual visual inspection for electronic line reclosers. electronic l~~L~~ine reclosers ~~and sectionalizers shall~~will be visually inspected ~~concurrently with the existing battery replacement program and~~ concurrently with the Distribution Circuits and Line Inspection Program every five years.~~each yea~~ All items on the current Recloser Inspection Form are, for electronic line reclosers, able to be monitored remotely including battery status, amp rating and counter readings for all phases. In addition, all electronic line reclosers continually report their status, whether failed, online or offline and report this status to Duke Energy's Distribution Management Systems (DMS)~~r~~. ref 4901:1-10- 27(0)(1e1d).

Non-electronic line reclosers and sectionalizes shall be visually inspected each year. The units shall be inspected for signs of damage or deterioration and the operations-counter readings shall be recorded. Items to look for are black or burnt marks on equipment and/or molten metal,

indicating that a flash has occurred at the recloser installation. Based on the inspection results, repair work orders shall be prepared as needed and tracked until complete.

A Commissioning Test is performed on all newly installed electronically controlled reclosers. ~~Hydraulic under oil units shall be removed from service every 6 years for maintenance. Vacuum under oil units shall be removed from service every 7 years for maintenance. Work Orders shall be initiated for annual inspections of reclosers. Inspectors shall visually inspect the recloser site for issues, document the counter reading, etc. The inspectors then shall enter the Work Order information into an Excel spreadsheet.~~Non-electronic units shall be removed from service and replaced every six (6) years.

(e) Line capacitors

Electronic remote monitoring will replace the annual visual inspection wherever the capability has been installed and activated. Distribution line capacitors will still be reviewed visually within the existing requirements of the *5* year line patrol program.

As part of the Duke Energy SmartGrid Capacitor upgrades, Duke Energy has implemented two components for monitoring· the status of capacitors. The first component is through our D~~O~~MS system. Alarms are received from capacitors, through D~~O~~MS, and alert our operators to take action. The second component is CapCentral. CapCentral is a software program that queries historical data in our PI database and identifies trends that need to be addressed.

593075 Missing 3 sentences from previous version…add back
Add note to refer to 4901:1-10- 27(0)(1e1e).

DMS

The DMS system is set up to receive two types of alarms. We intentionally limited the

types of alarms in DMS to those conditions where an operator would need to take action, for the health of the system.

1.) High/Low Voltage Alarm - If too many capacitor banks are in service on the system during low load conditions then a voltage rise on the system occurs. If there are not enough capacitors on the system during peak load conditions then low voltage may occur. In both of these conditions, an operator would need to take action to bring the system back into normal operating conditions.

High Neutral Current Alarm - This occurs when one or two phases of the three phase capacitor bank is removed from service. This can be caused by a fuse operating or a switch failing to

close. In this case, because of the voltage imbalance introduced, the operator removes the bank from service. After repairs are completed the bank is restored to service.

CapCentral

The CapCentral system is set up to help us maintain oversight over our fleet of capacitors on our system, based on historical data reported by the capacitor and stored in our PI database. The data points we query do not need immediate action by an operator to maintain the health of the system, but they are data points that give indication to the health of our system and fleet of capacitors. The data points we query using CapCentral are: Delta Voltage, Frequency of Operations, High/Low Voltage, Self Diagnostic, Remote Manual, Loss of Communications, and High Neutral Current.

Based on the results of monitoring the statuses of these capacitors, repair work orders are prepared as needed and tracked until complete.

~~The repair intervals for issues found during an inspection are the same duration as Circuit and Line inspections. A Priority 10 = 72 hours, Priority 20 = 60 working days maximum, Priority 70 = end of year following inspection year, and Priority 99 = no time frame, not a safety or reliability issue. The repair work for Priority 99 issues shall be completed when other equipment is repaired at that location. LEVEL 1 (Ll) = 72 hours, LEVEL 3 (L3) = 60 working days maximum, LEVEL 5 (LS)= 6 to 12 months, and LEVEL 7 (L7) = no time frame, not a safety or reliability issue. The repair work for Level 7 issues shall be completed when other equipment is repaired at that location.~~

(g) ~~Substations~~

~~All Duke Energy safety rules shall be observed when entering any substation:~~
~~Appropriate Personal Protective Equipment~~
~~Minimum Approach Distance~~
~~Personal Protective Grounds~~
~~Special Precautionary Techniques~~
~~Environmental Rules and Regulations~~

~~Station Visual Inspection~~

~~Substation visual inspections shall be performed once a month in compliance with inspection program 4901:1-10-27 (D)(l),(3). These visual inspections and recorded readings can help indicate the need for maintenance on a piece of equipment, reasons for unplanned outages, the presence of unbalanced or overloaded circuits, and the presence of potentially dangerous situations. Bus structure, circuit breakers, transformers, the control building, and the general yard are specific items that shall be covered under the station visual inspection. Substation inspections are tiered in two categories: visual inspections, and comprehensive inspections. The visual inspection is focused on protecting the health and safety of the public, environmental protection, assessing components critical for station reliability, and overall material and site conditions. The comprehensive inspection shall include the above in addition to a detailed inspection of each asset including recording critical parameters of substation electrical equipment (if not recorded through online/remote monitoring).~~

The monthly station visual inspection includes the following:
Visual inspections of the station fence and gate to ensure they are secure, intact, and in good working condition. Inspection of equipment grounds to ensure they are in place for personnel protection. Inspection of station general conditions and vegetation. Inspection of oil containing equipment for any leaks or conditions that could result in a leak, as well as assessment of oil containment devices for any cracks, leaks, or damage that could prevent effective containment. Inspection of transformer cooling to ensure proper operation. Verification that fire extinguishers are in good condition with acceptable tank pressure.

The comprehensive station inspection includes all of the above, in addition to the following:
Visual inspections of the bus structure and the equipment mounted in the structure. are performed every time the substation is entered. When performing the inspection, items or conditions that appears abnormal should be closely inspected, such as a sudden change in color on the bus structure which could Indicate a spot where flashing has occurred or where overheating has occurred. The connection points and lines of a static line shall be visually checked for damage. Insulators, bushings, and arresters are checked for broken, cracked, or discoloration. Air break, load break or disconnect switches are visually inspected to ensure that they are properly seated if closed and that padlocks are in place and locked (if installed). Wave traps, coupling capacitor transformers, potential transformers, fault bus and other equipment mounted on the bus structure shall be checked for signs of overheating, loose connections, vandalism, corrosion, dirt, and lightning strikes. Steel structures are also inspected for signs of excessive rust, cracks, excessive vibration and debris.

Visual inspections on circuit breakers and reclosers will vary depending on the type/model of the circuit breaker/recloser. The overall appearance of the circuit breaker shall be visually checked for anything abnormal such as cracks, chips, or oil leaks. High/low gas pressures and temperatures, air pressure, oil level, counter numbers, elapsed time readings on the compressors, and compressor oil level are all checked and recorded as applicable. Critical parameters are recorded. The semaphore indications shall also be checked to ensure true circuit breaker status.

The overall appearance of the power transformer shall be visually checked for anything abnormal such as oil leaks, fans and pumps not operating, and bushings that are cracked, chipped, or leaking. The main tank and load tap changer liquid temperatures and winding temperatures are checked and recorded. Lightning arresters are also checked and the counters are recorded if applicable. The load tap changer compartment and controls are checked for signs of damage and correct automatic operation. Load tap changer tap position, drag hand position, counter readings, and number of operations are recorded as applicable. The Mulsifyre* system, a high velocity water spray system, and nitrogen supplies are checked and valves are opened verified to ensure the system is in a state of readiness. Transformer coolers shall be inspected for cleanliness. Critical readings required for equipment trending are recorded (if not recorded through online/remote monitoring).

The yard shall be visually inspected for damage and deterioration from vandalism, accidents. The general appearance of the yard shall be checked for excessive vegetation and equipment appearance. The yard lights shall be visually checked and any bulbs that are blown are replaced.

Equipment In control buildings shall be visually inspected and readings recorded. An operator shall visually check all relays for targets and records required information and resets targets. This person shall also ensure that primary relay and backup relay indicating lights are lit and checks the remainder of indicating lights to ensure they agree with equipment status. The annunciator panel shall be tested to ensure all lamps are operational and alarm cutout switches closed unless tagged. The control panel switches are checked to ensure they are in the proper position. The operator shall also change charts and records date, time, and initials the chart where applicable. Digital fault recorder targets shall be checked and reset as necessary. The fault bus shall be tested to ensure the voltage level is approximately 15 volts. Power station panels shall be checked for tripped breakers or breakers placed in the wrong position. Station power supplies are checked to ensure both the normal and reserve power sources are available and the DC control panels shall be checked to ensure switches are in the proper position. Microprocessor relays shall be checked for proper time and to determine any displays or indications of relay failure or malfunction. Relay trouble alarms are to be reported to the appropriate energy control center. The substation batteries and battery charger shall be visually inspected. Fire extinguishers shall be visually inspected to ensure acceptable pressure in the tank

Corrective maintenance work orders shall be generated for any abnormal or degraded conditions that could negatively impact station or equipment reliability.

Infrared Inspection - No changes

Power Factor Testing

Power factor tests shall be periodically performed on a time period from 2 – 9 years based on station equipment type/size/condition/criticality, in accordance with the Duke Energy Ohio Maintenance Interval Schedule. Power factor tests establish baseline readings on new equipment for future reference when tests are performed to evaluate the integrity of equipment at later date. Refer to Exhibit E for power factor intervals.

The guidelines set forth In the Power Factor Test Set instructions are followed. The readings from the Power Factor Test Set shall then be recorded for future assessment or compare readings to evaluate the piece of equipment being tested.

Dissolved Gas Analysis Testing-Transformer and Transformer Load Tap Changer Oil Sampling

A dissolved gas analysis test shall be performed on transformers with a 3-phase rating 7.5 MVA-49.9 MVA or low side voltage >69kV once per year. A dissolved gas analysis test shall be performed on transformers with a 3-phase rating 50 MVA and larger low side voltage >230kV twice per year. The dissolved gas analysis determines the gas levels within the insulating oil and overall health of the transformer.

A dissolved gas analysis test shall be performed on transformer load tap changers once per year for arc-in-oil type designs. GE: LRT200·2 w/fiberglass drum, LRT300 and LRT500, Reinhausen: RMV-A and RMV-11,

Westinghouse: UVT. A dissolved gas analysis test shall be performed on transformer load tap changers twice per year for ABB: UZE w/filter, Allis Chalmers: SJ5 w/filter and TLF w/filter, ASEA/Waukesha: UZD w/fllter, GE: LRT48 w/filter, LR65 w/fllter, LRT65 w/fllter, LRT68 w/filter,

~~unn w/filter, LR83 w/filter, LRSB3 w/fllter, and LRT83 w/filter, McGraw Edison: V2PA, Westinghouse: UNR w/filter, URS w/filter, URT w/filter, and UTS w/filter, also twice per year for ABE!: UZE no filter, Allis Chalmers/Siemens: TLB w/filter and TLH 21 w/filter, Allis Chalmers:~~
~~SJS no filter and TLF no filter, ASEA/Waukesha: UZD no filter, Federal Pacific: TCS46 w/filter, TCS25 w/filter, and TC25E w/filter, GE: LRT200 w/paper drum, LRT48 no filter, LR65 no filter, LRT65 no filter, LRT68 no filter, LRT72 no filter, LR83 no filter, LRS83 no filter, and LRT83 no filter, McGraw Edison: 394 w/fllter, 550 w/filter, 550B w/filter, and SSOC w/filter, Moloney: TMB~~
~~w/filter, TC-MA w/filter, TC-MB w/filter, TC·MC w/filter, Westinghouse: UNR no filter, URS no filter, URT no filter, UTS no filter, and un w/filter. A dissolved gas analysis test shall be performed on transformer load tap changers three times per year for Allis Chalmers/Siemans: TLB no filter and TLH 21 no fllter, Federal Pacific: TCS46 no filter, and TC2SE no filter, McGraw Edison: 394 no filter, 550 no filter, 550B no filter, and 550C no filter, Moloney: T-MB no filter, TC-MA no filter, TC-MB no filter, TC-MC no filter, and Westinghouse: un no filter. The dissolved gas analysis determines the gas levels within the insulating oil and overall health of the load tap changer.~~

~~**Circuit Breaker Inspection** No change~~

~~**Metal Enclosed Capacitor Assemblies**~~
~~Metal enclosed capacitor assemblies without unbalanced protection shall be internally inspected each year and every 3 years for metal enclosed capacitor assemblies with unbalanced protection. The capacitors within enclosures shall be inspected to ensure equipment is functioning properly.~~
~~Capacitors must be de-energized for a minimum of five minutes before they are grounded. Duke Energy Ohio shall check isolation and check voltage and ground after five minutes. Duke Energy Ohio shall visually check all electrical connections, check capacitor fuses and replace blown fuses. after checking capacitor with capacitor tester and check fuse clips and all ground connections. Duke Energy Ohio shall inspect capacitors for any damage or leaking cases, broken or cracked bushings, and replace if necessary. Duke Energy Ohio shall clean and inspect insulators for damage and clean/repair/replace if necessary. The metal enclosed house shall be inspected for water damage or other degradation requiring repair. Corrective maintenance work orders shall be generated for any deficiencies noted that could negatively impact capacitor reliability. If isolation permits, clean and lubricatedisconnect switch and ground disconnect if equipped. Duke Energy Ohio shall clean and inspect neutral pot for damage and repair/replace if necessary and clean and inspect capacitor structure or enclosure for damage and clear isolation and return equipment to service.~~
~~**Planned Maintenance** No changes~~

Transmission (69kV and above)[4]

[4] Transmission specific items have been broken out into this section of the document. Categories applicable to both T&D appear in both sections, i.e. Poles and Towers.

(a) Poles and Towers[5]

Duke Energy Ohio shall inspect all Duke Energy Ohio owned wood poles on a 10 year schedule and treat, repair or replace as needed. Poles and towers shall be visually inspected in compliance with inspection program 4901:1-10-27 (E)(l)~~,(2)~~(a). The goal shall be to maintain adequate strength and integrity of poles and towers per the National Electrical Safety Code. Based on the inspection results, repair work orders shall be prepared as needed and tracked until complete.

All equipment and hardware on poles shall be inspected as follows: Duke Energy shall check condition of base of the pole for rotting, termites, and other abnormalities. Poles involved with landslides or "wash outs", leaning for any reason; objects hanging on or near pole; burning pole, cross-arms, and/or braces; ground wire broken; cross-arms or broken braces; bird holes; and vehicular damage. Communities or municipalities often have permission to post/attach traffic control and similar signs on utility poles. Business, political, and yard sale or similar signs shall be removed.

Towers shall be inspected as follows: Duke Energy Ohio will inspect for loose, bent, rusty, or missing steel; Duke Energy Ohio shall inspect numbers and "Danger Hi-Voltage" signs; base of tower rusted; involved with landslides or "wash outs"; objects hanging on or near tower; and flashings lights on tower.

(b) Circuit and Line Inspections[6]

All transmission circuits shall be inspected at least once every year as part of the transmission inspection program 4901:1-10-27(D)(2). Inspectors shall document physical defects or other potential hazards to the safe and reliable operation of the circuits. Based on the inspection results, those findings that are determined to be critical will be immediately reported for assessment and repair. Otherwise, repair work orders are prepared as needed and tracked until complete.

When ~~-~~defects that could reasonably be expected to endanger life or property are found, the inspector will contact the appropriate company employee so it can be addressed immediately.

~~*All remaining deficiencies shall be corrected by the end of the year following the completion of the inspection or testing that originally revealed such deficiencies.*~~

[5] Clarified that *wood* poles are to be inspected on a 10-year schedule. It is Duke Energy Transmission's practices to replace wood poles with steel or concrete when inspection results determine pole replacement is necessary, which is new since the last time this document was filed. Added requirements for steel and concrete poles and towers to be inspected on a 12-year schedule. Removed reference to Exhibit A Pole Inspection Specification; this spec is outdated and does not represent current industry best practices for inspections of Transmission structures.

[6] Modified this section specific to Transmission requirements of 4901:1-10-27; removed outdated references to Distribution specific processes.

~~Two-pole conditions are those where in the field, two poles sit side by side and where one pole is in the process of being removed/changed out. Duke Energy Ohio shall log two-pole conditions when found in the field. Enter pole numbers, physical location, and attachments; type and number of attachments.~~

(g) Substations [7]

All Duke Energy safety rules shall be observed when entering any substation:

Appropriate Personal Protective Equipment

Minimum Approach Distance

Personal Protective Grounds

Special Precautionary Techniques

Environmental Rules and Regulations

Station Visual Inspection

Substation visual inspections shall be performed once a month in compliance with inspection program 4901:1-10-27 (D)(3). These visual inspections and recorded readings can help indicate the need for maintenance on a piece of equipment, reasons for unplanned outages, the presence of unbalanced or overloaded circuits, and the presence of potentially dangerous situations. Bus structure, circuit breakers, transformers, the control building, and the general yard are specific items that shall be covered under the station visual inspection. Substation inspections are tiered in two categories: visual inspections, and comprehensive inspections. The visual inspection is focused on protecting the health and safety of the public, environmental protection, assessing components critical for station reliability, and overall material and site conditions. The comprehensive inspection shall include the above in addition to a detailed inspection of each asset including recording critical parameters of substation electrical equipment (if not recorded through online/remote monitoring).

The monthly station visual inspection includes the following:
Visual inspections of the station fence and gate to ensure they are secure, intact, and in good working condition. Inspection of equipment grounds to ensure they are in place for personnel protection. Inspection of station general conditions and vegetation. Inspection of oil containing equipment for any leaks or conditions that could result in a leak, as well as assessment of oil containment devices for any cracks, leaks, or damage that could prevent effective containment. Inspection of transformer cooling to ensure proper operation. Verification that fire extinguishers are in good condition with acceptable tank pressure.

[7] Revised this section to reflect Duke Energy's current Substation Inspection Program, which maintains a top priority on public safety, security, and grid reliability while optimizing resources to be able to implement equipment repairs, preventive maintenance, and end of life asset replacements. Requirements of 4901:1-10-27 (D)(3) inspection program are met.

The comprehensive station inspection includes all of the above, in addition to the following:
Visual inspections of the bus structure and the equipment mounted in the structure When performing the inspection, items or conditions that appear~~s~~ abnormal should be closely inspected, such as a sudden change in color on the bus structure which could Indicate a spot where flashing has occurred or where overheating has occurred. The connection points and lines of a static line shall be visually checked for damage. Insulators, bushings, and arresters are checked for broken, cracked, or discoloration. Air break, load break or disconnect switches are visually inspected to ensure that they are properly seated if closed and that padlocks are in place and locked (if installed). Wave traps, coupling capacitor transformers, potential transformers, fault bus and other equipment mounted on the bus structure shall be checked for signs of overheating, loose connections, vandalism, corrosion, dirt, and lightning strikes. Steel structures are also inspected for signs of excessive rust, cracks, excessive vibration and debris.

Visual inspections on circuit breakers and reclosers will vary depending on the type/model of the circuit breaker/recloser. The overall appearance shall be visually checked for anything abnormal such as cracks, chips, or oil leaks. High/low gas pressures and temperatures, air pressure, oil level, counter numbers, elapsed time readings on the compressors, and compressor oil level are all checked as applicable. Critical parameters are recorded. The semaphore indications shall also be checked to ensure true circuit breaker status.

The overall appearance of the power transformer shall be visually checked for anything abnormal such as oil leaks, fans and pumps not operating, and bushings that are cracked, chipped, or leaking. The main tank and load tap changer liquid temperatures and winding temperatures are checked. Lightning arresters are also checked and the counters are recorded if applicable. The load tap changer compartment and controls are checked for signs of damage and correct automatic operation. Load tap changer tap position, drag hand position, counter readings, and number of operations are ~~recorded~~checked as applicable. The Mulsifyre* system, a high velocity water spray system, and nitrogen supplies are checked and valves are verified to ensure the system is in a state of readiness. Transformer coolers shall be inspected for cleanliness. Critical readings required for equipment trending are recorded (if not recorded through online/remote monitoring).

The yard shall be visually inspected for damage and deterioration from vandalism, accidents. The general appearance of the yard shall be checked for excessive vegetation and equipment appearance. The yard lights shall be visually checked and any bulbs that are blown are replaced. Equipment In control buildings shall be visually inspected and readings recorded. An operator shall visually check all relays for targets and ~~records required information and~~ reset~~s~~ targets. This person shall also ensure that primary relay and backup relay indicating lights are lit and checks the remainder of indicating lights to ensure they agree with equipment status. Digital fault recorder targets shall be checked and reset as necessary. Power station panels shall be checked for tripped breakers or breakers placed in the wrong position. Station power supplies are checked to ensure both the normal and reserve power sources are available. Microprocessor relays shall be checked for proper time and to determine any displays or indications of relay failure or malfunction. Relay trouble alarms are to be reported to the appropriate energy control center. The substation batteries and battery charger shall be visually inspected. Fire extinguishers shall be visually inspected to ensure acceptable pressure in the tank. Critical readings required for equipment trending are recorded (if not recorded through online/remote monitoring).

Corrective maintenance work orders shall be generated for any abnormal or degraded conditions that could negatively impact station or equipment reliability.

Infrared Inspection

An infrared scan of substation equipment shall be performed based on station type/size/condition/criticality, in accordance with the Duke Energy Maintenance Interval Schedule, with a nominal frequency of annually. All outdoor substation equipment shall be scanned using suitable infrared detection equipment to check for signs of abnormal heating or below normal expected temperature. Abnormal heating may be caused by high resistance connections, excessive loading, restricted air or oil flow, or deteriorated equipment. Below normal temperatures can be caused by unbalanced loading, restricted air or oil flow, or device malfunctions.

Bus conductor, connectors, fittings, fuses, bushings, lighting arresters, switches, transformer case and auxiliary equipment, circuit breakers interrupter tanks, line neutral and static connections and power cable terminations shall be scanned for abnormalities. Control and relay cabinet doors shall be opened to scan circuit breakers, contactors, control wiring, fuses, heaters, relay terminals and terminal blocks. Station batteries shall be checked for uneven heating, high resistance connections, and contamination losses. The thermography and field repair records shall be reviewed and analyzed to determine cause.

Power Factor Testing[8]

Power factor tests shall be periodically performed based on station equipment type/size/condition/criticality, in accordance with the Duke Energy Maintenance Interval Schedule. Power factor tests establish baseline readings on new equipment for future reference when tests are performed to evaluate the integrity of equipment at later date.
The guidelines set forth In the Power Factor Test Set instructions are followed. The readings from the Power Factor Test Set shall then be recorded for future assessment or compare readings to evaluate the piece of equipment being tested.

Dissolved Gas Analysis Testing-Transformer and Transformer Load Tap Changer Oil Sampling[9]

A dissolved gas analysis test shall be performed on transformers with a 3-phase rating 7.5 MVA or low side voltage >69kV once per year. A dissolved gas analysis test shall be performed on transformers with a low side voltage >230kV twice per year. The dissolved gas analysis determines the gas levels within the insulating oil and overall health of the transformer. A dissolved

[8] Revised section based on Duke Energy Transmission's current maintenance and inspection program, which uses a graded approach to power factor test frequency based on equipment voltage and criticality. Removed Exhibit E, power factor intervals, which was outdated.

[9] Revised section based on Duke Energy Transmission's current maintenance and inspection program, which uses a graded approach to DGA test frequency based on equipment voltage and criticality. Removed all specific references to LTC make/models; the original intent was to capture arc-in-oil designs which are to be tested annually. Replaced with: "A dissolved gas analysis test shall be performed on transformer load tap changers once per year for arc-in-oil type designs."

gas analysis test shall be performed on transformer load tap changers once per year for arc-in-oil type designs. The dissolved gas analysis determines the gas levels within the insulating oil and overall health of the load tap changer. For Transformers with remote gas monitors installed, local grab samples are not required.

Circuit Breaker Inspection

~~A circuit breaker inspection shall be performed every 3 years for all air, vacuum, gas, and oil circuit breakers.~~ Circuit breakers shall be inspected based on type/size/criticality/condition in accordance with the Duke Energy Maintenance Interval Schedule. The purpose of this inspection is to provide a non-intrusive method of evaluating the circuit breaker to ensure its integrity.

Metal Enclosed Capacitor Assemblies[10]

Metal enclosed capacitor assemblies shall be internally inspected each year. The capacitors within enclosures shall be inspected to ensure equipment is functioning properly. Duke Energy Ohio shall visually check all electrical connections, check capacitor fuses and replace blown fuses. Duke Energy Ohio shall inspect capacitors for any damage or leaking cases, broken or cracked bushings, and replace if necessary. Duke Energy Ohio shall inspect insulators for damage and clean/repair/replace if necessary. The metal enclosed house shall be inspected for water damage or other degradation requiring repair. Corrective maintenance work orders shall be generated for any deficiencies noted that could negatively impact capacitor reliability.

Planned Maintenance[11]- ~~No changes~~

Planned Maintenance is implemented in accordance with 4901:1-10-27(E)(1). Planned work tasks and frequencies are defined by the Duke Energy Transmission Maintenance Interval Schedules. Work Orders are planned, scheduled, bundled, and coordinated to balance reliability needs of the customer with efficiency of execution. Work Orders are generated, executed, and completed in accordance with Duke Energy Transmission Work Management procedures.

Corrective Maintenance[12]-

Corrective Maintenance is implemented per requirements of 4901:1-10-27(E)(4). Prioritization of corrective work orders is accomplished in accordance with Duke Energy Transmission Work Management procedures. Work is planned, scheduled, bundled, and coordinated to balance reliability needs of the customer with efficiency of execution. Lower priority work orders that do not have a direct impact on station/circuit/equipment reliability may be initiated for tracking and trending purposes only. When deficiencies are not corrected by the end of the year following the completion of the inspection or testing that originally revealed such deficiencies, a reason code shall be documented per 4901:1-10-27(E)(4) requirements.

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[10] Simplified requirements of this section by stating that all metal enclosed capacitors shall be inspected annually (previous requirement was either every year or every 3 years based on design). Removed safety and maintenance practice requirements as these are outdated.

[11] Revised section based on latest Duke Energy Transmission work management practices which balance efficiency of execution with reliability needs of the customer.

[12] Revised section based on latest Duke Energy Transmission work management practices which balance efficiency of execution with reliability needs of the customer.