

U.S. Nuclear Regulatory Commission
Staff Position on the License Renewal Rule (10 CFR 54.4) as It Relates to
the Station Blackout Rule (10 CFR 50.63)

Staff Position

Consistent with the requirements specified in Title 10, Section 54.4(a)(3), of the *Code of Federal Regulations* (10 CFR 54.4(a)(3)) and 10 CFR 50.63(a)(1), the scope of license renewal should include the offsite recovery path from the transmission system to the Class 1E distribution system. The offsite and onsite power circuits must permit functioning of structures, systems, and components necessary to respond to the event. The reasons for support of this position follow.

Rationale

In the license renewal rule, 10 CFR 54.4(a)(3) requires that the scope of license renewal include "All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for...station blackout (10 CFR 50.63)." In the station blackout (SBO) rule, 10 CFR 50.63(a)(1) states that each light-water-cooled nuclear power plant licensed to operate must be able to withstand and recover from an SBO of a specified duration that is based on factors that include "(iii) The expected frequency of loss of offsite power; and (iv) The probable time needed to restore offsite power." In this regard, the SBO rule is consistent with the staff findings identified in the statement of considerations and NUREG-1032, "Evaluation of Station Blackout Accidents at Nuclear Power Plants," issued June 1988. In particular, with regard to factor (iv), the staff found that restoration of offsite power (0.6 hours median time to restore) is more likely to terminate an SBO event than restoration of the emergency diesel generators (8 hours median time to repair).

In Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," General Design Criterion (GDC) 17, "Electric Power Systems," requires that two physically independent circuits shall supply electric power from the transmission network to the onsite electric distribution system. These circuits must be designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. A switchyard common to both circuits is acceptable. Each of these circuits shall be designed to be available soon enough after a loss of all onsite alternating current (ac) power supplies and the loss of the other offsite electric power circuit to ensure that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. One of these circuits (the immediate access circuit) shall be designed to be available within a few seconds following a loss-of-coolant accident to ensure the maintenance of core cooling, containment integrity, and other vital safety functions.

Plants not licensed in accordance with GDC 17 were licensed to satisfy plant-specific principal design criteria presented in the plant updated final safety analysis report (FSAR). These criteria are similar to GDC 17. The electric grid is the source of power to the offsite power system. Therefore, all operating plants have offsite power requirements similar to GDC 17. The plant technical specifications embody the operational restrictions for the design requirements for the loss of offsite power sources.

SBO is the loss of offsite and onsite ac electric power to the essential and nonessential switchgear buses in a nuclear power plant. It does not include the loss of ac power fed from inverters powered by station batteries or loss of ac power from an alternate ac power source. The U.S. Nuclear Regulatory Commission added the SBO rule to the regulations in 10 CFR Part 50 because, as operating experience accumulated, concern arose that the reliability of both the offsite and onsite ac power systems might be less than originally anticipated, even for designs that met the requirements of GDC 17 and GDC 18, "Inspection and Testing of Electric Power Systems." The results of risk studies indicate that estimated core melt frequencies from SBOs vary considerably between plants and could be a significant risk contributor for some plants.

As a result, the SBO rule required that nuclear power plants have the capability to withstand and recover from the loss of offsite and onsite ac power of a specified duration (the coping duration). In their plant evaluations, licensees followed the guidance specified in Regulatory Guide (RG) 1.155, "Station Blackout," issued August 1988, and NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," to determine their required plant-specific coping duration. The agency based the criteria specified in RG 1.155 to calculate a plant-specific coping duration on the expected frequency of loss of offsite power and the probable time needed to restore offsite power, as well as the other two factors (onsite emergency ac power source redundancy and reliability) specified in 10 CFR 50.63(a)(1). In requiring that a plant's coping duration be based in part on the probable time needed to restore offsite power, 10 CFR 50.63(a)(1) specifies that the offsite power system be an assumed method of recovering from an SBO. Disregarding the offsite power system as a means of recovering from an SBO would not meet the requirements of the 10 CFR 50.63 rule and would result in a longer required coping duration.

The use of the offsite power system within 10 CFR 50.63(a)(1) as a means of recovering from an SBO should not be construed to be the only acceptable means of recovering from an SBO. A licensee could, for example, recover offsite power or emergency (onsite) power. It is not possible to determine before an actual SBO event which source of power can be returned first. As a result, 10 CFR 50.63(c)(1)(ii) and its associated guidance in RG 1.155, Sections 1.3 and 2, require procedures to recover from an SBO that include restoration of offsite and onsite power.

Based on the above, licensees rely on both the offsite and onsite power systems to meet the requirements of the SBO rule. Elements of both offsite and onsite power are necessary to determine the required coping duration under 10 CFR 50.63(a)(1), and the procedures required by 10 CFR 50.63(c)(1)(ii) must address both offsite power and onsite power restoration. It follows, therefore, that both systems are used to demonstrate compliance with the SBO rule and must be included within the scope of license renewal consistent with the requirements of 10 CFR 54.4(a)(3). The onsite power system is included within the scope of license renewal on the basis of the requirements under 10 CFR 54.4(a)(1) (safety-related systems). The equipment that is relied upon to cope with an SBO (e.g., alternate ac power sources) is included within the scope of license renewal on the basis of the requirements under 10 CFR 54.4(a)(3). The offsite power system is therefore necessary to complete the required scope of the electrical power systems under license renewal.

The staff has recently noted during the review of license renewal applications that some applicants have not included all of the components and structures within the scope of license renewal needed for recovering the offsite source from an SBO event as required by 10 CFR 54.4(a)(3). Failure to include all of the structures and components within the scope of license renewal will result in those structures and components not being subject to aging

management review, and the effects of aging will not be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation in accordance with 10 CFR 54.21(a)(1) and (a)(3).

During its evaluation of licensee compliance with the requirements in 10 CFR 50.63, "Loss of All Alternating Current Power," the staff has assessed the offsite power recovery paths that are credited in the licensee evaluation of SBO coping duration. The SBO coping duration evaluation is based on the criteria specified in 10 CFR 50.63(a)(1). The staff's regulatory assessment and acceptance of licensees' compliance with the SBO rule for offsite power is based on the site-related characteristics and power design characteristics as defined in RG 1.155, and also the availability and reliability of the offsite power including the protective coordination of switchyard breakers.

The offsite power systems of U.S. nuclear power plants consist of a transmission system component and a switchyard that provides a source of power and a plant system component that connects that power source to a plant's onsite electrical distribution system which powers safety equipment. The staff considers each plant design individually, reviewing the plant's FSAR and associated electrical drawings. The key to performing the scoping for the SBO recovery path is defining the boundary of the offsite power source at the switchyard. A switchyard can have multiple offsite lines supplying the switchyard buses. Although switchyard designs vary, most plants have either a ring bus or breaker-and-a-half scheme.

The scoping boundary, as outlined in the Standard Review Plan-License Renewal (SRP-LR), Section 2.5.2.1.1, should be from the breaker or breakers from the switchyard (bus side). If there is a circuit breaker between the power transformer (startup, reserve, auxiliary, or main transformer) and the switchyard bus, and the circuit breaker is directly bolted to the switchyard bus, then that circuit breaker is acceptable as the scoping boundary. If there is a disconnect switch, but no circuit breaker exists between the transformer and the switchyard bus, then the circuit breaker(s) connected to the switchyard bus that feeds the power transformer (startup, reserve, auxiliary, or main transformer) should be acceptable as the scoping boundary.

The circuit breaker, as the scoping boundary, provides connection to offsite power via the switchyard bus, which can be powered by any of the incoming transmission lines. This breaker should be at the transmission system voltage to ensure adequate protection of safety bus and the recovery of offsite power. The staff believes that the circuit breaker needs to be within the scope of license renewal because of its ability to provide plant power, protect downstream circuits and provide plant operator-controlled isolation and energization ability. In addition, a circuit breaker coordinates with other protective devices to minimize the probability of loss of offsite power and prevent transients from affecting the onsite distribution system as offsite power is being restored. For these reasons, a circuit breaker remains as the scoping boundary. Using a disconnect switch or other component downstream of the breaker is not consistent with the staff position of compliance with the SBO rule and is not acceptable for meeting the SBO scoping requirements for license renewal.

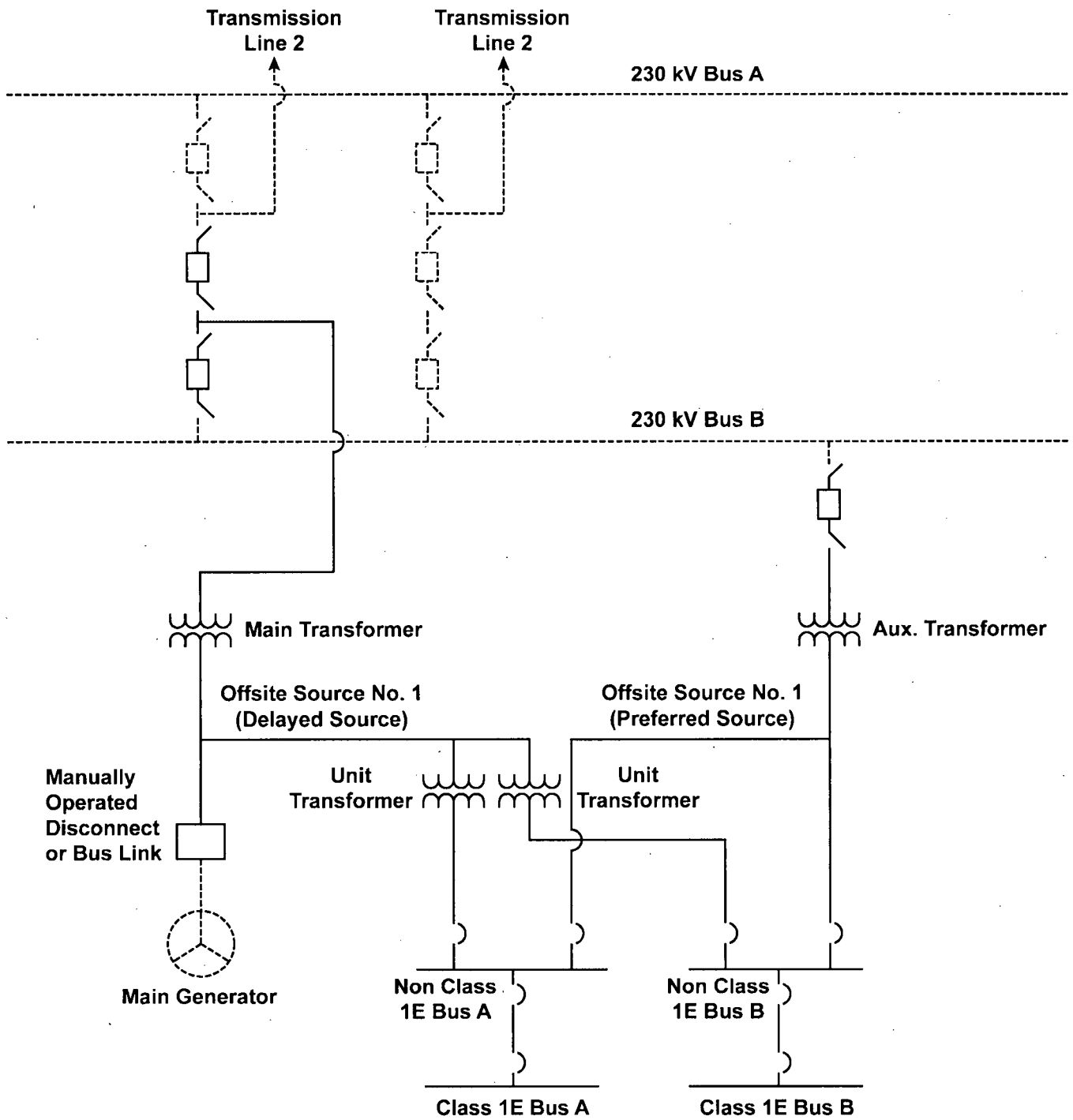
As discussed above, for purposes of the license renewal, the staff has determined that the offsite recovery paths that must be included within the scope of license renewal, in accordance with 10 CFR 54.4(a)(3), consist of circuits from two independent sources. Both paths start from the switchyard breaker to the plant Class 1E safety buses. This path includes (1) switchyard circuit breakers that connect to the offsite power system (i.e., grid), (2) power transformers, (3) intervening overhead or underground circuits (i.e., cables, buses and connections, transmission conductors and connections, insulators, disconnect switches, and associated components), (4)

circuits between the circuit breakers and power transformers, (5) circuits between the power transformers and onsite electrical distribution system, and (6) the associated control circuits and structures. The attached figures (Figures 1–4) show examples of different configurations of the SBO offsite power recovery path that are acceptable to the staff and meet the license renewal scoping requirements in accordance with 10 CFR 54.4(a)(3).

The ownership of switchyard components is not a factor in ensuring that the effects of aging will be adequately managed for components and structures needed for recovering the offsite circuits from an SBO event consistent with the requirements in 10 CFR 54.4, “Scope,” and 10 CFR 54.21, “Contents of Application—Technical Information.” The staff recognizes that there are interfaces and control agreements between the licensee and transmission system operator. These agreements do not preclude the applicant from complying with requirements specified in 10 CFR 54.4 and 10 CFR 54.21.

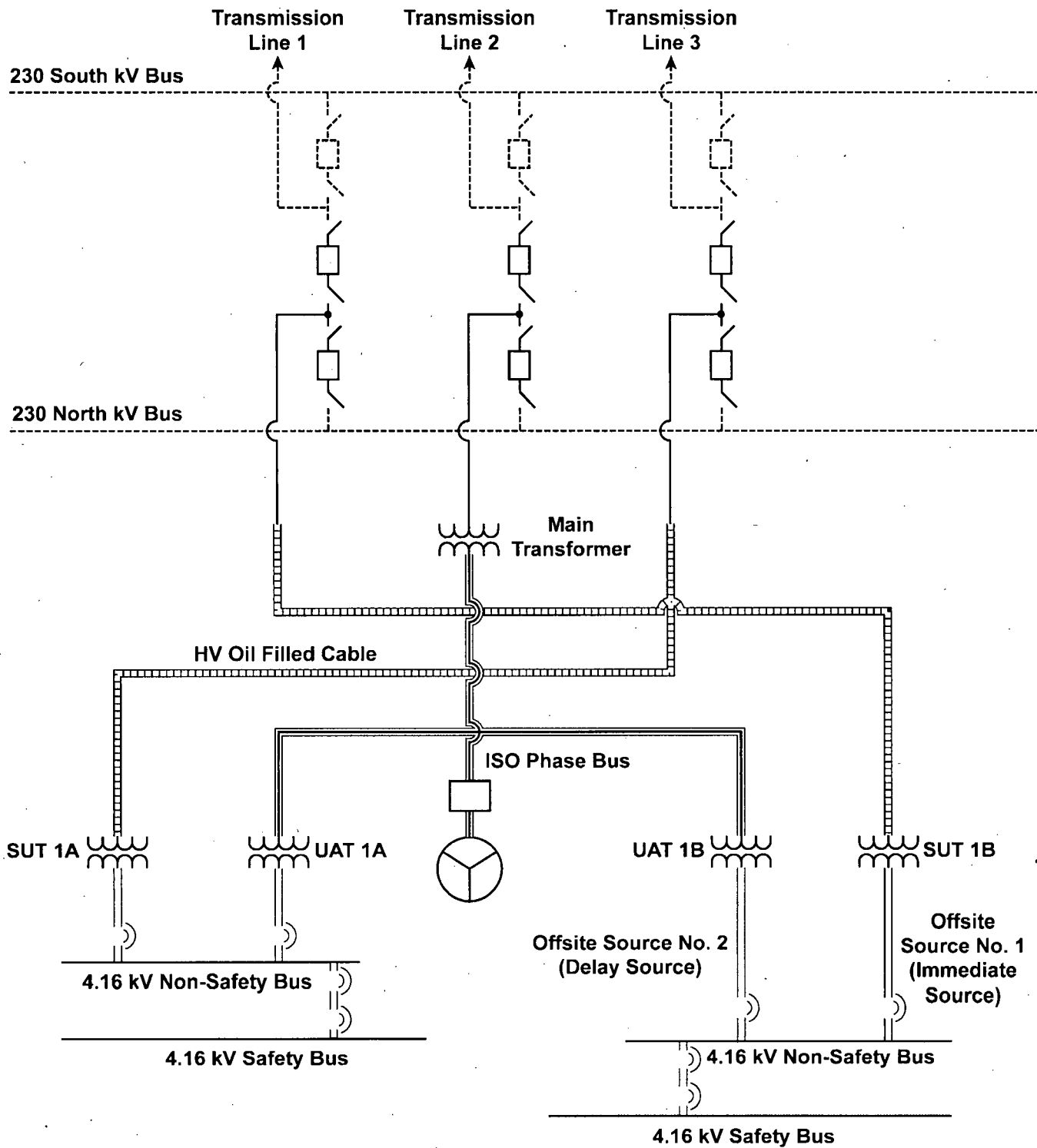
Designating the appropriate offsite power system long-lived passive structures and components that are part of this circuit path as subject to an aging management review will ensure the maintenance of the bases underlying the SBO requirements over the period of the extended license. This is consistent with the Commission’s expectations in including the SBO event under 10 CFR 54.4(a)(3) of the license renewal rule.

DRAFT



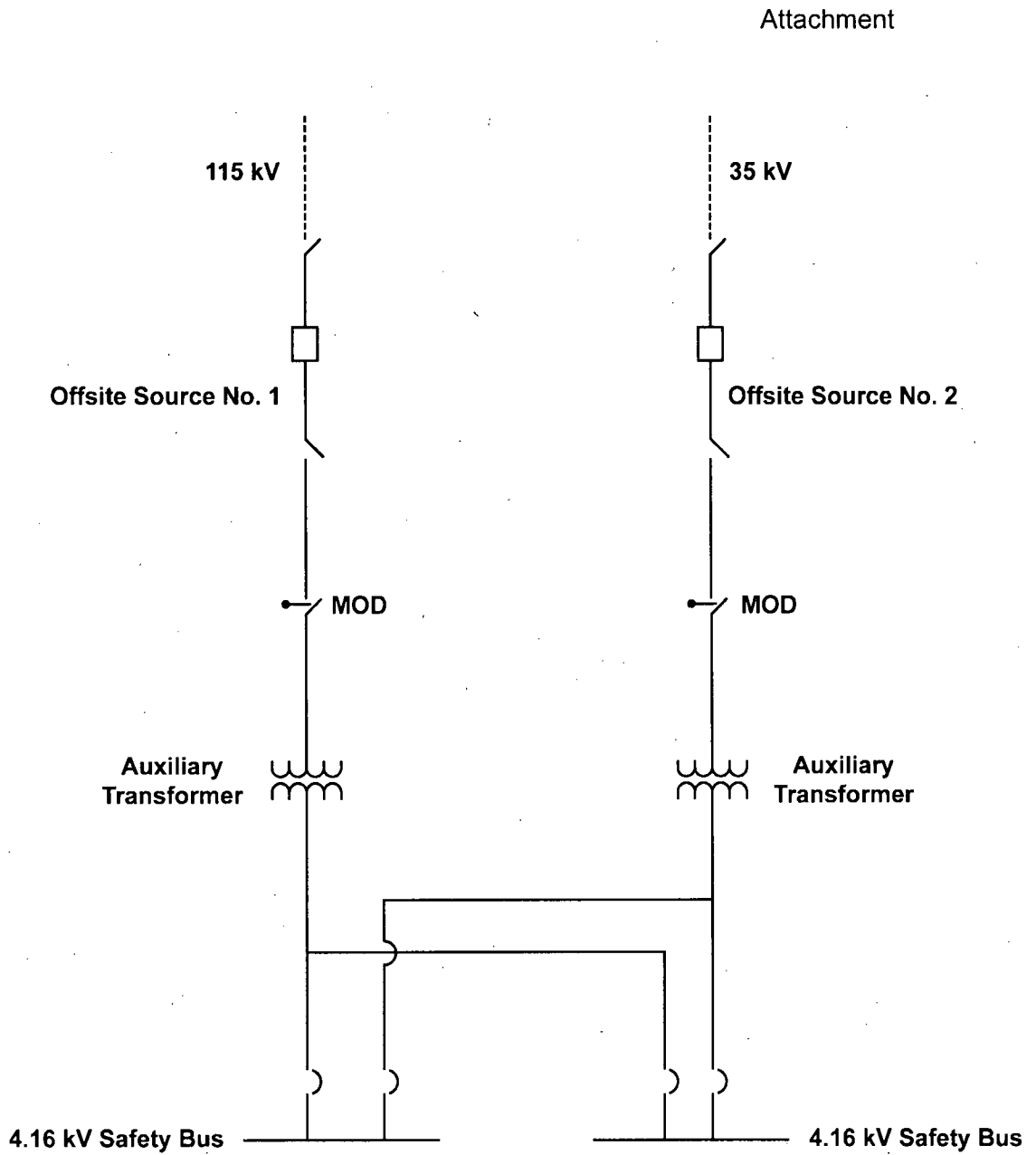
Note: Solid lines are within the scope of license renewal.

Figure 1



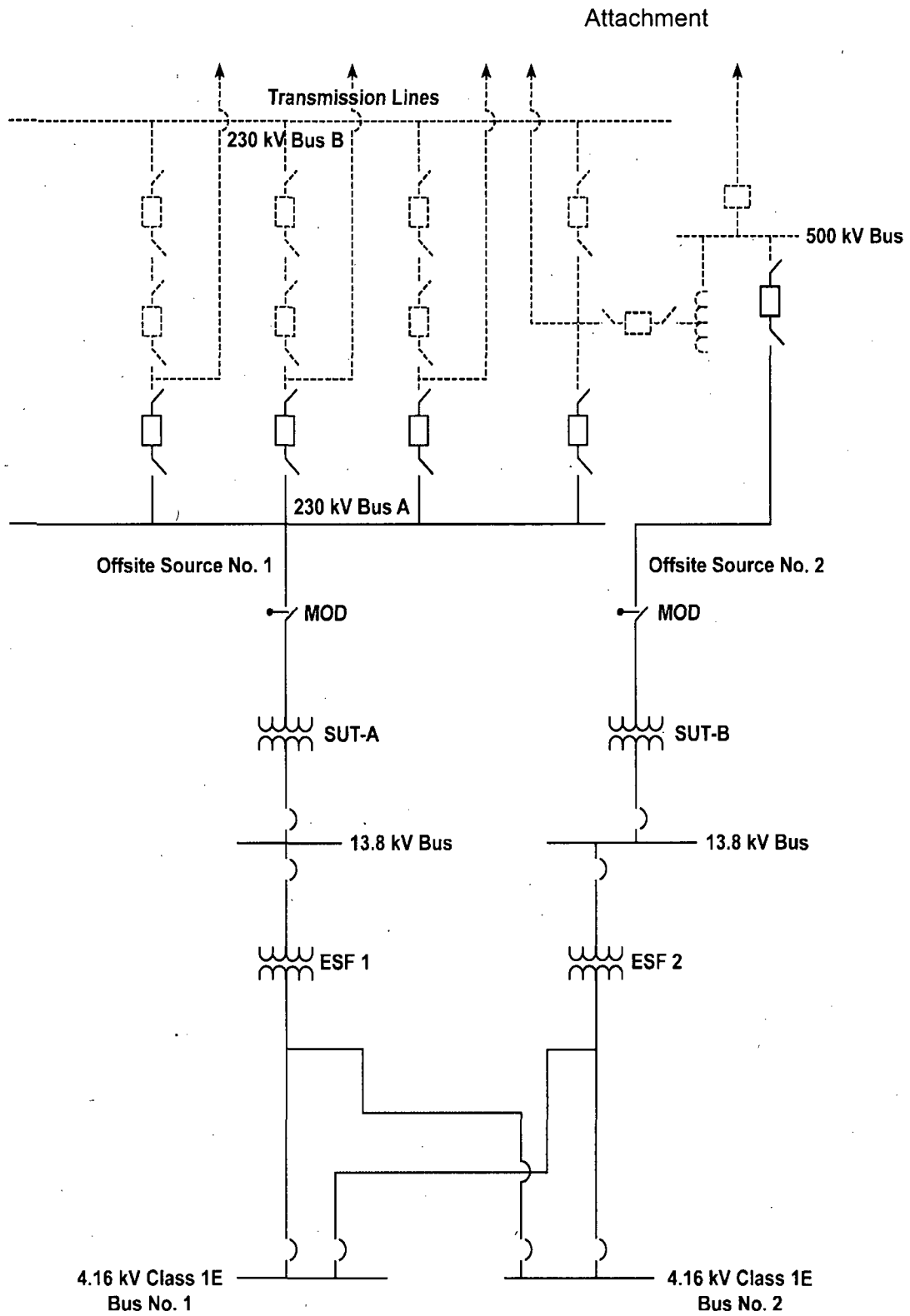
Note: Solid lines are within the scope of license renewal.

Figure 2



Note: Solid lines are within the scope of license renewal.

Figure 3



Note: Solid lines are within the scope of license renewal.

Figure 4