

Callaway Plant Unit 2

Combined License Application

Part 5: {Appendix G Evacuation Time Estimate for the Callaway Nuclear Plant 10-Mile Emergency Planning Zone Through 2018}

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1.0 INTRODUCTION

This Evacuation Time Estimate (ETE) report provides an estimate of the time required to evacuate the population of the Plume Exposure Pathway Emergency Planning Zone (EPZ) surrounding the AmerenUE Callaway Nuclear Power Plant (Callaway Plant) in Callaway County, Missouri. The report revises the information in the current Evacuation Time Estimate contained in Appendix G of the Radiological Emergency Response Plan (RERP) for the facility (AmerenUE, 2008). The time estimate considers and evaluates evacuation scenarios for the region's population and Callaway Plant Workers through the year 2018, which includes the time period for construction through the first year of full operation of the construction of the new nuclear power generating unit (Callaway Plant Unit 2) at the Callaway Facility. Emergency planning and evacuation time will be impacted by the planned construction of a second unit at the Callaway Plant site because of the impact such a major construction project will have on regional population demographics. The potential impact will vary over time with the build-up of the construction workforce to a peak level, then declining to a stable operational level after startup of the new Callaway Plant Unit 2 reactor and generating unit.

The following Nuclear Regulatory Commission (NRC) guides were used in the preparation of the ETE:

- ◆ Appendix 4, *Evacuation Time Estimates within the Plume Exposure Pathway Emergency Planning Zone*, of NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," Revision 1 (NRC, 1980)
- ◆ NUREG/CR-6863 "Development of Evacuation Time Estimate Studies for Nuclear Power Plants" (a revision of NUREG/CR-4831) (SNL, 2005)

Population, demographic, and other census data used in this report were extracted from the 2000 U.S. Census Bureau (USCB) files (<http://www.census.gov/>), or from data provided by the Missouri Census Data Center (MCDC), which is a sponsored program of the Missouri State Library within the office of the Missouri Secretary of State (<http://mcdc2.missouri.edu/>). The MCDC has been a partner in the U.S. Census Bureau's State Data Center program since 1979. Ring study distribution of population within the 10-mile vicinity of the Callaway Plant was performed by factoring year 2000 census ring study data previously reported by AmerenUE (AmerenUE, 2008). AmerenUE developed this data using MCDC ring study tools, surveys of regional census block maps, review of local emergency evacuation plans, and 911 data. The most recent decennial census was conducted in 2000. Actual validated census data (except for certain large municipalities) are not available beyond the year 2000. However, the U.S. Census Bureau developed population projection factors based on historical trends which can be used to extrapolate general population data into the future with a reasonable degree of accuracy.

Regional spatial mapping was performed using the ArcGIS Desktop version 9.1 (ArcView GIS mapping software). Traffic time estimates and roadway capacity assumptions are based on Missouri Department of Transportation regional traffic flow patterns, U.S. Department of Transportation roadway capacity data, the Transportation Research Board (TRB) division of the National Research Council (NRC), and evacuation time estimate modeling that was performed at the time of licensing the Callaway Plant Unit 1 Facility in 1984. This analysis considers three cases:

- ◆ The current operating (base) year of 2008 – Population and demographic statistics were updated to the present year based on regional changes in demography including

residential population, transient population, of special facility residents, the number of Callaway plant workers, and the number of outage workers. The plant's current worker population is 867, with most workers assigned to the first shift. The current manpower outage requirement (when it is performed) is estimated at 1,500 workers, most being assigned to the first shift. An outage involves refueling and/or other maintenance on the nuclear reactor section, and/or maintenance and cleaning of the downside steam generators and turbines. Outages are typically performed in the spring or fall.

- ◆ Future operating year 2016 – Calculation of an evacuation time estimate for the peak year of construction for Callaway Plant Unit 2 nuclear reactor and generating unit. Demographics are extrapolated using USCB projection models for anticipated regional changes in demography and residential population. Other than an increase in worker population, the transient population (tourists, campers, etc.) is expected to remain relatively stable. Similarly, the population residing at special facilities (hospitals, nursing homes, schools, jails, etc.) is also expected to remain stable. Callaway plant worker, outage worker, and construction worker estimates and related assumptions are based on the anticipated manpower demand over the planned construction schedule, with a peak labor demand reached during operation year 2016. It is assumed that the plant worker population will remain at 867, outage worker manpower will remain at 1,500, and construction worker manpower will increase to 3,950. Most of these workers would be assigned to the first shift.
- ◆ Future year 2018 – Calculation of the evacuation time estimate for the expected full year of operation of Callaway Plant Unit 1 and Unit 2 (startup of Unit 2 is anticipated in 2017). Demographics are extrapolated using US Census Bureau projection models for regional changes in demography including residential population. The increase of permanent regular plant workers for the operation of Callaway Plant Unit 2 is estimated to be 363 for a total of 1,230 employees, with most being assigned to the first shift. The peak construction worker population of 3,950 would no longer be onsite once Unit 2 is completed, started up and becomes fully operational. In addition to regular plant workers, it is assumed that up to 1,500 outage workers could be present onsite, with most of those assigned to the first shift.

1.1 SITE LOCATION

The Callaway Plant is located in Callaway County, Missouri, approximately 90 miles west of St. Louis, 25 miles northeast of Jefferson City, and 10 miles southeast of Fulton. A regional site location map is shown in [Figure 1.0-1](#).

[Figure 1.0-2](#) shows the layout of the existing Callaway Plant Unit 1 Plant Site. [Figure 1.0-3](#) shows the layout of the site with Unit 2 and the construction worker parking lot added.

1.2 EMERGENCY PLANNING ZONE

Federal regulations defined a plume exposure pathway EPZ consisting of an area about 10 miles in radius around each nuclear power facility. The extent of the EPZ varies per site and is defined as that region for which Plume Exposure Pathway emergency planning is required. This zone is the area for which emergency and evacuation planning is necessary to insure the protection of populations from direct radiation exposure in the event of an accident or release. [Figure 1.0-4](#) shows a regional map including major roadways and other features influencing a

regional evacuation in the vicinity of the Callaway Plant. The limits of the EPZ are also shown on [Figure 1.0-4](#).

At a minimum, the evacuation time analysis must consider evacuation within the 10-mile zone. The largest population center in the region is the City of Fulton. Fulton is the location of most of the special facilities and transient facilities including hotels, schools, nursing homes, child development centers, and a hospital. [Figure 1.0-5](#) provides an insert detail for [Figure 1.0-4](#), showing the City limits of Fulton and the locations of special facilities and transient populations that participate in the regional evacuation planning process. For the Callaway site, the center point between the two reactors (Unit 1 and Unit 2) is used for defining the 10-mile radius. The exact center point is located at 38° 45' 45.53" north latitude by -91° 46' 56.34" west longitude. The area encompassed within the 10-mile radius of the Callaway Plant is predominantly rural with a total year 2000 population of 6,849 persons according to year 2000 census statistics and block surveys conducted by AmerenUE.

The EPZ comprises an area that is part of four counties. Most of the EPZ is in Callaway County, but also included are parts of Gasconade, Montgomery, and Osage Counties. Within the EPZ, demographic properties are evaluated to determine the number of persons evacuating, any special or limiting requirements of various population groups, and the number of automobiles that would be involved, to determine the traffic demand on the roadway relative to the roadway capacity and the time required for departing the EPZ. For the purposes of more accurately defining evacuation routes and logistics, the EPZ is divided up into subareas and/or sectors based on population density, roadway patterns, and political subdivisions. For the Callaway site, the EPZ boundary purposely extends out beyond the 10-mile radius although this is not necessarily required by NUREG guidance. During the early regional planning at the time of original licensing, the EPZ was extended beyond 10 miles to include the significant political divisions of the City of Fulton city limits and the town of Rhineland. In addition to those population centers, the EPZ for the most part was drawn to follow an identifiable boundary such as a major roadway, river, or county line. The City of Fulton as the largest population center in the region had a reported US 2000 Census population of 12,084 residents. The outskirts of the City of Fulton are located approximately 10 miles to the northwest (upwind) of the Callaway Plant. The downtown and more heavily populated areas are located beyond 10 miles (approximately 10.5 to 11 miles out and beyond). The City of Fulton western EPZ boundary is US Highway 54, which is fixed based on a recent agreement with the City. Evacuation routes include Business 54, Highway 54, and State Route F. An agreement has been reached with the City of Fulton not to extend the EPZ any further as the city continues to grow and expand westward beyond the Highway 54 bypass.

Fulton serves as the Callaway county seat. Fulton business and industry include a large distribution warehouse, a technology and business park, an industrial park, a firebrick plant, a potato chip company, farm implement manufacturers, and other diversified businesses. The Fulton Public School District has five schools within the city limits. These are also outside of the 10-mile radius zone but are within the EPZ and identified as part of the special facility population. There is one parochial school in the city. Two colleges, Westminster College and William Woods University, are located in Fulton, along with the Missouri School for the Deaf. The Fulton State Hospital is located on the outskirts of Fulton, within the EPZ and just within the 10-mile radius of the plant. This historic facility was established in 1851 and was the first public mental institution west of the Mississippi River. On the outskirts of Fulton and within the EPZ is located the Fulton Reception and Diagnostic Center (a state correctional facility). The Diagnostic Center is also within the 10 mile-radius of the plant and is approximately a ½ mile from the Fulton State Hospital. The Diagnostic Center and State Hospital house the largest sheltering populations in the region. During an evacuation emergency, the institutionalized

populations in these facilities along with nursing homes, hospitals, and other places where residents cannot be readily relocated will be sheltered in place at their respective facilities. These and other special facility populations are discussed in [Section 2.3](#).

The greater roadway network found within approximately 10 miles of the Callaway Plant is typical of a rural low population area. Roadways within the EPZ are two lane and paved roads with no turning lanes and a limited or no paved shoulder. Intersections are generally marked with stop or yield signs rather than stop lights, until reaching more populated areas such as the city of Fulton, which is considered mostly urban by the US Census Bureau. The two major regional transportation routes are Interstate 70 that crosses the region just outside of the 10-mile plant radius defining the extent of the EPZ to the north, and US Highway 54 which defines the western extent of the EPZ around Fulton, and lies approximately 12 miles to west of the plant. The EPZ contains one railroad line, the Union Pacific, which is located immediately south of the Missouri River.

The Missouri River flows from west to east approximately 5 miles south of the plant. The river cuts completely across the southern portion of the EPZ. There are no bridges across the Missouri River within the EPZ. Thus traffic on the northern side of the River must evacuate to the north or east/west on State Highway 94. Traffic on the south side of the Missouri River will evacuate along roads heading to the south or southeast.

1.3 EPZ SUBAREAS

[Figure 1.0-6](#) shows the EPZ boundary, the major roadways and the 2-, 5-, and 10-mile radius areas surrounding the plant. The EPZ as shown in [Figure 5](#), is roughly divided into subareas that are at 90° sectors of the 2-, 5-, and 10-mile radial zones. These areas are required to be evaluated for limited evacuation in addition to evacuation of the entire EPZ. The subareas follow the sector division to the extent possible, but also divide the area along major roadways, traffic routes, or areas of concentrated populations (housing developments or neighborhoods). These subareas are established for assigning traffic loads to the most likely evacuation routes and so that the notification and evacuation of a particular population segment/sector can be done more conveniently, in the event that only a limited area within the EPZ requires evacuation.

The area within the EPZ is largely rural with a low population density with the exception of Fulton. [Figure 1.0-7](#) shows the boundary limits of each of the 15 EPZ subareas designated as follows: C1 through C11 in Callaway County, M1 and M2 in Montgomery County, O1 in Osage County, and G1 in Gasconade County. For the purposes of calculating the evacuation time estimate and roadway traffic demand, the total population contained within the EPZ for the Callaway Plant site includes those residing within the area encompassed by the 10-mile radius around facility, plus the populations in the City of Fulton in Callaway County and Rhineland in Montgomery County. The distribution of residential population is discussed below in [Section 2.1](#).

2.0 TRAFFIC DEMAND ESTIMATION

The traffic demand estimate involves calculating the traffic load on the various regional evacuation routes. This is determined by estimating and/or confirming the area's population relative to the transportation resources available, and the logistics of relocating impacted populations out of the EPZ. In estimating the evacuation time for the Callaway EPZ, three population segments are considered: permanent residents, transients, and residents of special facilities. In addition, various types of worker categories (which are included as part of the

transient population) are considered which include regular plant workers, construction workers, and outage workers. For evacuation purposes, within the category of regular plant workers are essential and non-essential workers. It is assumed that all workers except a very limited number of essential regular plant workers would be evacuated.

2.1 PERMANENT RESIDENTS

The permanent resident population includes all people residing within the EPZ who are not living in institutions. The permanent resident population to be evacuated is estimated using 2000 Census data. The population distribution of the EPZ is broken down by county in [Table 1.0-1](#) and is projected forward from the Year 2000 Census to 2018. Census Bureau population scaling factors are used to project population data forward from the last decennial census conducted in 2000.

This permanent resident general population can be further divided into two groups:

- ◆ Auto-owning-That part of the population which has an automobile(s) available for evacuation from the EPZ.
- ◆ Non-auto-owning-That part of the population which does not have an auto available for evacuation from the EPZ and, therefore, must be transported by other means.

For purposes of evacuation, vehicles are associated with residences (housing units) rather than individuals, which are discussed later in [Section 2.4](#).

2.2 TRANSIENTS

Transients are all non-residents of the EPZ who are temporarily located within it. This category includes tourists, campers, patrons of hotels, motels, bed & breakfasts, and other lodging facilities, workers from outside the EPZ, plant workers, and certain other groups. [Table 1.0-2](#) is a compilation of the transient populations in the EPZ and the reference locations of temporary residence. The transient population includes those staying at lodging establishments, campgrounds, or recreational areas, and these are not expected to vary significantly through year 2018. The plant worker population is included in the transient population totals. Worker populations are expected to vary significantly over the next 10 years due to the buildup in response to the construction of Callaway Plant Unit 2. Because of the large number of plant workers located in a single place, there will be a need to accommodate this population as part of site regional emergency evacuation planning. [Table 1.0-3](#) summarizes the projected distribution of the plant worker population through the year 2018, when Units 1 and 2 are both expected to be in full operation. The worst case traffic demand estimate is projected to occur during 2016, the peak year of construction of Callaway Plant Unit 2. At that time, the maximum onsite worker population is estimated to increase to 5,093 persons, which includes the 76 essential workers who would not be evacuating the plant. The large number of worker vehicles evacuating at one time will exceed the capacity of plant exits resulting in a traffic backup within the plant parking lots. This will result in a mobilization delay for this population group.

Further complicating this evacuation scenario is the fact that a number of these workers may establish permanent residence and reside within the EPZ. Although evacuating plant workers would normally be directed to leave the EPZ and report to an established Reception and Care Center(s), it is a limited possibility that some of these workers, once beyond the limits of the plant may decide to stop along the way out of the EPZ to pick up their families, or return to their

residences within the EPZ, in the same way as the general population worker that leaves work upon notification to evacuate and drives into the EPZ to their place of residence in order to evacuate their families and pick up essential personal belongings. Although Ameren would instruct plant workers living within the EPZ to avoid this, and instead expect workers to plan in advance other options for securing the safe evacuation and subsequent reuniting with their families outside of the EPZ, the possibility exists and is evaluated for comparison purposes of determining the upper evacuation time limit. The general population class of Callaway Plant worker families who reside within the EPZ would become the evacuation time limiting case in year 2016 as a result of the added delay of so many worker vehicles leaving the facility at one time. The analysis demonstrates that this population group should plan alternative advance arrangements for the most timely evacuation in the event of such necessity.

Once the construction of Callaway Plant Unit 2 is complete in 2018, the total evacuating worker population is expected to decrease to 2,369. This estimate includes the maximum number of non-essential, regular-permanent plant workers, and temporary outage workers who may be onsite at that time. Although there will be a mobilization delay exiting the plant proper under all transient worker scenarios, the lower number of employees reduces the exit time so that it does not become overly limiting.

The traffic demand estimate is the number of vehicles used in the evacuation which are then assigned to various evacuation routes to determine if the available roadway capacity is adequate for the traffic demand-load. The number of vehicles used per evacuating individual varies for the different population groups and categories of persons within each group. For all transient populations other than workers and those residing in hotels, an average evacuation vehicle demand factor of 3 persons per vehicle is assumed. For those persons staying in hotels, an average vehicle evacuation vehicle demand of 2 persons per vehicle is assumed. For the worker populations, 1.3 persons per vehicle is assumed for evacuating temporary workers (construction and outage workers), and 1.0 person per evacuating vehicle is assumed for regular plant workers.

2.3 SPECIAL FACILITY RESIDENTS

Special facility residents include those confined to institutions such as hospitals, nursing homes, public schools, and jails. They are dependent on the institution to provide shelter or the means for evacuation. The populations of special facility residents are summarized in [Table 1.0-4](#) and [Table 1.0-5](#). [Table 1.0-4](#) presents school population for the region's secondary schools. [Table 1.0-5](#) presents population data for non-school institutions which include private pre-schools, child development centers, nursing homes and assisted living centers, hospitals, and other facilities. School populations are presented at the year 2000 level which is higher than current enrollments. These data are used to reflect a more conservative case as school populations do fluctuate.

Not all special facility residents will be evacuated. The residents of schools, pre-schools, and day care facilities will evacuate to designated locations outside the EPZ (not back to home residences), while other special facilities such as nursing homes, hospitals, and jails will shelter residents according to their specific facility response plans.

2.4 POPULATION AND VEHICLE ESTIMATES BY SUBAREA AND SECTOR

In the case of evacuating only part of the EPZ, evacuation time estimates are needed for each subarea. NUREG 0654 states the areas of evacuation to be considered are as follows:

Radius	Area
About 2 miles	Four 90° Sectors
About 5 miles	Four 90° Sectors
About 10 miles (EPZ)	Four 90° Sectors
About 10 miles (EPZ)	Entire EPZ

Figure 1.0-8, Figure 1.0-9, and Figure 1.0-10 show the general population breakdown by 22° sectors at a distance of 2-, 5-, and 10 miles for years 2008, 2016, and 2018, respectively. Figure 1.0-11, Figure 1.0-12, and Figure 1.0-13 show the distribution of the general population by EPZ subarea. The delineations of the subareas correspond approximately to the 90° sector divisions. The highest general residential population will occur in 2018. The average general population growth rate is projected by the US Census Bureau to be approximately 0.5 percent annually.

The transient population distribution for the period of 2008 to 2018 by 22° sector and by EPZ subarea is presented in Figure 1.0-14 and Figure 1.0-15. This population is expected to remain largely stable over that time period with the exception of the worker population as noted. The highest transient population will occur in 2016 during peak construction of Callaway Plant Unit 2.

Figure 1.0-16 and Figure 1.0-17 show the special facility population distribution by 22° sector and by EPZ subarea for the period of 2008 to 2018. These populations are also expected to be relatively stable over this period with the exception of schools. School population statistics reflect the higher reported school enrollments from an earlier survey conducted by AmerenUE (AmerenUE, 2008) during the last update of the Evacuation Time Estimate. Although enrollment has declined as reflected in a more recent 2008 survey, the expectation is that in addition to the normal variability of enrollment from year to year, the school population will increase with the immigration of a number of new construction workers moving into the area with their families.

The ratios of population to housing units and of automobiles to housing units within an area were determined from US census demographic data from across each of the four counties comprising the EPZ. Total population data, occupied housing unit summary data, and automobile ownership data for the four-county regional area are available from the US Census Bureau. In calculating the automobile demand estimate, the assumption was made that if an occupied housing unit had one auto, it would be used in an evacuation. If two were available, half of the families would use one and half would use two, yielding an average of 1.5 autos per housing unit. For those housing units with three or more autos available, it was assumed that an average of two autos would be used in an evacuation. From the Census 2000 population data, housing occupation rates, and automobile availability data, automobile usage rates can then be determined. These rates were then used to obtain the vehicle evacuation demand within each sector. To be conservative, the lowest (most conservative) occupied housing rate and the highest (most conservative) evacuation vehicle availability was applied to the entire EPZ. This results in the proportionally higher traffic demand estimate. If the roadway capacity is not exceeded using these results, then backups should not occur. Summary data for determining these factors are presented in Table 1.0-6. It was determined that the lowest (most conservative) occupied housing rate of 2.486 persons per occupied household occurs in Gasconade County. The highest (most conservative) evacuation vehicle availability occurs in Callaway County at 1.470 vehicles per occupied household.

Future vehicle availability was calculated calculating the projected number of occupied housing units (N) in a sector based on population. When the general population statistics are

projected into the future, the number of occupied housing units in a sector can be conservatively determined by dividing the projected population (P) by the lowest calculated occupied housing rate (R) of 2.486 persons per OHU as follows:

$$N = P/R \text{ where}$$

N = Calculated number of occupied households

P = Projected sector population

R = 2.486 = the calculated ratio of population to housing units based on county wide regional US Census Data

The future traffic demand estimate (V) for the number of vehicles evacuating a sector or subarea is then calculated by multiplying the number of occupied housing units (N) by the highest calculated rate of autos per person (Y) as follows:

$$V = N*Y \text{ where}$$

V = number of vehicles

N = number of housing units in the sub-area or sector being examined

Y = 1.470 = ratio of autos likely to be used in an evacuation per occupied household

On this basis, from the total projected population estimates in [Table 1.0-1](#) and sector projected population estimates in [Table 1.0-7](#), [Table 1.0-8](#), and [Table 1.0-9](#), estimates for the automobile evacuation traffic demand were determined for each of the 22° radial sectors at 2-, 5-, and 10-miles, for the years 2008, 2016, and 2018. These data are presented on [Figure 1.0-18](#), [Figure 1.0-19](#), and [Figure 1.0-20](#), and shown in [Table 1.0-7](#), [Table 1.0-8](#), and [Table 1.0-9](#). Similarly, the general population traffic demand was also determined for each EPZ subarea by factoring base population data for each of the years 2008, 2016, and 2018. The EPZ subarea traffic demand data for the same years are presented on [Figure 1.0-21](#), [Figure 1.0-22](#), and [Figure 1.0-23](#) and are also summarized in [Table 1.0-17](#), [Table 1.0-18](#), and [Table 1.0-19](#).

The automobile traffic demand estimate for the transient population other than plant workers was determined by making a reasonable assumption there would be an average occupancy of 3 persons per vehicle, except for those transients lodging in motels for which an average of 2 persons per vehicle were assumed.

In making the assignment of the number of transient autos to each sector or subarea, the transient populations located in each sector or subarea were divided by the respective vehicle occupancy rate. As noted in [Section 2.2](#), ride sharing by transient plant workers evacuating the plant was assumed to be limited. The average vehicle occupancy amongst regular plant workers in an evacuation was assumed to be 1 person per vehicle. Among evacuating temporary workers (construction and outage) average vehicle occupancy was assumed to be 1.3 persons per vehicle. The transient vehicle demand for years 2008 through 2018 distributed amongst the 22° sectors at 2-, 5-, and 10-miles from the Callaway Plant is shown on [Figure 1.0-24](#) and for the same years by EPZ subzone on [Figure 1.0-25](#). The transient vehicle demand for years 2008 through 2018 by EPZ subarea is shown in [Table 1.0-17](#), [Table 1.0-18](#), and [Table 1.0-19](#). The transient worker population was all assigned to one subarea (C1).

The special facility populations are expected to remain relatively stable through 2018 with some increase expected in the school enrollment during the years of construction, which would be accommodated within the statistics presented. The special facilities that evacuate will be using buses according to their individual special facility evacuation plans. For the purposes of calculating the traffic demand estimate, the number of buses/trips was estimated by assuming an occupancy rate of 40 persons per bus per facility, rounding up any remainder and assuming each bus would require a round trip into and out of the EPZ. There are specific plans for each special facility which may reflect a slightly higher or lower bus occupancy rate depending on the exact buses used. However, this potential variability in the special facility traffic demand estimate relative to the estimated number of overall vehicles used in evacuating general population is small and would not have any impact on the evacuation time estimate calculation for any population group. Vehicle distribution for special facility evacuation demand by sector and by EPZ subarea is presented on [Figure 1.0-26](#) and [Figure 1.0-27](#) respectively and on [Table 1.0-17](#), [Table 1.0-18](#), and [Table 1.0-19](#).

Evacuation of the non-auto owning general population that must rely on municipal provided transportation will involve a limited number of buses and trips in and out of the EPZ. The traffic demand for this population group is already accounted for in the factoring of the general population statistics to calculate the traffic demand estimate.

3.0 TRAFFIC CAPACITY

3.1 IDENTIFICATION OF PRIMARY EVACUATION ROUTES

The location, types, and capacities of the local roadways were examined in order to estimate an evacuation time. Although a series of routes out of the area have been designated for EPZ evacuation, all roads out of the EPZ are potentially available. Designated routes lead as directly as possible out of the EPZ. In almost all instances, the designated evacuation route is normally the fastest way out of the EPZ for the area served by that particular route. The routes do not require special traffic control measures, such as one-way operation on normally two-way roads, contra-flow on freeways, etc. These evacuation routes are indicated on [Figure 1.0-28](#), and each is designated by a letter. Under exceptional or unusual conditions such as flooding of Highway 94 or Highway 100, alternate evacuation routes will be identified by county authorities if necessary. Potential areas of concern are identified in county plans and procedures dealing with evacuation impediments.

3.2 ASSIGNMENT OF TRAFFIC TO PRIMARY EVACUATION ROUTES

When assigning traffic to the evacuation routes, the travel shed of each route is determined. The travel shed of a particular route is the area of population for which that route is the fastest means of exit from the EPZ. The travel sheds for the evacuation routes in the Callaway EPZ are determined by extending the major evacuation routes, as identified on [Figure 1.0-28](#), so that all of the population areas in the EPZ are attached to one or another of the evacuation routes. This process is straightforward for those population areas immediately adjacent to the major evacuation routes, where it is obvious which population areas feed any given evacuation route. For population areas more distant from the major evacuation routes, the evacuation path is not as clear, and routings are made on the basis of travel time estimates. Some population areas are midway between evacuation routes and are equally well served by two different routes. In such cases, a line equidistant between the evacuation routes represents the boundary between the travel shed areas for the different evacuation routes. After establishing the travel shed of each route, the vehicles to be used in an evacuation (see [Section 2.4](#)) are assigned to the appropriate

evacuation route. [Table 1.0-10](#), [Table 1.0-11](#), and [Table 1.0-12](#) summarize the assigned traffic demand data for each primary evacuation route by general, transient, and special facility populations for the years 2008, 2016, and 2018.

The vehicle distributions used to determine the evacuation time estimates are calculated, totaled, and presented in [Table 1.0-7](#), [Table 1.0-8](#), [Table 1.0-9](#), [Table 1.0-17](#), [Table 1.0-18](#), and [Table 1.0-19](#). This same data summarizing the number of evacuating vehicles for the various population groups for years 2008, 2016, and 2018 are shown graphically on [Figure 1.0-18](#), [Figure 1.0-19](#), [Figure 1.0-20](#), [Figure 1.0-21](#), [Figure 1.0-22](#), [Figure 1.0-23](#), [Figure 1.0-24](#), [Figure 1.0-25](#), [Figure 1.0-26](#), and [Figure 1.0-27](#). It should be noted that populations in the 22° 10-mile radius sectors are not intended to match corresponding EPZ subarea population totals exactly as the radial sectors do not follow the exact boundaries established for the EPZ subareas. Also, the cities of Fulton and Rhineland are outside of the 10-mile radius. Their populations are included in the EPZ subarea population totals but are not included in the 22° 10-mile radius sector totals.

3.3 ROADWAY CAPACITY

The capacity of a roadway is the number of cars that can use the road in a given amount of time. The main constraint on the capacity of a roadway is a critical intersection or “bottleneck” location. This is a location where the flow of traffic is restricted, and as a result, will cause the time needed for evacuation to increase.

The capacity of an intersection is based on a maximum hourly vehicular flow of 1,400 vehicles per lane, with full assignment of the right-of-way and no cross-traffic (Transportation Research Board, 1985). At the critical intersections which establish the capacity of the evacuation routes, the total capacity is adjusted downward by 15 percent of the maximum to reflect this cross-street traffic. The resulting capacity is 1,200 vehicles per lane per hour (vph) on the roads.

4.0 ANALYSIS OF EVACUATION TIMES

The purpose of an evacuation is to remove the population of the affected subareas as rapidly as possible in order to minimize possible exposure to radiation. The evacuated population will be directed to Reception and Care Centers where they will be registered and monitored. The evacuation response times for the general populations, transient populations, and special facility populations are presented in [Table 1.0-13](#), [Table 1.0-14](#), [Table 1.0-15](#), and [Table 1.0-15](#). The assumptions and methodologies for making these calculations are discussed below.

4.1 ASSUMPTIONS AND METHODOLOGY

4.1.1 ADVERSE TIME LIMITING FACTORS TO CONSIDER

To estimate the time required for a population group to evacuate an area, a range of scenarios must be considered that include normal conditions, adverse conditions, and other variability that influences the ability of the overall population to respond to an evacuation alarm. These factors include day vs. night, workday vs. weekend, winter vs. summer, notification and preparation times, travel speed, traffic delays, weather, and other adverse conditions that may be present.

4.1.1.1 Time of Day

Daytime and weekdays are more critical periods than night time or weekends for an evacuation because more family members will be working, attending school, or away from home for some other reason. In most cases for the general population, this would necessitate a trip home to gather family and belongings. If an evacuation occurs during a morning Callaway Plant shift change, the largest worker population would be present as the 1st and 3rd shifts would be onsite and in transition at the same time.

4.1.1.2 Time of Year

Peak transient periods occur during the summer, but children are at home and many people take their vacation during the summer. Weather is generally more favorable in the summer than in winter. In contrast, children are in school and fewer people are on vacation during winter, resulting in a larger presence of the local population and increasing the wintertime evacuation demand. The plant population may be largest in spring or fall when outages are scheduled, involving the addition of approximately 1,500 total temporary (transient) workers.

4.1.1.3 Weather Conditions

Weather would also be a more critical factor during the winter than summer. Snowy or icy conditions would reduce roadway speeds and limit roadway capacity. Additionally, Highway 94 (as well as other roadways), which is the major southern evacuation route from the EPZ area between the Callaway Plant and the Missouri River, is subject to heavy flooding in the spring. There are potential alternative routes and mitigating measures that allow for diverting traffic in the event of flooding. However, traffic diversion will result in delays as diversion routes may be more circuitous, less improved, or otherwise limit traffic capacity. As indicated in the prior revision of the evacuation time estimate (AmerenUE, 2008), local road flooding on Highway 94 and other routes could extend the evacuation time by one to two hours while awaiting county resources to divert traffic or otherwise mitigate the impacts of flooding. Adverse weather in the late winter or early spring that results in both flooding and freezing (icy) road conditions would be the most limiting.

4.1.1.4 Callaway Plant Unit 2 Plant Construction

Over the next 10 years, the peak transient population will occur in 2016 as a result of the large number of workers added during construction of Callaway Plant Unit 2 (estimated to be 3,950 total workers for all shifts). The maximum number of workers onsite requiring evacuation is therefore estimated to be 5,017.

4.1.1.5 Summary: Worst Case Adverse Conditions

In summary, the worst weather condition under which an evacuation might occur would be in late winter/early spring with an occurrence of heavy/freezing rain causing local flooding. The worst time of day would be a morning evacuation at around 8:00 a.m. during the peak construction year of 2016. This would result in the highest combined residential, transient, and special facility population-traffic demand. At that time, transient workers' autos would represent approximately 26.6 percent of the evacuating vehicle traffic demand. Between 2016 and 2018 there is a nominal projected increase in the residential population of just less than 1 percent (186 persons). That growth is not significant as it will offset by a net decrease in the transient worker population which will drop from a high number of 5,017 evacuating workers in 2016, to a post-construction number of 2,369 evacuating workers by 2018. Further, more than half of the projected general population increase between 2016 and 2018 would be expected to occur in the Fulton Area within the EPZ, but out of the 10-mile radial zone.

4.1.2 TIME TO RECEIVE NOTIFICATION

Before an evacuation takes place, people must receive notification that an evacuation is underway. Provisions have been made to notify essentially all of the population within the EPZ of an evacuation within 15 minutes. It is assumed that the population will begin preparations to evacuate immediately upon receiving notification. This assumption applies to the general population, which is composed of the permanent residents and transients, and also to special facilities.

4.1.3 RESPONSE TIME OF TRANSIENT POPULATION GROUPS

Transient populations (other than Callaway Plant workers) have only to board their vehicles and exit the EPZ upon receiving the notice to evacuate, which will be faster than for the permanent residents that live within the EPZ, especially those who must first go home. There are currently approximately 377 regular plant workers that are part of the general population along with their families that reside within the EPZ. Based on the availability of temporary housing such as hotels and apartments, where regional growth is occurring (west and north of the present city limits of Fulton), the demographics of the regional skilled labor pool, and the other factors, it was estimated that 83 percent of workers who come into the area for the construction of Callaway Plant Unit 2 will reside in counties outside of the EPZ, and 17 percent will reside either temporarily or permanently in Callaway County. Based on current worker distribution, approximately 62 percent of these Callaway County workers were projected to reside within Fulton. It was assumed that of the remainder, half of those or approximately 19 percent would reside within the EPZ outside of Fulton. The remaining 19 percent would live beyond the EPZ in the vicinity of Kingdom City and beyond where additional transient housing is locally available. In the worst case, most of the transient plant workers (all but second shift) would be onsite at the time of evacuation. [Table 1.0-3](#) shows that only a small number of approximately 144 workers at peak construction in 2016 would be living within the EPZ and not be onsite at the time of an evacuation. It is unlikely that plant workers who are also permanent residents within the EPZ would return home after a plant evacuation, especially if directed to leave the EPZ and report to a Reception and Care Center(s). Most likely the families of these plant workers, if having no other transportation alternatives, would elect to evacuate by the same means as provided for the general non-auto owning population, reuniting with their plant worker relative at a Reception and Care Center(s). However, a calculation is provided for time comparison purposes for a plant worker that returns to a home residence within the EPZ to evacuate family members.

As long as roadway capacity is not exceeded resulting in backups, the demand load imposed by the departure of the transient population would not interfere with the time required for permanent residents to evacuate. Plant workers will experience a mobilization delay of up to 101 minutes (worst case in 2016) as the exiting traffic rate will be limited by an assumed two independent exits from the plant parking lots, with each exit having a vehicle traffic capacity of 1,200 cars per hour. Because of this mobilization delay exiting the plant during the peak year of construction, evacuation of plant worker families residing within the EPZ defines the time-limiting case for the evacuation time estimate in 2016. The time estimate calculation indicates that plant workers owning only one vehicle that is used for commuting to the Callaway Plant, should anticipate making other arrangements for their families and should not plan on returning home in the event an order is issued for public evacuation. The time estimate comparison of these cases is noted in by the summaries provided in [Table 1.0-13](#) and [Table 1.0-16](#).

4.1.4 AUTOMOBILE OWNERSHIP

There are two segments of the general population group: auto-owning, and non-auto-owning. Of the auto-owning group, those who are at work will require the most time to evacuate since it is assumed they will first return to their homes in the EPZ. On the average, these people are assumed to be no further than 20 miles from home and to drive 40 miles per hour. This is the same speed assumed for vehicles leaving the EPZ unless adverse weather conditions are present. Under adverse conditions, 30 miles per hour travel speed is assumed because of a 25 percent reduction in speed for such conditions (NUREG/CR-6863). Once at home, it is estimated that most people can be ready to leave within 60 minutes. An additional 5 minutes is added under adverse conditions to allow residents to prepare their vehicle for safe travel (e.g. remove any snow or ice, warm up vehicle, and defrost windows).

For people who do not own vehicles, the same amount of time for notification and preparation will be required: 75 minutes under normal conditions, 80 minutes under adverse conditions. The non-auto-owning population would not require the additional time required to travel back into the EPZ from work to prepare for evacuation (22 to 30 minutes depending on travel conditions). Instead, upon receiving notification, it is assumed that this group would already be at home and would begin to make immediate preparations to reach a Reception and Care Center. It is assumed that many of these people would be able to ride with friends or family who do own autos.

However, there are those that may not be able to secure a ride with others and would need to be accommodated by regional emergency planning. County and Special Facility evacuation plans are in place to use special facility buses (e.g., school buses) to complete the evacuation of non-auto-owning residents from the EPZ. However, residents in this population group must wait for evacuation of special facility populations first. Once special facility populations have been transported to designated Reception and Care Center(s), the buses would re-enter the EPZ to evacuate non-auto-owning residents.

Although the non-auto-owning residents would be ready to leave the EPZ slightly ahead of the auto-owning population, they will need to wait for a bus that is returning from transporting special facility residents to their designated Reception and Care Center. So, although the preparation time for the non-auto-owning population group is less than for the auto-owning population, the need to wait for transportation adds up to an additional 22 to 30 minutes to the evacuation time (depending on the road conditions), plus the time involved in waiting for completion of the initial evacuation of the special facility populations (which is between 86 and 108 minutes). Thus this group defines the longest estimated evacuation time of any population group residing within the EPZ.

The annual emergency preparedness brochure sent to local residents by AmerenUE and Callaway County emergency planning authorities also provides a method for disabled residents to arrange in advance for addressing special transportation needs in the event of a required evacuation.

The response times for the general population cases are summarized in [Table 1.0-13](#).

4.1.5 EVACUATION OF CALLAWAY PLANT WORKERS

Facility workers are considered part of the transient population but are addressed separately because of their large number concentrated at the center of the EPZ and because most likely they would be at the greatest risk for potential radiological exposure should an actual release occur. Under the current plant procedures, unless conditions warrant immediate and

simultaneous public notification and evacuation, Callaway Plant workers are notified first before the general population. Under the most likely scenario, no radiological release would have occurred. Evacuation of plant workers would be initiated but as a precautionary measure. The occurrence of a rapid release event resulting in radiological exposure outside the facility is considered a very unlikely probability.

It is assumed that all non-essential plant workers would be able to begin evacuation from the Callaway Plant within 15 minutes of notification to evacuate. Since these workers will be trained in how to respond to an evacuation notice, there would be a minimal delay expected in stopping work, getting to personal vehicles, and being ready to evacuate from parking areas. Some workers may be temporarily delayed in needing to secure their work environment, de-energizing operating machinery, exiting from elevated areas or confined spaces, stabilizing loads and cranes, removal of unnecessary protective clothing or safety equipment, collection of personal belongings, and then traveling the distance to personal vehicles to await exit and evacuation out of the EPZ.

As discussed in [Section 4.1.1](#), the worst case scenario for plant workers would be an evacuation under adverse weather conditions right at the time of the morning shift change. At this time, the night and the day shift are potentially onsite at the same time. Plant worker population estimates through 2018 are summarized in [Table 1.0-3](#). The plant worker population comprises more than 5,000 persons at the peak of construction reached in year 2016.

The concentration of worker vehicles at the center of the EPZ will place a significant capacity demand on local roadways. For calculating the evacuation time estimate, it is assumed two independent exits from the Callaway Plant facility, leading to local major evacuation roadways will be available. The current plan noting the configuration of worker parking lots and location of exits allows for three independent exits, but the use of one or more of these could be limited under a rapid release scenario. In the very unlikely event of a rapid release event occurring that results in the potential for radiological exposure, the plant population would be asked to exit in a manner that would limit the amount of exposure time within the radioactive plume. The direction of the plume would determine and may limit or prevent the use of certain evacuation routes that lie in the Plume Exposure Pathway. The direction and route(s) used for evacuation would be determined by plant Health Physics Staff at the time an evacuation notification is made.

The assumption in the ETE for calculating evacuation times for the transient worker population is that there will be at least two independent exits/routes for evacuation. However, if the evacuation routing out of the plant were to become severely limited to only one independent route, then the mobilization delay as noted in [Table 1.0-14](#) for the transient population evacuating subarea C1 would be doubled (202 minutes worst case).

Roadway capacity is limited to 1200 vehicles per hour, per lane, per exit. Plant workers will be instructed in advance regarding plant evacuation procedures so that in the event of an actual evacuation notification, traffic flow from the plant will proceed smoothly and timely so as to minimize any delay leaving the plant and to avoid traffic congestion or backup on local roadways.

The estimated evacuation route traffic demand for regional evacuation routes is shown on [Table 1.0-10](#), [Table 1.0-11](#), and [Table 1.0-12](#) and shows the traffic demand from the evacuating plant worker transient population as taking the more likely routes based on the prevailing wind direction, which is to the northeast (refer to meteorology in FSAR Section 2.7). However, as noted above, the transient worker population may be directed to take alternative routes to

limit exposure within the plume exposure pathway. The total surface road capacities within each EPZ subarea are shown on [Table 1.0-17](#), [Table 1.0-18](#), and [Table 1.0-19](#) which indicate that the regional road capacities would not be exceeded.

Other conditions which could influence evacuation time include flooding. A number of local routes are subject to seasonal flooding and detour, in particular, State Highway 94. Should there be severe flooding on State Highway 94 (or other roadways), evacuation time could be extended 1 to 2 hours in the affected area(s) until county resources are mobilized to reroute traffic or mitigate flood impacts.

4.2 CALCULATIONS

4.2.1 GENERAL POPULATION EVACUATION

It was assumed that the general population will require 15 minutes to receive notification, 30 minutes to drive into the EPZ to their home residence, and 60 minutes to prepare for an evacuation for a total of 1 hour and 45 minutes under normal conditions, and 2 hours under adverse conditions (refer to [Table 1.0-13](#) and [Table 1.0-16](#)). The following calculation estimates the amount of time needed by the general population to leave the EPZ, and the time to verify that evacuation is complete.

The capacity of the local roadways is more than adequate for the local population, and no time delays due to traffic back-up are anticipated. The following formula was used to calculate the time to enter/leave the EPZ to/from a given subarea:

$$T = (60 \text{ minutes/hr}) * D/S$$

Where:

T = elapsed time (in minutes) to enter/leave the EPZ to/from a given subarea

D = for a given subarea, the distance to be traveled from the point nearest to the plant to the EPZ boundary. When more than one evacuation route is available for a subarea, the longest direct route is assumed for the worst case

S = the speed of the evacuating vehicles (40 mph in normal conditions and 30 mph in adverse conditions).

For evacuation of non-auto owning residents, the travel time requires a round trip. The special facility buses used to evacuate this population group which must reenter the EPZ after completing the evacuation of their designated special facility populations. After re-entering the EPZ, buses must meet and pick up stranded residents. There is additional time assumed to load the non-auto owning residential population. The bus(es) must then turn around and drive out to exit the EPZ, discharging these residents at a Reception and Care Center(s). The evacuation time estimate also includes confirmation time which is assumed to be the same as for the general population due to the logistics of picking up individual residents who may need assistance. The general auto owning population requires 1 hour and 45 minutes to be at the point of leaving the EPZ (2 hours under adverse conditions). The special facility buses that come back to the EPZ for the non-auto-owning population, require 1 hour and 26 minutes (1 hour and 48 minutes under adverse conditions) to complete the evacuation of the special facility populations. Therefore, it is assumed that the time needed for the busses to evacuate special

facility populations will be used as the notification and preparation time for the evacuation of the non-auto owning population group.

The verification time is the time required to confirm evacuation has been completed and was included in the time estimate for each population group. Verification time and confirmation of evacuation is discussed in [Section 5.0](#). By adding the notification and preparation time to the travel times inside and outside of the EPZ, and factoring in the time for verification, the total time it will take to evacuate the EPZ from a given subarea was obtained for the various general populations. These calculated response time estimates for the general populations are summarized in [Table 1.0-13](#).

As noted earlier, a special general population case occurs for the evacuation of transient Callaway Plant worker families. The expectation is that if the only family transportation is being utilized by the plant worker and no other transportation is readily available, these families will end up utilizing the provisions made available for non-auto owning residents. Evacuating workers would be directed to exit the EPZ and meet at a Reception and Care Center(s) where they could reunite with their families at that location. However, for comparison purposes, these evacuation times were estimated assuming there is a remote possibility a plant worker might elect to stop and pickup up family members along a directed evacuation route. Evacuation of this population group is first dependent on the time required for the transient Callaway Plant workers to be able to leave the plant and drive to their home residence. Upon arriving, the preparations for evacuation in the same manner as the auto owning general population can begin. The final step is for the family to enter their available vehicle and continue the drive out of the EPZ. This special case becomes the limiting evacuation scenario (longest evacuation time) during the year 2016. This evacuation case is summarized in [Table 1.0-16](#).

4.2.2 TRANSIENT POPULATION EVACUATION

[Table 1.0-14](#) provides a summary of the evacuation time calculations for the transient population. The transient population is primarily limited to the concentrations in Fulton at the various hotels, motels, inns and the permanent plant and temporary construction workers at the Callaway Plant. The worst case evacuation time for the transient population occurs in the year 2016 at the height of Unit 2 construction when more than 5,000 workers may potentially be onsite at a given time and are given the order to evacuate. Although these workers are likely to be prepared to evacuate sooner than the general population, there is a delay due to the large number of cars and the limited capacity of plant exits to distribute traffic onto independent evacuation routes. At this peak period of construction, a time of 15 minutes is estimated for a Callaway Plant worker to mobilize (i.e., enter vehicle). However a delay of up to 101 minutes results from the bottleneck of vehicles in the plant parking lot. The worst case transient evacuation time is 198 minutes to exit the EPZ and confirm evacuation under normal conditions and 226 minutes under adverse conditions. Flooding in Highway 94 could result in an additional delay of up to 1 – 2 hours while traffic is rerouted or flooding is mitigated.

4.2.3 SPECIAL FACILITY POPULATION EVACUATION

Special facility populations evacuate to designated Reception and Care Centers. [Table 1.0-15](#) provides a summary of response times for the various special facility populations. The times are based on estimates reported in current special facility plans. The vehicles (buses) used for special facility evacuations contact emergency evacuation coordinators directly when departing the special facility and when they arrive at the designated Reception and Care Center(s). Because communication is direct with coordinators, an hour to confirm special facility population evacuation is assumed adequate.

4.3 EVACUATION TIME ESTIMATE SUMMARY

The maximum time for the auto-owning general population to evacuate the EPZ is 3 hours and 7 minutes (187 minutes) under normal conditions and 3 hours and 50 minutes (230 minutes) under adverse conditions.

The maximum time for the non-auto-owning general population to evacuate the EPZ is 3 hours and 36 minutes (216 minutes) under normal conditions and 4 hours and 33 minutes (273 minutes) under adverse conditions.

The maximum time for the Callaway Plant worker family to evacuate is 4 hours and 3 minutes (243 minutes) under normal conditions and 4 hours and 36 minutes (276 minutes) under adverse conditions. This maximum time estimate occurs in 2016 at peak construction for Callaway Plant Unit 2, and decreases by 50 minutes by year 2018.

The maximum time for the transient population to evacuate the EPZ is 3 hours 19 minutes (199 minutes) under normal conditions and 3 hours 46 minutes (226 minutes) under adverse conditions. This maximum time estimate occurs in the year 2016 at the peak of construction.

The maximum time for special facility populations to evacuate is 2 hours and 26 minutes (146 minutes) under normal conditions and 2 hours 48 minutes (168 minutes) under adverse conditions.

The response times and evacuation time estimates for all population groups within all EPZ subareas are presented and summarized in [Table 1.0-13](#), [Table 1.0-14](#), [Table 1.0-15](#), [Table 1.0-16](#), [Table 1.0-17](#), [Table 1.0-18](#), and [Table 1.0-19](#).

5.0 CONFIRMATION OF EVACUATION

Emergency workers at access control points will be able to observe the beginning and end of the traffic flow out of an evacuation area. Access control personnel should and will be able to confirm the cessation of traffic flow for each of the evacuation routes. Emergency workers within the evacuation area (such as transportation providers, field monitoring teams, traffic control personnel, etc.) will be able to provide information on the progress of the evacuation, people who need assistance, or observed problems. NUREG-0654 requires confirmation time to be included for the purposes of calculating the evacuation time estimate. One hour is added for the confirmation time of the general populations and transient populations evacuating under normal conditions, and one hour and 20 minutes are added to both populations evacuating under adverse conditions to account for the decrease in road speed. Buses are assumed to be in radio or phone contact with dispatchers and evacuation response coordinators as they report upon departure from the special facility and upon arrival at their arrival at the Special Reception and Care Centers to response coordinators. Thus, the time required to confirm the departure and arrival of buses transporting special facilities to Reception and Care Centers or evacuating other special needs individuals (e.g. non-auto owning, disabled, etc.) is not dependent on road conditions as might be the case for the general population where observation for a reduced and eventual stop of traffic flow may be necessary. Thus one hour is assumed for special facility evacuation confirmation under all conditions.

Individuals having special notification or transportation needs are identified in a data file, and will be provided individual assistance during an evacuation in accordance with their needs. All evacuating special facilities go to Reception and Care Centers. Special facility plans indicate that they will contact emergency officials upon departure from the facility and upon arrival at the Special Reception and Care Center. As the longest special facility evacuation time is 1 hour

and 48 minutes under adverse conditions and the longest travel time is 30 minutes from any EPZ subarea, confirmation of arrival at the Reception and Care Center(s) should be completed within 180 minutes, depending upon the travel time from the EPZ boundary to the Reception and Care Center(s).

The longest evacuation time estimate indicates that more than 4 and one half hours under adverse conditions may be required to complete and confirm the evacuation of Callaway Plant worker families at the peak year of construction in 2016. This case is limiting due to the traffic delay resulting from a bottle neck occurring exiting the plant parking lot. Pre and post construction of Unit 2, the general non-auto owning resident becomes the limiting consideration requiring the longest time through confirmation in the evacuation time estimate.

6.0 REFERENCES

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Table 1.0-1—Permanent Resident Population within the EPZ

Jurisdiction	Census Year 2000			Projected Year 2008 ⁽¹⁾			Projected Year 2016 ⁽²⁾			Projected Year 2018 ⁽³⁾		
	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
	Population ⁽⁴⁾	Population ⁽⁵⁾	Population ⁽⁵⁾	Population	Population	Population	Population	Population	Population	Population	Population	Population
Callaway County	17,366		5,094	18,201		5,339	18,939		5,556	19,108		5,605
City of Fulton		12,084			12,665			13,179			13,296	
Mokane		188			197			205			207	
Osage County	943		487	988		510	1,028		531	1,038		536
Chamois		456			478			497			502	
Gasconade County	123			129			134			135		
Morrison	—	123			129			134			135	
Montgomery County	677		501	710		525	738		546	745		551
Rhineland		176			184			192			194	
Total	19,109	13,027	6,082	20,028	13,654	6,375	20,840	14,207	6,633	21,026	14,334	6,692

Notes:

1. Represents a projected estimate of population using 1.0481 x year 2000 population as US Census Bureau Scaling Factor for year 2008
2. Represents a projected estimate of population using 1.0906 x year 2000 population as US Census Bureau Scaling Factor for year 2016
3. Represents a projected estimate of population using 1.1003 x year 2000 population as US Census Bureau Scaling Factor for year 2018
4. These are confirmed US Census Bureau population figures for the listed jurisdictions
5. Total population basis for year 2000 equals the 10-mile radius sector population reported by AmerenUE of 6,849 plus the US Census Bureau populations of 12,084 for Fulton and 176 for Rhineland which are outside of the 10-mile radius but within the Emergency Planning Zone

Table 1.0-2—Transient Populations within the 4-County EPZ Region

Location	Evacuating Population	Vehicles Evacuating	Available Rooms	EPZ Sub Area	Location latitude/longitude ⁽⁷⁾
Budget Host – Westwoods Motel	21	11	21	C9	38° 50' 50.53" N x -91° 58' 01.17" W
Holiday Inn Express	63	32	63	C9	38° 52' 40.36" N x -91° 57' 34.99" W
Loganberry Inn	6	3	6	C9	38° 50' 58.79" N x -91° 57' 10.54" W
Travelier Motel	32	16	32	C9	38° 50' 18.39" N x -91° 57' 08.11" W
Total EPZ Hotel/Motel/Inn Population⁽²⁾	122	62	122	-	-
Churchill Memorial (at Westminster College)	82	28	-	C9	38° 50' 55.62" N x -91° 57' 15.61" W
Harmony Hill Youth Camp	250	84	-	C2	38° 46' 42.89" N x -91° 50' 06.31" W
Katy Trail State Park ⁽³⁾	200	67	-	C7, C5, C4, M2	38° 42' 36.80" N x -91° 46' 27.85" W
Reform Conservation Area ⁽⁴⁾	85	29	-	C1, C5, C6	38° 45' 45.53" N x -91° 46' 56.34" W
Wildwood Lot Owners Association	300	100	-	C3	38° 47' 41.86" N x -91° 46' 31.47" W
Total EPZ Tourist/Camper Population	917	308	-	-	-
Callaway NPP Site Workers (2008)	2,054	1,743	-	C1	38° 45' 45.53" N x -91° 46' 56.34" W
Callaway NPP Site Workers (2016)	5,017 ⁽⁶⁾	4,023	-	C1	38° 45' 45.53" N x -91° 46' 56.34" W
Callaway NPP Site Workers (2018)	2,371	2,060	-	C1	38° 45' 45.53" N x -91° 46' 56.34" W
Total Transient Population Evacuating (2008)⁽⁵⁾	3,093	2,113	-	-	-
Total Transient Population Evacuating (2016)⁽⁵⁾	6,056	4,393	-	-	-
Total Transient Population Evacuating (2018)⁽⁵⁾	3,410	2,430	-	-	-

Notes:

1. These population figures are based on recent (January-February 2008) telephone or written contacts with the facility or estimates based on previously reported data. Worker estimates are based on existing plant operating and maintenance labor and the planned level of effort for Unit 2 construction.
2. Transient population in hotels, motels, and inns are determined by assuming 2 people per room at a 50% occupancy rate. The number of evacuating autos is calculated at 2 persons per vehicle temporarily staying at these facilities and 3 persons per vehicle visiting all other locations.
3. The Katy Trail is a 225 mile (365 km) Rails to Trails bike trail across the state of Missouri. The longitude and latitude indicated is the approximate closest point the trail passes near to Callaway NPP. Population figure represents Katy Trail State Park peak trail use per day in the EPZ, from Mokane east to McKittrick, based on trail counter data reported by Missouri Department of Natural Resources.
4. The Reform Conservation Area is comprised of Ameren owned property extending beyond the Owner Controlled Area of the Plant that is managed for regional conservation and recreation purposes under agreement with the Missouri Department of Conservation. It is part of the contiguous parcel of land on which the plant is built.
5. It is assumed that other than for site workers, the transient population at these facilities will remain relatively stable between 2008 and 2018. The site worker population for purposes of determining the

demand estimate will decrease (as a result of the completion of Callaway Plant Unit 2 construction) by 2658 persons by year 2018.

6. Reflects the maximum case of combined regular plant, outage, and construction workers onsite/evacuating during the peak construction year of 2016. Refer to [Table 1.0-3](#) for a detailed breakdown of the worker population estimate. Up to 86 essential plant workers will remain/shelter onsite to manage/respond to the emergency. This evacuating population represents a peak traffic demand load of 4023 automobiles carrying 1.3 workers per vehicle for temporary worker populations (outage and construction) and 1.0 worker per vehicle for regular non-essential plant employee populations, evacuating from the Plant EPZ subzone C1.
7. Longitude and latitude locations should be considered approximate. They were developed from a variety of mapping resources and satellite imagery for the purpose of providing the general vicinity location of the feature within the EPZ. However, the coordinates are not necessarily from sources such as USGS topographic maps, which have been validated back to a certified State or North American coordinate system. Some reference an exact building location, while others reference a driveway entrance (for multi-complex facilities), a nearby street, or parcel location.

Table 1.0-3—Summary of Transient Plant Worker Populations for Years 2008 through 2018

Worker Category	Year 2008 Population Requiring Evacuation (Current Operation)		Year 2016 Population Requiring Evacuation (Peak Construction Unit 2)		Year 2018 Population Requiring Evacuation (Unit 2 Full Operation)	
	Worker Population	Evacuating Vehicles ⁽²⁾	Worker Population	Evacuating Vehicles ⁽²⁾	Worker Population	Evacuating Vehicles ⁽²⁾
Unit 1 Day Shift Plant Personnel	661	661	661	661	661	661
Essential Personnel	76 ⁽³⁾	-	76 ⁽³⁾	-	86 ⁽³⁾	-
Unit 1 Night Shift Plant Personnel	43	43	43	43	43	43
Outage Workers Day Shift	1,275	981	1,275	981	1,275	981
Outage Workers Night Shift	75	58	75	58	75	58
Unit 2 Day Shift Construction Workers	0	0	2,765	2,127	0	-
Unit 2 Night Shift Construction Workers	0	0	198	153	0	-
Unit 2 Day Shift Plant Personnel	0	0	0	0	299	299
Unit 2 Night Shift Plant Personnel	0	0	0	0	18	18
Second Shift Workers Not Onsite but Living Within EPZ ⁽⁴⁾	98	N/A	507	N/A	113	N/A
Plant Evacuation Totals	2,054	1,743	5,017	4,023⁽⁵⁾	2,371⁽⁴⁾	2,060

Notes:

1. Maximum onsite Plant Worker Population occurs at Morning Shift Change when both first shift and 3rd shift personnel are onsite and transitioning. There will be 2nd (swing) shift worker populations. However, these are small compared to the combined population of the first shift. Also, as a result of 3 staggered morning shifts, only last change of the morning shift would be onsite when the swing shift begins arriving.
2. Assumes 1.3 people per vehicle for temporary workers (construction and outage) and 1 person per vehicle for regular plant workers.
3. Essential response personnel to remain onsite including technicians, operators, and response coordinators for Unit 1 or Unit 2 response. Each Unit when operational requires 10 persons assigned as power reactor operators and control room support staff.
4. These workers include all second shift workers (regular plant workers, construction workers, and outage workers) that are not onsite at the time of evacuation, but they reside or are expected to reside within the EPZ. Their traffic demand is accounted for in totals for the general population or for the various hotels/motels/inns, campgrounds, etc. This population is not included in the plant evacuation total.
5. Reflects the worst case traffic demand estimate.

Table 1.0-4—Special Facility Populations within the 4-County EPZ Region - School Populations

All Non-Sheltering			
School ⁽¹⁾	Students & Staff ^(1, 2, 3)	Subarea	Latitude x Longitude ⁽⁴⁾
Callaway R-II South (Mokane)	1,097	C7	38° 41' 14.61" N x -91° 53' 23.22" W
Fulton Public Schools	2,727	C9	-
Fulton Academy	Included above	C9	38° 51' 54.12" N x -91° 56' 07.72" W
Fulton Senior High School	Included above	C9	38° 52' 23.50" N x -91° 56' 23.50" W
Fulton Middle School	Included above	C9	38° 51' 20.60" N x -91° 56' 30.08" W
Fulton Elementary Schools	Included above	C9	-
Bartley	Included above	C9	38° 50' 18.63" N x -91° 57' 08.53" W
Bush	Included above	C9	38° 51' 12.81" N x -91° 56' 07.19" W
McIntire	Included above	C9	38° 50' 49.43" N x -91° 57' 34.62" W
Missouri School for the Deaf	340	C9	38° 50' 50.44" N x -91° 56' 31.18" W
Osage R-I	287	O1	-
Chamois High School	Included above	O1	38° 40' 07.28" N x -91° 46' 21.53" W
Osage City Elementary School	Included above	O1	38° 40' 07.28" N x -91° 46' 21.53" W
St. Peter's Parochial School	174	C9	38° 51' 41.14" N x -91° 56' 12.71" W
William Woods University - Fulton Preschool	17	C9	38° 51' 30.46" N x -91° 56' 56.78" W
Williamsburg Elementary	228 ⁽⁵⁾	(5)	38° 55' 04.12" N x -91° 43' 16.81" W
Total School Population Evacuating	4,642		

Notes:

1. Student populations are also included in the residential population figures presented on [Table 1.0-1](#). Upon notification to evacuate, students are not returned to home residence locations within the EPZ, but are evacuated to designated assembly areas according to school facility evacuation plans.
2. Institutional Staff populations (e.g. school teachers, hospital staff, nursing home staff, attendants, security guards, etc.) include maximum staff normally present at any one time, but not second and third shifts.
3. A 2008 survey indicated that total regional school populations have declined some since 2000. However, because of anticipated regional population growth through 2018 and additional enrollment that may result from some transient construction workers temporarily relocating families to the area, for regional evacuation planning purposes, school populations are left unchanged since the last revision of the Evacuation Time Estimate report.
4. Longitude and latitude locations should be considered approximate. They were developed from a variety of mapping resources and satellite imagery for the purpose of providing the general vicinity location of the feature within the EPZ. However, the coordinates are not necessarily from sources such as USGS topographic maps, which have been validated back to a certified State or North American coordinate system. Some reference an exact building location, while others reference a driveway entrance (for multi-complex facilities), a nearby street, or parcel location.
5. This Callaway County Elementary School is shown on the map but lies just outside the EPZ to the north-northeast. Its population is not included in the evacuation planning estimate totals. In the event of an evacuation, students that live within the EPZ are not required to return to the EPZ, but are covered by a special facility plan.

Table 1.0-5—Special Facility Populations within the 4-County EPZ Region – Non-School Populations

Sheltering ⁽²⁾					
Institution	Residents/ Patients	Staff ⁽³⁾	Total	Sub area	Latitude x Longitude ⁽⁴⁾
Ashbury Heights RCFI	12	1	13	C9	38° 50' 23.46" N x -91° 57' 39.64" W
Bristol Manor	12	1	13	C9	38° 50' 30.29" N x -91° 57' 46.49" W
Callaway Community Hospital	53	49	102	C9	38° 50' 32.17" N x -91° 57' 58.63" W
Callaway County Jail (County Correctional Center)	104	20	124	C9	38° 50' 39.01" N x -91° 55' 57.30" W
Churchill Terrace of Fulton - Assisted Living	42	12	54	C9	38° 50' 35.53" N x -91° 57' 51.78" W
Fulton Manor Care Center	52	21	73	C9	38° 52' 04.16" N x -91° 56' 24.23" W
Fulton Nursing and Rehabilitation Center	100	21	121	C9	38° 51' 40.20" N x -91° 56' 38.21" W
Fulton Reception & Diagnostic Center	1,302	75	1,377	C9	38° 50' 45.12" N x -91° 55' 20.07" W
Fulton State Hospital	496	220	716	C9	38° 50' 49.73" N x -91° 56' 26.60" W
Jefferson Lodge	94	18	112	C9	38° 51' 09.49" N x -91° 56' 59.02" W
Presbyterian Manor at Fulton	36	21	57	C9	38° 51' 05.06" N x -91° 56' 46.27" W
Riverview Nursing Home (Mokane)	60	14	74	C7	38° 40' 51.39" N x -91° 52' 52.89" W
Non-School Populations —Non-Sheltering					
Institution	Residents/ Patients	Staff (3)	Total	Sub Area	Latitude x Longitude ⁽²⁾
Bright Beginnings Preschool	closed ⁽⁵⁾	-	-	C9	38° 52' 51.52" N x -91° 56' 42.46" W
Care A Lot Learning Center	49	7	56	C9	38° 50' 21.76" N x -91° 57' 19.65" W
Central Missouri HDC-CDC	20	5	25	C9	38° 50' 04.04" N x -91° 57' 37.31" W
Growing Years Child Development Center	40	7	47	C9	38° 51' 02.39" N x -91° 58' 12.01" W
Missouri Girls Town ⁽⁶⁾	56	50	106	C9, C10	-
Hope House	Included Above	-	-		38° 55' 52.54" N x -91° 48' 10.72" W
OH House	Included Above	-	-		38° 55' 52.54" N x -91° 48' 10.72" W
Gerbes House	Included Above	-	-		38° 55' 52.54" N x -91° 48' 10.72" W
McClain House	Included Above	-	-		38° 55' 52.54" N x -91° 48' 10.72" W
Karches House	Included Above	-	-		38° 55' 52.54" N x -91° 48' 10.72" W
Mudd House	Included Above	-	-		38° 55' 52.54" N x -91° 48' 10.72" W
Step House	Included Above	-	-		38° 51' 03.03" N x -91° 58' 34.86" W
Rosa Parks Center	12	2	14	C9	38° 51' 28.77" N x -91° 56' 57.27" W
Total Non-School Special Facility Population	2,540	544	3,084	-	-
Total Non-School Population Evacuating	177	71	248	-	-

Notes:

1. These population figures are based on recent (January-February 2008) telephone or written contacts with the facility, numbers contained in the most current special facility plans, estimates based on previously reported data or extrapolations from population/demographic data reported by the US

Census Bureau.

2. Denotes onsite sheltering populations at facilities that will shelter residents according to facility sheltering plans and will not contribute vehicles to the traffic demand estimate or extend the evacuation time for the EPZ. These populations are not included in the total non-school population evacuating.
3. Staff populations include maximum staff normally present at any one time, but not second and third shifts.
4. Longitude and latitude locations should be considered approximate. They were developed from a variety of mapping resources and satellite imagery for the purpose of providing the general vicinity location of the feature within the EPZ. However, the coordinates are not necessarily from sources such as USGS topographic maps, which have been validated back to a certified State or North America coordinate system. Some reference an exact building location, while others reference a driveway entrance (for multi-complex facilities), a nearby street, or parcel location.
5. The owner reported during a phone confirmation on 2/27/08 that the facility is now closed.
6. Missouri Girls Town has two main campuses. The population is divided with 15 persons located in Subarea C9 in downtown Fulton; the remainder at the larger residence location in Subarea C10.

Table 1.0-6—Calculation of Housing Unit Occupancy Factors and Automobile Evacuation Availability Factors Based on 4-County Wide Regional Demographics

	Callaway County	Gasconade County	Montgomery County	Osage County
Total Population	40,766	15,342	12,136	13,062
Total Occupied Housing Units (OHUs)	14,416	6,171	4,775	4,922
Ratio of population to total OHUs ⁽²⁾	2.828	2.486 ⁽²⁾	2.542	2.654
0 Vehicle OHUs	786	377	312	307
1 Vehicle OHUs	4,308	1,856	1,343	1,062
2 Vehicles OHUs	5,761	2,511	1,842	1,867
3 Vehicles OHUs	2,626	1,050	887	1,145
4 Vehicles OHUs	725	266	276	423
5+ Vehicles OHUs	210	111	115	118

	Callaway County	Gasconade County	Montgomery County	Osage County
0 Vehicle OHUs vehicles evacuating	0	0	0	0
1 Vehicle OHUs vehicles evacuating ⁽³⁾	4,308	1,856	1,343	1,062
2 Vehicle OHUs vehicles evacuating ⁽⁴⁾	8,642	3,767	2,763	2,801
3 Vehicle OHUs vehicles evacuating ⁽⁵⁾	5,252	2,100	1,774	2,290
4 Vehicle OHUs vehicles evacuating ⁽⁵⁾	1,450	532	552	846
5+ Vehicle OHUs vehicles evacuating ⁽⁵⁾	420	222	230	236
Total Vehicles Evacuating	20,072	8,477	6,662	7,235
Ratio of Evacuating Vehicles to total OHUs ⁽⁶⁾	1.392	1.374	1.395	1.470

Notes:

1. Population and demographic data obtained from Missouri Census Data Center report of US Census Bureau Official Year 2000 Decennial Census. The overall variability between assuming the most conservative factors and the least conservative factors would result in a net difference in the traffic demand estimate (i.e. number of general population trips) of 21.7 percent. Since the roadway capacity is not exceeded, the net difference of using the most conservative factors in later calculations results in no increase in the evacuation time estimate for the general population.
2. The most conservative ratio of population to occupied housing units in the 4-county region is 2.486 persons per OHU, since it results in the highest OHU, therefore the highest number of vehicles. This is used for calculation purposes in [Table 1.0-7](#), [Table 1.0-8](#), and [Table 1.0-9](#).
3. Assumes 1 vehicle evacuating from each OHU
4. Assumes an average of 1.5 vehicles evacuating from each OHU
5. Assumes 2 vehicles evacuating from each OHU
6. The most conservative vehicle availability factor (e.g. that would result in the largest traffic demand estimate) in the 4-county region is 1.470 vehicles available per OHU. This value is used for calculation purposes in [Table 1.0-7](#), [Table 1.0-8](#), and [Table 1.0-9](#).

Table 1.0-7—Sector Residential Population Evacuation Traffic Loading Summary for Operating Year 2008⁽¹⁾

Radial Sector (22 °)	2-Mile Radius (3 km)			5-Mile Radius (8 km)			10-Mile Radius (16 km)				
	Sector Population ⁽²⁾ (0 - 2 miles) (0 - 3 km)	Occupied Housing Units ⁽³⁾	Vehicles Evacuating ⁽⁴⁾	Sector Population ⁽²⁾ (2 - 5 miles) (3 - 8 km)	Cumulative Population	Occupied Housing Units ⁽³⁾ (cumulative)	Vehicles Evacuating ⁽⁴⁾ (cumulative)	Sector Population ⁽²⁾ (5 - 10 miles) (8 - 16 km)	Cumulative Population	Occupied Housing Units ⁽³⁾ (cumulative)	Vehicles Evacuating ⁽⁴⁾ (cumulative)
N	0	0	0	59	59	24	35	267	326	131	193
NNE	0	0	0	101	101	40	59	304	405	163	239
NE	0	0	0	56	56	22	33	183	239	96	141
ENE	2	1	1	30	32	13	19	71	104	42	61
E	0	0	0	21	21	8	12	61	82	33	48
ESE	0	0	0	165	165	66	97	81	245	99	145
SE	0	0	0	152	152	61	90	122	274	110	162
SSE	0	0	0	48	48	19	29	246	295	118	174
S	0	0	0	41	41	16	24	713	754	303	446
SSW	0	0	0	177	177	71	105	87	264	106	156
SW	0	0	0	146	146	59	86	637	783	315	463
WSW	7	3	4	31	39	16	23	440	479	193	283
W	16	6	9	135	151	61	89	523	674	271	399
WNW	2	1	1	172	174	70	103	694	868	349	513
NW	0	0	0	70	70	28	42	533	604	243	357
NNW	16	6	9	80	95	38	56	690	785	316	464
Sector SUM	43	17	25	1,483	1,526	614	902	5,652	7,178	2,888	4,245
Fulton ⁽⁵⁾									12,665	5,095	7,489
Rhineland ⁽⁵⁾									184	74	109
Worker Autos (from Table 1.0-3)											
Special Facility Buses/Trips (from Table 1.0-12)											
Transient Autos (from Table 1.0-2)											
Total Evacuating Population Automobile Demand Estimate ⁽⁶⁾									20,028	8,056	14,216

Notes:

1. Populations are projected from base data reported by the Year 2000 Decennial Census and established US Census Bureau Incremental year population trend

factors. Roundoff of decimal fraction may result in a variability of 1 - 2 persons when columns or rows are added or accumulated.

2. Original radial sector populations and populations assigned to EPZ subzones as provided in Attachment I are based on data reported in 2002 developed and/or reviewed by Ameren that included Missouri Census Data Center summaries, local and regional radiological emergency response plans, review of 911 and local census block data, and other community data.
3. A population weighted average of 2.486 persons per OHU across all 4 counties is used for calculation purposes.
4. An average vehicle evacuation use factor of 1,470 vehicles per OHU is assumed for estimating the total residential traffic demand load.
5. The population within the 10-mile plant radius plus the populations in Fulton and Rhineland comprise the total estimated residential populations requiring evacuation from the EPZ.
6. The automobile demand estimate is calculated for the general population by dividing the general population totals by 2.486 persons per occupied house and multiplying that result by 1.470 vehicles per occupied house for the total number of vehicles. The automobile demand for transient populations is calculated by dividing the number of tourist transients by 3, the number staying in hotels by 2, the number of outage and construction workers by 1.3, and the number of regular plant workers by 1 and adding those results up for the total. The automobile demand estimate for special facilities is determined by dividing the number of evacuating person at each facility by 40 persons per vehicle, rounding up to a whole number and multiplying that result by 2 to determine the total number of vehicle trips into and back out of the EPZ for each bus.

Table 1.0-8—Sector Residential Population Evacuation Traffic Loading Summary for Operating Year 2016

Radial Sector (22 °)	2-Mile Radius (3 km)				5-Mile Radius (8 km)				10-Mile Radius (16 km)			
	Sector Population ⁽²⁾ (0 - 2 miles) (0 - 3 km)	Occupied Housing Units ⁽³⁾	Vehicles Evacuating ⁽⁴⁾		Sector Population ⁽²⁾ (2 - 5 miles) (3 - 8 km)	Cumulative Population	Occupied Housing Units ⁽³⁾ (Cumulative)	Vehicles Evacuating ⁽⁴⁾ (Cumulative)	Sector Population ⁽²⁾ (5 - 10 miles) (8 - 16 km)	Cumulative Population	Occupied Housing Units ⁽³⁾ (Cumulative)	Vehicles Evacuating ⁽⁴⁾ (Cumulative)
N	0	0	0		61	61	25	36	278	339	136	201
NNE	0	0	0		105	105	42	62	316	421	169	249
NE	0	0	0		58	58	23	34	191	249	100	147
ENE	2	1	1		32	34	14	20	74	108	43	64
E	0	0	0		22	22	9	13	63	85	34	50
ESE	0	0	0		171	171	69	101	84	255	103	151
SE	0	0	0		158	158	64	94	127	285	114	168
SSE	0	0	0		50	50	20	30	256	306	123	181
S	0	0	0		43	43	17	25	742	784	315	464
SSW	0	0	0		184	184	74	109	91	275	111	163
SW	0	0	0		152	152	61	90	663	815	328	482
WSW	8	3	5		33	40	16	24	458	498	200	295
W	16	7	10		141	157	63	93	544	701	282	415
WNW	2	1	1		179	181	73	107	722	903	363	534
NW	0	0	0		73	73	29	43	555	628	253	371
NNW	16	7	10		83	99	40	59	718	817	329	483
Sector SUM	45	18	26		1,543	1,588	639	939	5,882	7,470	3,005	4,417
Fulton ⁽⁵⁾												
Rhineland ⁽⁵⁾										13,179	5,301	7,793
										192	77	113
Worker Autos (from Table 1.0-3)												4,023
Special Facility Buses/Trips (from Table 1.0-12)												260
Transient Autos (from Table 1.0-2)												370
Total Evacuating Population Automobile Demand Estimate ⁽⁶⁾										20,840	8,383	16,976

Notes:

1. Populations are projected from base data reported by the Year 2000 Decennial Census and established US Census Bureau Incremental year population trend

factors. Roundoff of decimal fraction may result in a variability of 1 - 2 persons when columns or rows are added or accumulated.

2. Original radial sector populations and populations assigned to EPZ subzones as provided in Attachment I are based on data reported in 2002 developed and/or reviewed by Ameren that included Missouri Census Data Center summaries, local and regional radiological emergency response plans, review of 911 and local census block data, and other community data.
3. A population weighted average of 2.486 persons per OHU across all 4 counties is used for calculation purposes.
4. An average vehicle evacuation use factor of 1.470 vehicles per OHU is assumed for estimating the total residential traffic demand load.
5. The population within the 10-mile plant radius plus the populations in Fulton and Rhineland comprise the total estimated residential populations requiring evacuation from the EPZ.
6. The automobile demand estimate is calculated for the general population by dividing the general population totals by 2.486 persons per occupied house and multiplying that result by 1.470 vehicles per occupied house for the total number of vehicles. The automobile demand for transient populations is calculated by dividing the number of tourist transients by 3, the number staying in hotels by 2, the number of outage and construction workers by 1.3, and the number of regular plant workers by 1 and adding those results up for the total. The automobile demand estimate for special facilities is determined by dividing the number of evacuating person at each facility by 40 persons per vehicle, rounding up to a whole number and multiplying that result by 2 to determine the total number of vehicle trips into and back out of the EPZ for each bus.

Table 1.0-9—Sector Residential Population Evacuation Traffic Loading Summary for Operating Year 2018

Radial Sector (22 °)	2-Mile Radius (3 km)			5-Mile Radius (8 km)			10-Mile Radius (16 km)				
	Sector Population ⁽²⁾ (0 - 2 miles) (0 - 3 km)	Occupied Housing Units ⁽³⁾	Vehicles Evacuating ⁽⁴⁾	Sector Population ⁽²⁾ (2 - 5 miles) (3 - 8 km)	Cumulative Population	Occupied Housing Units ⁽³⁾ (Cumulative)	Vehicles Evacuating ⁽⁴⁾ (Cumulative)	Sector Population ⁽²⁾ (5 - 10 miles) (8 - 16 km)	Cumulative Population	Occupied Housing Units ⁽³⁾ (Cumulative)	Vehicles Evacuating ⁽⁴⁾ (Cumulative)
N	0	0	0	62	62	25	36	281	342	138	202
NNE	0	0	0	106	106	42	62	319	425	171	251
NE	0	0	0	58	58	23	34	193	251	101	148
ENE	2	1	1	32	34	14	20	75	109	44	64
E	0	0	0	22	22	9	13	64	86	35	51
ESE	0	0	0	173	173	69	102	85	257	104	152
SE	0	0	0	160	160	64	94	128	287	116	170
SSE	0	0	0	51	51	20	30	259	309	124	183
S	0	0	0	43	43	17	25	748	791	318	468
SSW	0	0	0	186	186	75	110	91	277	112	164
SW	0	0	0	153	153	62	90	669	822	331	486
WSW	8	3	5	33	41	16	24	462	503	202	297
W	17	7	10	142	158	64	94	549	707	285	418
WNW	2	1	1	180	183	73	108	728	911	366	539
NW	0	0	0	74	74	30	44	560	634	255	375
NNW	17	7	10	84	100	40	59	724	824	332	487
Sector SUM	45	18	27	1,557	1,602	644	947	5,934	7,536	3,031	4,456
Fulton ⁽⁵⁾											
Rhineland ⁽⁵⁾									13,296	5,348	7,862
									194	78	115
Worker Autos (from Table 1.0-3)											2,060
Special Facility Buses/Trips (from Table 1.0-12)											260
Transient Autos (from Table 1.0-2)											370
Total Evacuating Population Automobile Demand Estimate ⁽⁵⁾									21,026	8,458	15,123

Notes:

1. Populations are projected from base data reported by the Year 2000 Decennial Census and established US Census Bureau Incremental year population trend

factors. Roundoff of decimal fraction may result in a variability of 1 - 2 persons when columns or rows are added or accumulated.

2. Original radial sector populations and populations assigned to EPZ subzones as provided in Attachment I are based on data reported in 2002 developed and/or reviewed by Ameren that included Missouri Census Data Center summaries, local and regional radiological emergency response plans, review of 911 and local census block data, and other community data.
3. A population weighted average of 2.486 persons per OHU across all 4 counties is used for calculation purposes.
4. An average vehicle evacuation use factor of 1.470 vehicles per OHU is assumed for estimating the total residential traffic demand load.
5. The population within the 10-mile plant radius plus the populations in Fulton and Rhineland comprise the total estimated residential populations requiring evacuation from the EPZ.
6. The automobile demand estimate is calculated for the general population by dividing the general population totals by 2.486 persons per occupied house and multiplying that result by 1.470 vehicles per occupied house for the total number of vehicles. The automobile demand for transient populations is calculated by dividing the number of tourist transients by 3, the number staying in hotels by 2, the number of outage and construction workers by 1.3, and the number of regular plant workers by 1 and adding those results up for the total. The automobile demand estimate for special facilities is determined by dividing the number of evacuating person at each facility by 40 persons per vehicle, rounding up to a whole number and multiplying that result by 2 to determine the total number of vehicle trips into and back out of the EPZ for each bus.

Table 1.0-10—Traffic Assigned to Primary Evacuation Routes - Year 2008

Evacuation Route	Route Number	General Population Estimated Evacuation Vehicle Demand	Transient Population Estimated Evacuation Vehicle Demand	Special Facility Estimated Evacuation Vehicle Demand
A	U.S. Highway 54 East	2,091	30	66
B	Route Z	1,192	0	0
C	Route JJ	560	889	0
D	Route D	187	108	6
E	Route YY	125	0	0
F	Route P	160	0	0
G	Route K	197	6	0
H	State Route 94 East	637	25	0
I	State Route 100 East	260	0	0
J	Route N	57	0	0
K	State Route 89	314	0	16
L	State Route 100 West	267	0	0
M	State Route 94 West	987	896	56
N	U.S. Highway 54 West	1,984	36	50
O	Route F	1,796	30	66
P	Route O	1029	93	0
Total		11,843	2,113	260

Total Estimated 2008 Traffic Demand all routes = 14,216 vehicles/trips

Table 1.0-11—Traffic Assigned to Primary Evacuation Routes - Year 2016

Evacuation Route	Route Number	General Population Estimated Evacuation Vehicle Demand	Transient Population Estimated Evacuation Vehicle Demand	Special Facility Estimated Evacuation Vehicle Demand
A	U.S. Highway 54 East	2176	30	66
B	Route Z	1,241	0	0
C	Route JJ	583	2,029	0
D	Route D	194	108	6
E	Route YY	130	0	0
F	Route P	166	0	0
G	Route K	205	6	0
H	State Route 94 East	663	25	0
I	State Route 100 East	271	0	0
J	Route N	59	0	0
K	State Route 89	326	0	16
L	State Route 100 West	277	0	0
M	State Route 94 West	1,027	2,036	56
N	U.S. Highway 54 West	2,065	36	50
O	Route F	1,869	30	66
P	Route O	1,071	93	0
Total		12,323	4,393	260

Total Estimated 2016 Traffic Demand all routes = 16,976 vehicles/trips

Table 1.0-12—Traffic Assigned to Primary Evacuation Routes - Year 2018

Evacuation Route	Route Number	General Population Estimated Evacuation Vehicle Demand	Transient Population Estimated Evacuation Vehicle Demand	Special Facility Estimated Evacuation Vehicle Demand
A	U.S. Highway 54 East	2,196	30	66
B	Route Z	1,252	0	0
C	Route JJ	588	1,047	0
D	Route D	196	108	6
E	Route YY	131	0	0
F	Route P	168	0	0
G	Route K	207	6	0
H	State Route 94 East	669	25	0
I	State Route 100 East	273	0	0
J	Route N	60	0	0
K	State Route 89	329	0	16
L	State Route 100 West	280	0	0
M	State Route 94 West	1,036	1,055	56
N	U.S. Highway 54 West	2,083	36	50
O	Route F	1,885	30	66
P	Route O	1,080	93	0
Total		12,433	2,430	260

Total Estimated 2018 Traffic Demand all routes = 15,123 vehicles/trips

Table 1.0-13—Response Times for Evacuating General Population 2008 - 2018

Subarea	Normal Conditions										Adverse Conditions																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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	General Population Notification Time (Minutes)	General Population Return Time to EPZ (Minutes)	General Population Mobilization Time (Minutes)	Time to drive out of EPZ (Minutes)	Confirmation Time (Minutes)	Total General Population Evacuation Time (Minutes)	Notification and Preparation Time for Non-Auto Owning Residents (Minutes)	Time for Bus to drive in and out of the EPZ (Minutes)	Bus Loading and Departure Time (Minutes)	Confirmation Time (Minutes)	Total General Population Evacuation Time (Minutes)	Notification and Preparation Time for Non-Auto Owning Residents (Minutes)	Time for Bus to drive in and out of the EPZ (Minutes)	Bus Loading and Departure Time (Minutes)	Confirmation Time (Minutes)	Total General Population Evacuation Time (Minutes)	Notification and Preparation Time for Non-Auto Owning Residents (Minutes)	Time for Bus to drive in and out of the EPZ (Minutes)	Bus Loading and Departure Time (Minutes)	Confirmation Time (Minutes)	Total General Population Evacuation Time 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Notes:

1. Even though the general population increases by approximately 5% during the 10-year period of Unit 2 permitting, construction, and full operation, since the road capacity is not exceeded by the additional traffic demand, the evacuation time estimate for the general population within the EPZ remains the same through 2018.
2. Time values are rounded to the nearest minute.

Table 1.0-14—Response Times for Evacuating Transient Population 2008 - 2018
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Subarea	2008								2016								2018													
	Normal Conditions				Adverse Conditions				Normal Conditions				Adverse Conditions				Normal Conditions				Adverse Conditions									
	Transient Population Notification Time (min)	Transient Population Mobilization time (min)	Time to drive out of the EPZ (min)	Confirmation Time (Min)	Total Transient Evacuation Time (min)	Transient Population Notification Time (Min)	Transient Population Mobilization time (Min)	Time to drive out of the EPZ (Min)	Confirmation Time (Minutes)	Total Transient Evacuation Time (min)	Transient Population Notification Time (Min)	Transient Population Mobilization time (Min)	Time to drive out of the EPZ (Min)	Confirmation Time (Min)	Total Transient Evacuation Time (min)	Transient Population Notification Time (Min)	Transient Population Mobilization time (Min)	Time to drive out of the EPZ (Min)	Confirmation Time (Min)	Total Transient Evacuation Time (min)	Transient Population Notification Time (Min)	Transient Population Mobilization time (Min)	Time to drive out of the EPZ (Min)	Confirmation Time (Min)	Total Transient Evacuation Time (min)					
Within 2 Miles (3 Kilometers) (Nominally)																														
C1	15	44 ⁽²⁾	23	60	142	15	44 ⁽²⁾	30	80	169	15	101 ⁽³⁾	23	60	199	15	101 ⁽³⁾	30	80	226	15	52 ⁽⁴⁾	23	60	150	15	52 ⁽⁴⁾	30	80	177
Within 2 – 5 Miles (3 – 8 Kilometers) (Nominally)																														
C2	15	15	20	60	110	15	15	26	80	136	15	15	20	60	110	15	15	26	80	136	15	15	20	60	110	15	15	26	80	136
C3	15	15	20	60	110	15	15	26	80	136	15	15	20	60	110	15	15	26	80	136	15	15	20	60	110	15	15	26	80	136
C4	15	15	20	60	110	15	15	26	80	136	15	15	20	60	110	15	15	26	80	136	15	15	20	60	110	15	15	26	80	136
C5	15	15	15	60	105	15	15	20	80	130	15	15	15	60	105	15	15	20	80	130	15	15	15	60	105	15	15	20	80	130
C6	15	15	21	60	111	15	15	28	80	138	15	15	21	60	111	15	15	28	80	138	15	15	21	60	111	15	15	28	80	138
Within 5 – 10 Miles (8 – 16 Kilometers) (Nominally)																														
C7	15	15	12	60	102	15	15	16	80	126	15	15	12	60	102	15	15	16	80	126	15	15	12	60	102	15	15	16	80	126
C8	15	15	11	60	102	15	15	14	80	124	15	15	11	60	102	15	15	14	80	124	15	15	11	60	102	15	15	14	80	124
C9	15	15	6	60	96	15	15	8	80	118	15	15	6	60	96	15	15	8	80	118	15	15	6	60	96	15	15	8	80	118
C10	15	15	14	60	104	15	15	18	80	128	15	15	14	60	104	15	15	18	80	128	15	15	14	60	104	15	15	18	80	128
C11	15	15	15	60	105	15	15	20	80	130	15	15	15	60	105	15	15	20	80	130	15	15	15	60	105	15	15	20	80	130
M1	15	15	9	60	99	15	15	12	80	122	15	15	9	60	99	15	15	12	80	122	15	15	9	60	99	15	15	12	80	122

Table 1.0-14—Response Times for Evacuating Transient Population 2008 - 2018
(Page 2 of 2)

Subarea	2008								2016								2018									
	Normal Conditions				Adverse Conditions				Normal Conditions				Adverse Conditions				Normal Conditions				Adverse Conditions					
	Transient Population Notification Time (min)	Transient Population Mobilization time (min)	Time to drive out of the EPZ (min)	Confirmation Time (Min)	Total Transient Evacuation Time (min)	Transient Population Notification Time (Min)	Transient Population Mobilization time (Min)	Time to drive out of the EPZ (Min)	Confirmation Time (Minutes)	Total Transient Evacuation Time (min)	Transient Population Notification Time (Min)	Transient Population Mobilization time (Min)	Time to drive out of the EPZ (Min)	Confirmation Time (Min)	Total Transient Evacuation Time (min)	Transient Population Notification Time (Min)	Transient Population Mobilization time (Min)	Time to drive out of the EPZ (Min)	Confirmation Time (Min)	Total Transient Evacuation Time (min)	Transient Population Notification Time (Min)	Transient Population Mobilization time (Min)	Time to drive out of the EPZ (Min)	Confirmation Time (Min)	Total Transient Evacuation Time (min)	
	Transient Population Notification Time (min)	Transient Population Mobilization time (min)	Time to drive out of the EPZ (min)	Confirmation Time (Min)	Total Transient Evacuation Time (min)	Transient Population Notification Time (min)	Transient Population Mobilization time (min)	Time to drive out of the EPZ (Min)	Confirmation Time (Minutes)	Total Transient Evacuation Time (min)	Transient Population Notification Time (Min)	Transient Population Mobilization time (Min)	Time to drive out of the EPZ (Min)	Confirmation Time (Min)	Total Transient Evacuation Time (min)	Transient Population Notification Time (Min)	Transient Population Mobilization time (Min)	Time to drive out of the EPZ (Min)	Confirmation Time (Min)	Total Transient Evacuation Time (min)	Transient Population Notification Time (Min)	Transient Population Mobilization time (Min)	Time to drive out of the EPZ (Min)	Confirmation Time (Min)	Total Transient Evacuation Time (min)	
M2	15	15	12	60	102	15	15	16	80	126	15	15	15	12	60	102	15	15	16	80	126	15	15	16	80	126
G1	15	15	3	60	93	15	15	4	80	114	15	15	15	3	60	93	15	15	4	80	114	15	15	3	60	93
O1	15	15	12	60	102	15	15	16	80	126	15	15	15	12	60	102	15	15	16	80	126	15	15	12	60	102

Notes:

1. The transient population is expected to remain relatively constant with the exception of the plant worker population which will increase through the peak year of construction in 2016 and decline to a constant level once the new Unit achieves full operation by year 2018
2. Reflects the time required for evacuating 1743 worker vehicles from the plant parking lots through 2 independent evacuation routes leading out of the EPZ.
3. Reflects the time required for evacuating 4023 worker vehicles from the plant parking lots through 2 independent evacuation routes leading out of the EPZ.
4. Reflects the time required for evacuating 2060 worker vehicles from the plant parking lots through 2 independent evacuation routes leading out of the EPZ.
5. Time values are rounded to the nearest minute.

Table 1.0-15—Response Times for Evacuating Special Facilities Population 2008 - 2018

Institution	Total Evacuating Special Facility Population	Subarea	No. of Buses/Trips ⁽¹⁾	Time to Assemble Buses Best Case (minutes)	Time to Assemble Buses Worst Case (minutes)	Time to Load Buses (minutes)	Time to Leave (minutes)	Driving Time Out of EPZ Normal Conditions (minutes)	Driving Time Out of the EPZ Adverse Conditions (minutes)	Confirmation Time	Total Evacuation Time Estimate Normal Conditions (Best Case) (minutes)	Total Evacuation Time Estimate Adverse Conditions (Worst Case) (minutes)
Bright Beginnings Preschool	Closed ⁽²⁾	C9	0	-	-	-	-	-	-	-	-	-
Care A Lot Learning Center	56	C9	4	60	80	15	5	6	8	60	146	168
Central Missouri HDC-CDC	25	C9	2	60	80	15	5	6	8	60	146	168
Growing Years Child Development Center	47	C9	4	60	80	15	5	6	8	60	146	168
Missouri Girls Town⁽³⁾	106	C9, C10	2/6	-	-	15	5	6	8	60	86	88
Rosa Parks Center	13	C9	2	15	15	15	5	6	8	60	101	103
Callaway R-II South (Mokane)	1,097	C7	56	15	60	15	5	12	16	60	107	156
Fulton Public Schools	2,727	C9	138	15	45	10	5	6	8	60	96	128
Missouri School for the Deaf	340	C9	18	45	45	15	5	6	8	60	131	133
Osage R-I	287	O1	16	15	30	10	10	12	16	60	107	126
St. Peter's Parochial School	174	C9	10	15	45	15	5	6	8	60	101	133
William Woods University - Fulton Preschool	17	C9	2	60	80	15	5	6	8	60	146	168
Total Special Facility Population Evacuating	4,889	-	260	-	-	-	-	-	-	-	-	-

Notes:

1. The number of bus trips is calculated by dividing the facility population by an average bus occupancy rate of 40 persons per bus, rounding up any remainder to the nearest whole number, and multiplying by 2 for a round trip in and out of the EPZ.
2. Facility owner recently reported the facility has been closed.
3. Population is divided between subareas C9 and C10 as 15 persons and 91 persons respectively. Even though the Fulton location is outside the EPZ, the facility remains in the evacuation plan.
4. Since the special facility populations listed are conservative and not expected to increase significantly above these reported figures and the roadway capacity will not be exceeded as a result of increases in transient or general facility populations, the maximum evacuation time estimate for the special facility population will remain unchanged through 2018.
5. Time values rounded to the nearest minute.

Table 1.0-16—Response Times for Evacuating Callaway Plant Worker Families as Part of General Population 2008 - 2018
(Page 1 of 2)

Subarea	Normal Conditions												Adverse Conditions											
	2008						2016						2008						2016					
	Notification and Preparation Time (min)	Worker Drive time to Residence to pickup family (min)	Mobilization Time (min)	Time to drive out of EPZ (min)	Confirmation Time (min)	Total Transient Worker Family Evacuation Time (min)	Notification and Preparation Time (min)	Worker Drive time to Residence to pickup family (min)	Mobilization Time (min)	Time to drive out of EPZ (min)	Confirmation Time (min)	Total Transient Worker Family Evacuation Time (min)	Notification and Preparation Time (min)	Worker Drive time to Residence to pickup family (min)	Mobilization Time (min)	Time to drive out of EPZ (min)	Confirmation Time (min)	Total Transient Worker Family Evacuation Time (min)	Notification and Preparation Time (min)	Worker Drive time to Residence to pickup family (min)	Mobilization Time (min)	Time to drive out of EPZ (min)	Confirmation Time (min)	Total Transient Worker Family Evacuation Time (min)
C1	N/	N/	N/	N/	N/	N/A	N/A	N/	N/	N/	N/	N/A	N/A	N/	N/	N/	N/	N/A	N/	N/A	N/	N/A	N/A	N/A
	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Within 2 Miles (3 Kilometers) (Nominally)																								
C2	44	3	60	20	60	187	101	3	60	20	60	244	51.5	3	60	20	60	194	44	4	65	26	80	276
	44	3	60	20	60	187	101	3	60	20	60	244	51.5	3	60	20	60	194	44	4	65	26	80	276
C3	44	3	60	20	60	187	101	3	60	20	60	244	51.5	3	60	20	60	194	44	4	65	26	80	276
	44	3	60	20	60	187	101	3	60	20	60	244	51.5	3	60	20	60	194	44	4	65	26	80	276
C4	44	3	60	20	60	187	101	3	60	20	60	244	51.5	3	60	20	60	194	44	4	65	26	80	276
	44	3	60	20	60	187	101	3	60	20	60	244	51.5	3	60	20	60	194	44	4	65	26	80	276
C5	44	8	60	15	60	187	101	8	60	15	60	244	51.5	8	60	15	60	194	44	10	65	20	80	276
	44	8	60	15	60	187	101	8	60	15	60	244	51.5	8	60	15	60	194	44	10	65	20	80	276
C6	44	2	60	21	60	187	101	2	60	21	60	244	51.5	2	60	21	60	194	44	2	65	28	80	276
	44	2	60	21	60	187	101	2	60	21	60	244	51.5	2	60	21	60	194	44	2	65	28	80	276
Within 5 – 10 Miles (8 – 16 Kilometers) (Nominally)																								
C7	44	10	60	13	60	187	101	10	60	13	60	244	51.5	10	60	13	60	194	44	14	65	16	80	276
	44	10	60	13	60	187	101	10	60	13	60	244	51.5	10	60	13	60	194	44	14	65	16	80	276
C8	44	12	60	11	60	187	101	12	60	11	60	244	51.5	12	60	11	60	194	44	16	65	14	80	276
	44	12	60	11	60	187	101	12	60	11	60	244	51.5	12	60	11	60	194	44	16	65	14	80	276
C9	44	17	60	6	60	187	101	17	60	6	60	244	51.5	17	60	6	60	194	44	22	65	8	80	276
	44	17	60	6	60	187	101	17	60	6	60	244	51.5	17	60	6	60	194	44	22	65	8	80	276
C10	44	9	60	14	60	187	101	9	60	14	60	244	51.5	9	60	14	60	194	44	12	65	18	80	276
	44	9	60	14	60	187	101	9	60	14	60	244	51.5	9	60	14	60	194	44	12	65	18	80	276
C11	44	8	60	15	60	187	101	8	60	15	60	244	51.5	8	60	15	60	194	44	10	65	20	80	276
	44	8	60	15	60	187	101	8	60	15	60	244	51.5	8	60	15	60	194	44	10	65	20	80	276
M1	44	14	60	9	60	187	101	14	60	9	60	244	51.5	14	60	9	60	194	44	18	65	12	80	276
	44	14	60	9	60	187	101	14	60	9	60	244	51.5	14	60	9	60	194	44	18	65	12	80	276

Table 1.0-16—Response Times for Evacuating Callaway Plant Worker Families as Part of General Population 2008 - 2018
(Page 2 of 2)

Subarea	Normal Conditions												Adverse Conditions																							
	2008						2016						2018						2008						2016						2018					
	Notification and Preparation Time (min)	Worker Drive time to Residence to pickup family (min)	Mobilization Time (min)	Time to drive out of EPZ (min)	Confirmation Time (min)	Total Transient Worker Family Evacuation Time (min)	Notification and Preparation Time (min)	Worker Drive time to Residence to pickup family (min)	Mobilization Time (min)	Time to drive out of EPZ (min)	Confirmation Time (min)	Total Transient Worker Family Evacuation Time (min)	Notification and Preparation Time (min)	Worker Drive time to Residence to pickup family (min)	Mobilization Time (min)	Time to drive out of EPZ (min)	Confirmation Time (min)	Total Transient Worker Family Evacuation Time (min)	Notification and Preparation Time (min)	Worker Drive time to Residence to pickup family (min)	Mobilization Time (min)	Time to drive out of EPZ (min)	Confirmation Time (min)	Total Transient Worker Family Evacuation Time (min)	Notification and Preparation Time (min)	Worker Drive time to Residence to pickup family (min)	Mobilization Time (min)	Time to drive out of EPZ (min)	Confirmation Time (min)	Total Transient Worker Family Evacuation Time (min)						
M2	44	11	60	12	60	187	101	11	60	12	60	194	44	14	65	16	80	219	101	14	65	16	80	276	52	14	65	16	80	227						
G1	N/	N/	N/	N/	N/	N/A	N/A	N/	N/	N/	N/	N/A	N/	N/	N/	N/	N/	N/A	N/A	N/A	N/A	N/	N/	N/A	N/	N/	N/A	N/A	N/A	N/A						
O1	N/	N/	N/	N/	N/	N/A	N/A	N/	N/	N/	N/	N/A	N/	N/	N/	N/	N/	N/A	N/A	N/A	N/A	N/	N/	N/A	N/	N/	N/A	N/A	N/A	N/A						

Notes:

1. Even though the general population increases by approximately 5% during the 10-year period of Unit 2 permitting, construction, and full operation, since the road capacity is not exceeded by the additional traffic demand, the evacuation time estimate for the general population within the EPZ remains the same through 2018.
2. Time values are rounded to the nearest minute.

Table 1.0-17—Summary of Evacuation Time Estimates for Callaway Nuclear Power Plant - Operating Year 2008

(Page 1 of 2)

Subarea	Permanent resident population	Occupied housing units	Permanent Resident Vehicles used for evacuation	Maximum Distance from Subzone to exit EPZ (miles)	Maximum Distance from Subzone to Exit EPZ (kilometers)	Transient Population Evacuating	Transient Population Evacuating Vehicles Used in Evacuation	Special Facility Population Evacuating	Special Facility Buses/Trips Used in Evacuation	Within 2 Miles (3 Kilometers) (Nominally)										Evacuation Capacity Vehicles per Hour	Auto Owning General Population Evacuation Time Normal Conditions (min)	Auto Owning General Population Evacuation Time Adverse Conditions (min)	Non-Auto Owning General Population Evacuation Time Normal Conditions (min)	Non-Auto Owning General Population Evacuation Time Adverse Conditions (min)	Plant Worker Family Evacuation Normal Conditions (min)	Plant Worker Family Evacuation Time Adverse Conditions (min)	Transient Population Evacuation Normal Conditions (min)	Transient Population Evacuation Time Adverse Conditions (min)	Special Facility Population Evacuation Normal Conditions (min)	Special Facility Population Evacuation Time Adverse Conditions (min)
C1 ⁽¹⁾	39	16	23	15	24	2,082	1,752	0	0	7,200	188	230	216	273	187	219	142	169	N/A	N/A										
Subtotal 0 - 2 Miles (0 - 3 km)																														
	39	16	23	15	-	2,082	1,752	0	0	7,200	-	-	-	-	-	-	-	-	-	-										
Within 2 to 5 Miles (3 - 8 Kilometers) (Nominally)																														
C2	295	119	174	13	21	250	84	0	0	3,600	185	226	210	265	187	219	110	136	N/A	N/A										
C3	371	149	219	13	21	300	100	0	0	3,600	185	226	210	265	187	219	110	136	N/A	N/A										
C4 ⁽¹⁾	451	181	267	13	21	50	17	0	0	3,600	185	226	210	265	187	219	110	136	N/A	N/A										
C5 ⁽¹⁾	159	64	94	10	16	78	26	0	0	2,400	180	220	201	253	187	219	105	130	N/A	N/A										
C6	398	160	235	14	23	29	10	0	0	3,600	186	228	213	269	187	219	111	138	N/A	N/A										
Subtotal 2 - 5 Miles (3 - 8 km)																														
	1,674	673	989	-	-	707	237	0	0	16,800	-	-	-	-	-	-	-	-	-	-										
Within 5 to 10 Miles (8 - 16 Kilometers) (Nominally)																														
C7 ⁽¹⁾	1,222	492	722	8	13	50	17	1,097	56	3,600	177	216	195	245	187	219	102	126	107	156										
C8	1,956	787	1,157	7	11	0	0	0	0	4,800	176	214	192	241	187	219	N/A	N/A	N/A	N/A										
C9	12,665	5,095	7,490	4	6	204	90	3,414	182	4,800	171	208	183	229	187	219	96	118	146	168										
C10	435	175	257	9	14	0	0	91	6	2,400	179	218	198	249	187	219	N/A	N/A	86	88										
C11	363	146	215	10	16	0	0	0	0	2,400	180	220	201	253	187	219	N/A	N/A	N/A	N/A										

Table 1.0-17—Summary of Evacuation Time Estimates for Callaway Nuclear Power Plant - Operating Year 2008
(Page 2 of 2)

Subarea	Permanent resident population	Occupied housing units	Permanent Resident Vehicles used for evacuation	Maximum Distance from Subzone to exit EPZ (miles)	Maximum Distance from Subzone to Exit EPZ (Kilometers)	Transient Population Evacuating	Transient Population	Special Facility Population Evacuating	Special Facility Buses/Trips Used in Evacuation	Evacuation Capacity Vehicles per Hour	Auto Owning General Population Evacuation Time Normal Conditions (min)	Auto Owning General Population Evacuation Time Adverse Conditions (min)	Non-Auto Owning General Population Evacuation Time Normal Conditions (min)	Non-Auto Owning General Population Evacuation Time Adverse Conditions (min)	Plant Worker Family Evacuation Normal Conditions (min)	Plant Worker Family Evacuation Normal Conditions (min)	Transient Population Evacuation Time Normal conditions (min)	Transient Population Evacuation Time Adverse conditions (min)	Special Facility Population Evacuation Time Normal Conditions (min)	Special Facility Population Evacuation Time Adverse conditions (min)
M1	164	66	97	6	10	0	0	0	0	3,600	174	212	189	237	187	219	N/A	N/A	N/A	N/A
M2 ⁽¹⁾	486	195	287	8	13	50	17	0	0	2,400	177	216	195	245	187	219	N/A	N/A	N/A	N/A
G1	118	47	70	2	3	0	0	0	0	1,200	168	204	177	221	187	219	N/A	N/A	N/A	N/A
O1 ⁽¹⁾	906	364	536	8	13	0	0	287	16	3,600	177	216	195	245	187	219	102	126	107	128
Subtotal 5 – 10 Miles (8 – 16 km)	18,315	7,367	10,831	-	-	304	124	4,889	260	28,800	-	-	-	-	-	-	-	-	-	-
Total EPZ	20,028	8,056	11,843	-	-	3,093	2,113	4,889	260	52,800	-	-	-	-	-	-	-	-	-	-

Notes:

- Evacuation routes in these EPZ subareas are potentially subject to road flooding during period of extended or heavy precipitation, which could extend the evacuation time estimate by 1 to 2 hours while county maintenance and traffic control resources are alerted to mitigate storm impacts and/or reroute traffic around flood prone areas.
- Time values are rounded to the nearest minute.

Table 1.0-18—Summary of Evacuation Time Estimates for Callaway Nuclear Power Plant - Operating Year 2016

(Page 1 of 2)

Subarea	Within 2 Miles (3 Kilometers) (Nominally)										Within 2 to 5 Miles (3 – 8 Kilometers) (Nominally)																Within 5 to 10 Miles (8 – 16 Kilometers) (Nominally)															
	Permanent resident population	Occupied housing units	Permanent Resident Vehicles used for evacuation	Maximum Distance from Subzone to exit EPZ (miles)	Maximum Distance from Subzone to Exit EPZ (Kilometers)	Transient Population Evacuating	Transient Population Vehicles Used in Evacuation	Special Facility Population Evacuating	Special Facility Buses/Trips Used in Evacuation	Evacuation Capacity Vehicles per Hour	Auto Owning General Population Evacuation Time Normal Conditions (min)	Auto Owning General Population Evacuation Time Adverse Conditions (min)	Non-Auto Owning General Population Evacuation Time Normal Conditions (min)	Non-Auto Owning General Population Evacuation Time Adverse Conditions (min)	Plant Worker Family Evacuation Normal Conditions (min)	Plant Worker Family Evacuation Normal Conditions (min)	Transient Population Evacuation Normal Conditions (min)	Transient Population Evacuation Normal Conditions (min)	Time Adverse conditions (min)	Special Facility Population Evacuation Time Normal Conditions (min)	Special Facility Population Evacuation Time Adverse conditions (min)	Time Normal Conditions (min)	Special Facility Population Evacuation Time Normal Conditions (min)	Special Facility Population Evacuation Time Adverse conditions (min)	Time Normal Conditions (min)	Special Facility Population Evacuation Time Normal Conditions (min)	Special Facility Population Evacuation Time Adverse conditions (min)															
C1 ⁽¹⁾	41	16	24	15	24	5,017	4,032	0	0	7,200	188	230	216	273	N/A	N/A	199	226	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A													
Subtotal 0 - 2 Miles (0 - 3 km)	41	16	24	-	-	5,017	4,032	0	0	7,200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-														
C2	307	124	181	13	21	250	84	0	0	3,600	185	226	210	265	244	276	110	136	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
C3	386	155	228	13	21	300	100	0	0	3,600	185	226	210	265	244	276	110	136	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
C4 ⁽¹⁾	470	189	278	13	21	50	17	0	0	3,600	185	226	210	265	244	276	110	136	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
C5 ⁽¹⁾	166	67	98	10	16	78	26	0	0	2,400	180	220	201	253	244	276	105	130	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
C6	414	166	245	14	23	29	10	0	0	3,600	186	228	213	269	244	276	111	138	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
Subtotal 2 - 5 Miles (3 – 8 km)	1,743	701	1030	-	-	707	237	0	0	16,800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-														
C7 ⁽¹⁾	1,271	511	752	8	13	50	17	1,097	56	3,600	177	216	195	245	244	276	102	126	107	156	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
C8	2,033	819	1,203	7	11	0	0	0	0	4,800	176	214	192	241	244	276	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
C9	13,179	5,301	7,793	4	6	204	90	3,414	182	4,800	171	208	183	229	244	276	96	118	146	168	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
C10	453	182	268	9	14	0	0	91	6	2,400	179	218	198	249	244	276	N/A	N/A	96	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
C11	378	152	223	10	16	0	0	0	0	2,400	180	220	201	253	244	276	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
M1	171	69	101	6	10	0	0	0	0	3,600	174	212	189	237	244	276	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
M2 ⁽¹⁾	506	204	299	8	13	50	17	0	0	2,400	177	216	195	245	244	276	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														

Table 1.0-18—Summary of Evacuation Time Estimates for Callaway Nuclear Power Plant - Operating Year 2016
(Page 2 of 2)

Subarea	Permanent resident population	Occupied housing units	Permanent Resident Vehicles used for evacuation	Maximum Distance from Subzone to exit EPZ (miles)	Maximum Distance from Subzone to Exit EPZ (Kilometers)	Transient Population Evacuating	Transient Population Vehicles Used in Evacuation	Special Facility Population Evacuating	Special Facility Buses/Trips Used in Evacuation	Evacuation Capacity Vehicles per Hour	Auto Owning General Population Evacuation Time Normal Conditions (min)	Auto Owning General Population Evacuation Time Adverse Conditions (min)	Non-Auto Owning General Population Evacuation Time Normal Conditions (min)	Non-Auto Owning General Population Evacuation Time Adverse Conditions (min)	Plant Worker Family Evacuation Normal Conditions (min)	Plant Worker Family Evacuation Normal Conditions (min)	Transient Population Evacuation Time Normal conditions (min)	Transient Population Evacuation Time Adverse conditions (min)	Special Facility Population Evacuation Time Normal Conditions (min)	Special Facility Population Evacuation Time Adverse conditions (min)	
G1	123	49	73	2	3	0	0	0	0	1,200	168	204	177	221	N/A	N/A	N/A	N/A	N/A	N/A	N/A
O1 ⁽¹⁾	942	379	557	8	13	0	0	287	16	3,600	177	216	195	245	N/A	N/A	N/A	102	126	107	128
Subtotal 5 – 10 Miles (8 – 16 km)	19,056	7885	11,269	-	-	304	124	4,889	260	28,800	-	-	-	-	-	-	-	-	-	-	-
Total EPZ	20,840	8,383	12,323	-	-	6,124	4,393	4,889	260	52,800	-	-	-	-	-	-	-	-	-	-	-

Notes:

- Evacuation routes in these EPZ subareas are potentially subject to road flooding during period of extended or heavy precipitation, which could extend the evacuation time estimate by 1 to 2 hours while county maintenance and traffic control resources are alerted to mitigate storm impacts and/or reroute traffic around flood prone areas.
- Time values are rounded to the nearest minute.

Table 1.0-19—Summary of Evacuation Time Estimates for Callaway Nuclear Power Plant - Operating Year 2018

(Page 1 of 2)

[illegible]

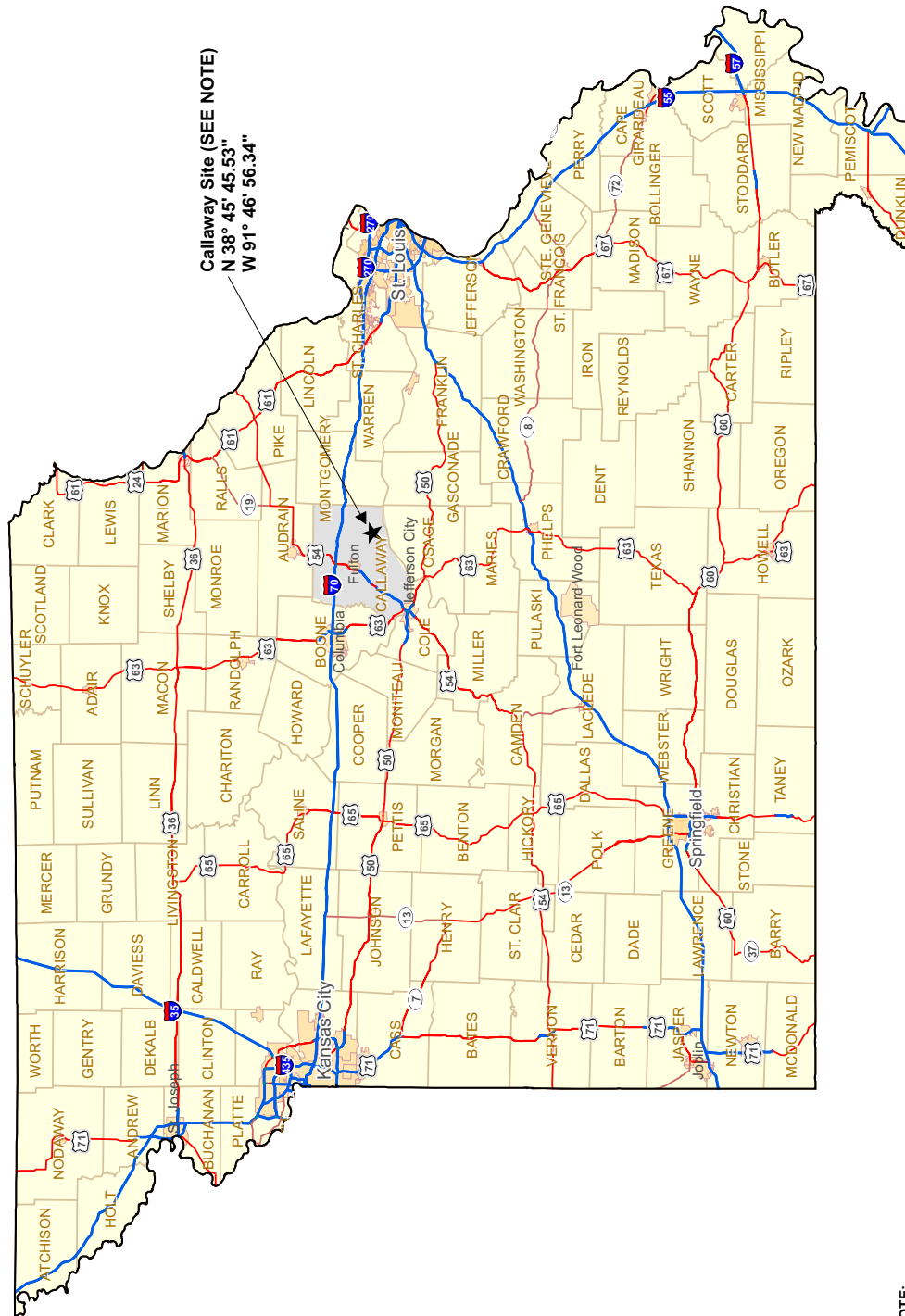
Table 1.0-19—Summary of Evacuation Time Estimates for Callaway Nuclear Power Plant - Operating Year 2018
(Page 2 of 2)

Subarea	Permanent resident population	Occupied housing units	Permanent Resident Vehicles used for evacuation	Maximum Distance from Subzone to exit EPZ (miles)	Maximum Distance from Subzone to Exit EPZ (kilometers)	Transient Population Evacuating	Transient Population Vehicles Used in Evacuation	Special Facility Population Evacuating	Special Facility Buses/Trips Used in Evacuation	Evacuation Capacity Vehicles per Hour	Auto Owning General Population Normal Conditions (min)	Auto Owning General Population Evacuation Time Adverse Conditions (min)	Non-Auto Owning General Population Evacuation Time Normal Conditions (min)	Non-Auto Owning General Population Evacuation Time Adverse Conditions (min)	Plant Worker Family Evacuation Normal Conditions (min)	Plant Worker Family Evacuation Adverse Conditions (min)	Transient Population Evacuation Time Normal Conditions (min)	Transient Population Evacuation Time Adverse Conditions (min)	Special Facility Population Evacuation Time Normal Conditions (min)	Special Facility Population Evacuation Time Adverse Conditions (min)	Time Normal Conditions (min)	Time Adverse Conditions (min)
O1 ⁽¹⁾	951	383	562	8	13	0	0	287	16	3,600	177	216	195	245	N/A	N/A	102	126	107	128	107	128
Subtotal 5 – 10 Miles (8 – 16 km)	19,227	7,734	11,370	-	-	304	124	4,889	260	28,800	-	-	-	-	-	-	-	-	-	-	-	-
Total EPZ	21,026	8,458	12,433	-	-	3,408	2,428	4,889	260	52,800	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

- Evacuation routes in these EPZ subareas are potentially subject to road flooding during period of extended or heavy precipitation, which could extend the evacuation time estimate by 1 to 2 hours while county maintenance and traffic control resources are alerted to mitigate storm impacts and/or reroute traffic around flood prone areas.
- Time values are rounded to the nearest minute.

Figure 1.0.1—Missouri Site Location Map



NOTE:
REFERENCE CENTER POINT OF PLANT SITE
IS DEFINED AS THE MIDPOINT BETWEEN EXISTING
REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR
FOR CALLAWAY PLANT UNIT 2.

Figure 1.0-2—Existing Callaway Plant Layout

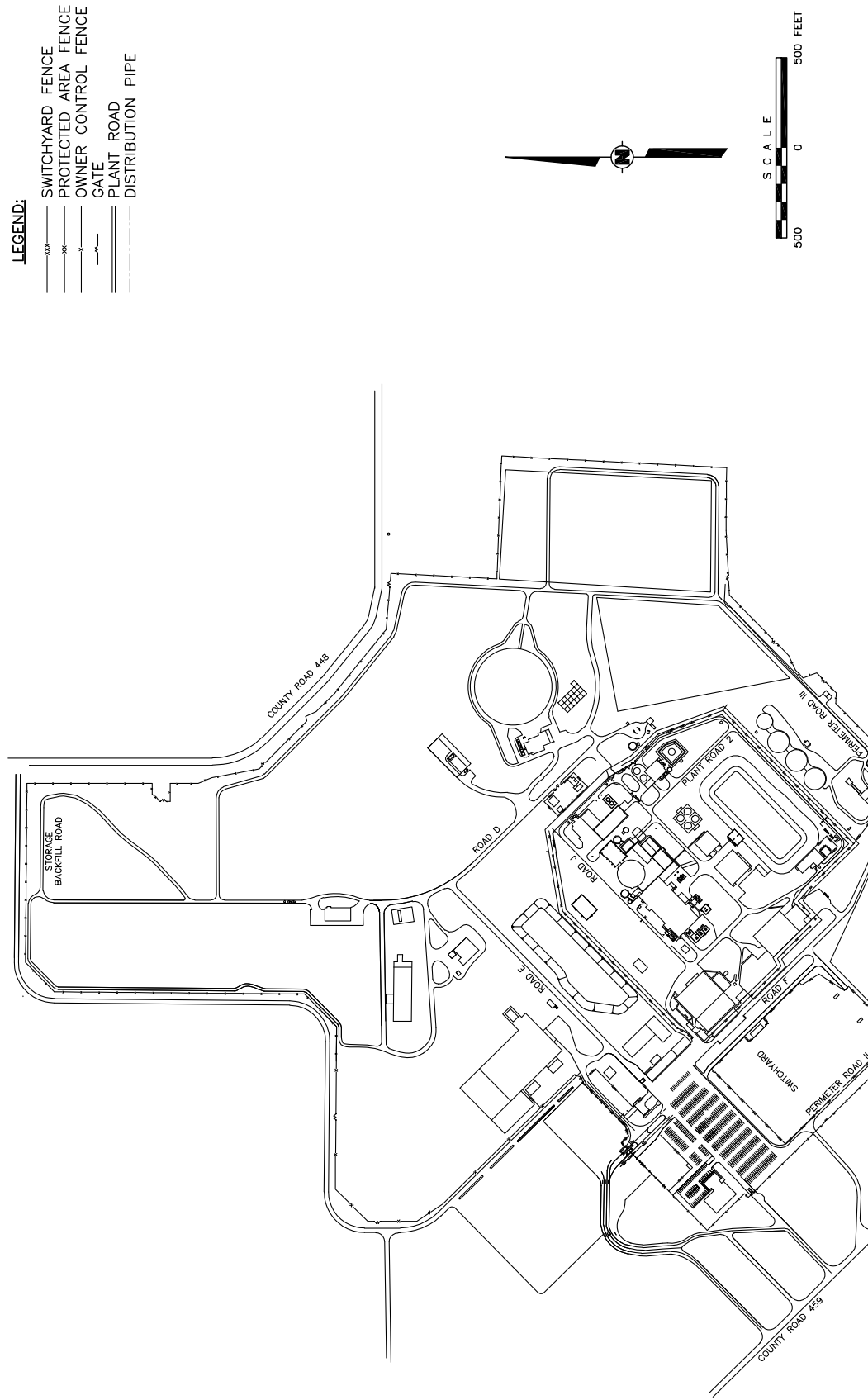


Figure 1.0-3—Callaway Plant Layout Showing Unit 2

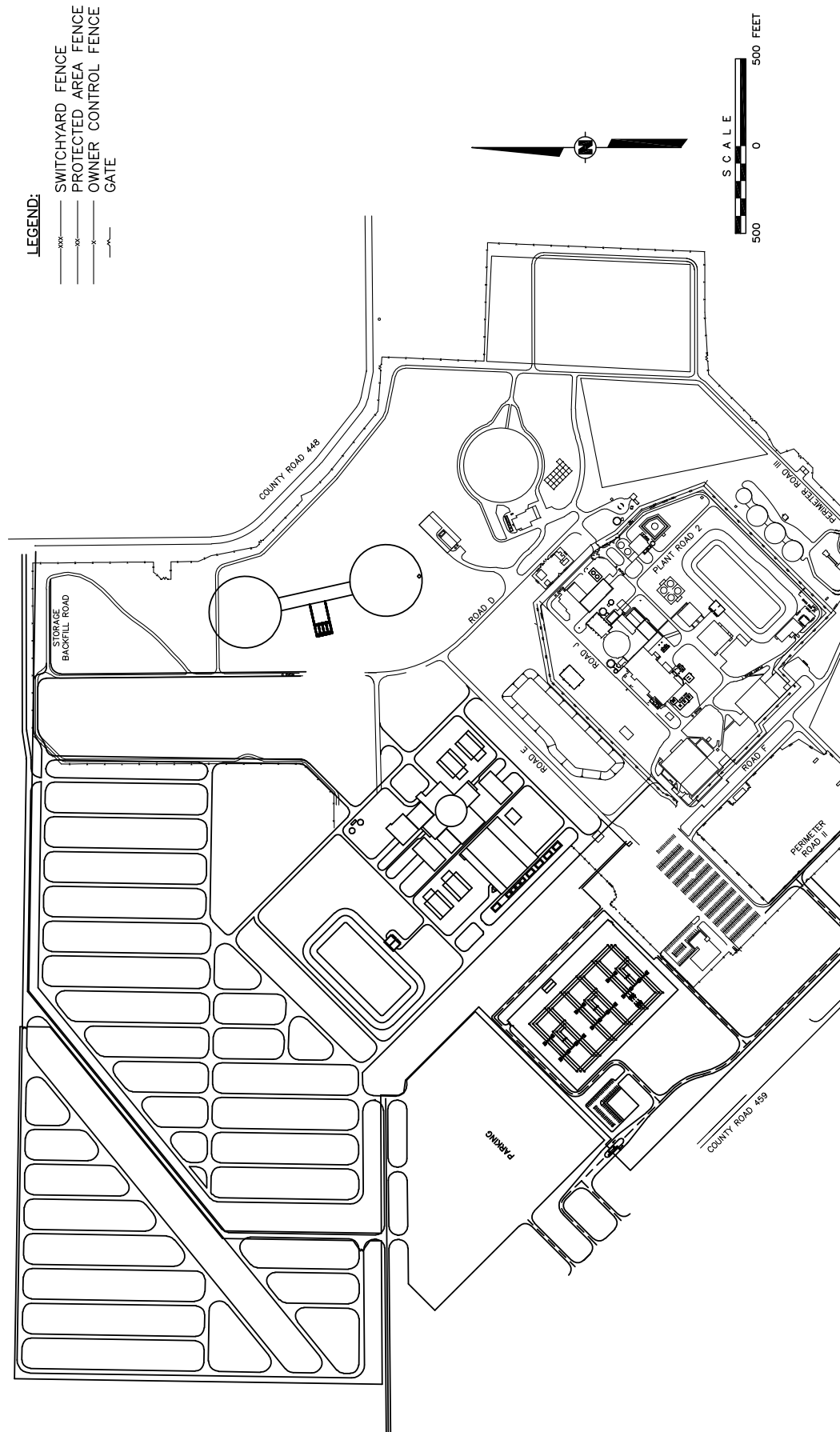
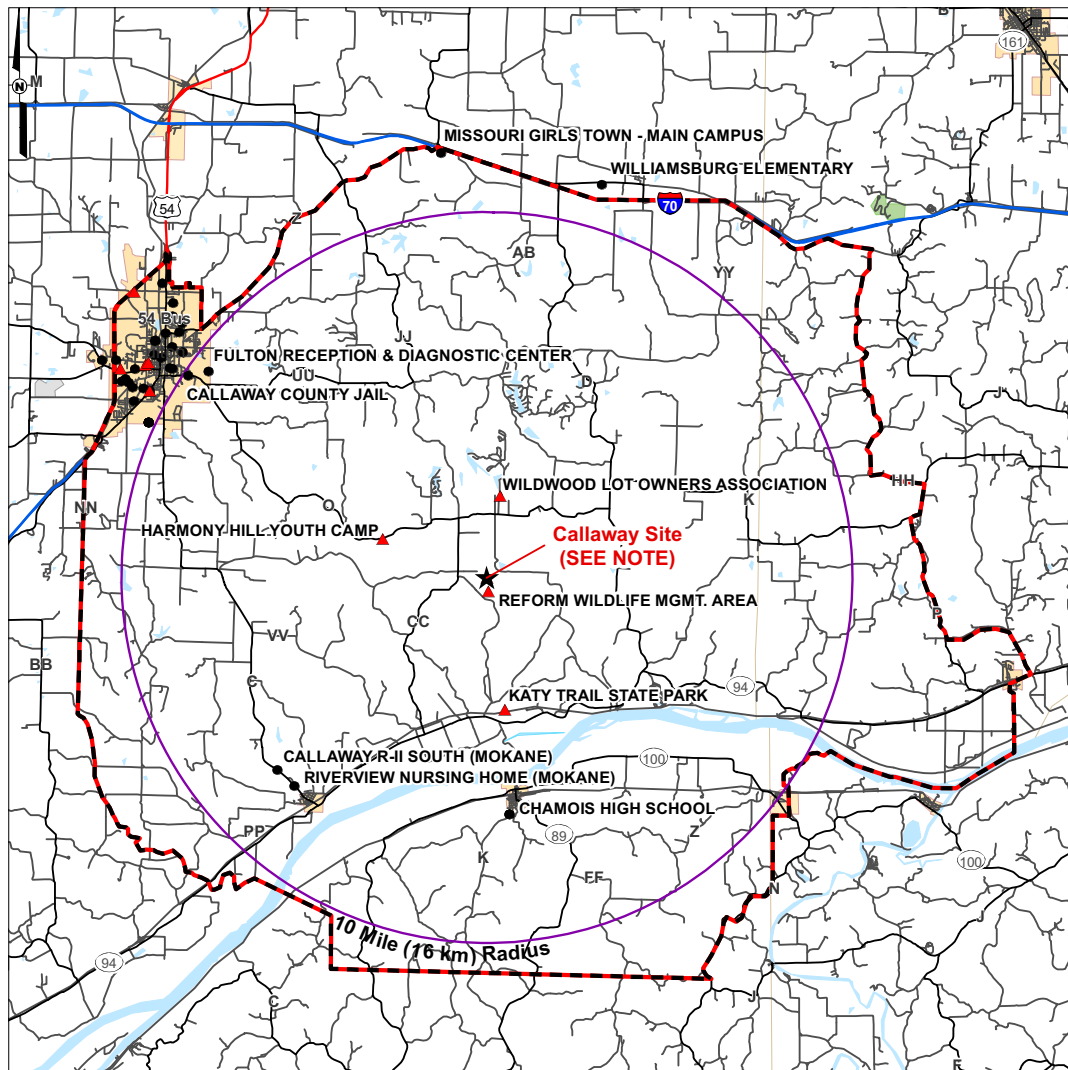


Figure 1.0-4—Regional Map Showing EPZ Boundary and Locations of Major Features**LEGEND:**

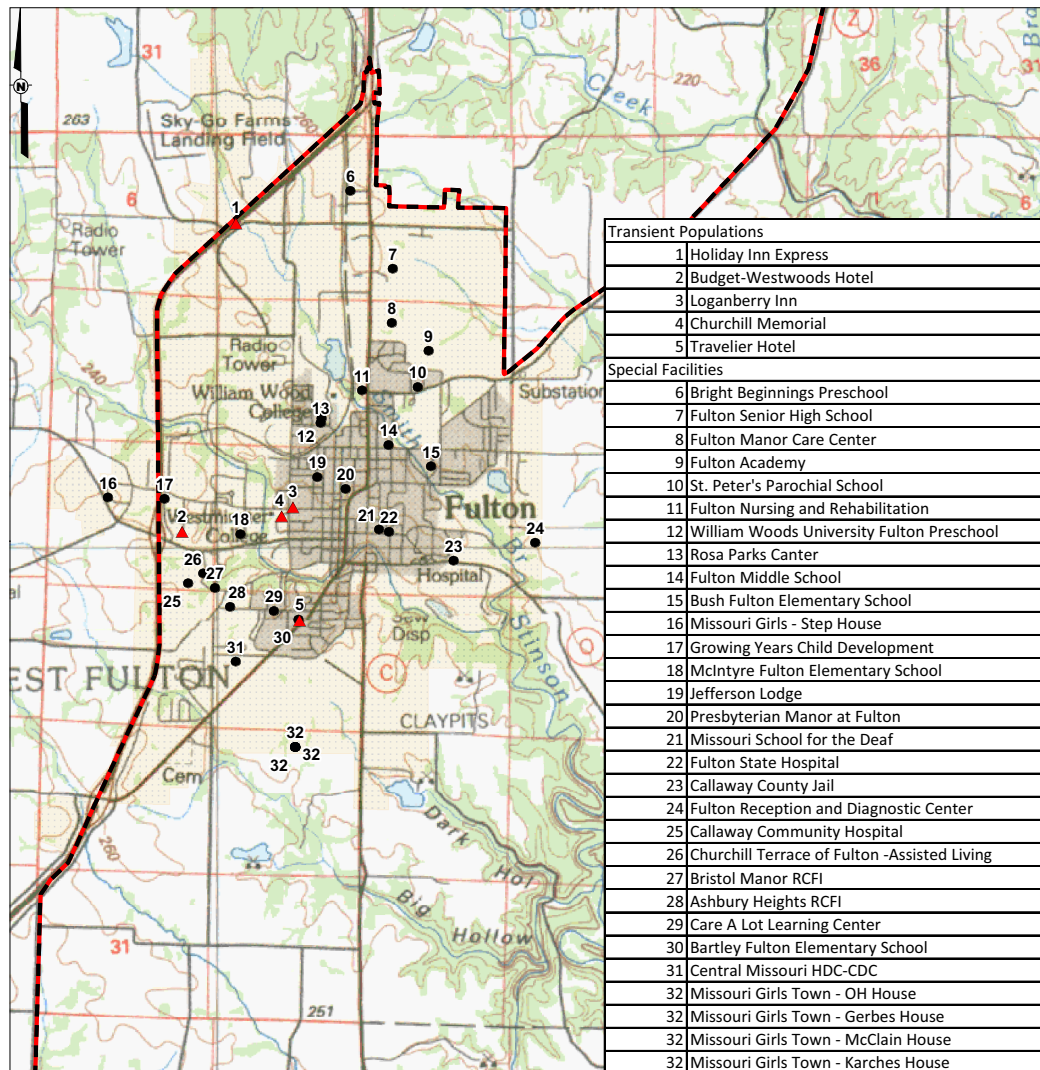
- ★ Callaway Site
- Special Facility
- ▲ Transient Populations
- 10 Mile (16 km) Radius
- ▭ Limits of Emergency Planning Zone (EPZ)
- Interstate
- Primary US State Highways
- Secondary State/County Roads
- Local Roads (LETTER SYMBOL REFERS TO COUNTY ROADS)
- City Limits

REFERENCE:

Google Earth and Google Maps was used to determine Special Facility and Transient locations. www.google.com
 ESRI StreetMap Pro [CD-ROM], 2007, Streets, Waterbodies, & City Limits

NOTE:

REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.

Figure 1.0-5—Regional Map Detail for the City of Fulton - Insert for Figure 1.0-4**LEGEND:**

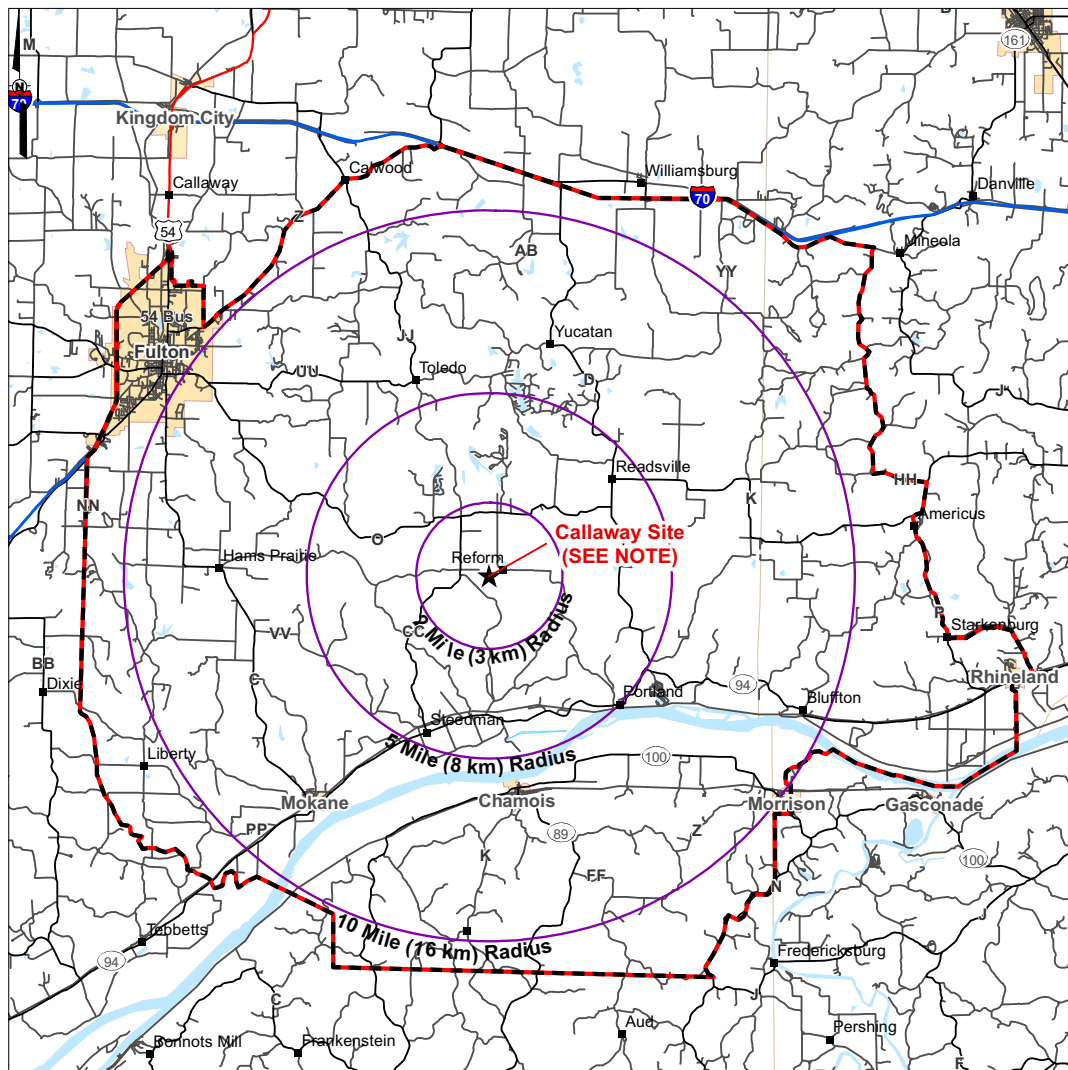
- Special Facility
- ▲ Transient Populations
- ▨ Fulton Designated Boundary
- ▭ Emergency Planning Zone (EPZ)

0 0.5 1
Miles

REFERENCE:

Google Earth and Google Maps was used to determine Special Facility and Transient locations. www.google.com
USGS 1x2 degree series 1:100K DRG: Fulton, 1984 & Jefferson City, 1984.

Figure 1.0-6—Regional Map Showing Major Roadways, EPZ Boundary, and 2-5-10 Mile Radius



LEGEND:

- ★ Callaway Site
- Towns
- 2-5-10 Mile Radius
- ▭ Emergency Planning Zone (EPZ)
- Interstate
- Primary US State Highways
- Secondary State/County Roads
- Local Roads (LETTER SYMBOL REFERS TO COUNTY ROADS)
- Major Towns/City Limits

0 2 4
Miles

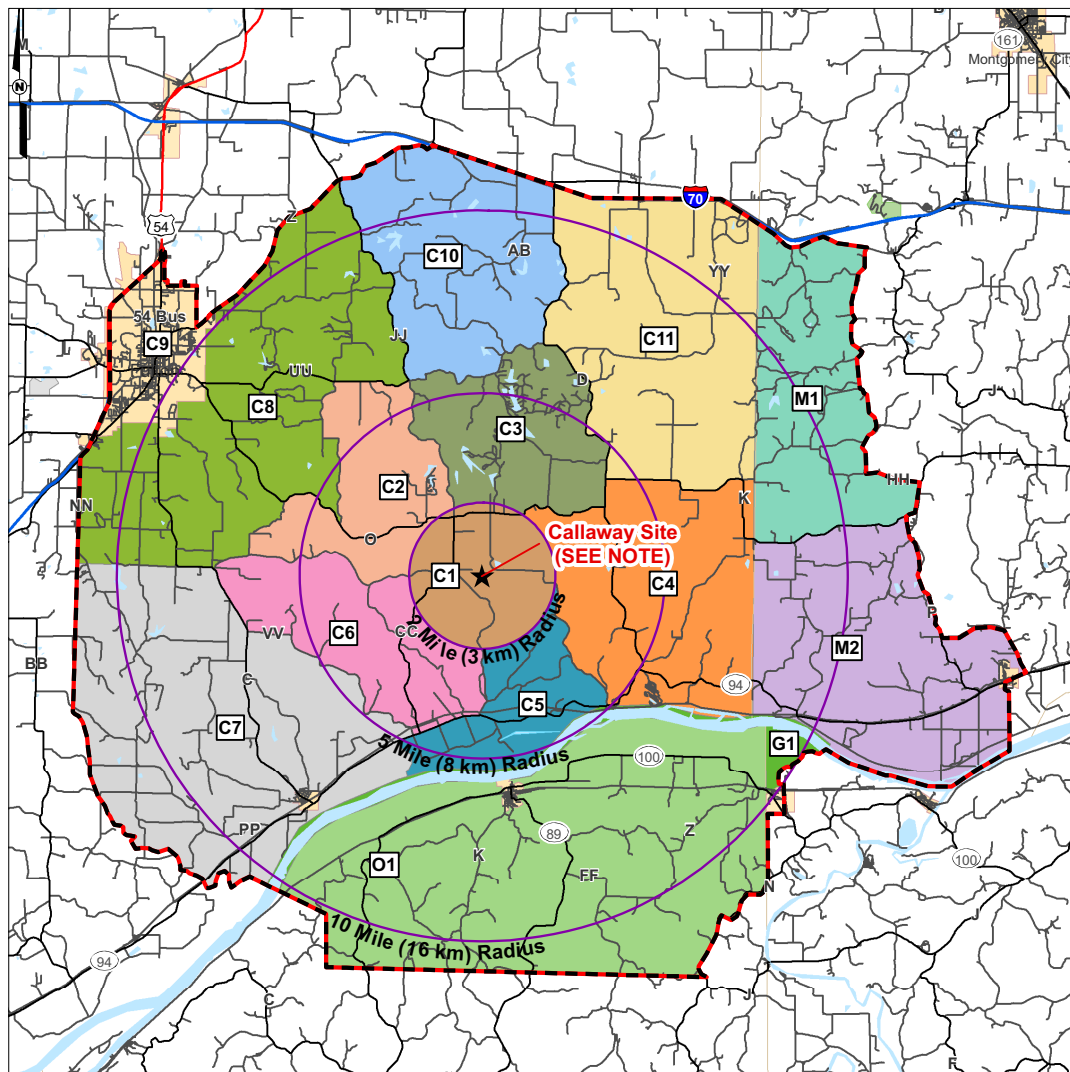
NOTE:

REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.

REFERENCE

ESRI StreetMap Pro [CD-ROM], 2007, Streets, Waterbodies, & City Limits

Figure 1.0-7—Regional Map Showing EPZ Boundary and EPZ Subareas with 2-5-10 Mile Radius



LEGEND:

- ★ Callaway Site
- 2-5-10 mile Radius
- Emergency Planning Zone (EPZ)
- C1 EPZ Subareas
- Interstate
- Primary US State Highways
- Secondary State/County Roads
- Local Roads (LETTER SYMBOL REFERS TO COUNTY ROADS)
- Major Towns/City Limits

0 2 4
Miles

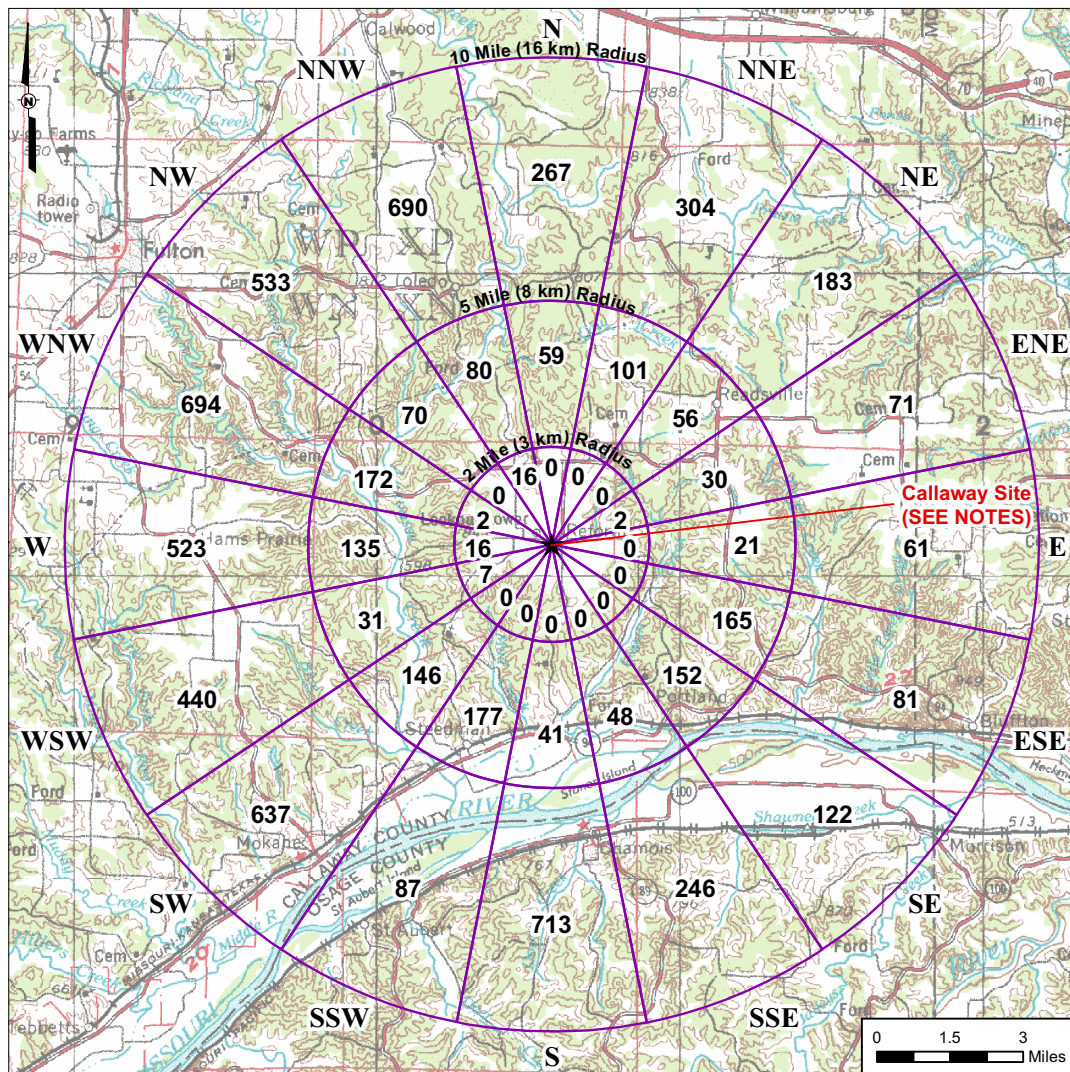
NOTE:

REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.

REFERENCE:

ESRI StreetMap Pro [CD-ROM], 2007, Streets, Waterbodies, & City Limits

Figure 1.0-8—2008 General Population Distribution by 22° Radial Sector Out to 10 Miles



LEGEND:

- ★ Callaway Site
- 41 General Population Assignment

NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.

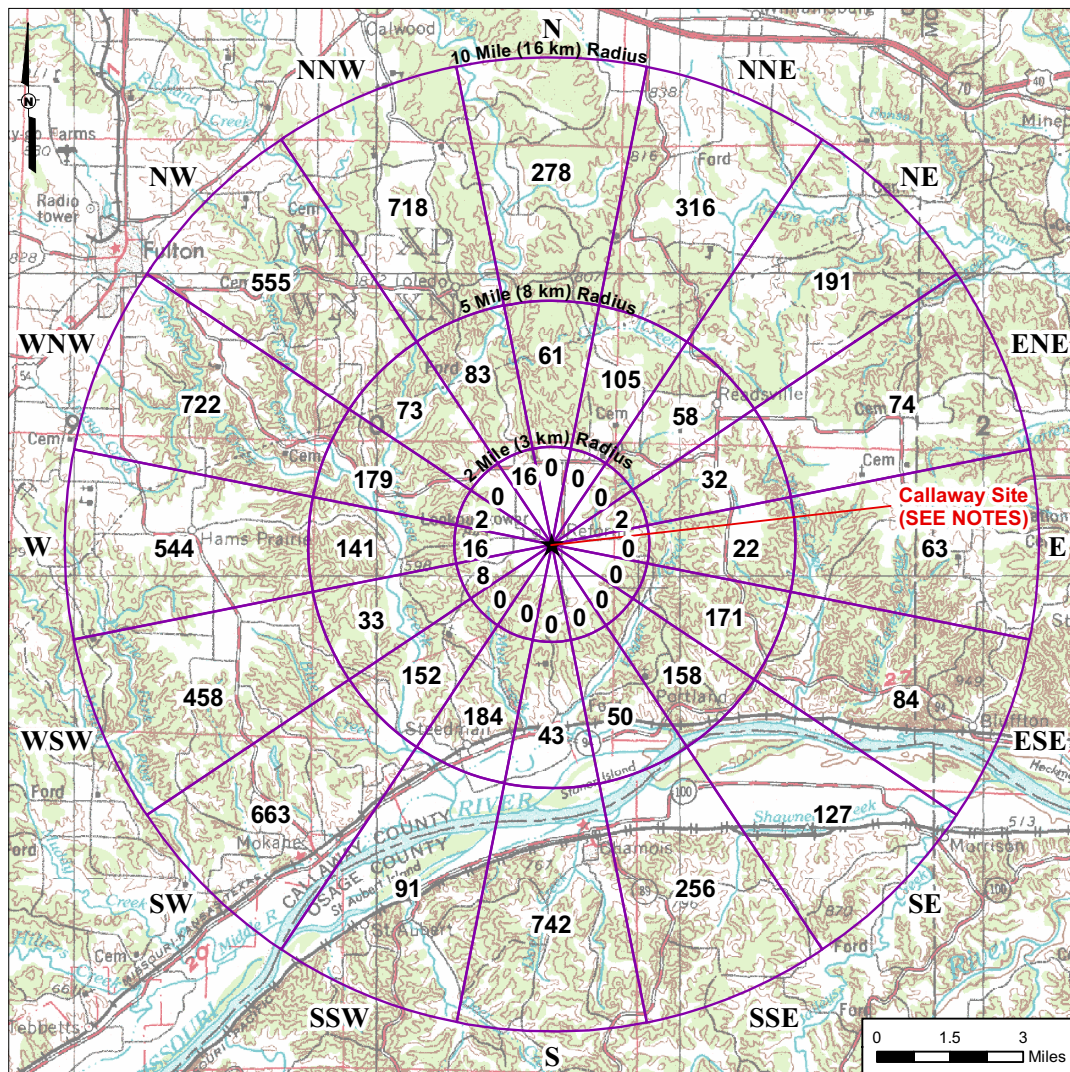
2. DATA PROVIDED IN TABLE 5.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

2008 Population Totals			
Ring Miles	Ring Population	Total Miles	Cumulative Population
0 - 2	43	0 - 2	43
2 - 5	1,484	0 - 5	1,527
5 - 10	5,652	0 - 10	7,179

Figure 1.0-9—2016 General Population Distribution by 22° Radial Sector Out to 10 Miles



LEGEND:

- ★ Callaway Site
- 43 General Population Assignment

NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.

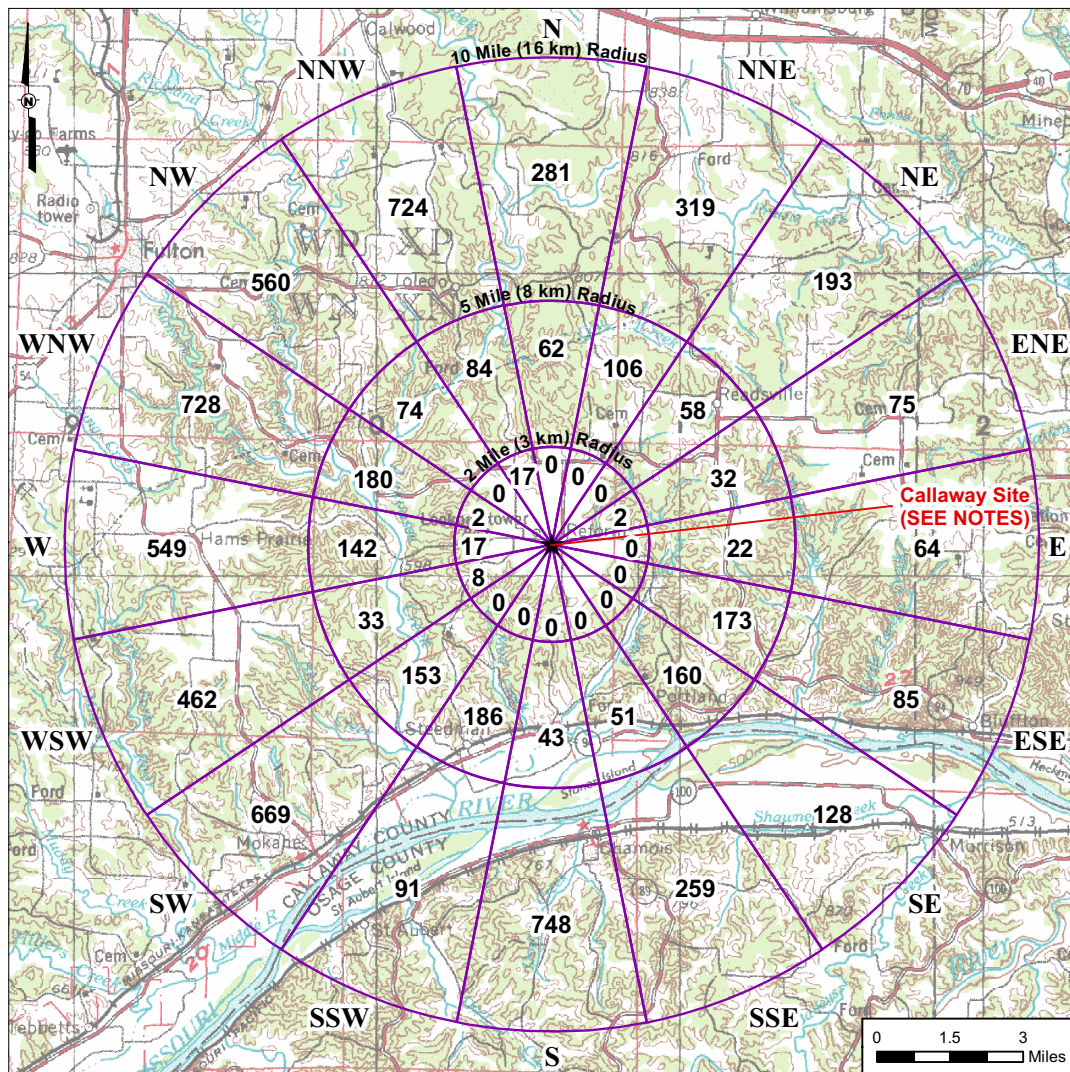
2. DATA PROVIDED IN TABLE 6.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

2016 Population Totals			
Ring Miles	Ring Population	Total Miles	Cumulative Population
0 - 2	44	0 - 2	44
2 - 5	1,545	0 - 5	1,589
5 - 10	5,882	0 - 10	7,471

Figure 1.0-10—2018 General Population Distribution by 22° Radial Sector Out to 10 Miles



LEGEND:

- ★ Callaway Site
- 43 General Population Assignment

NOTES:

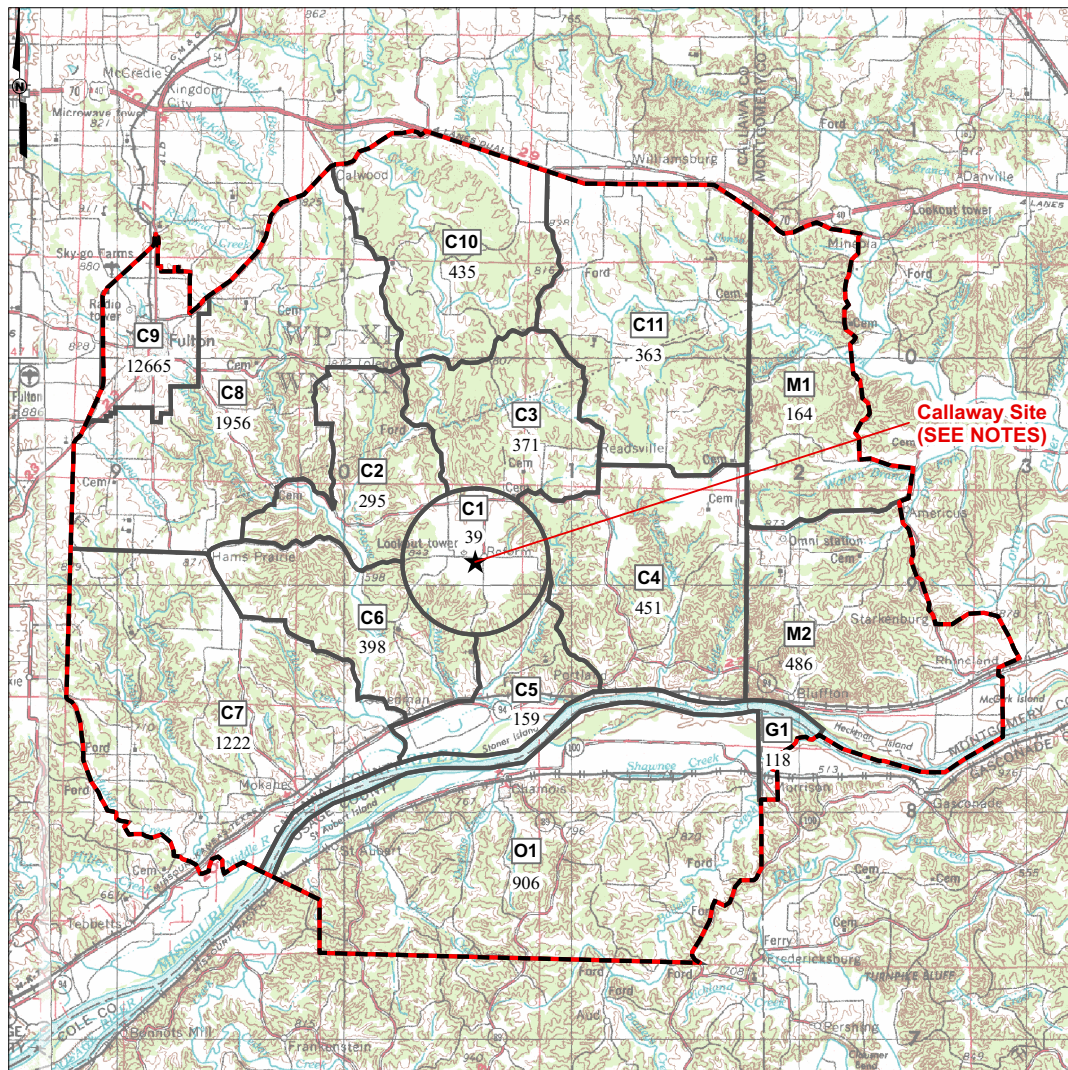
1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.

2. DATA PROVIDED IN TABLE 7.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

2018 Population Totals			
Ring Miles	Ring Population	Total Miles	Cumulative Population
0 - 2	45	0 - 2	45
2 - 5	1,557	0 - 5	1,602
5 - 10	5,934	0 - 10	7,536

Figure 1.0-11—2008 General Population Distribution by EPZ Subarea**LEGEND:**

- ★ Callaway Site
- ▭ Limits of Emergency Planning Zone (EPZ)
- ▭ C1 EPZ Subarea
- 39 General Population Assignment

0 2 4
Miles

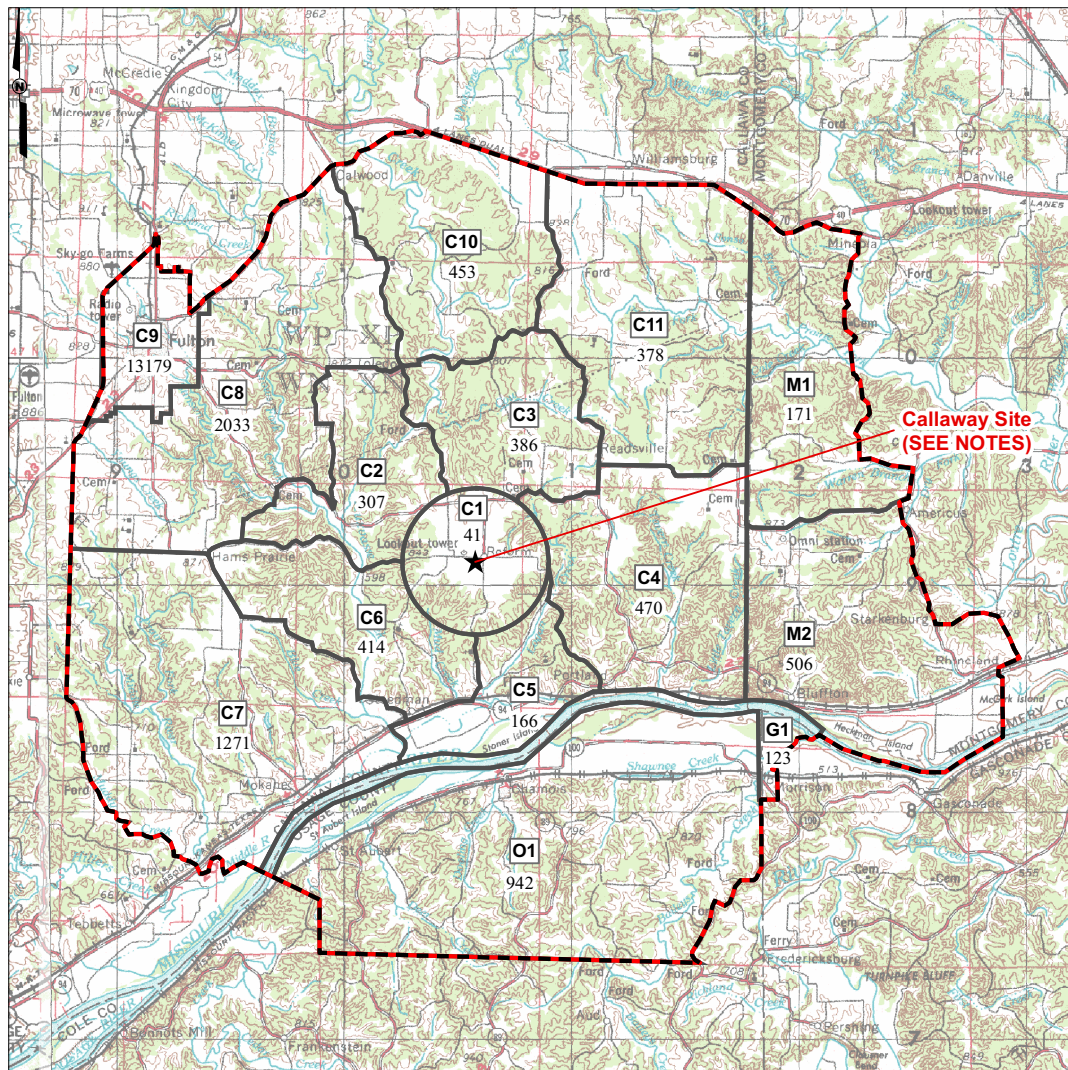
NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.

2. DATA PROVIDED IN TABLE 10A.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.
- USGS 1x2 degree series 1:100K DRG: Fulton, 1984 & Jefferson City, 1984.

Figure 1.0-12—2016 General Population Distribution by EPZ Subarea**LEGEND:**

- ★ Callaway Site
- ▭ Limits of Emergency Planning Zone (EPZ)
- ▭ C1 EPZ Subarea
- 41 Projected Population

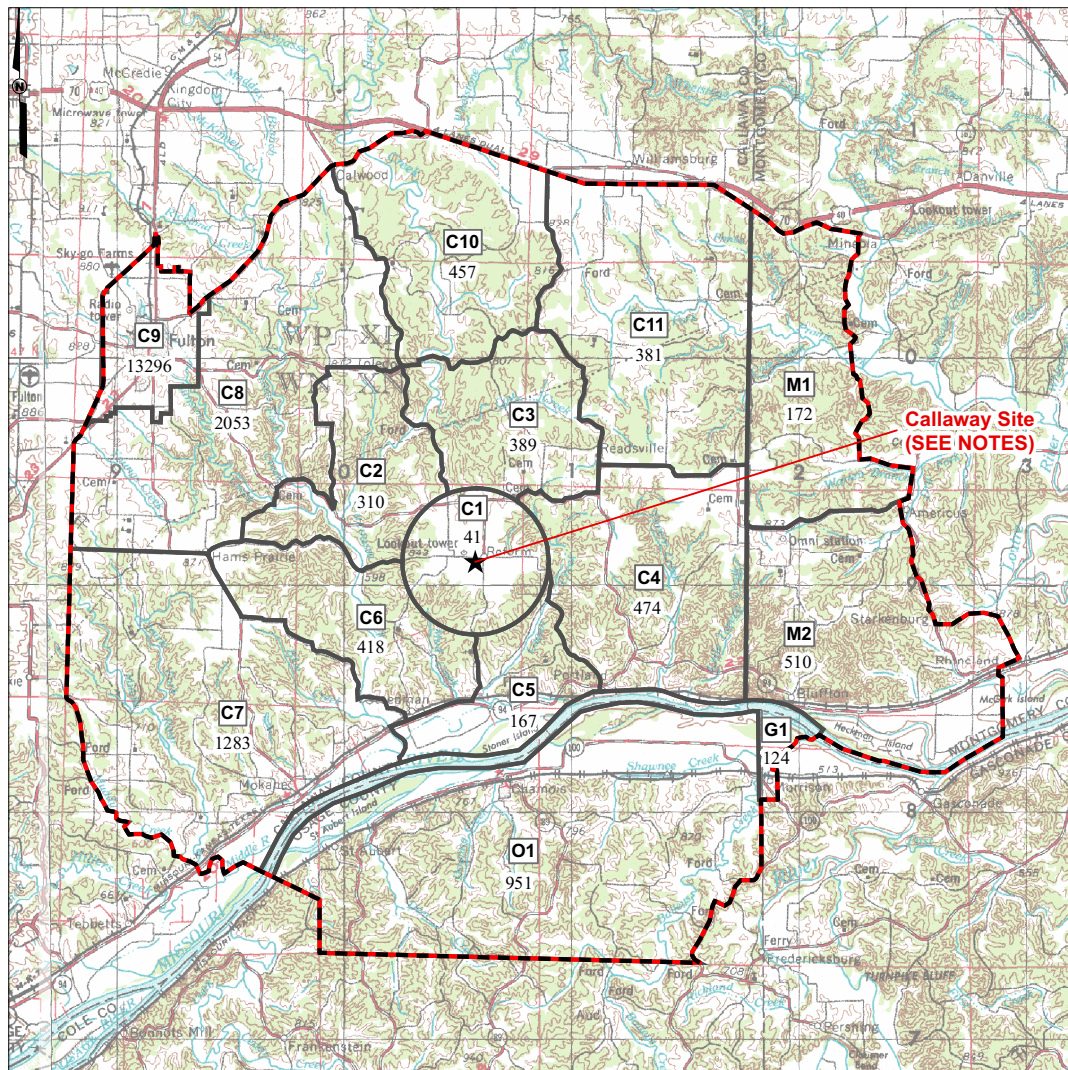
0 2 4
Miles

NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.
2. DATA PROVIDED IN TABLE 10B.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.
- USGS 1x2 degree series 1:100K DRG: Fulton, 1984 & Jefferson City, 1984.

Figure 1.0-13—2018 General Population Distribution by EPZ Subarea**LEGEND:**

- ★ Callaway Site
- ▭ Limits of Emergency Planning Zone (EPZ)
- ▭ C1 EPZ Subarea
- 41 Projected Population

0 2 4
Miles

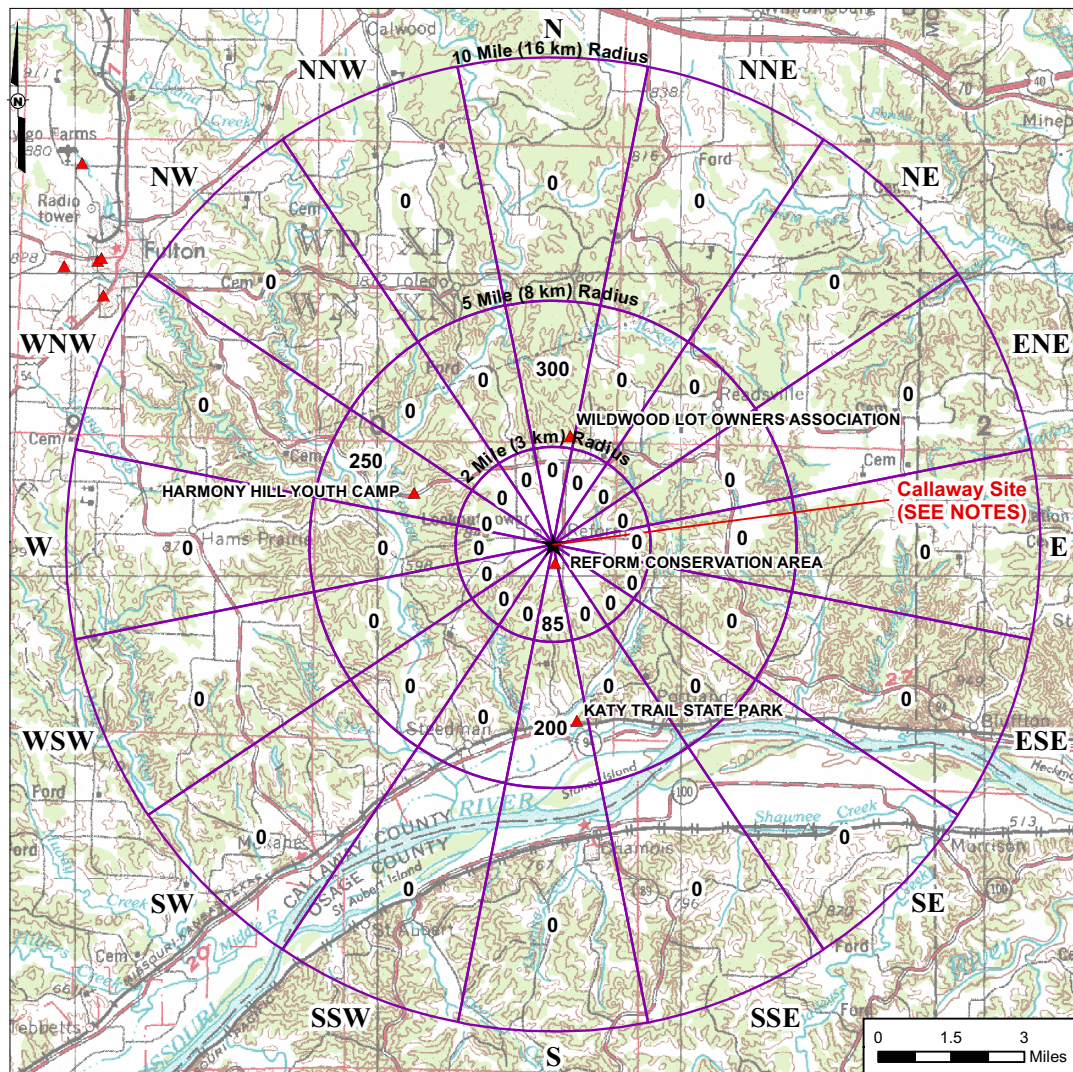
NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.
2. DATA PROVIDED IN TABLE 10C.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.
- USGS 1x2 degree series 1:100K DRG: Fulton, 1984 & Jefferson City, 1984.

Figure 1.0-14—2008 - 2018 Transient Population Distribution by 22° Sector Out to 10 Miles



LEGEND:

- ★ Callaway Site
- ▲ Transient Populations
- 85 Transient Population Assignment - *transient population totals are expected to remain constant from 2008 - 2018; worker population numbers change.*

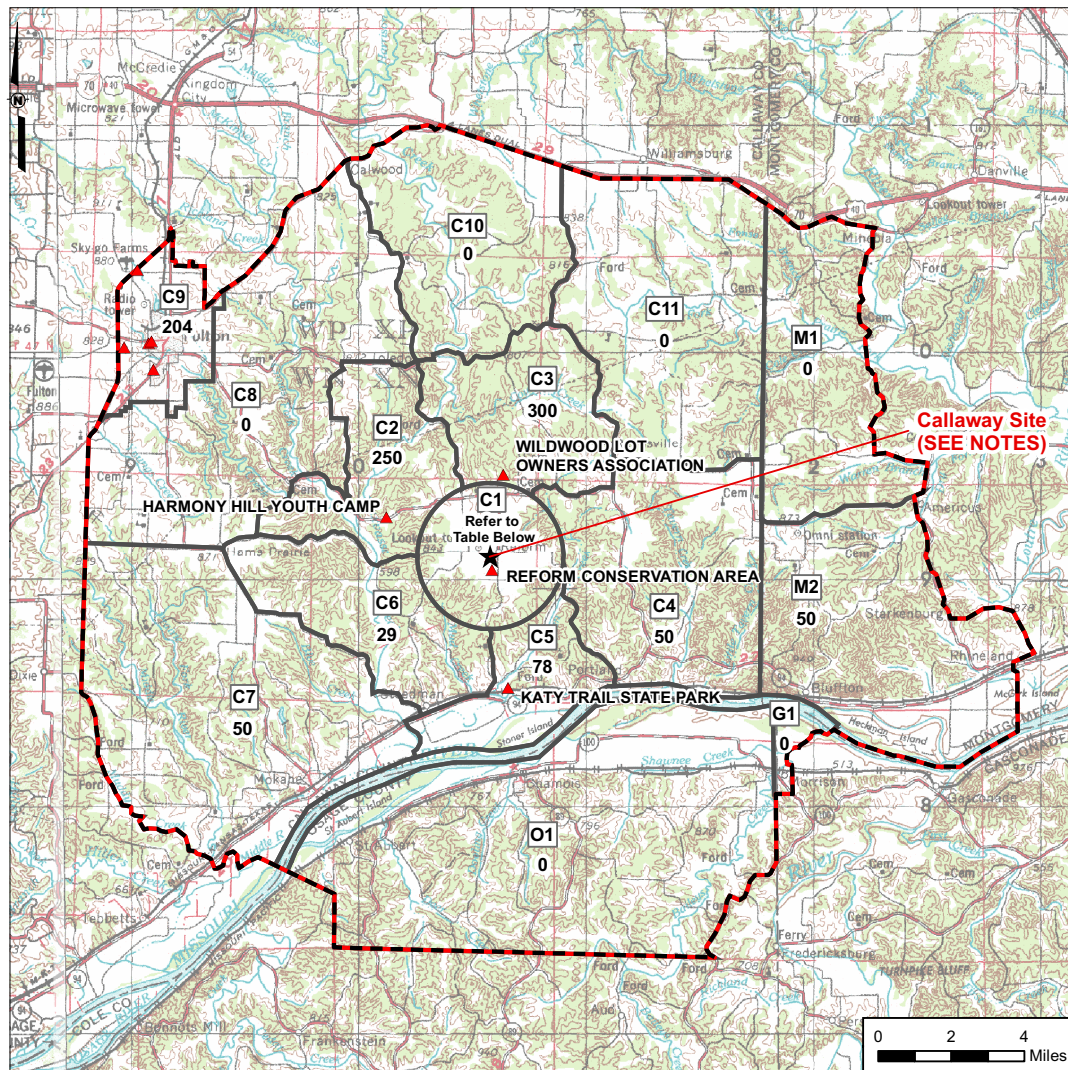
REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- Google Earth and Google Maps was used to determine Transient locations. www.google.com
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.
2. SECTOR TOTALS AS SHOWN FROM 0-2 MILES (0-3 KM) DO NOT INCLUDE CALLAWAY NPP TEMPORARY OR PERMANENT PLANT WORKERS. REFER TO C1 SUBAREA POPULATION SUMMARY TABLE ON FIGURE 8B FOR WORKER POPULATION TOTALS.
3. DATA PROVIDED IN TABLES 2 AND 2A.
4. TRANSIENT POPULATIONS LOCATED IN THE EPZ SUBAREA C9 (FULTON) ARE IDENTIFIED ON FIGURE 3A.

Figure 1.0-15—2008 - 2018 Transient Population Distribution by EPZ Subarea

**LEGEND:**

- ★ Callaway Site
- ▲ Transient Populations
- ▭ Limits of Emergency Planning Zone (EPZ)
- ▭ C1 EPZ Subareas
- 50 Transient Population Assignment - *transient population totals are expected to remain constant from 2008 - 2018; worker population numbers change.*

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- Google Earth and Google Maps was used to determine Transient locations. www.google.com
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

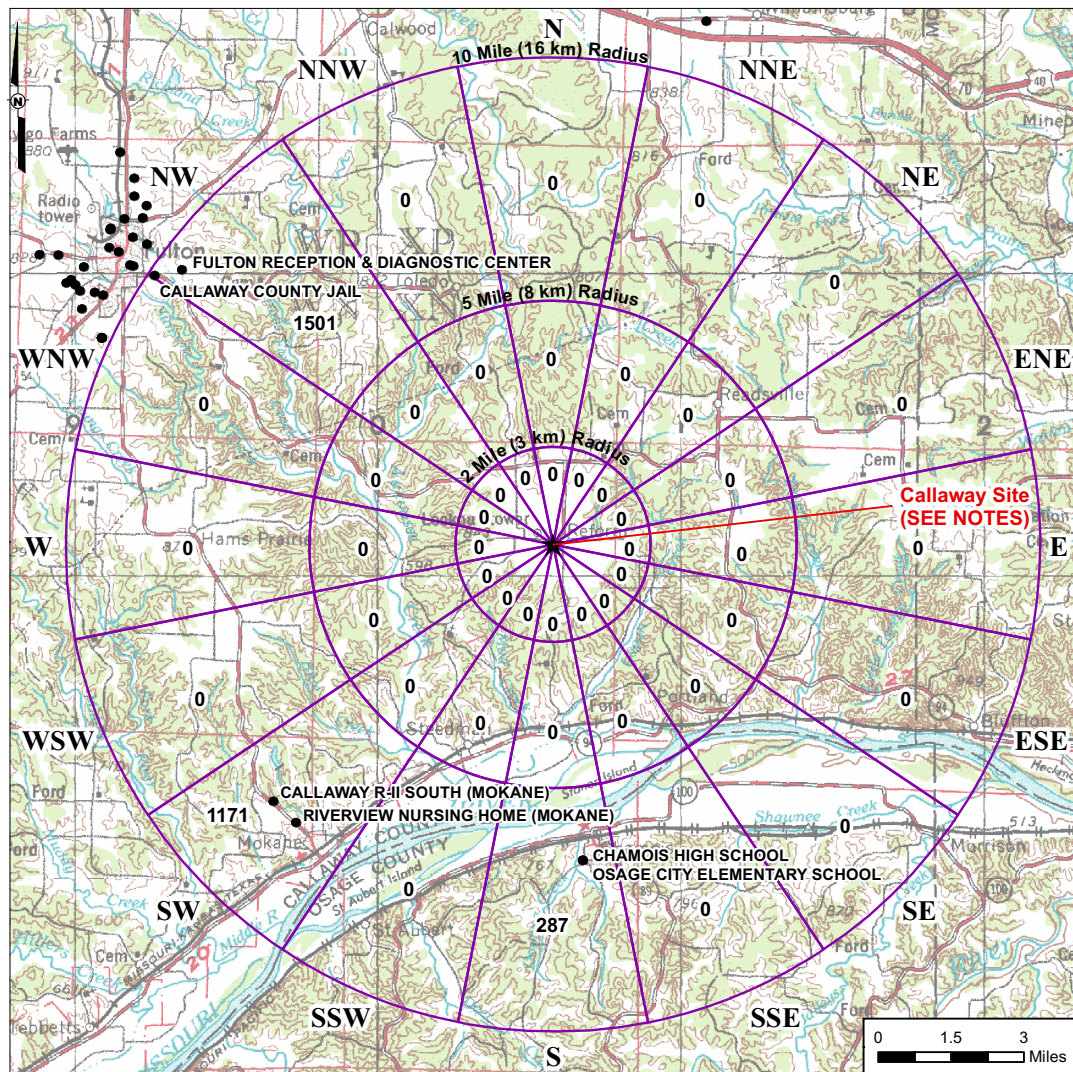
C1 Population Total

Year	2008	2016	2018
Worker Population	2,054	5,017 ⁽²⁾	2,371
Other			
Transient	28	28	28
Total	2,082	5,045	2,399

NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.
2. SECTOR TOTALS AS SHOWN FROM 0-2 MILES (0-3 KM) DO NOT INCLUDE CALLAWAY NPP TEMPORARY OR PERMANENT PLANT WORKERS. REFER TO C1 SUBAREA POPULATION SUMMARY TABLE ON FIGURE 8B FOR WORKER POPULATION TOTALS.
3. DATA PROVIDED IN TABLES 2 AND 2A.
4. TRANSIENT POPULATIONS LOCATED IN EPZ SUBAREA C9 ARE IDENTIFIED ON FIGURE 3A.

Figure 1.0-16—2008 - 2018 Special Facility Population Distribution by 22° Sector out to 10 Miles



LEGEND:

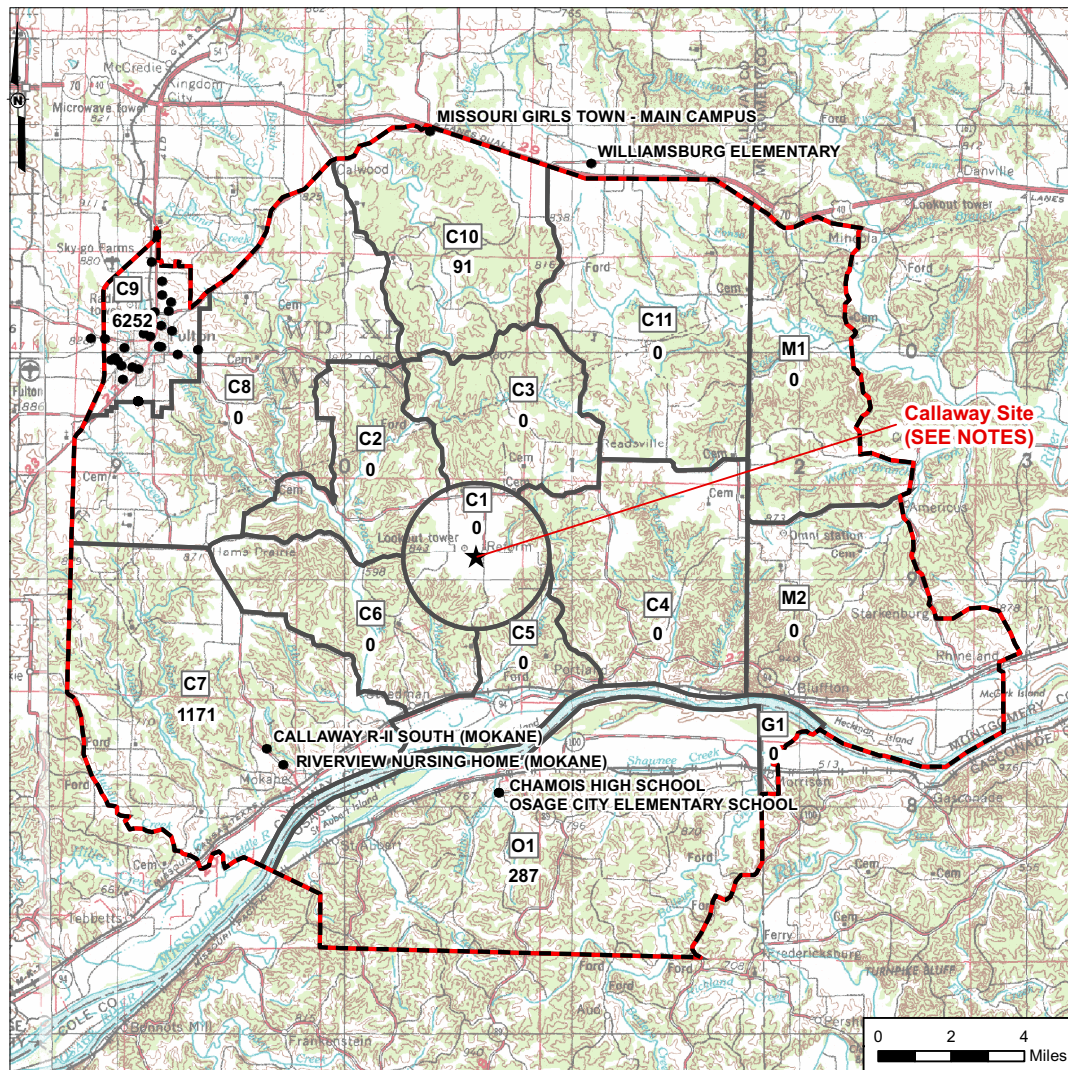
- ★ Callaway Site
- Special Facility
- 50 Special Facility Population Assignment - *special facility population totals are expected to remain constant from 2008 - 2018.*

NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.
2. DATA PROVIDED IN TABLES 3A AND 3B. SPECIAL FACILITY POPULATIONS ARE EXPECTED TO REMAIN STABLE FOR THE PERIOD OF 2008-2018. TABLES INCLUDE SHELTERING AND NON-SHELTERING (EVACUATION POPULATION).
3. SPECIAL FACILITIES LOCATED IN THE EPZ SUBAREA C9 (FULTON) ARE IDENTIFIED ON FIGURE 3A.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- Google Earth and Google Maps was used to determine Special Facility locations. www.google.com
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

Figure 1.0-17—2008 - 2018 Special Facility Population Distribution by EPZ Subarea**LEGEND:**

- ★ Callaway Site
- Special Facilities
- ▭ Limits of Emergency Planning Zone (EPZ)
- ▭ EPZ Subareas
- 287 Special Facility Population Assignment - special facility population totals are expected to remain constant from 2008 - 2018.

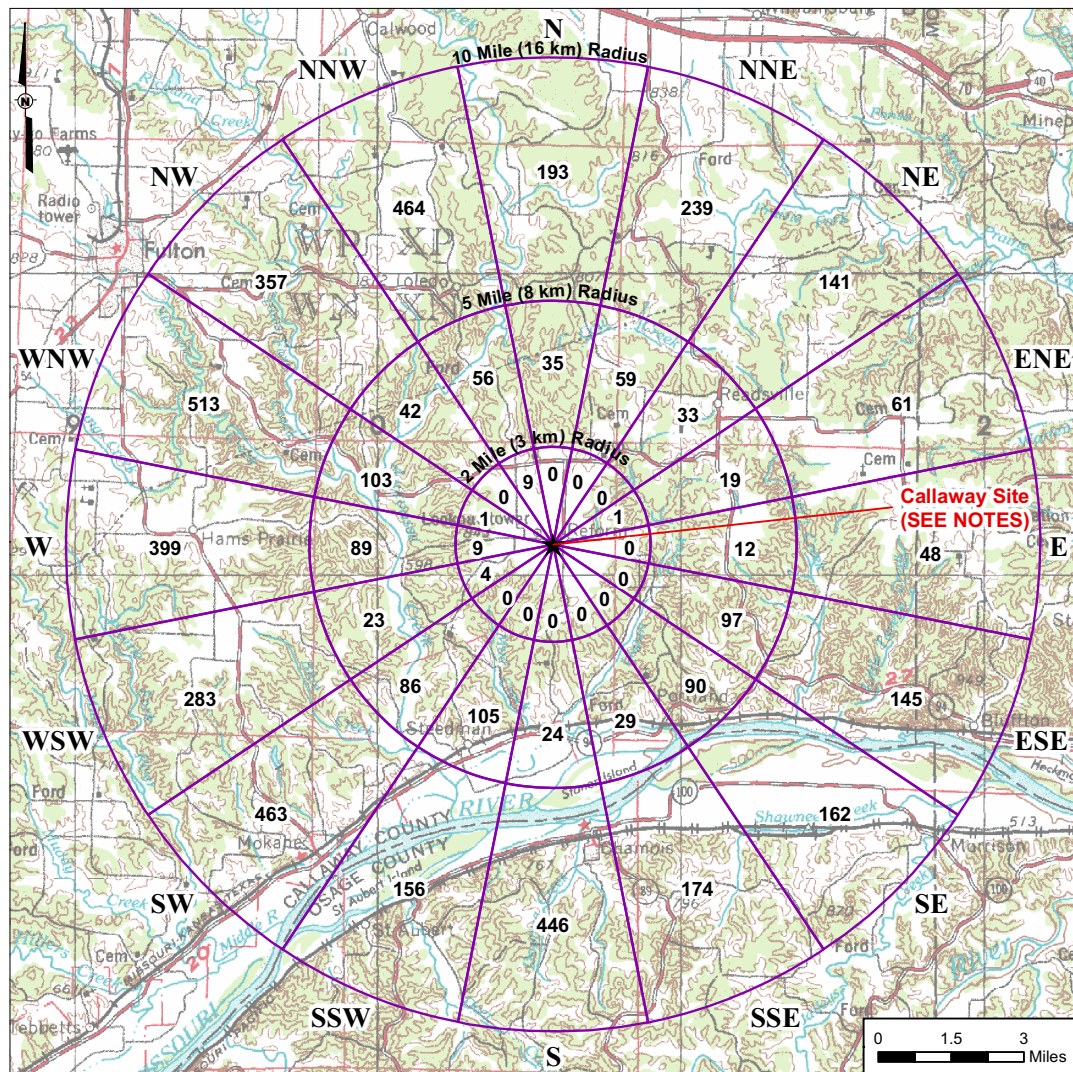
NOTE:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.
2. DATA PROVIDED IN TABLES 3A AND 3B. SPECIAL FACILITY POPULATIONS ARE EXPECTED TO REMAIN STABLE FOR THE PERIOD OF 2008-2018. TABLES INCLUDE SHELTERING AND NON-SHELTERING (EVACUATION POPULATION).
3. SPECIAL FACILITIES LOCATED IN EPZ SUBAREA C9 ARE IDENTIFIED ON FIGURE 3A.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- Google Earth and Google Maps was used to determine Transient locations. www.google.com
- USGS 1x2 degree series 1:250K DRG: St. Louis, 1969.

Figure 1.0-18—2008 General Population Evacuation Vehicle Distribution by 22° Radial Sector Out to 10 Miles



LEGEND:

★ Callaway Site

463 Number of Vehicles Evacuating

NOTES:

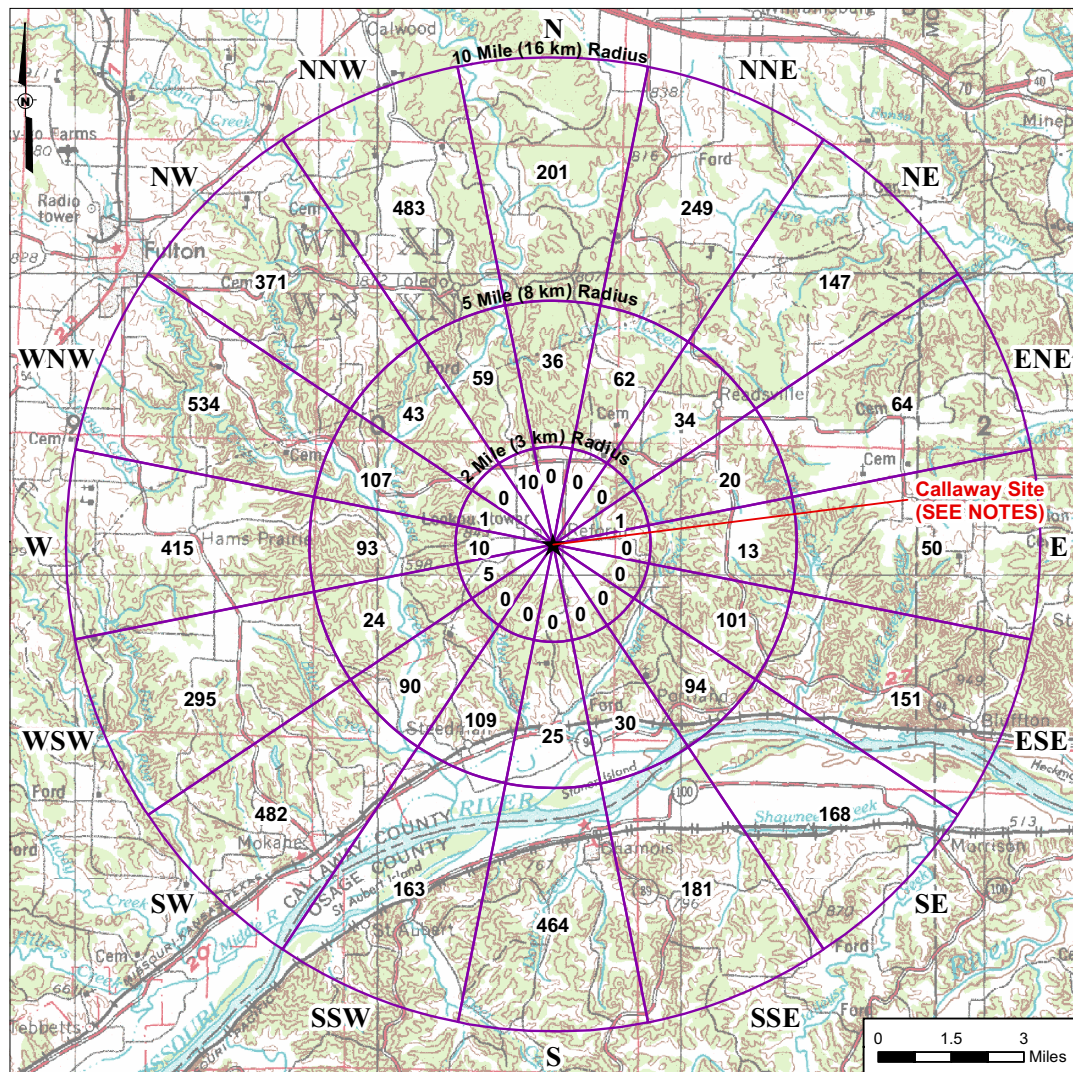
1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.

2. AN AVERAGE VEHICLE EVACUATION USE FACTOR OF 1.47 VEHICLES PER OCCUPIED HOUSING UNITS IS ASSUMED FOR ESTIMATING RESIDENTIAL TRAFFIC DEMAND LOAD. DATA PROVIDED IN TABLE 5.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

Figure 1.0-19—2016 General Population Evacuation Vehicle Distribution by 22° Radial Sector Out to 10 Miles



LEGEND:

- ★ Callaway Site
- 482 Number of Vehicles Evacuating

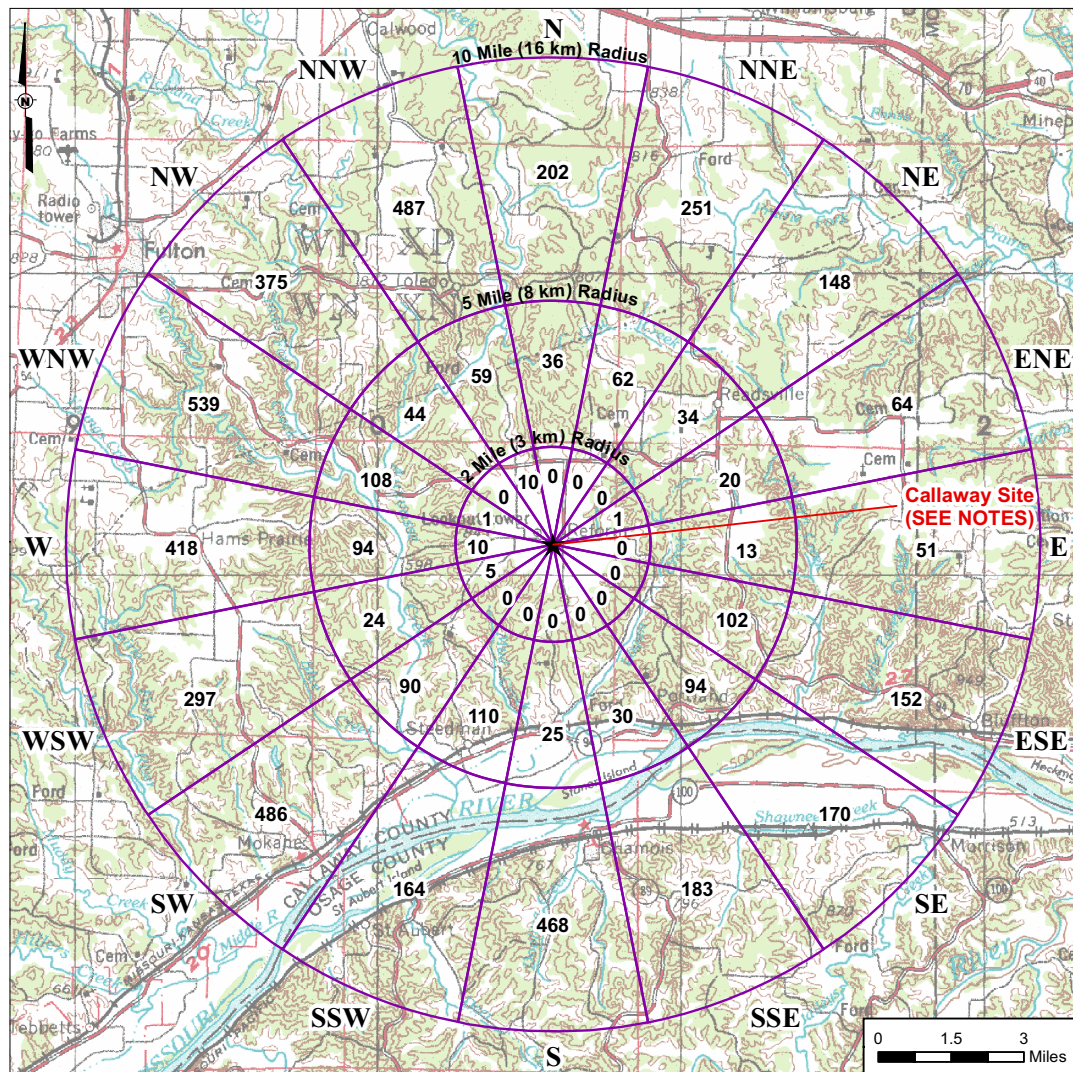
NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.
2. AN AVERAGE VEHICLE EVACUATION USE FACTOR OF 1.47 VEHICLES PER OCCUPIED HOUSING UNITS IS ASSUMED FOR ESTIMATING RESIDENTIAL TRAFFIC DEMAND LOAD. DATA PROVIDED IN TABLE 6.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

Figure 1.0-20—2018 General Population Evacuation Vehicle Distribution by 22° Radial Sector Out to 10 Miles



LEGEND:

★ Callaway Site

486 Number of Vehicles Evacuating

NOTES:

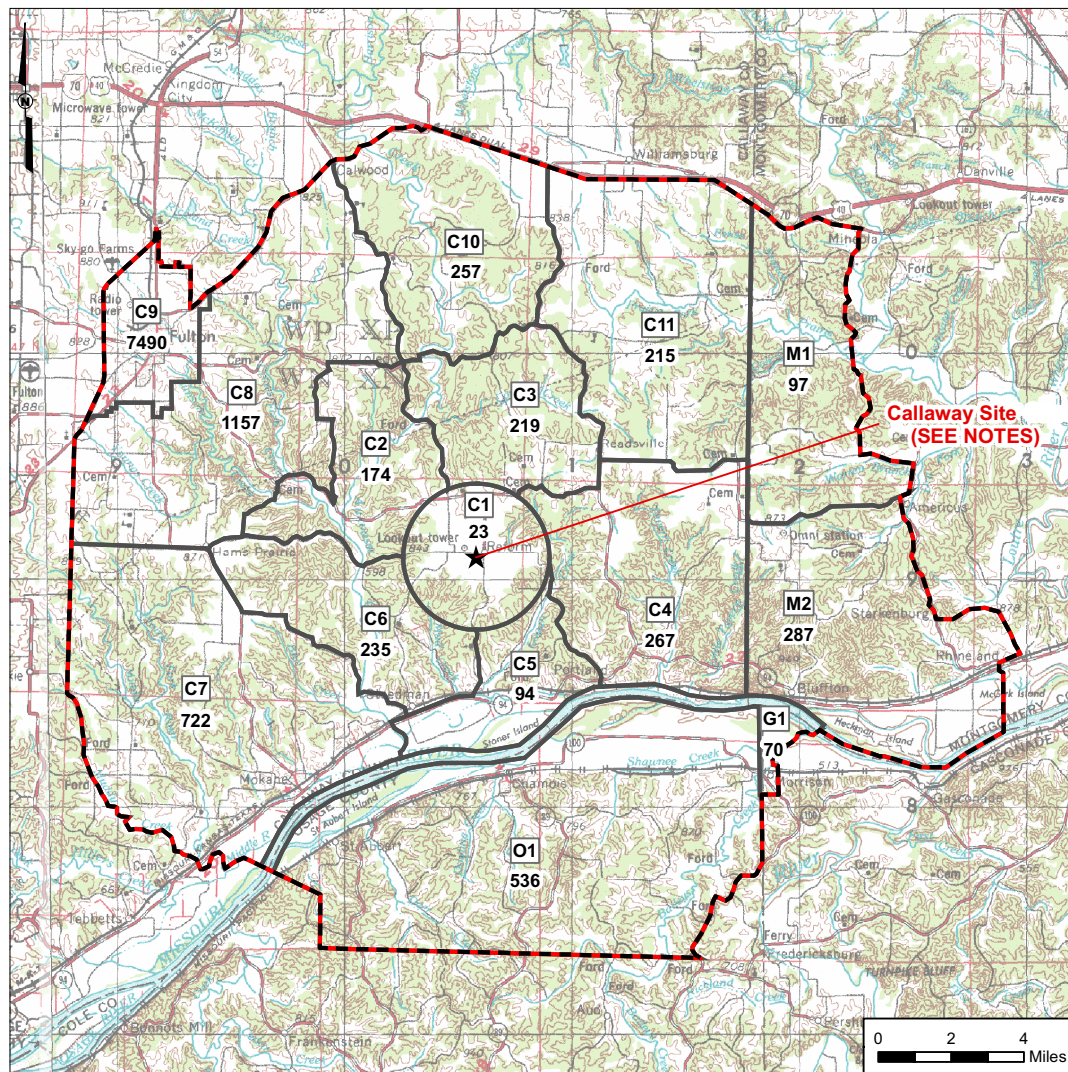
1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.

2. AN AVERAGE VEHICLE EVACUATION USE FACTOR OF 1.47 VEHICLES PER OCCUPIED HOUSING UNITS IS ASSUMED FOR ESTIMATING RESIDENTIAL TRAFFIC DEMAND LOAD. DATA PROVIDED IN TABLE 7.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

Figure 1.0-21—2008 General Population Evacuation Vehicle Distribution by EPZ Subarea



LEGEND:

- ★ Callaway Site
- Limits of Emergency Planning Zone (EPZ)
- C1 EPZ Subareas
- 23 Number of Vehicles Evacuating

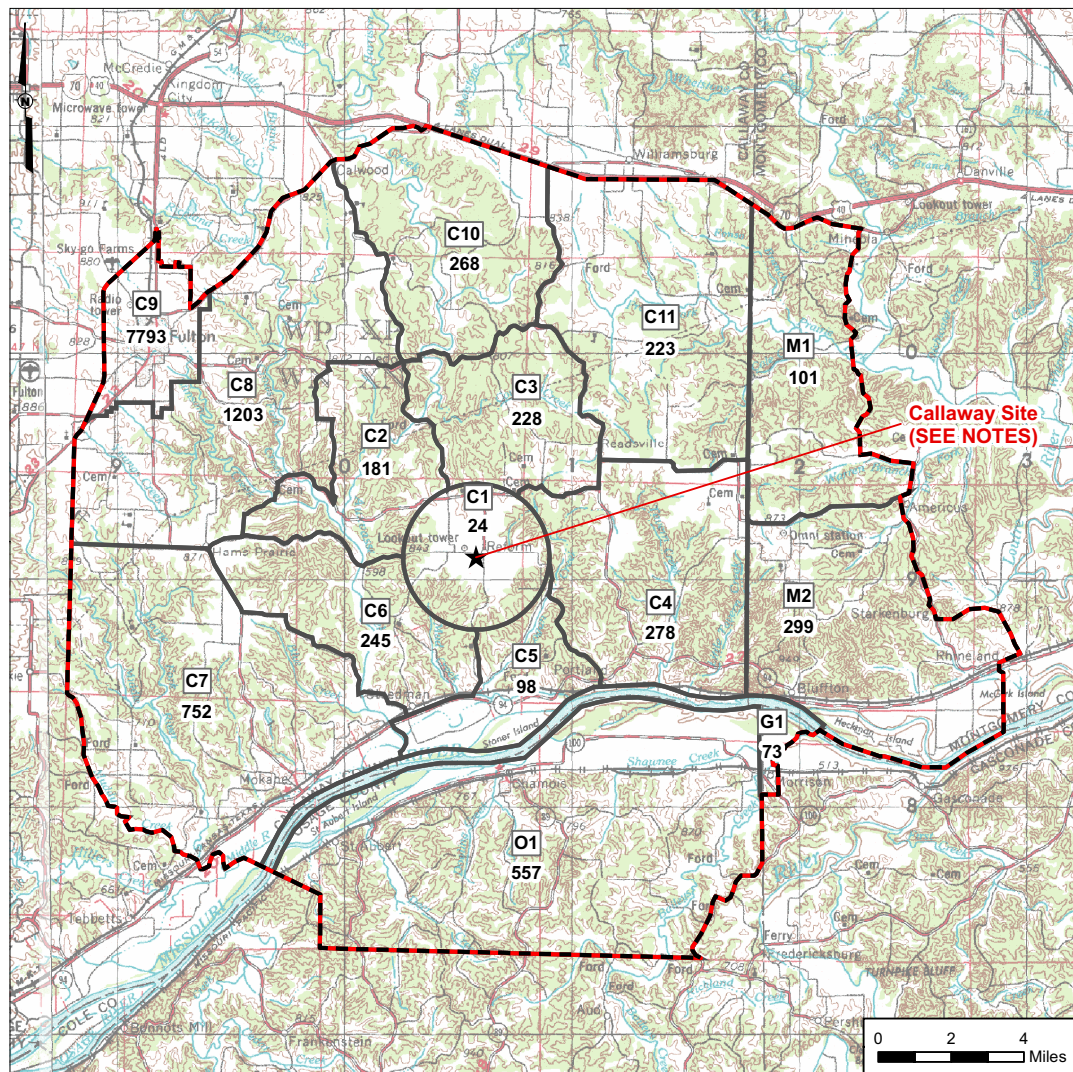
NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY UNIT 1 AND REACTOR FOR CALLAWAY UNIT 2.
2. AN AVERAGE VEHICLE EVACUATION USE FACTOR OF 1.47 VEHICLES PER OHU IS ASSUMED FOR ESTIMATING RESIDENTIAL TRAFFIC DEMAND LOAD. DATA PROVIDED IN TABLE 10A.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

Figure 1.0-22—2016 General Population Evacuation Vehicle Distribution by EPZ Subarea



LEGEND:

- ★ Callaway Site
- ▭ Limits of Emergency Planning Zone (EPZ)
- ▭ EPZ Subareas
- 24 Number of Vehicles Evacuating

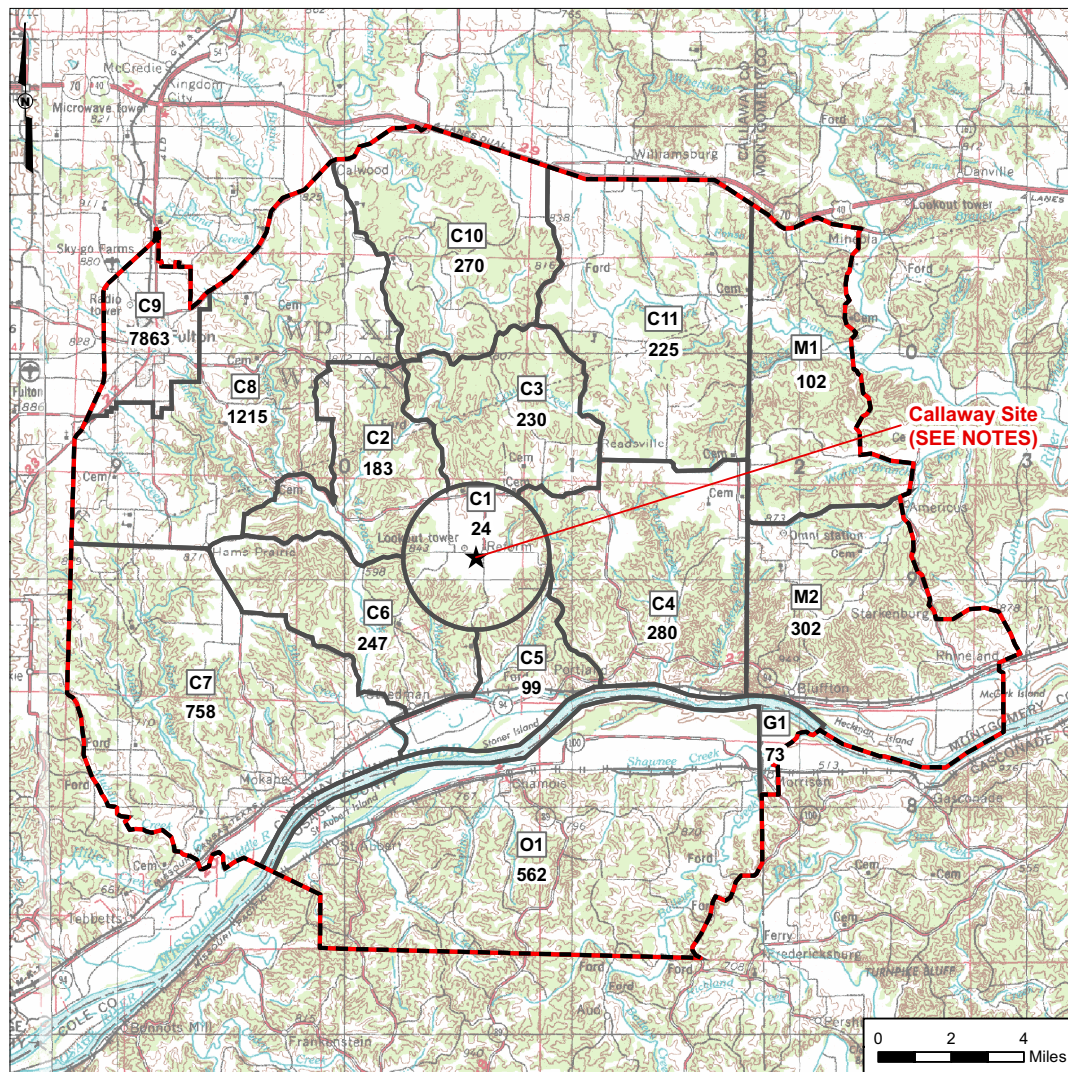
NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.
2. AN AVERAGE VEHICLE EVACUATION USE FACTOR OF 1.47 VEHICLES PER OCCUPIED HOUSING UNITS IS ASSUMED FOR ESTIMATING RESIDENTIAL TRAFFIC DEMAND LOAD. DATA IS PROVIDED IN TABLE 10B.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

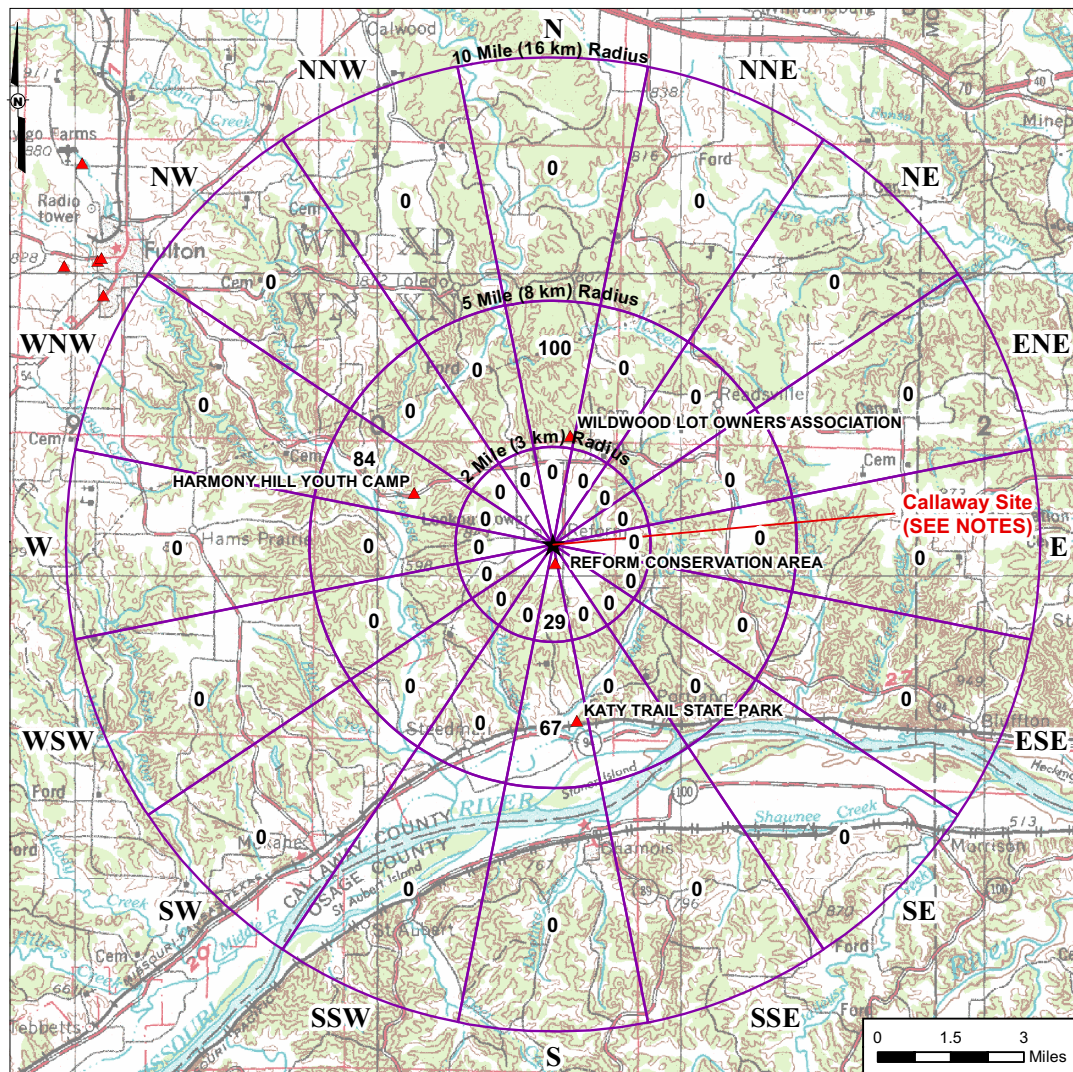
Figure 1.0-23—2018 General Population Evacuation Vehicle Distribution by EPZ Subarea



REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

Figure 1.0-24—2008 - 2018 Distribution of Vehicles/Trips during Transient Population Evacuation by 22° Sector



LEGEND:

- ★ Callaway Site
- ▲ Transient Populations
- 67 Number of Vehicles Evacuating - *transient vehicle totals are expected to remain constant from 2008-2018; worker vehicle numbers change..*

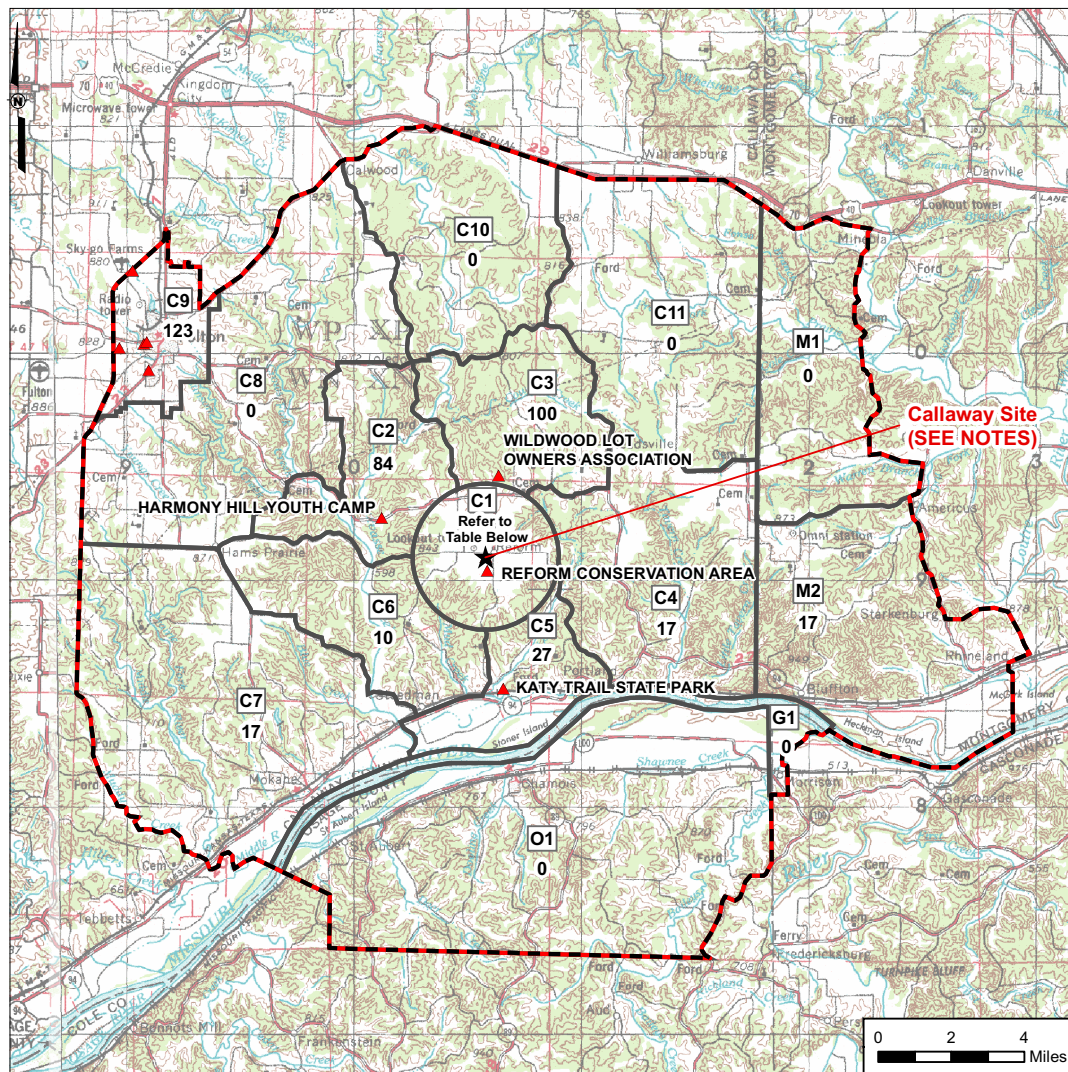
NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.
2. SECTOR TOTALS AS SHOWN FROM 0-2 MILES (0-3 KM) DO NOT INCLUDE PLANT WORKERS. DATA PROVIDED IN C1 SUBAREA VEHICLE TOTAL SUMMARY TABLE ON FIGURE 12B FOR TOTAL WORKER VEHICLES EVACUATION.
3. DATA PROVIDED ON TABLES 2 AND 2A.
4. TRANSIENT POPULATIONS LOCATED IN EPZ SUBAREA C9 (FULTON) ARE IDENTIFIED ON FIGURE 3A.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- Google Earth and Google Maps was used to determine Transient locations. www.google.com
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

Figure 1.0-25—2008 - 2018 Distribution of Vehicles/Trips during Transient Population Evacuation by EPZ Subarea



LEGEND:

- ★ Callaway Site
- ▲ Transient Populations
- ▭ Limits of Emergency Planning Zone (EPZ)
- ▭ C1 EPZ Subareas
- 27 Number of Vehicles Evacuating - *transient vehicle totals are expected to remain constant from 2008-2018; worker vehicle numbers change.*

C1 Vehicle Total			
Year	2008	2016	2018
Worker Vehicles	1,743	4,023 ⁽²⁾	2,060
Other Transient	9	9	9
Total	1,752	4,032	2,069

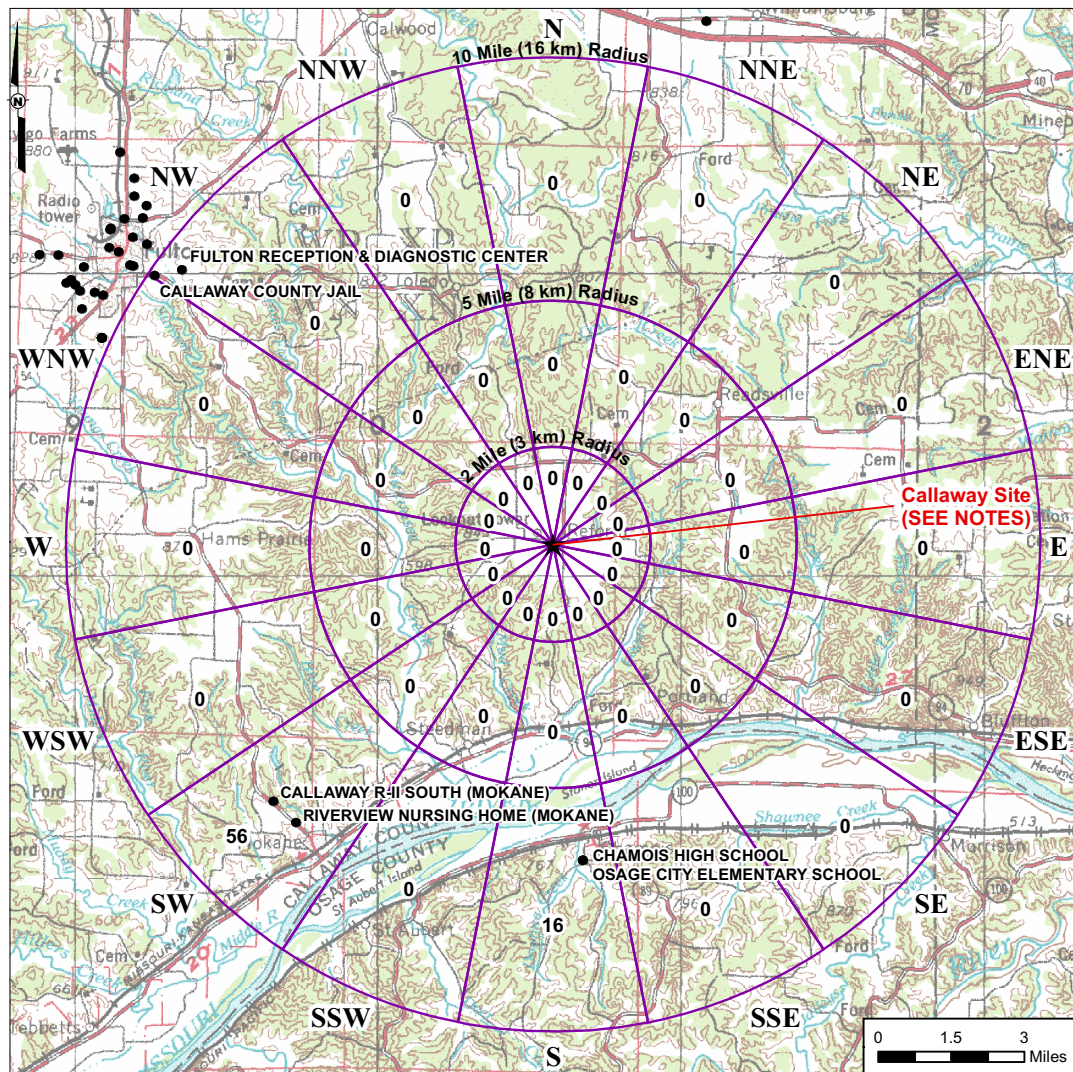
NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.
2. REFLECTS THE MAXIMUM CASE OF WORKERS ONSITE/EVACUATING DURING THE PEAK CONSTRUCTION YEAR OF 2016.
3. DATA PROVIDED IN TABLES 2, 2A, 10A, 10B, AND 10C.
4. TRANSIENT POPULATIONS LOCATED IN EPZ SUBAREA C9 ARE IDENTIFIED ON FIGURE 3A.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- Google Earth and Google Maps was used to determine Transient locations. www.google.com
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

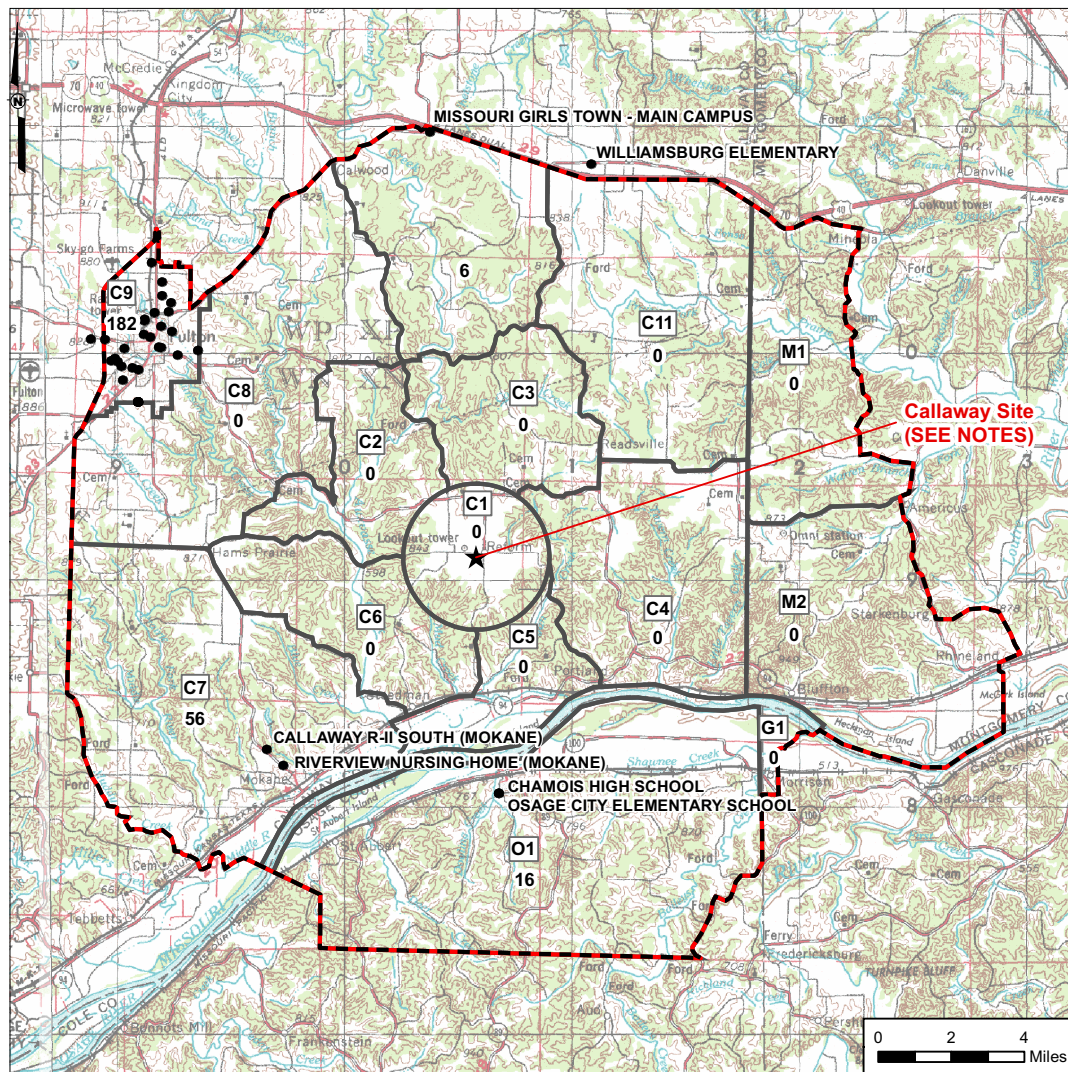
Figure 1.0-26—2008 - 2018 Distribution of Vehicles/Trips during Special Facility Evacuation by 22° Sector



REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- Google Earth and Google Maps was used to determine Transient locations. www.google.com
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

Figure 1.0-27—2008 - 2018 Distribution of Vehicles/Trips during Special Facility Evacuation by EPZ Subarea



LEGEND:

- ★ Callaway Site
- Special Facilities
- ▭ Limits of Emergency Planning Zone (EPZ)
- ▭ C1 EPZ Subareas
- 198 Number of Vehicles Evacuating - special facility vehicle totals are expected to remain constant from 2008 - 2018.

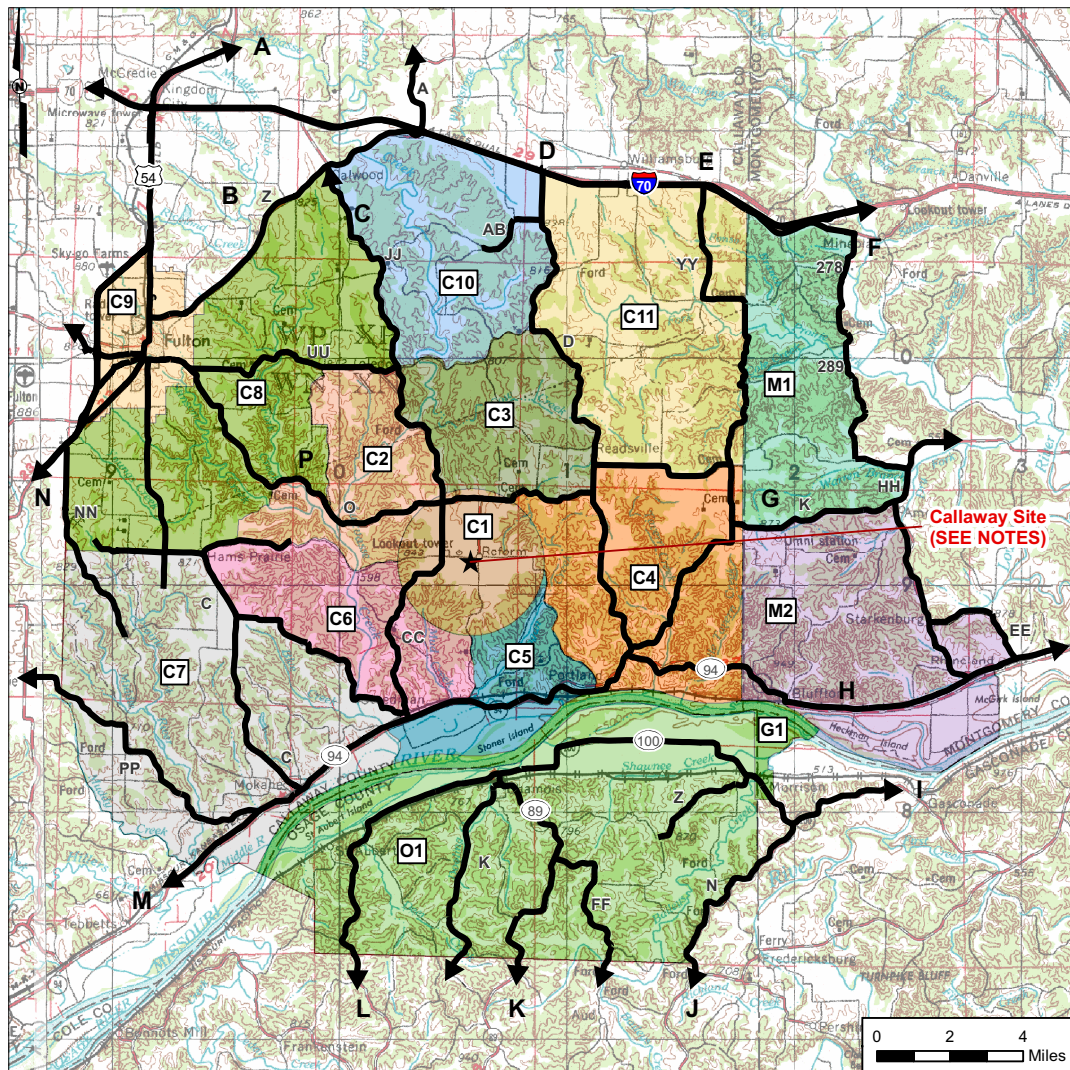
NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.
2. THE NUMBER OF BUS TRIPS IS CALCULATED BY DIVIDING THE FACILITY POPULATION BY AN AVERAGE OCCUPANCY RATE OF 40 PERSONS PER BUS, ROUNDING UP ANY REMAINDER TO THE NEAREST WHOLE NUMBER, AND MULTIPLYING BY 2 FOR A ROUND TRIP IN AND OUT OF THE EPZ. TOTALS INCLUDE SHELTERING POPULATIONS.
3. DATA PROVIDED IN TABLES 3A, 3B, 10A, 10B, AND 10C.
4. SPECIAL FACILITIES LOCATED IN EPZ SUBAREA C9 ARE IDENTIFIED ON FIGURE 3A.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- Google Earth and Google Maps was used to determine Transient locations. www.google.com
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.

Figure 1.0-28—Major Evacuation Routes

**LEGEND:**

- ★ Callaway Site
- C1** EPZ Subareas
- ➔ Major Evacuation Routes

NOTES:

1. REFERENCE CENTER POINT OF PLANT SITE IS DEFINED AS THE MIDPOINT BETWEEN EXISTING REACTOR FOR CALLAWAY PLANT UNIT 1 AND REACTOR FOR CALLAWAY PLANT UNIT 2.
2. DATA PROVIDED IN TABLES 8A THROUGH 8C FOR TRAFFIC ASSIGNED TO PRIMARY EVACUATION ROUTES FOR THE YEAR 2008 THROUGH 2018.

REFERENCES:

- Appendix G: "Evacuation Time Estimate for the Callaway Nuclear Plant Emergency Planning Zone", RERP-REV32, January, 2008.
- Google Earth and Google Maps was used to determine Transient locations. www.google.com
- USGS 1x2 degree series 1:250K DRG: St Louis, 1969.