AIR FORCE POTENTIAL TO EMIT (PTE) GUIDE

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December 2014

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1 Introduction

Potential to Emit (PTE) is defined in 40 CFR 52.21 and 70.2 as "the maximum capacity of a stationary source to emit any air pollutant under its physical and operational design." Both 40 CFR 52.21 and 70.2 also state that "any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable".

The "maximum capacity" of a stationary source to emit a pollutant is based on the equipment's physical and operational design and on inherent non-design physical limitations. In most cases the maximum capacity of a source is based on the source's physical and operational equipment design; however, there are sources for which inherent non-equipment related physical limitations restrict the potential emissions of individual emission units. These inherent non-equipment limitation are indirect restrictions on emissions that are called a non-equipment "limiting factor." A non-equipment limiting factor, while often overlooked when evaluating physical or operational design, are unavoidably and inherently physically prohibits increased capacity. Given "any physical or operational limitation … shall be treated as part of its design," non-equipment limiting factors are part of a source's design and should be considered and accounted for in establishing the maximum capacity of a stationary source.

This guide evaluates Air Force-specific air emission sources for inherent non-equipment limiting factors to ensure, as a minimum, they are included when estimating PTE for major source determinations and establishing permit limits. The guide provides in-depth discussions of methodologies and documented results for regulatory review/validation.

The Air Force-specific inherent non-equipment limiting factors established under this guide are considered de facto minimum federally enforceable limits for Air Force sources. As such, they are to be considered as the minimum (stating point) federally enforceable limits when establishing new or renewing operating permits and the minimum default limits when performing a major source determination.

2 PTE Definition

PTE is a theoretical calculation (which may differ from actual emissions) used to determine if a site is a major source. According to 40 CFR 52.21 & 70.2, PTE is the annual maximum capacity of a stationary source to emit under its physical and operational design. And, according to 40 CFR 70.2, any physical or operational limitation on the source to emit an air pollutant shall be treated as part of its design if the limitation is enforceable by the EPA; physical or operational limitations include:

- Air pollution control equipment and restrictions on hours of operation, or
- Limitations on the type or amount of material combusted, stored, or processed

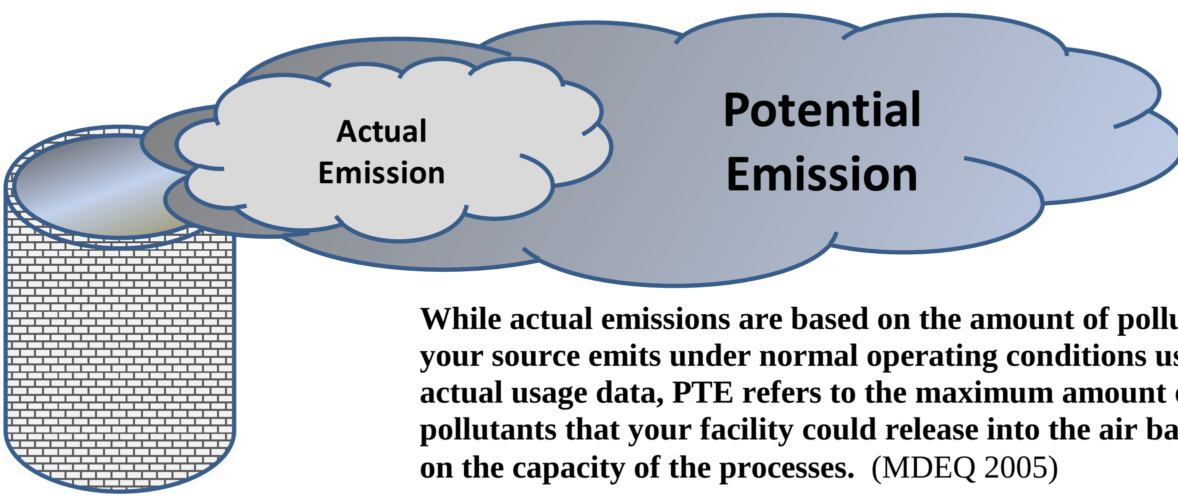
This definition is clearly referring to PTE as an evaluation of annual maximum capacity to emit from currently existing stationary sources operated under currently existing physical or operational limitations. Therefore,

- Only existing stationary sources from the current Air Emissions Inventory (AEI) are to be included and do not include any mobile, transitory (temporary), or theoretical future sources.
- Physical or operational limitation (if enforceable by the EPA) must be accounted for in assessing the annual maximum capacity.

In general terms, PTE (see Figure 1, Actual vs. PTE Emissions) is the maximum air contaminants a source could emit if:

- Operated at maximum process capacity rate or operated at 100% of its design capacity (accounting for);
- Operated for a total Process Period (Time) of one year (8,760 hrs);
- Materials that emit the most air contaminants are used or processed 100% of the time; and
- Air pollution control equipment is turned off.

Figure 1, Actual vs. Potential Emissions



While actual emissions are based on the amount of pollutants your source emits under normal operating conditions using actual usage data, PTE refers to the maximum amount of pollutants that your facility could release into the air based on the capacity of the processes. (MDEQ 2005)

3 EPA Physical and Operational Limitations Guidance

As far back as the EPA's June 13, 1989 memorandum titled "Guidance on Limiting Potential to Emit in New Source Permitting," the EPA has acknowledged and accepted that there are physical and operational limitations on a source's PTE (Seitz 1989):

> "Emission limits are restrictions over a given period of time on the amount of a pollutant which may be emitted from a source into the outside air. Production limits are restrictions on the amount of final product which can be manufactured or otherwise produced at a source. Operational limits are all other restrictions on the manner in which a source is run, including hours of operation, amount of raw material consumed, fuel

> combusted, or conditions which specify that the source must install and maintain add-on controls that operate at a specified emission rate or efficiency. All production and operational limits except for hours of operation are limits on a source's capacity utilization. Potential emissions are defined as the product of a source's emission rate at maximum operating capacity, capacity utilization, and hours of operation."

PTE is limited by the amount of final product a source can physically manufacture/produce and the how a source is run. The 1989 memorandum clarifies that all production and operational limits (except for hours of operation) are limits on a source's capacity utilization which in turn limits PTE. The memorandum defines "production limits" as restrictions on the amount of final product which can be manufactured or otherwise produced at a source and further defines "operational limits" as "all other restrictions on the manner in which a source is run, including hours of operation, amount of raw material consumed, fuel combusted, or conditions which specify that the source must install and maintain add-on controls that operate at a specified emission rate or efficiency." In other words, PTE is limited by physical manufacturing or production limits and the how a source is run (which includes hours of operation, amount of raw material, fuel combusted, or source control inherent to the operation of the source).

In a later memorandum dated January 25, 1995, the EPA addressed a number of issues related to the determination of a source's PTE under section 112 and title V of the Clean Air Act (Act). One of the issues discussed in the memorandum was the term "maximum capacity of a stationary source to emit under its physical and operational design," which is part of the definition of PTE. The memorandum clarified that inherent physical limitations, and operational design features which restrict the potential emissions of individual emission units, can be taken into account. This clarification was intended to address facilities for which the theoretical use of equipment is much higher than could ever actually occur in practice. For such facilities, if their inherent limitations can be documented by a source and confirmed by the permitting agency, EPA believes these inherent limitations can be factored into estimates of a stationary source's PTE. For example, EPA does not believe that the maximum capacity language requires a paint spray booth at an auto body shop must assume that (even if the source could be in operation year-round) spray equipment is operated 8,760 hours per year in cases where there are inherent physical limitations on the number of cars that can be painted within any given period of time. (Seitz 1995a)

Therefore, based on EPA guidance, PTE emissions can be defined as the product of a source's emission rate at maximum operating capacity, capacity utilization, and hours of operation and not just based on operating for 8,760 hours per year.

4 Potential Gross Income Analogy

Given PTE is the annual maximum capacity to emit from currently existing stationary sources operated under currently existing physical or operational limitations, PTE is analogous to an employee's annual potential to earn or Potential Gross Income (PGI).

For example, if John Smith was hired at $10/hr and had no limit on the hours he was allowed work (straight pay, no overtime pay). His PGI could be calculated as follows:

$$\boldsymbol{PGI = E \; = A \times EF}$$

Where:

E = Earnings (earnings per year, \$/yr)
A = Annual Work Activity Rate (hours per year, hr/yr)
EF = Earnings Factor (pay rate, \$/hr)

Given there are 8,760 hr/yr, it could easily be concluded that John's PGI is equal to \$87,600/yr (i.e., \$10/hr x 8,760 hr/yr); however, this would be incorrect! Even if John worked 7 days/wk he has physical or operational limitations that make earning \$87,600/yr impossible. The problem stems from the assumption that the Annual Work Activity Rate (A) is equal to continuously working over the entire year.

To correct the error the Annual Work Activity Rate (A) must be further evaluated. The Annual Work Activity Rate (A) is a function of the Hourly Work Rate (C) and the Total Time Period (T), as follows:

$$\boldsymbol{A = C \times T = \frac{t}{8{,}760\ hr/yr} \times T}$$

Where:

C = Actual Average Hourly Work Rate (weighted over the time period T, \$/hr)
T = Total Process Time Period (hr), for PTE is 8,760 hr
t = Actual Time Worked (total hours worked during the time period T, hr)

As such, the first equation above may be rewritten as follows:

$$\boldsymbol{PGI = E \; = C \times T \times EF = \frac{t}{8{,}760\ hr/yr} \times T \times EF}$$

Upon interviewing John on his specific physical or operational limitations, it was evident that he needs time for sleep (6 hr/day), eating (2 hr/day), and hygiene (2 hr/day); which combined to 10 hr/day of limitations. Therefore, John can only work a maximum of 14 hr/day:

$$\text{PGI} = \text{E} \; = \frac{t}{8{,}760\text{ hr}} \times EF = \frac{\left(\frac{14\ \cancel{hr}}{\cancel{day}} x \ \frac{365\ \cancel{dys}}{\cancel{yr}}\right)}{8{,}760\ \cancel{\text{hr}}/\cancel{\text{yr}}} \times 8{,}760 \frac{\cancel{hr}}{yr} \times \frac{\$10}{hr} = \$51{,}100/yr$$

\$51,100 <<< \$87,600 (a 42% over-estimation)

PGI is analogous to PTE; like PGI's Annual Work Activity Rate, the PTE Annual Activity Rate (material throughput per year) in most cases should < 8,760 hr because of unavoidable constraints. Therefore, a full evaluation of physical or operational limitations is needed to eliminate over-estimations of PTE.

5 Maximum Process Capacity Rate

The maximum capacity rate is the maximum throughput or capability rate of a stationary source to emit under its physical and operational design (Seitz 1998). Physical design is the planned purpose and function of a piece of equipment while the operational design is the planned *procedural* process for operating a piece of equipment. The physical and operational designs result in both intentional and unintentional inherent physical limitations that the EPA allows to be accounted for when estimating PTE. Therefore, the maximum process rate for a piece of equipment does not imply it is continuously running for an entire one-year process period (run for 8,760 hr/yr), but is actually the worst case Activity Rate (e.g., runtime or other measure of rate) applied over a one-year process period (i.e., 8,760 hrs).

In estimating PTE it is assumed that sources are operated at maximum process capacity rate (or operated at 100% design capacity) over a total process period of one year (8,760 hrs). However, physical or operational design limitations (e.g., process bottlenecks, permit conditions, air quality rules, and compliance/enforcement documents, etc.) restrict the capacity of various sources to actually emit for a full 8,760 hours during a total process period of 1 year. Aware of potential bottlenecks and legal constraints on emissions, the EPA has acknowledged that inherent physical and operational limitations for the operation of a source may restrict the potential emissions and therefore can be taken into account (Seitz 1995b). One specific example provided by the EPA was a paint spray booth, as “single-emission unit type operation,” having inherent limitations that make 8,760 hours per year unrealistic. Additionally, the “EPA believes that 500 hours is an appropriate default assumption for estimating the number of hours an emergency generator could be expected to operate under worst-case conditions”; however, “alternative estimates can be made on a case-by-case basis where justified.”

According to the EPA “any physical or operational limitation on the source to emit an air pollutant, including air pollution control equipment and restrictions on hours of operation, or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation is enforceable”. (Seitz 1998)

Additionally in a 1995 memorandum on options for limiting the PTE, the EPA has also stated “clearly, there are sources for which inherent physical limitations for the operation restrict the potential emissions of individual emission units. Where such inherent limitations can be documented by a source and confirmed by the permitting agency, EPA believes that States have the authority to make such judgments and factor them into estimates of a stationary source's potential to emit”. (Seitz 1995a)

The memorandum continues to clarify by stating “the EPA believes that the most straightforward examples of such inherent limitations is for single-emission unit type operations. For example, EPA does not believe that the "maximum capacity" language requires that owner of a paint spray booth at a small auto body shop must assume that (even if the source could be in operation year-round) spray equipment is operated 8760 hours per year in cases where there are inherent physical limitations on the number of cars that can be painted within any given period of time”. (Seitz 1995a)

Therefore, while it is a given that PTE is a worst case estimate over a one year (8,760 hrs) process period, the actual quantity of PTE emissions is directly dependent and proportional to the maximum process capacity rate of a source. This is a very important concept; PTE is an estimate of the worst case emissions over a one year process period with the actual quantity of emissions directly dependent on the maximum process capacity rate of a source, not the process period. Additionally, the maximum process capacity rate of a source is always <8,760 hrs/yr due to physical and operational design constraints.

6 PTE Determination Ground Rules

The following general ground rules ensure PTE estimates are accurately derived while not being overly conservative:

1. Start by listing all existing stationary sources only; do not include the following sources:
   - Mobile,
   - Portable,
   - Temporary, or
   - Theoretical future.

2. Only include fugitive stationary sources if required by state/local requirements. Only PTE emissions for HAPs are usually required if fugitive stationary sources are required by state/local requirements.

3. Assume that each source operates:
   - At 100% of its design capacity;
   - For a process period with a duration of 8,760 hr/yr;
   - At an average hourly consumption rate, C_{AEI};
   - Using materials that emit the most air contaminants or processed 100% of the time; and
   - With air pollution control equipment turned off.

4. Identify potential limitations that may affect the Hourly Consumption Rate (e.g., Maximum Process Time)

5. Verify limitations, they must:
   - Be unchanging and unavoidable physical constraints.
   - Result in predictable upper limits on operations and capacity.
   - Include control measures only if they are operated and maintained continuously and for reasons other than air quality.

6. If such limitations are present, assume the equipment (source) operates for the maximum Hourly Consumption Rate (e.g., maximum number of hours) allowed by the limitations. Determine batch operations (emissions are not continuous) PTE by multiplying the emissions per batch by the maximum number of batches per year.

7 PTE Limiting Factors

Using the PTE determination ground rules presented above, typical Air Force source categories were evaluated for major physical and/or operational limiting factors on process capacity rate. The table below (Table 1, Limiting Factors on PTE Maximum Process Capacity Rate) shows typical source categories that were included in Air Force PTEs and their major physical and/or operational limiting factors on process capacity rate (and therefore PTE). The table also shows mobile and transitory sources that were occasionally inappropriately included in PTE inventories. The table shows that the installation mission is usually the single most physical and/or operational limiting factor on process capacity rate. The installation mission is NOT the single most physical and/or operational limiting factor only for: External Combustion (ECOM) - Comfort Boilers, Aboveground Storage Tank (AST), Underground Storage Tank (UST), Internal Combustion Engines (ICOM) - Generators, and Wet Cooling Towers (COOL) - Comfort. Therefore, for these mission-driven source categories the PTE values are directly proportional to installation mission or its mission multiplier (M).

Table 1, Limiting Factors on PTE Maximum Process Capacity Rate

Source Category	Physical or Operational Limitations on Maximum Process Capacity Rate	
	Primary	Secondary
Aboveground Storage Tank (AST)	Throughput	Mission
Abrasive Blasting (ABCL)	Mission	Setup time
Aircraft Engine Testing (JET)	Mission	Batch processing time
Dry Cleaning Operations (CLN)	Mission	Batch processing time
Ethylene Oxide Sterilizers (STER)	Mission	Batch processing time
External Combustion (ECOM) - All Other	Mission	Cycling time
External Combustion (ECOM) - Comfort Boilers	Weather	Cycling time
Fire Training (FIRE)	Mission	Personnel (unit manning document)
Fuel Cell (CELL)	Mission	Flight operations
Fuel Transfer - Fuel Dispensing (FDSP)	Mission	Tank throughput

Table 1, Limiting Factors on PTE Maximum Process Capacity Rate (continued)

Source Category	Physical or Operational Limitations on Maximum Process Capacity Rate	
	Primary	Secondary
Fuel Transfer - Fuel Loading Racks (FLD)	Mission	tank throughput
Incinerators (INCN)	Mission	Refuse acceptance rate
Internal Combustion Engines (ICOM) - Generators & Fire Pumps	Emergencies	Maintenance & monitoring
Internal Combustion Engines (ICOM) - Other	Mission	
Laboratory Chemicals (LAB)	Mission	
Landfills (LAND)	Mission	Refuse acceptance rate
Metal Plating (MPLT)	Mission	Batch processing time
Misc. Chemical Use (CHEM)	Mission	
Non-Destructive Inspection (NDI)	Mission	
OB/OD of Energetic Materials (OBOD)	Mission	Batch processing time
Ozone Depleting Chemicals (ODC)	Mission	
Pesticide Application (PEST)	Mission	
Printing Operations (PROP)	Mission	Batch processing time
Rocket Engine Testing (RTST)	Mission	Batch processing time
Small Arms Firing (MUN) - Fixed locations only	Mission	Personnel (unit manning document)
Solvent Cleaning Machines (DEGR)	Mission	
Surface Coatings (SURF)	Mission	Batch processing time

Table 1, Limiting Factors on PTE Maximum Process Capacity Rate (continued)

Underground Storage Tank (UST)	Throughput	Mission
Waste Solvent Reclamation (WSR)	Mission	Batch processing time
Wastewater Treatment Plants (WWT)	Mission	Regulatory limit
Welding (WELD)	Mission	Personnel (unit manning document)
Wet Cooling Towers (COOL) - Comfort	Weather	
Wet Cooling Towers (COOL) - Industrial	Mission	
Woodworking (WOOD)	Mission	
Small Arms Firing (MUN) - Open range	Mobile; non-point source munitions that are not detonated at a facility	
Aircraft Deicing Operations (DICE)	Not a source as used; no emissions at freezing	
Aircraft Fight Operations	Mobile	
Auxiliary Power units (APUs)	Mobile	
Non-road Engines & Equipment	Mobile	
On-road Vehicles	Mobile	
Asphalt Paving Operations (ASPH)	Transitory, short-term source	
Fuel Spill (SPRL)	Transitory, short-term source	
Heavy Construction Operations (CNST)	Transitory, short-term source	
Open/Prescribed Burning (OPB)	Transitory, short-term source	
Site Restoration (RDL)	Transitory, short-term source	

8 Mission Multiplier Estimating Methodology

8.1 Rational for Mission Multiplier Estimating Methodology

For an AEI or PTE, the Annual Emissions (E_{AEI}) equals the emission generated per year (lb/yr) and is calculated by multiplying the actual Activity Rate (A) by an Emission Factor (EF) and accounting for control devices with an Emission Reduction factor (ER). The general equation for emission estimation using an emission factor is:

$$\mathrm{E} = \mathrm{A} \times \mathrm{EF} \times \left(1 - \frac{ER}{100\%}\right)$$

Equation 1

Where:

E = Emissions (emissions per year, lb/yr)
A = Annual Activity Rate (material throughput per year, e.g. gal/yr)
EF = Emission Factor (emissions per unit of material processed, e.g. lb/gal)
ER = Overall emission control reduction efficiency (%)

In the AEI formula above, the Annual Activity Rate (A) is in fact the <u>actual</u> material throughput for the specified year. Therefore, Annual Activity Rate (A) is a function of Consumption Rate (C) and the Total Time Period (T), as follows:

$$A = C \times T$$

Equation 2

Where:

C = Average Hourly Consumption Rate over the time period T (material processed/hr)
T = Total Process Time Period (hr), for AEIs & PTEs = 1 yr or 8,760 hr

As such, Equation 1 above may be rewritten as follows by incorporating Equation 2:

$$\mathrm{E} = C \times T \times \mathrm{EF} \times \left(1 - \frac{ER}{100\%}\right)$$

Equation 3

In an AEI, the Annual Activity Rate (A) is usually used directly and presented as annual throughput per year. However, Annual Activity Rate is in fact an average Hourly Consumption Rate (C, as the <u>actual material throughput capacity</u> for the specified time period of T or 8,760 hrs) multiplied by the Total Process Time Period (T) over one year which is 8,760 hrs.

$$A_{AEI} = C_{AEI} \times \mathrm{T} = \left(\frac{annual\ throughput}{8{,}760\ hr}\right) \times 8{,}760\ \left(\frac{hr}{yr}\right) = \frac{anual\ throughput}{yr}$$

or

$$A_{AEI} \; = \; C_{AEI} \times \mathrm{T} = \left(\frac{annual\ throughput}{T}\right) \times T \left(\frac{hr}{yr}\right) \; = \frac{anual\ throughput}{yr}$$

Equation 4

For a PTE Equations 1, 2, and 3 above still apply; however, the source must be operated at the maximum process capacity rate or operated at 100% of its design capacity (accounting for physical or operational limitation). Therefore, the Average Hourly Consumption Rate (C) in this case is the Maximum Hourly Consumption Rate (C_{Max} or C_{PTE}) and; therefore, the Annual Activity Rate (A) is the Maximum Annual Activity Rate (A_{Max} or A_{PTE}). While usually C_{AEI} is not equal to C_{PTE}, they can be related for linear algorithms by a Maximum Multiplier (M) which is the ratio of C_{PTE} over C_{AEI}:

$$C_{PTE} = \; C_{AEI} \; \times \; M$$

Equation 5

Where:

M = Maximum Multiplier (unitless)

Therefore, the Hourly Consumption Rate in this case is the Maximum Average Hourly Consumption Rate (C_{Max} or C_{PTE}) for the specified year while the Total Process Time Period (T) remains 8,760 hrs. The Maximum Average Hourly Consumption Rate (C_{Max} or C_{PTE}) is the maximum material throughput capacity for the specified year divided by the actual maximum Process Time (t, the maximum time a process could physically occur over a year).

$$A_{PTE} \; = \; \left(\frac{max\ annual\ throughput}{t\ hr}\right) \times 8{,}760 \left(\frac{hr}{yr}\right)$$
$$= C_{PTE} \times 8{,}760 \left(\frac{hr}{yr}\right) = C_{AEI} \times M \times 8{,}760 \left(\frac{hr}{yr}\right)$$

Equation 6

$$M = \frac{A_{PTE}}{A_{AEI}} = \frac{C_{PTE}}{C_{AEI}} = \frac{E_{PTE}}{E_{AEI}} = \frac{max\ annual\ throughput}{annual\ throughput}$$

Equation 7

Therefore, for PTE, Equation 3 may be rewritten for linear algorithms:

$$\mathrm{E}_{PTE} \; = \mathrm{M} \times C_{AEI} \times 8{,}760 \left(\frac{hr}{yr}\right) \times \; \mathrm{EF} \; \times \left(1 \; - \; \frac{ER}{100\%}\right)$$

Equation 8

$$E_{PTE} = M \times E_{AEI}$$

Equation 9

8.2 PTE Mission Maximum Multiplier Determination

PTE for historically mission-driven stationary sources all have linear algorithms for estimating emissions; therefore, PTE can be estimated by deriving a maximum mission capacity multiplier (mission multiplier, $\mathbf{M_{Mission}}$). Often, PTE is overestimated by the misconception that you must assume sources' runtime hours are 8,760 hrs/yr (24 hours a day, seven days a week) as a worst case. However, the 8,760 hrs/yr is often physically impossible due to limiting factor/s. In the case of historically mission-driven stationary sources, the limiting factor is not the hours the sources can run, rather the limiting factor is actually how much the mission can increase. Therefore, a more realistic method for calculating PTE for historically mission-driven stationary source activities ties potential emissions to the operational capacity of the base's mission. The ratio of potential maximum operational mission capacity to actual operations, or mission multiplier, can be used to determine PTE for historically mission-driven stationary source activities.

Statistically speaking, mission multiplier is the mission-weighted average of potential increases in ten mission categories. To estimate the base's mission multiplier, a comparison is made between current actual mission versus an estimated increase in mission operations using only the current resources (i.e., manpower and equipment). PTE is an evaluation of currently existing resources; therefore, it does not include theoretical future resources and is based on past years resources at a maximum capacity only. This concept of using only the current resources is imperative to establishing a correct mission multiplier.

Step 1, Estimate Mission Category Percentages
To determine potential emissions in this manner, it is necessary to first establish the composition of your base's current mission. A base's current mission composition can be divided into any combination of ten mission categories (see below and Appendix A, Mission Multiplier Worksheet); however, usually one to three categories provides enough detail for PTE estimates. Based on your professional judgment, estimate the percentage each mission category that makes up your base's current major mission (usually only one to three categories). Record the estimated current mission category percentages in the Mission Multiplier Worksheet column "a".

a. Aircraft: Every-day flight operations, maintenance activities, and training associated with all types of military aircraft (i.e., combat, helicopter, bomber, tanker, transport/cargo, drone, etc.).

b. Special Forces/Field Operations: All activities, operations and training associated with Special Forces or troop field operations. For Air Force, normally associated with Air Force Special Operations Command (AFSOC) only.

c. Training (Non-Aircraft): All formal training NOT associated with aircraft, Special Operations, or troop field operations; including basic training, AFIT, SOS, ACSC, AWC, etc.

d. Space: All operations, maintenance activities, and training associated with space, satellites, and Intercontinental Ballistic Missiles (ICBM).

e. Research: All activities associated with scientific research for the discovery, development, and integration of aerospace warfighting technologies. Normally associated with the Air Force Research Laboratory (AFRL) experiments and technical demonstrations associated with: weapons, geophysics, astronautics, avionics, electronics, flight dynamics, materials, aero propulsion and power, armament, human resources, medical, occupational, and environmental research.

f. Nuclear: All activities associated with nuclear capabilities, normally associated with the Air Force Nuclear Weapons Center (AFNWC).

g. Weapons Sustainment: All activities associated with the sustainment of weapon systems' readiness including depot maintenance, supply chain management and installation support (Normally associated with the Air Force Sustainment Center, AFSC).

h. Cyberspace: All activities associated with cyberspace Intelligence, Surveillance, and Reconnaissance (ISR) functions.

i. Medical: All activities associated with a medical mission.

j. Administrative: Any other administrative mission not included in the above missions

Ensure that your estimated current mission category percentages add up to 100% by totaling them at the bottom of column "b" in the Mission Multiplier Worksheet. If the total does not equal 100%, then adjust your estimated current mission category percentages accordingly.

Step 2, Estimate Maximum Mission Category Increases
Next, you need to estimate the maximum potential increase of operations for each mission category operations as a percent of the current mission. It is critical that this increase only take into account the current resources (i.e., manpower and equipment). Do not consider increasing manpower, equipment, or theoretical future resources. Record the estimated potential percent increases for each mission category in the Mission Multiplier Worksheet column "b".

Step 3, Calculate Maximum Mission Category PTE Increases
The PTE increase for each mission category is the overall maximum percent increase for a specified category taking into account ONLY the current resources (i.e., manpower and equipment). The PTE increases are calculated by multiplying the estimated percentage of each mission category by 100% plus the maximum potential percent increase for each mission category:

$$(\text{PTE Increase})_i = (\text{Mission Category Percentage})_i \times (100\% + \text{Max. Potential Percent Increase})_i$$

Equation 10

Record the estimated PTE Increases for each mission category in the Mission Multiplier Worksheet column "c".

Step 4, Calculate PTE Mission Maximum Multiplier
The PTE Maximum Multiplier ($M_{Mission}$) is found by adding all of the Maximum Mission Category PTE Increases (PTE Increase) and the Adjusted Maximum Multiplier (Adjusted $M_{Mission}$) is found by adding a Safety Factor (SF):

$$M_{Mission} = \sum (PTE\ Increase)_i$$

Equation 11

$$Adjusted\ M_{Mission} = \left[\sum (PTE\ Increase)_i\right] + SF = M_{Mission} + SF$$

Equation 12

Note: Safety Factor, also known as Factor of safety, is applied to the calculated Mission Maximum Multiplier to ensure the estimated multiplier is conservative. Safety factors are needed to account for potential imperfections in the estimating of Mission Category Percentages and to ensure the derived mission multiplier is a *liberal estimate* (i.e., conservatively high). A Safety Factor is automatically applied to Mission Maximum Multiplier ($M_{Mission}$) as follows: 10% is added to all estimated $M_{Mission}$ under 140%, 0 to 10% is inversely proportionally added to all estimated $M_{Mission}$ between 140 to 150% (e.g., SF = 10% for $M_{Mission}$ = 140% and SF = 0% for $M_{Mission}$ = 150%), and 0% is added to all estimated $M_{Mission}$ greater than 150%.

Step 5, Calculate PTE Emissions

The PTE emissions can now be determined by simply multiplying the AEI emissions (E_{AEI}) by the PTE Maximum Multiplier (M) as shown in Equation 9 above:

$$E_{PTE} = M_{\text{Mission}} \times E_{AEI}$$

8.3 PTE Mission Maximum Multiplier Example

Base X's mission is twofold: aircraft (KC-135s) and space (satellite tracking).

- The base has a wing with ten KC-135s. The Director of Operations reports that the current infrastructure can increase current flight operations by 27% and support an additional ten aircraft of like type.
- The base currently tracks satellites 24 hours a day for 5 days a week; however, with the current equipment and personnel they could operate 24 hours a day for 7 days a week.
- The AEI emissions for NOx are 234 tons.

Step 1, Estimate Mission Category Percentages

The Base Planning Office estimated that 90% of the overall base mission was "aircraft" and 10% was "space". Insert these values in column "a" of the Mission Multiplier Worksheet (see Figure 2, Mission Multiplier Worksheet Example). Add all the values in column "a" at the bottom of the worksheet to ensure they add up to 100% (adjust as needed).

Figure 2, Mission Multiplier Worksheet Example

Mission Multiplier Worksheet

Base: Cannon AFB **Date:** 3/14/20xx

Missions Only take in to account the current resources (i.e., manpower and equipment), do not consider increasing manpower, equipment or theoretical future resources.	column "a" Percent of Total Current Mission (%)	column "b" Potential Increase in Mission Operations (%)	column "c" Adjusted PTE Increase (%) c = a x (b + 100%)
Aircraft Every day fight operations, maintenance activities, and training associated with all types of military aircraft (i.e., combat, helicopter, bomber, tanker, transport/cargo, drone, etc.).	90.00%	27.00%	114.30%
Special Forces/Field Operations All activities, operation, and training associated with Special Forces or troop field operations. For the Air Force, normally associated with AFSOC only.			
Training (Non-Aircraft) All formal training NOT associated with aircraft or troop field operations, including basic training, AFIT, SOS, ACSC, AWC, etc.	10.00%	40.00%	14.00%
Space All operations, maintenance activities, and training associated with space, satellites, and intercontinental ballistic missiles (ICBM).			
Research All activities associated with scientific research for the discovery, development, and integration of aerospace warfighting technologies. Normally associated with the Air Force Research Laboratory (AFRL) experiments and technical demonstrations associated with: weapons, geophysics, astronautics, avionics, electronics, flight dynamics, materials, aero propulsion and power, armament, human resources, medical, occupational, and			
Nuclear All activities associated with nuclear capabilities, normally associated with the Air Force Nuclear Weapons Center (AFNWC).			
Weapons Sustainment All activities associated with the sustainment of weapon systems' readiness including depot maintenance, supply chain management, and installation support. Normally associated with the Air Force Sustainment			
Cyberspace All activities associated with cyberspace intelligence, surveillance, and reconnaissance (ISR) functions.			
Medical All activities associated with a medical mission.			
Administrative Any other administrative mission not included in the above missions.			

Current Total = Σ (column "a") = 100.00%

Mission Maximum Multiplier = Σ (column "c") = 128.30%

Safety Factor (up to 10% if Multiplier < 150%) = 10.00%

Adjusted Mission Maximum Multiplier = 138.30%

Step 2, Estimate Maximum Mission Category Increases

Aircraft Mission Increase = 27%, not 100% or 127%. When asked to provide a rough estimate of maximum sustainable increase (in percent increase) in flight operations (i.e., sorties) with only the current resources (i.e., manpower and equipment), the Director of Operations reported that it could only increase by 27%. The additional ten aircraft are only hypothetical; therefore, they don't currently exist at the base so they don't count towards the PTE estimate.

Space Mission Increase = 40%. With the current resources, the base could increase this mission category by 2 days/wk ÷ 5 days/wk = 0.4 or 40% more.

Insert these values in column "b" of the Mission Multiplier Worksheet (see Figure 2. Mission Multiplier Worksheet Example).

Step 3, Calculate Maximum Mission Category PTE Increases

Adjusted PTE Increase (%) = column "c" = column "a" x (column "b" + 100%)

$$Aircraft = 90\% \times (100\% + 27\%) = 114.3\%$$

$$Space = 10\% \times (100\% + 40\%) = 14.0\%$$

Insert these values in column "c" of the Mission Multiplier Worksheet (see Figure 2. Mission Multiplier Worksheet Example).

Step 4, Calculate PTE Maximum Mission Multiplier ($M_{Mission}$) and Adjusted $M_{Mission}$

$M_{Mission}$ = Sum of all the values in column "c"

$$M_{Mission} = 114.3\% + 14.0\% = 128.3\%$$

Add all the values in column "c" at the bottom of the worksheet to record the PTE Maximum Mission Multiplier ($M_{Mission}$).

Adjusted $M_{Mission}$ = $M_{Mission}$ + SF

SF automatically assigned 10% by spreadsheet

Adjusted $M_{Mission}$ = 128.3% + 10% = 138.3%

Step 5, Calculate PTE Emissions

Knowing the AEI emissions for NOx is 234 tons/yr, the PTE emissions can be determined by simply multiplying the AEI emission (E_{AEI}) by the PTE Maximum Mission Multiplier ($M_{Mission}$) of 1.38 (138.3%) as shown in Equation 9 above:

$$E_{PTE} = M_{Mission} \times E_{AEI} = 1.38 \times 234\ tons/yr = 322.9\ tons/yr$$

9 PTE for ASTs & USTs

While mission is still a major limiting factor for ASTs and USTs you cannot directly apply a Maximum Mission Multiplier because the estimating model is not a simple linear algorithm. In this case you still calculate the Maximum Mission Multiplier ($M_{Mission}$); however, you need to apply it to the current AEI throughput of the tank and then rerun the TANKS model to establish the PTE estimate.

$$\mathbf{Throughput}_{\boldsymbol{Max}} = \mathbf{Throughput}_{\boldsymbol{AEI}} \times \boldsymbol{M}_{\text{Mission}}$$

Equation 12

10 PTE for External Combustion (ECOM) - Comfort Boilers

Comfort heating external combustion sources (i.e., boilers, furnaces, and heaters) are used during the colder months only to provide comfort for personnel. The further the temperature is from the standard comfort temperature of 65°F or 18.3°C (ASHRAE 2005), the more heat required per hour; and, the longer the temperature is from the standard comfort temperature, the longer a heating external combustion unit is in use. As such, the local climate indirectly dictates emissions by directly driving the time a heating external combustion unit is in use.

10.1 Mean Temperature Method

The *Daily (or monthly) Mean Temperature Method* is used to define the duration of operation of a heating external combustion source. It applies the standard algorithm and emission factors; however, the maximum multiplier is derived from local climate data that determines the operating time. The method can be applied to individual sources or to a whole source class (e.g., all boilers). The time (t) a heating unit operates in a year is directly proportional to the fuel consumed which, in turn, is dependent on the local climate (i.e., daily temperature). The more hours the temperature is from the standard comfort temperature (i.e., 65°F), the longer a heating external combustion unit is in use.

By using local normal daily/monthly mean temperature data you can determine the average number of days (and therefore hours) a heating unit will need to be in use. The normal daily/monthly mean temperature data is considered a conservative approach for PTE estimates given that we are assuming the external combustion source is operating 24 hours a day during operation and a 30-year average normal temperature data is used. The 30-year average normal temperature data is used to ensure the temperature is truly representative of an expected worst case use and to eliminate annual variations. The daily/monthly mean temperatures are used (as opposed to the maximum or minimum) to provide an appropriate gauge against the 65°F comfort temperature. The local normal daily/monthly mean temperature data can be obtained from the base's weather shop; however, the 30-year local normal monthly mean temperature data provided in this document was obtained from the National Oceanic and Atmospheric Administration (NOAA): http://www.ncdc.noaa.gov/oa/climate/online/ccd/meantemp.html).

The PTE operation time or expected operating time per year (t) is equal to the sum of all days that the normal daily mean temperature is less than the standard comfort temperature (65°F), multiplied by 24 hours per day:

$$t = 24\frac{hr}{day} \times \sum_{n=1}^{365}(T_{d\bullet mean} < 65°F)_i$$

$$t = 24\frac{hr}{day} \times \sum_{n=1}^{12}[(T_{m\bullet mean} < 65°F)_i \times days\ in\ Month]$$

$$t = 24\frac{hr}{day} \times Heating\ Days$$

Equation 13

Where:

t = Time operated in a year (hrs)
$T_{d\bullet mean}$ = 30-year normal daily mean temperature (°F)
$T_{m\bullet mean}$ = 30-year normal monthly mean temperature (°F)
Heating Days = Total average heating days per year (30 year average); found by looking up in Appendix B or C

Hourly PTE Fuel Consumption Rate (C_{PTE}) for external combustion units can be calculated using the Rated capacity of heat source and Heat value of the fuel burned with the following equation:

$$C_{\mathrm{PTE}} = \frac{RC}{HV} \times \frac{t}{T}$$

Equation 14

Where:

C_{PTE} = Hourly PTE Fuel Consumption Rate (material burned per hour)
t = time operated (hr) over the Total Process Period of 1 yr or 8,760 hr
RC = Rated capacity of heat source (MMBtu per hour)
HV = Heat value for worst case fuel (MMBtu/ton of coal; MMBtu/10^3gal of fuel oils and LPG; and MMBtu/10^6 scf of natural gas)
T = Total Process Time Period (hr), for AEIs & PTEs = 8,760 hr

By substituting Equation 14 into Equation 3 you can estimate PTE emission over the time period T when the operating time (t) is known, as derived above:

$$E_{PTE} = \left(\frac{RC}{HV} \times \frac{t}{T}\right) \times T \times EF \times \left(1 - \frac{ER}{100\%}\right)$$

or

$$E_{PTE} = C_{PTE} \times T \times EF \times \left(1 - \frac{ER}{100\%}\right)$$

Equation 15

It is important to note that there are locations where the climate will result in no heating days (i.e., days where the mean temperature falls below 65°F), in this case the time operated in a year (t) is equal to zero and results in an estimated PTE emission (E_{PTE}) of zero! This is not an error; this reflects that external combustion of fossil fuel is not normally used in these climates because external combustion is not an effective or efficient means of comfort heating for such climate (normally electric heating is employed).

If you find yourself in a situation where external combustion sources have an AEI emission (E_{AEI}) greater than zero and an estimated PTE emission (E_{PTE}) of zero, the external combustion sources are being used for more than just comfort heating. In these cases, PTE emission (E_{PTE}) should be calculated using Mission Maximum Multiplier Method described above.

10.2 Comfort Boiler Mean Temperature Method

By using local normal daily (or monthly) mean temperature data against the ASHRAE 65°F comfort temperature, you can determine the average number of days the heating unit will be operated. The normal mean temperature data is considered a conservative approach for PTE estimates, if assuming the external combustion source is operating 24 hours a day during operation and a 30-year average normal temperature data is used. The 30-year average normal temperature data is used to ensure the temperature is truly representative of an expected worst case use and to eliminate annual variations.

Step 1, Determine hours of operation (t)

a. Obtain the heating days (operating days) over a one year (8760 hr) process period; provided in appendix tables:

- **By installation**; in Appendix B, Representative Heating and Cooling day Data
- **By closest weather station**; in Appendix C, Weather Station Heating and Cooling day Data

Note: Appendix C should only be used if your installation is not identified in Appendix A. Appendix A takes into account distance as well as the elevation of the base relative to the weather station.

b. Estimate hours of operation (t) over a one year process period using **Equation 13**.

$$t = 24\frac{hr}{day} \times \ Heating\ Days$$

Note: If Heating Days is zero then it is assumed the external combustion sources are being used for more than just comfort heating. In these cases, PTE emission (E_{PTE}) should be calculated using Mission Maximum Multiplier Method described above.

Step 2, Calculate the PTE Hourly Consumption Rate

Using **Equation 14** calculate the PTE Hourly Consumption Rate (C_{PTE}, the worst case expected material processed per hour):

$$C_{PTE} = \frac{RC}{HC} \times \frac{t}{T}$$

NOTE: For dual fuel boilers/furnaces the fuel that emits the most air contaminants must be used.

Step 3: Calculate PTE Emissions

Use **Equation 15** to calculate the PTE Emissions (E_{PTE}):

$$E_{PTE} = C_{PTE} \times T \times EF \times \left(1 - \frac{ER}{100\%}\right)$$

Alternatively:

Use **Equation 7** to calculate the Maximum Boiler Multiplier (M_{Boiler}):

$$M_{Boiler} = \frac{A_{PTE}}{A_{AEI}}$$

Then using **Equation 9**, calculate the PTE Emissions (E_{PTE}):

$$E_{PTE} = M_{Boiler} \times E_{AEI}$$

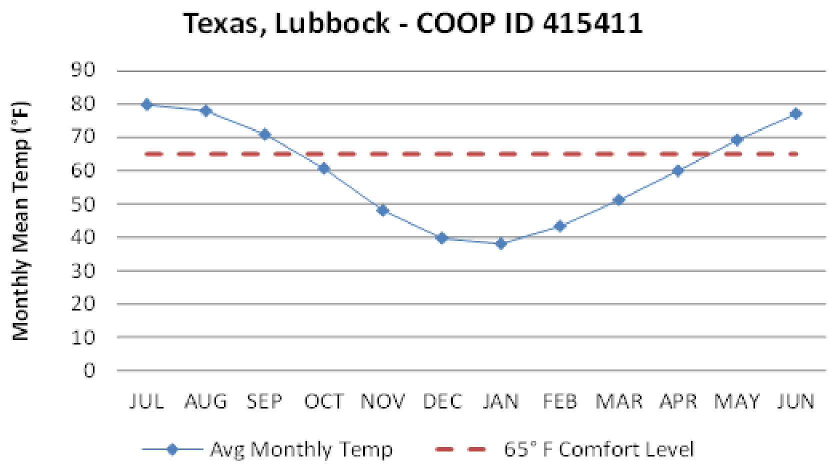
10.3 ECOM - Comfort Boiler Example

Calculate E_{AEI} & E_{PTE} for Cannon AFB Bldg #77:

- 2.05 MMBtu/hr Bryant boiler with a 60% emission control reduction efficiency
- Fueled with NG with HV = 1026 Btu/scf (40 CFR 98, Table C-1)
- 1,267,056 scf of NG was combusted during the year
- AEI emission were 50.94 lb/yr
- EF_{NOx} = 100 lb/10^6 scf

Step 1: Determine hours of operation (t) over a one year process period
Look up the Cannon AFB in Appendix B, Representative Heating and Cooling day Data, to obtain the total heating days per year. According to Appendix B, the closest NOAA weather station to Cannon AFB is Lubbock, TX (COOP ID 415411) with 211 heating days.

Cannon AFB Climatological Data



t = 24 hr/day x 211 days
= 5,064 hrs

Step 2: Calculate the PTE Hourly Consumption Rate

Using Equation 14, calculate the PTE Hourly Consumption Rate (C_{PTE}, the worst case expected material processed per hour):

$$C_{PTE} = \frac{RC}{HC} \times \frac{t}{T} = \frac{2.05\ \cancel{\text{MMBtu}}/\text{hr}}{1{,}026\ \cancel{\text{Btu}}/\text{scf}} \times \frac{5{,}064\ \cancel{hr}}{8{,}760\ \cancel{hr}} \times \frac{10^6 \cancel{Btu}}{\cancel{MMBtu}} = 1{,}155.0\ \frac{scf}{hr}$$

Step 3: Calculate PTE Emissions

Using Equation 15, calculate the PTE Emissions (E_{PTE}):

$$\mathrm{E}_{PTE} = C_{PTE} \times T \times EF \times \left(1 - \frac{ER}{100\%}\right)$$

$$\mathrm{E}_{PTE} = 1{,}155.0\ \frac{\cancel{scf}}{\cancel{hr}} \times 8{,}760\ \frac{\cancel{hr}}{yr} \times \frac{100\ \text{lb}}{10^6 \cancel{scf}} \times \left(1 - \frac{60\cancel{\%}}{100\cancel{\%}}\right) = 405\ \frac{lb}{yr}\ NO_X$$

Alternatively:

Using Equation 7, calculate the Maximum Boiler Multiplier (M_{Boiler}):

$$M_{Boiler} = \frac{A_{PTE}}{A_{AEI}} = \frac{C_{PTE} \times T}{C_{AEI}} = \frac{1{,}155.0\ \frac{\cancel{scf}}{\cancel{hr}} \times 8{,}760\ \cancel{hr}}{1{,}267{,}056\ \cancel{\text{scf}}} = 7.951$$

Then using Equation 9, calculate the PTE Emissions (E_{PTE}):

$$E_{PTE} = M_{Boiler} \times E_{AEI} = 7.951 \times 50.94\ \frac{lb}{yr} = 405\ \frac{lb}{yr} NO_X$$

11 PTE for Wet Cooling Towers (COOL) - Comfort

Cooling towers' PTE is effectively the inverse of heating external combustion sources in that they will only operate during the hotter months to provide comfort for personnel. The further the temperature is above the standard comfort temperature of 65°F or 18.3°C (ASHRAE 2005a), the more cooling required; and, the longer the temperature is above the standard comfort temperature, the longer a wet cooling tower unit is in use. As such, the local climate indirectly dictates emissions by directly driving the time a wet cooling tower is in use. As with external combustion units you will use the Daily Mean Temperature Method to define the duration of operation of a wet cooling tower source.

The time (t) a wet cooling tower unit is operated in a year is directly proportional to the amount of drift the wet cooling tower generates which in turn is dependent on the local climate (i.e., daily temperature). The more hours the temperature is above the standard comfort temperature (i.e., 65°F), the longer a wet cooling tower unit is in use.

Using local 30-year normal temperature ensures it is representative of an expected worst case use and eliminates annual variations. The daily mean temperature is used (as opposed to the maximum or minimum) to provide an appropriate gauge against the 65°F comfort temperature. The local normal daily mean temperature data can be obtained from the base's weather shop; however, the 30-year local normal daily mean temperature data provided in this document was obtained from the National Oceanic and Atmospheric Administration (NOAA): http://www.ncdc.noaa.gov/oa/climate/online/ccd/meantemp.html.

The PTE operation time or expected operating time per year (t) is equal to the sum of all days that the normal daily mean temperature is greater than the standard comfort temperature (65°F), multiplied by 24 hours per day:

$$t = 24\frac{hr}{day} \times \sum_{n=1}^{365}(T_{d\bullet mean} > \ 65°F)_i$$

$$t = 24\frac{hr}{day} \times \sum_{n=1}^{12}[(T_{m\bullet mean} > \ 65°F)\ _i \ \times \ days\ in\ Month]$$

$$t = 24\frac{hr}{day} \times \ Cooling\ Days$$

Equation 16

Cooling Days = Total average cooling days per year (30 year average); found by looking up in Appendix B or C

As shown in Equation 17 below, emissions are calculated based on the number of days the unit is operated:

$$E_{PM} = Q \ \times \ (2.04 \times 10^{-5}) = WFR \ \times \ D \ \times \ (2.04 \times 10^{-5})$$

Equation 17

Therefore, the Maximum Cooler Multiplier (M):

$$M_{Cool} = \frac{D_{PTE}}{D_{AEI}} = \frac{t}{D_{AEI}}$$

Equation 18

And, you calculate the PTE Emissions (E_{PTE}):

$$E_{PTE} = M_{Cool} \times E_{AEI}$$

Where:

E_{PTE} = PTE Emissions of total PM (lb/yr)
Q = Quantity of circulating water per year (gal/yr)
2.04E-05 = Constant, assuming TLD = 1.7lb/10^3gal & TDS = 12,000 ppm (lb/gal)
WFR = Circulating water flow rate (gal/day)
D = Number of days cooling tower was in operation during the year (day/yr)

NOTE: Assuming wet coolers run continuously during the operating time (t), there is an extremely low statistical possibility (though highly improbable) that the D_{AEI} could be greater than t in the event of extreme weather. Therefore, in the event of extreme weather during the AEI year (where the D_{AEI} > t) the D_{AEI} should be used to calculate PTE emission. In other words, E_{AEI} = E_{PTE} in the event of extreme weather during the AEI year (were the D_{AEI} > t).

12 PTE for Emergency Internal Combustion Engines (ICOM) - Generators & Fire Pumps

The EPA published specific guidance for calculating PTE for emergency generators (Seitz 1995b) which allowed sources to limit the potential hours of operation to 500 hr/yr at 100% of the generator's capacity. This guidance has been used to calculate PTE for all generators designated for emergency use and operated for fewer than 500 hours per year; however, within the same guidance memorandum the EPA authorized source owners to make case-by-case historical data-driven PTE estimates. Based on the EPA guidance, the Air Force performed an analysis of Air Force-unique historic source data and has further refined the **Air Force-specific PTEs of 160 hr/yr for emergency generators and 40 hr/yr for fire pumps**.

12.1 Emergency Generators

Emergency Generator PTE

Based on the EPA's 1995 memorandum (Seitz 1995b) authorizing source owners to make case-by-case historical data-driven PTE estimates, an analysis of Air Force-unique historic source data was performed to establish an Air Force-specific emergency generator PTE. The Air Force has been recording runtime for their emergency generators for years. Using the historic generator runtimes collected from 1994 to 2010, factual-based inferences (i.e., statistically drawn conclusions from available evidence) on PTE capacity rates scenarios was derived to a relative degree of confidence (i.e., greater than 99% confidence).

A confidence interval shows the intervals (upper and lower limits) in which a measurement (in this case annual generator runtimes) falls corresponding to a given probability. In other words, with a 99% confidence interval, we can be confident that 99% of the single annual generator runtime will fall within this estimated range of all generator runtimes. With PTE effectively being an upper-boundary maximum that will not be exceed, the confidence interval around the upper percentile is appropriate (not the confidence interval around the mean) to represent PTE. Since there is no maximum value associated with a continuous distribution (like a normal distribution), it is standard practice to settle for a confidence interval around a sufficiently high percentile that will exceed nearly all the population measurement. Generally, the upper 99th percentile is used, implying that at the most 1 in 100 measurements would ever exceed the PTE.

If the dataset is approximately normal, then the simplified parametric confidence interval "68-95-99.7 rule" or the "empirical rule" can be applied to infer several confidence intervals. Based on the empirical rule, one standard deviation from the mean accounts for 68.27% of the values in the dataset; while two standard deviations from the mean account for 95.45%; and three standard deviations account for 99.73%.

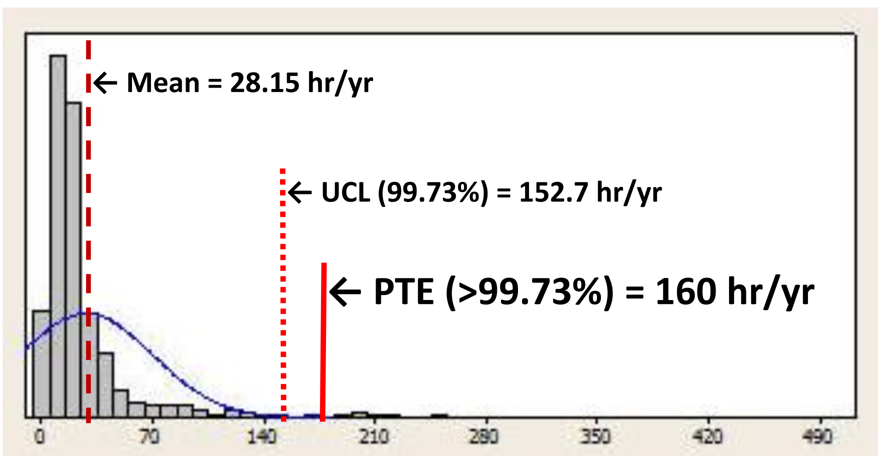
PTE is a measure worst-case annual operating time; therefore, the upper confidence limit (UCL) of the dataset's 99th percentile or greater would provide a representative PTE for a specified confidence. Therefore, if the emergency generator dataset had an approximate normal distribution, PTE could be derived using the "empirical rule" at 99.73% (1 in 1,429 measurements) confidence at three standard deviations above the mean. Based on the Air Force's statistical analysis of emergency generators:

$$\boldsymbol{A(PTE_{Normal})} = \boldsymbol{\mu + 3\sigma} = 28.15 + (3 \times 41.54) = \mathbf{152.7}\ \boldsymbol{hrs/yr}$$

Where:

μ = mean = 28.15 hrs/yr
σ = standard deviation = 41.54 hrs/yr
n = 2,629 measurements

Figure 3, Emergency Generators Histogram and Confidence Intervals



The above 99.73% UCL assumes a normal distribution of the dataset and yields a PTE of approximately 153 hrs/yr runtime. However, the statistical analysis demonstrated that the generator runtime dataset was not a normal distribution and skewed toward zero; therefore, using the upper 99.73% UCL for a PTE value would be a conservative estimate of a worst case. Additionally, for ease of use and to add a slight factor of safety, the Air Force recommends used a PTE value of ***160 hr/yr for all emergency generators***. For more details on the statistical analysis see Appendix F, Emergency Internal Combustion Engines Analysis.

Warning on Emergency Generator Use

Based on definition and continuous compliance requirements for emergency generators under 40 CFGR 63 Subpart ZZZZ, National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines, emergency generators can be operated for a maximum of 100 hours per calendar year (for maintenance and testing, emergency demand response, and operation in approved non-emergency situations for 50 hours per year). As such, generators are not or no longer considered "emergency" generators if:

- Used for any non-emergency use not approved under 40 CFR 63.6640(f)(3) and (4), which is dependent on location classification as a major or area sources for HAPs;
- Approved non-emergency use exceeds 50 hr/yr; or
- Total maintenance, testing and approved non-emergency time exceeds 100 hr/yr.

12.2 Fire Pumps

Again, based on the EPA's 1995 memorandum (Seitz 1995b) authorizing source owners to make case-by-case historical data-driven PTE estimates, an analysis of Air Force-unique historic source data was performed to establish an Air Force-specific emergency fire pump PTE. The Air Force has been recording runtime for their emergency generators for years. Using the historic generator runtimes collected from the 2001 to 2010, factual-based inferences (i.e., statistically draw conclusions from available evidence) on PTE capacity rates scenarios was derived to a relative degree of confidence (i.e., greater than 99% confidence).

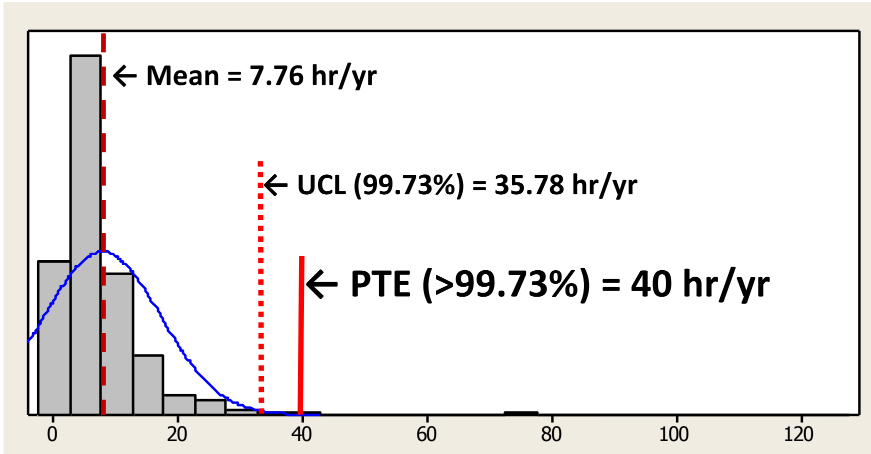
As with emergency generator, the "68-95-99.7 rule" was applied to infer a 99.73% confidence intervals for emergency fire pumps. Based on the empirical rule, three standard deviations account for 99.73% confidence. PTE is a measure worst-case annual operating time; therefore, the UCL of the dataset would provide a representative PTE for a 99.73% confidence. Therefore, if the emergency fire pump dataset had an approximate normal distribution, PTE could be derived using the "empirical rule" at 99.73% (1 in 1,429 measurements) confidence at three standard deviations above the mean. Based on the Air Force's statistical analysis of emergency fire pumps:

$$\boldsymbol{A(PTE_{Normal}) = \mu + 3\sigma} = 7.76 + (3 \times 9.34) = \mathbf{35.78\ hrs/yr}$$

Where:

μ = mean = 7.76 hrs/yr
σ = standard deviation = 9.34 hrs/yr
n = 811 measurements

Figure 4, Fire Pump Histogram and Confidence Intervals



The above 99.73% UCL assumes a normal distribution of the dataset and yields a PTE of approximately 36 hrs/yr runtime. However, the statistical analysis demonstrated that the generator runtime dataset was not a normal distribution and skewed toward zero; therefore, using the upper 99.73% UCL for a PTE value would be a conservative estimate of a worst case. Additionally, for ease of use and to add a slight factor of safety, the Air Force recommends used a PTE value of ***40 hr/yr for all emergency generators***. For more details on the statistical analysis see Appendix F, Emergency Internal Combustion Engines.

12.3 Previous 500 hr/yr Rule

Previously, the EPA published specific guidance for calculating PTE for emergency generators (Seitz 1995b) which allowed sources to limit the potential hours of operation to 500 hr/yr at 100% of the generator's capacity. This guidance has been used to calculate PTE for all generators (Nation-wide) designated for emergency use and operated for fewer than 500 hrs per yr; however, the Air Force Analysis shows the 500 hr/yr is excessive and over conservative. Using the EPA guidance, the Air Force has further refined their Air Force-specific PTE values down to ***160 hy/yr for emergency generators*** ***and*** ***40 hr/yr for fire pumps***.

13 Air Force PTE Guideline/Policy

An erroneous common practice within the Air Force was to confuse the maximum process capacity rate with the process period of one year (8,760 hours in one year). The current standard practice throughout the Air Force is to accept the default interpretation of the PTE definition to assume all emission sources are emitting at a continuous rate for the entire year or 8,760 hours per year. (AFCEE, 2009)

This resulted in the erroneous assumption of a maximum process capacity rate of 8,760 hr/yr over the process period of one year. This practice was considered acceptable because it is a conservative assumption; however, this has resulted in gross overestimations which have driven unwarranted permitting and fees. A more correct methodology and practice allowed under EPA guidance and regulations is to account for a source's physical or operational limitations to emit air pollutants. Therefore, the following guidelines must be followed when performing PTE estimates:

13.1 De Facto Minimum Federally Enforceable Limits

This guide evaluates Air Force-specific air emission sources for inherent non-equipment limiting factors to ensure, as a minimum, they are included when estimating PTE for major source determinations and establishing permit limits. The Air Force-specific inherent non-equipment limiting factors established under this guide are considered de facto minimum federally enforceable limits for Air Force sources. As such, they are to be considered as the minimum (stating point) federally enforceable limits when establishing new or renewing operating permits and the minimum default limits when performing a major source determination.

13.2 PTE Frequency

Be sure to recalculate PTE with the current AEI or whenever new processes are added or changes are made which may increase the PTE.

13.3 PTE Sources

A PTE estimate is just a worst-case scenario of the current stationary AEI. Therefore, only sources in the AEI should be included. Specifically:

a) Include only stationary sources. Do not include any mobile, portable, or temporary sources.

b) Include only the existing sources in the current stationary source AEI and any stationary sources that were inactive (i.e., not used for the entire time; however, still available for use) during the AEI. Do not include any projected future sources.

c) Existing Resources: PTE is a worst-case estimate of emissions from the current stationary AEI (and any new sources since the AEI) based on physical and operational design constraints. The available resources (i.e., manpower, equipment, supply lines, etc.) are usually physical and/or operational design constraints that greatly reduce the potential for sources to emit. Therefore, it is important to include only existing resources (i.e., manpower, equipment, supply lines, etc.). Do not add or expand the current resources.

d) Permitted Sources: If the emission source is identified in an air permit then it is a "permitted source." Review all Permits that have been issued to the facility. These permits contain valuable information which will assist in calculating the PTE. For example, limits contained in a permit can usually be used to restrict the PTE.
In fact, any permit limitation can legally restrict potential to emit if it meets two criteria: 1) it is federally enforceable (i.e., contained in a permit issued pursuant to an EPA-approved permitting program or a permit directly issued by EPA) and 2) it is enforceable as a practical matter. (Seitz 1989)

e) Fugitive Emissions: Air contaminants that cannot reasonably be exhausted through a stack or a building structure are called fugitive emissions. Examples of fugitive emissions include dust blowing from rock and coal piles and dust kicked up by vehicles traveling on roadways. Volatile Organic Compound (VOC) emissions from outdoor leaking valves or flanges are also fugitive emissions. Include quantifiable fugitive emissions in any PTE calculation ONLY if:

i) The fugitive emissions are Hazardous Air Pollutants (HAPs).

ii) The facility is subject to a New Source Performance Standard (NSPS) or National Emission Standard for Hazardous Air Pollutants (NESHAP) promulgated before August 7, 1980.

13.4 Mission Multiplier Methodology

The ratio of potential maximum operational mission capacity to actual operations, or mission multiplier, shall be used to determine PTE for historically mission-driven stationary source activities. These sources include all stationary source categories except for external combustion sources, wet cooling towers used for comfort, and all storage tanks (AST & UST). To estimate the base's mission multiplier, a comparison is made between current actual mission operations versus an estimated increase in mission operations <u>using only currently available resources (i.e., manpower and equipment)</u>.

13.5 Tanks (AST & UST)

A Maximum Mission Multiplier for tanks cannot be applied directly because the estimating model is not a simple linear algorithm. In this case the Maximum Mission Multiplier is still calculated; however, it must be applied to the current AEI throughput of the tank being evaluated and then the TANKS model re-run using the newly established PTE throughput to derive the PTE estimate.

13.6 External Combustion Comfort Boilers

The <u>*Daily Mean Temperature Method*</u> is used to define the duration of operation of a heating external combustion source. It applies the standard algorithm and emission factors; however, the maximum multiplier is derived from local climate data driving the operating time. The PTE is restricted by the number of days in a year a boiler would need to be in operation to maintain a comfort temperature of at least 65°F (ASHRAE 2005a). The method can be applied to individual sources or to a whole source class (e.g., all boilers).

13.7 Wet Cooling Towers (COOL) - Comfort

Cooling towers' PTE is effectively the inverse of heating external combustion sources in that they will only operate during the hotter months to provide comfort for personnel. The PTE is limited by the number of days in a year that the temperature is greater than 65°F (ASHRAE 2005a). As with external combustion units, the Daily Mean Temperature Method is used to define the duration of operation of a wet cooling tower source.

13.8 Emergency ICOM

Based on the EPA guidance, the Air Force performed an analysis of Air Force-unique historic source data and has further refined the <u>**Air Force-specific PTEs of 160 hr/yr for emergency generators and 40 hr/yr for fire pumps**</u>.

14 Major or Minor Source Determination

Once a facility's PTE has been calculated, a determination of whether that facility is a "major" or "minor" source of air pollution may be made. This is critical since major sources are subject to more regulations than minor sources. Compare the facility's PTE to the thresholds listed in Table 2, Major Source thresholds, below.

If the facility's PTE is below all the major source thresholds, it is considered a true minor source and not subject to an Operating Permit Program or any of the other major source requirements. It is important for a facility to keep records showing all calculations and assumptions.

If the facility's PTE exceeds any of the major source thresholds, it is considered a major source, and has two options:

1. ***Title V:*** Comply with the major source requirements and may be subject to any of the following requirements.

    a. **Operating Permit Program:** All major sources of air pollution are subject to an Operating Permit Program and must apply for an Operating Permit (Title V or state equivalent). Normally the permit must be renewed every five years. In addition, sources subject to the permit must submit annual and/or semi-annual certification reports as well as report any deviations from permit conditions that occur throughout the year.

    b. **Annual Air Emissions:** Major sources are subject to annual emissions fees. The fee amount is assessed based upon the emissions reported to the state.

    c. **National Emission Standards for Hazardous Air Pollutants NESHAPs (also known as MACT Standards):** Certain industrial categories that exceed the major source thresholds for HAPs may be subject to a federal NESHAP.

2. ***Synthetic Minor:*** Limit the PTE using one of the mechanisms described in Part 4 to avoid being a major source. If the PTE makes the facility a major source but the actual emissions are well below the major source thresholds, it can avoid being a major source by limiting the PTE. The PTE can be reduced by accepting legally and practically enforceable limits on the operation of the source/s. A facility which limits its PTE will become a "synthetic minor" source. This means that although it is technically a major source, the facility has accepted limits that make it a minor source.

Table 2, Major Source Thresholds

Type of Pollutant	Major Source Threshold
Particulate Matter (PM)	100 tons/year
Volatile Organic Compounds (VOCs)	100 tons/year
• Ozone Marginal, or Moderate	100 tons/year
• Ozone Serious	50 tons/year
• Ozone Severe	25 tons/year
• Ozone Extreme	10 tons/year
Carbon Monoxide (CO)	100 tons/year
Nitrogen Oxides (NOx)	100 tons/year
• Ozone Marginal, or Moderate	100 tons/year
• Ozone Serious	50 tons/year
• Ozone Severe	25 tons/year
• Ozone Extreme	10 tons/year
Sulfur Dioxide (SO)	100 tons/year
Lead (Pb)	10 tons/year
Hazardous Air Pollutants (HAPs)	
• Any single HAP	10 tons/year
• Any combination of HAPs	25 tons/year
Any other regulated air contaminant	100 tons/year
Greenhouse Gases (GHG) as CO_2e	100,000 tons/year

References

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ASHRAE 2005, “ASHRAE Handbook--Fundamentals. Chapter 32, Energy Estimating and Modeling Methods,” American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.

MDEQ 2005, “The Potential to Emit Workbook – A Practical Guide to Calculating and Evaluating Your Potential to Emit Air Contaminants,” Michigan Department of Environmental Quality (MDEQ), Environmental Science and Services Division, Clean Air Assistance Program, November 2005

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Seitz 1995a, Seitz J. A., Memorandum titled “Options for Limiting the Potential to Emit (PTE) of a Stationary Source Under Section 112 and Title V of the Clean Air Act,” U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, January 25, 1995.

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Seitz 1998, Seitz J. A., Memorandum titled “Potential to Emit (PTE) Guidance for Specific Source Categories,” U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, April 14, 1998.

Appendix A, Mission Multiplier Worksheet

Mission Multiplier Worksheet

Base: ______________________ **Date:** ____________

Missions Only take in to account the current resources (i.e., manpower and equipment), do not consider increasing manpower, equipment or theoretical future resources.	column "a" Percent of Total Current Mission (%)	column "b" Potential Increase in Mission Operations (%)	column "c" Adjusted PTE Increase (%) c = a x (b + 100%)
Aircraft Every day fight operations, maintenance activities, and training associated with all types of military aircraft (i.e., combat, helicopter, bomber, tanker, transport/cargo, drone, etc.).			
Special Forces/Field Operations All activities, operation, and training associated with Special Forces or troop field operations. For the Air Force, normally associated with AFSOC only.			
Training (Non-Aircraft) All formal training NOT associated with aircraft or troop field operations, including basic training, AFIT, SOS, ACSC, AWC, etc.			
Space All operations, maintenance activities, and training associated with space, satellites, and intercontinental ballistic missiles (ICBM).			
Research All activities associated with scientific research for the discovery, development, and integration of aerospace warfighting technologies. Normally associated with the Air Force Research Laboratory (AFRL) experiments and technical demonstrations associated with: weapons, geophysics, astronautics, avionics, electronics, flight dynamics, materials, aero propulsion and power, armament, human resources, medical, occupational, and			
Nuclear All activities associated with nuclear capabilities, normally associated with the Air Force Nuclear Weapons Center (AFNWC).			
Weapons Sustainment All activities associated with the sustainment of weapon systems' readiness including depot maintenance, supply chain management, and installation support. Normally associated with the Air Force Sustainment			
Cyberspace All activities associated with cyberspace intelligence, surveillance, and reconnaissance (ISR) functions.			
Medical All activities associated with a medical mission.			
Administrative Any other administrative mission not included in the above missions.			

Current Total = Σ (column "a") = ___________

Mission Maximum Multiplier = Σ (column "c") = ___________

Safety Factor (up to 10% if Multiplier < 150%) = ___________

Adjusted Mission Maximum Multiplier = ___________

Appendix B, Representative Heating and Cooling Day Data by Base

Installation		Weather Station (closest)				
Name	State	Station Name	State	COOP ID	Heating Days	Cooling Days
JBER - ELMENDORF AFB	AK	ANCHORAGE	AK	500280	365	0
JBER - FORT RICHARDSON	AK					
KULIS ANGB	AK					
OLIKTOK AFS-LRR	AK	BARROW	AK	500546	365	0
POINT BARROW AFS-LRR	AK					
CAPE NEWENHAM AFS-LRR	AK	BETHEL	AK	500754	365	0
CAPE ROMANZOF AFS-LRR	AK					
INDIAN MOUNTAIN AFS-LRR	AK	BETTLES	AK	500761	365	0
CLEAR AFS	AK	FAIRBANKS	AK	502968	365	0
EIELSON AFB	AK					
FORT YUKON	AK					
MURPHY DOME AFS-LRR	AK					
KING SALMON AFS-LRR	AK	KING SALMON	AK	504766	365	0
CAPE LISBURNE AFS-LRR	AK	KOTZEBUE	AK	505076	365	0
CAPE LISBURNE AIRPORT	AK					
TATALINA AFS-LRR	AK	MCGRATH	AK	505769	365	0
TIN CITY AFS-LRR	AK	NOME	AK	506496	365	0
BIRMINGHAM IAP	AL	BIRMINGHAM AP	AL	10831	201	164
MAXWELL-GUNTER AFB	AL	MONTGOMERY	AL	15550	183	182
MONTGOMERY REGIONAL AIRPORT	AL					
FORT SMITH REGIONAL AIRPORT	AR	FORT SMITH	AR	32574	202	163
LITTLE ROCK AFB	AR	NORTH LITTLE ROCK	AR	35320	191	174
GILA BEND AIR FORCE AUX FIELD	AZ	PHOENIX	AZ	26481	138	227
LUKE AFB	AZ					
SKY HARBOR IAP	AZ					
AF PLANT 44	AZ	TUCSON	AZ	28820	163	202
DAVIS-MONTHAN AFB	AZ					
TUCSON IAP	AZ					
BARRY GOLDWATER AIR FORCE RANGE (Air Force Portion)	AZ	YUMA	AZ	29660	111	254
FRESNO ANGB	CA	FRESNO	CA	43257	197	168
MARCH JARB	CA	LONG BEACH	CA	45085	186	179
CHANNEL ISLANDS ANGS	CA	LOS ANGELES AP	CA	45114	219	146
LOS ANGELES AFB	CA					
AF PLANT 42	CA	LOS ANGELES C.O.	CA	45115	176	189
EDWARDS AFB	CA					
SEPULVEDA ANGS	CA					
BEALE AFB	CA	SACRAMENTO	CA	47630	212	153
NORTH HIGHLANDS ANGS	CA					
TRAVIS AFB	CA					

Appendix B, Representative Heating and Cooling Day Data by Base

Installation		Weather Station (closest)				
Name	State	Station Name	State	COOP ID	Heating Days	Cooling Days
MOFFETT FIELD	CA	SAN FRANCISCO AP	CA	47769	365	0
ONIZUKA AFS	CA					
VANDENBERG AFB	CA	SANTA MARIA	CA	47946	365	0
CHEYENNE MOUNTAIN AFS	CO	COLORADO SPRINGS	CO	51778	297	68
PETERSEN AFB	CO					
SCHRIEVER AFB	CO					
USAF ACADEMY	CO					
USAF ACADEMY AUX AIR FIELD	CO					
BUCKLEY AFB	CO	DENVER	CO	803017	274	91
BUCKLEY AFB ANNEX	CO					
BRADLEY ANGB	CT	HARTFORD	CT	63456	267	98
JBAB - BELLEVUE	DC	WASHINGTON NAT'L AP	DC	448906	226	139
JBAB - BOLLING AFB	DC					
JBAB - NAVAL RESEARCH LAB	DC					
JBAB - NAVAL STATION ANACOSTIA	DC					
NEW CASTLE COUNTY AIRPORT	DE	CARIBOU	ME	171175	353	12
DOVER AFB	DE	WILMINGTON	DE	79595	244	121
TYNDALL AFB	FL	APALACHICOLA	FL	80211	153	212
JACKSONVILLE IAP	FL	JACKSONVILLE	FL	84358	154	211
HOMESTEAD JARB	FL	MIAMI	FL	85663	0	365
AVON PARK AIR FORCE RANGE	FL	ORLANDO	FL	86628	86	279
CAPE CANAVERAL AFS	FL					
DUKE FIELD	FL	PENSACOLA	FL	86997	156	209
EGLIN AFB	FL					
HURLBURT FIELD	FL					
MACDILL AFB	FL	TAMPA	FL	88788	84	281
PATRICK AFB	FL	VERO BEACH	FL	89214	71	294
AF PLANT 6	GA	ATLANTA	GA	90451	201	164
DOBBINS JARB	GA					
ROBINS AFB	GA	MACON	GA	95443	193	172
SAVANNAH HILTON HEAD AIRPORT	GA	SAVANNAH	GA	97847	172	193
MOODY AFB	GA	TALLAHASEE	FL	88758	159	206
ANDERSEN AFB	Guam	GUAM	PC	914229	0	365
COL. BUD DAY FIELD	IA	SIOUX CITY	IA	137708	261	104
DES MOINES ANGB	IA	WATERLOO	IA	138706	266	99
GOWEN FIELD ANGB	ID	BOISE	ID	101022	268	97
MOUNTAIN HOME AFB	ID					
GREATER PEORIA REGIONAL AIRPORT	IL	PEORIA	IL	116711	252	113
CAPITAL MAP	IL	SPRINGFIELD	IL	118179	242	123
SCOTT AFB	IL	ST. LOUIS	MO	237455	225	140

Appendix B, Representative Heating and Cooling Day Data by Base

Installation		Weather Station (closest)				
Name	State	Station Name	State	COOP ID	Heating Days	Cooling Days
FORT WAYNE ANGB	IN	FORT WAYNE	IN	123037	262	103
GRISSOM JARB	IN					
HULMAN AIRPORT	IN	INDIANAPOLIS	IN	124259	247	118
FORBES FIELD	KS	TOPEKA	KS	148167	236	129
MCCONNELL AFB	KS	WICHITA	KS	148830	228	137
LOUISVILLE IAP-STANDIFORD FIELD	KY	LOUISVILLE	KY	154954	226	139
NEW ORLEANS JRB	LA	NEW ORLEANS	LA	166660	147	218
BARKSDALE AFB	LA	SHREVEPORT	LA	168440	176	189
CAPE COD AFS	MA	BLUE HILL	MA	190736	282	83
HANSCOM AFB	MA	BOSTON	MA	190770	265	100
BARNES ANGB	MA	HARTFORD	CT	63456	267	98
WESTOVER JARB	MA					
OTIS ANGB	MA	PROVIDENCE	RI	376698	268	97
JBA - ANDREWS AFB-Governor's Bridge Globecom Annex	MD	BALTIMORE	MD	180465	244	121
MARTIN STATE AIRPORT	MD					
JBA - ANDREWS AFB	MD	WASHINGTON NAT'L AP	DC	448906	226	139
JBA - ANDREWS AFB-Brandywine Globecom Annex	MD					
JBA - ANDREWS AFB-Summerfield FHA Site 1	MD					
BANGOR ANGB	ME	PORTLAND	ME	176905	307	58
ALPENA ANGB	MI	ALPENA	MI	200164	331	34
SELFRIDGE ANGB	MI	DETROIT	MI	202103	264	101
BATTLE CREEK ANGB	MI	GRAND RAPIDS	MI	203333	280	85
DULUTH ANGB	MN	DULUTH	MI	212248	354	11
DULUTH ANGB ANNEX 1	MN					
DULUTH ANGB ANNEX 2	MN					
DULUTH ANGB ANNEX 3	MN					
DULUTH ANGB ANNEX 4	MN					
DULUTH ANGB ANNEX 5	MN					
MINNEAPOLIS-ST. PAUL JARS	MN	MINNEAPOLIS-ST.PAUL	MN	215435	274	91
WHITEMAN AFB	MO	COLUMBIA	MO	231791	241	124
ROSECRANS MEMORIAL AIRPORT	MO	KANSAS CITY	MO	234358	236	129
LAMBERT-ST. LOUIS IAP	MO	ST. LOUIS	MO	237455	225	140
THOMPSON FIELD ANGB	MS	JACKSON	MS	224472	189	176
KEY FIELD	MS	MERIDIAN	MS	225776	187	178
GULFPORT-BILOXI REGIONAL AIRPORT	MS	MOBILE	AL	15478	166	199
KEESLER AFB	MS					
COLUMBUS AFB	MS	TUPELO	MS	229003	205	160
GREAT FALLS INT'L AIRPORT	MT	GREAT FALLS	MT	243751	326	39
MALMSTROM AFB	MT					
CHARLOTTE/DOUGLAS IAP	NC	CHARLOTTE	NC	311690	206	159

Appendix B, Representative Heating and Cooling Day Data by Base

Installation		Weather Station (closest)				
Name	State	Station Name	State	COOP ID	Heating Days	Cooling Days
POPE AFB	NC	RALEIGH	NC	317069	218	147
SEYMOUR JOHNSON AFB	NC					
HECTOR INT'L AIRPORT	ND	FARGO	ND	322859	289	76
CAVALIER AFS	ND	GRAND FORKS	ND	323616	295	70
GRAND FORKS AFB	ND					
MINOT AFB	ND	WILLISTON	ND	329425	302	63
LINCOLN MUNICIPAL AIRPORT	NE	LINCOLN	NE	254795	249	116
OFFUTT AFB	NE	OMAHA EPPLEY AP	NE	256255	250	115
NEW BOSTON AFSTS	NH	CONCORD	NH	271683	293	72
NEWINGTON DEFENSE FUEL SUPPORT POINT	NH					
PEASE ANGS	NH					
ATLANTIC CITY ANGB	NJ	ATLANTIC CITY AP	NJ	280311	254	111
JBMDL - LAKEHURST NAVAL ENGINEERING STATION	NJ					
JBMDL - FORT DIX	NJ	PHILADELPHIA	PA	366889	238	127
JBMDL - MCGUIRE AFB	NJ					
JBMDL - MCGUIRE AFB AIR DEFENSE	NJ					
KIRTLAND AFB	NM	ALBUQUERQUE	NM	290234	233	132
HOLLOMAN AFB	NM	EL PASO	TX	412797	183	182
CANNON AFB	NM	LUBBOCK	TX	415411	211	154
NELLIS AIR FORCE RANGE	NV	LAS VEGAS	NV	264436	169	196
CREECH AFB	NV					
NELLIS AFB	NV					
NELLIS AFB - SMALL ARMS RANGE	NV					
RENO-TAHOE IAP	NV	RENO	NV	266779	285	80
STRATTON ANGB	NY	ALBANY	NY	300042	284	81
NIAGARA FALLS JARS	NY	BUFFALO	NY	301012	284	81
FRANCIS GABRESKI ANGB	NY	ISLIP	NY	304130	259	106
STEWART ANGB	NY	NEW YORK C.PARK	NY	305801	244	121
HANCOCK FIELD ANGB	NY	SYRACUSE	NY	308383	284	81
ROME ANG	NY					
ROME LAB	NY					
RICKENBACKER ANGB	OH	COLUMBUS	OH	331786	247	118
SPRINGFIELD ANGB	OH	DAYTON	OH	332075	255	110
WRIGHT-PATTERSON AFB	OH					
MANSFIELD LAHM AIRPORT	OH	MANSFIELD	OH	334865	278	87
CAMP PERRY	OH	TOLEDO	OH	338357	267	98
TOLEDO EXPRESS AIRPORT	OH					
YOUNGSTOWN JARS	OH	YOUNGSTOWN	OH	339406	285	80
TINKER AFB	OK	OKLAHOMA CITY	OK	346661	208	157
VANCE AFB	OK					
WILL ROGERS ANGB	OK					

Appendix B, Representative Heating and Cooling Day Data by Base

Installation		Weather Station (closest)				
Name	State	Station Name	State	COOP ID	Heating Days	Cooling Days
TULSA INT'L AIRPORT	OK	TULSA	OK	348992	203	162
ALTUS AFB	OK	WICHITA FALLS	TX	419729	191	174
KLAMATH FALLS AIRPORT/KINGSLEY FIELD	OR	MEDFORD	OR	355429	268	97
PORTLAND IAP	OR	PORTLAND	OR	356751	295	70
FORT INDIANTOWN GAP	PA	MIDDLETOWN/HARRISBURG INTL APT	PA	363699	250	115
HARRISBURG IAP	PA					
WILLOW GROVE ARS	PA	PHILADELPHIA	PA	366889	238	127
PITTSBURGH JARS	PA	PITTSBURGH	PA	366993	265	100
WAKE ISLAND AIRFIELD	PC	WAKE ISLAND	PC	914901	0	365
MUNIZ ANGB	PR	SAN JUAN	PR	668812	0	365
RAMEY AIR FORCE SOLAR OBSERVATORY	PR					
QUONSET STATE AIRPORT	RI	PROVIDENCE	RI	376698	268	97
JBC - CHARLESTON AFB	SC	CHARLESTON AP	SC	381544	180	185
JBC - NAVAL WEAPONS STATION CHARLESTON	SC	CHARLESTON C.O.	SC	381549	164	201
MCENTIRE ANGB	SC	COLUMBIA	SC	381939	192	173
SHAW AFB	SC					
ELLSWORTH AFB	SD	RAPID CITY	SD	396937	287	78
JOE FOSS FIELD	SD	SIOUX FALLS	SD	397667	278	87
ARNOLD AFB	TN	CHATTANOOGA	TN	401656	214	151
MCGHEE TYSON ANGB	TN	KNOXVILLE	TN	404950	224	141
MEMPHIS IAP	TN	MEMPHIS	TN	405954	195	170
NASHVILLE IAP	TN	NASHVILLE	TN	406402	218	147
DYESS AFB	TX	ABILENE	TX	410016	181	184
AF PLANT 4	TX	DALLAS-FORT WORTH	TX	412242	176	189
FORT WORTH JRB	TX					
LAUGHLIN AFB	TX	DEL RIO	TX	412360	139	226
ELLINGTON FIELD	TX	HOUSTON	TX	414300	147	218
GOODFELLOW AFB	TX	SAN ANGELO	TX	417943	180	185
BROOKS CITY-BASE	TX	SAN ANTONIO	TX	417945	148	217
JBSA - FORT SAM	TX					
JBSA - LACKLAND AFB	TX					
JBSA - RANDOLPH AFB	TX					
FORT HOOD	TX	WACO	TX	419419	168	197
SHEPPARD AFB	TX	WICHITA FALLS	TX	419729	191	174
HILL AFB	UT	SALT LAKE CITY	UT	427598	261	104
HILL AFB-LITTLE MOUNTAIN TEST ANNEX	UT					
HILL AFB-UTAH TRAINING TEST RANGE NORTH	UT					
HILL AFB-UTAH TRAINING TEST RANGE SOUTH	UT					
UTAH ANGB	UT					
JBA - FORT EUSTIS	VA	NORFOLK	VA	446139	218	147
JBA - LANGLEY AFB	VA					

Appendix B, Representative Heating and Cooling Day Data by Base

Installation		Weather Station (closest)				
Name	State	Station Name	State	COOP ID	Heating Days	Cooling Days
BURLINGTON IAP	VT	BURLINGTON	VT	431081	290	75
CAMP MURRAY	WA	OLYMPIA	WA	456114	365	0
JBL - FORT LEWIS	WA					
JBL - MCCHORD AFB	WA					
FAIRCHILD AFB	WA	SPOKANE	WA	457938	307	58
VOLK FIELD ANGB	WI	LA CROSSE	WI	474370	265	100
TRUAX FIELD	WI	MADISON	WI	474961	282	83
GENERAL MITCHELL ARS	WI	MILWAUKEE	WI	475479	277	88
YEAGER AIRPORT	WV	CHARLESTON	WV	461570	250	115
SHEPHERD FIELD	WV	WASHINGTON DULLES AP	DC	448903	246	119
CHEYENNE REGIONAL AIRPORT	WY	CHEYENNE	WY	481675	318	47
F.E. WARREN AFB	WY					

Appendix C, Weather Station Heating and Cooling Day Data

Weather Station				
Station Name	State	COOP ID	Heating Days	Cooling Days
ANCHORAGE	AK	500280	365	0
ANNETTE	AK	500352	365	0
BARROW	AK	500546	365	0
BETHEL	AK	500754	365	0
BETTLES	AK	500761	365	0
BIG DELTA	AK	500770	365	0
COLD BAY	AK	502102	365	0
FAIRBANKS	AK	502968	365	0
GULKANA	AK	503465	365	0
HOMER	AK	503665	365	0
JUNEAU	AK	504100	365	0
KING SALMON	AK	504766	365	0
KODIAK	AK	504988	365	0
KOTZEBUE	AK	505076	365	0
MCGRATH	AK	505769	365	0
NOME	AK	506496	365	0
ST. PAUL ISLAND	AK	508118	365	0
TALKEETNA	AK	508976	365	0
UNALAKLEET	AK	509564	365	0
VALDEZ	AK	509686	365	0
YAKUTAT	AK	509941	365	0
BIRMINGHAM AP	AL	10831	201	164
HUNTSVILLE	AL	14064	209	156
MOBILE	AL	15478	166	199
MONTGOMERY	AL	15550	183	182
FORT SMITH	AR	32574	202	163
LITTLE ROCK	AR	34248	199	166
NORTH LITTLE ROCK	AR	35320	191	174
FLAGSTAFF	AZ	23010	339	26
PHOENIX	AZ	26481	138	227
TUCSON	AZ	28820	163	202
WINSLOW	AZ	29439	243	12
YUMA	AZ	29660	111	254
BAKERSFIELD	CA	40442	185	180
BISHOP	CA	40822	245	120
EUREKA	CA	42910	365	0
FRESNO	CA	43257	197	168
LONG BEACH	CA	45085	186	179

Appendix C, Weather Station Heating and Cooling Day Data

Weather Station				
Station Name	State	COOP ID	Heating Days	Cooling Days
LOS ANGELES AP	CA	45114	219	146
LOS ANGELES C.O.	CA	45115	176	189
MOUNT SHASTA	CA	45983	328	37
REDDING	CA	47304	213	152
SACRAMENTO	CA	47630	212	153
SAN DIEGO	CA	47740	203	162
SAN FRANCISCO AP	CA	47769	365	0
SAN FRANCISCO C.O.	CA	47772	365	0
SANTA BARBARA	CA	47905	263	102
SANTA MARIA	CA	47946	365	0
STOCKTON	CA	48558	206	159
ALAMOSA	CO	50130	365	0
COLORADO SPRINGS	CO	51778	297	68
DENVER	CO	803017	274	91
GRAND JUNCTION	CO	53488	254	111
PUEBLO	CO	56740	259	106
BRIDGEPORT	CT	60806	261	104
HARTFORD	CT	63456	267	98
WASHINGTON NAT'L AP	DC	448906	226	139
WILMINGTON	DE	79595	244	121
APALACHICOLA	FL	80211	153	212
DAYTONA BEACH	FL	82158	113	252
FORT MYERS	FL	83186	5	360
GAINESVILLE	FL	83326	145	220
JACKSONVILLE	FL	84358	154	211
KEY WEST	FL	84570	0	365
MIAMI	FL	85663	0	365
ORLANDO	FL	86628	86	279
PENSACOLA	FL	86997	156	209
TALLAHASSEE	FL	88758	159	206
TAMPA	FL	88788	84	281
VERO BEACH	FL	89214	71	294
WEST PALM BEACH	FL	89525	0	365
ATHENS	GA	90435	206	159
ATLANTA	GA	90451	201	164
AUGUSTA	GA	90495	197	168
COLUMBUS	GA	92166	182	183
MACON	GA	95443	193	172

Appendix C, Weather Station Heating and Cooling Day Data

Weather Station				
Station Name	State	COOP ID	Heating Days	Cooling Days
SAVANNAH	GA	97847	172	193
HILO	HI	511492	0	365
HONOLULU	HI	511919	0	365
KAHULUI	HI	512572	0	365
LIHUE	HI	515580	0	365
DES MOINES	IA	131063	252	113
DUBUQUE	IA	132367	274	91
SIOUX CITY	IA	137708	261	104
WATERLOO	IA	138706	266	99
BOISE	ID	101022	268	97
LEWISTON	ID	105241	273	92
POCATELLO	ID	107211	305	60
CHICAGO	IL	111549	267	98
MOLINE	IL	115751	253	112
PEORIA	IL	116711	252	113
ROCKFORD	IL	117382	269	96
SPRINGFIELD	IL	118179	242	123
EVANSVILLE	IN	122738	230	135
FORT WAYNE	IN	123037	262	103
INDIANAPOLIS	IN	124259	247	118
SOUTH BEND	IN	128187	266	99
CONCORDIA	KS	141767	241	124
DODGE CITY	KS	142164	235	130
GOODLAND	KS	143153	263	102
TOPEKA	KS	148167	236	129
WICHITA	KS	148830	228	137
JACKSON	KY	154202	238	127
LEXINGTON	KY	154746	239	126
LOUISVILLE	KY	154954	226	139
PADUCAH	KY	156110	228	137
GREATER CINCINNATI AP	KY	151855	241	124
BATON ROUGE	LA	160549	163	202
LAKE CHARLES	LA	165078	156	209
NEW ORLEANS	LA	166660	147	218
SHREVEPORT	LA	168440	176	189
BLUE HILL	MA	190736	282	83
BOSTON	MA	190770	265	100
WORCESTER	MA	199923	293	72

Appendix C, Weather Station Heating and Cooling Day Data

Weather Station				
Station Name	State	COOP ID	Heating Days	Cooling Days
BALTIMORE	MD	180465	244	121
CARIBOU	ME	171175	353	12
PORTLAND	ME	176905	307	58
ALPENA	MI	200164	331	34
DETROIT	MI	202103	264	101
FLINT	MI	202846	286	79
GRAND RAPIDS	MI	203333	280	85
HOUGHTON LAKE	MI	203936	328	37
LANSING	MI	204641	286	79
MARQUETTE	MI	205184	365	0
MUSKEGON	MI	205712	291	74
SAULT STE. MARIE	MI	207366	365	0
DULUTH	MN	212248	354	11
INTERNATIONAL FALLS	MN	214026	343	22
MINNEAPOLIS-ST.PAUL	MN	215435	274	91
ROCHESTER	MN	217004	290	75
SAINT CLOUD	MN	217294	296	69
COLUMBIA	MO	231791	241	124
KANSAS CITY	MO	234358	236	129
ST. LOUIS	MO	237455	225	140
SPRINGFIELD	MO	237976	232	133
JACKSON	MS	224472	189	176
MERIDIAN	MS	225776	187	178
TUPELO	MS	229003	205	160
BILLINGS	MT	240807	287	78
GLASGOW	MT	243558	295	70
GREAT FALLS	MT	243751	326	39
HAVRE	MT	243996	309	56
HELENA	MT	244055	316	49
KALISPELL	MT	244558	365	0
MISSOULA	MT	245745	321	44
ASHEVILLE	NC	310300	253	112
CAPE HATTERAS	NC	311458	199	166
CHARLOTTE	NC	311690	206	159
GREENSBORO-WNSTN-SALM-HGHPT	NC	313630	227	138
RALEIGH	NC	317069	218	147
WILMINGTON	NC	319457	191	174
BISMARCK	ND	320819	294	71

Appendix C, Weather Station Heating and Cooling Day Data

Weather Station				
Station Name	State	COOP ID	Heating Days	Cooling Days
FARGO	ND	322859	289	76
GRAND FORKS	ND	323616	295	70
WILLISTON	ND	329425	302	63
GRAND ISLAND	NE	253395	257	108
LINCOLN	NE	254795	249	116
NORFOLK	NE	255995	262	103
NORTH PLATTE	NE	256065	271	94
OMAHA EPPLEY AP	NE	256255	250	115
OMAHA (NORTH)	NE	256260	250	115
SCOTTSBLUFF	NE	257665	280	85
VALENTINE	NE	258760	275	90
CONCORD	NH	271683	293	72
MT. WASHINGTON	NH	275639	365	0
ATLANTIC CITY AP	NJ	280311	254	111
ATLANTIC CITY C.O.	NJ	280325	246	119
NEWARK	NJ	286026	243	122
ALBUQUERQUE	NM	290234	233	132
CLAYTON	NM	291887	258	107
ROSWELL	NM	297610	207	158
ELKO	NV	262573	309	56
ELY	NV	262631	321	44
LAS VEGAS	NV	264436	169	196
RENO	NV	266779	285	80
WINNEMUCCA	NV	269171	291	74
ALBANY	NY	300042	284	81
BINGHAMTON	NY	300687	304	61
BUFFALO	NY	301012	284	81
ISLIP	NY	304130	259	106
NEW YORK C.PARK	NY	305801	244	121
NEW YORK (JFK AP)	NY	305803	254	111
NEW YORK (LAGUARDIA AP)	NY	305811	241	124
ROCHESTER	NY	307167	285	80
SYRACUSE	NY	308383	284	81
AKRON	OH	330058	273	92
CLEVELAND	OH	331657	272	93
COLUMBUS	OH	331786	247	118
DAYTON	OH	332075	255	110
MANSFIELD	OH	334865	278	87

Appendix C, Weather Station Heating and Cooling Day Data

Weather Station				
Station Name	State	COOP ID	Heating Days	Cooling Days
TOLEDO	OH	338357	267	98
YOUNGSTOWN	OH	339406	285	80
OKLAHOMA CITY	OK	346661	208	157
TULSA	OK	348992	203	162
ASTORIA	OR	350328	365	0
BURNS	OR	351175	345	20
EUGENE	OR	352709	319	46
MEDFORD	OR	355429	268	97
PENDLETON	OR	356546	277	88
PORTLAND	OR	356751	295	70
SALEM	OR	357500	311	54
SEXTON SUMMIT	OR	357698	365	0
ALLENTOWN	PA	360106	267	98
ERIE	PA	362682	270	95
MIDDLETOWN/HARRISBURG INTL APT	PA	363699	250	115
PHILADELPHIA	PA	366889	238	127
PITTSBURGH	PA	366993	265	100
AVOCA	PA	369705	273	92
WILLIAMSPORT	PA	369728	270	95
SAN JUAN	PR	668812	0	365
PROVIDENCE	RI	376698	268	97
CHARLESTON AP	SC	381544	180	185
CHARLESTON C.O.	SC	381549	164	201
COLUMBIA	SC	381939	192	173
GREENVILLE-SPARTANBURG AP	SC	383747	216	149
ABERDEEN	SD	390020	282	83
HURON	SD	394127	276	89
RAPID CITY	SD	396937	287	78
SIOUX FALLS	SD	397667	278	87
BRISTOL-JHNSN CTY-KNGSPRT	TN	401094	246	119
CHATTANOOGA	TN	401656	214	151
KNOXVILLE	TN	404950	224	141
MEMPHIS	TN	405954	195	170
NASHVILLE	TN	406402	218	147
OAK RIDGE	TN	406750	227	138
ABILENE	TX	410016	181	184
AMARILLO	TX	410211	230	135
AUSTIN/CITY	TX	410428	151	214

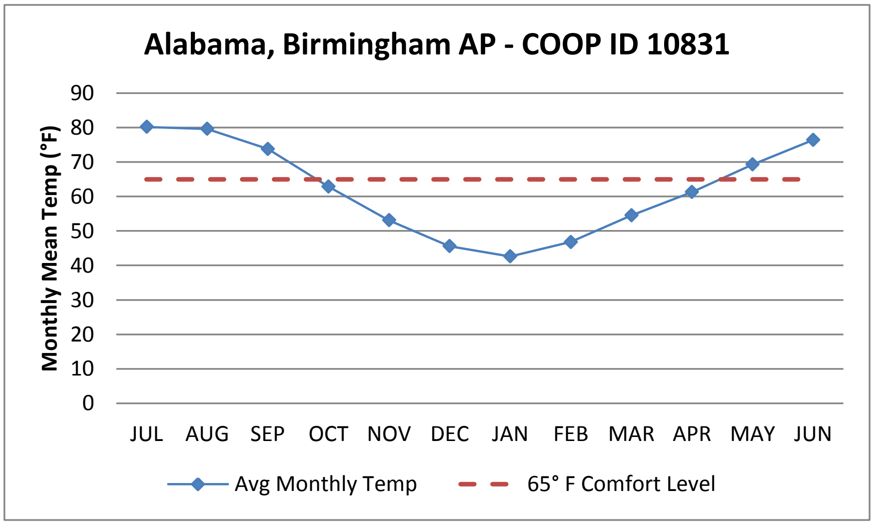
Appendix C, Weather Station Heating and Cooling Day Data

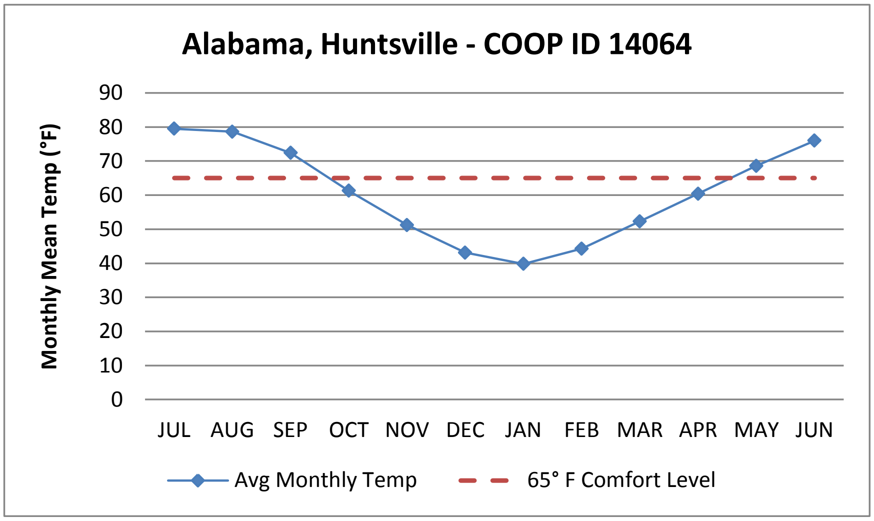
Weather Station				
Station Name	State	COOP ID	Heating Days	Cooling Days
AUSTIN/BERGSTROM	TX	813904	162	203
BROWNSVILLE	TX	411136	90	275
CORPUS CHRISTI	TX	412015	116	249
DALLAS-FORT WORTH	TX	412242	176	189
DALLAS-LOVE FIELD	TX	412244	168	197
DEL RIO	TX	412360	139	226
EL PASO	TX	412797	183	182
GALVESTON	TX	413430	123	242
HOUSTON	TX	414300	147	218
LUBBOCK	TX	415411	211	154
MIDLAND-ODESSA	TX	415890	188	177
PORT ARTHUR	TX	417174	148	217
SAN ANGELO	TX	417943	180	185
SAN ANTONIO	TX	417945	148	217
VICTORIA	TX	419364	134	231
WACO	TX	419419	168	197
WICHITA FALLS	TX	419729	191	174
MILFORD	UT	425654	274	91
SALT LAKE CITY	UT	427598	261	104
LYNCHBURG	VA	445120	243	122
NORFOLK	VA	446139	218	147
RICHMOND	VA	447201	228	137
ROANOKE	VA	447285	239	126
WASHINGTON DULLES AP	VA	448903	246	119
BURLINGTON	VT	431081	290	75
OLYMPIA	WA	456114	365	0
QUILLAYUTE	WA	456858	365	0
SEATTLE C.O.	WA	457458	324	41
SEATTLE SEA-TAC AP	WA	457473	328	37
SPOKANE	WA	457938	307	58
WALLA WALLA	WA	458928	261	104
YAKIMA	WA	459465	302	63
GREEN BAY	WI	473269	293	72
LA CROSSE	WI	474370	265	100
MADISON	WI	474961	282	83
MILWAUKEE	WI	475479	277	88
BECKLEY	WV	460582	274	91
CHARLESTON	WV	461570	250	115

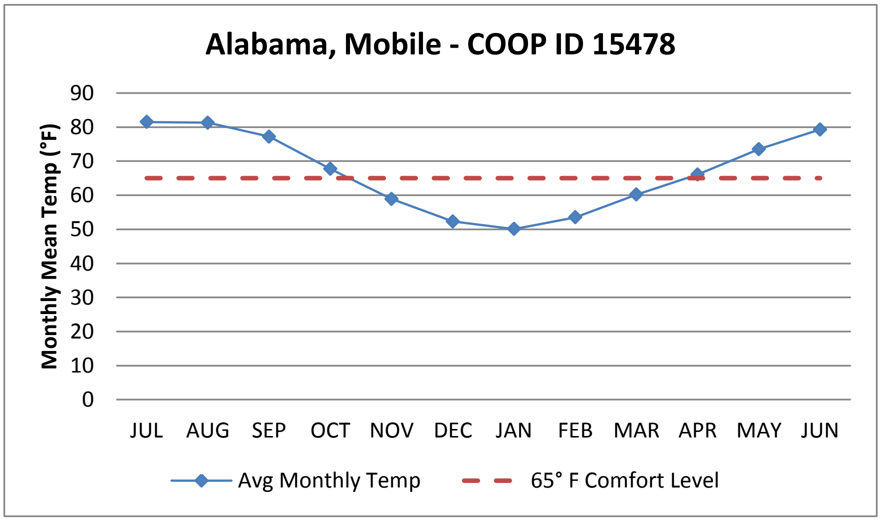
Appendix C, Weather Station Heating and Cooling Day Data

Weather Station				
Station Name	**State**	**COOP ID**	**Heating Days**	**Cooling Days**
ELKINS	WV	462718	284	81
HUNTINGTON	WV	464393	243	122
CASPER	WY	481570	303	62
CHEYENNE	WY	481675	318	47
LANDER	WY	485390	296	69
SHERIDAN	WY	488155	309	56
GUAM, PC	GU	914229	0	365
JOHNSTON ISLAND, PC		914320	0	365
KOROR, PC		914351	0	365
KWAJALEIN, MARSHALL IS., PC		914375	0	365
MAJURO, MARSHALL IS, PC		914460	0	365
PAGO PAGO, AMER SAMOA, PC		914690	0	365
POHNPEI, CAROLINE IS., PC		914751	0	365
CHUUK, E. CAROLINE IS., PC		914111	0	365
WAKE ISLAND, PC		914901	0	365
YAP, W CAROLINE IS., PC		914951	0	365

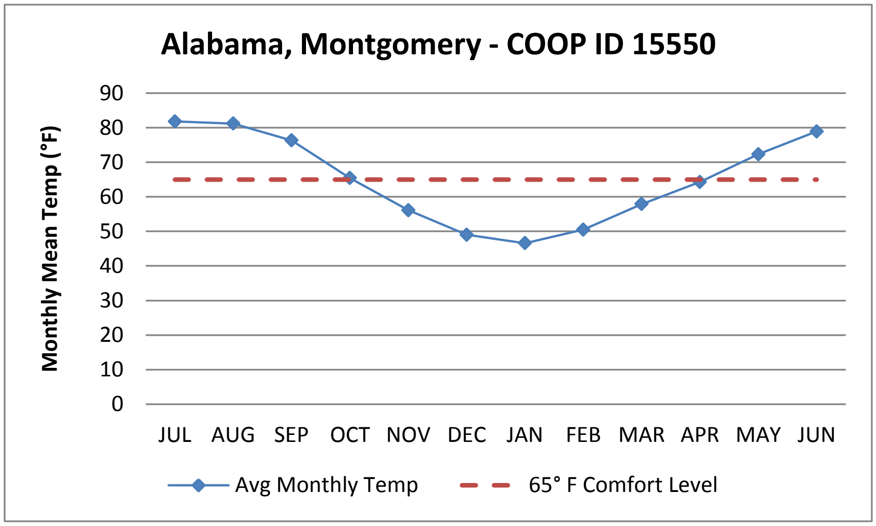
Appendix D, Weather Station Heating and Cooling Day Graphs

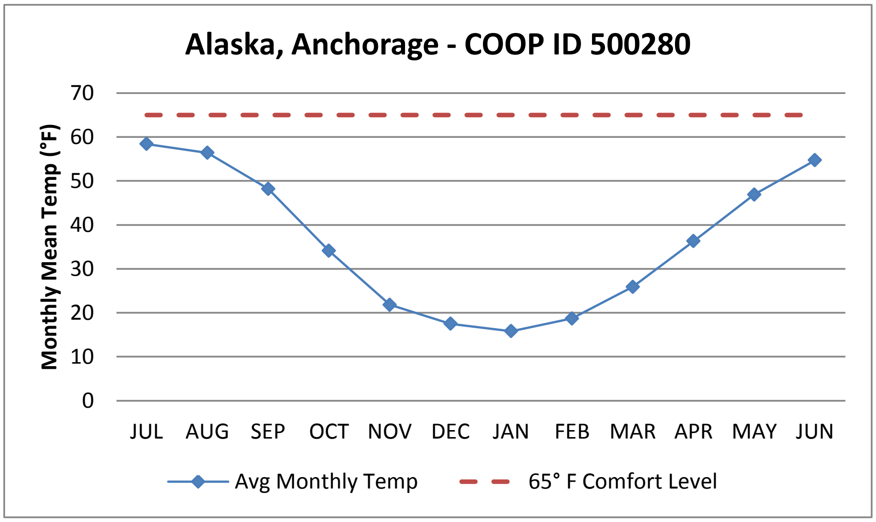


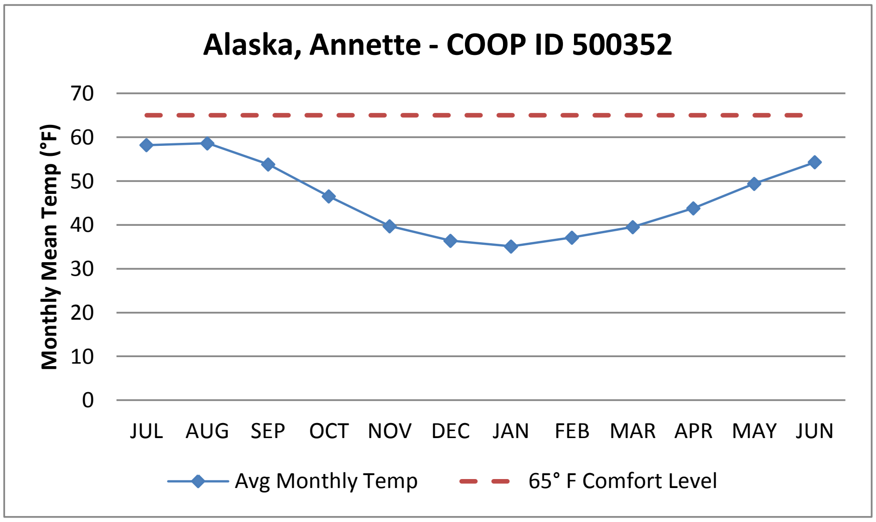




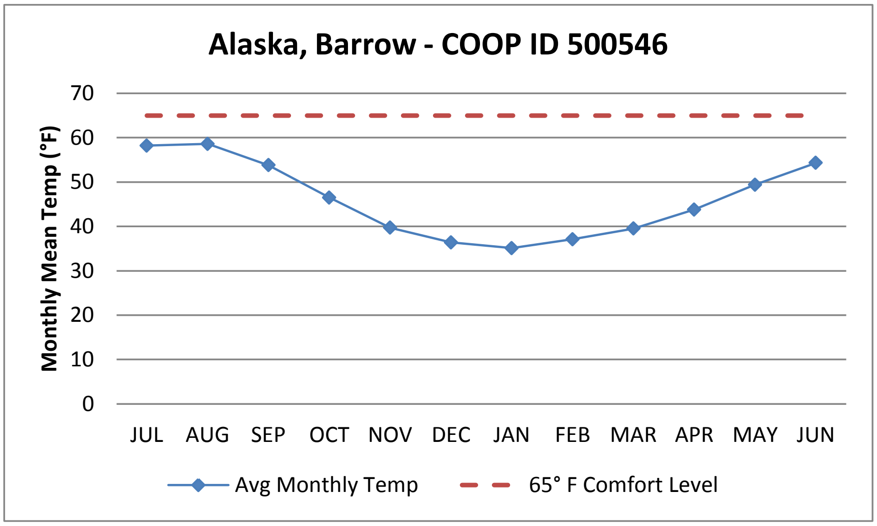
Appendix D, Weather Station Heating and Cooling Day Graphs

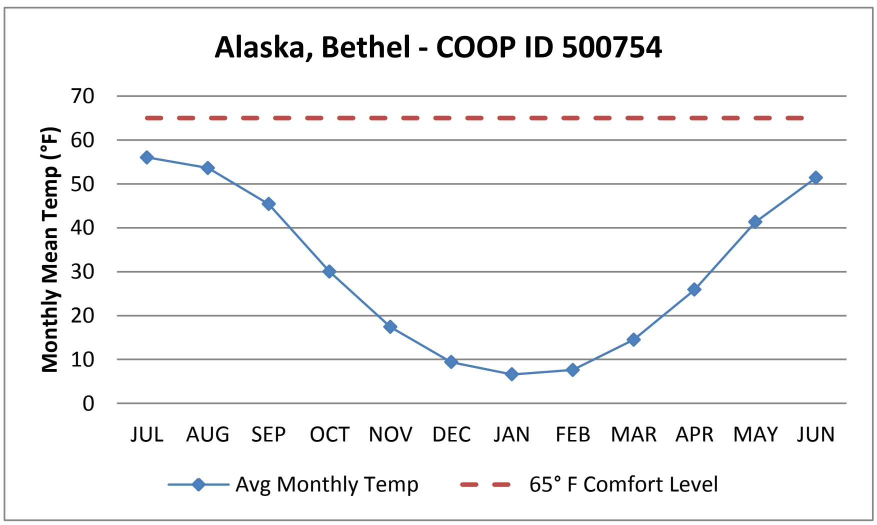


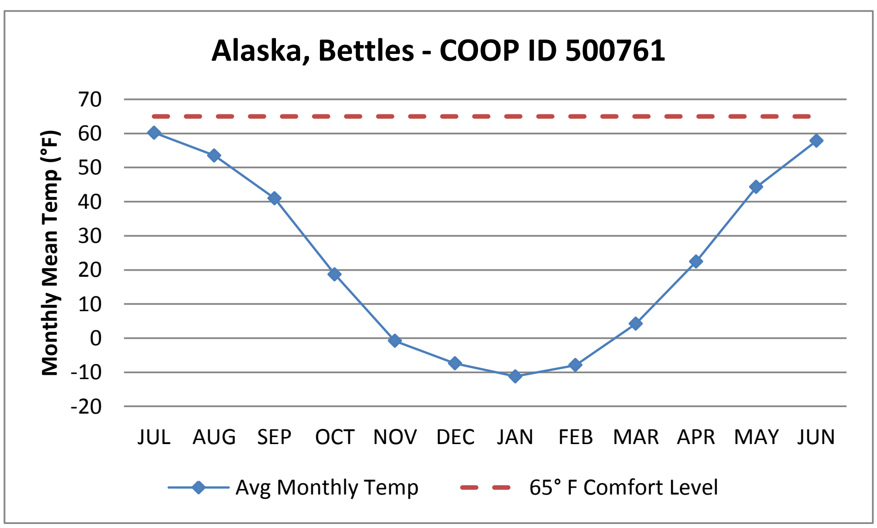




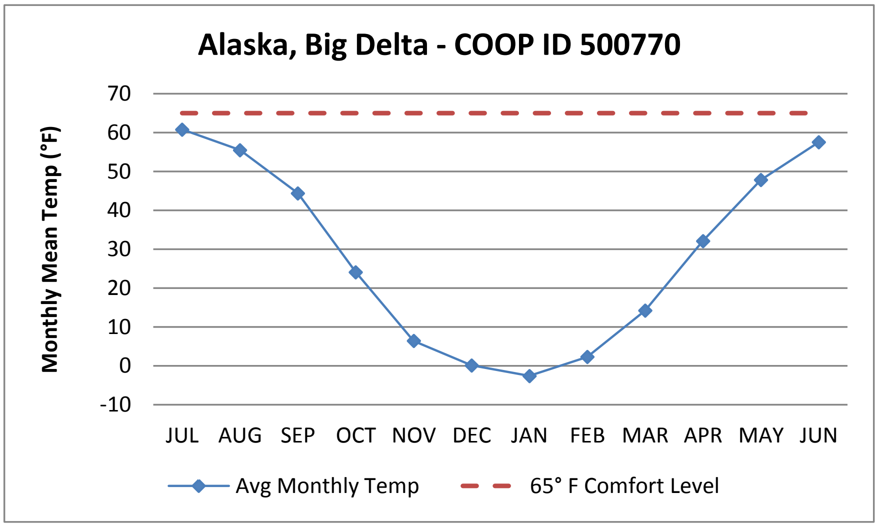
Appendix D, Weather Station Heating and Cooling Day Graphs

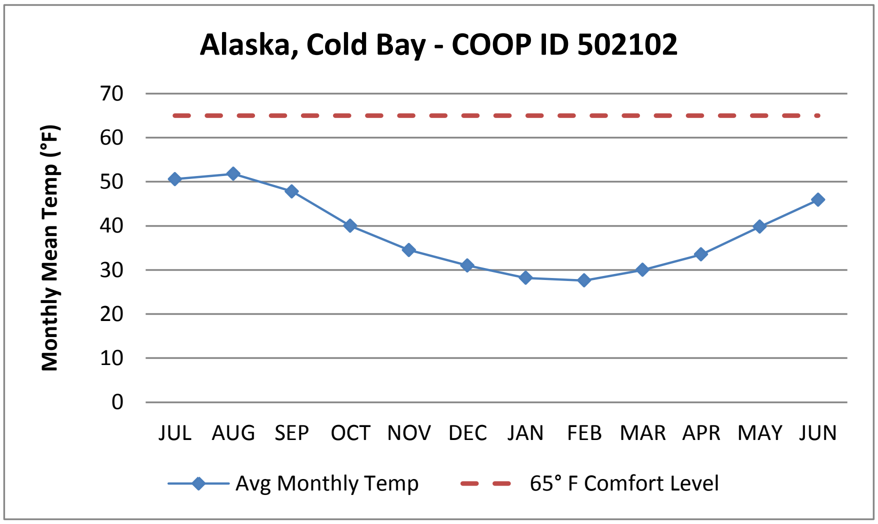


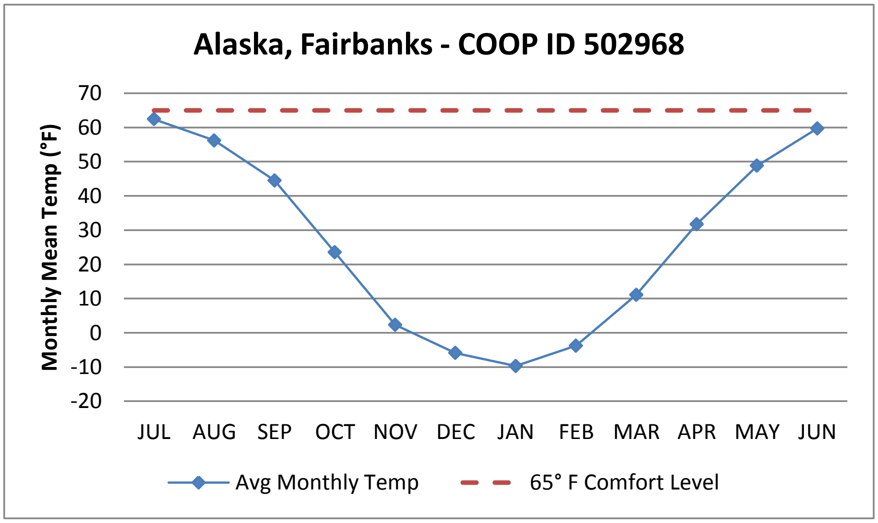




Appendix D, Weather Station Heating and Cooling Day Graphs







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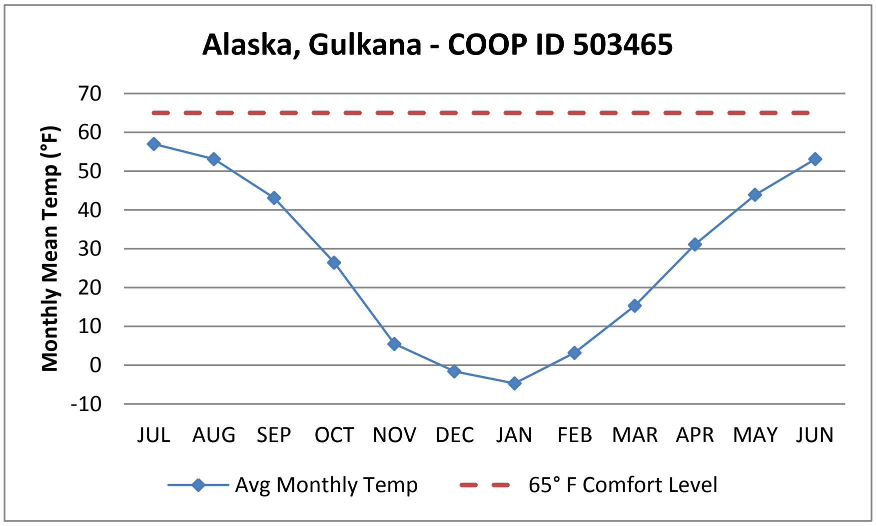

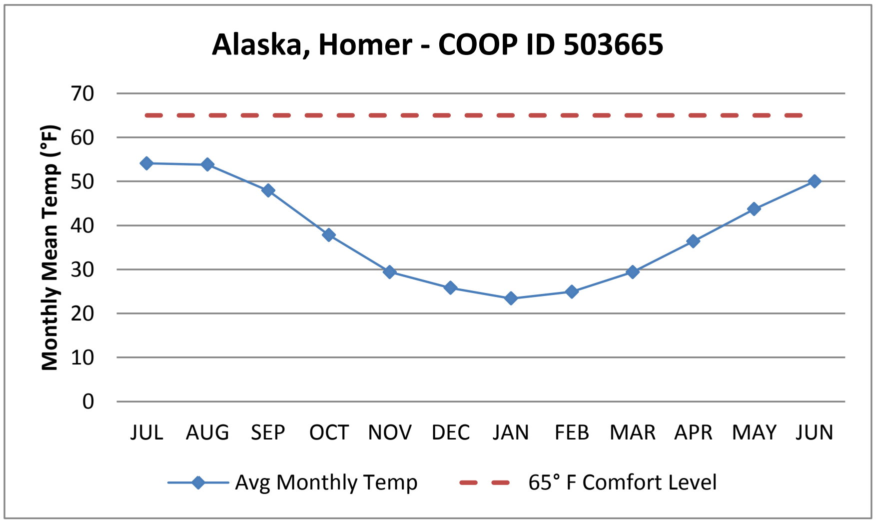

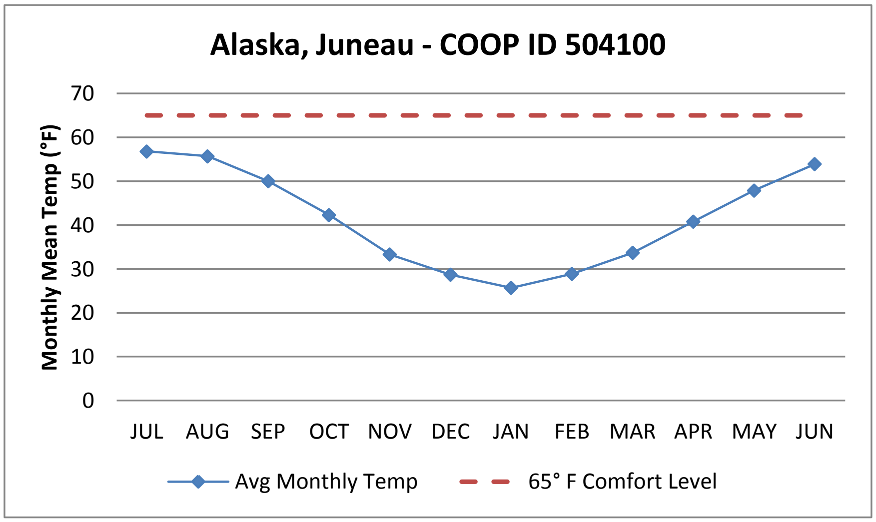

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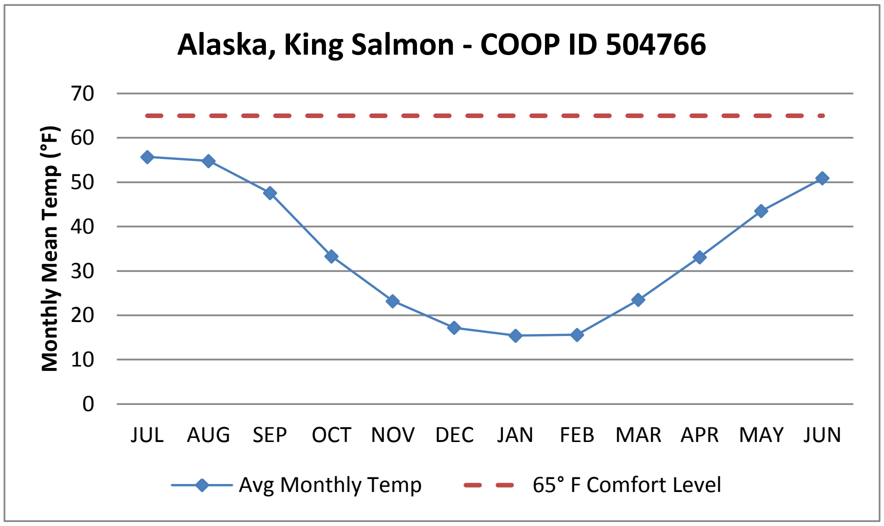

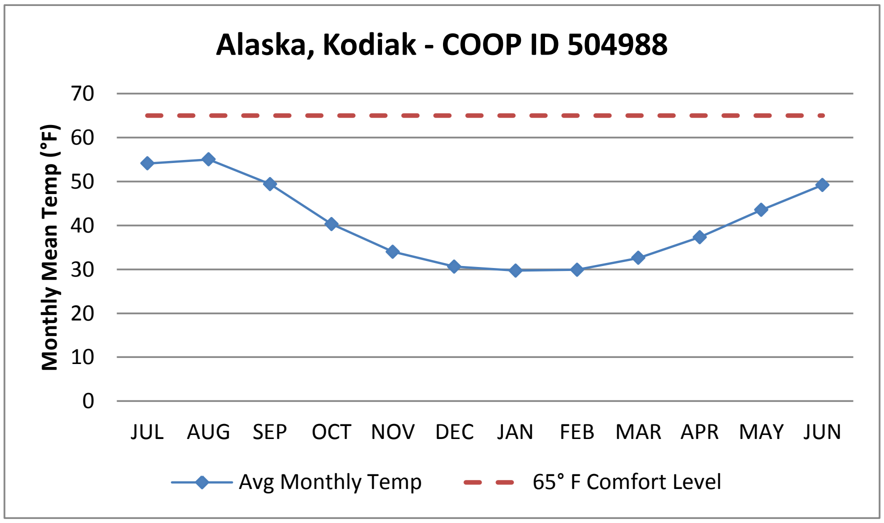

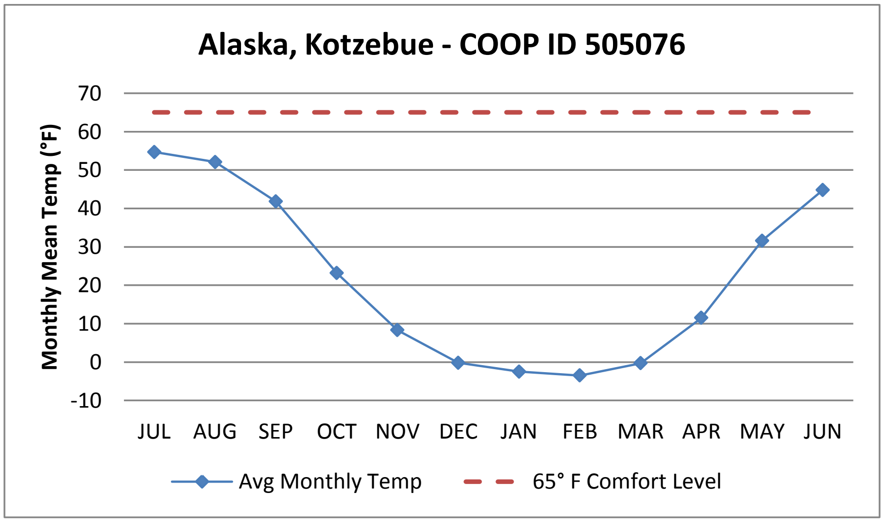

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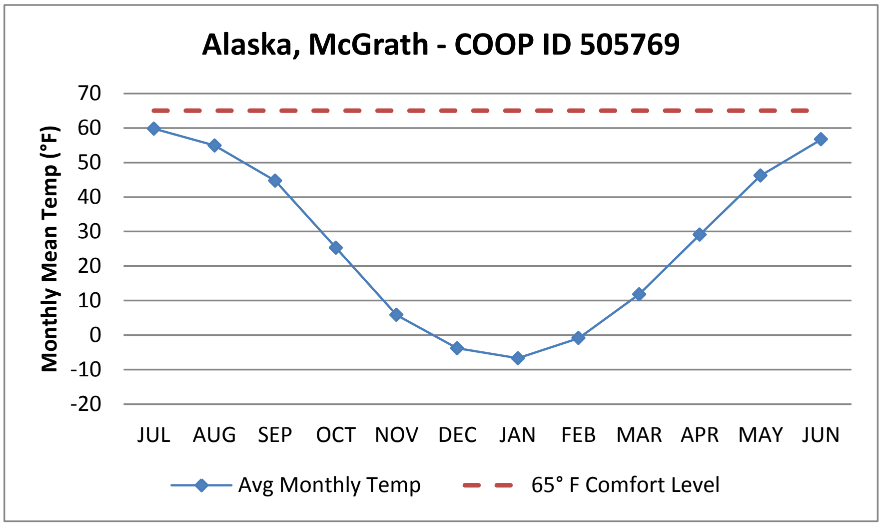

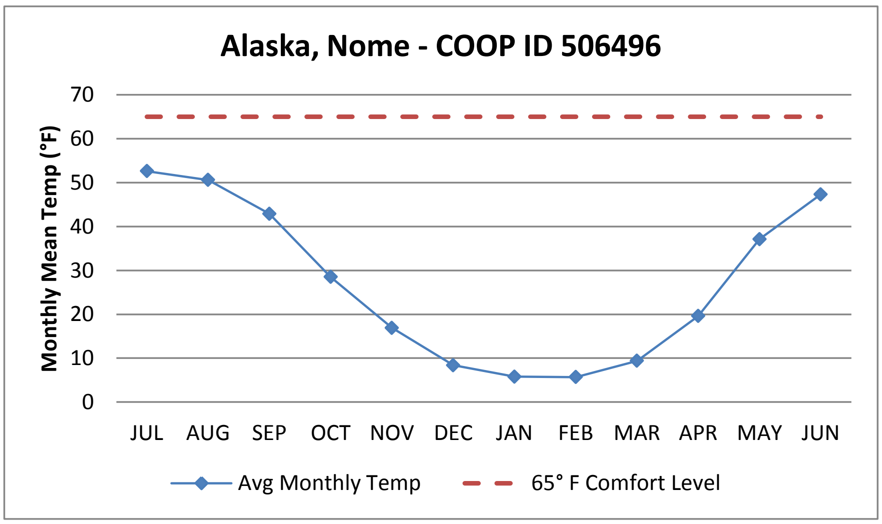

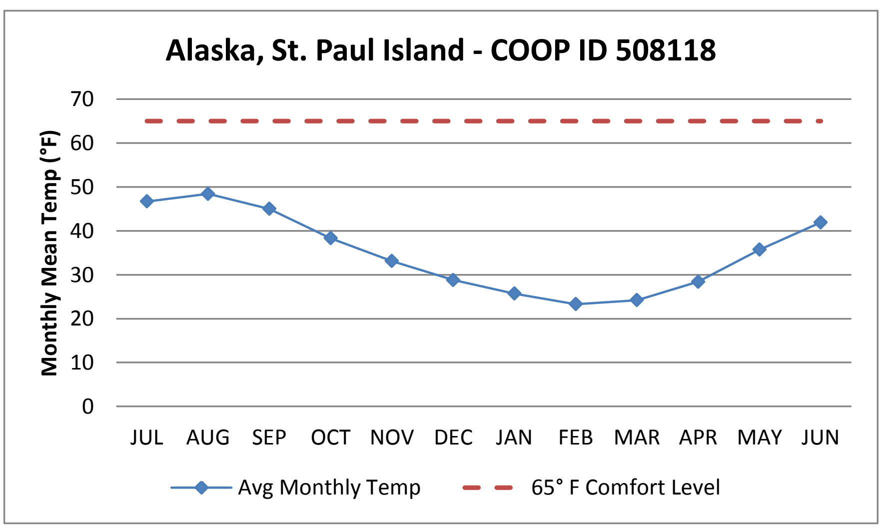

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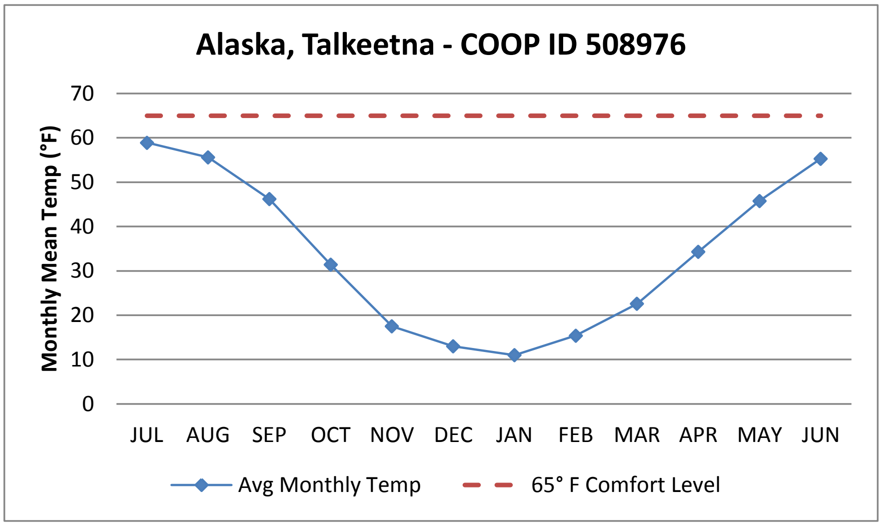

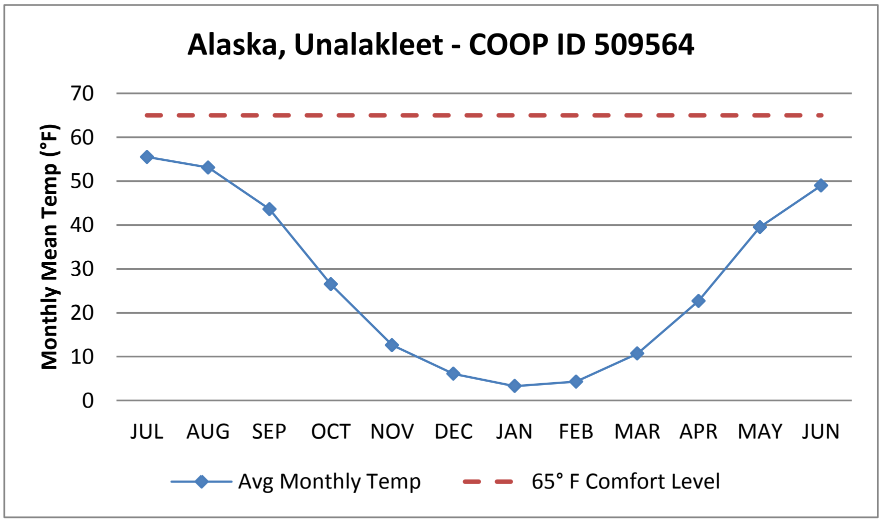

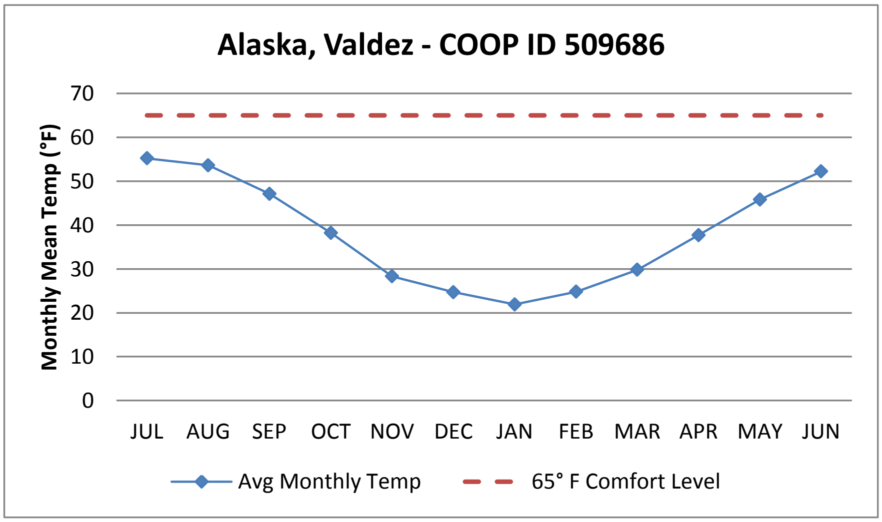

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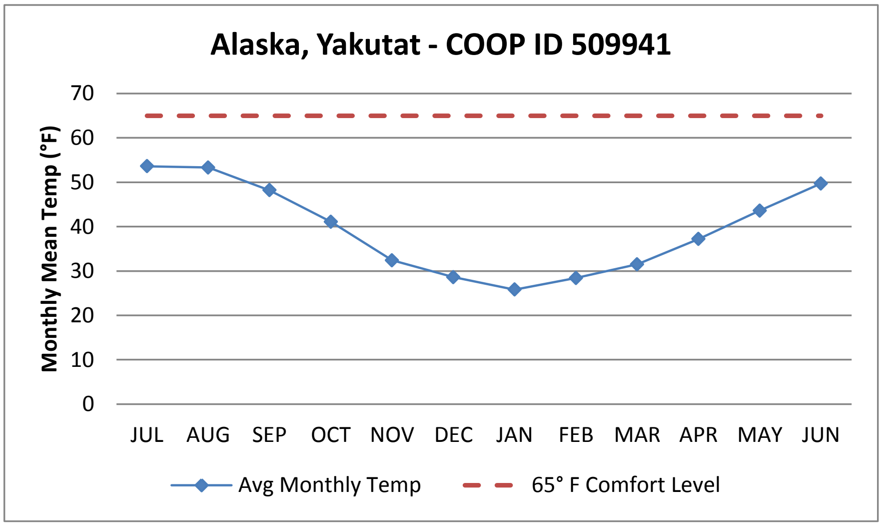

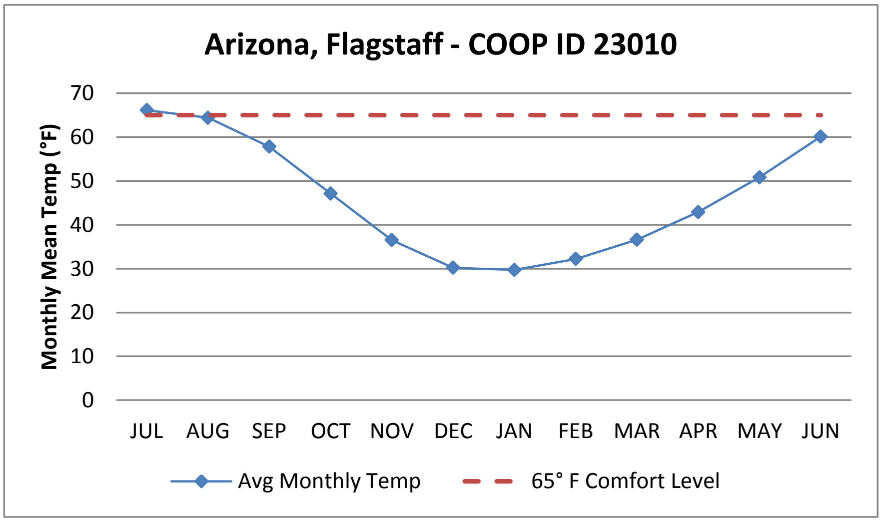

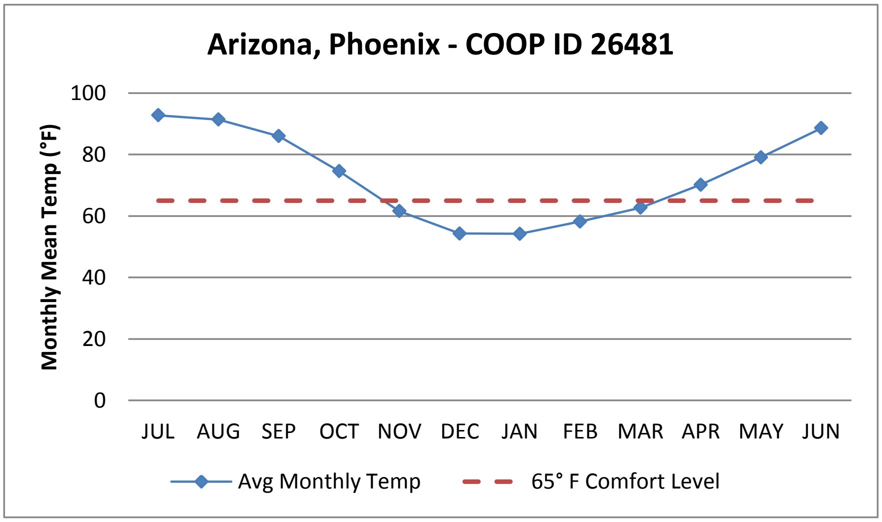

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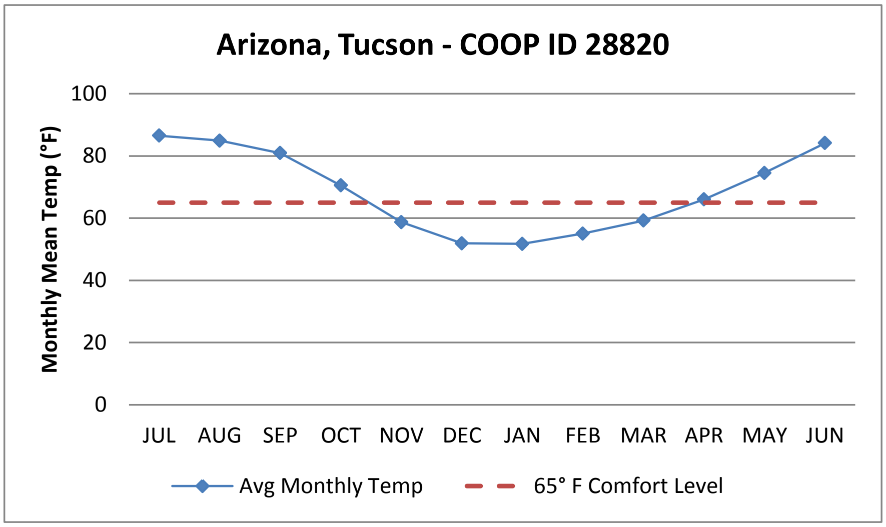

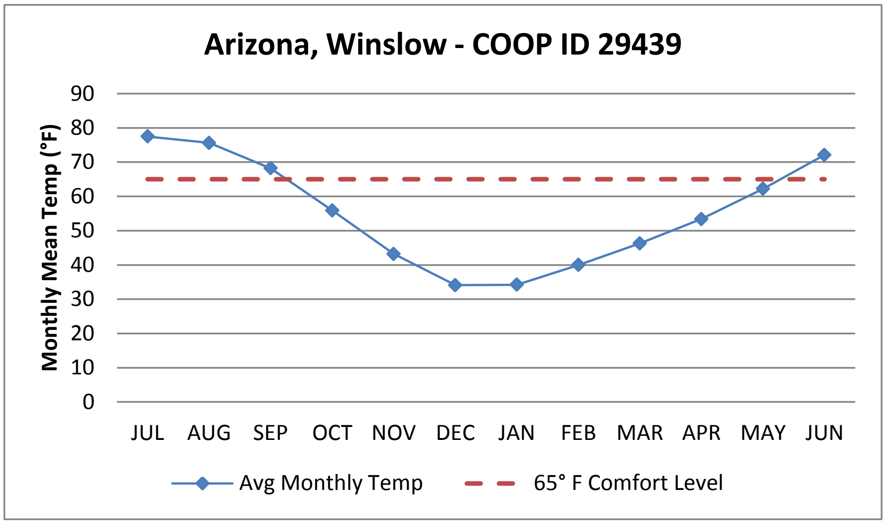

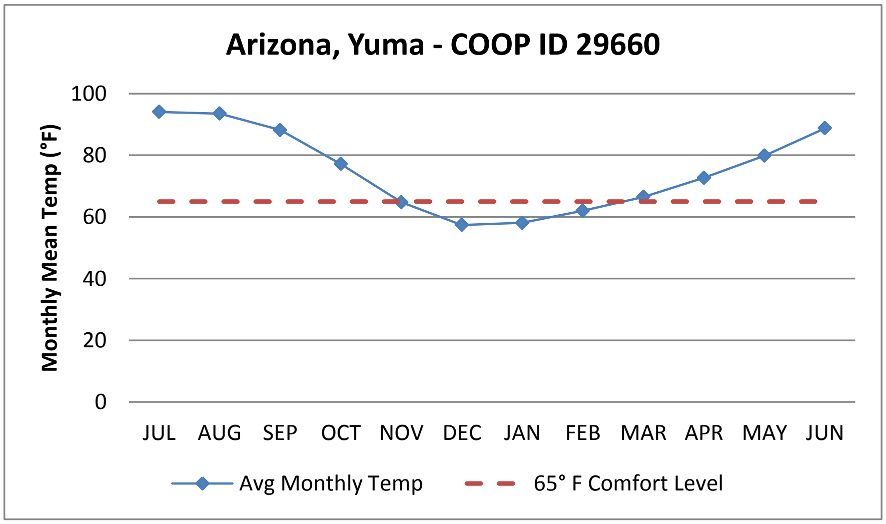

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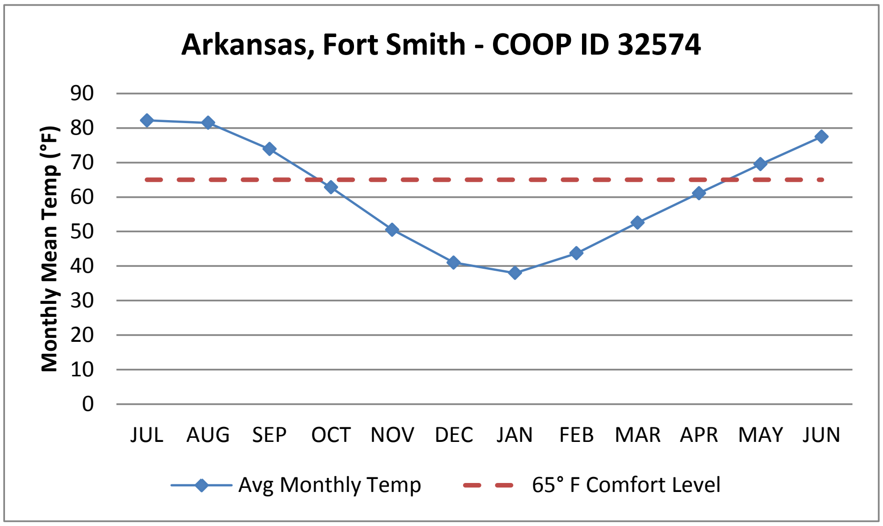

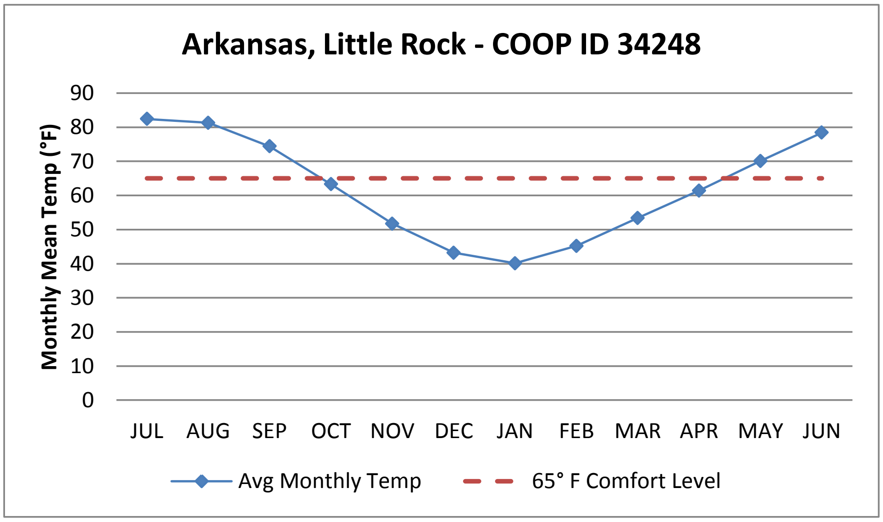

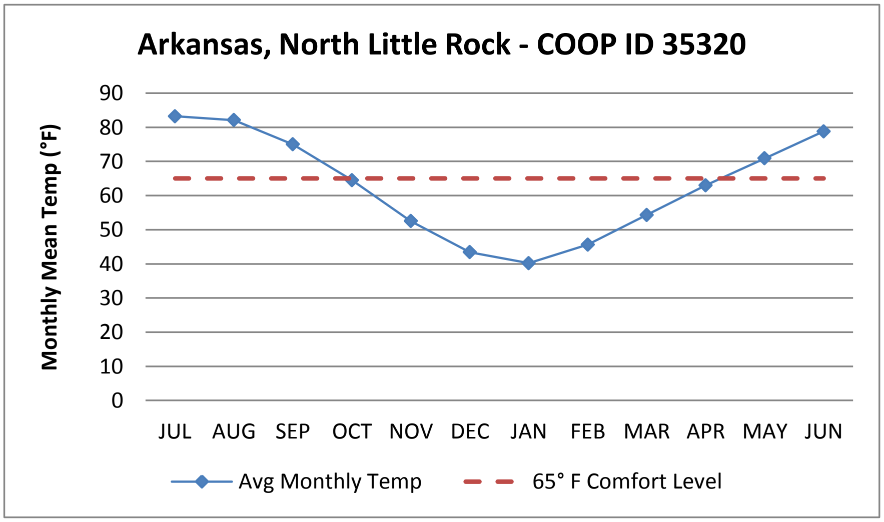

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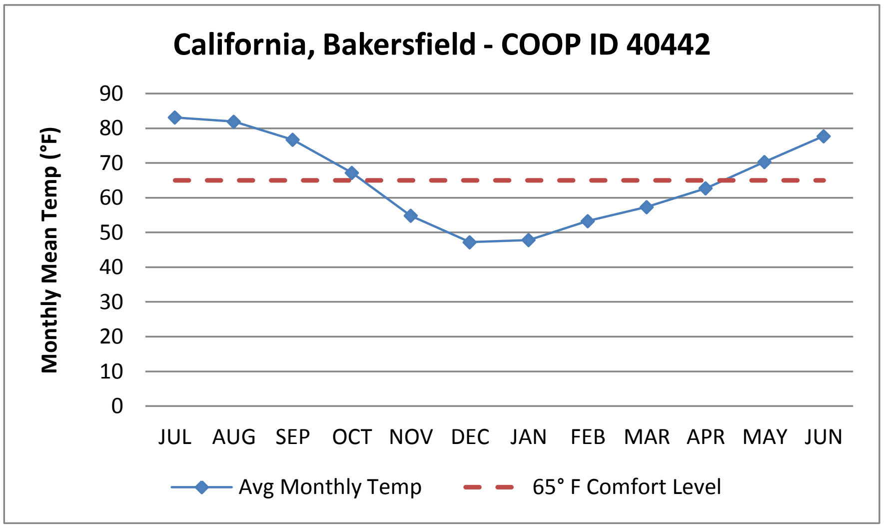

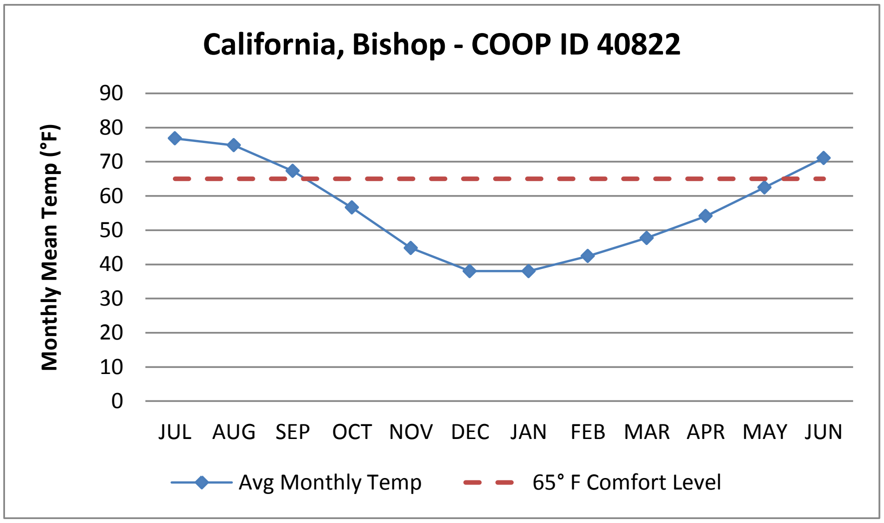

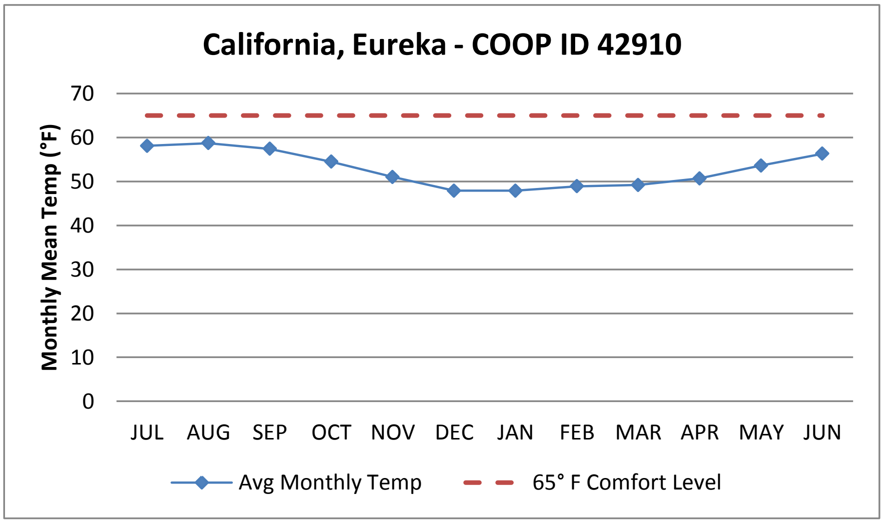

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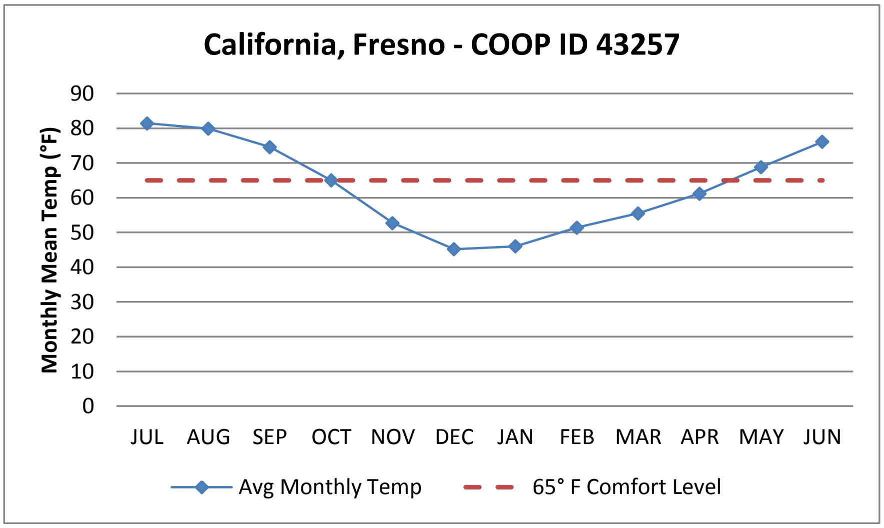

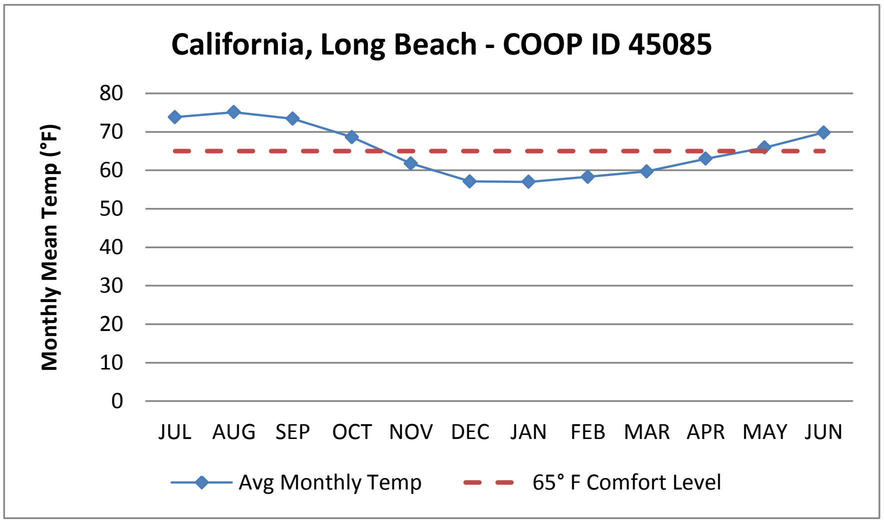

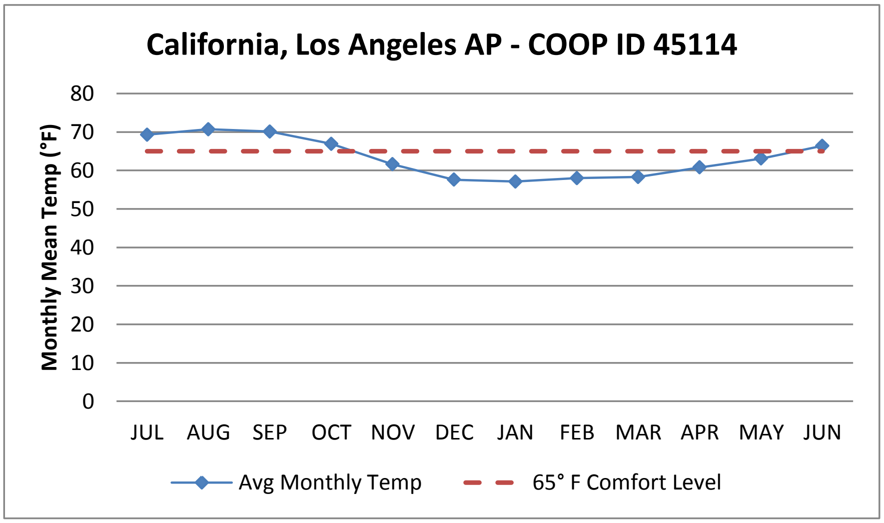

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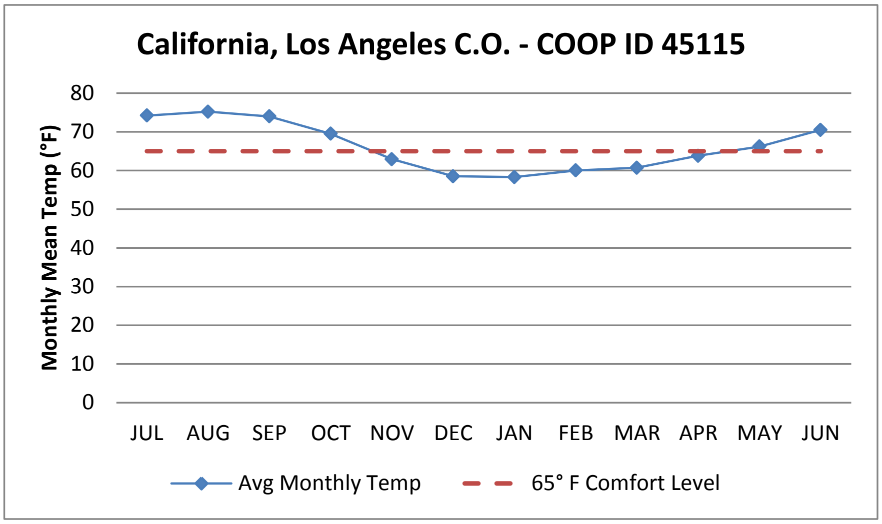
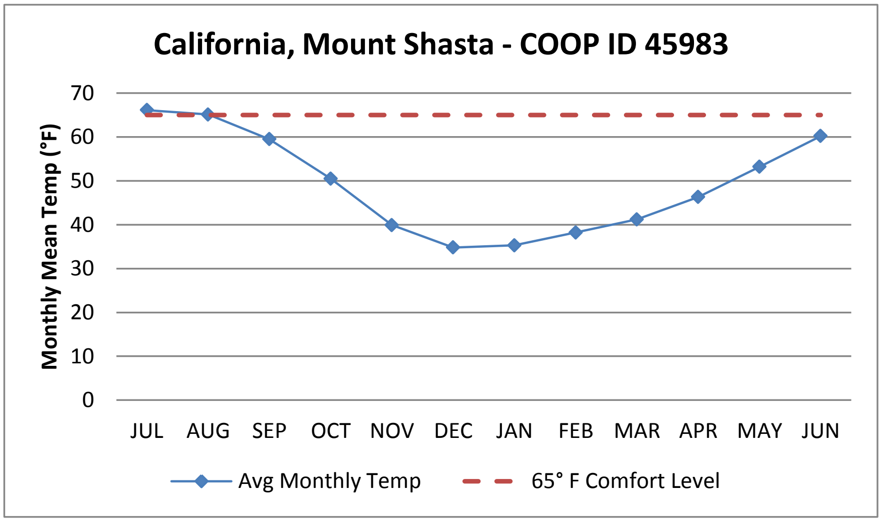
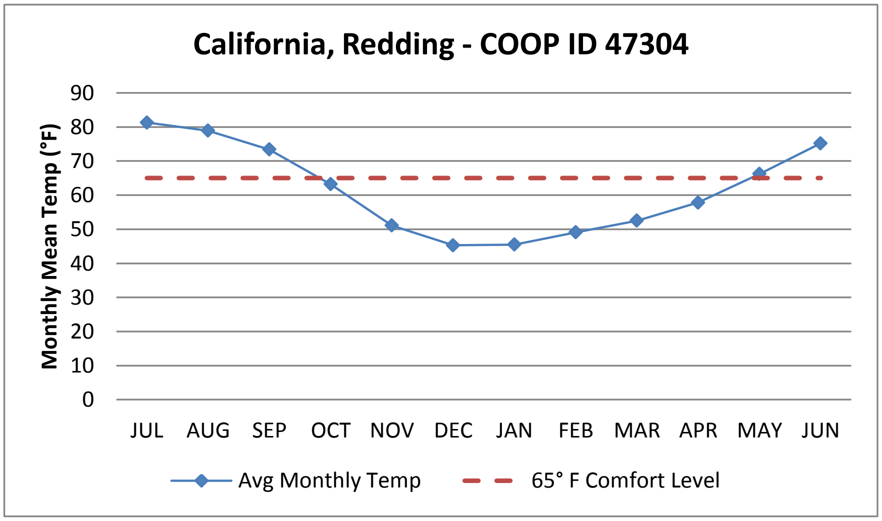
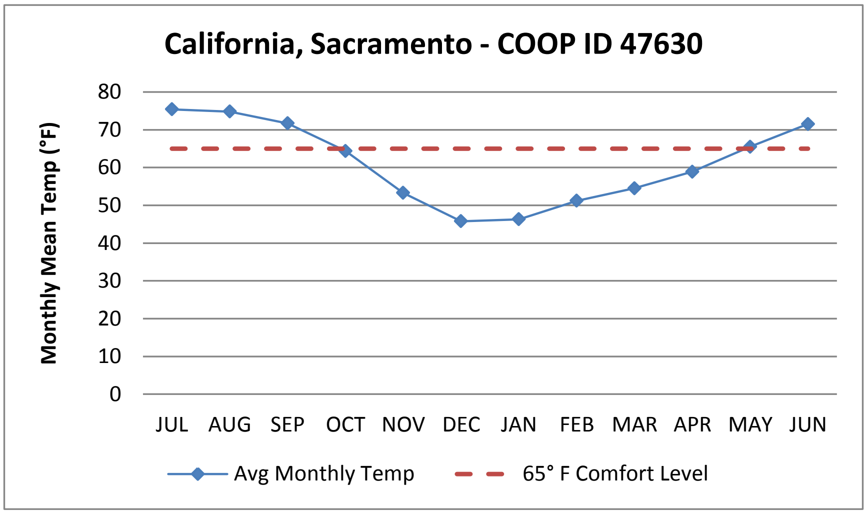
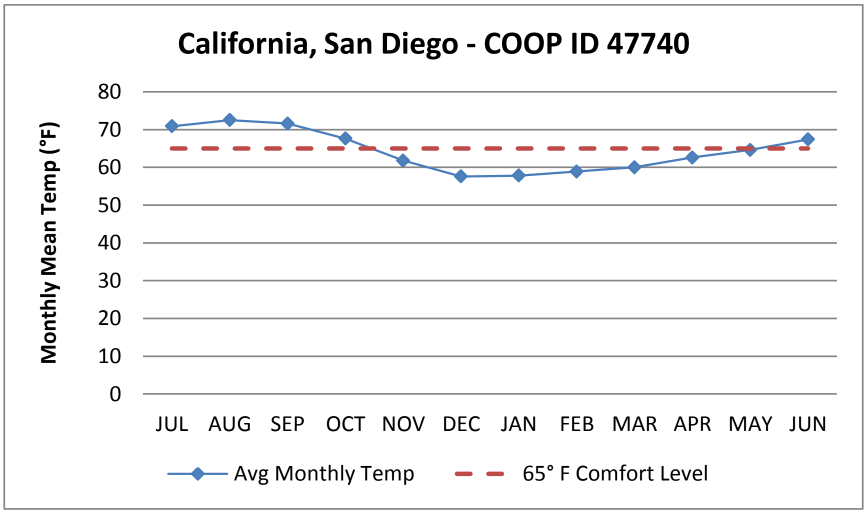


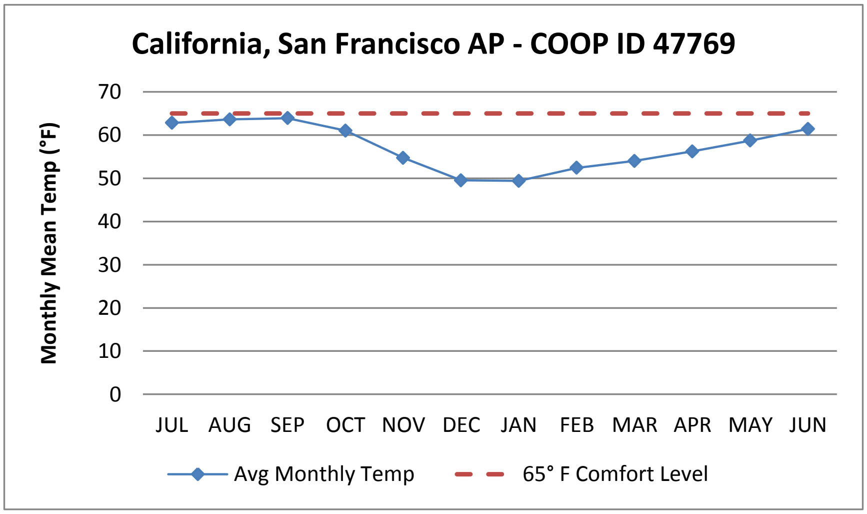




Appendix D, Weather Station Heating and Cooling Day Graphs







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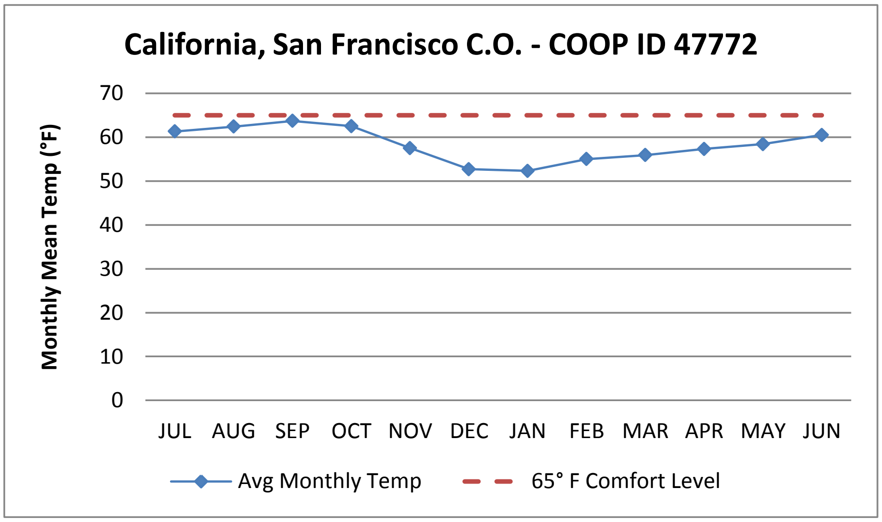

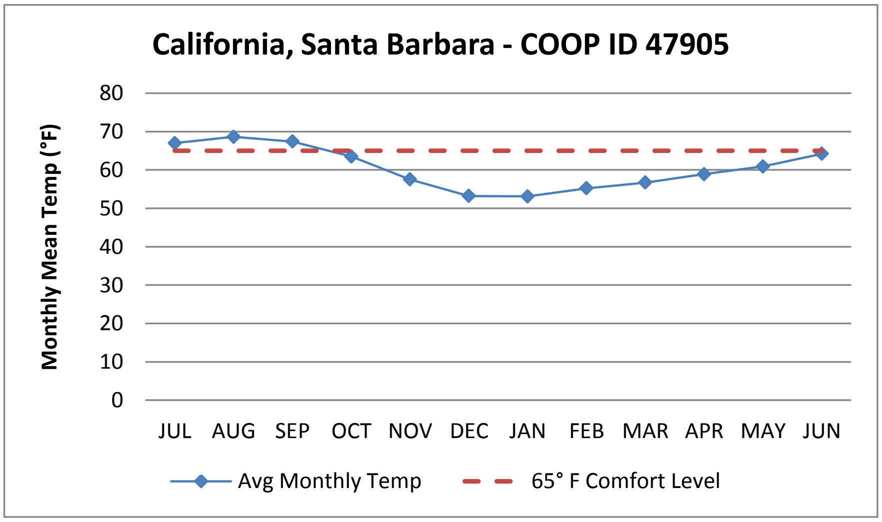

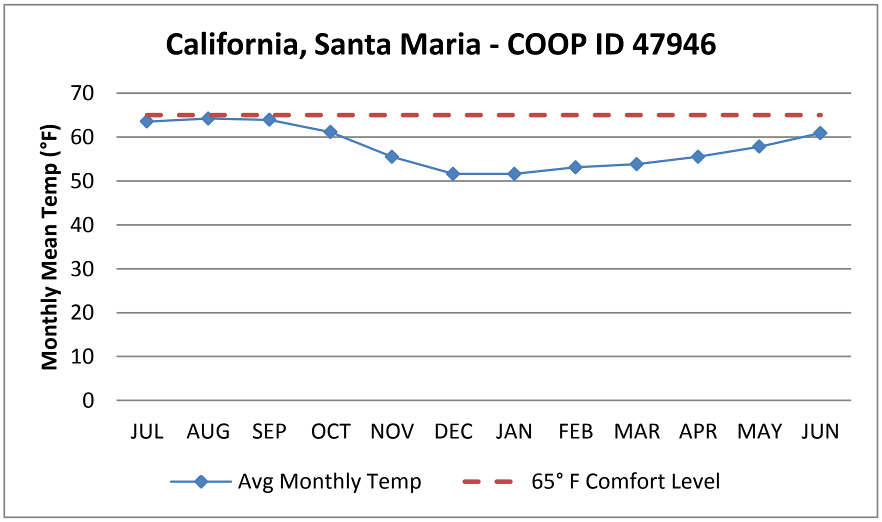

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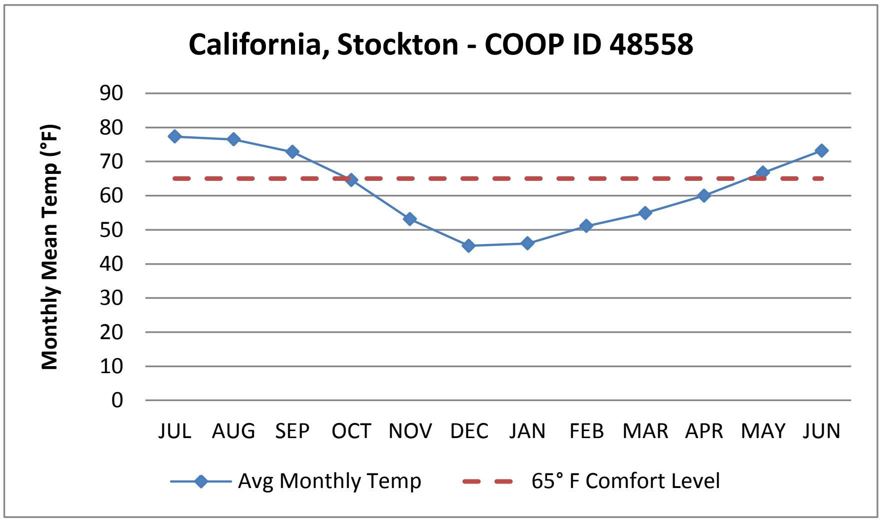

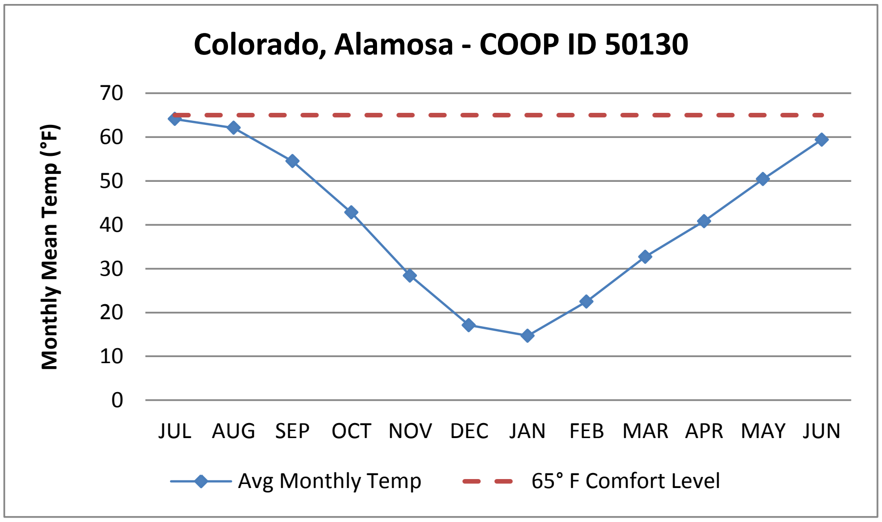

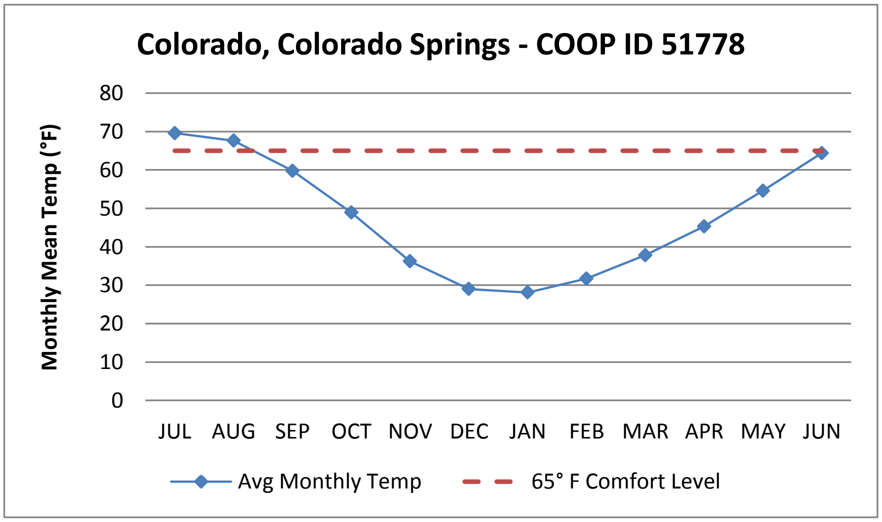

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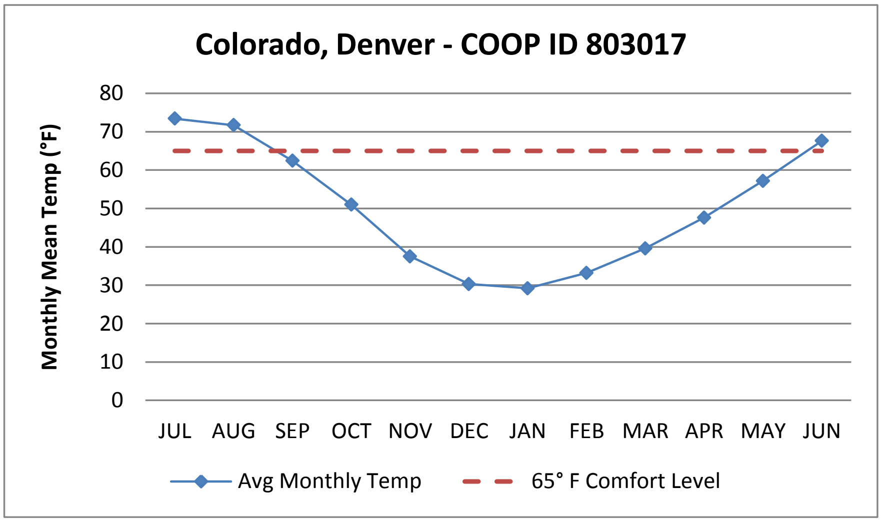

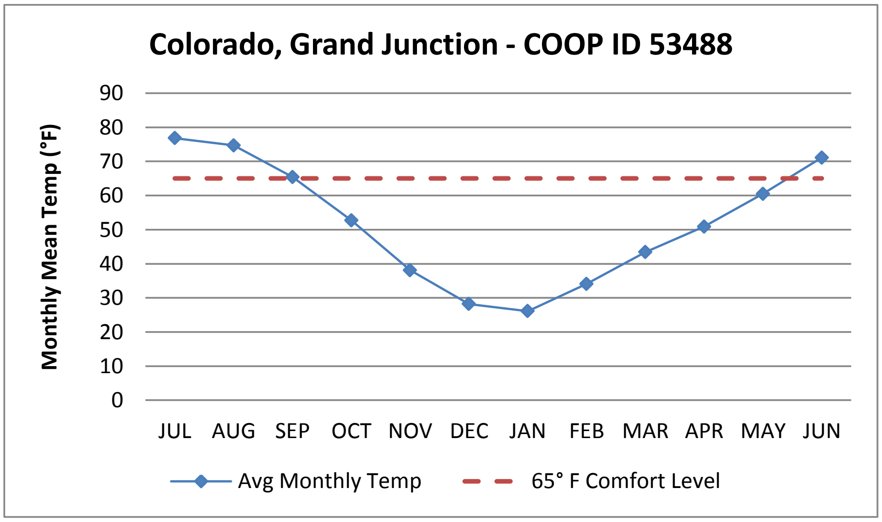

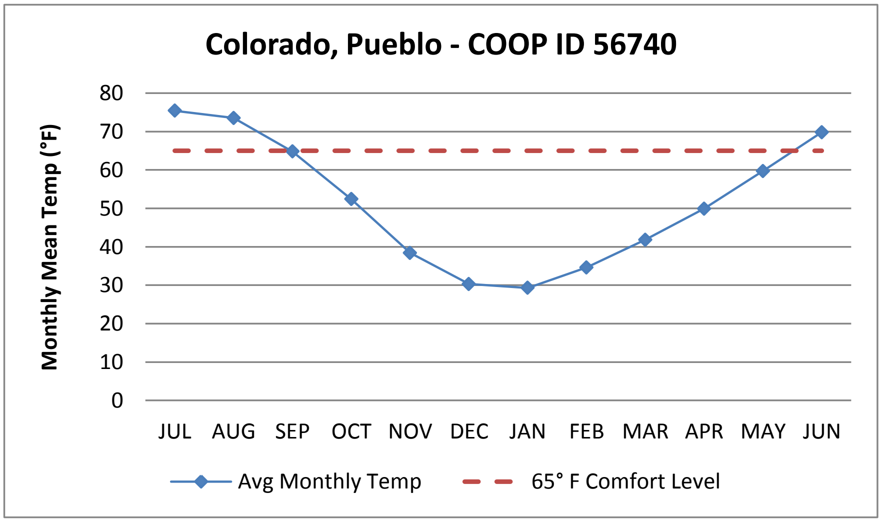

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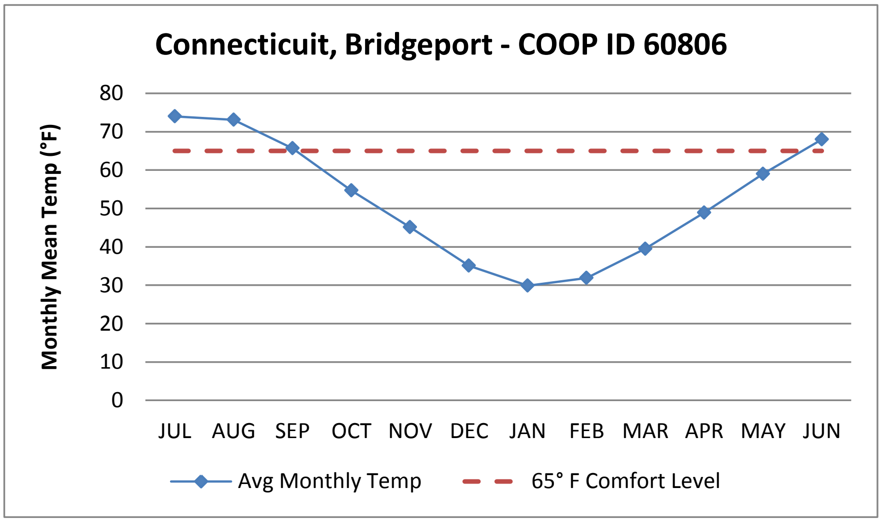

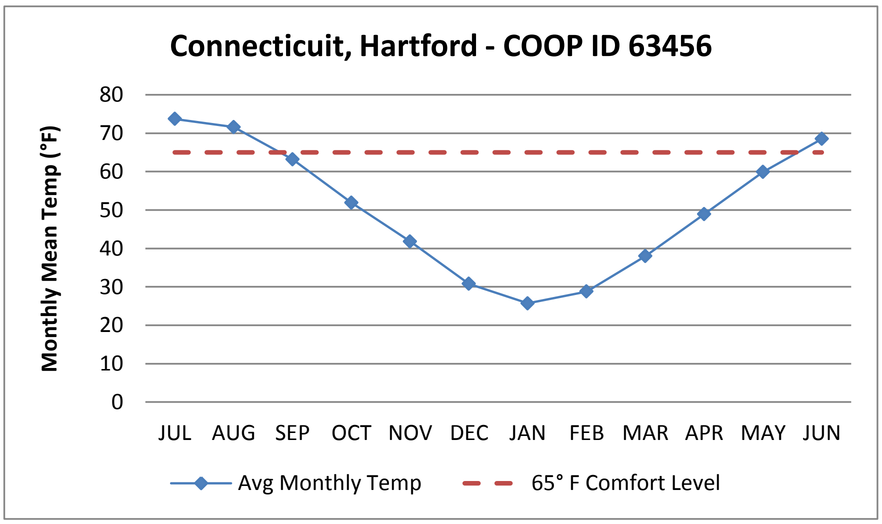

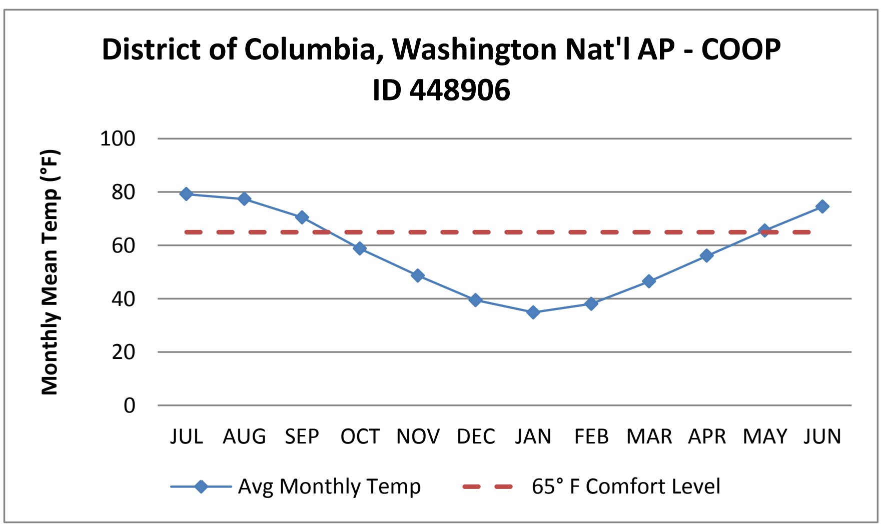

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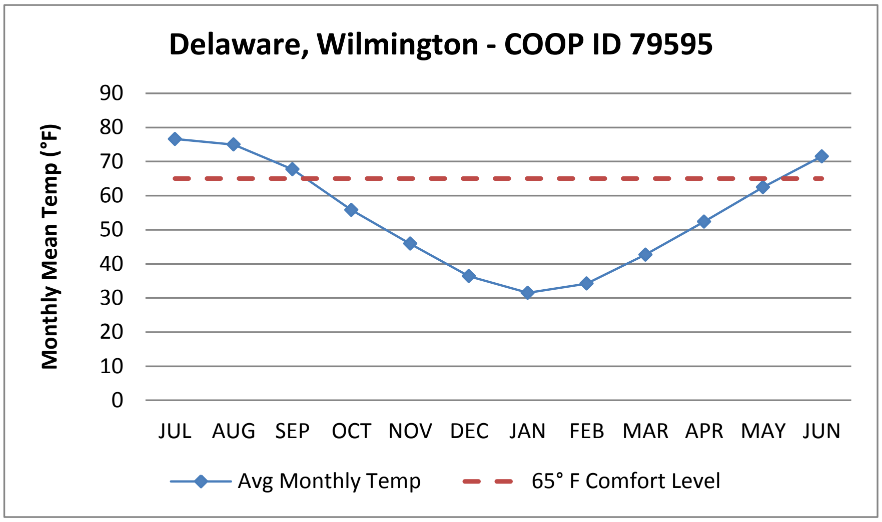

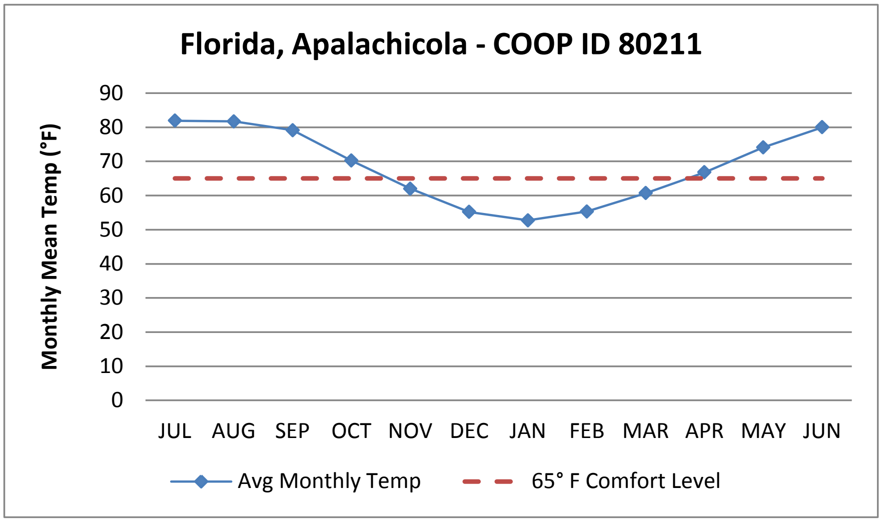

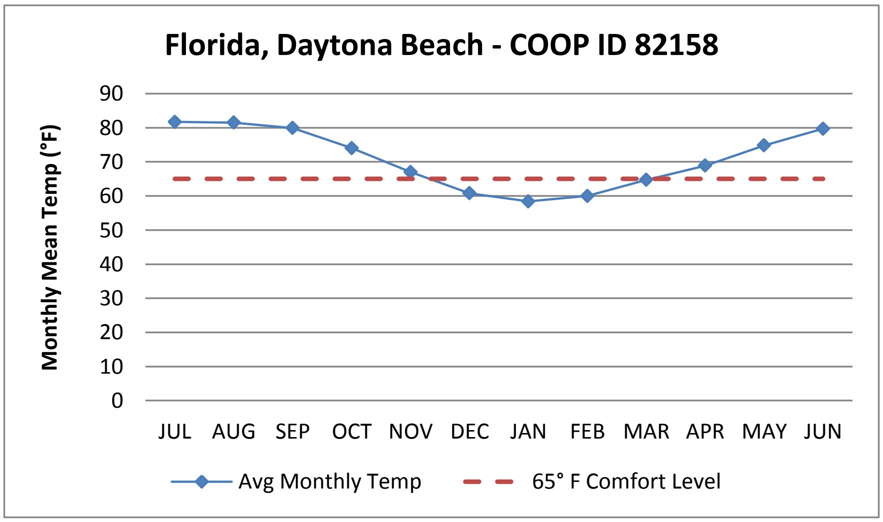

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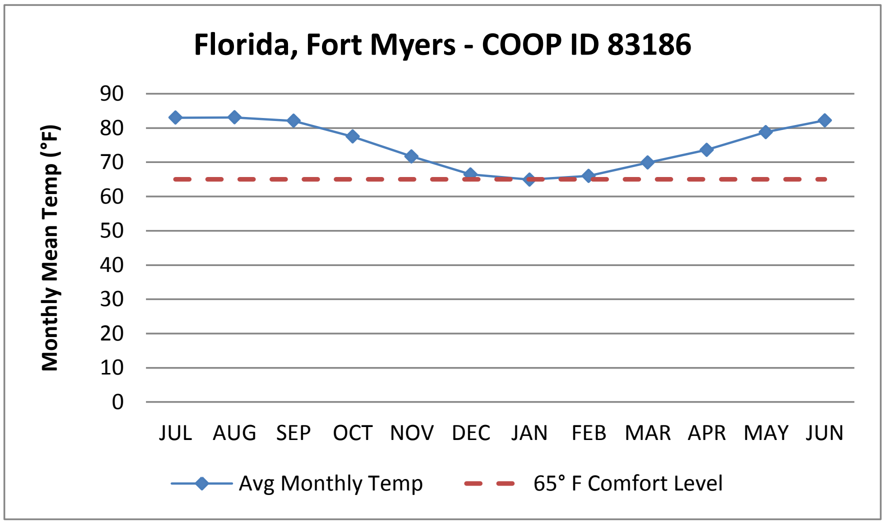

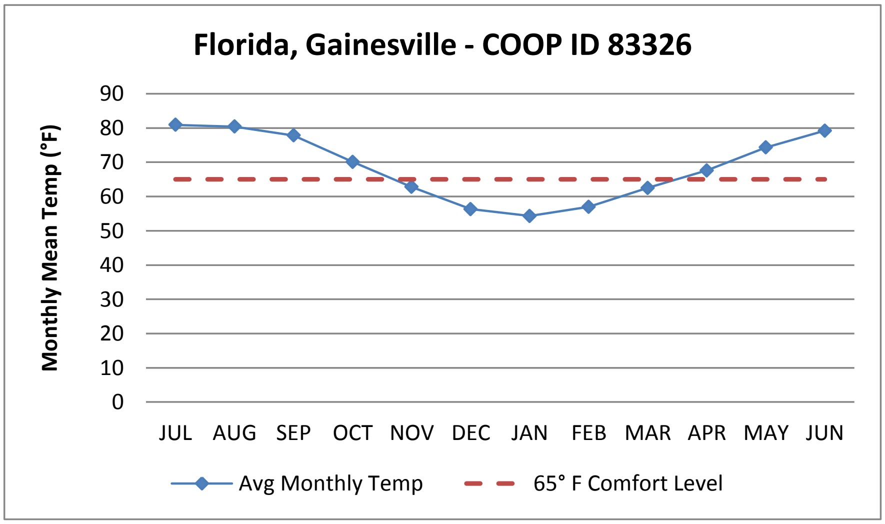

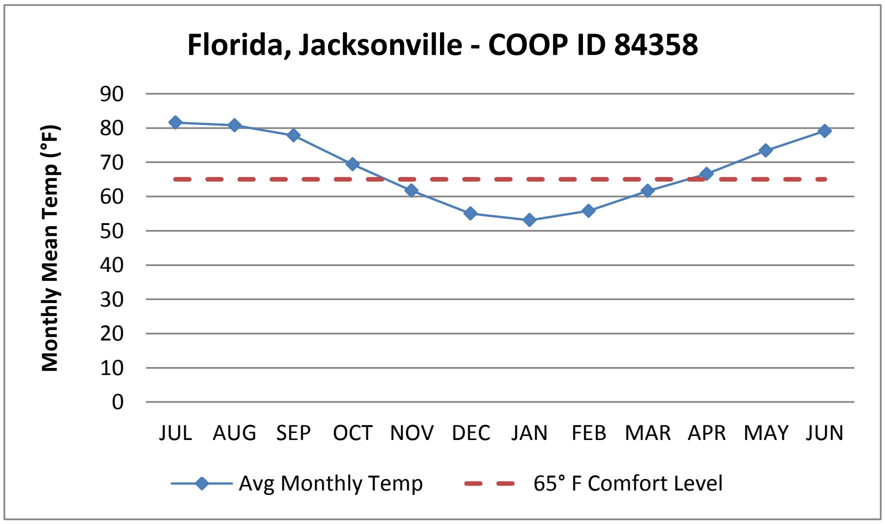

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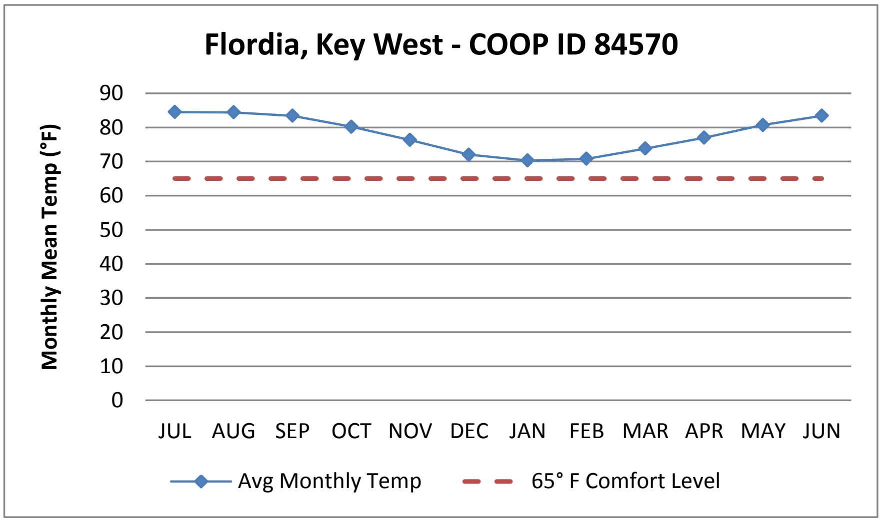

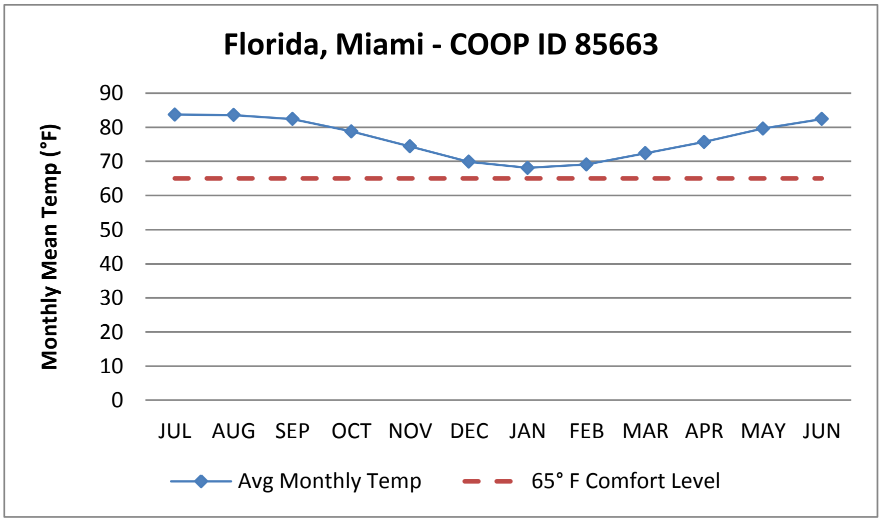

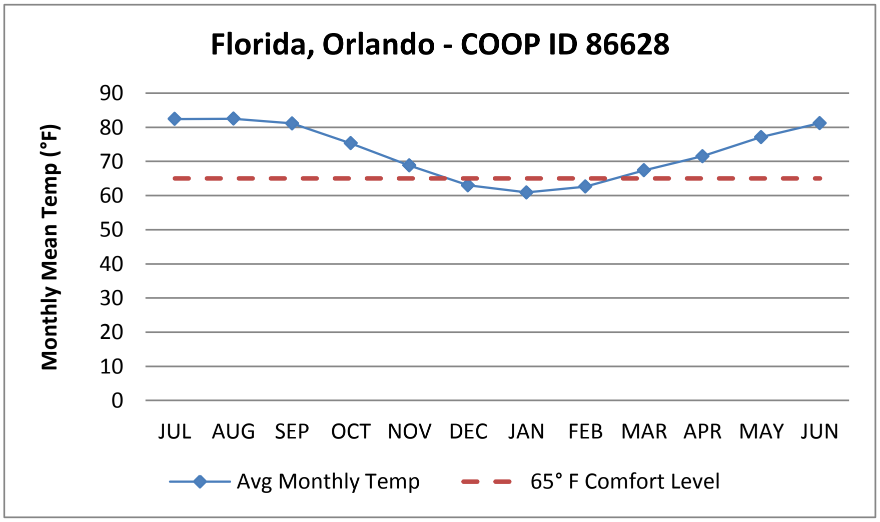

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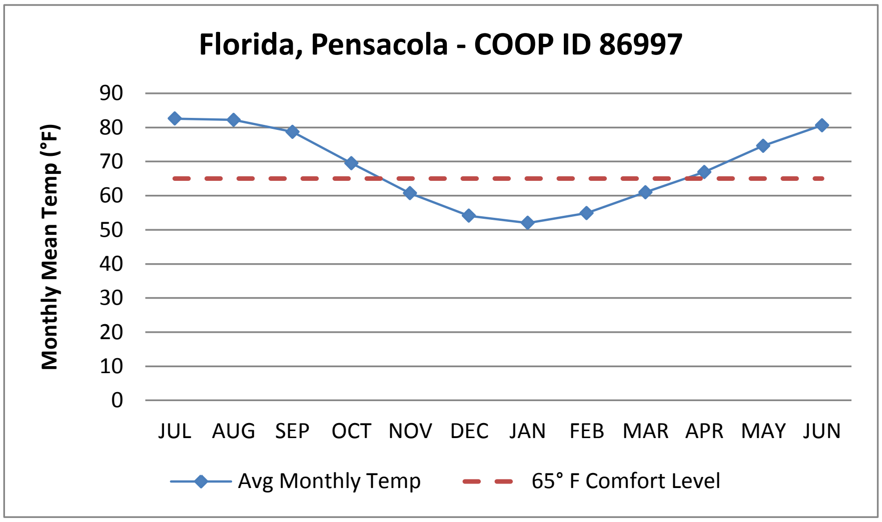

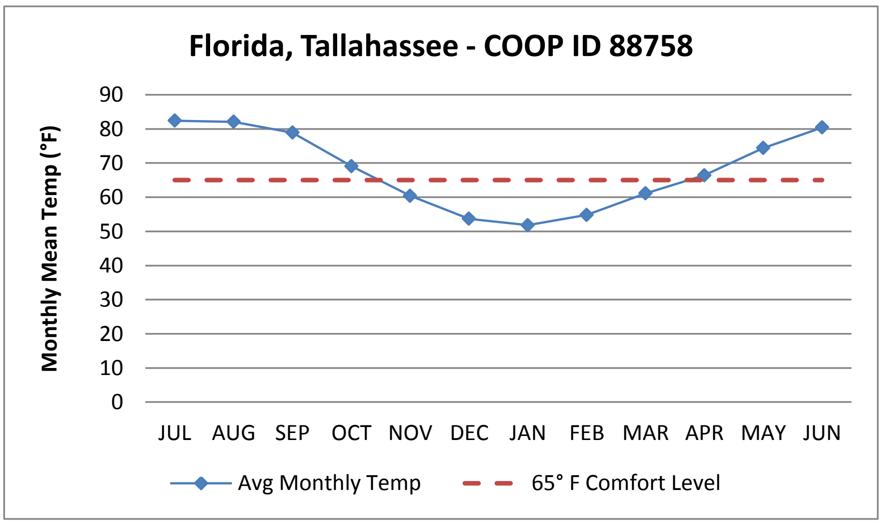

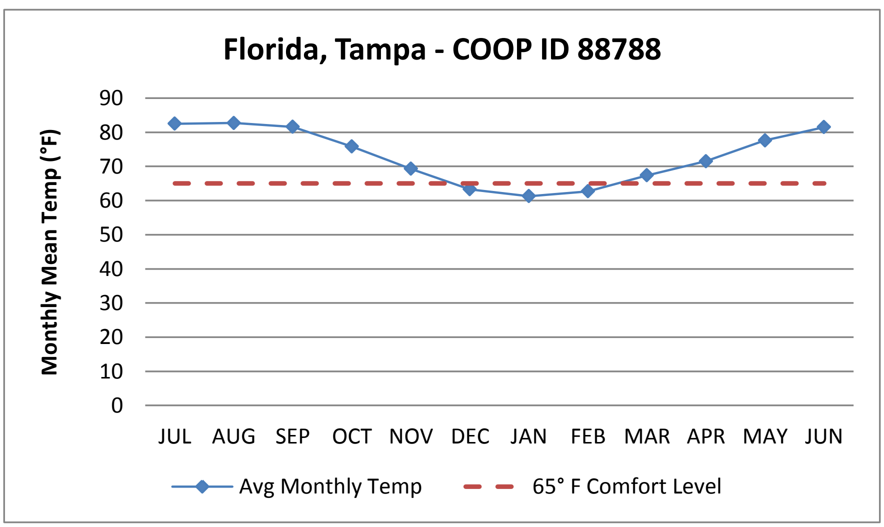

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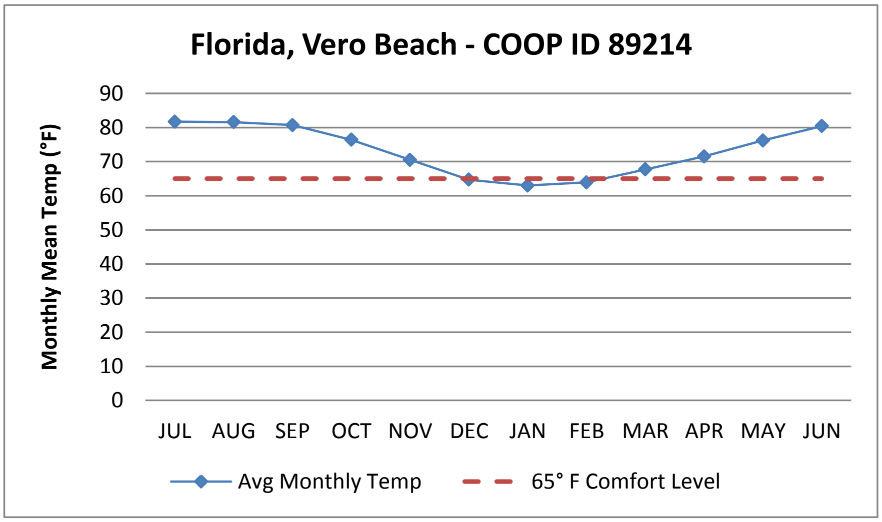

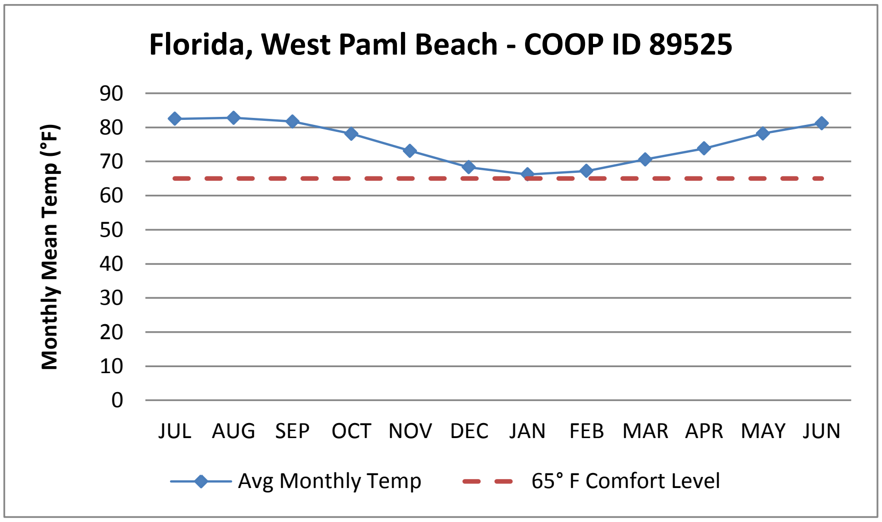

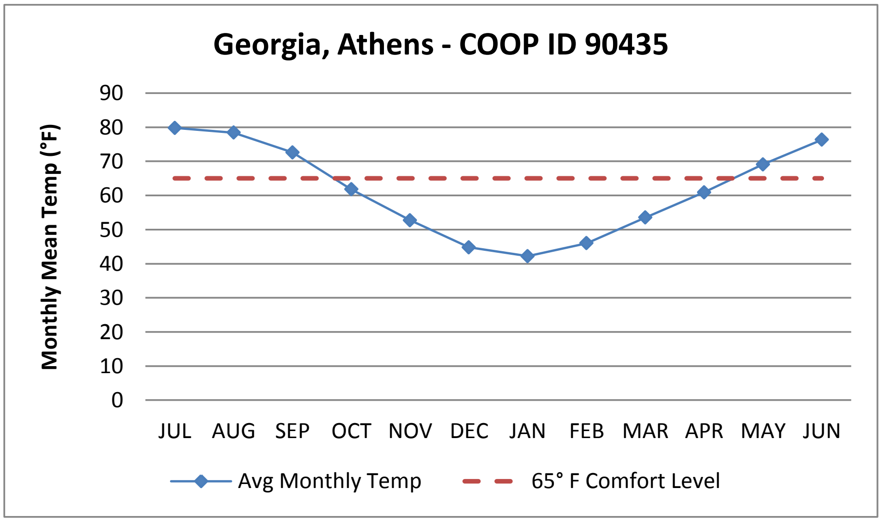

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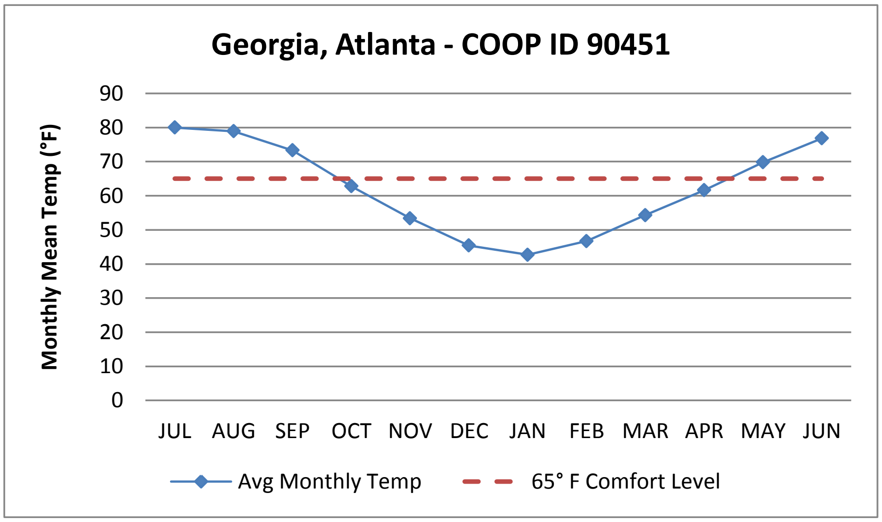

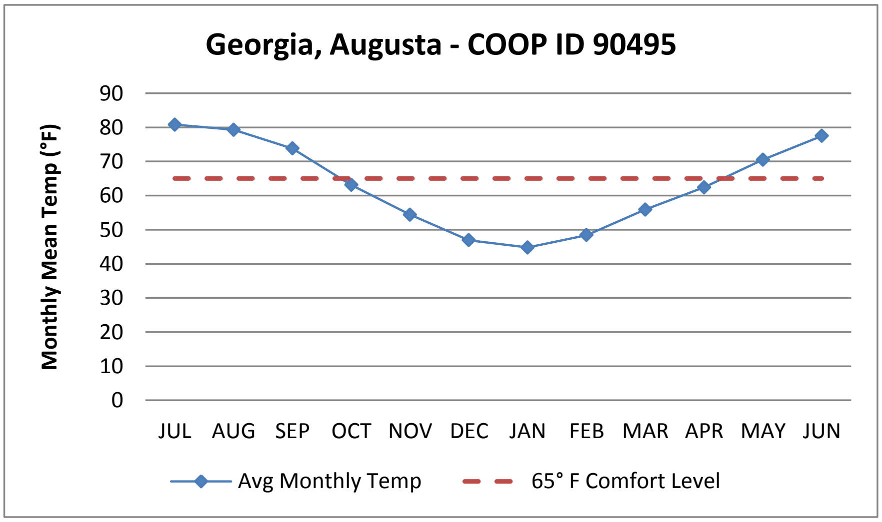

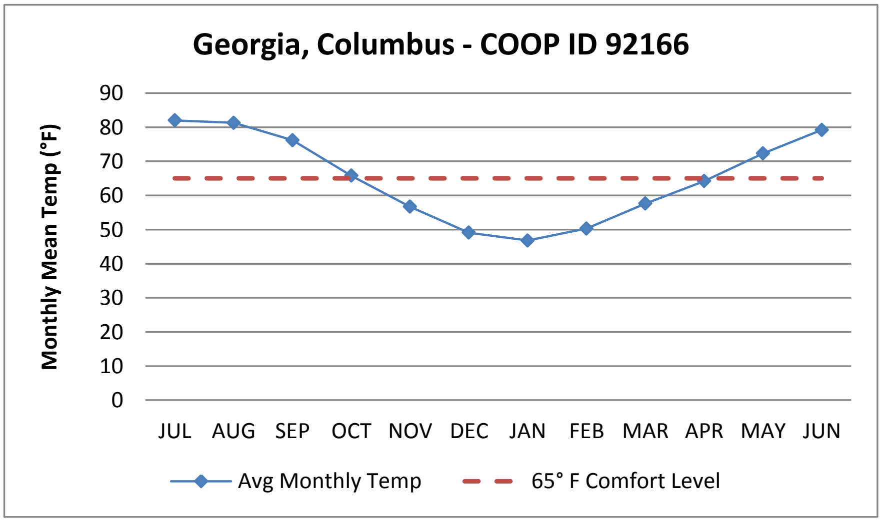

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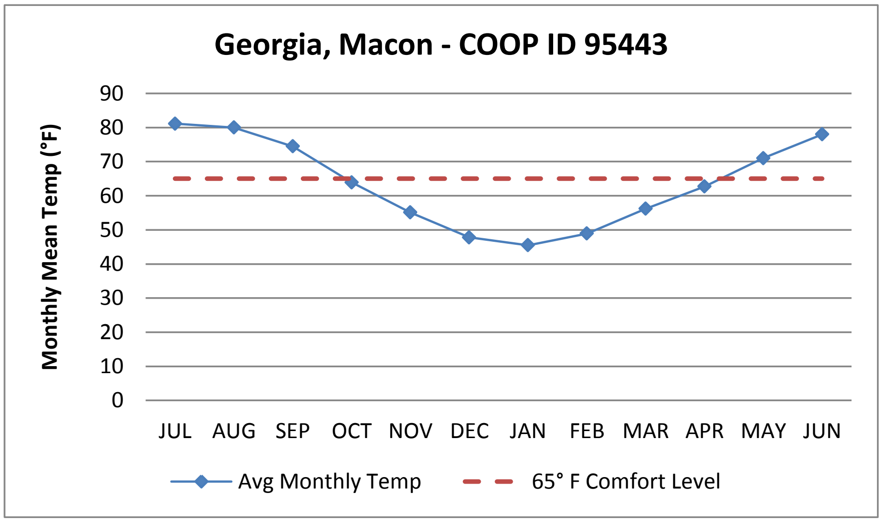

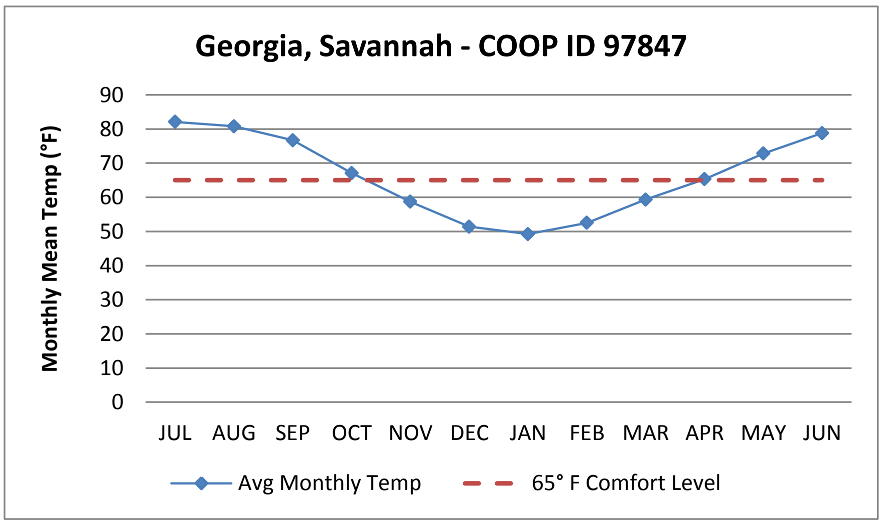

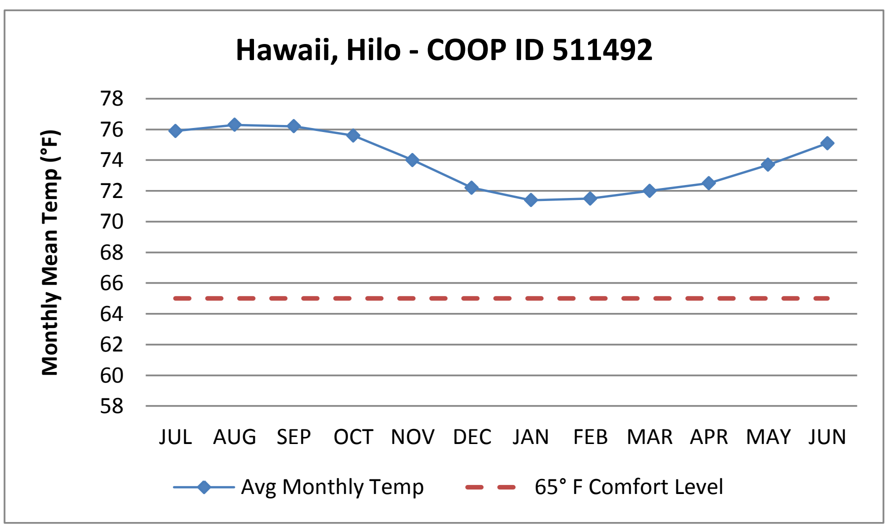

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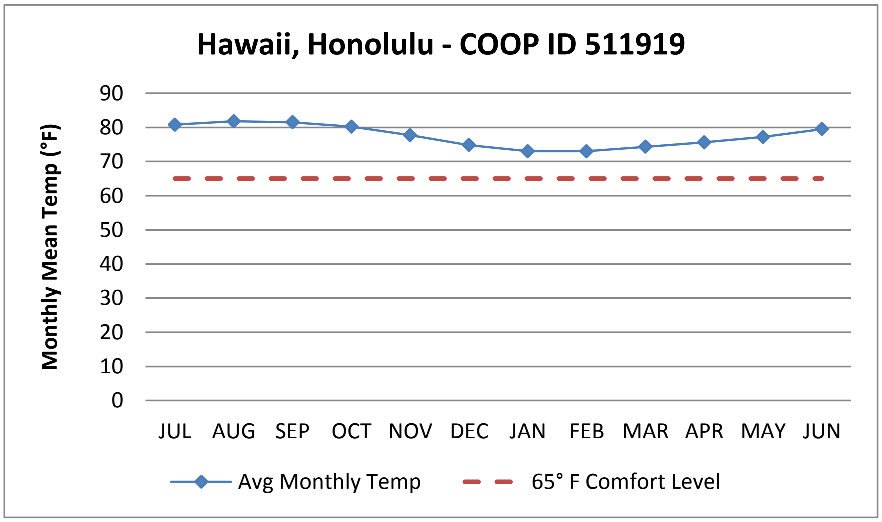

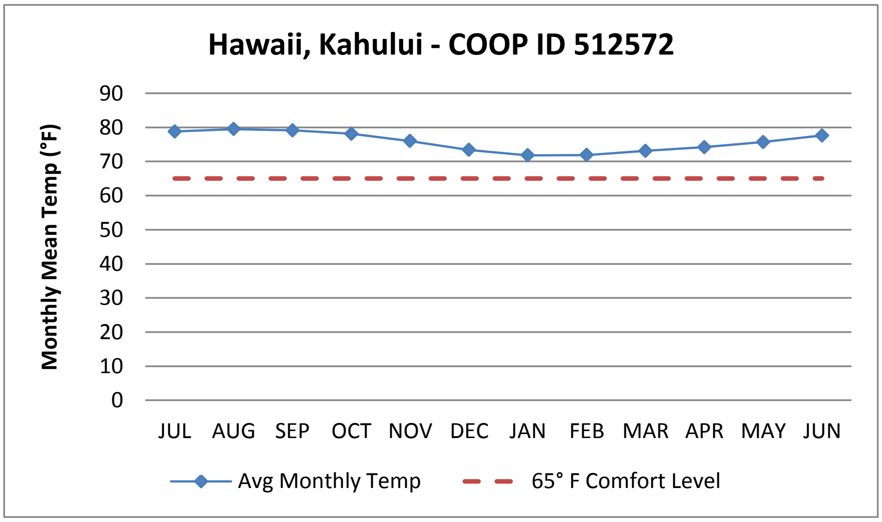

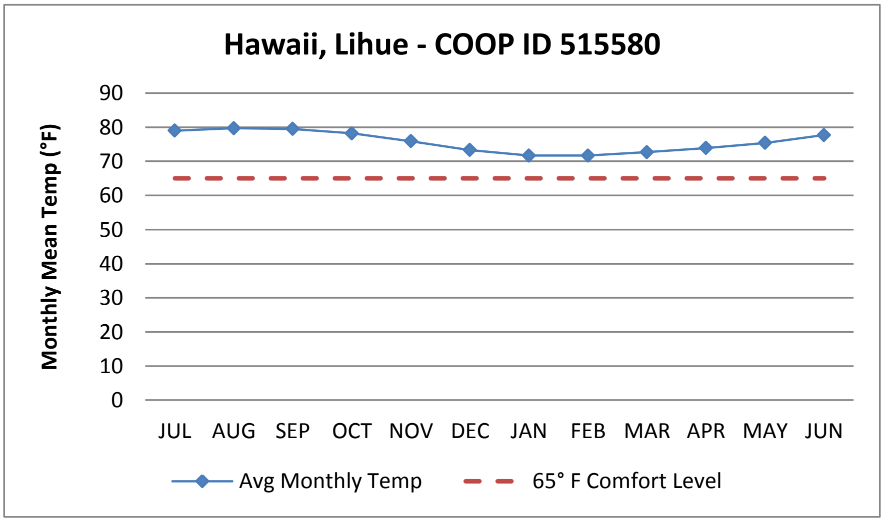

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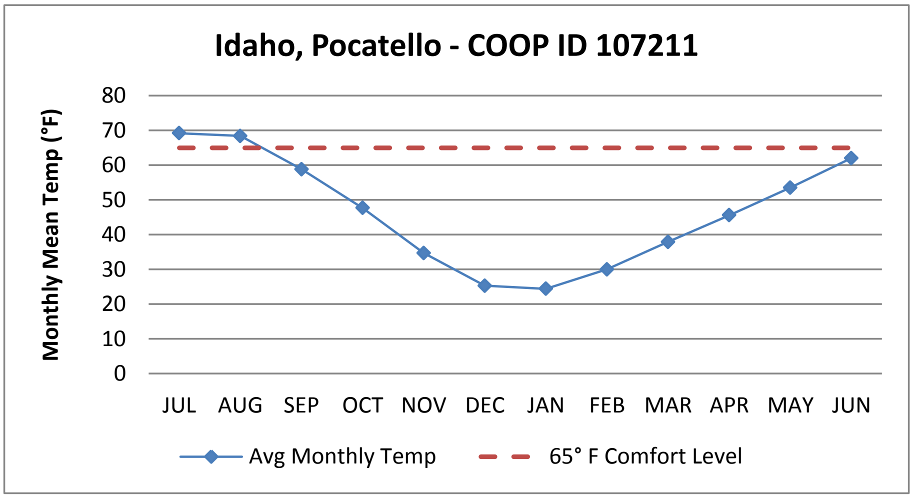

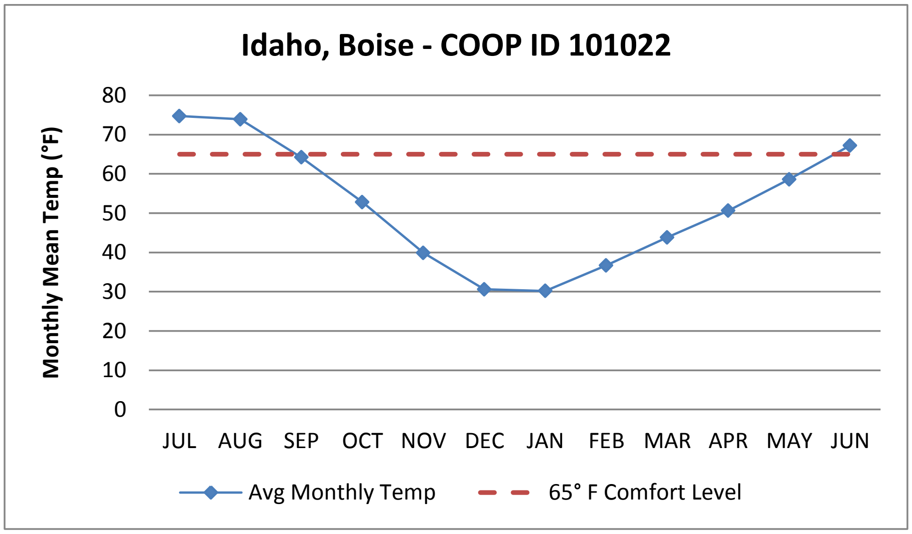

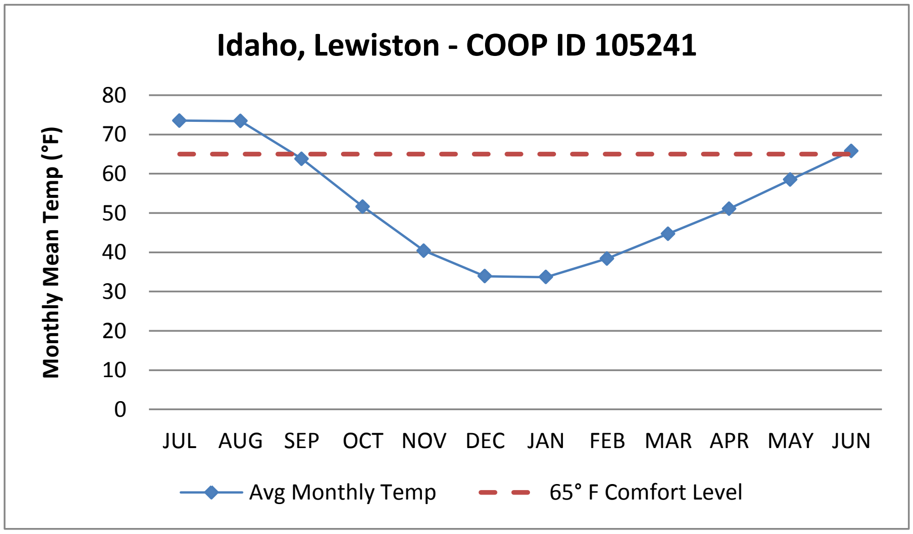

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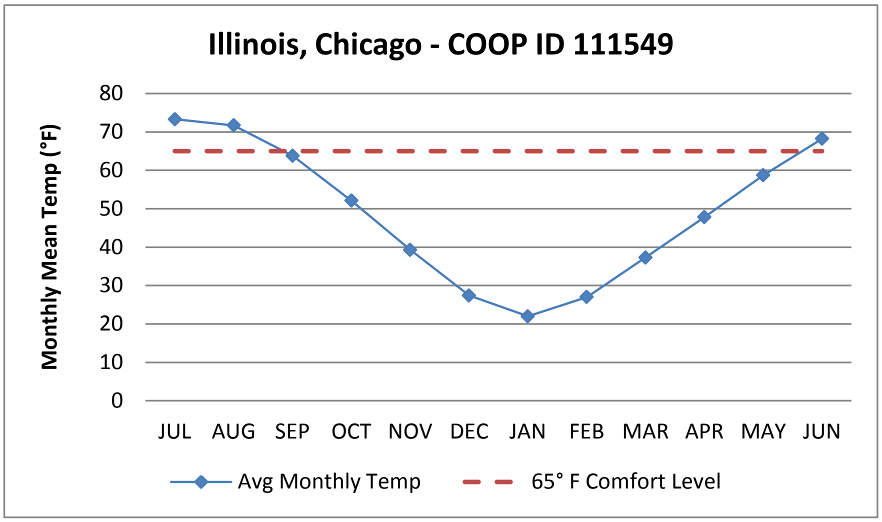

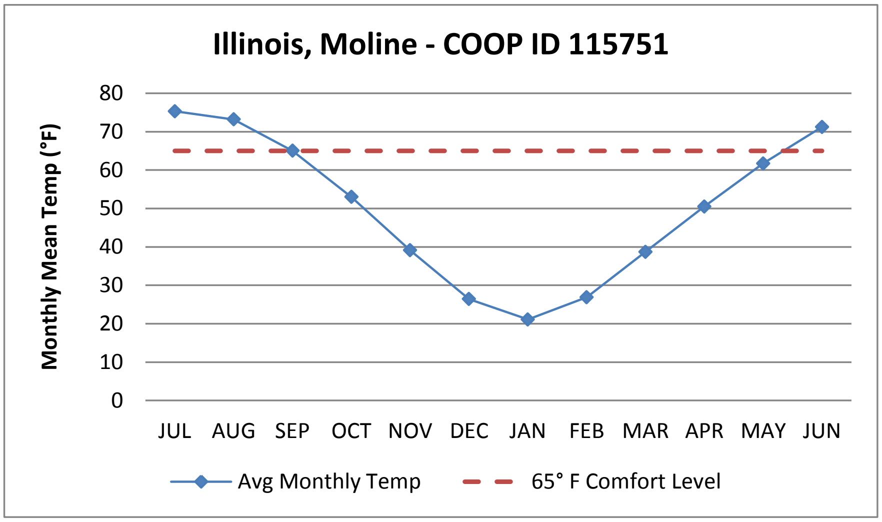

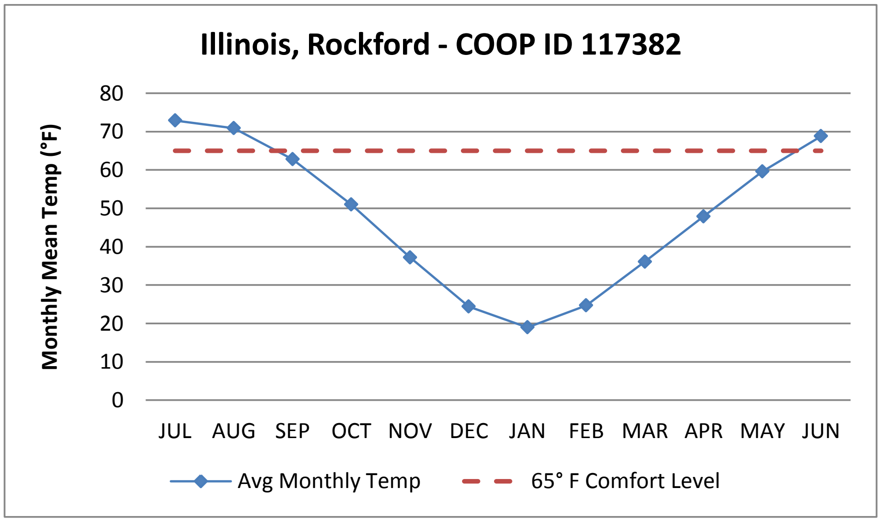

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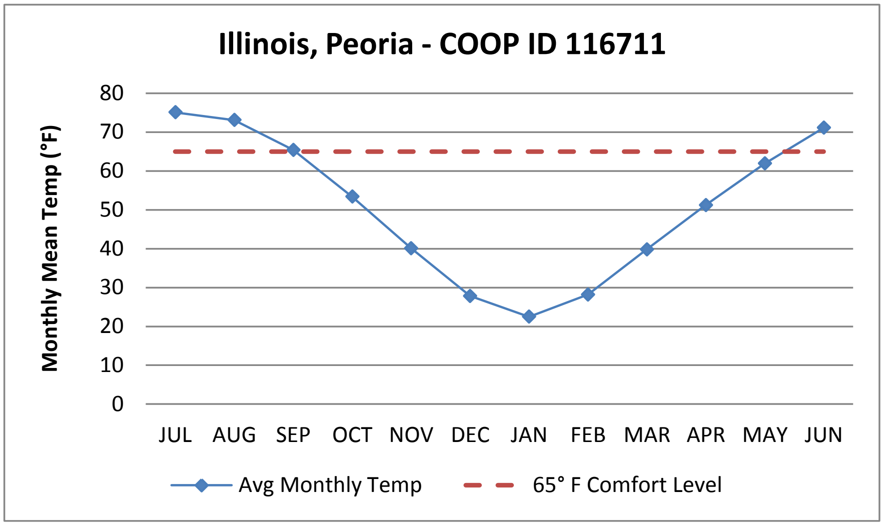

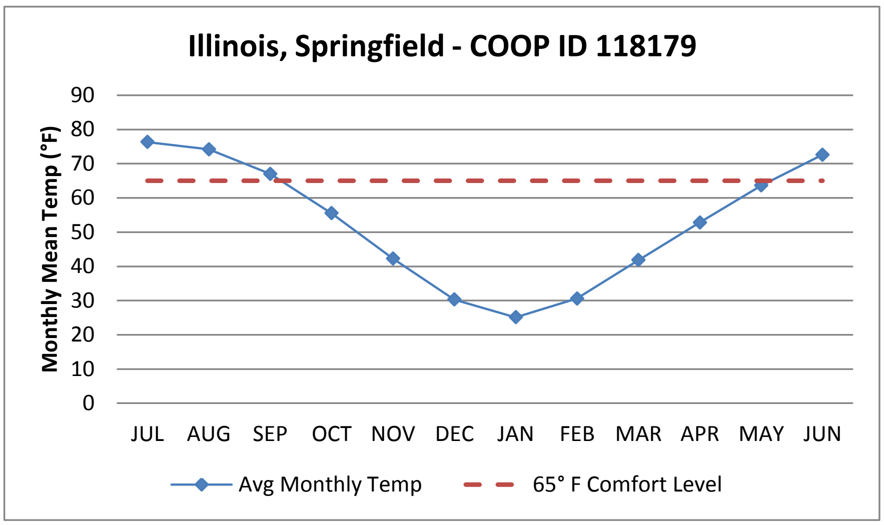

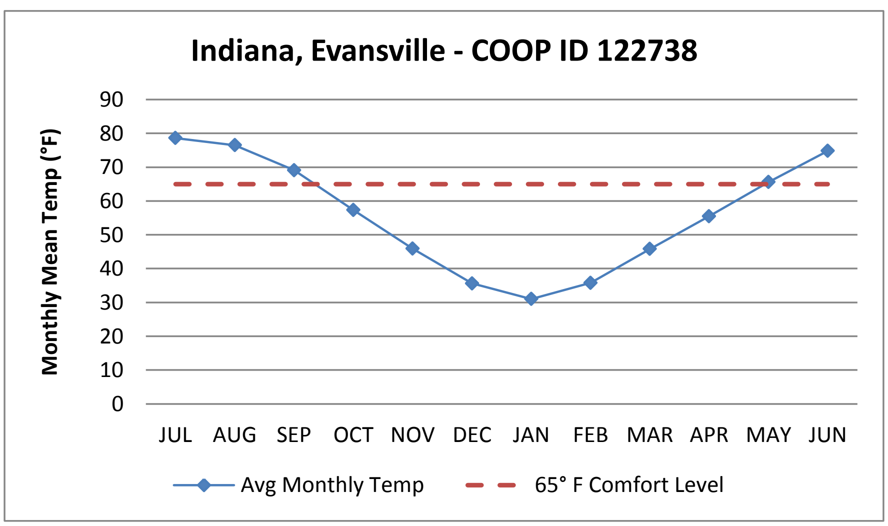

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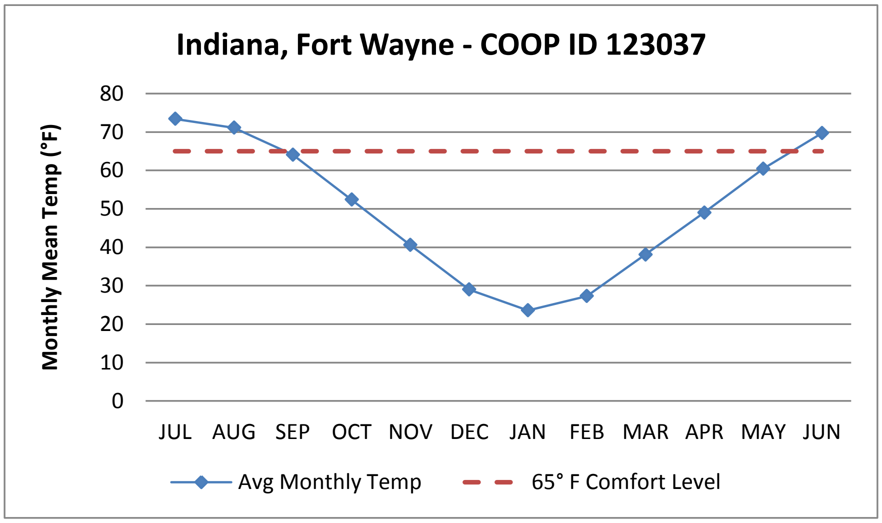

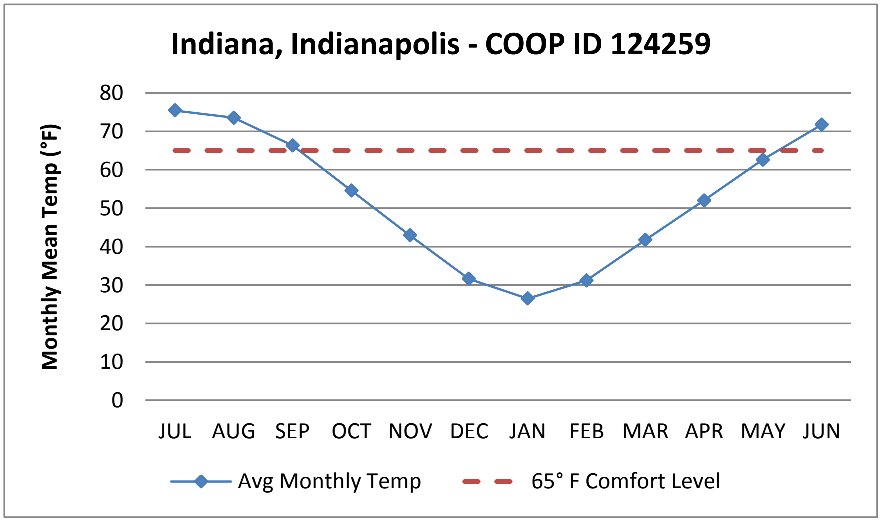

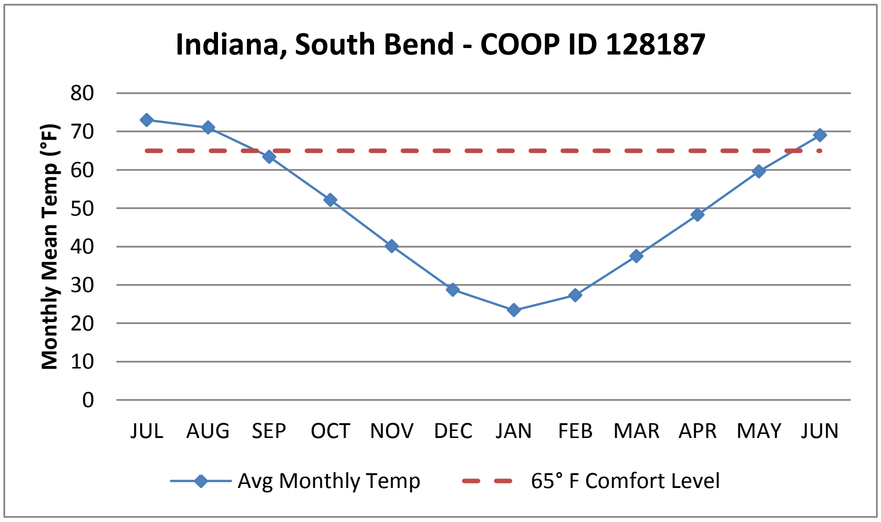

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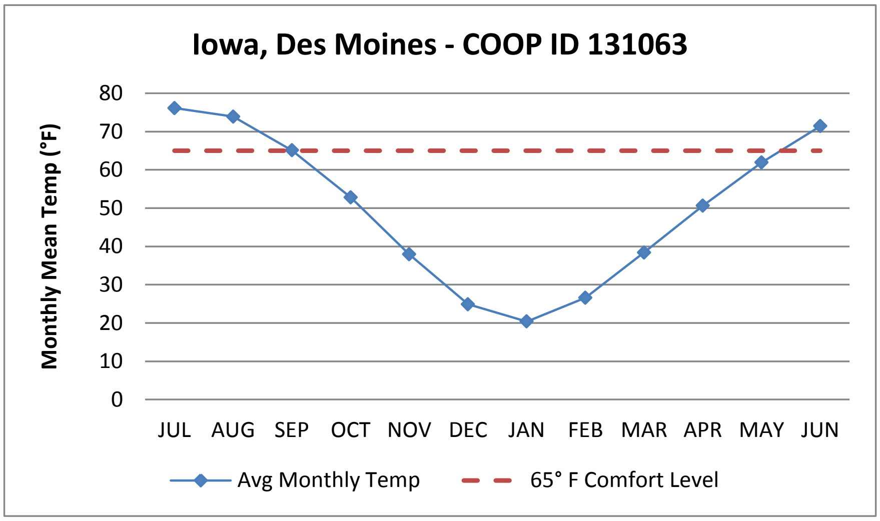

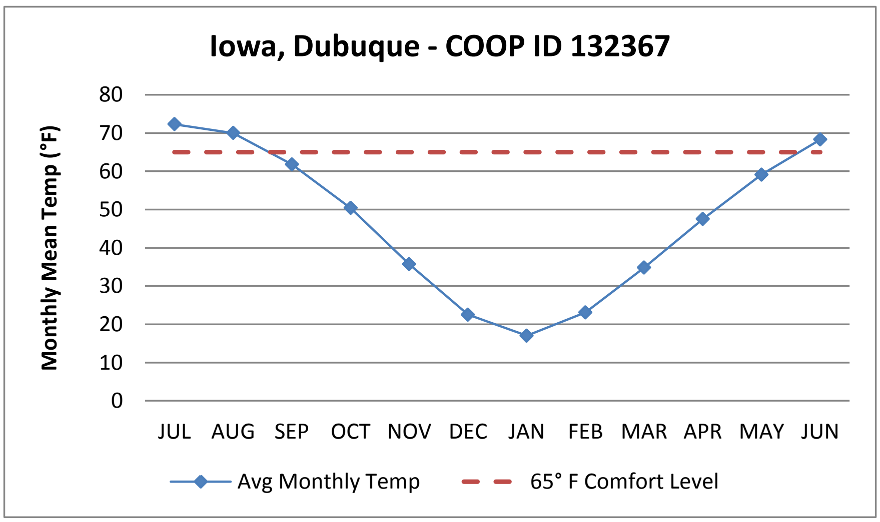

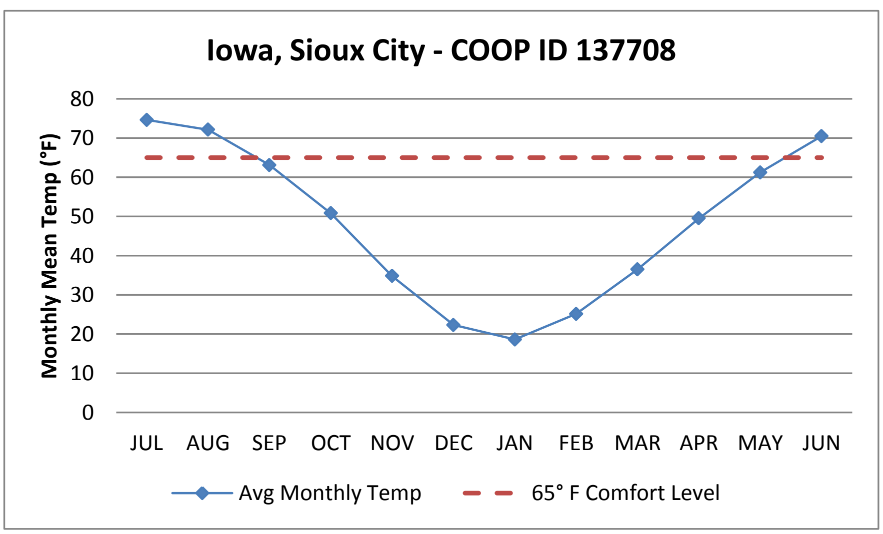

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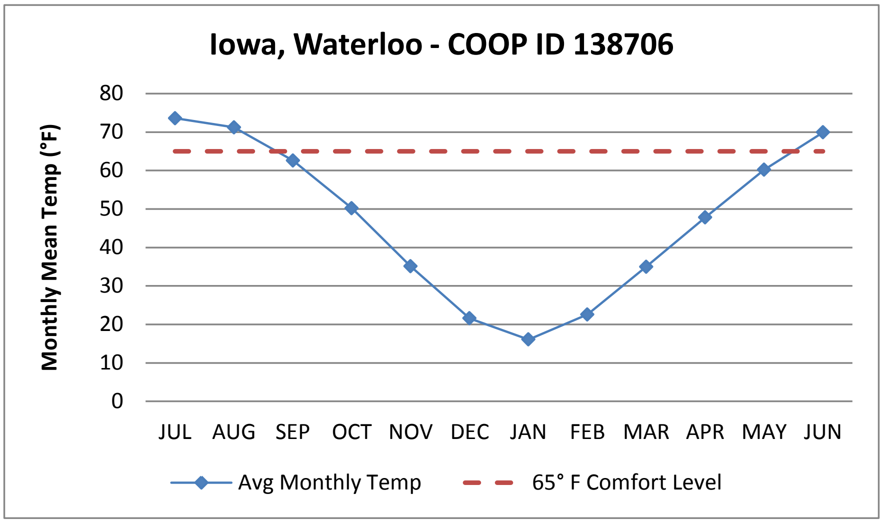

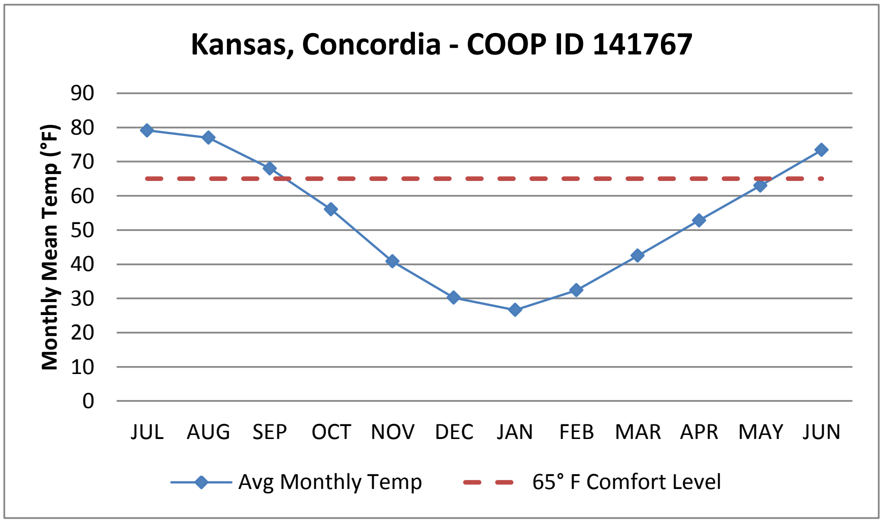

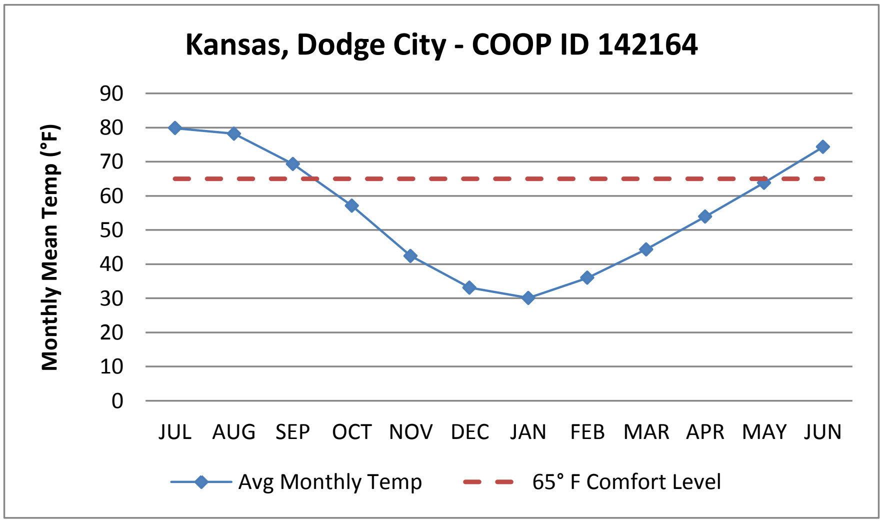

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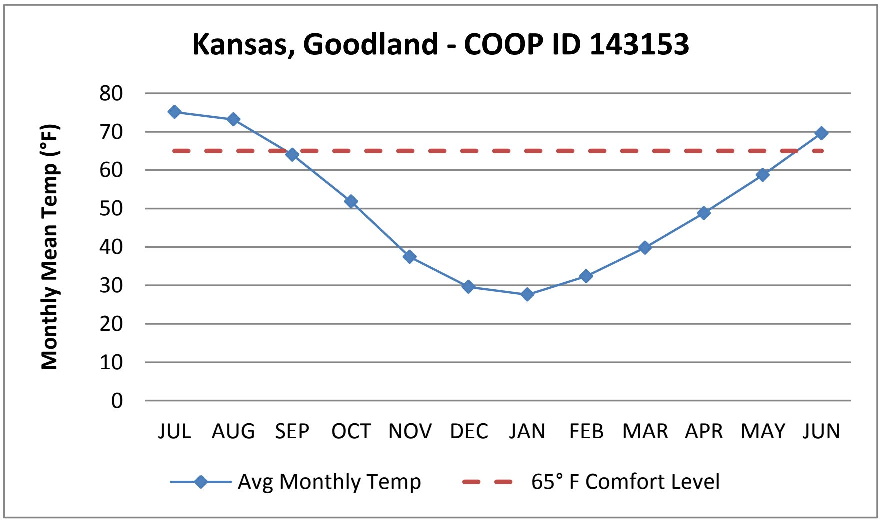

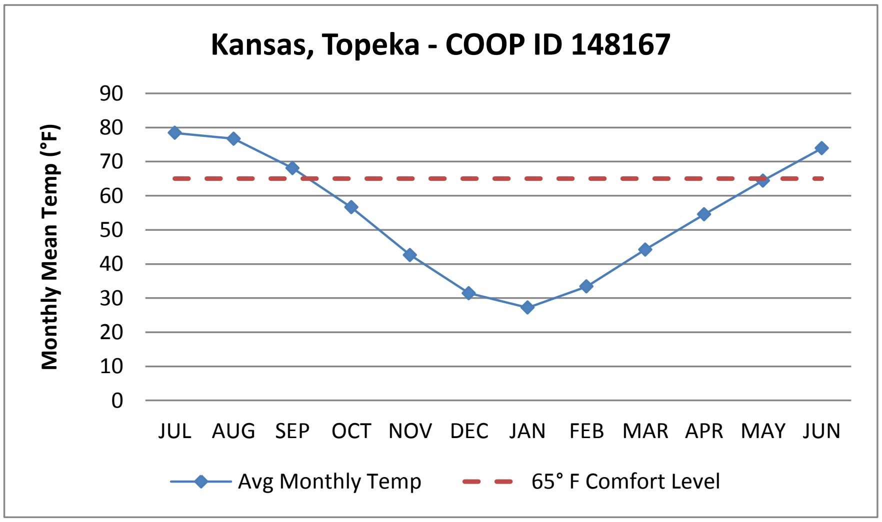

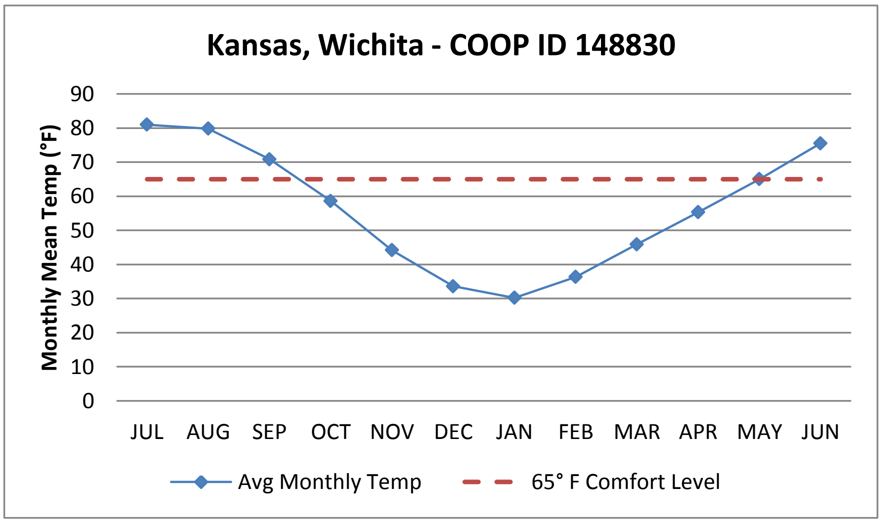

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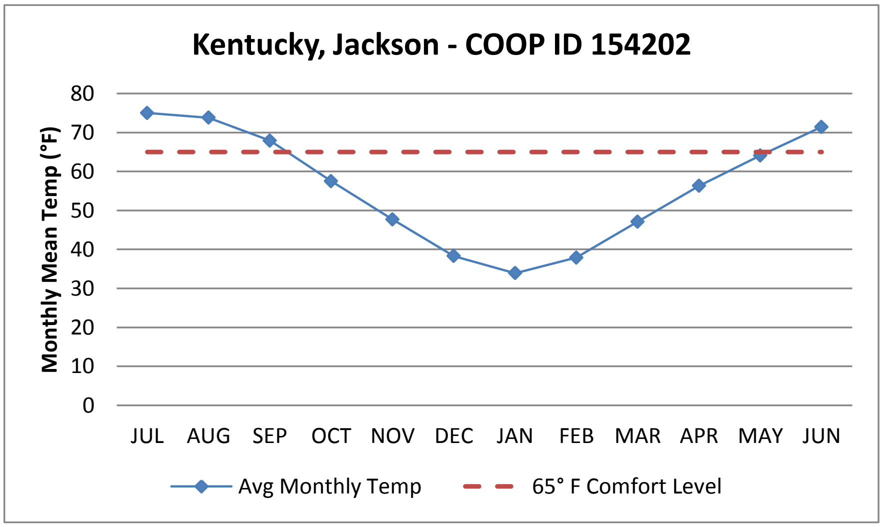

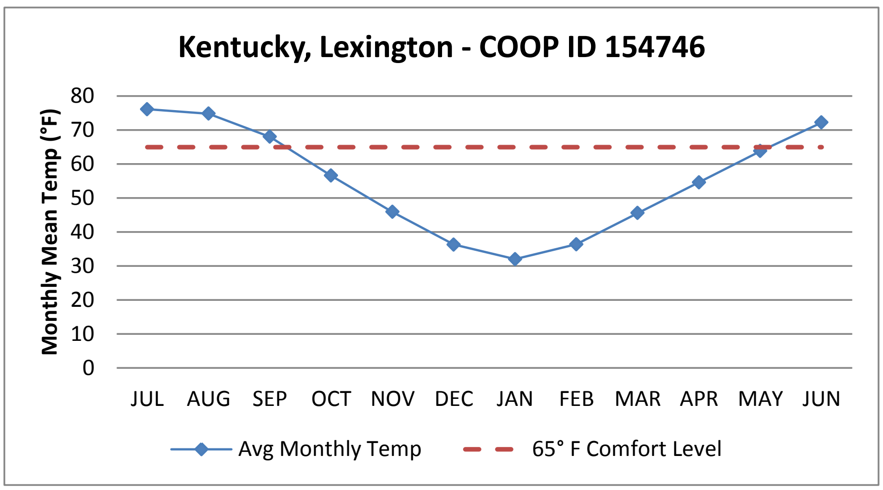

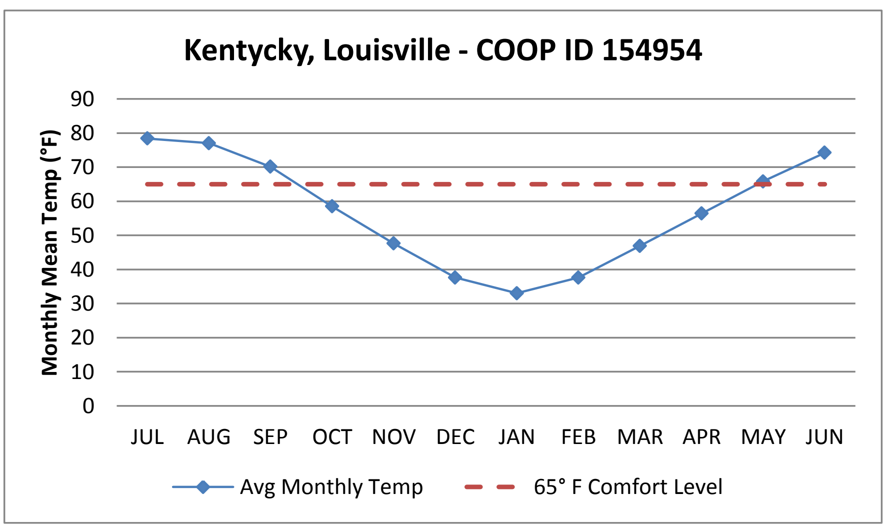

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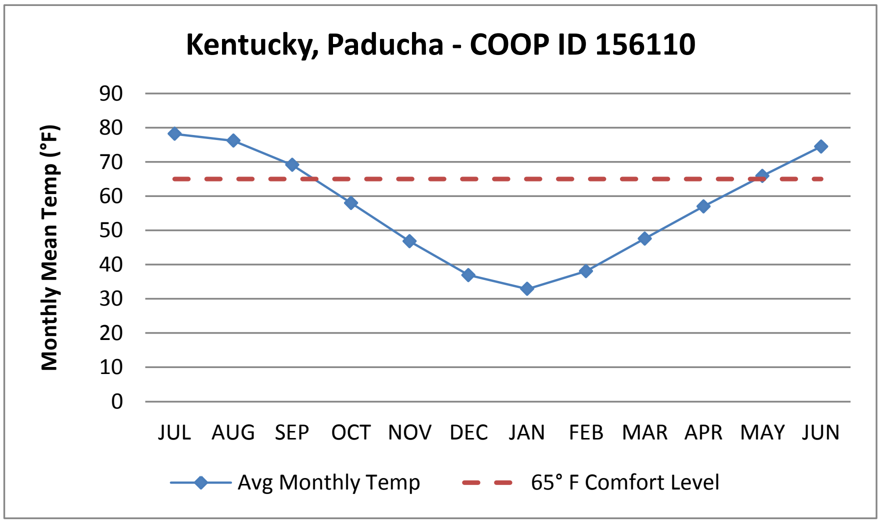

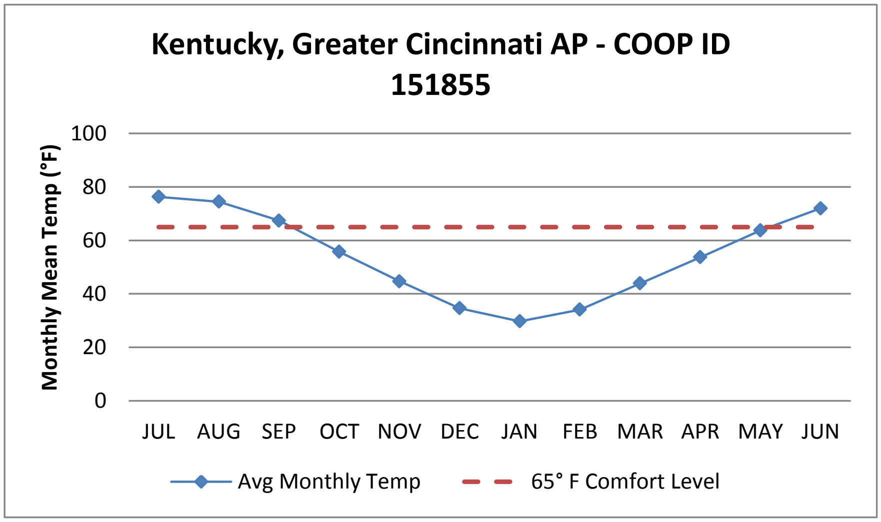

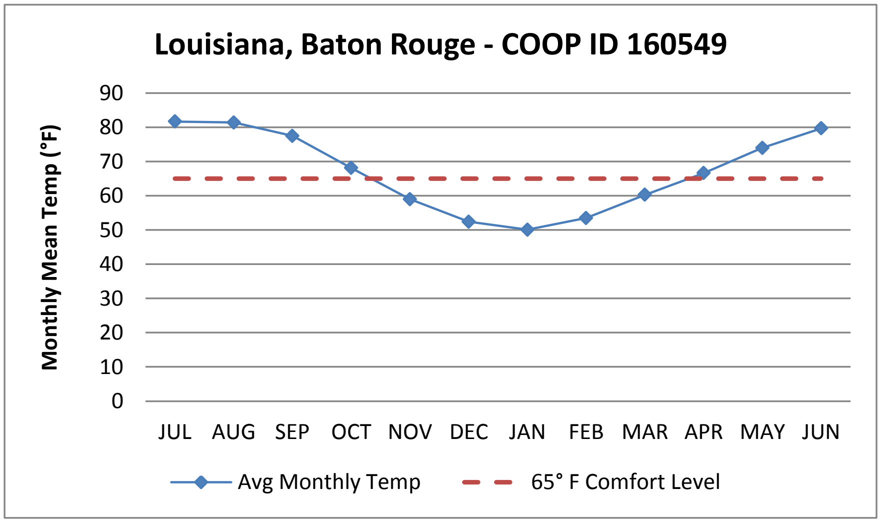

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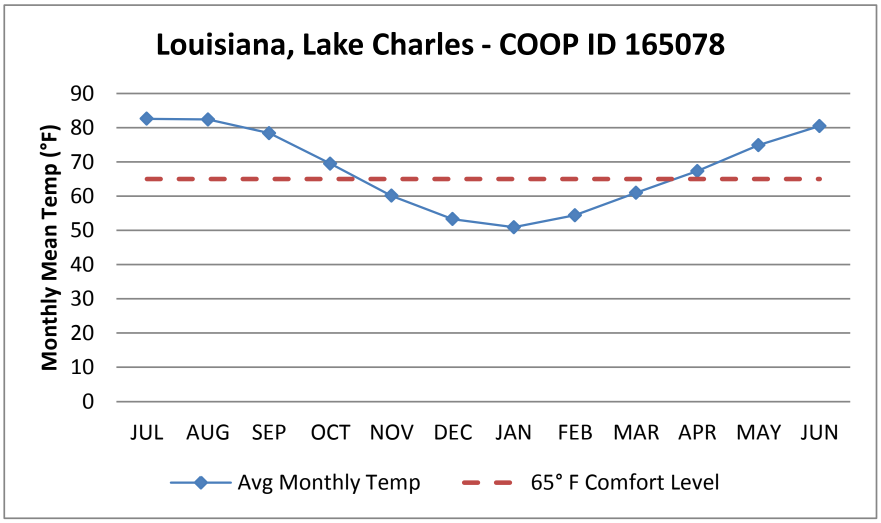

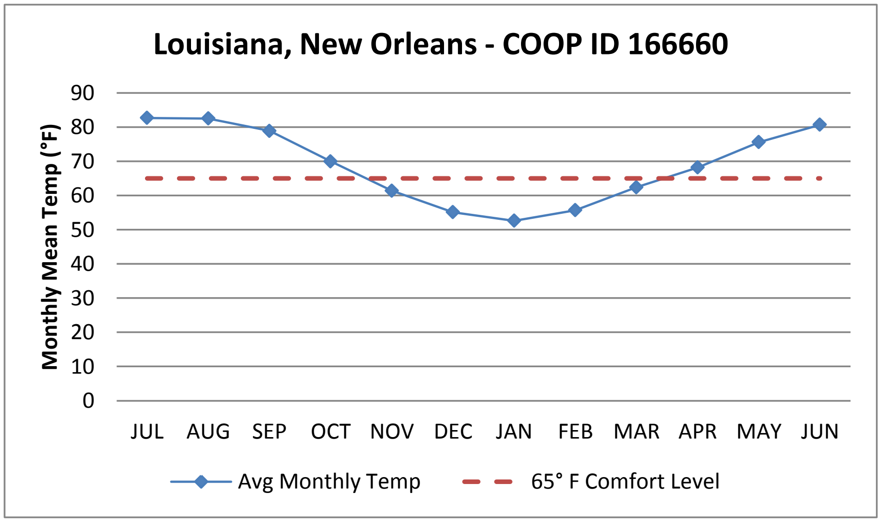

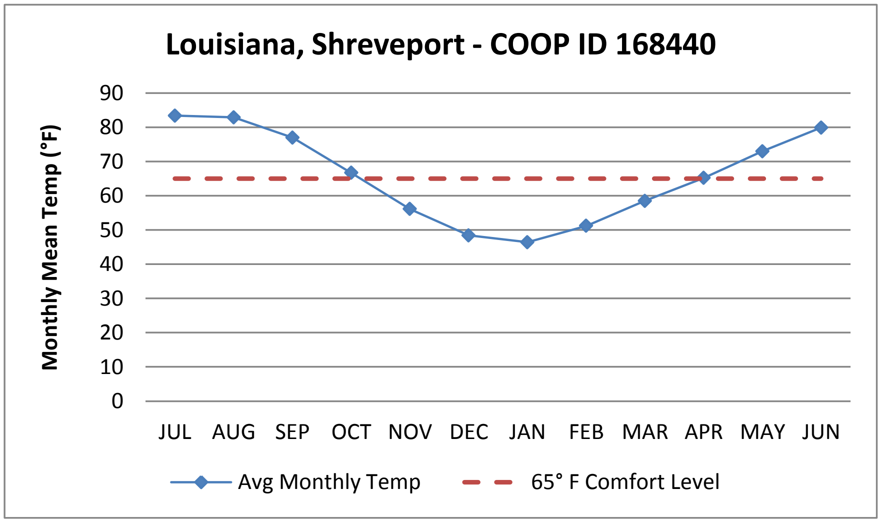

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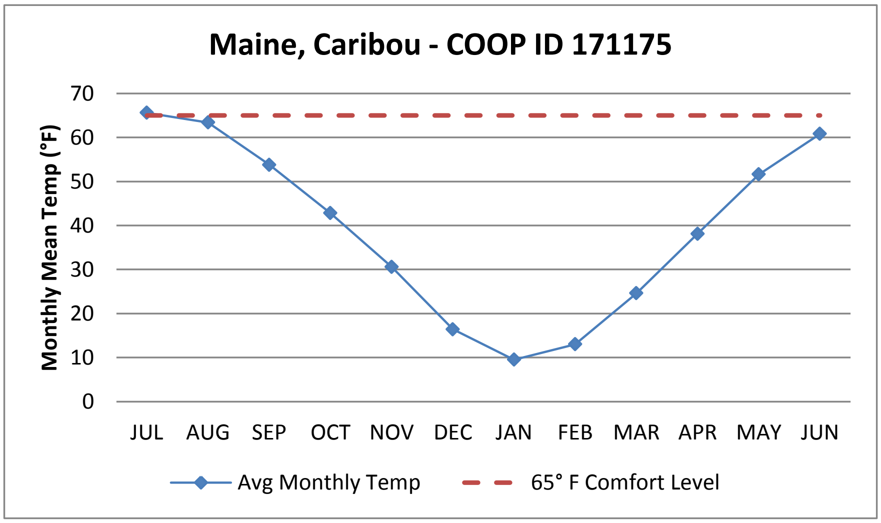

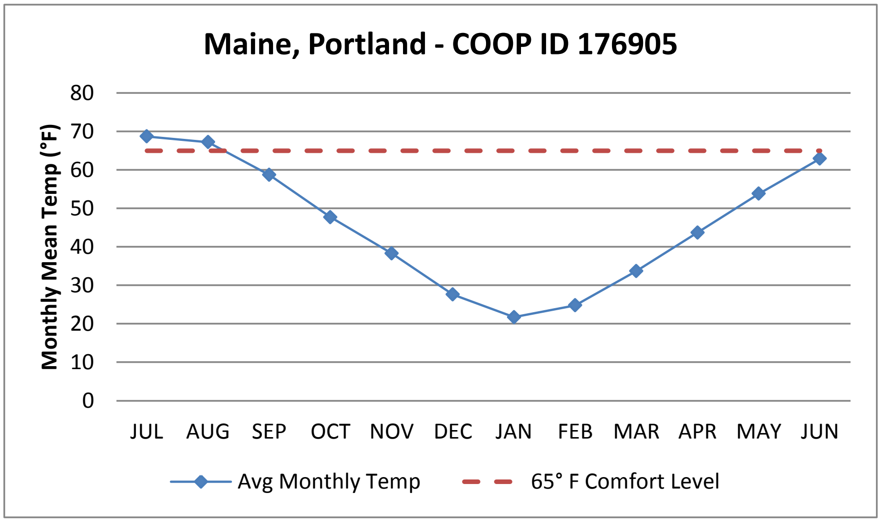

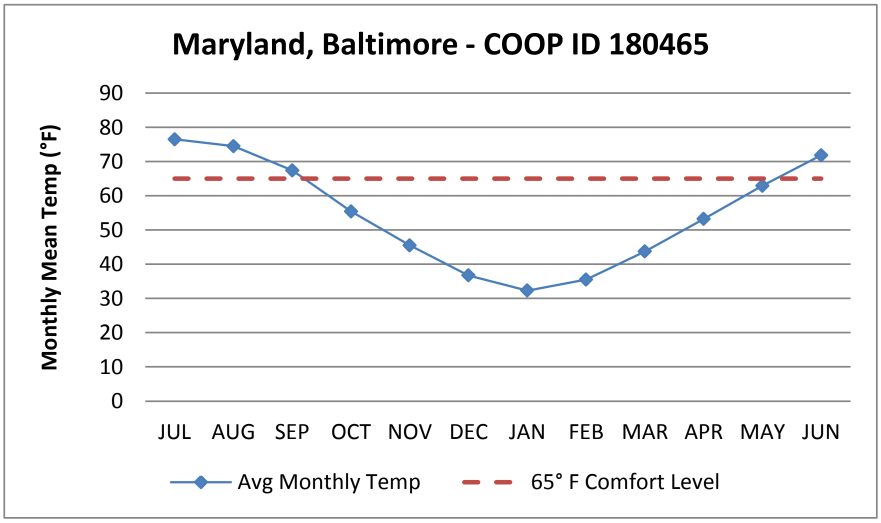

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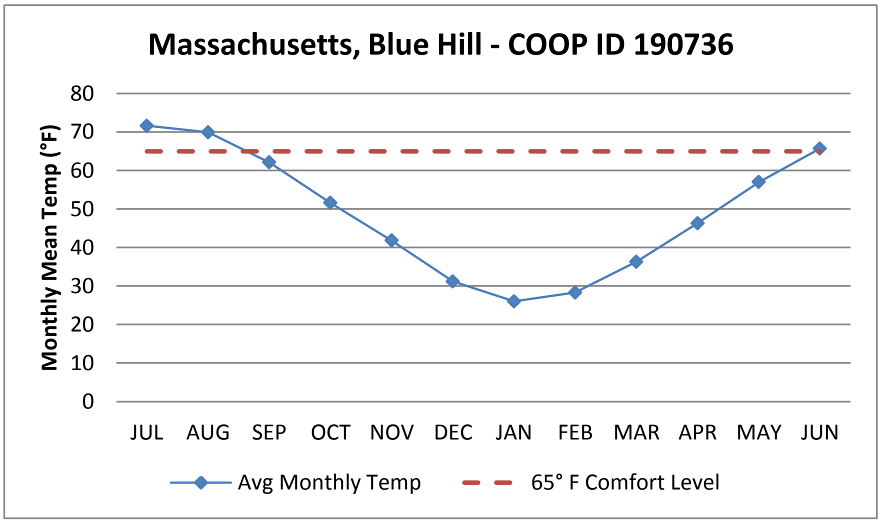

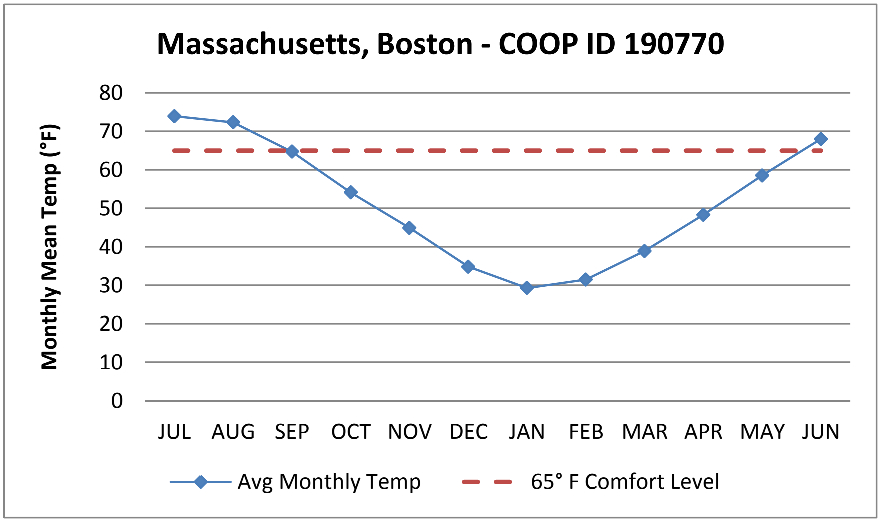

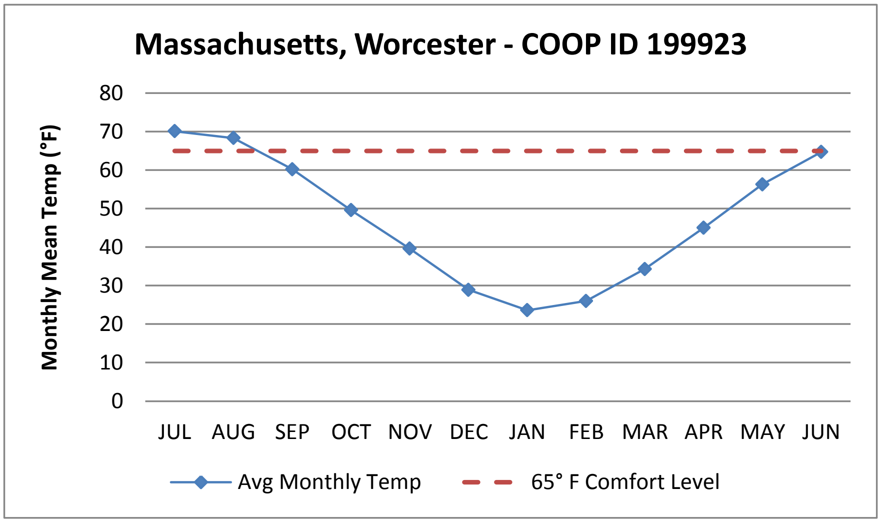

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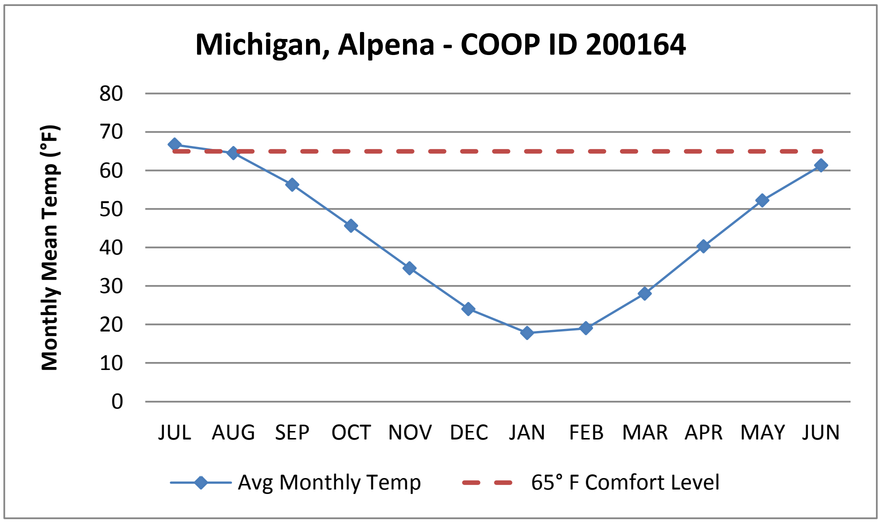

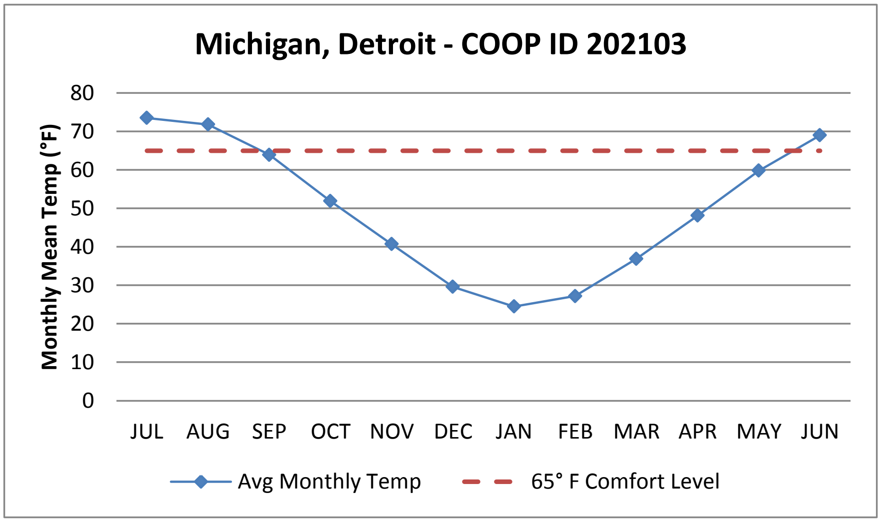

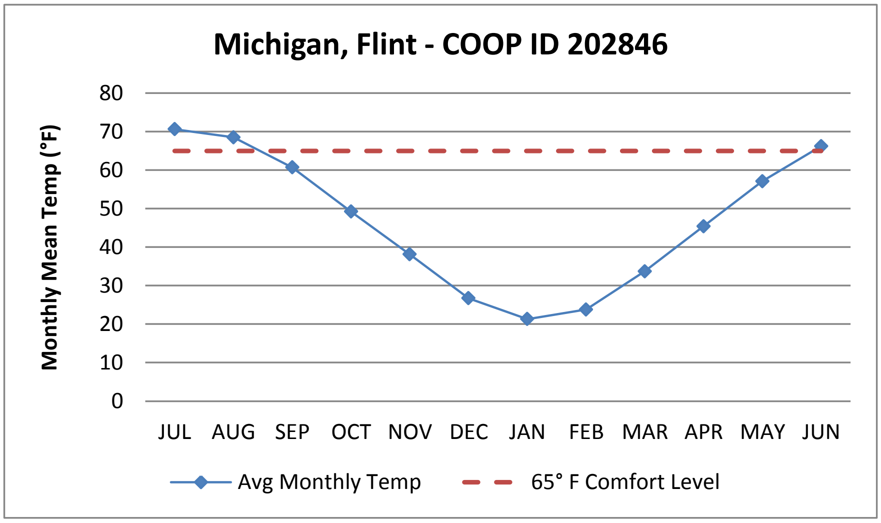

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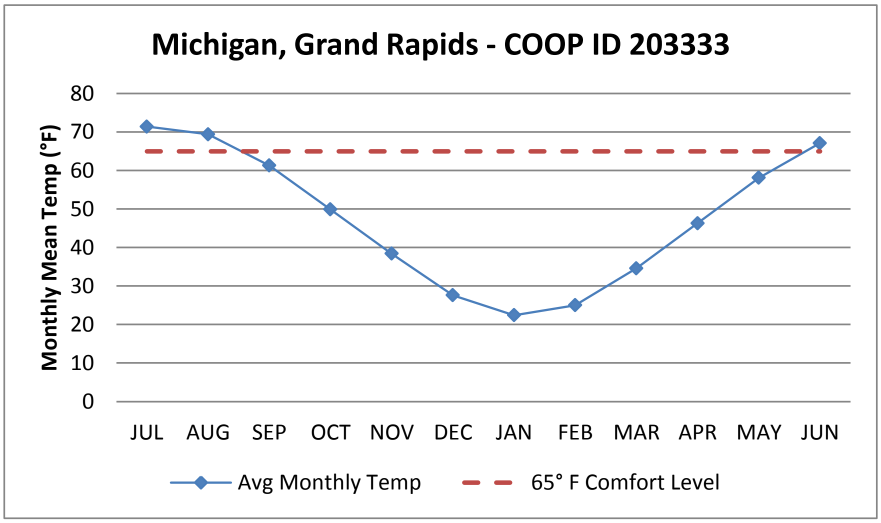

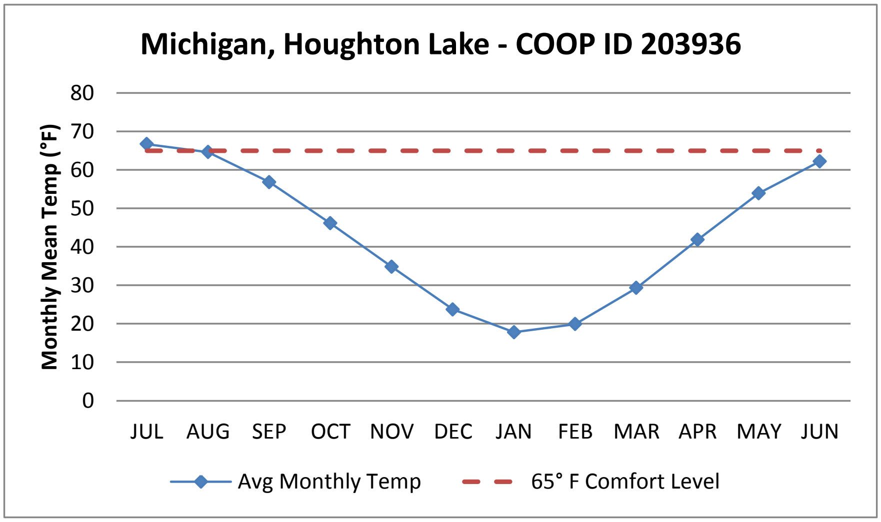

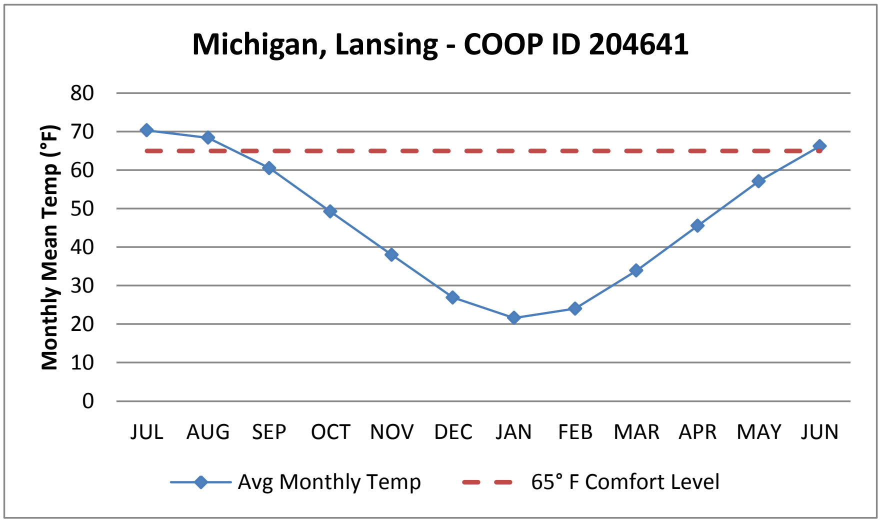

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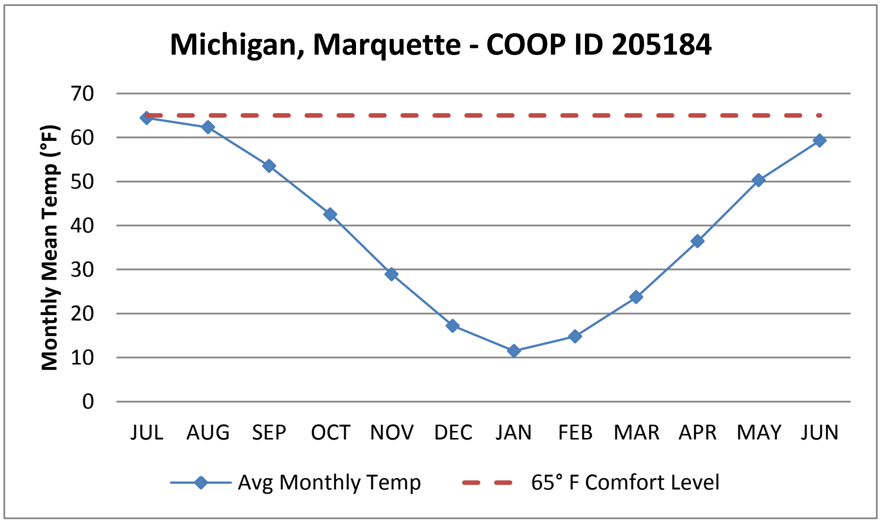

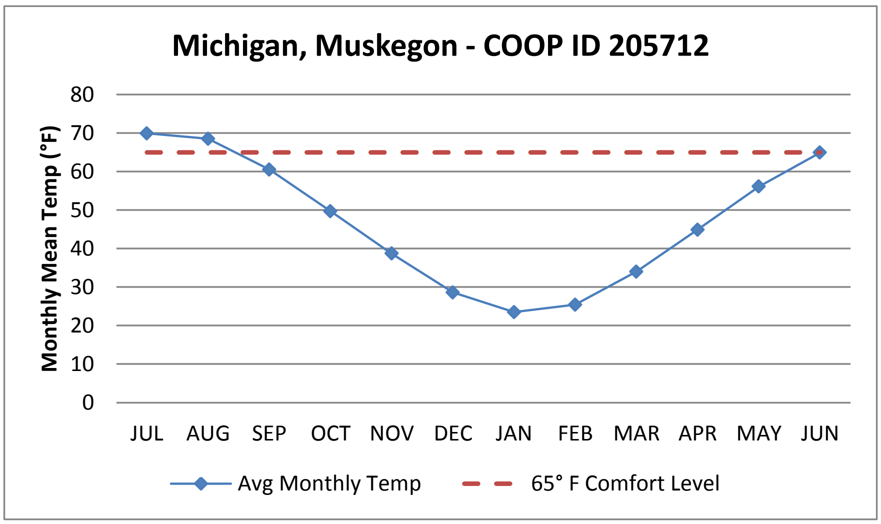

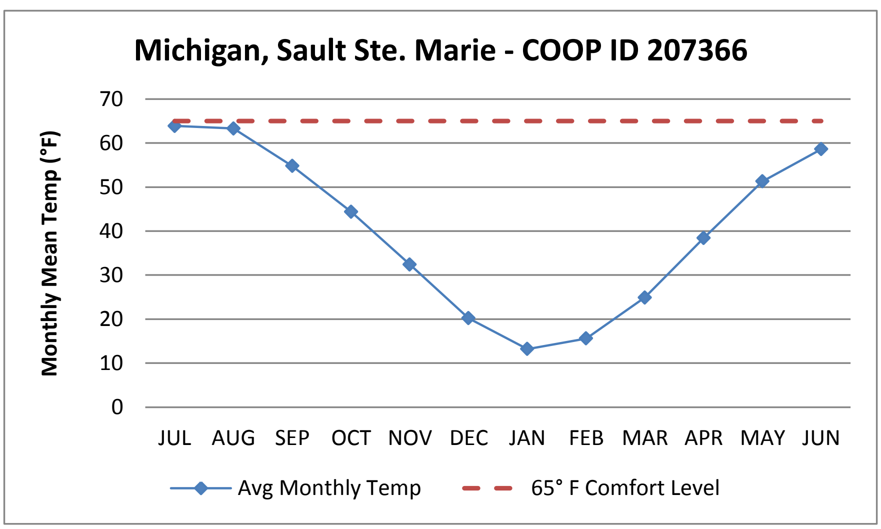

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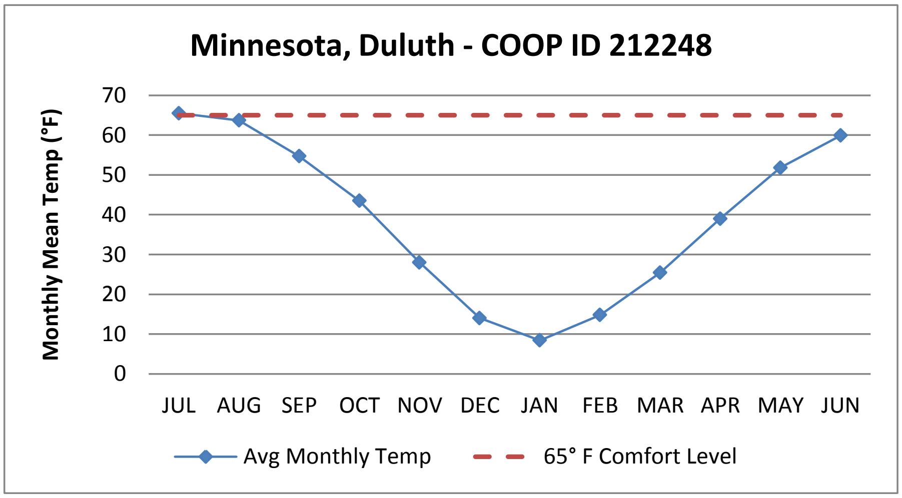

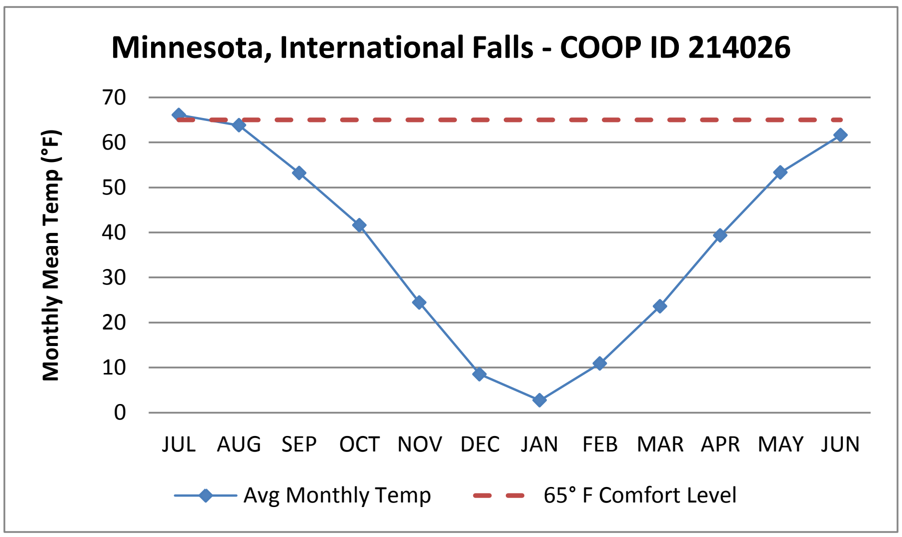

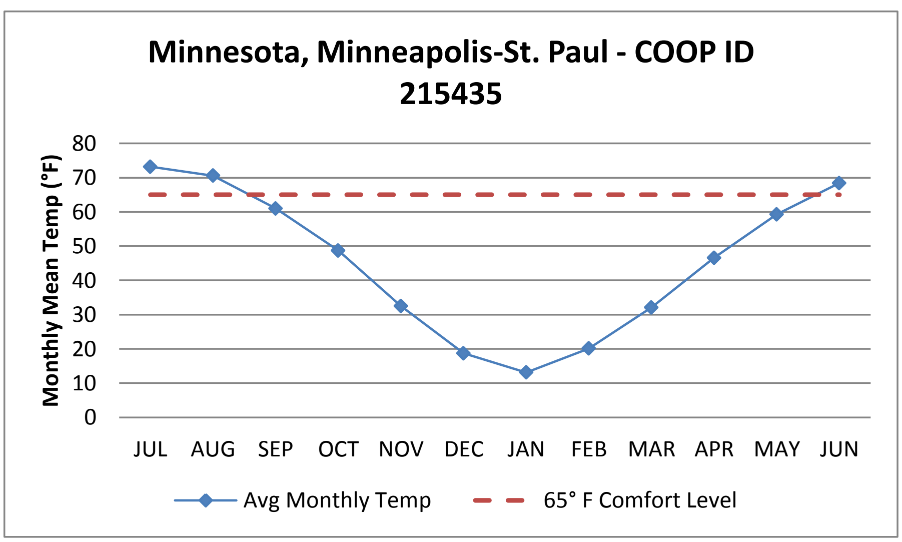

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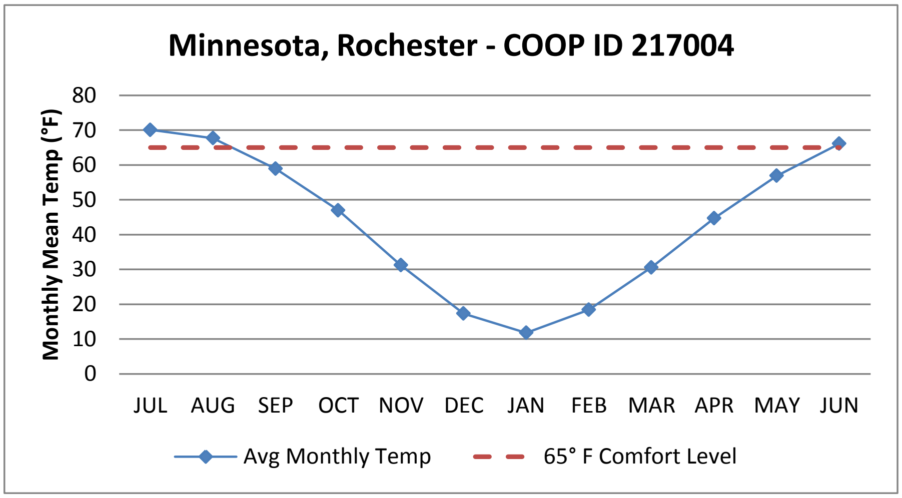

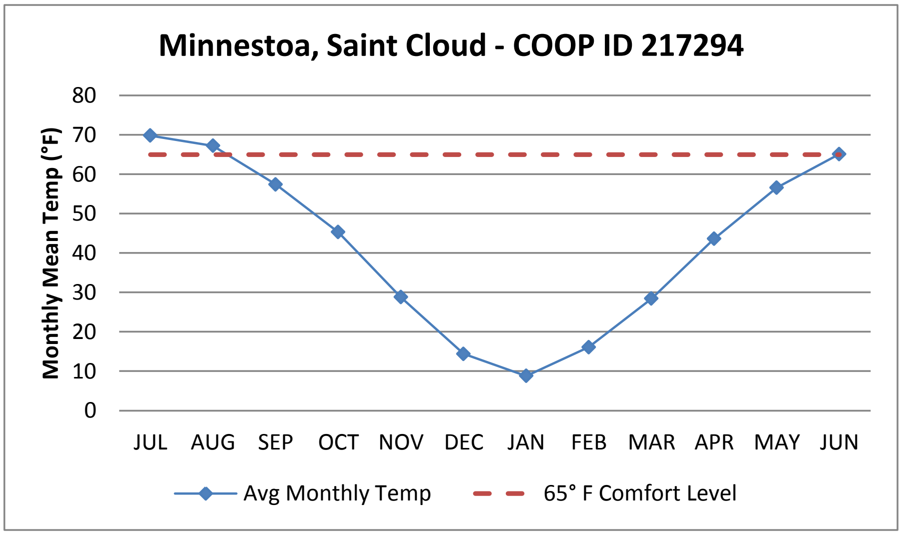

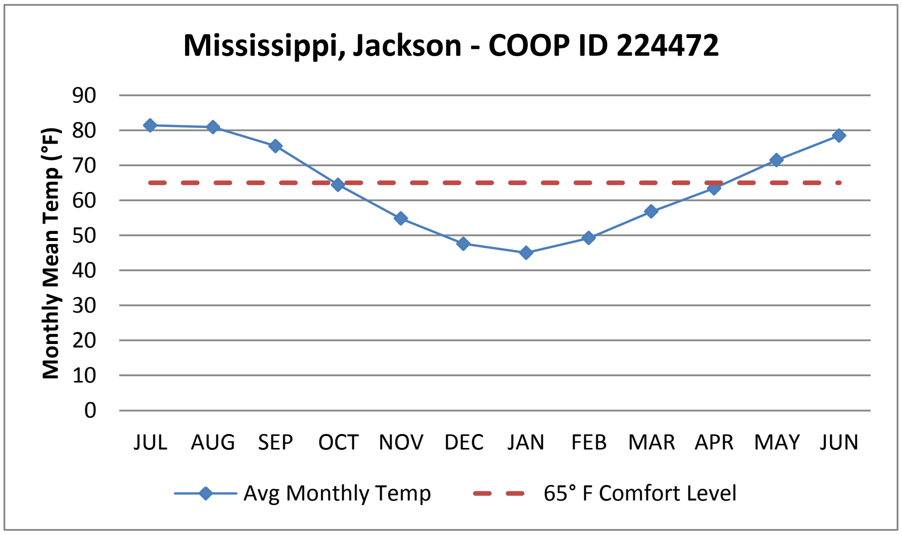

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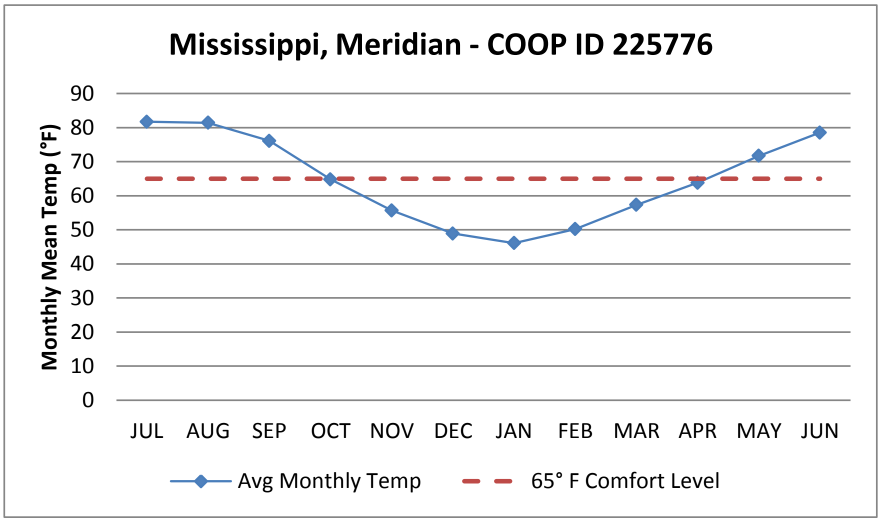

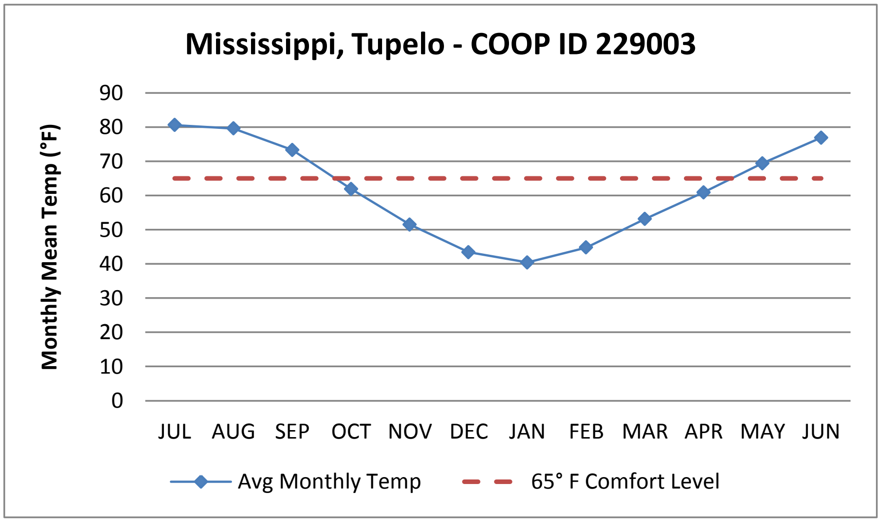

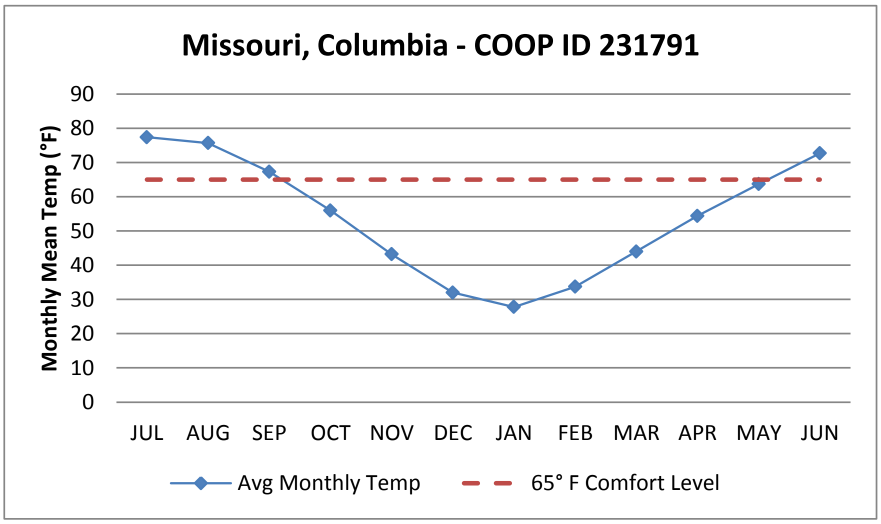

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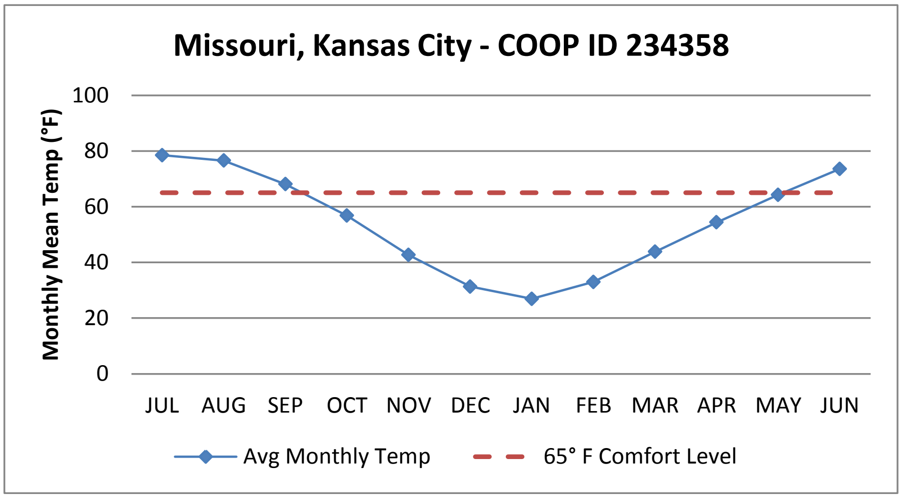

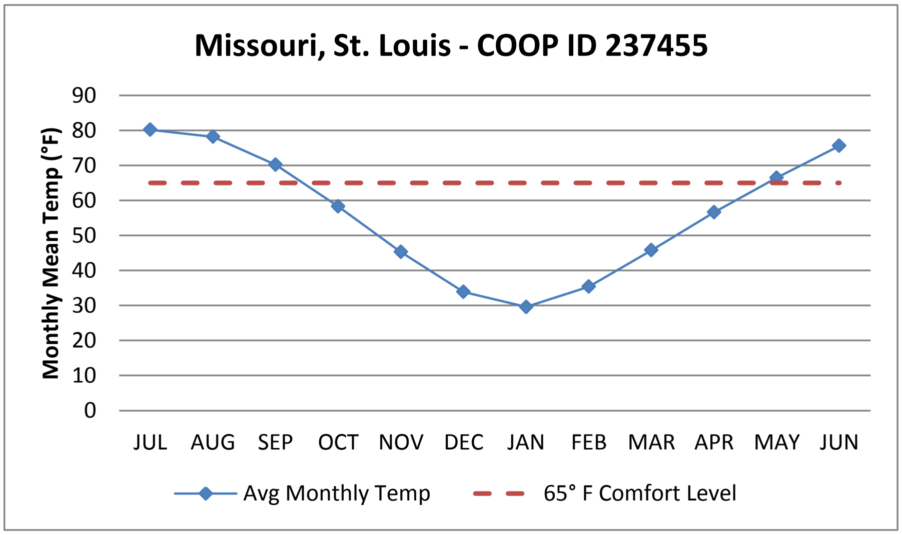

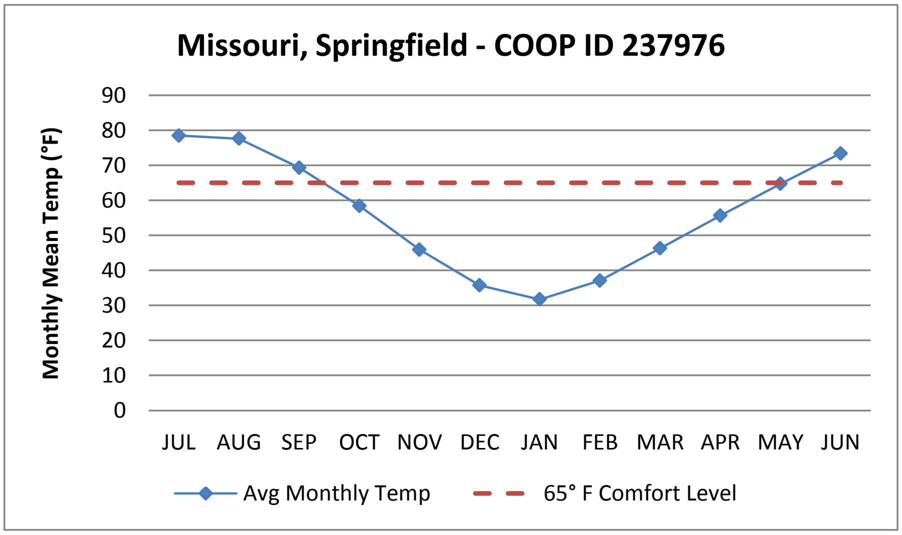

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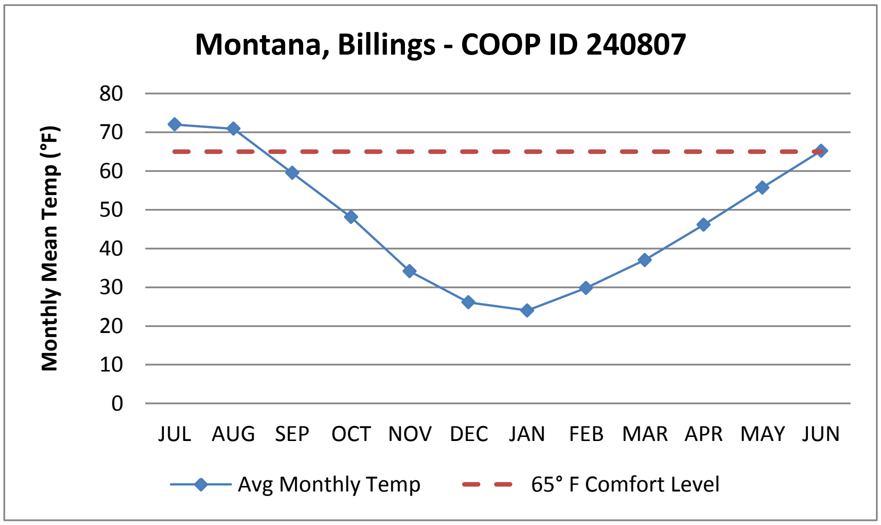

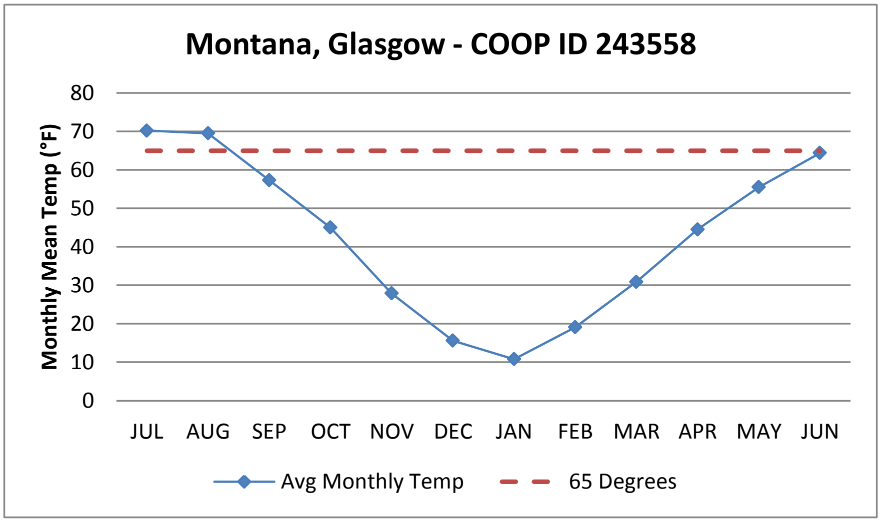

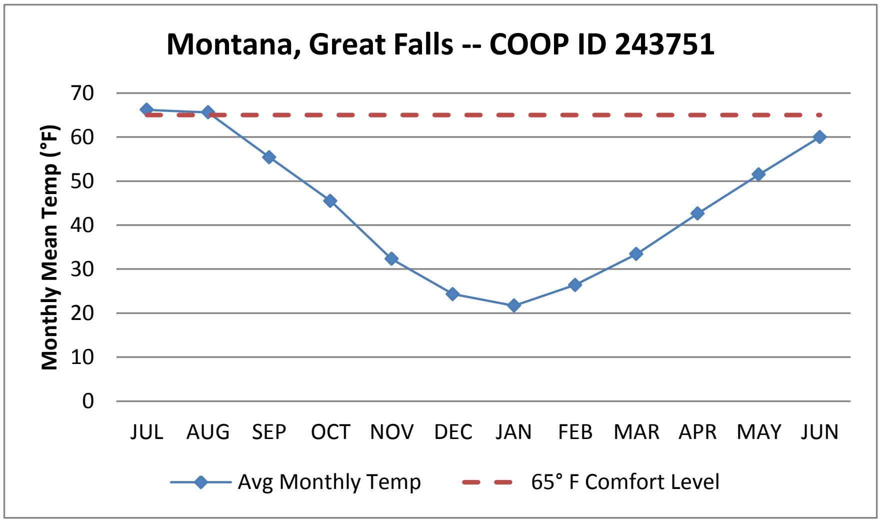

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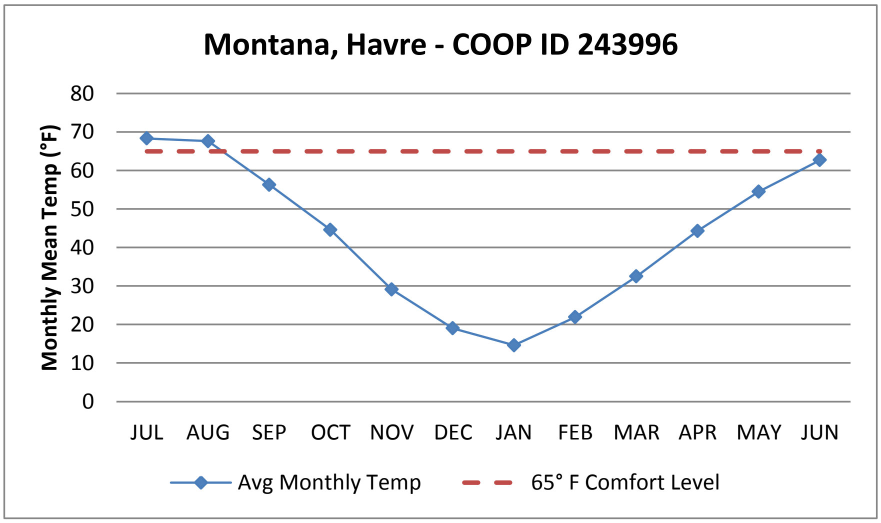

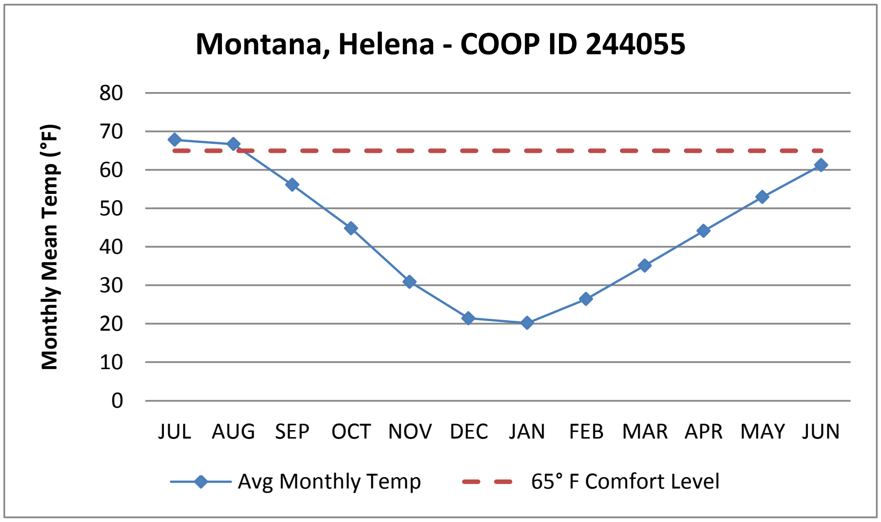

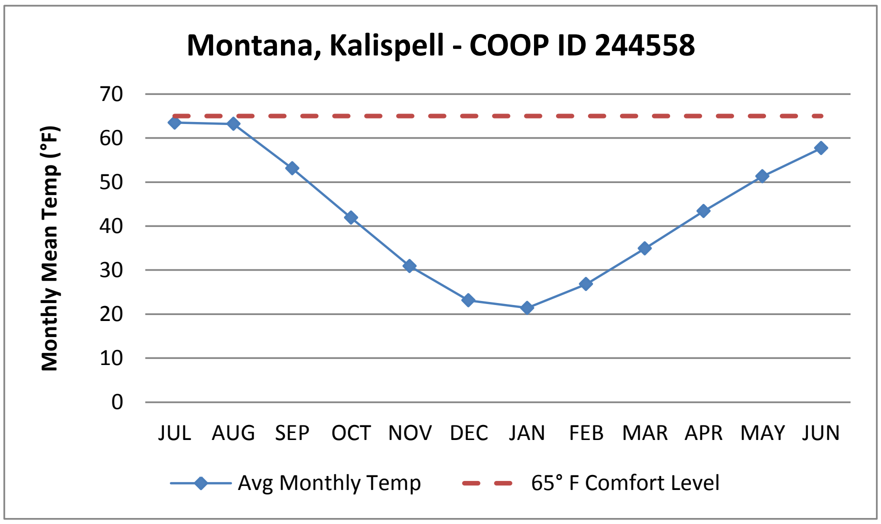

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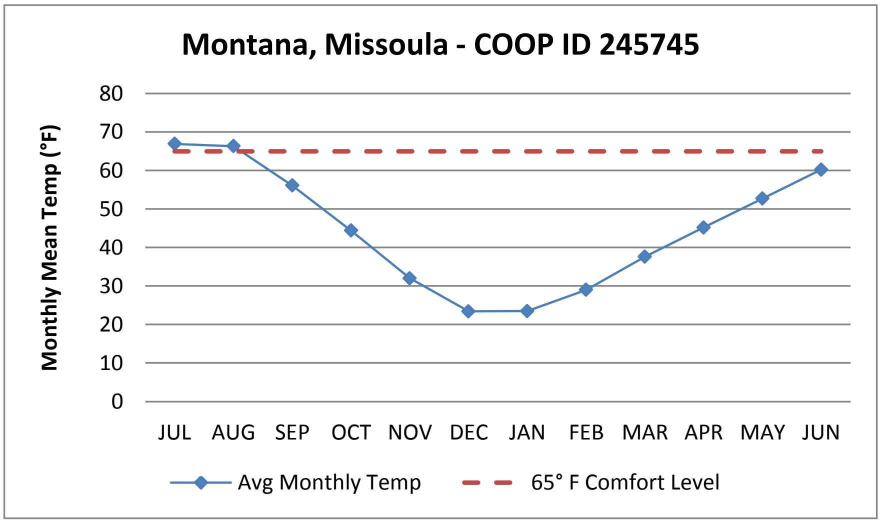

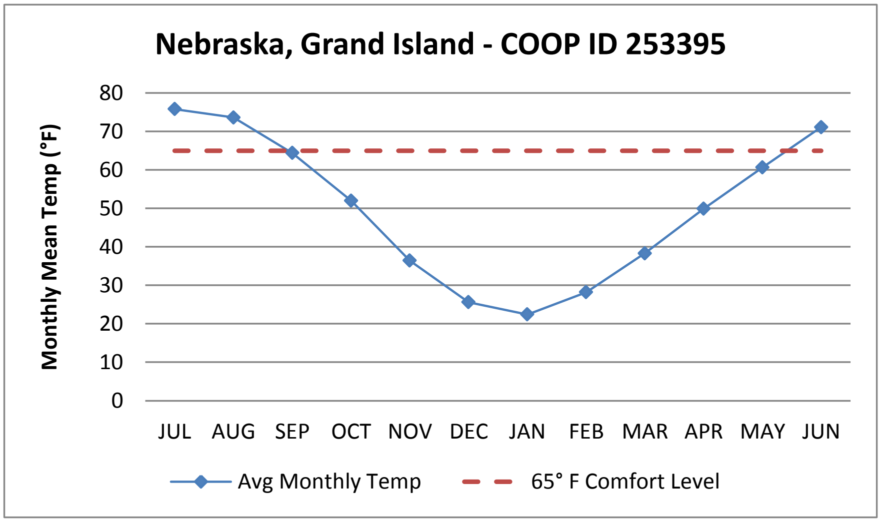

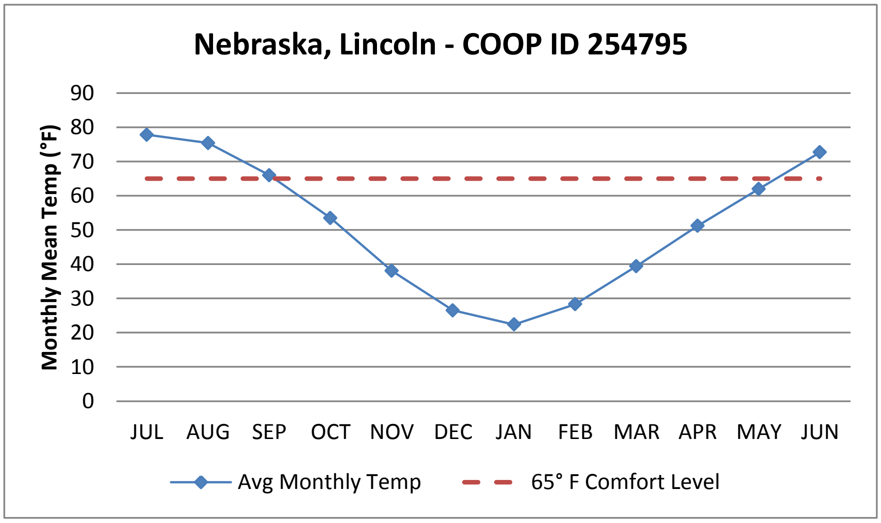

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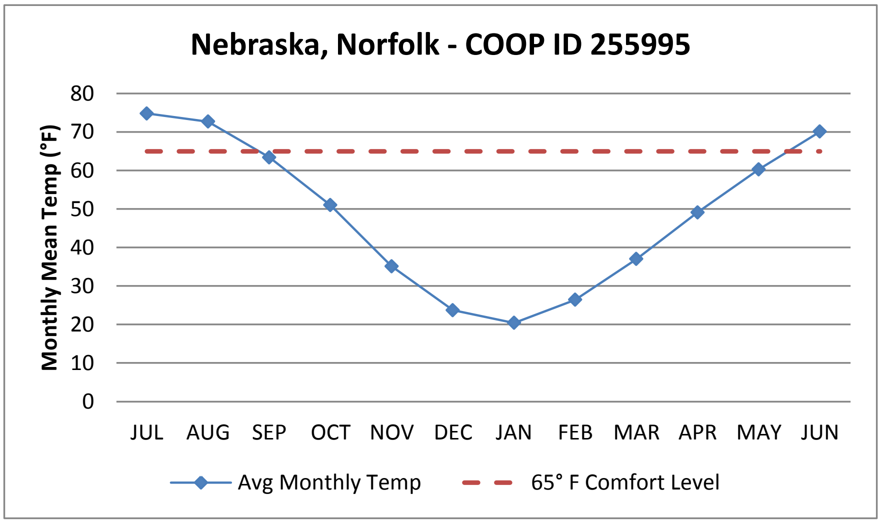

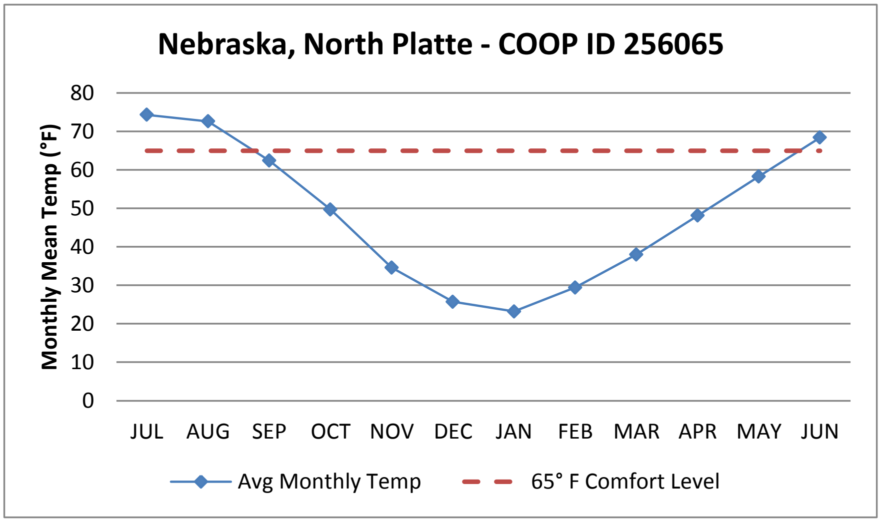

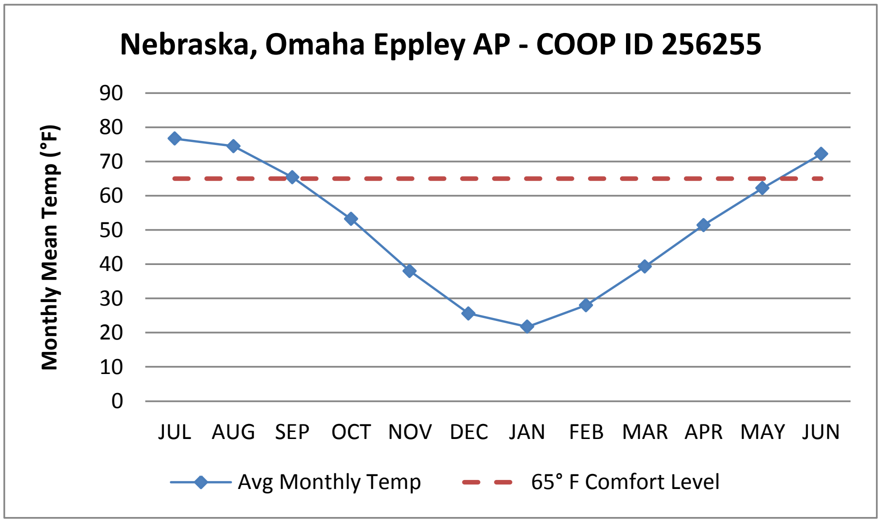

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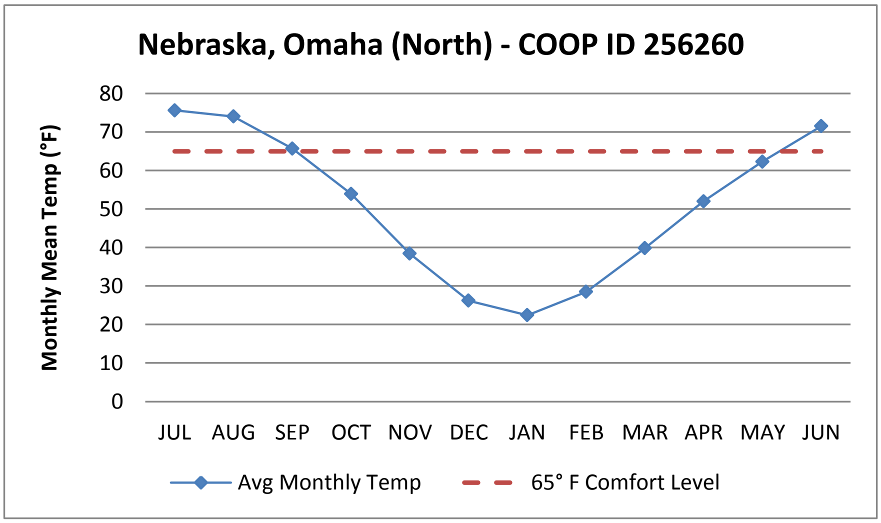

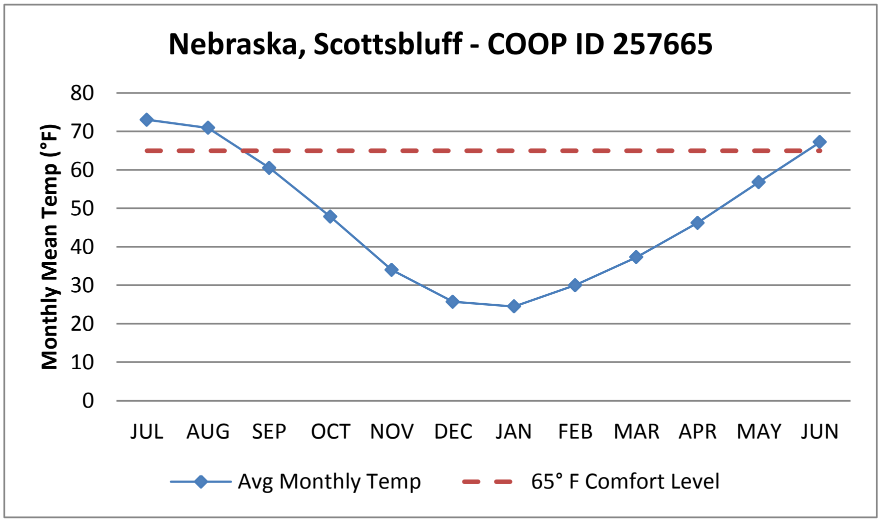

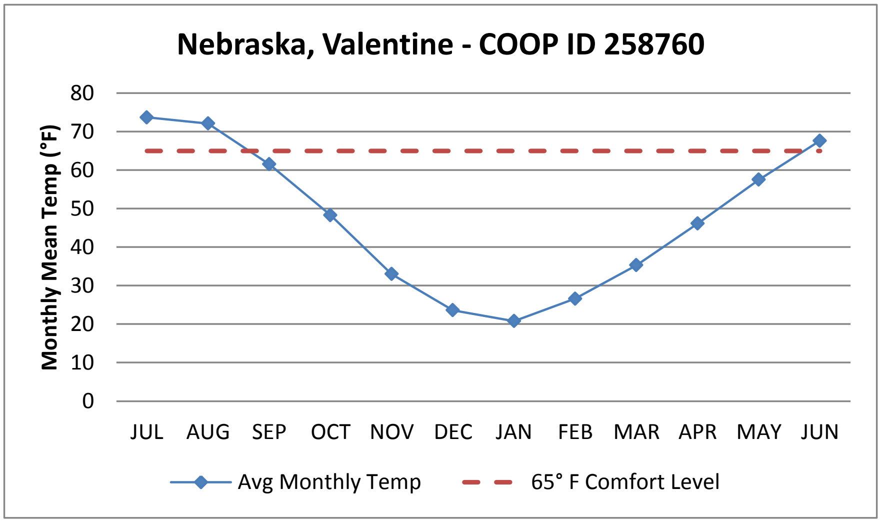

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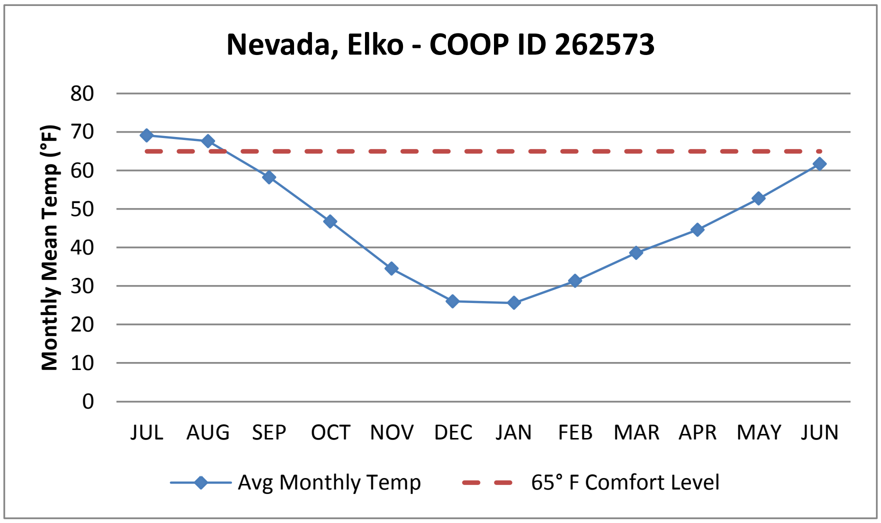

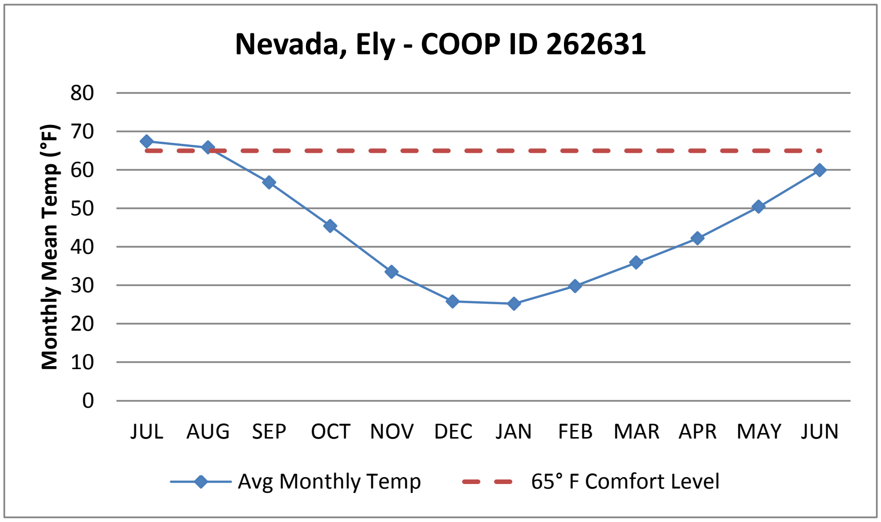

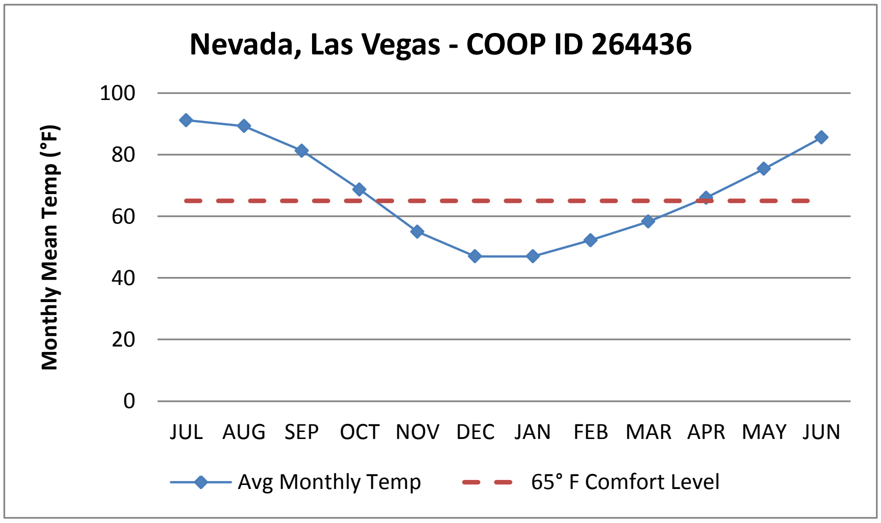

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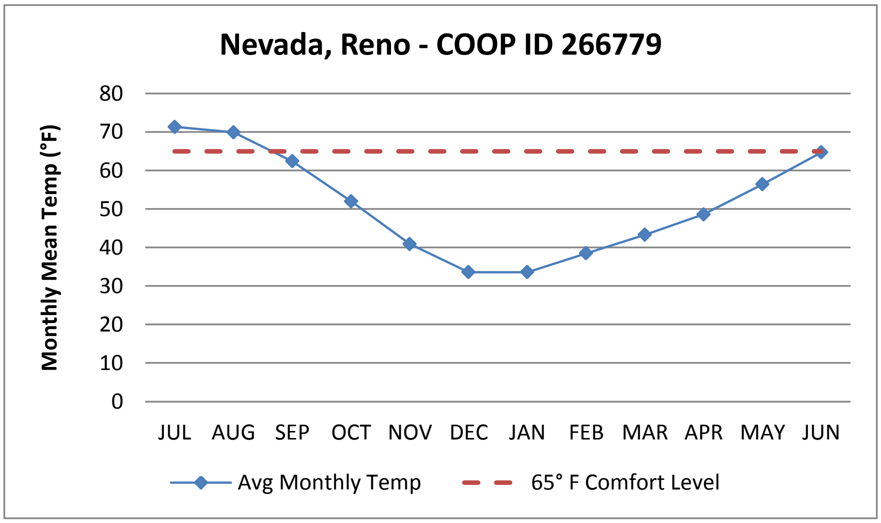

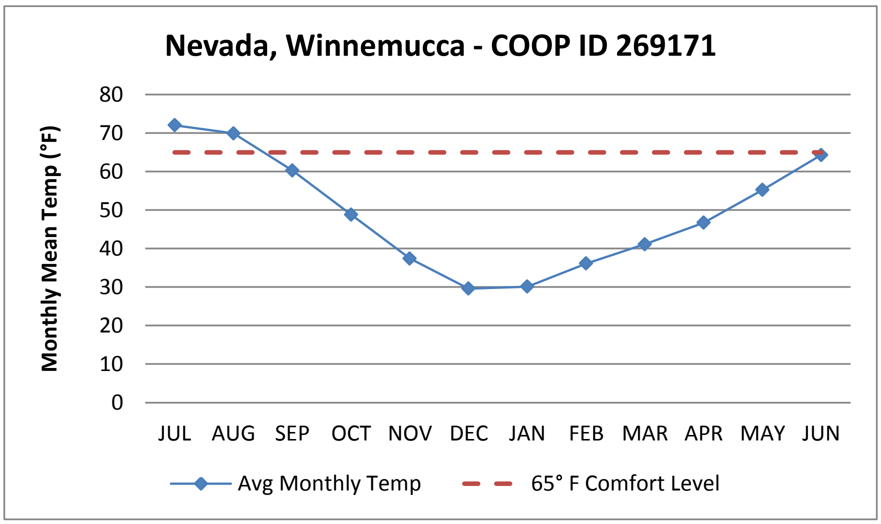

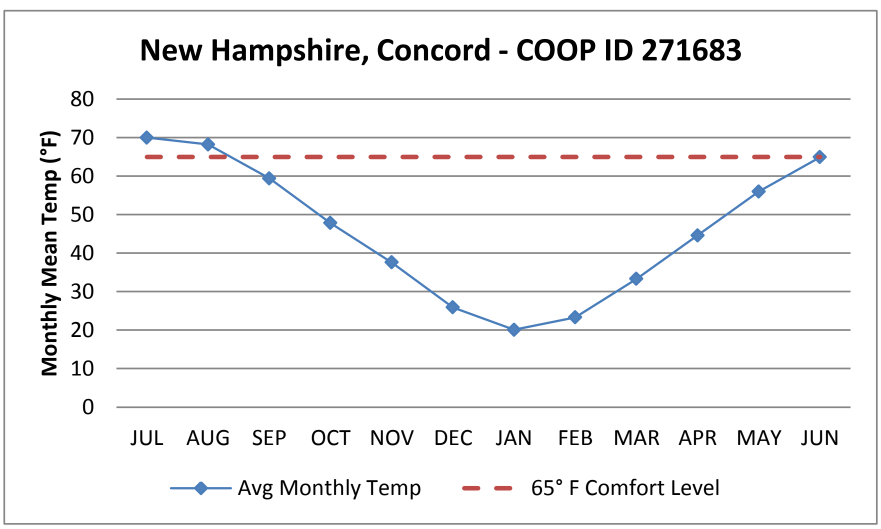

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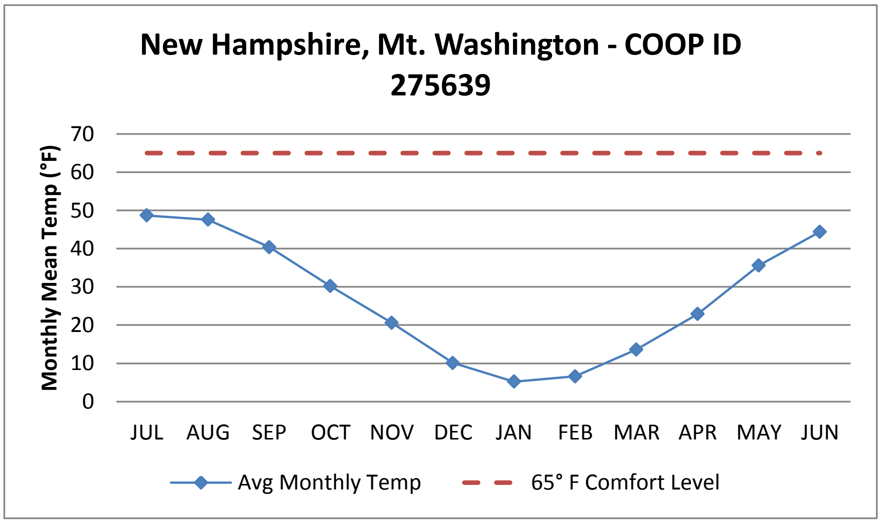

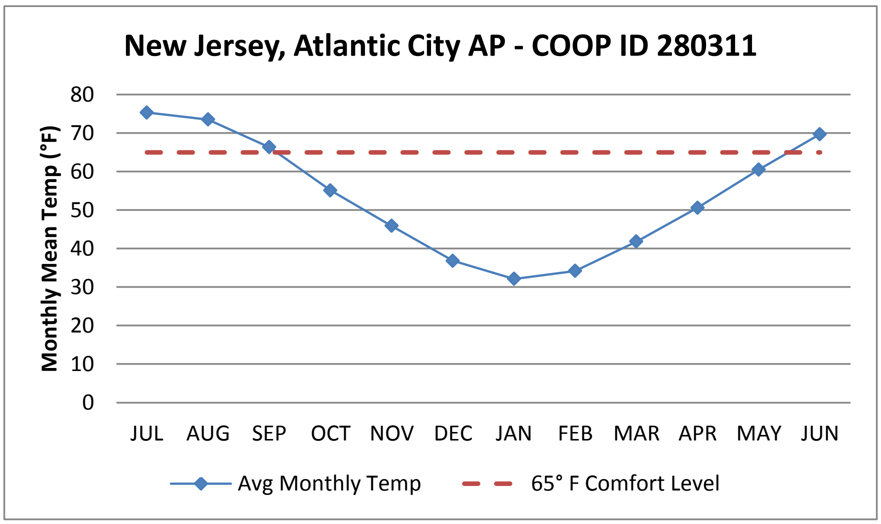

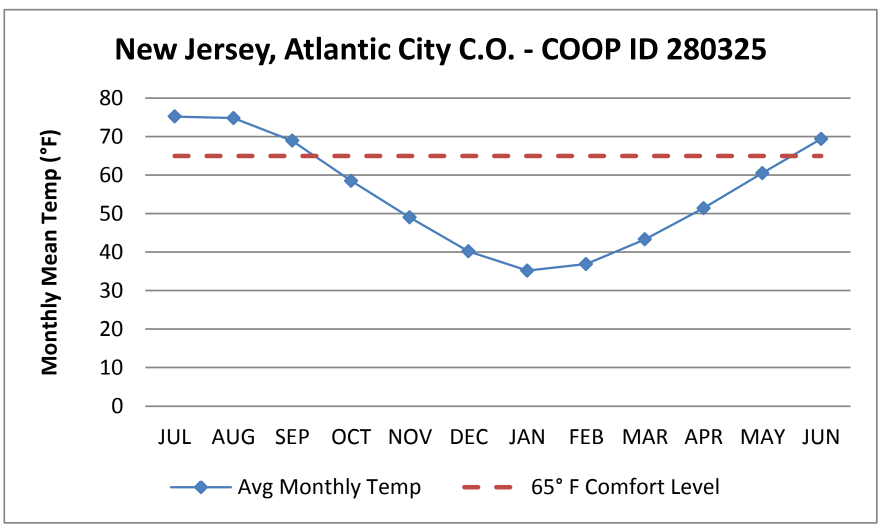

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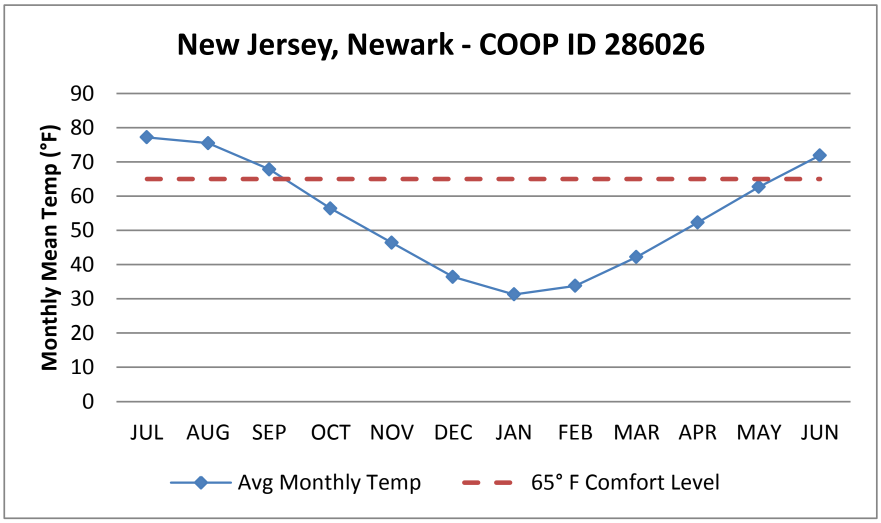

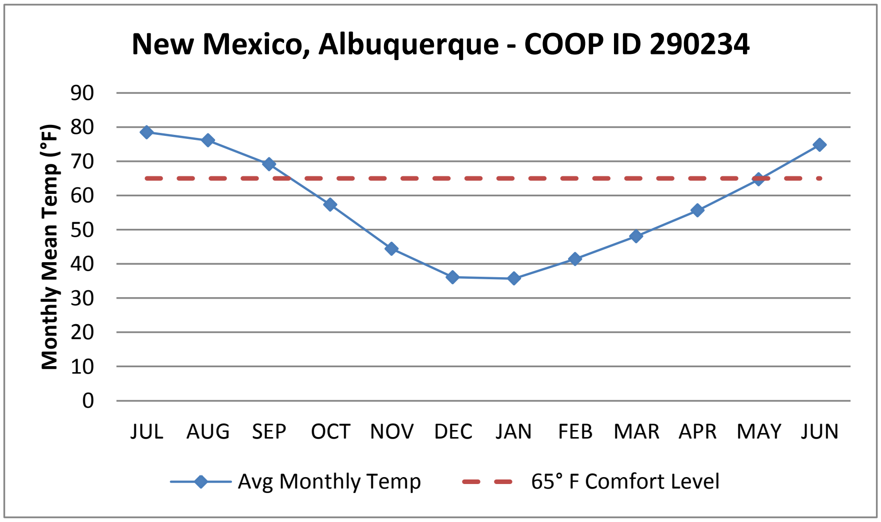

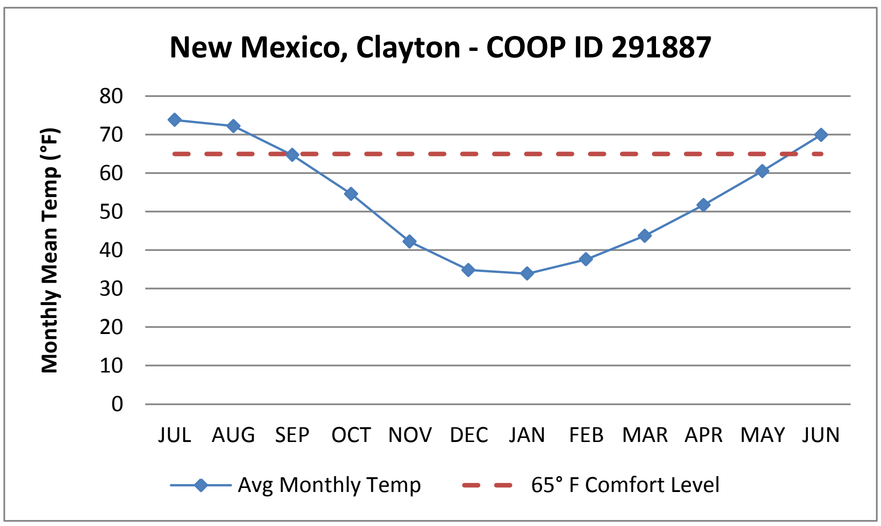

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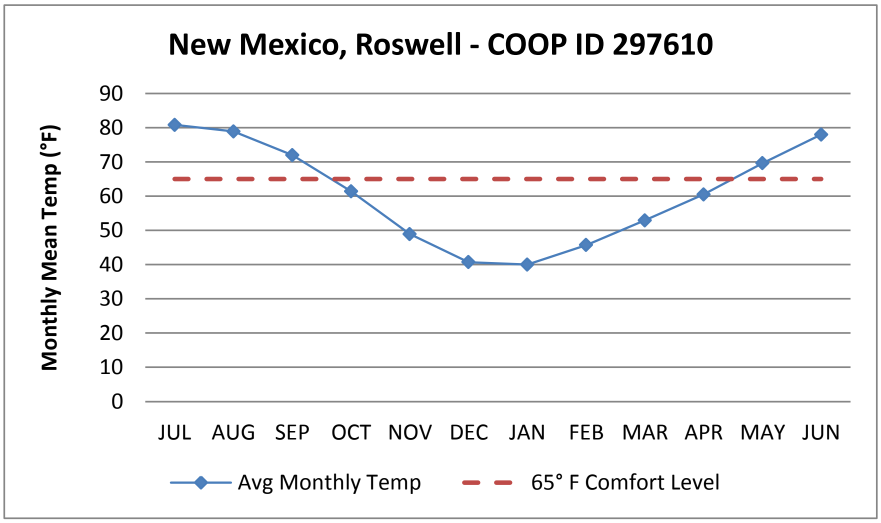

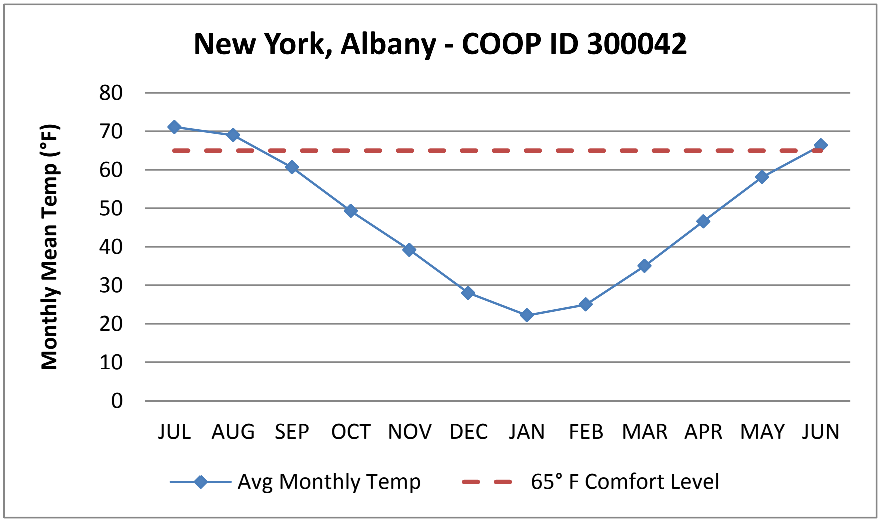

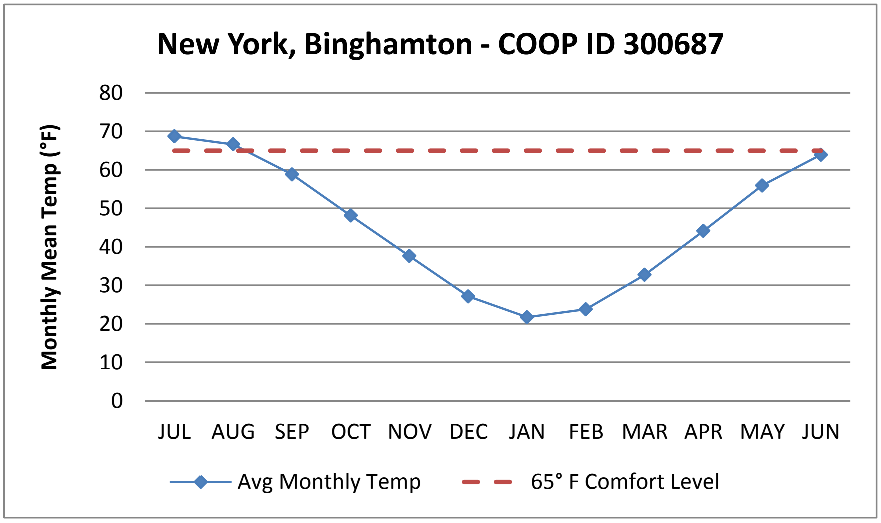

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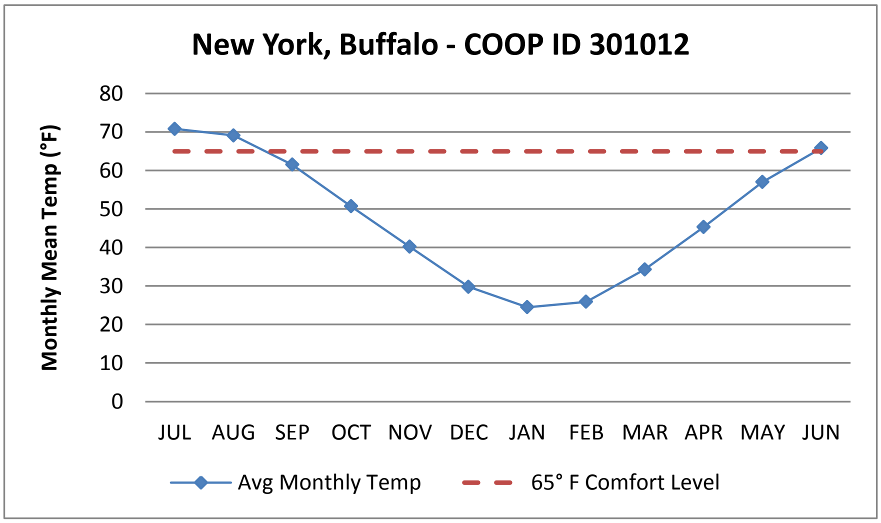

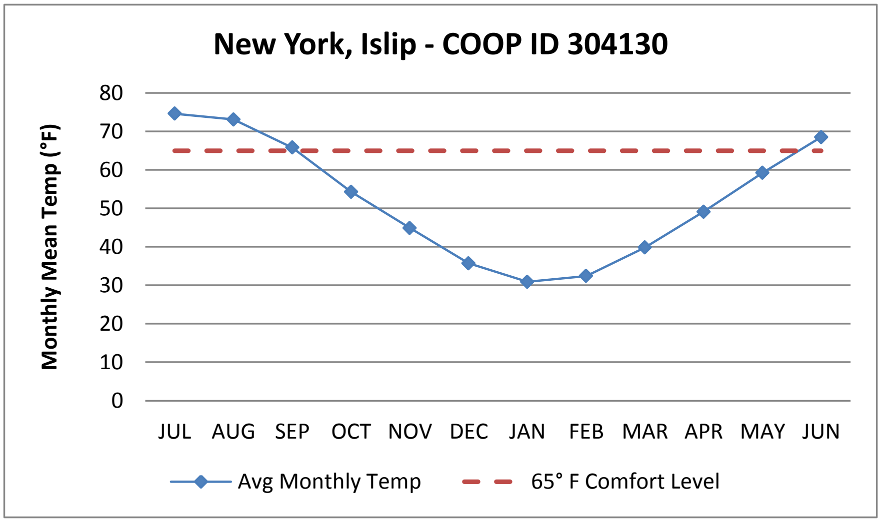

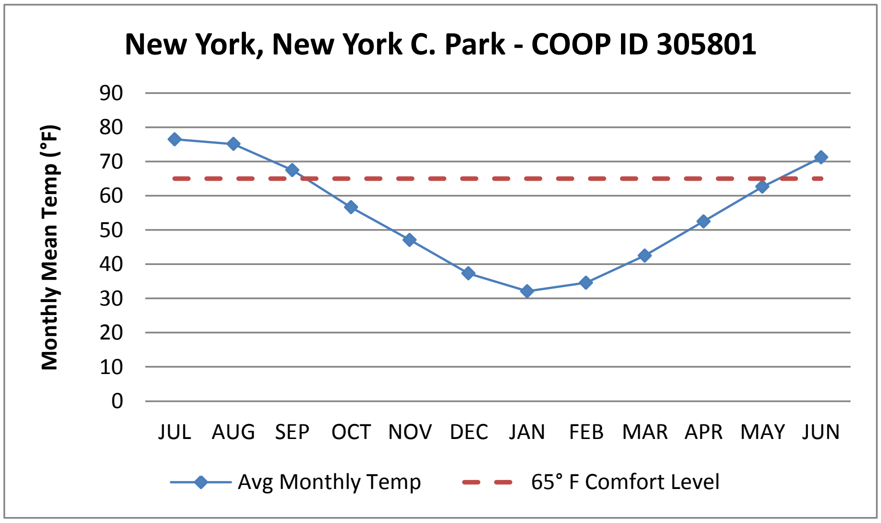

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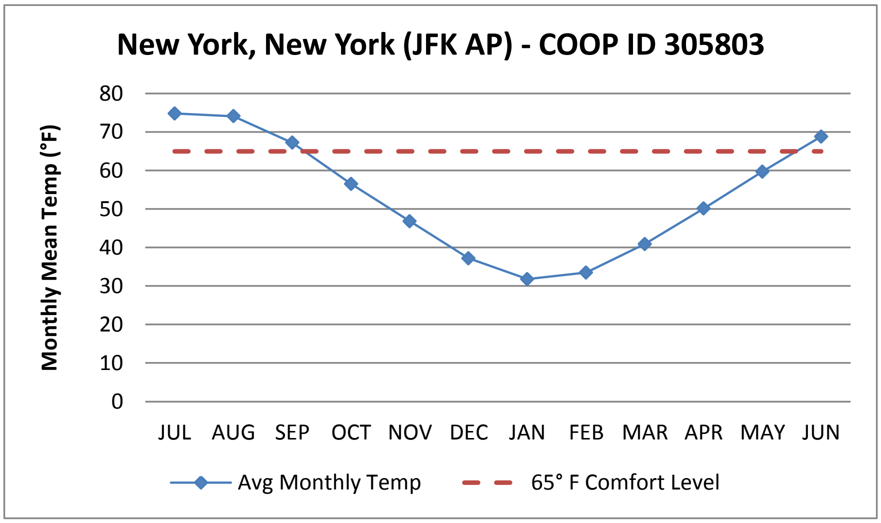

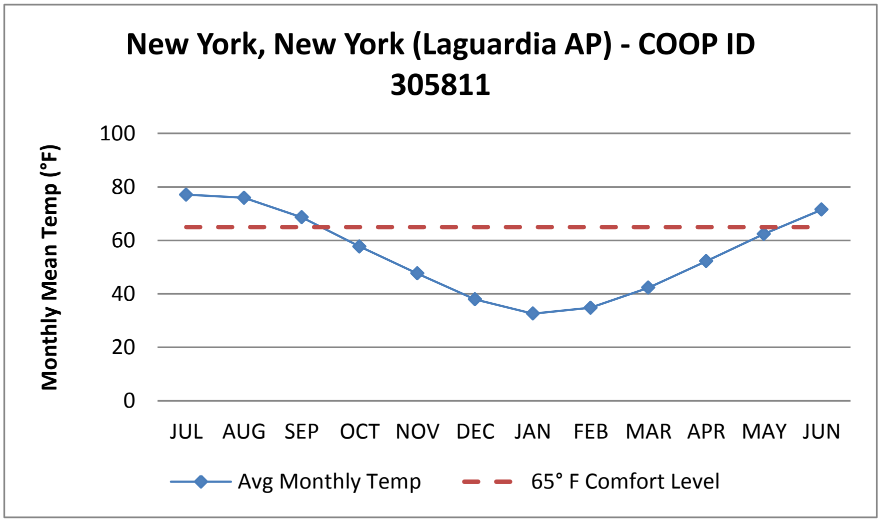

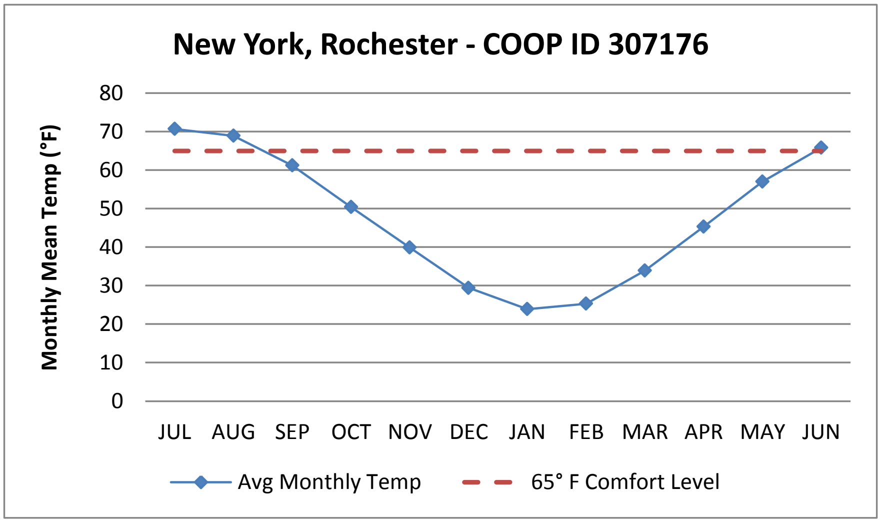

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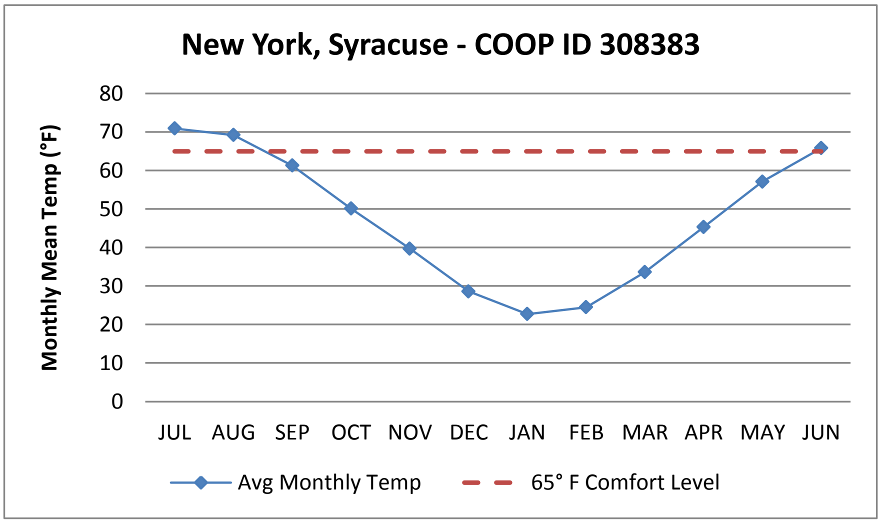

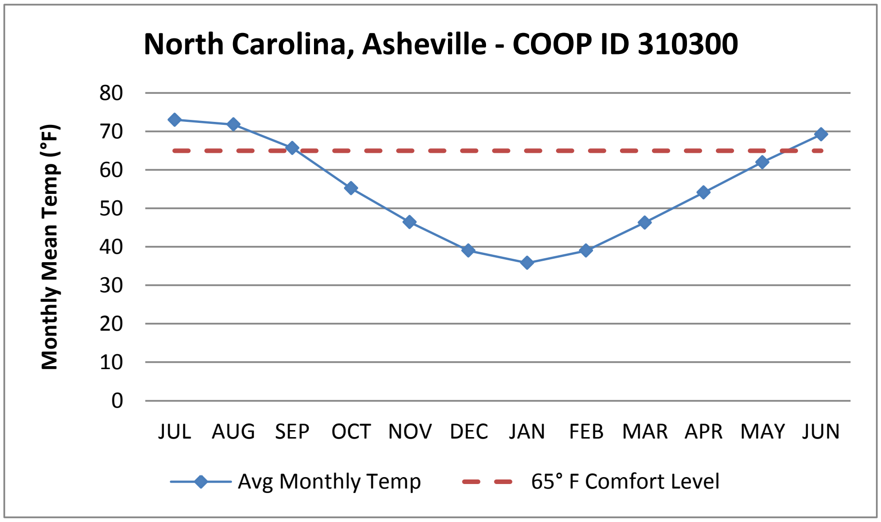

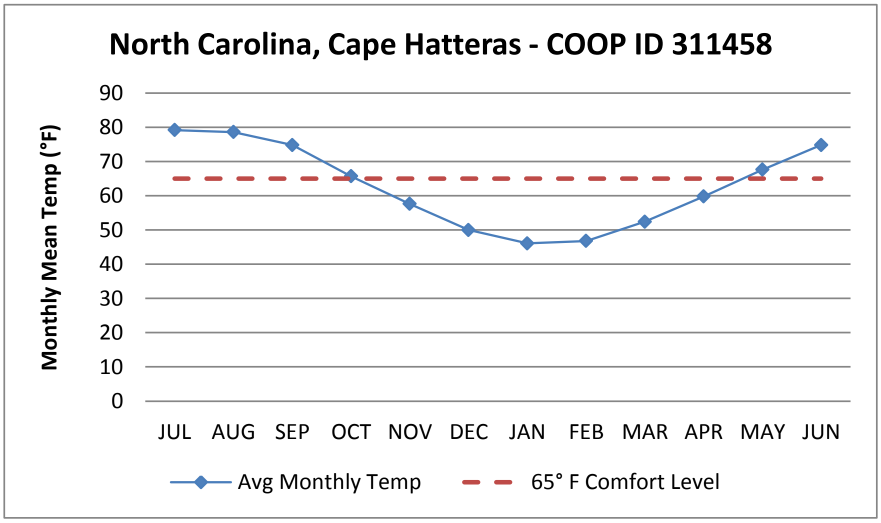

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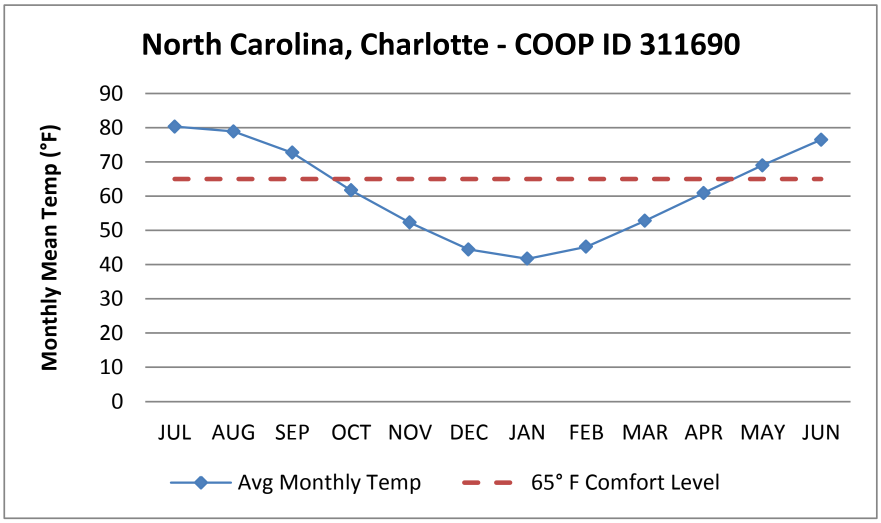

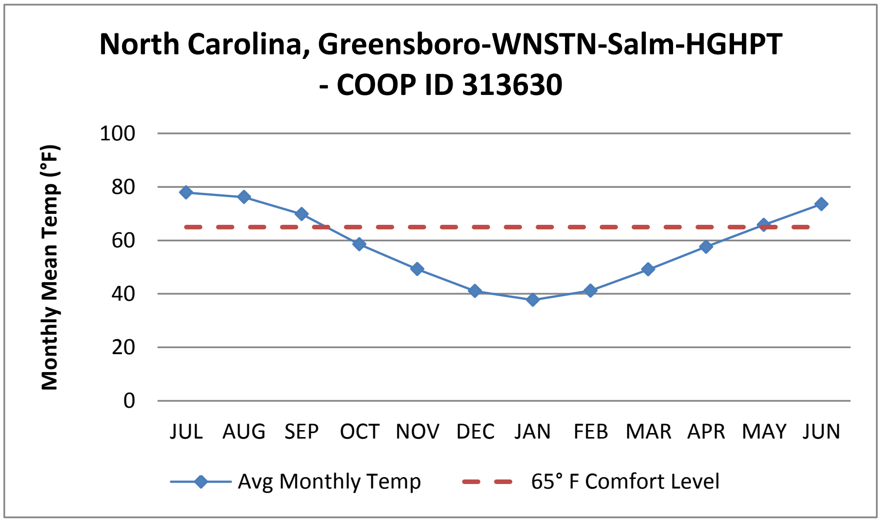

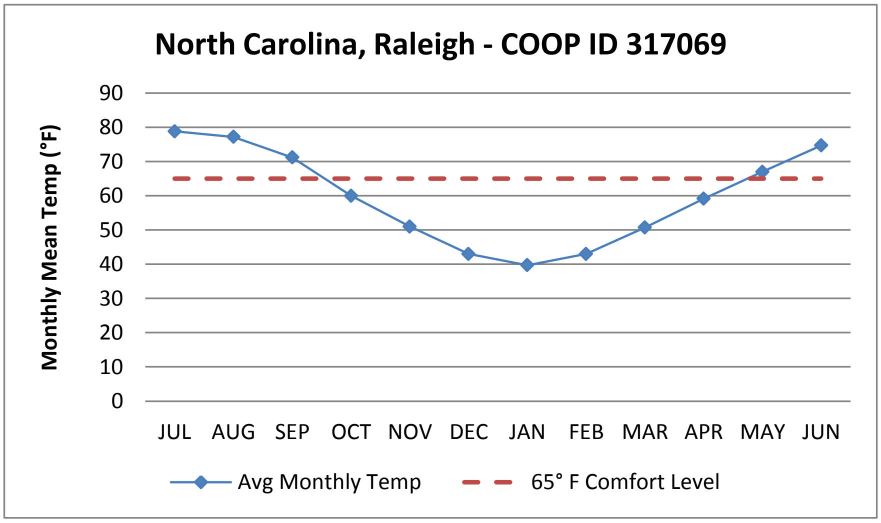

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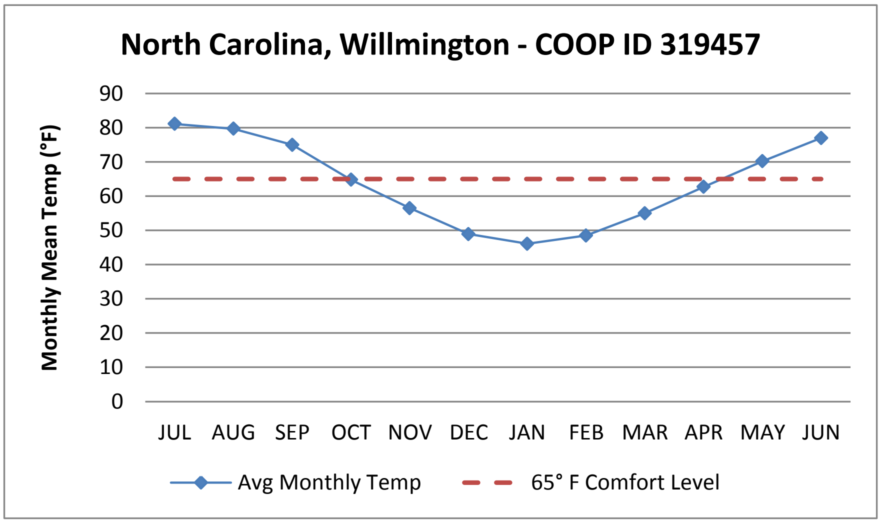

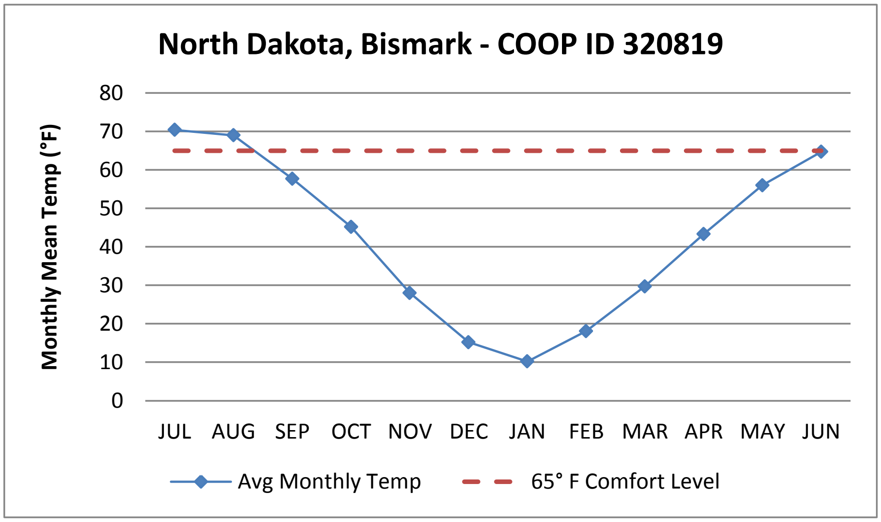

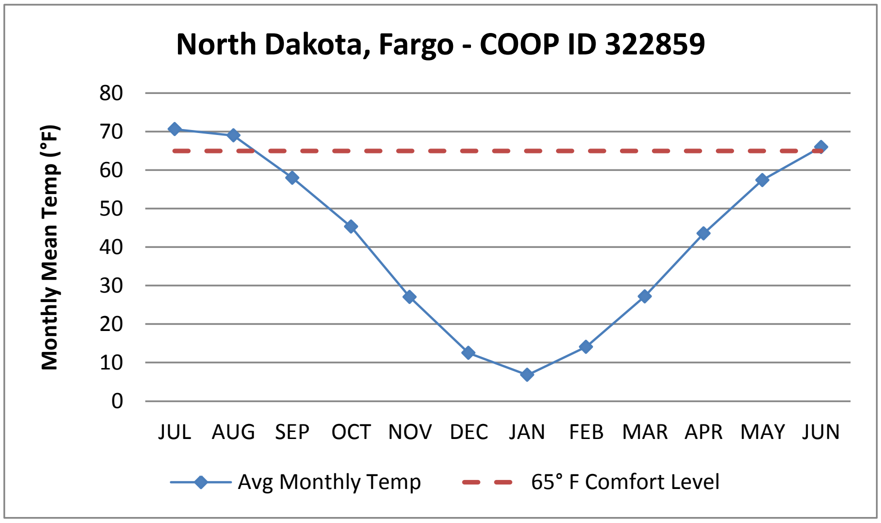

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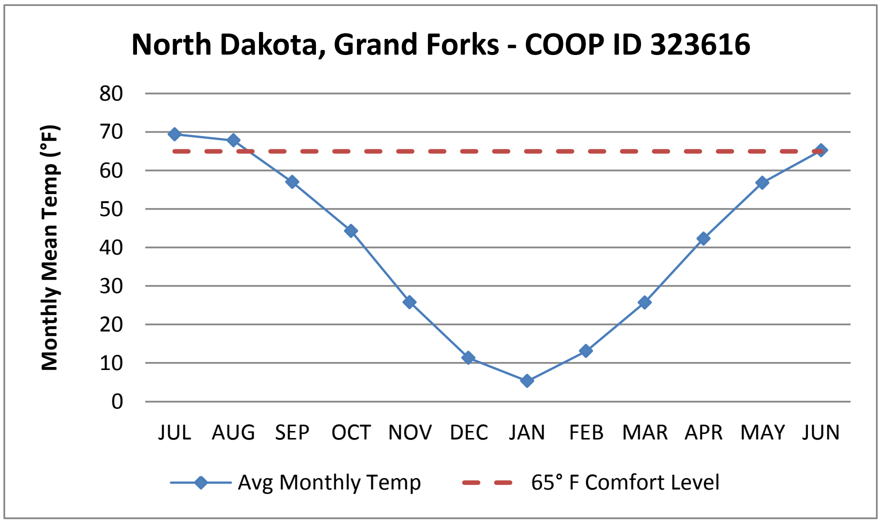

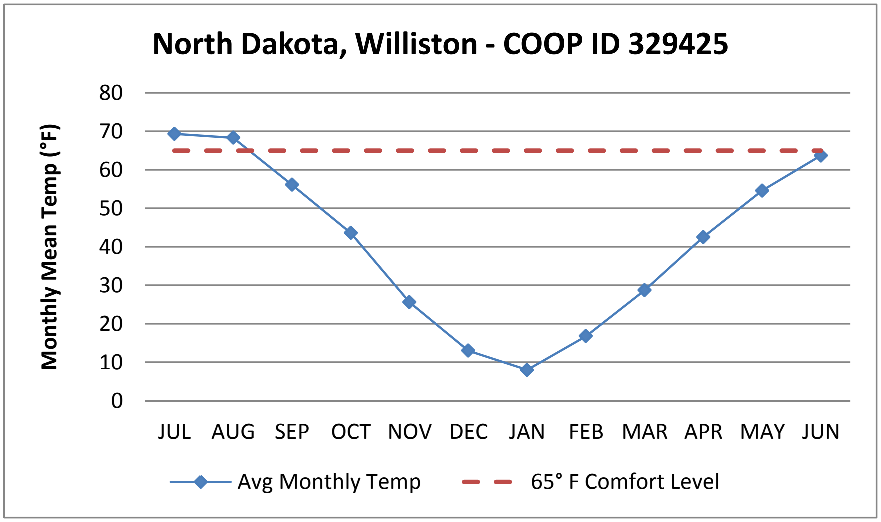

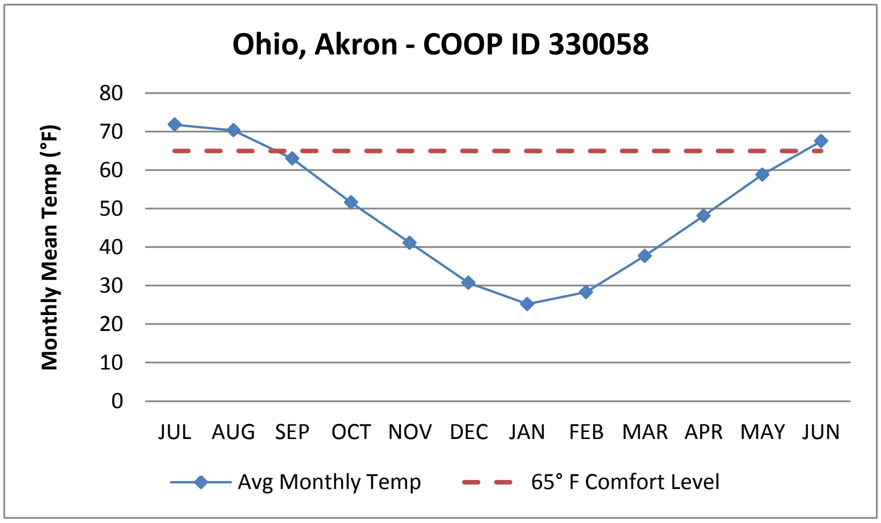

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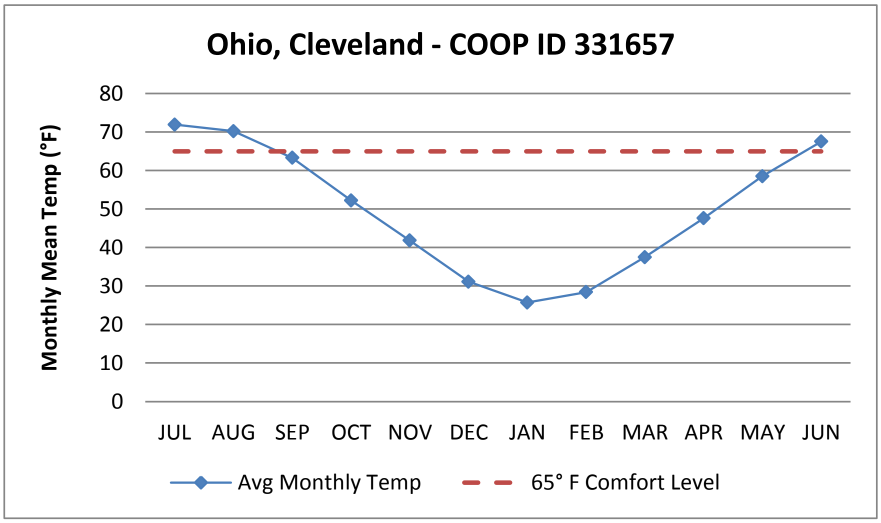
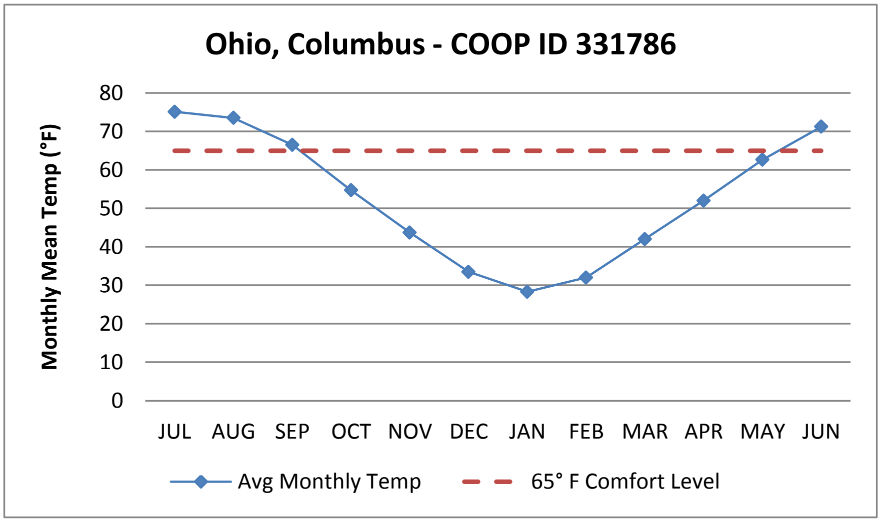
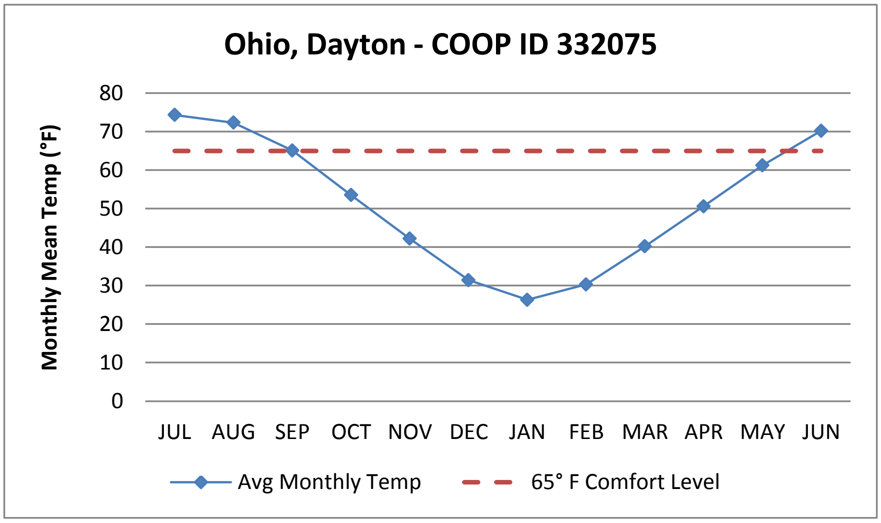
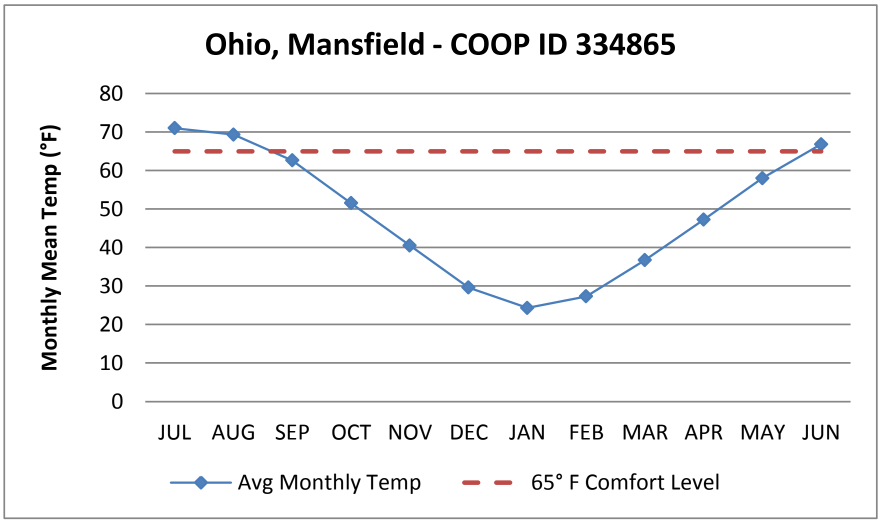
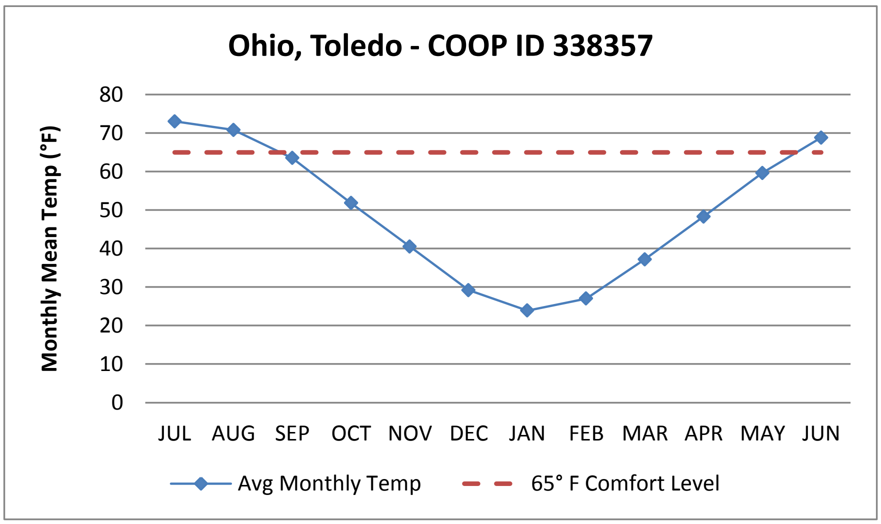


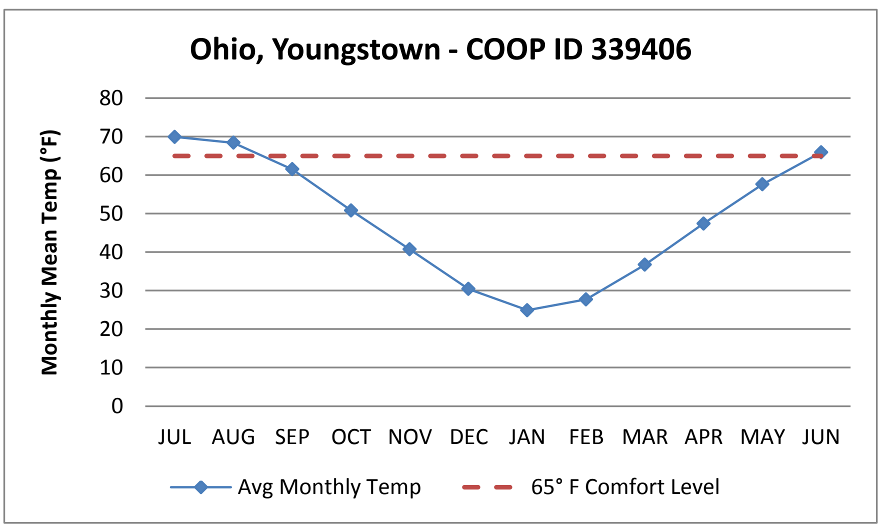




Appendix D, Weather Station Heating and Cooling Day Graphs







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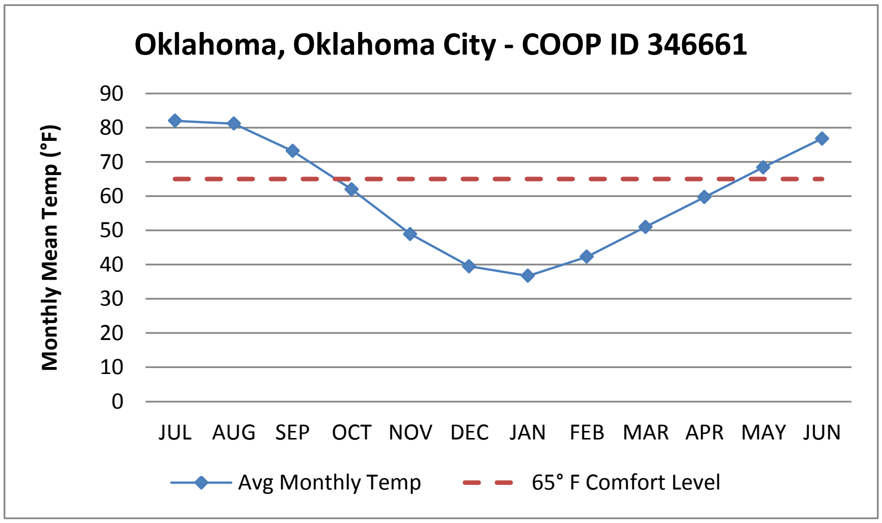

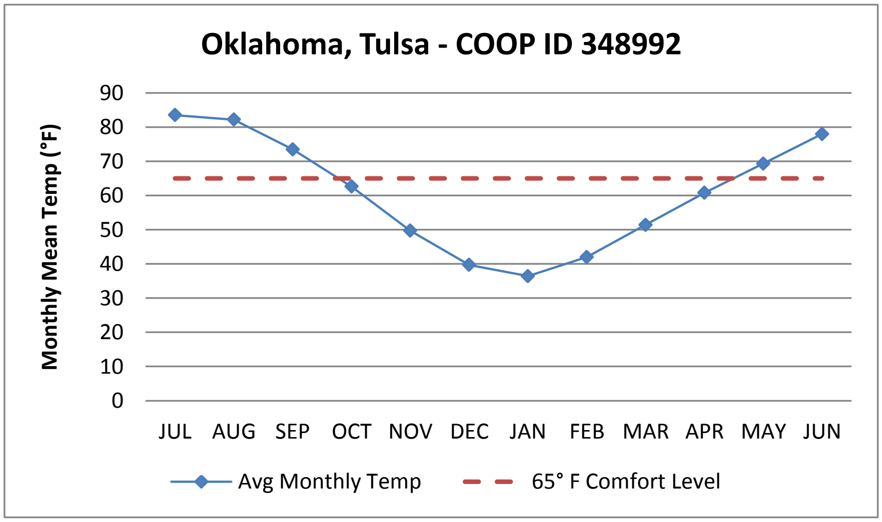

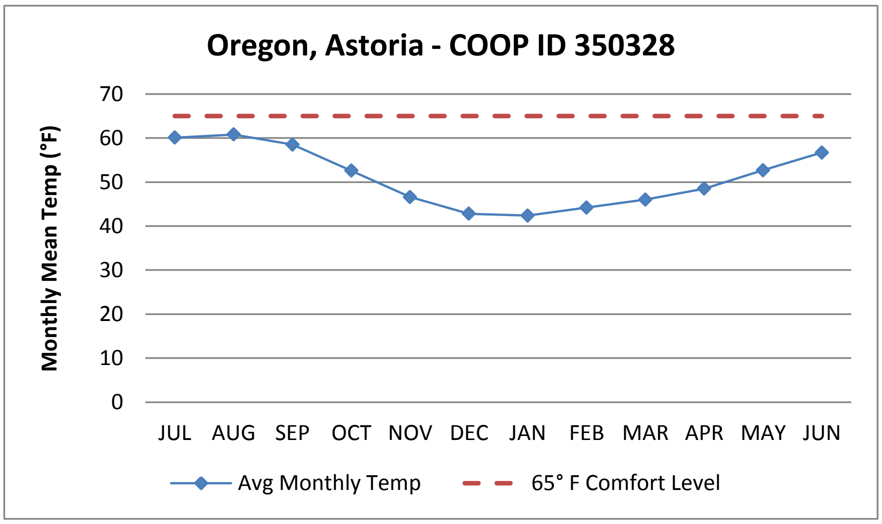

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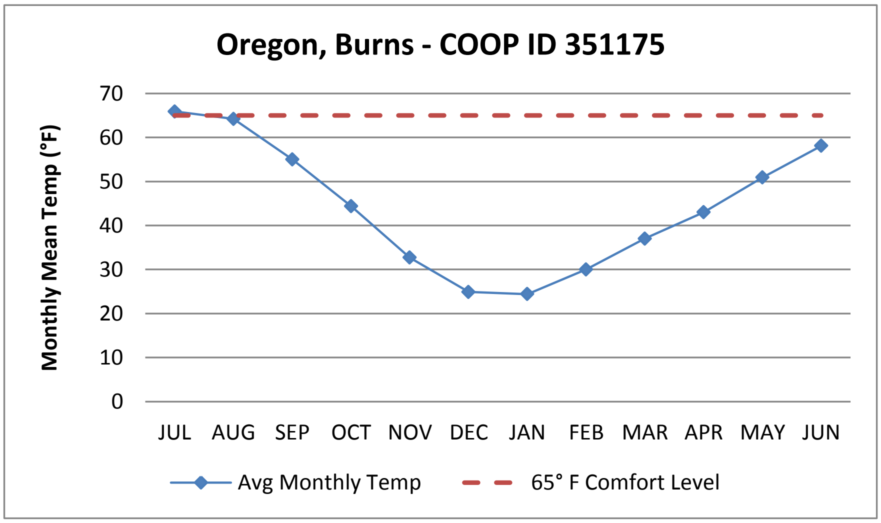

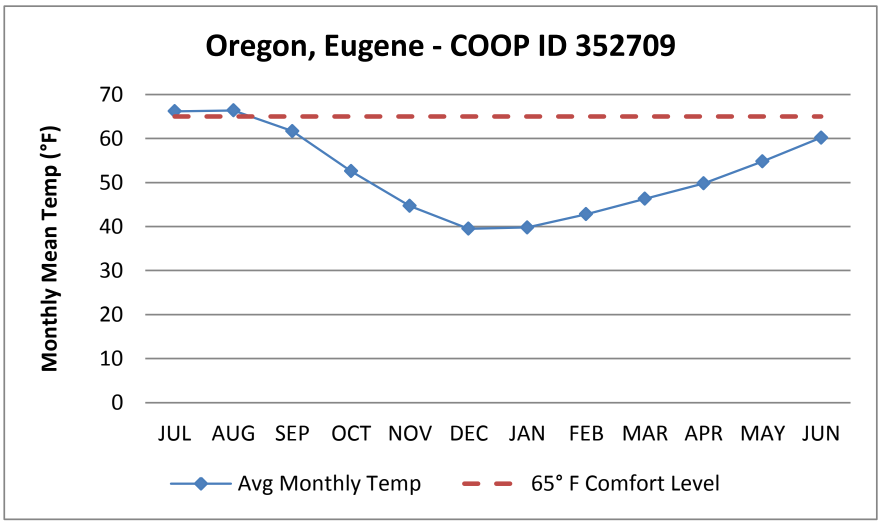

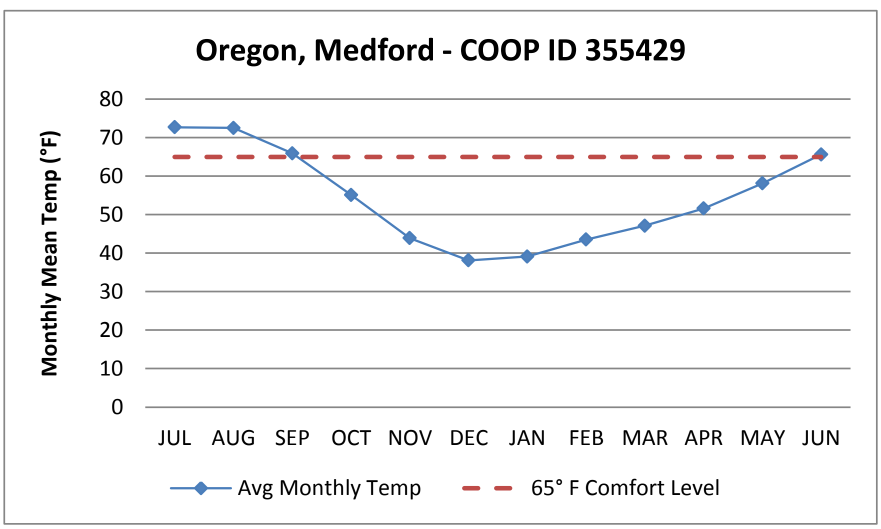

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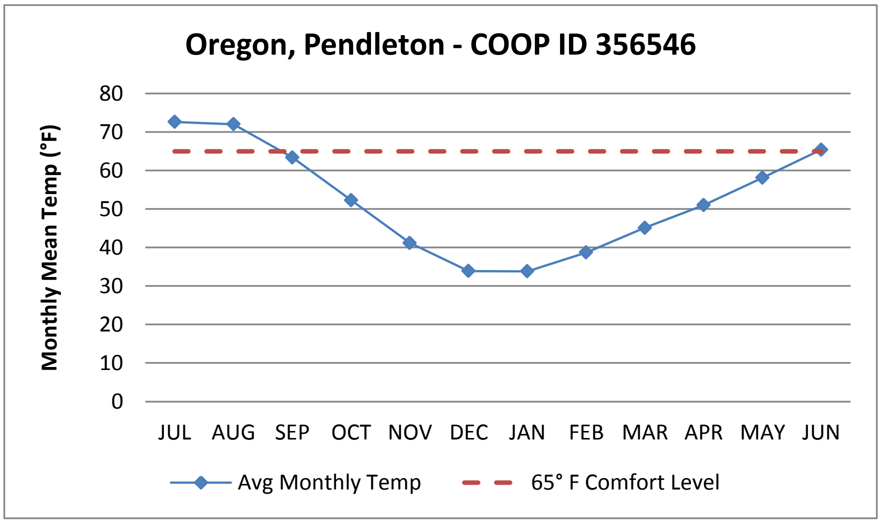

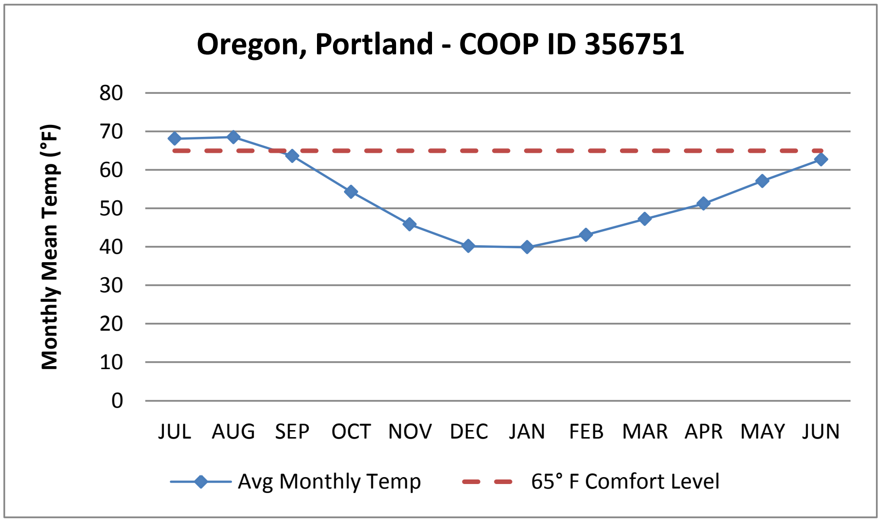

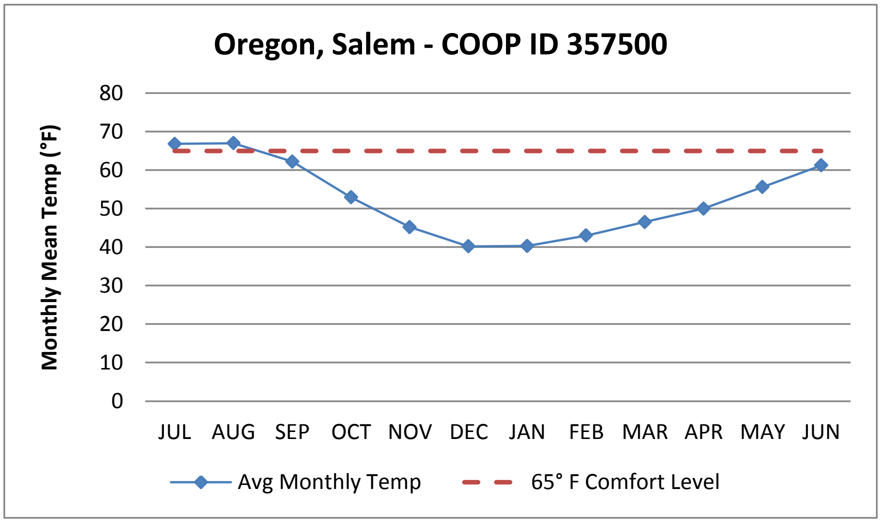

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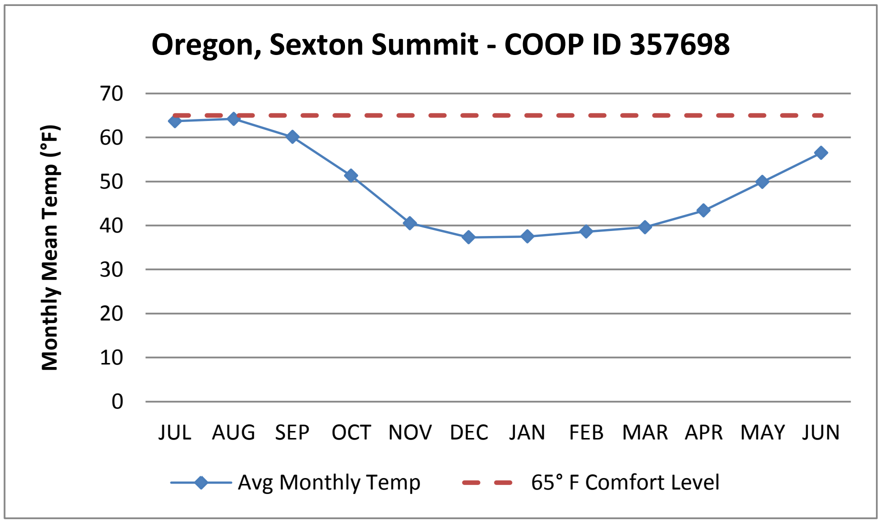

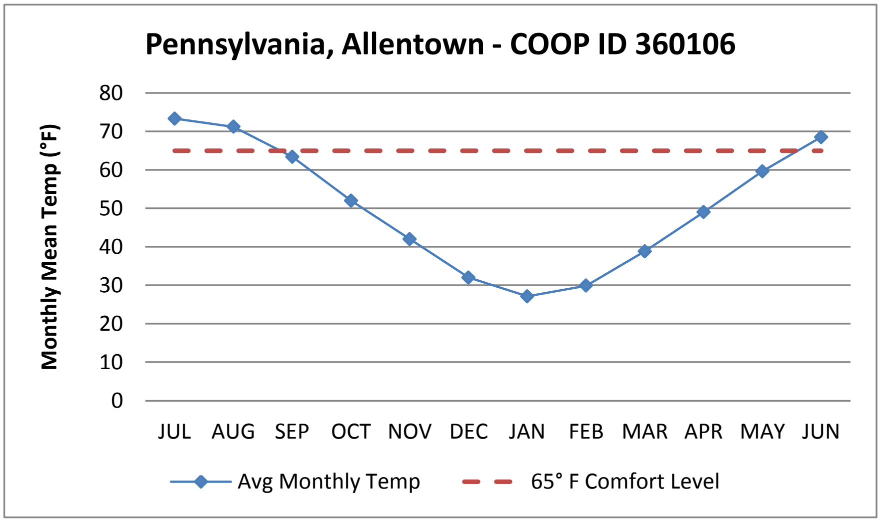

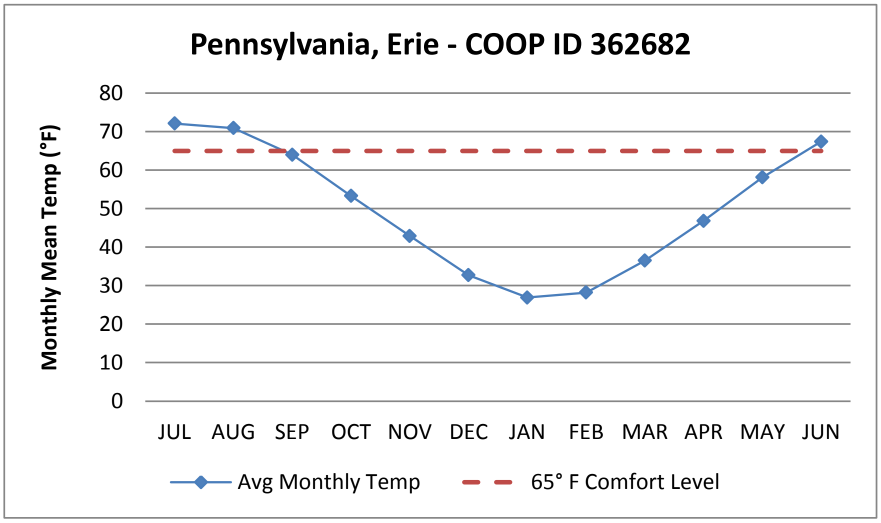

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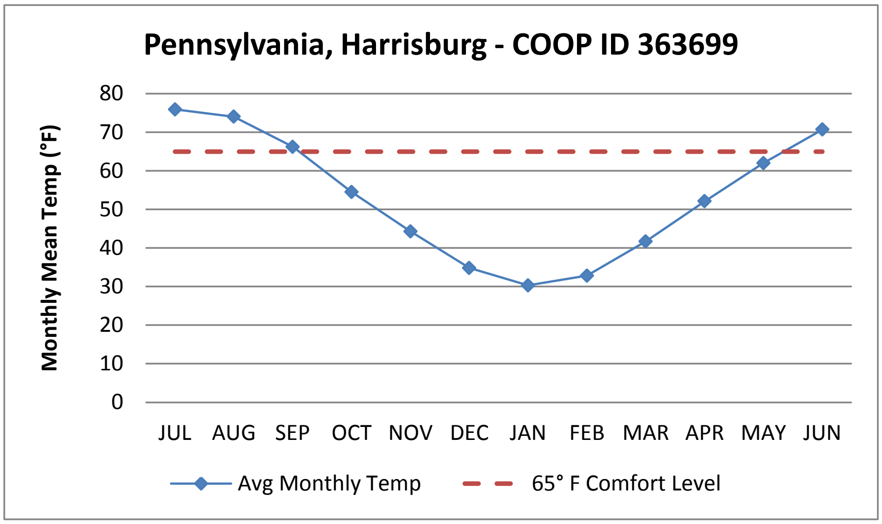

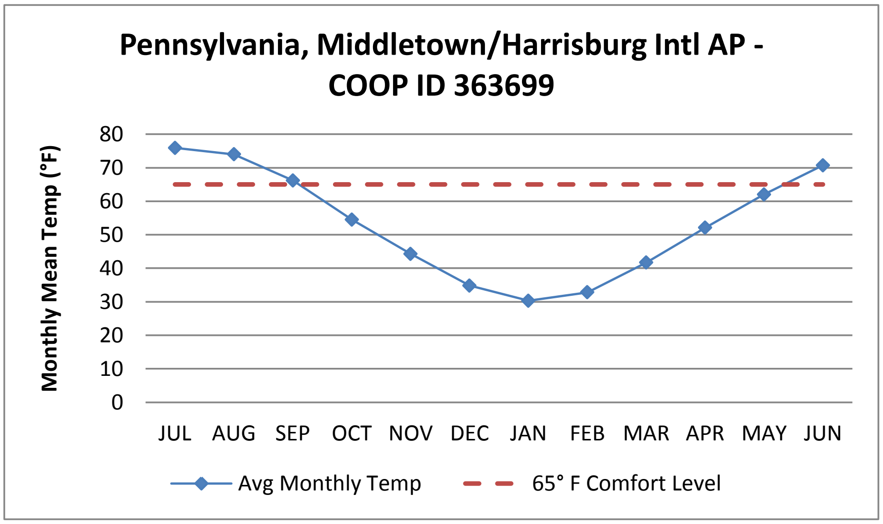

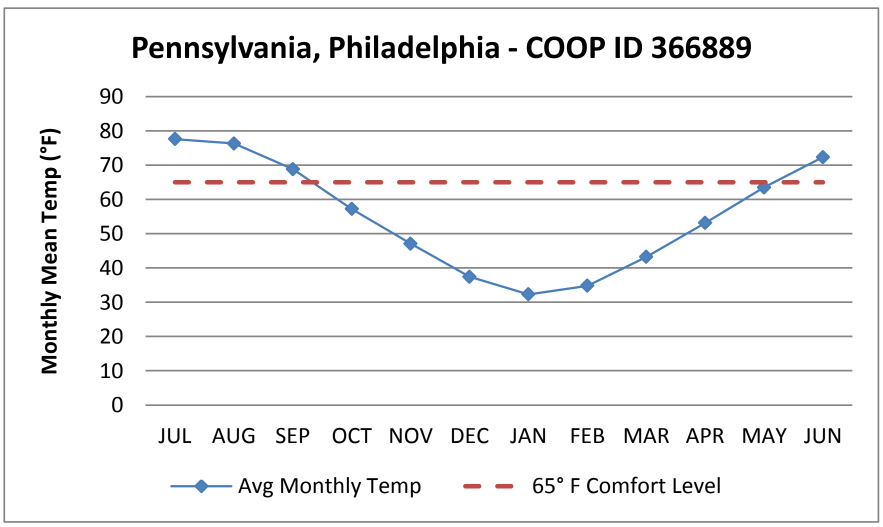

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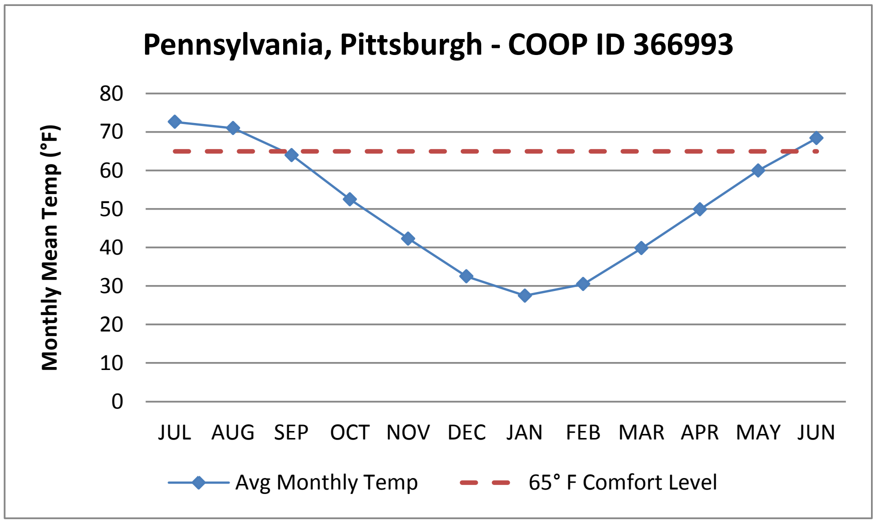

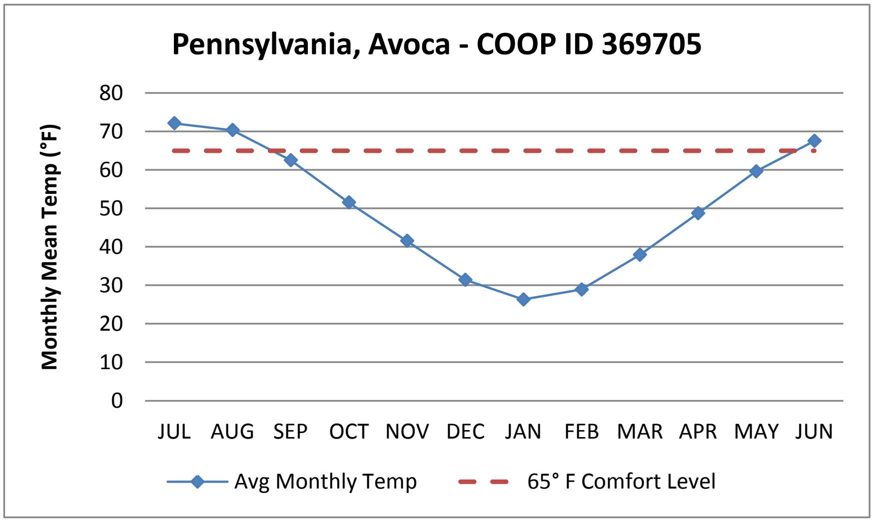

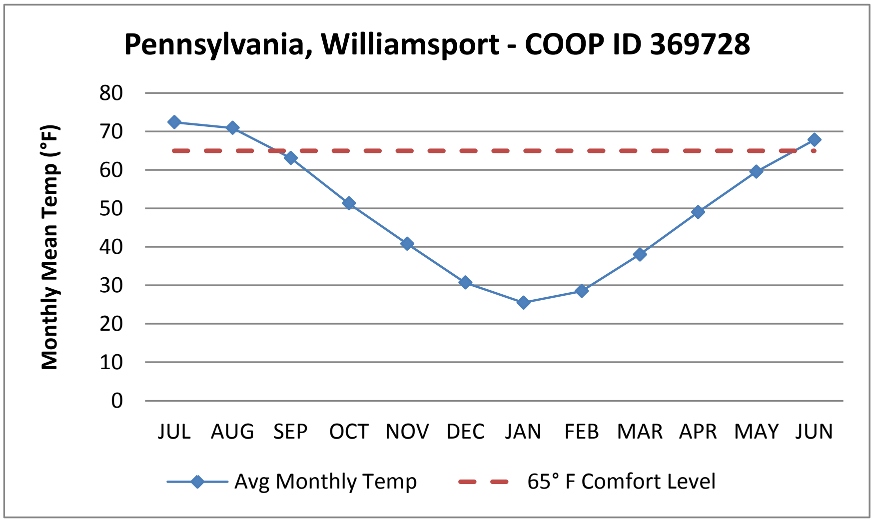

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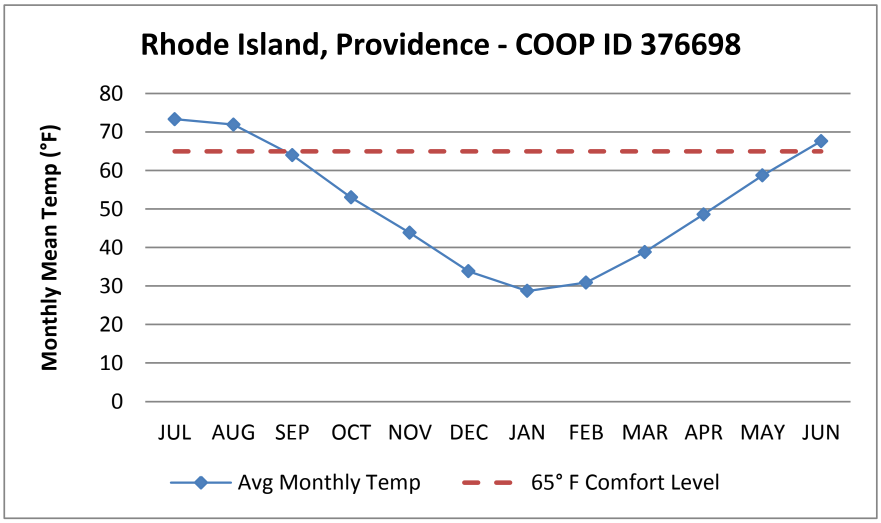

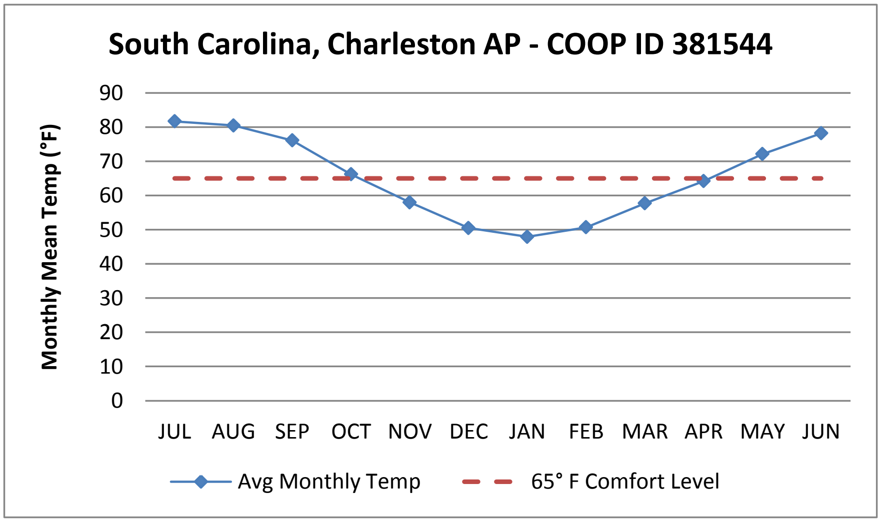

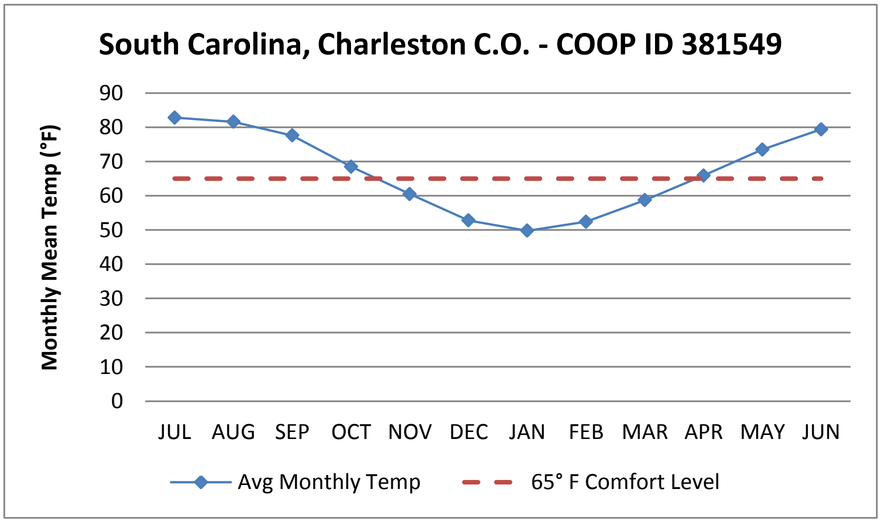

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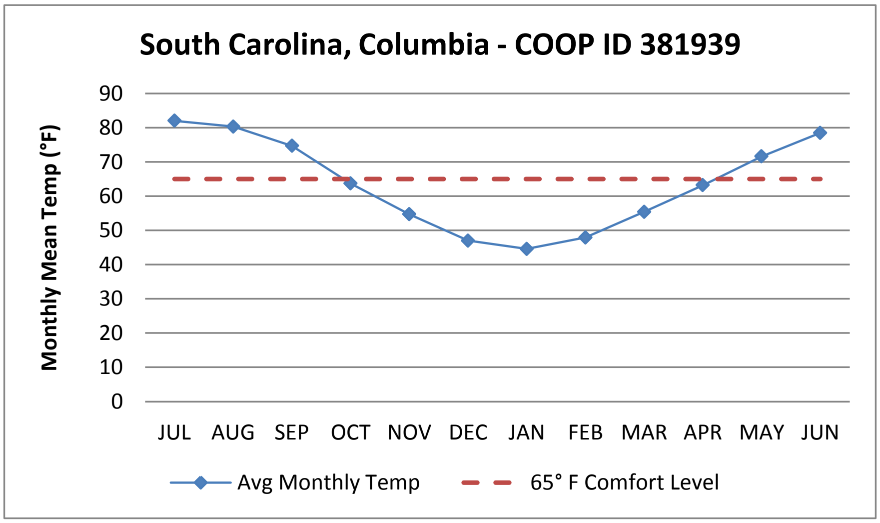

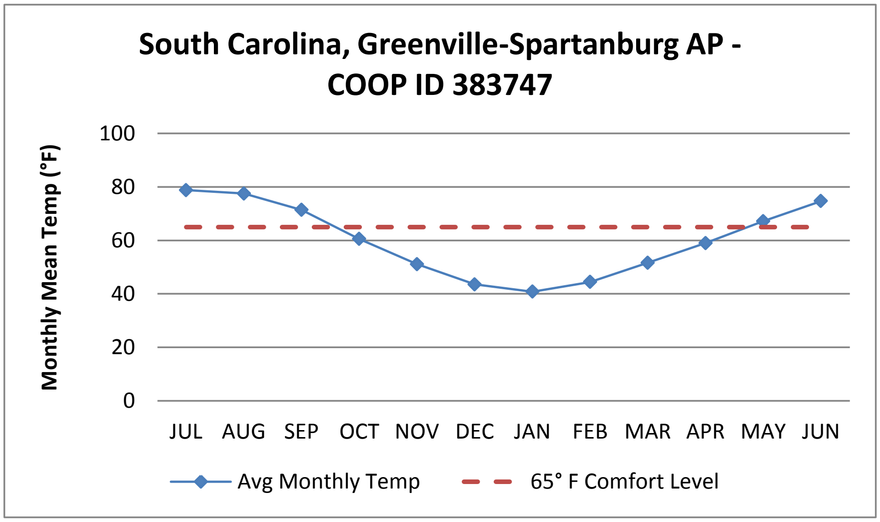

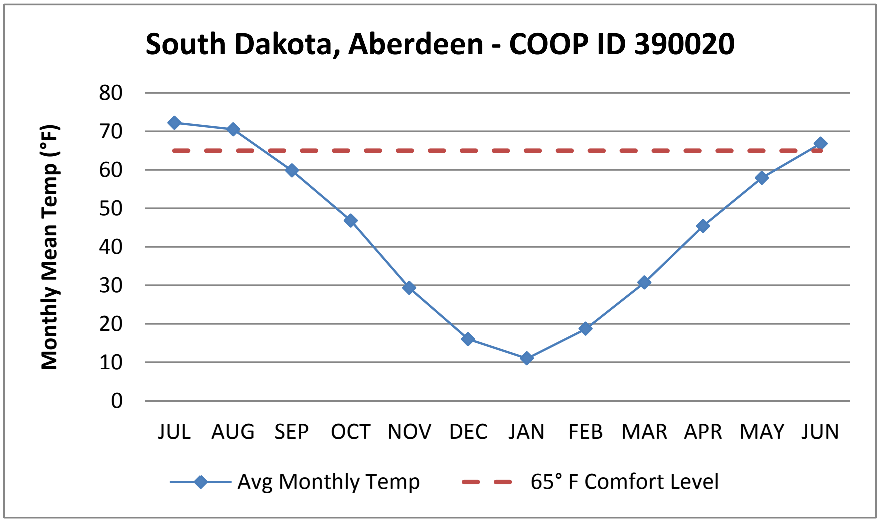

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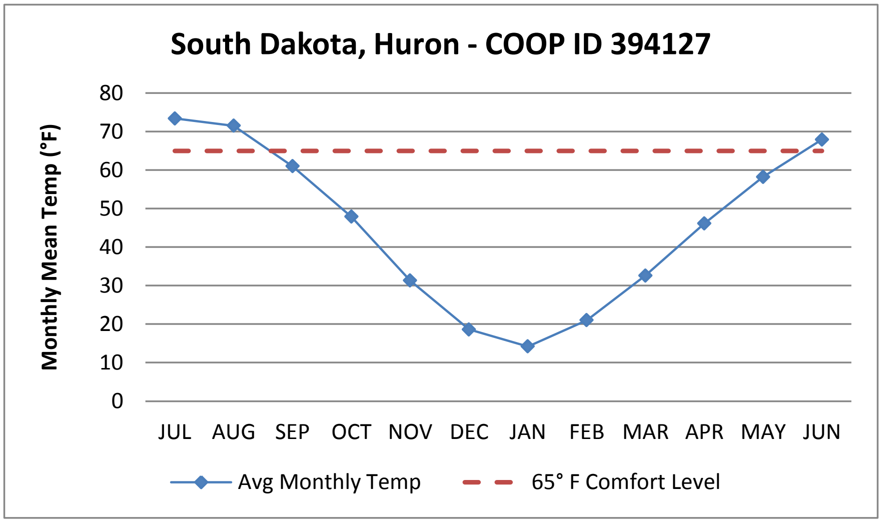

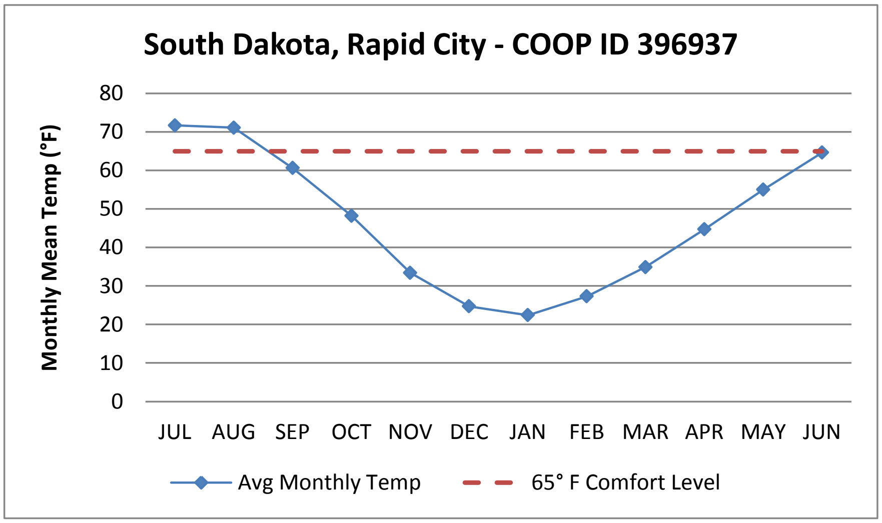

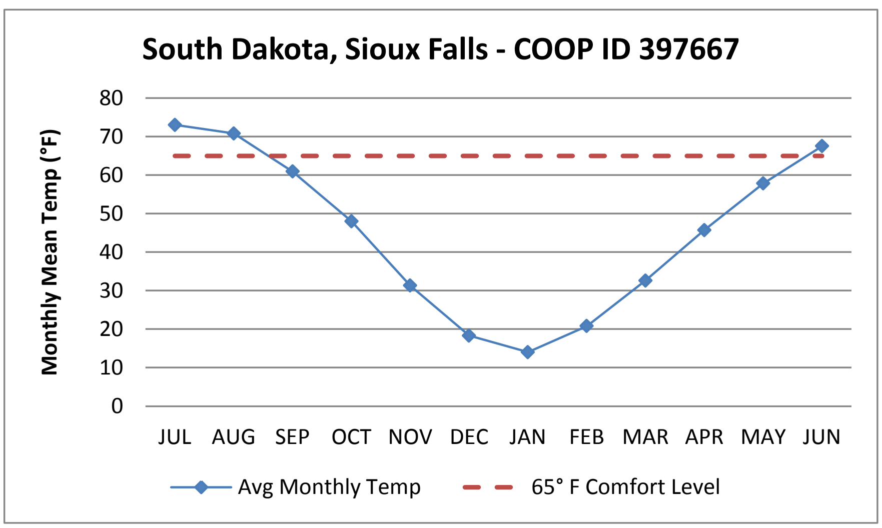

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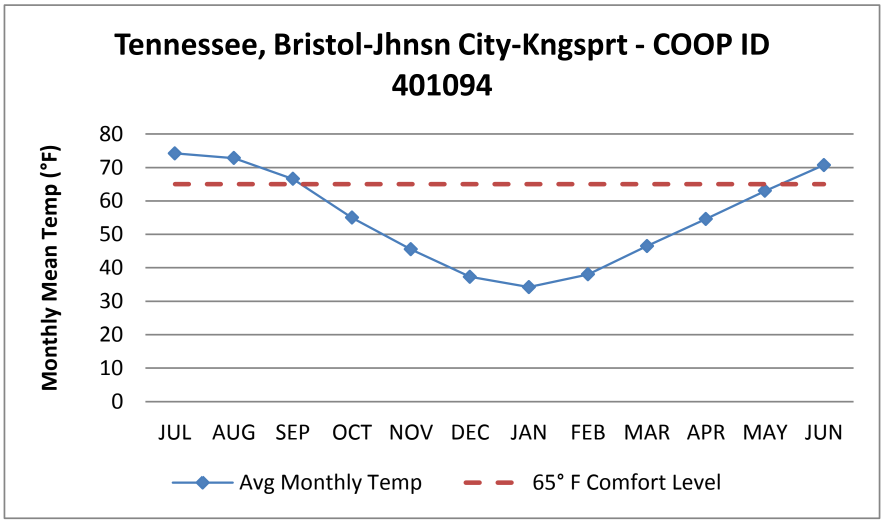

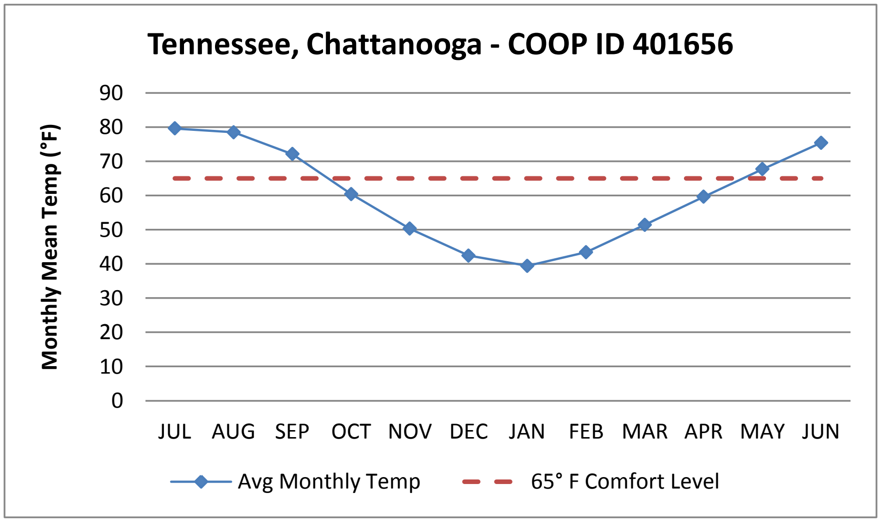

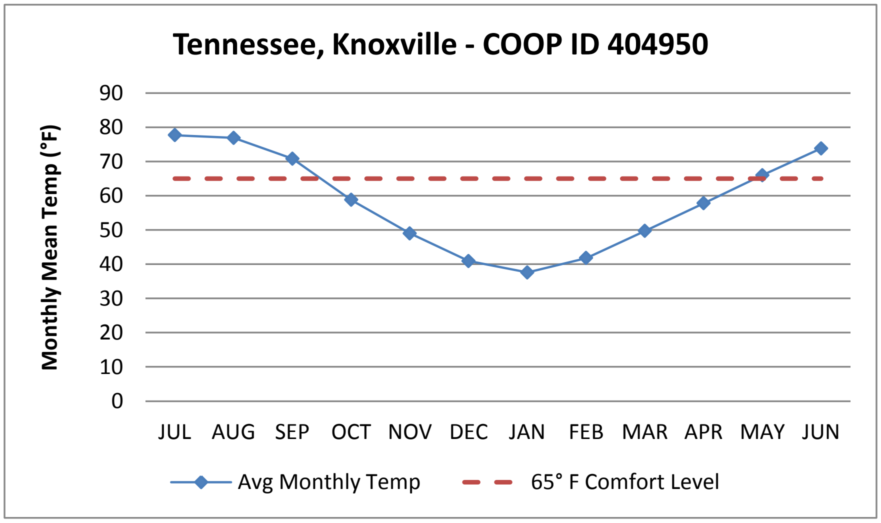

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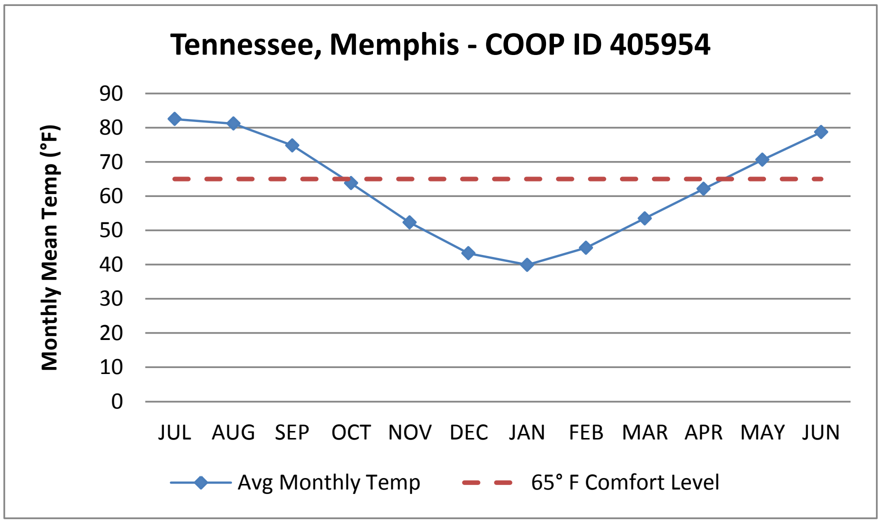

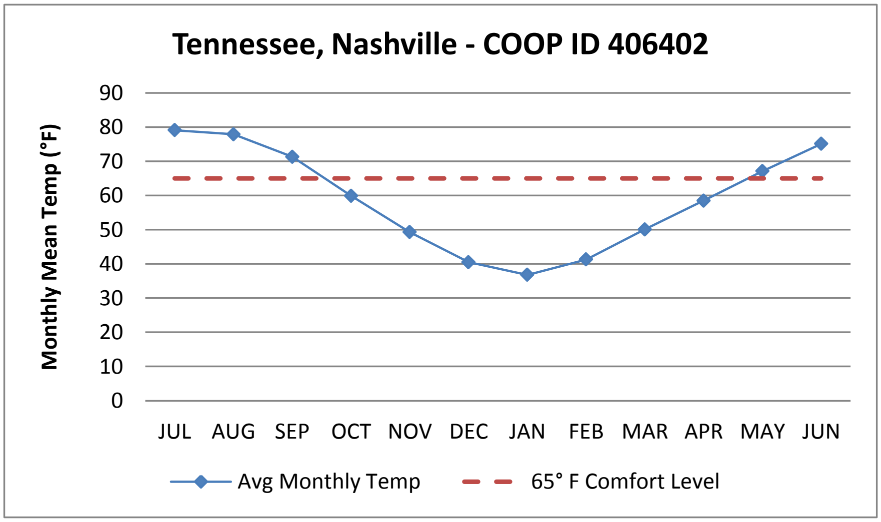

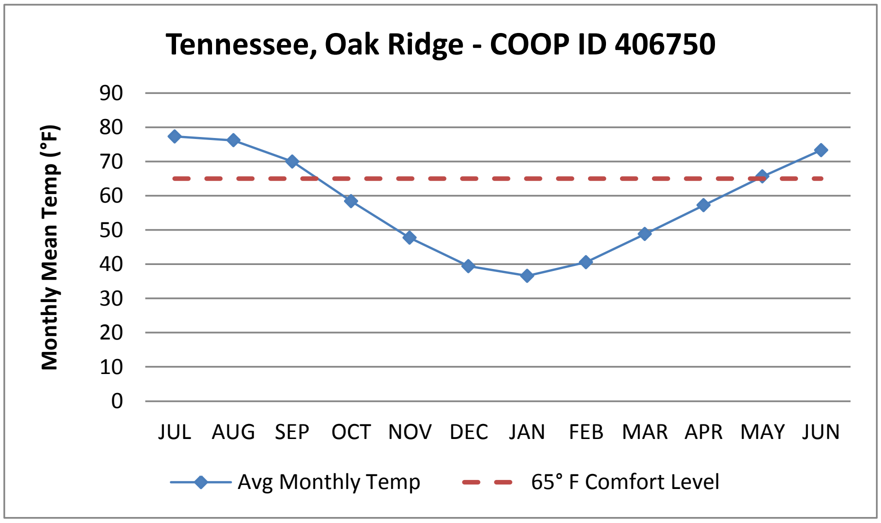

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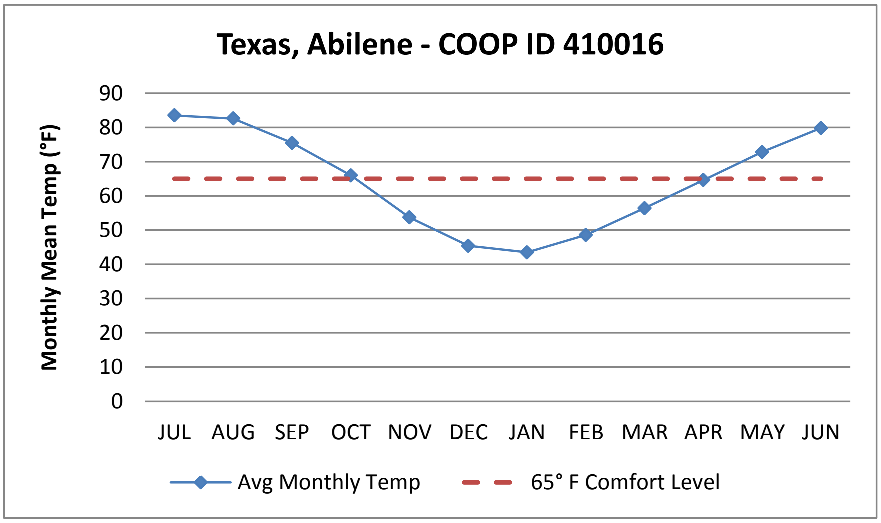

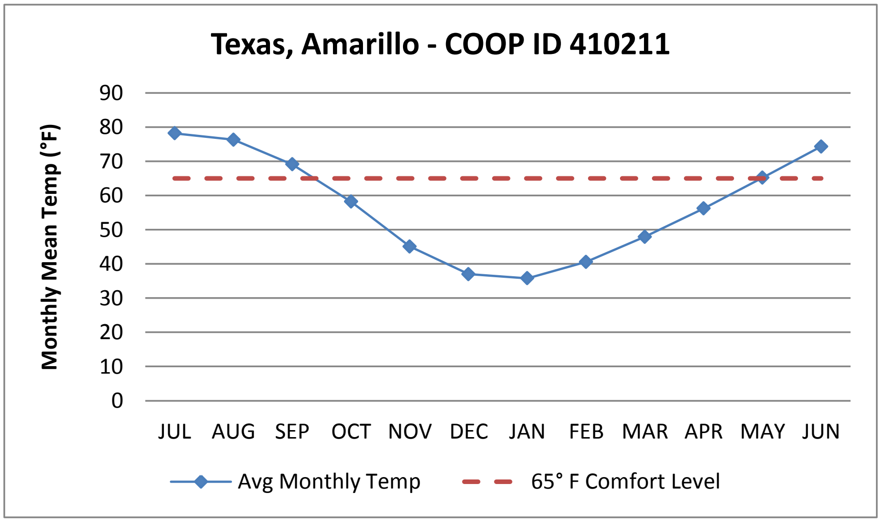

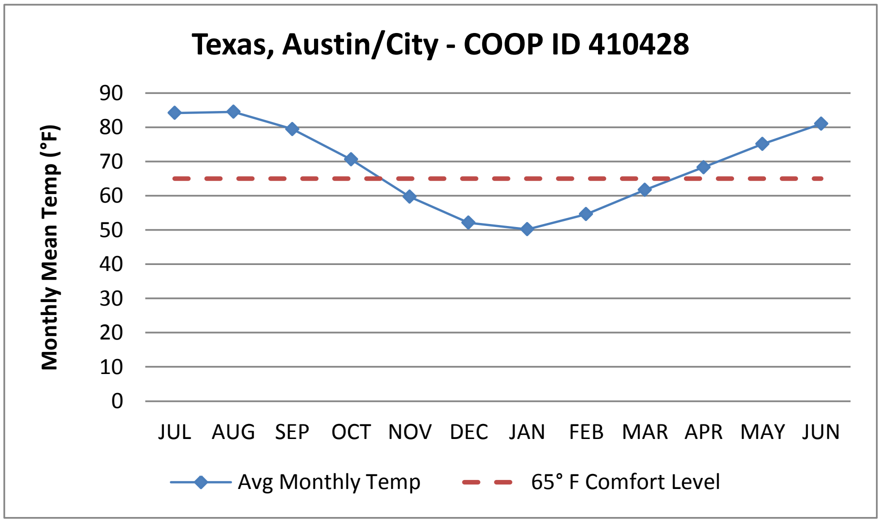

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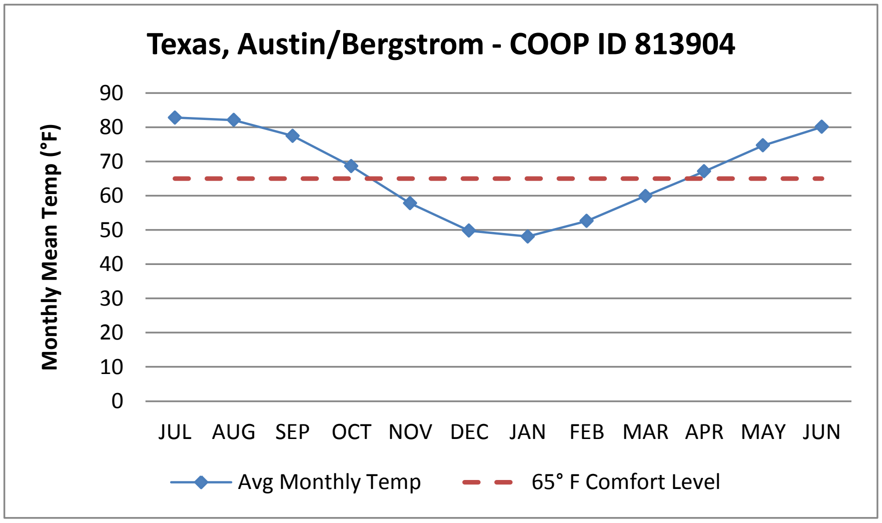

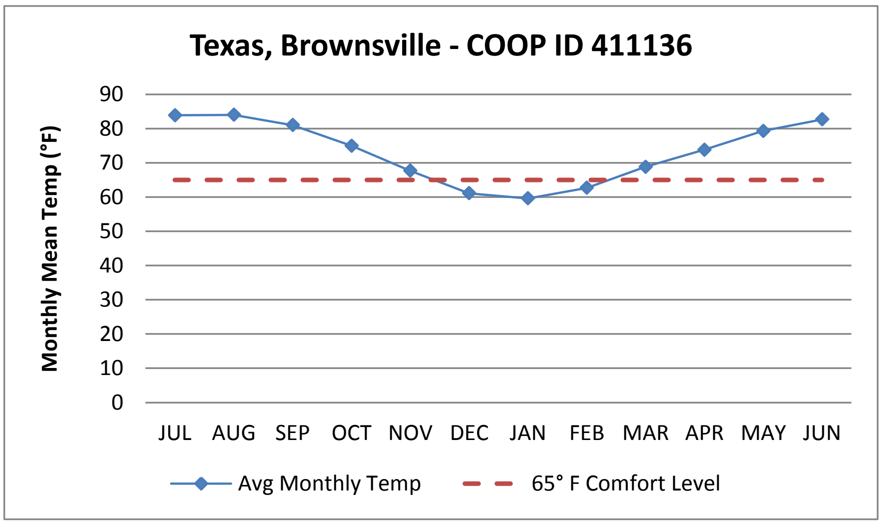

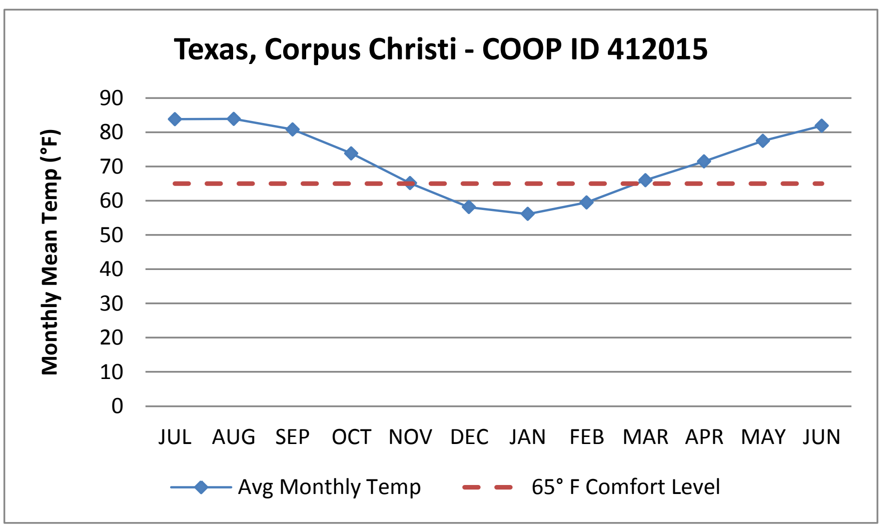

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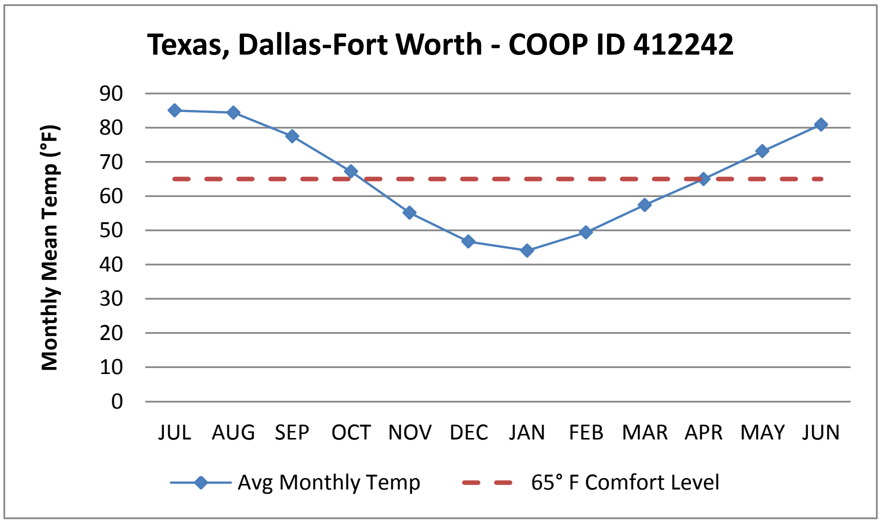

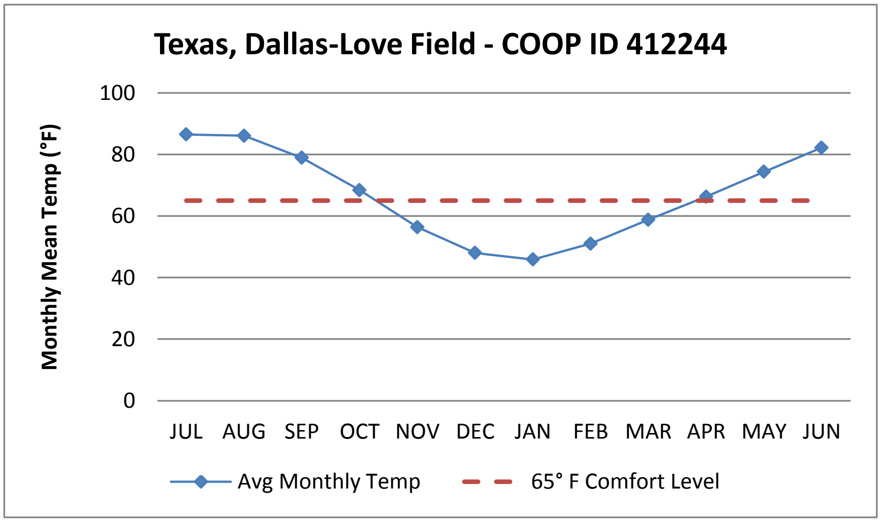

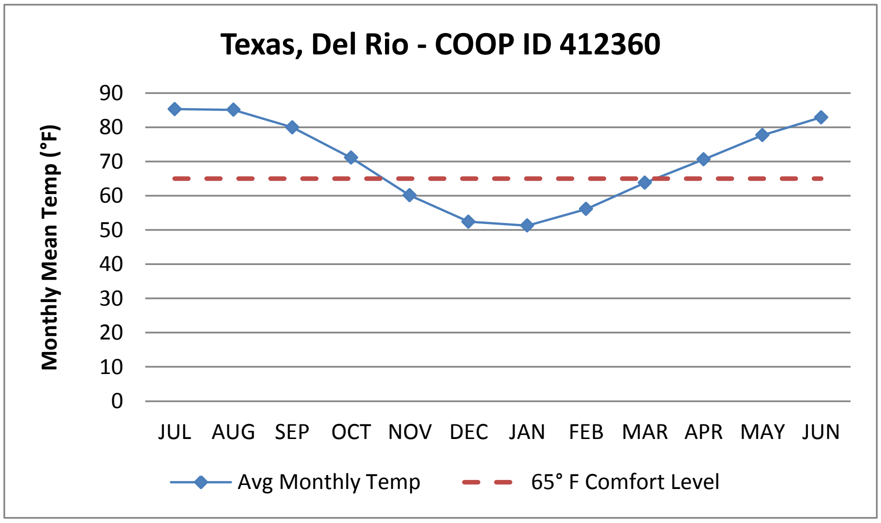

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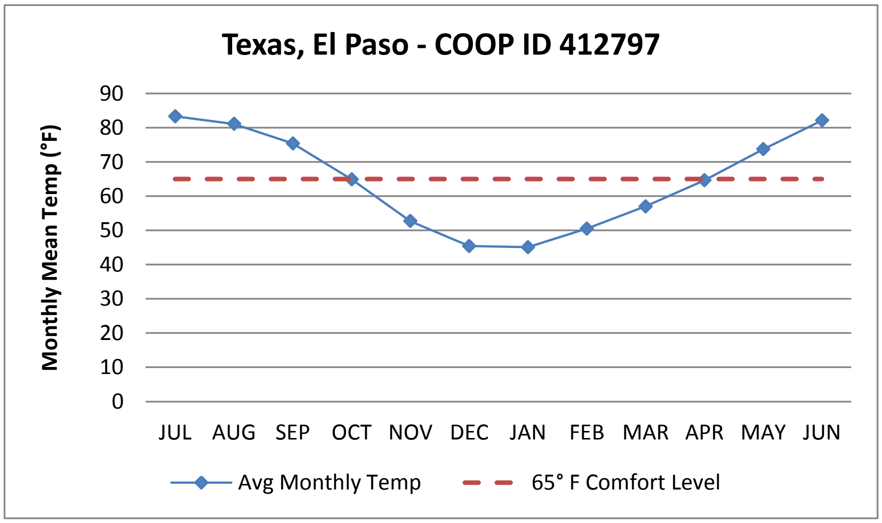

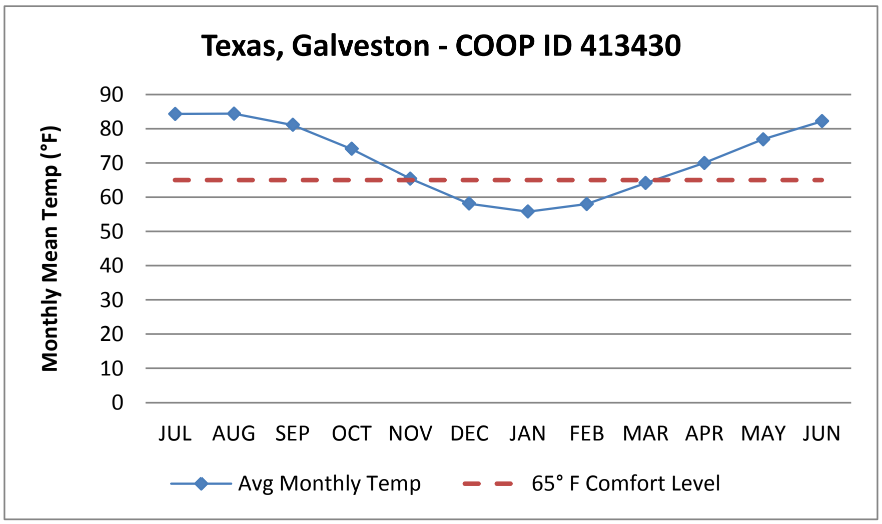

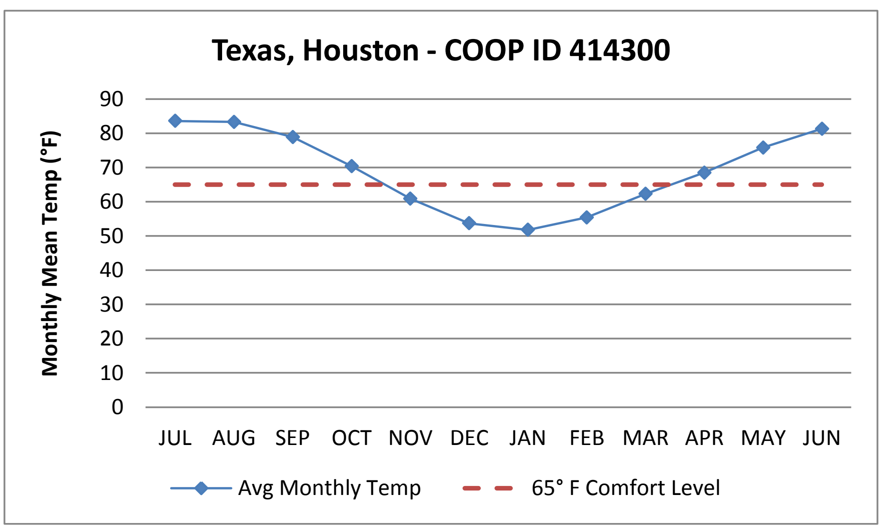

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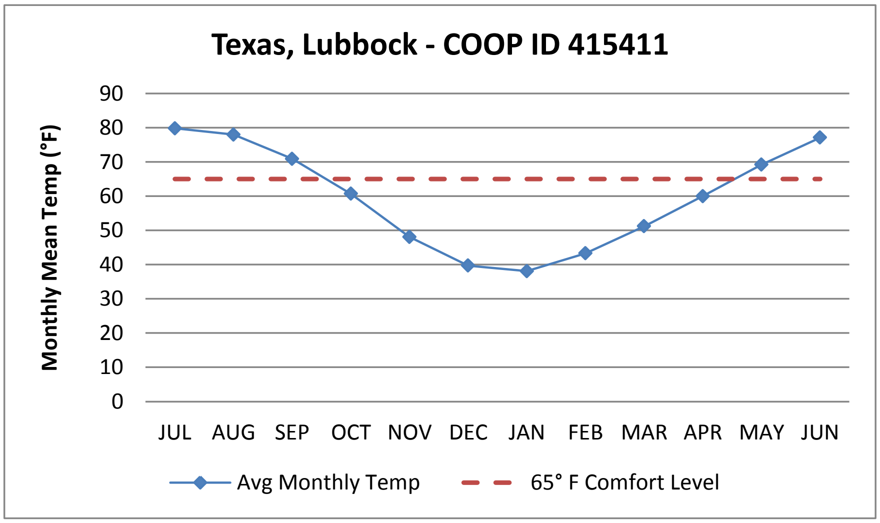

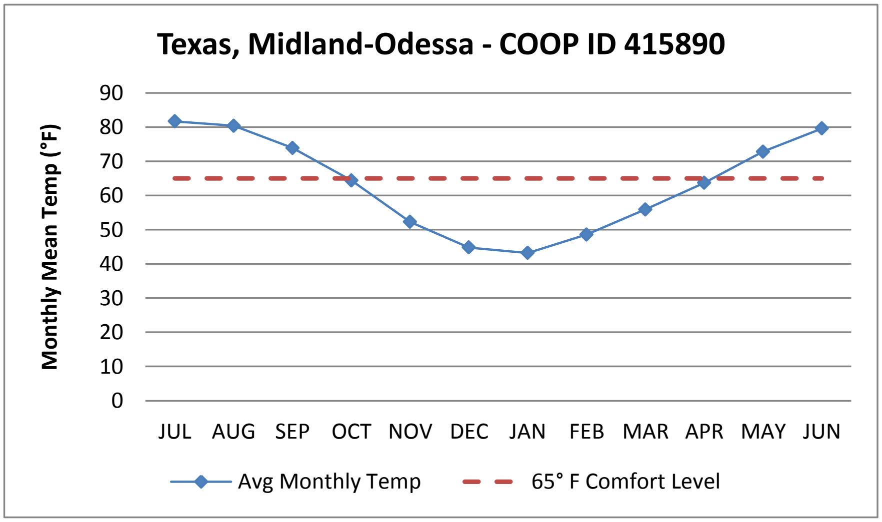

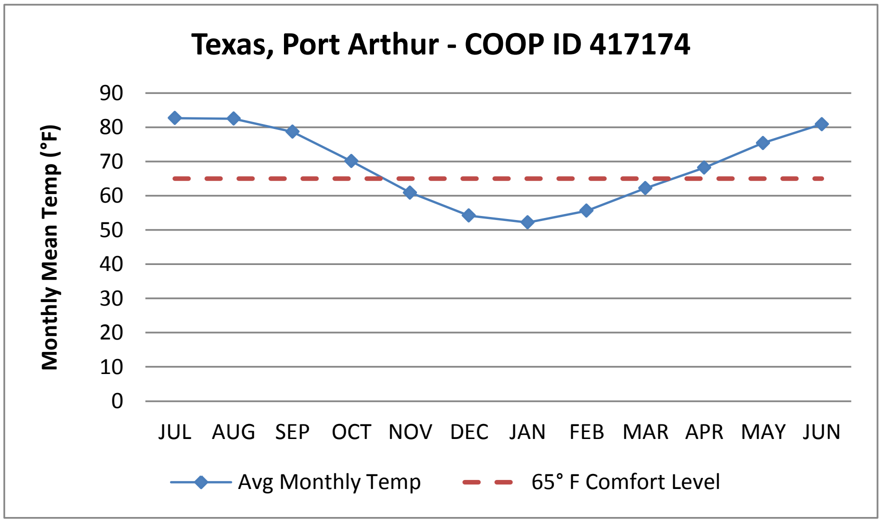

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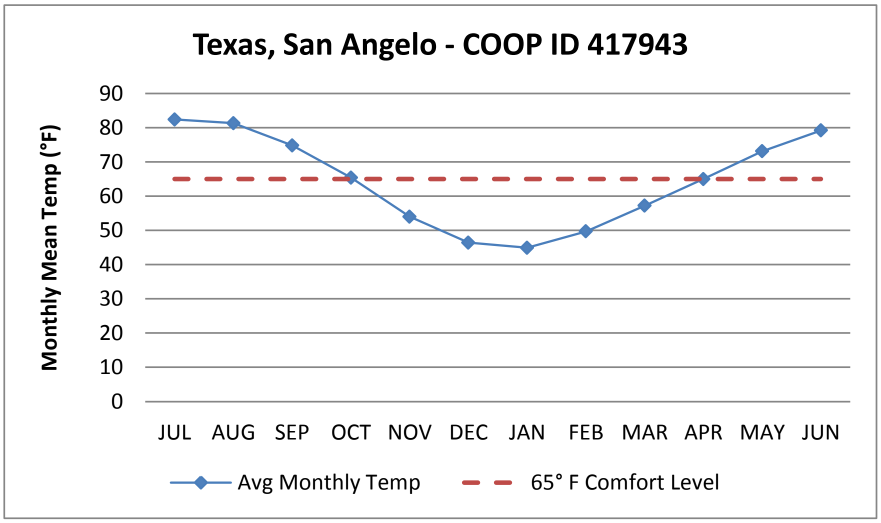

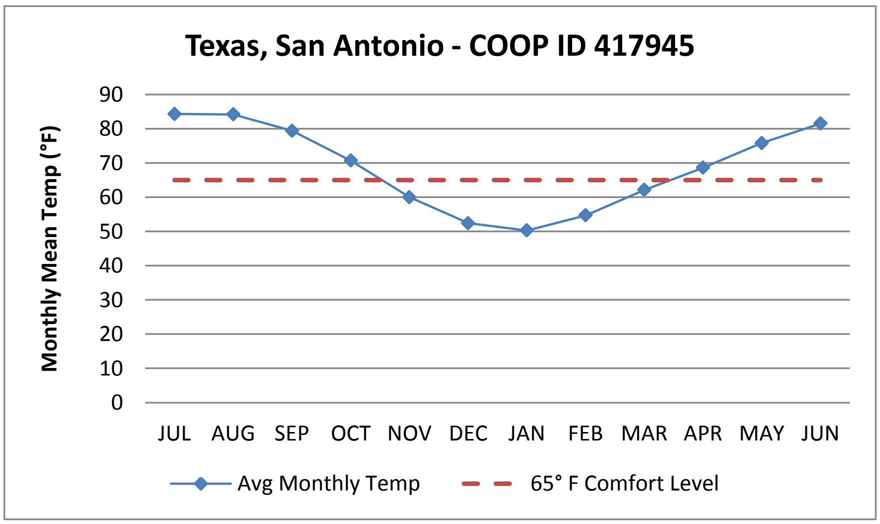

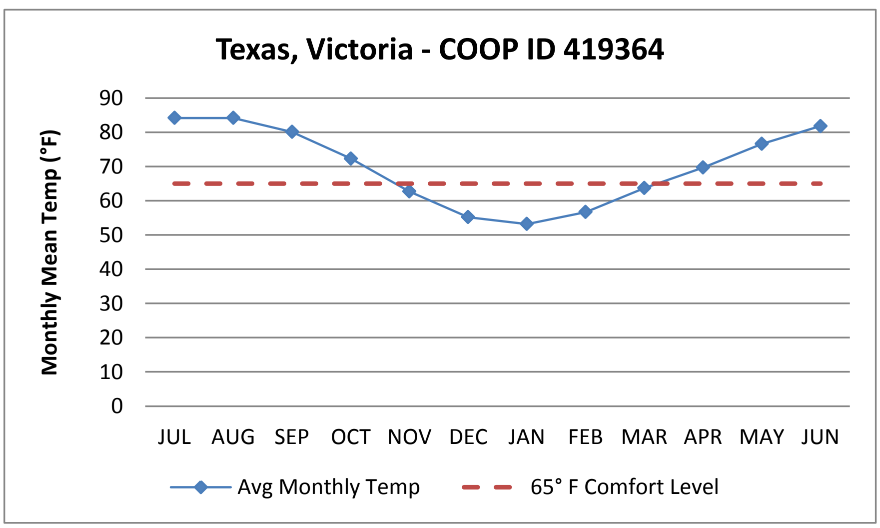

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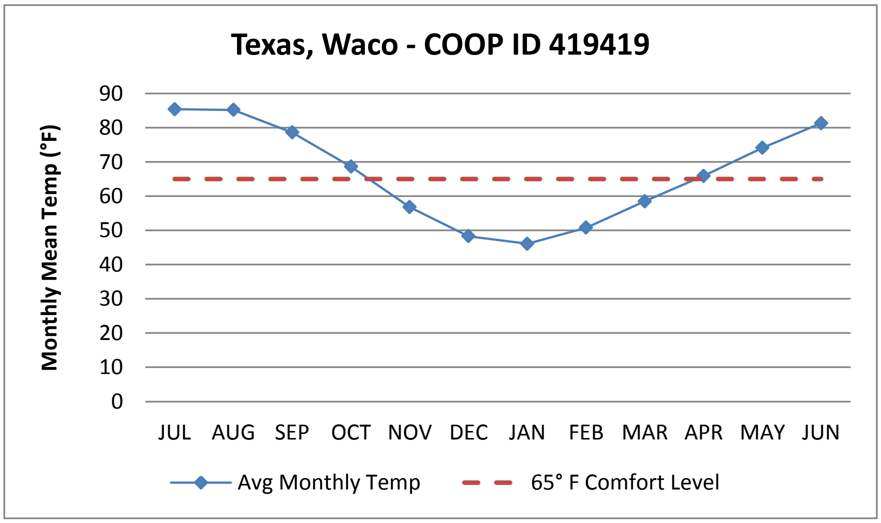

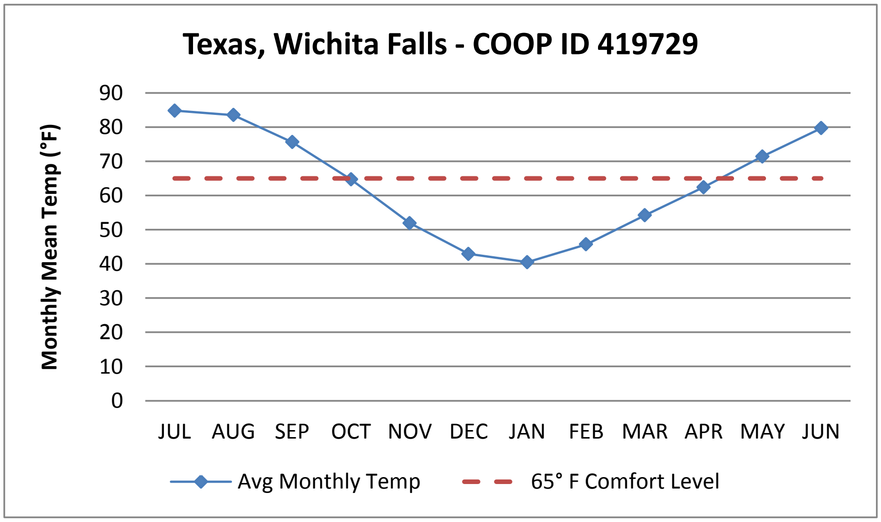

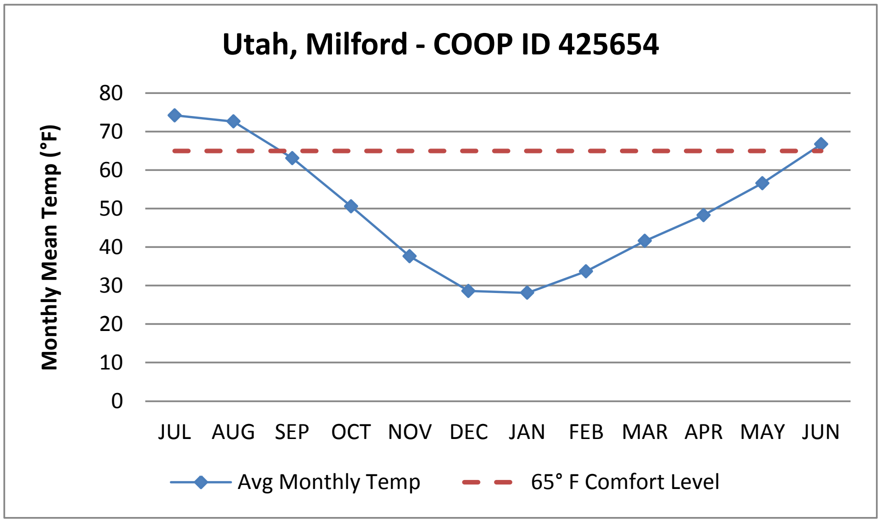

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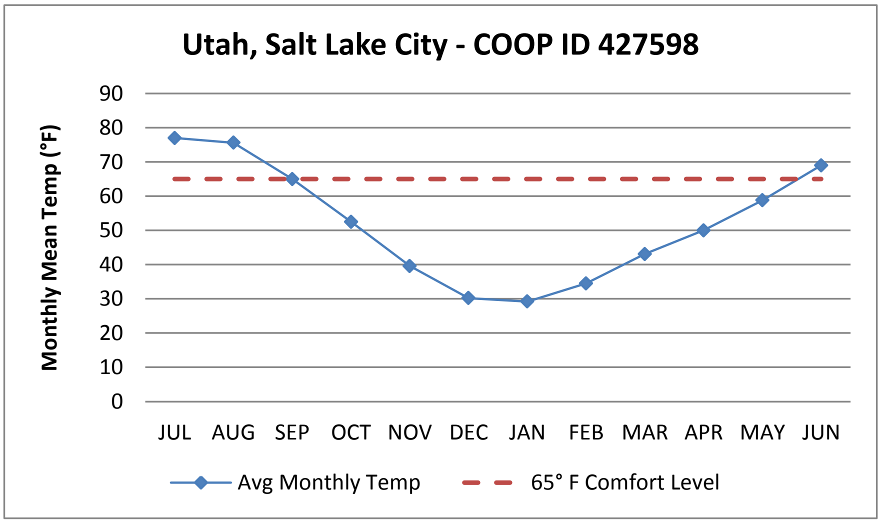

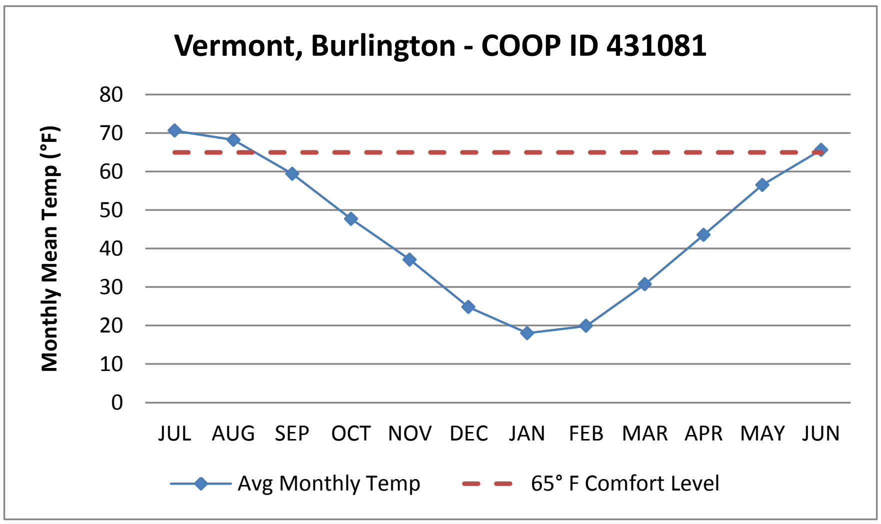

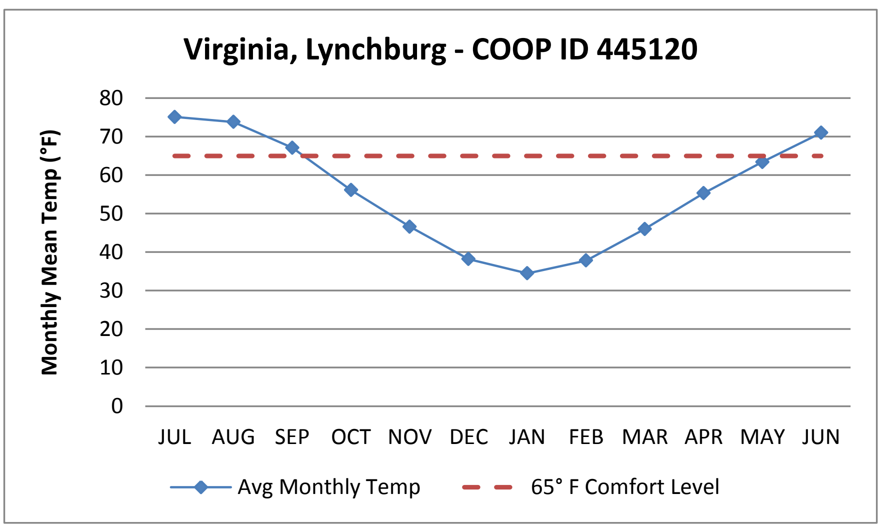

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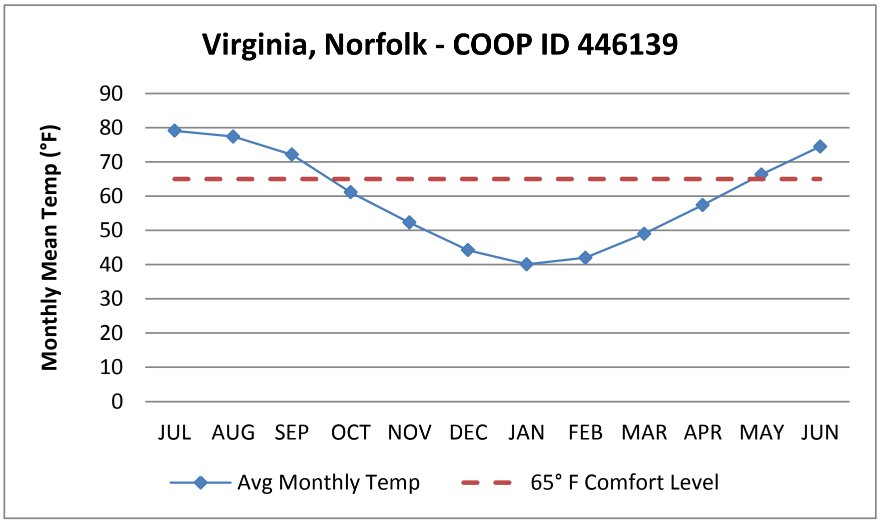

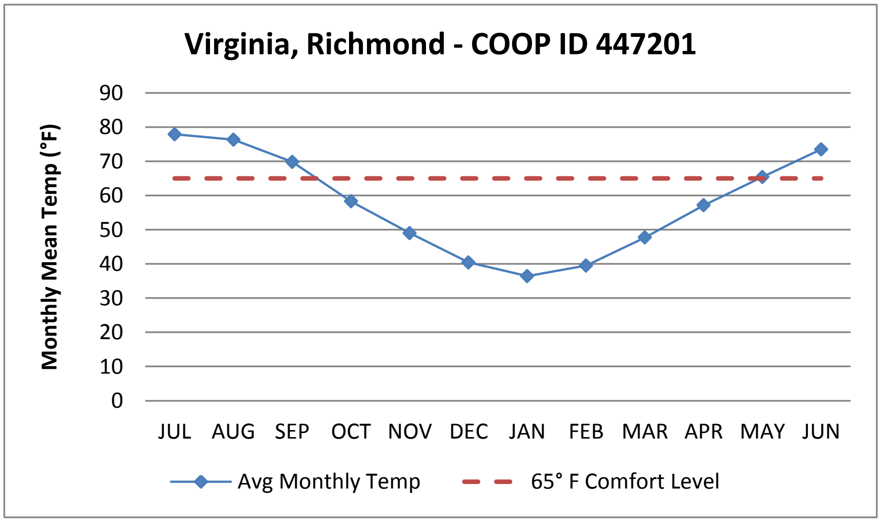

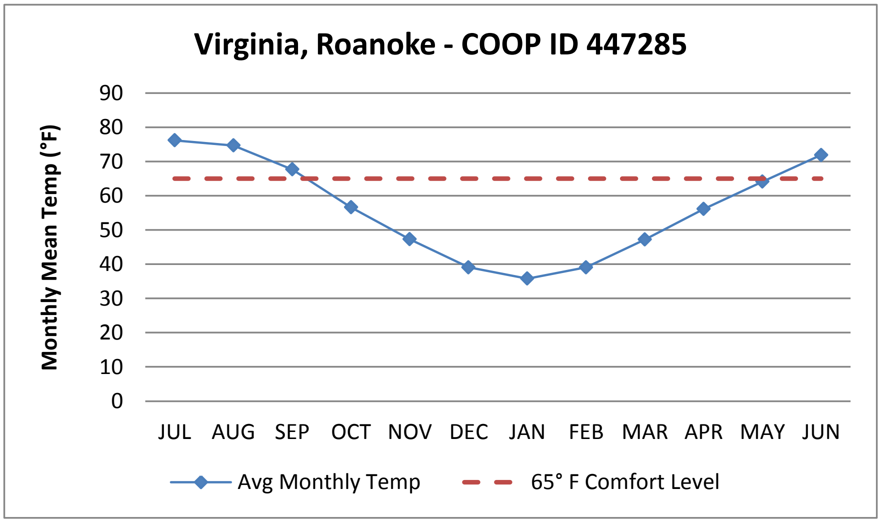

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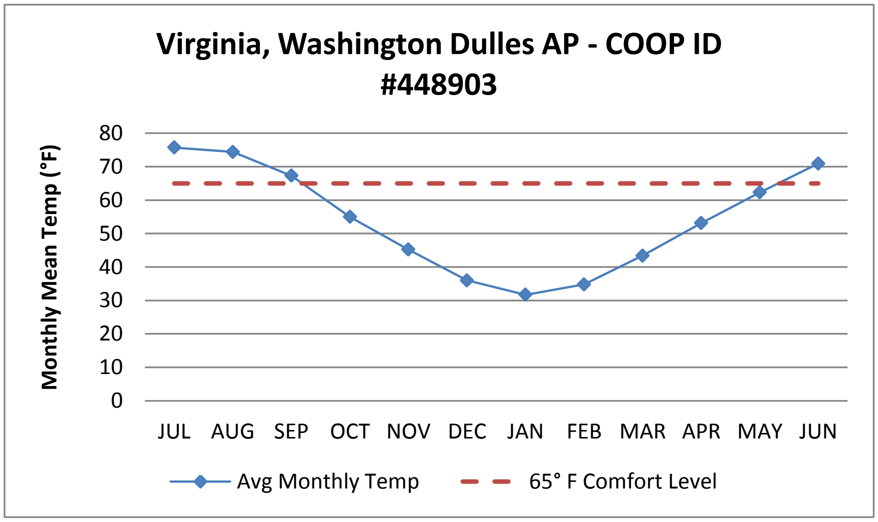

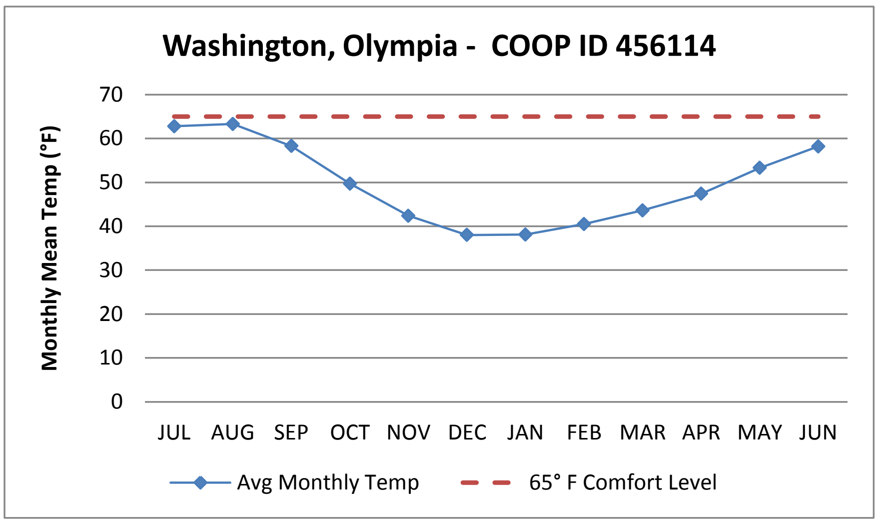

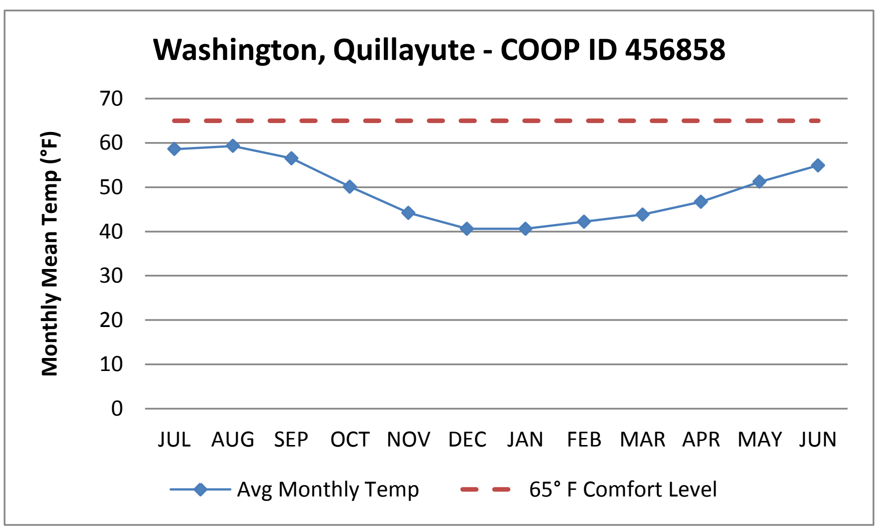

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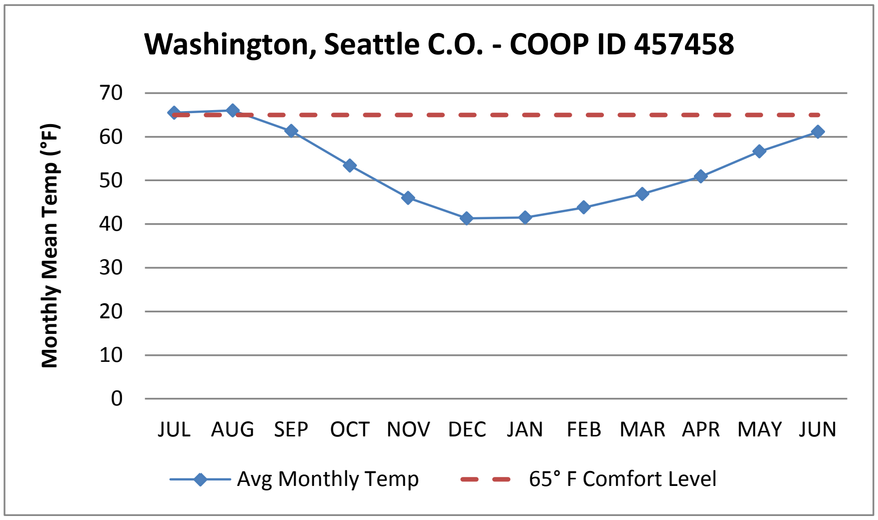

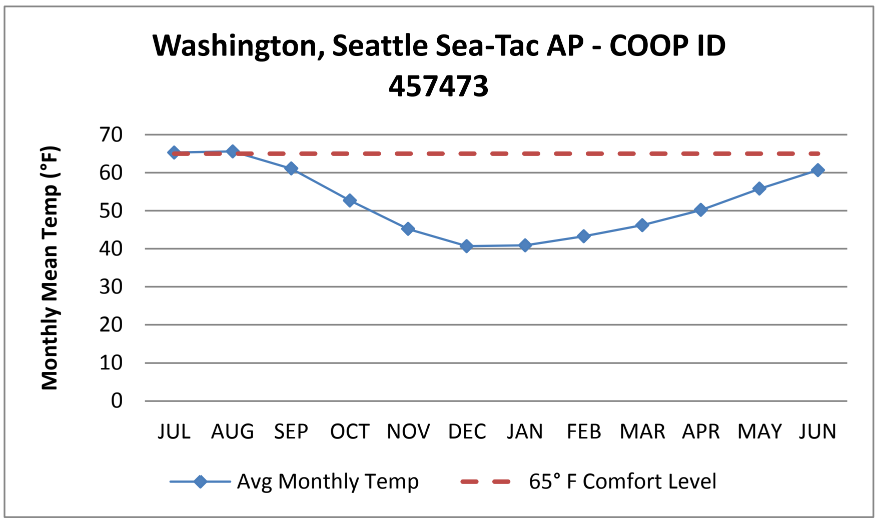

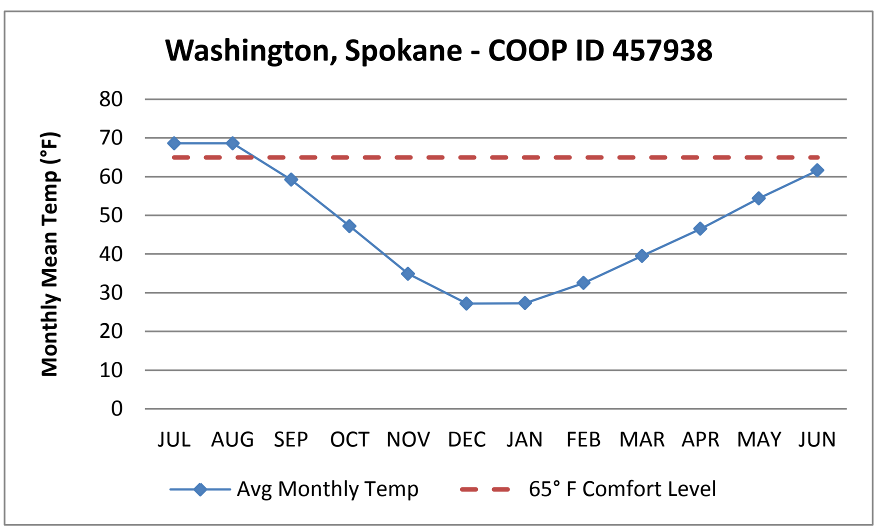

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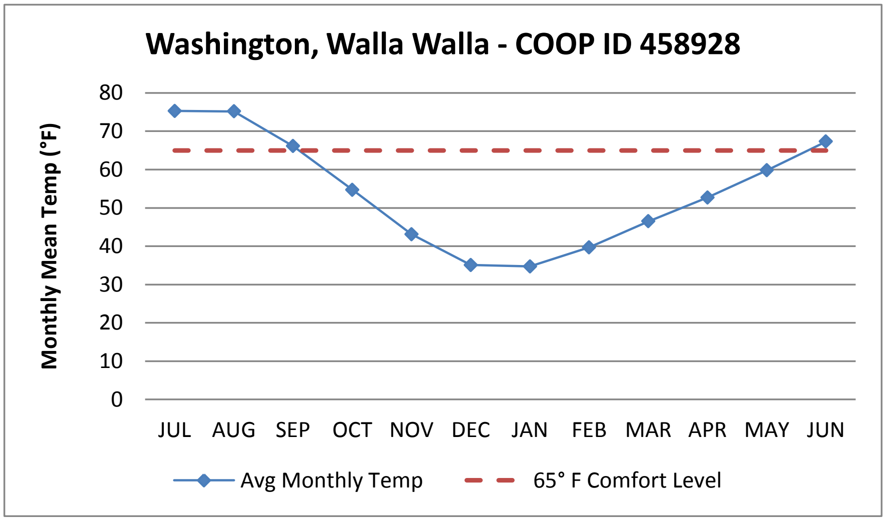
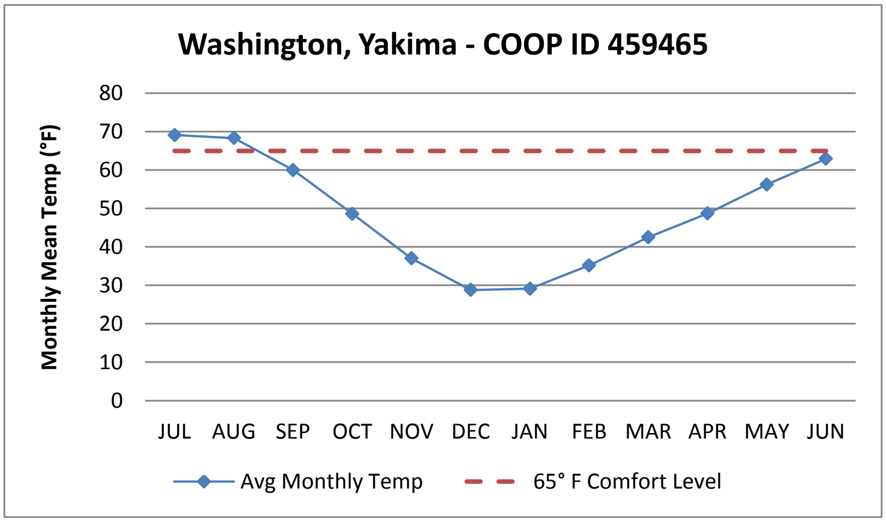
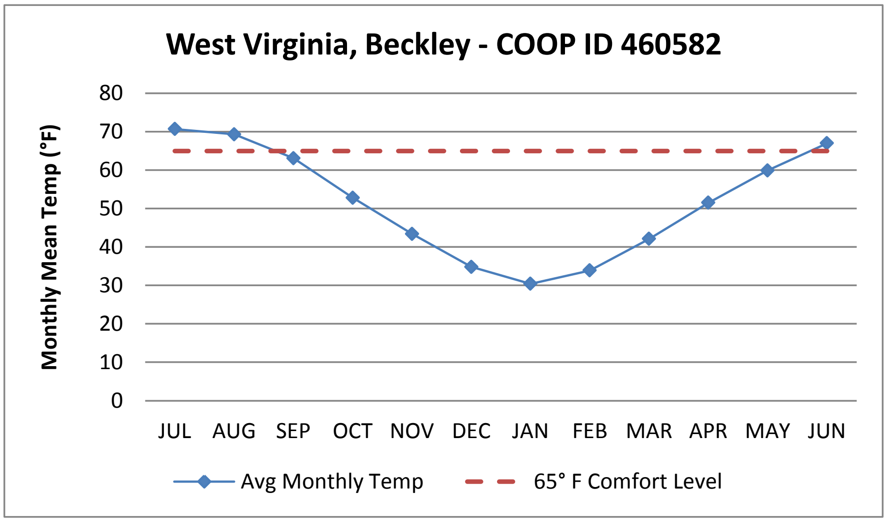
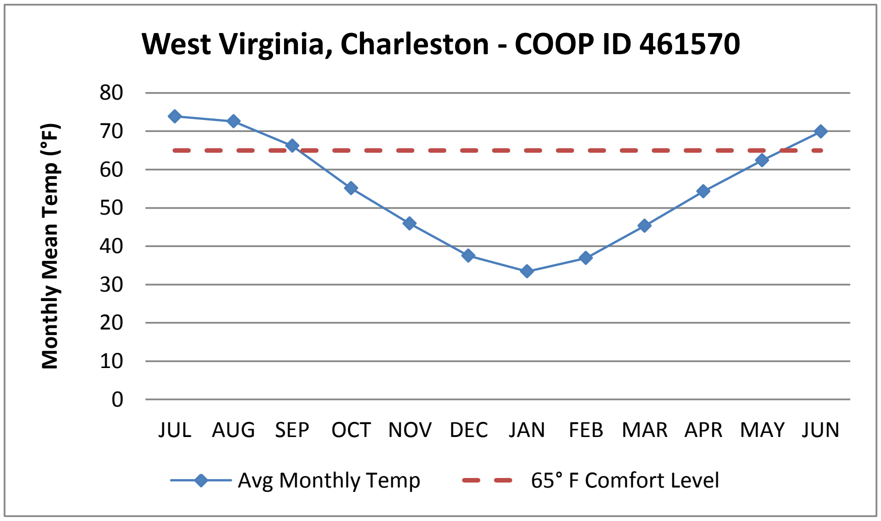
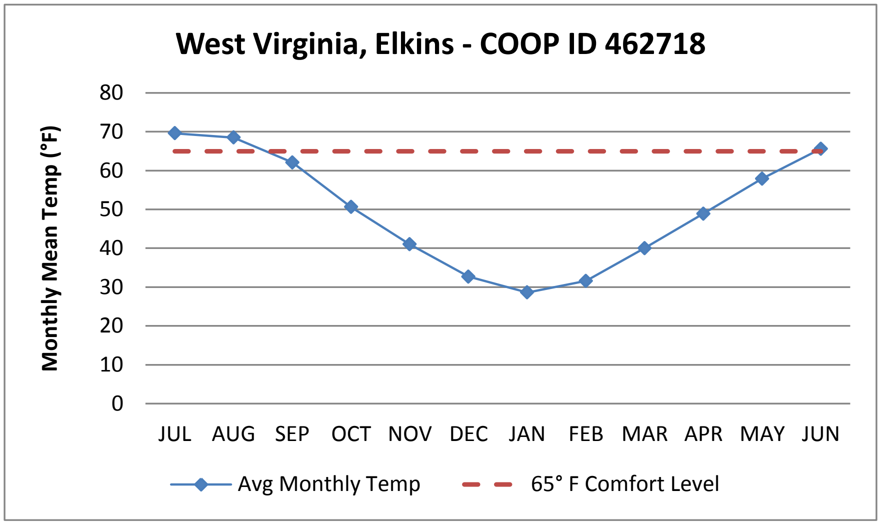


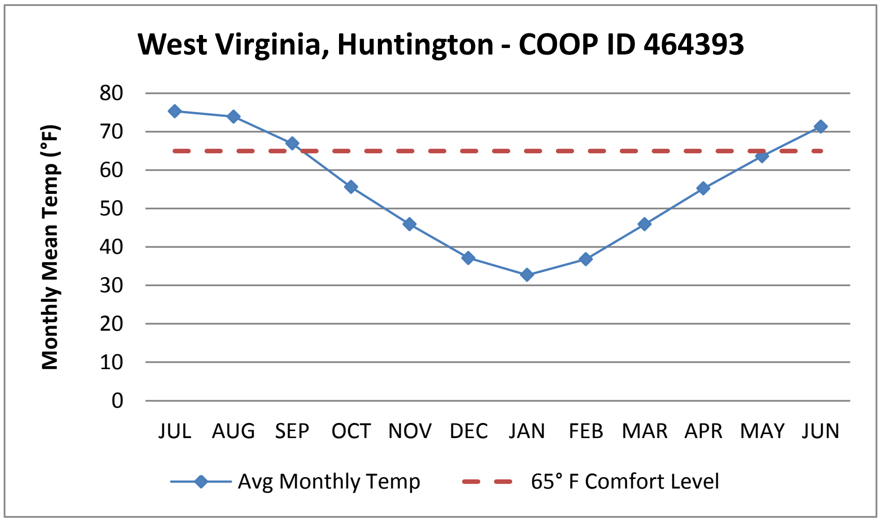




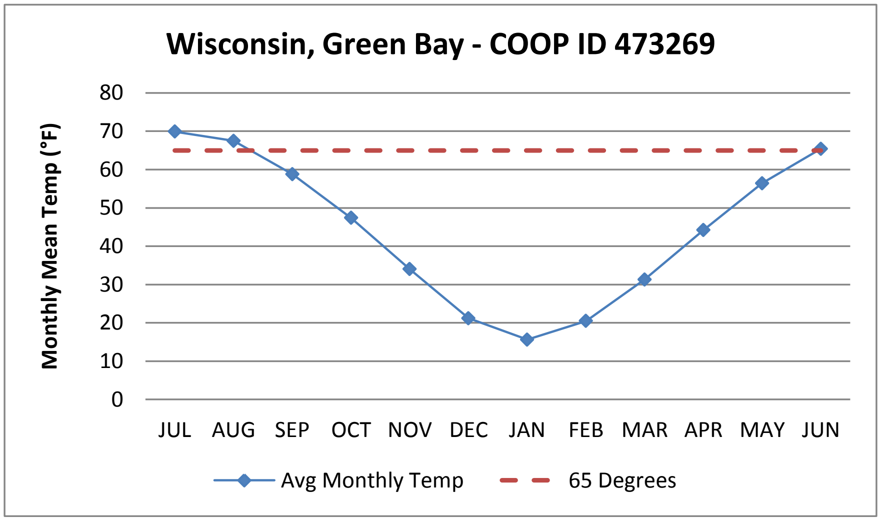
Appendix D, Weather Station Heating and Cooling Day Graphs

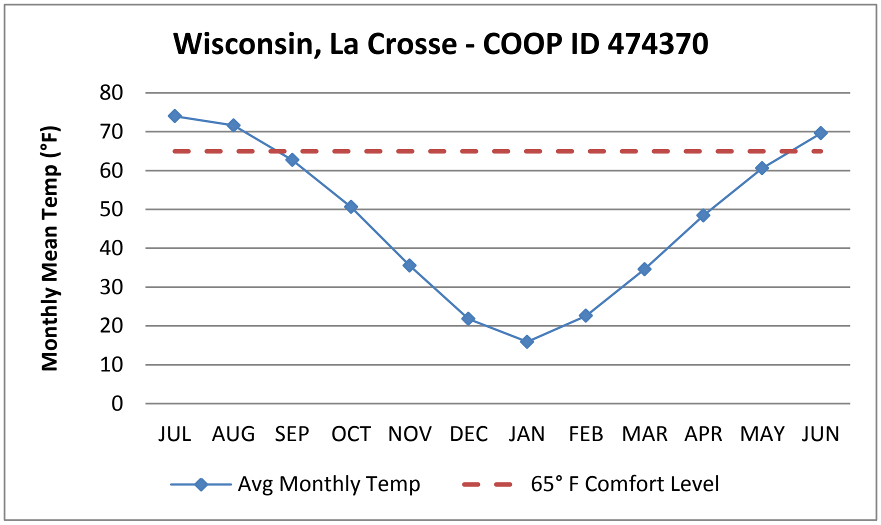


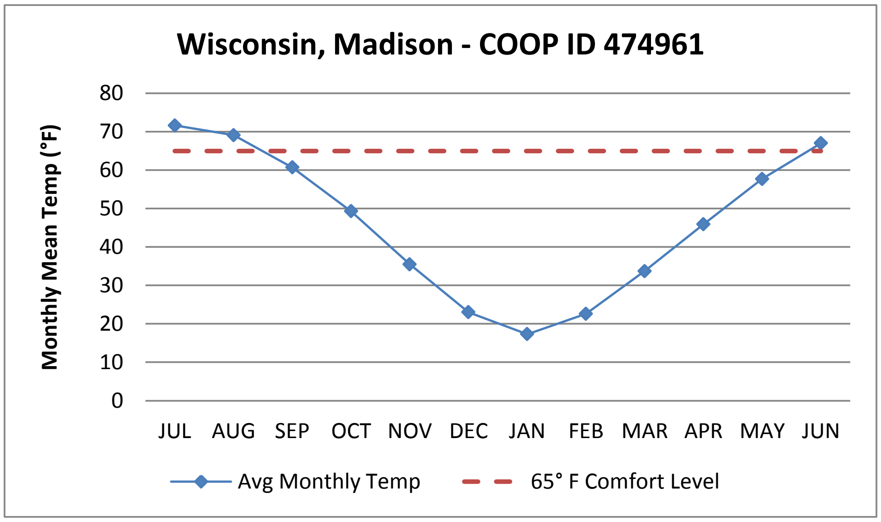




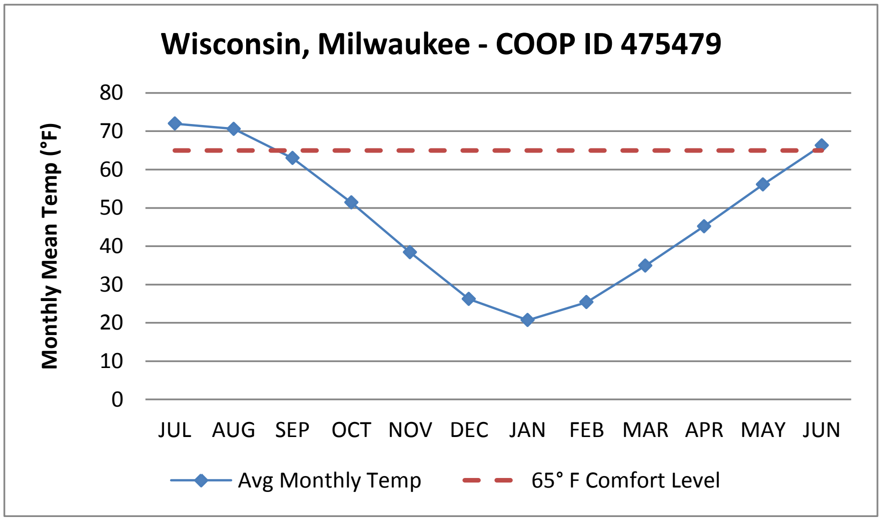
Appendix D, Weather Station Heating and Cooling Day Graphs

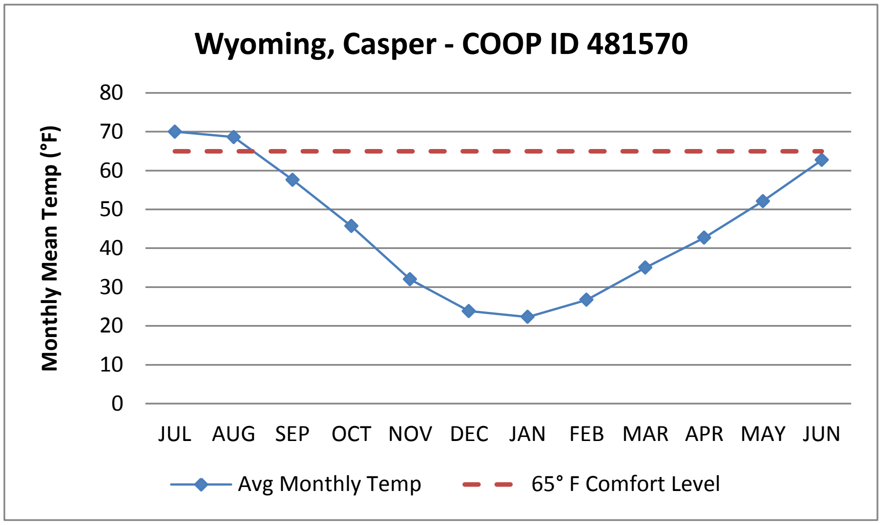


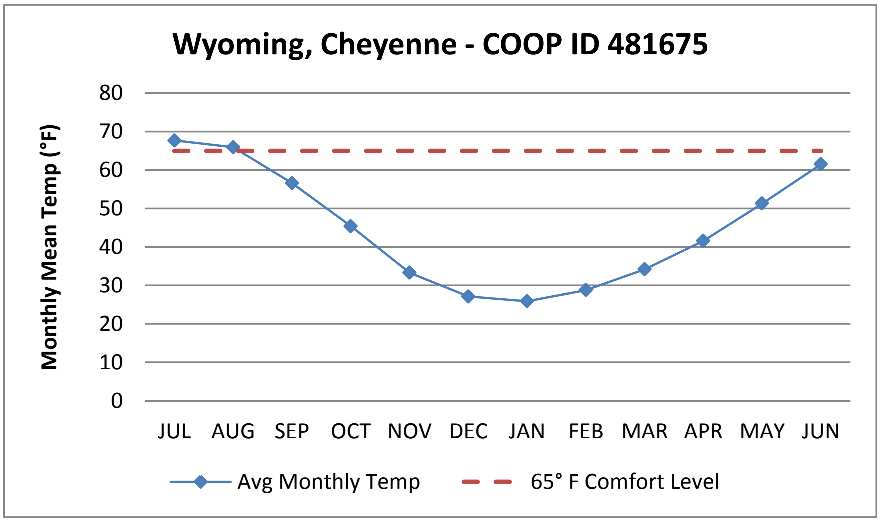




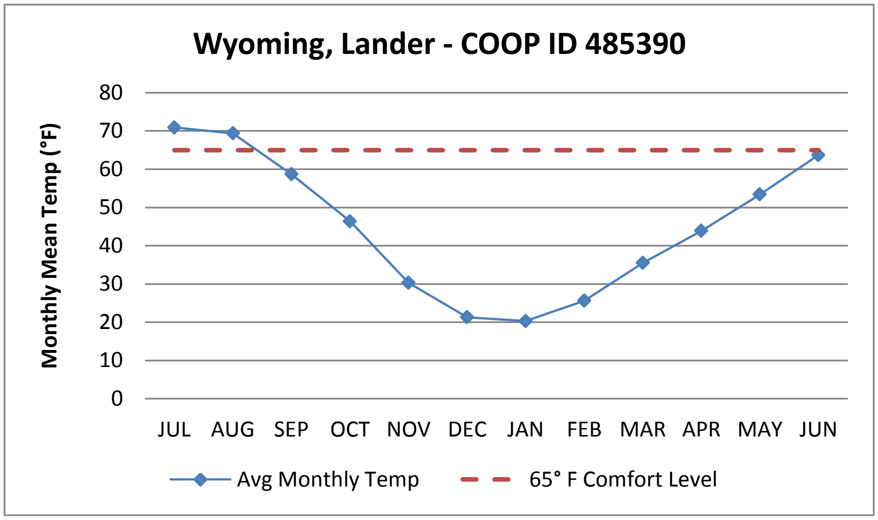
Appendix D, Weather Station Heating and Cooling Day Graphs

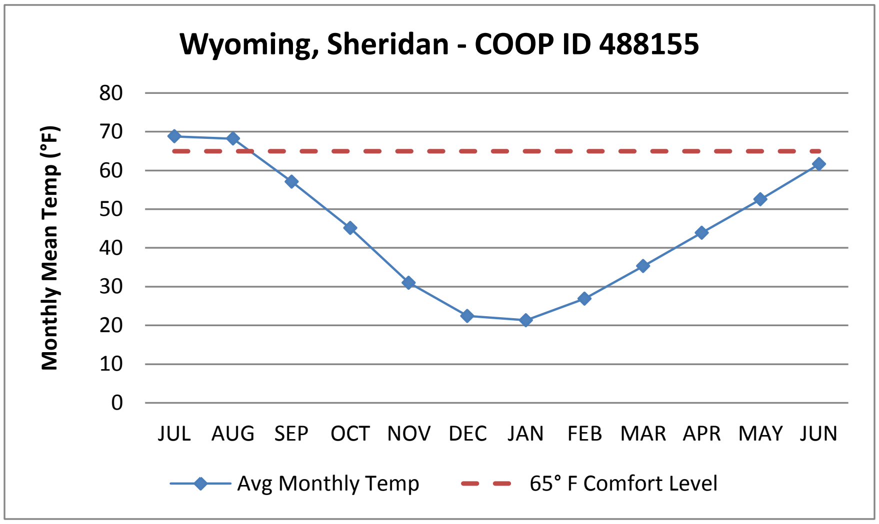


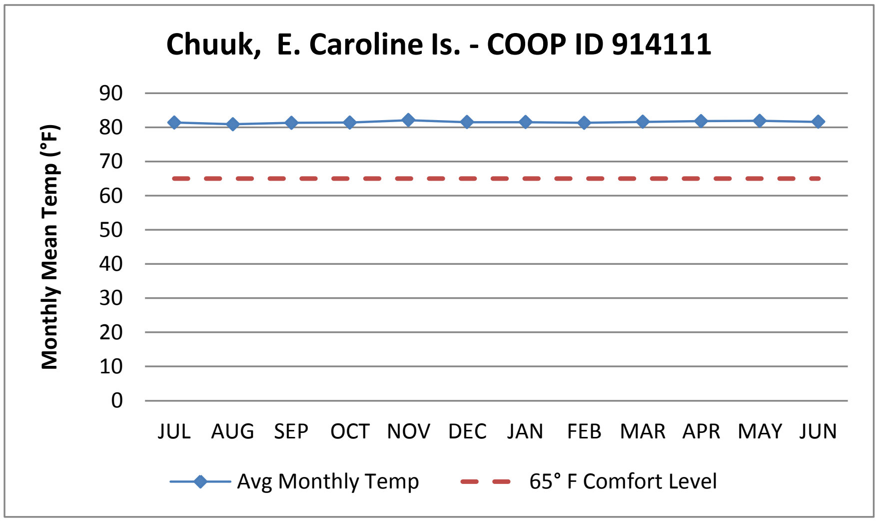




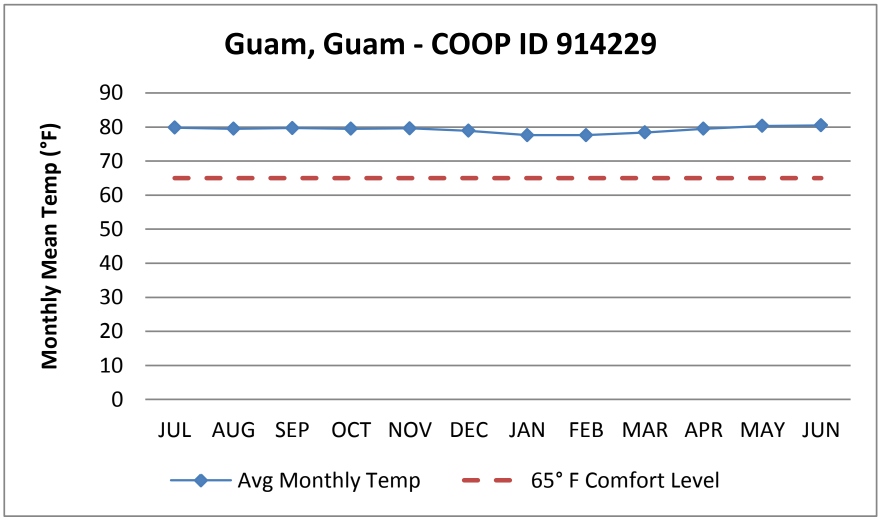
Appendix D, Weather Station Heating and Cooling Day Graphs

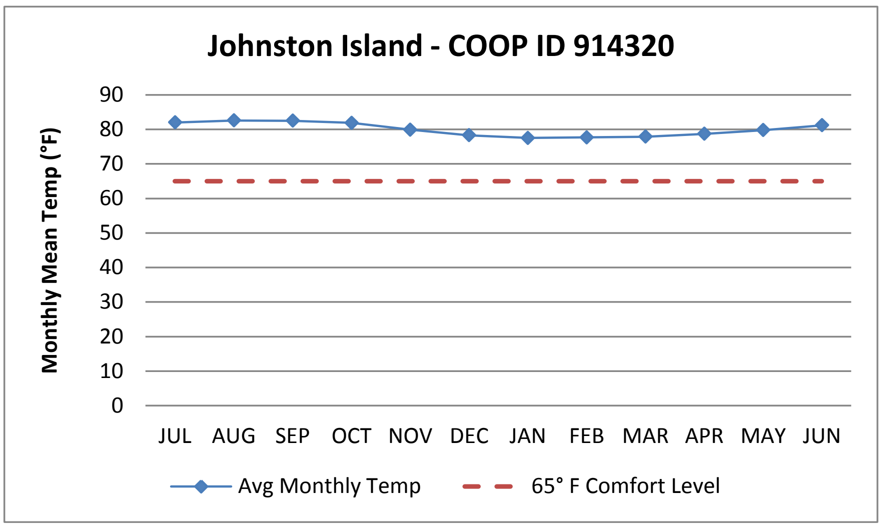


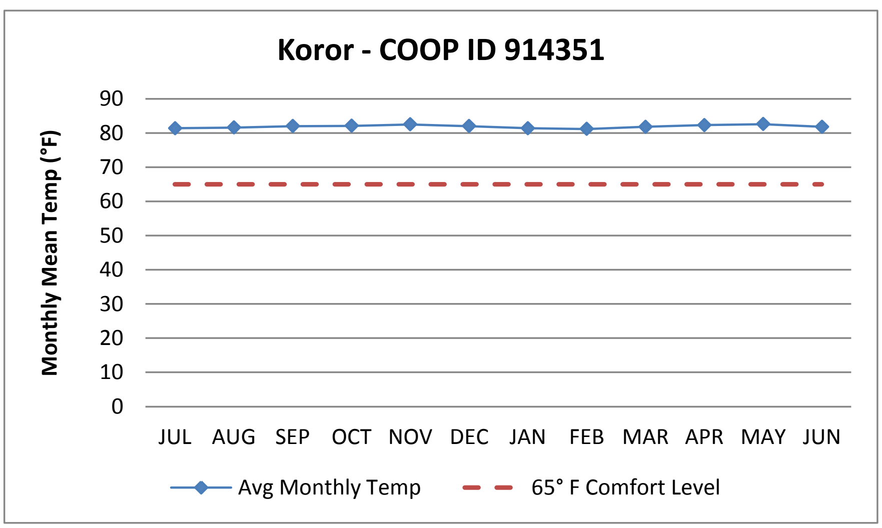




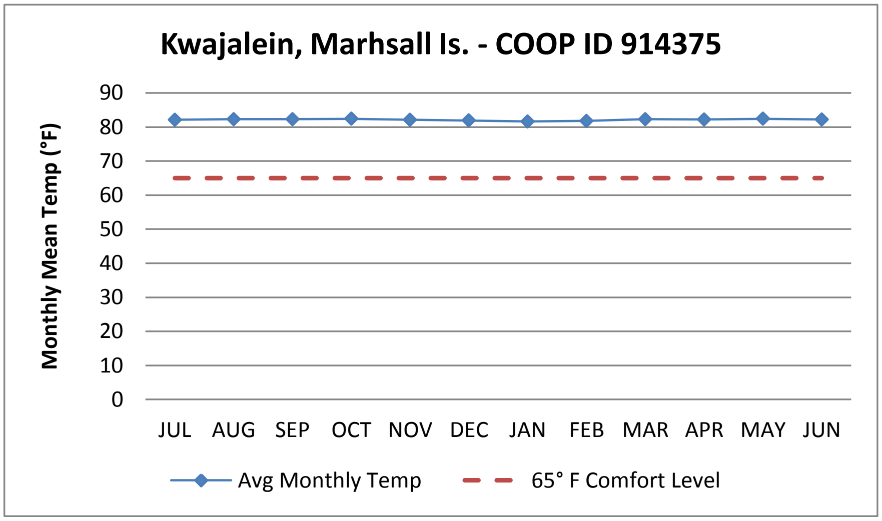
Appendix D, Weather Station Heating and Cooling Day Graphs

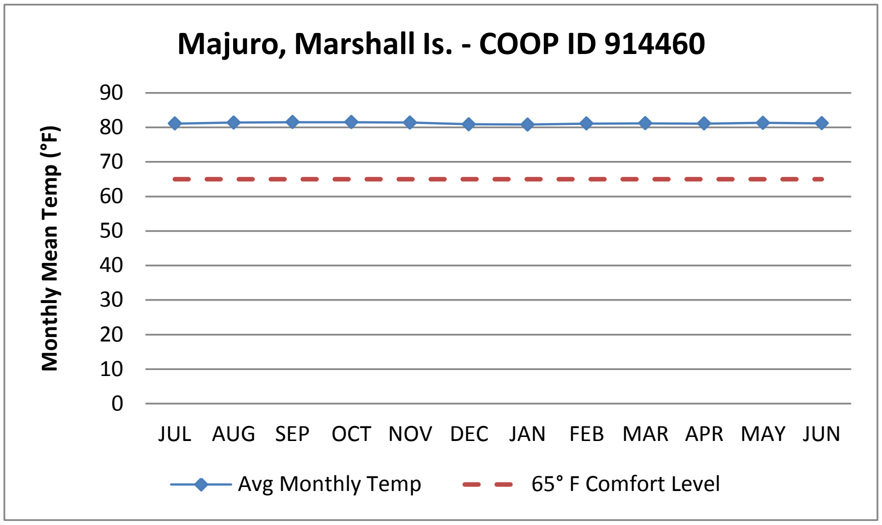


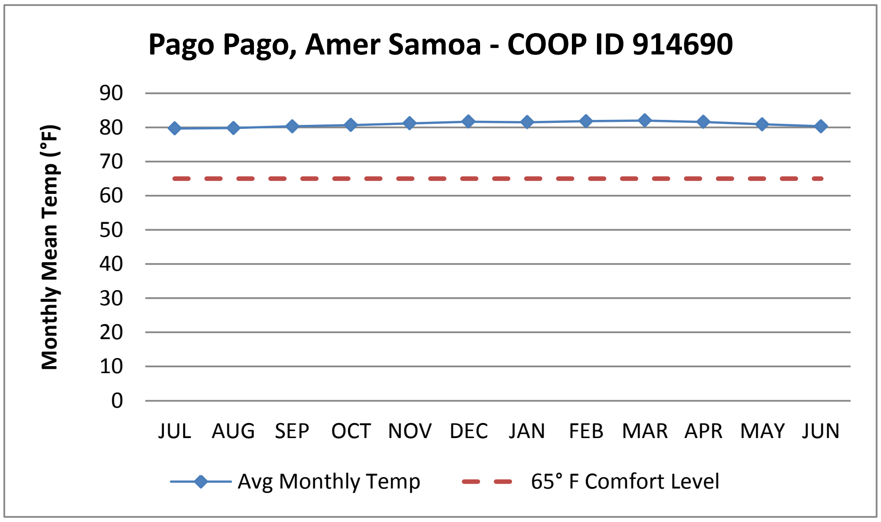




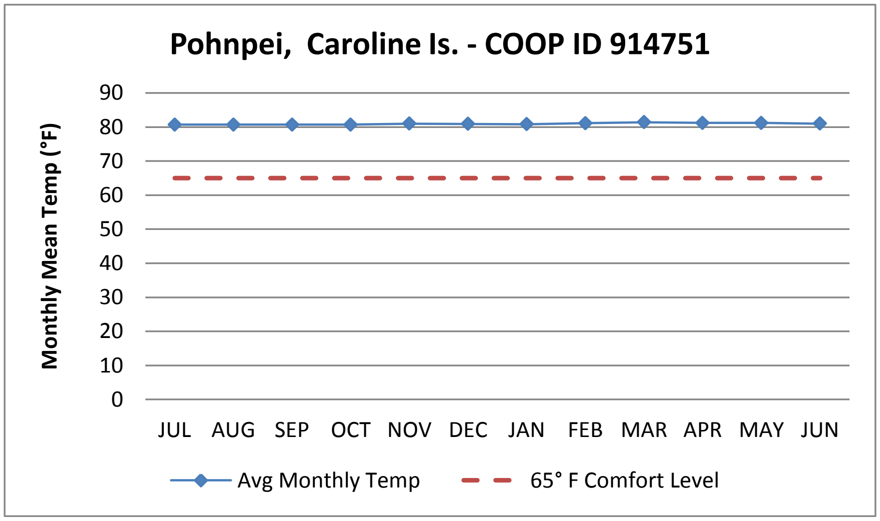
Appendix D, Weather Station Heating and Cooling Day Graphs

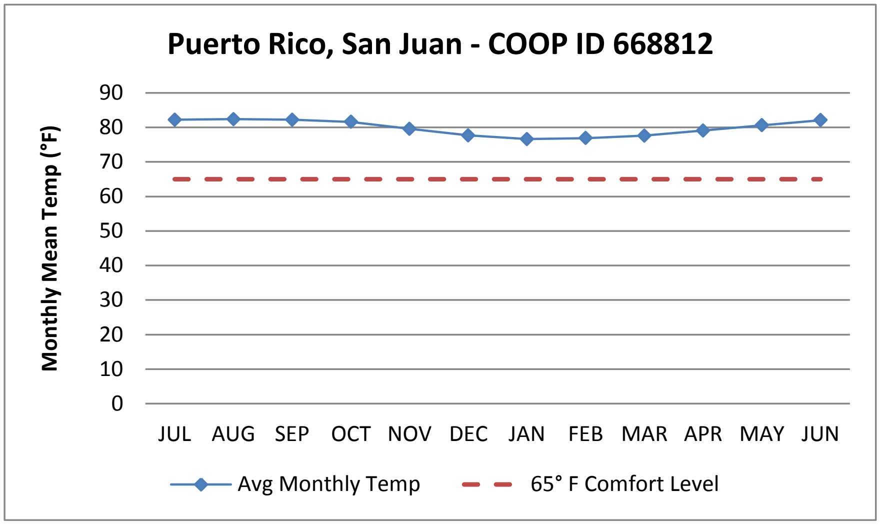


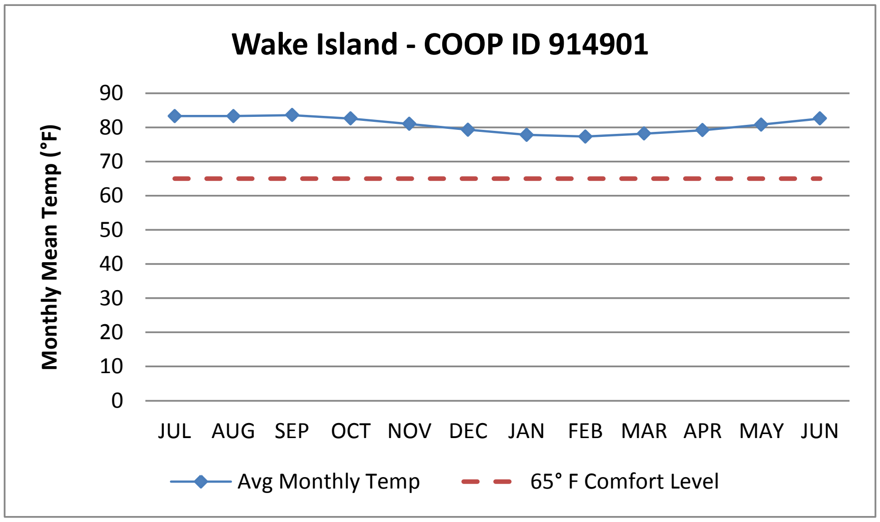




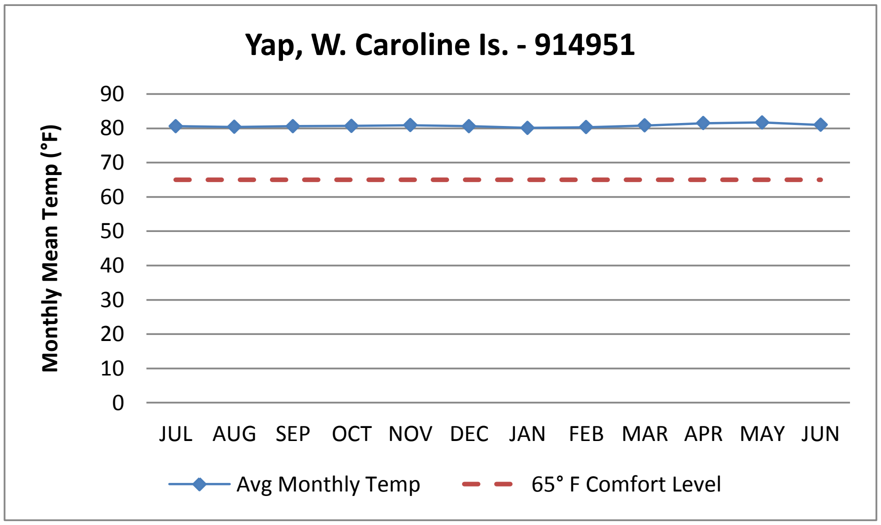
Appendix D, Weather Station Heating and Cooling Day Graphs







Appendix D, Weather Station Heating and Cooling Day Graphs



Appendix E, NOAA Monthly Mean Temperature Data (1971 to 2000)

WEATHER STATION			Monthly Mean Temperature (°F)												Annual
State	Name	COOP ID	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Mean (°F)
AK	ANCHORAGE	500280	15.8	18.7	25.9	36.3	46.9	54.7	58.4	56.4	48.2	34.1	21.8	17.5	36.3
AK	ANNETTE	500352	35.1	37.1	39.5	43.8	49.4	54.3	58.2	58.6	53.8	46.5	39.7	36.4	46.1
AK	BARROW	500546	-13.7	-15.9	-13.7	-0.5	20.1	35.0	40.4	38.7	31.2	14.6	-0.9	-10.6	10.4
AK	BETHEL	500754	6.6	7.6	14.5	25.9	41.3	51.4	56.0	53.6	45.4	30.0	17.4	9.4	29.9
AK	BETTLES	500761	-11.2	-7.9	4.2	22.4	44.3	57.8	60.2	53.5	41.0	18.7	-0.8	-7.4	22.9
AK	BIG DELTA	500770	-2.6	2.3	14.2	32.1	47.8	57.5	60.8	55.5	44.4	24.1	6.4	0.1	28.6
AK	COLD BAY	502102	28.2	27.6	30.0	33.5	39.8	45.9	50.6	51.8	47.8	40.0	34.5	31.0	38.4
AK	FAIRBANKS	502968	-9.7	-3.8	11.1	31.7	48.8	59.7	62.4	56.2	44.5	23.5	2.3	-5.9	26.8
AK	GULKANA	503465	-4.7	3.2	15.3	31.1	43.9	53.1	57.0	53.1	43.1	26.4	5.5	-1.6	27.1
AK	HOMER	503665	23.4	24.9	29.4	36.4	43.7	50.0	54.1	53.8	47.9	37.8	29.4	25.8	38.1
AK	JUNEAU	504100	25.7	28.9	33.7	40.8	47.9	53.9	56.8	55.7	50.0	42.3	33.3	28.7	41.5
AK	KING SALMON	504766	15.4	15.6	23.5	33.1	43.5	50.9	55.7	54.8	47.6	33.3	23.2	17.2	34.5
AK	KODIAK	504988	29.7	29.9	32.6	37.3	43.5	49.2	54.1	55.0	49.4	40.3	34.0	30.6	40.5
AK	KOTZEBUE	505076	-2.5	-3.5	-0.3	11.5	31.6	44.8	54.7	52.1	41.8	23.2	8.3	-0.2	21.8
AK	MCGRATH	505769	-6.7	-0.9	11.8	29.1	46.2	56.7	59.8	54.9	44.7	25.3	5.8	-3.8	26.9
AK	NOME	506496	5.8	5.7	9.4	19.6	37.1	47.3	52.6	50.6	42.9	28.5	16.9	8.4	27.1
AK	ST. PAUL ISLAND	508118	25.7	23.3	24.2	28.4	35.7	41.9	46.7	48.4	45.0	38.3	33.1	28.8	35.0
AK	TALKEETNA	508976	11.0	15.4	22.6	34.3	45.8	55.3	58.9	55.6	46.2	31.4	17.5	13.0	33.9
AK	UNALAKLEET	509564	3.3	4.3	10.7	22.7	39.5	49.0	55.5	53.1	43.6	26.5	12.6	6.1	27.2
AK	VALDEZ	509686	21.9	24.8	29.8	37.7	45.8	52.2	55.2	53.6	47.1	38.2	28.3	24.7	38.3
AK	YAKUTAT	509941	25.8	28.4	31.5	37.2	43.6	49.7	53.6	53.3	48.2	41.1	32.4	28.6	39.5
AL	BIRMINGHAM AP	10831	42.6	46.8	54.5	61.3	69.3	76.4	80.2	79.6	73.8	62.9	53.1	45.6	62.2
AL	HUNTSVILLE	14064	39.8	44.3	52.3	60.4	68.6	76.0	79.5	78.6	72.4	61.3	51.2	43.1	60.6
AL	MOBILE	15478	50.1	53.5	60.2	66.1	73.5	79.3	81.5	81.3	77.2	67.7	58.9	52.3	66.8
AL	MONTGOMERY	15550	46.6	50.5	57.9	64.3	72.3	78.9	81.8	81.2	76.3	65.4	56.1	49.0	65.1
AR	FORT SMITH	32574	38.0	43.7	52.6	61.1	69.5	77.5	82.2	81.5	73.9	62.8	50.5	41.0	61.2
AR	LITTLE ROCK	34248	40.1	45.2	53.4	61.4	70.1	78.4	82.4	81.3	74.4	63.3	51.7	43.2	62.1
AR	NORTH LITTLE ROCK	35320	40.2	45.6	54.3	63.0	70.9	78.8	83.2	82.1	75.0	64.5	52.5	43.4	62.8
AZ	FLAGSTAFF	23010	29.7	32.2	36.6	42.9	50.8	60.1	66.1	64.4	57.8	47.1	36.5	30.2	46.2
AZ	PHOENIX	26481	54.2	58.2	62.7	70.2	79.1	88.6	92.8	91.4	86.0	74.6	61.6	54.3	72.9
AZ	TUCSON	28820	51.7	55.0	59.2	66.0	74.5	84.1	86.5	84.9	80.9	70.5	58.7	51.9	68.7
AZ	WINSLOW	29439	34.2	40.0	46.3	53.4	62.2	72.1	77.5	75.6	68.2	55.9	43.2	34.1	55.2
AZ	YUMA	29660	58.1	62.0	66.5	72.7	79.9	88.8	94.1	93.5	88.2	77.2	64.8	57.4	75.3
CA	BAKERSFIELD	40442	47.8	53.3	57.3	62.7	70.3	77.7	83.1	81.9	76.7	67.2	54.8	47.2	65.0
CA	BISHOP	40822	38.0	42.4	47.7	54.1	62.5	71.1	76.8	74.8	67.3	56.6	44.8	38.0	56.2
CA	EUREKA	42910	47.9	48.9	49.2	50.7	53.6	56.3	58.1	58.7	57.4	54.5	51.0	47.9	52.9
CA	FRESNO	43257	46.0	51.4	55.5	61.2	68.8	76.1	81.4	79.9	74.6	65.0	52.7	45.2	63.2
CA	LONG BEACH	45085	57.0	58.3	59.7	63.0	65.9	69.8	73.8	75.1	73.4	68.6	61.8	57.1	65.3
CA	LOS ANGELES AP	45114	57.1	58.0	58.3	60.8	63.1	66.4	69.3	70.7	70.1	66.9	61.6	57.6	63.3

Appendix E, NOAA Monthly Mean Temperature Data (1971 to 2000)

WEATHER STATION			Monthly Mean Temperature (°F)												Annual
State	Name	COOP ID	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Mean (°F)
CA	LOS ANGELES C.O.	45115	58.3	60.0	60.7	63.8	66.2	70.5	74.2	75.2	74.0	69.5	62.9	58.5	66.2
CA	MOUNT SHASTA	45983	35.3	38.2	41.2	46.3	53.2	60.2	66.1	65.1	59.5	50.5	39.9	34.8	49.2
CA	REDDING	47304	45.5	49.1	52.5	57.8	66.2	75.2	81.3	78.9	73.4	63.2	51.1	45.3	61.6
CA	SACRAMENTO	47630	46.3	51.2	54.5	58.9	65.5	71.5	75.4	74.8	71.7	64.4	53.3	45.8	61.1
CA	SAN DIEGO	47740	57.8	58.9	60.0	62.6	64.6	67.4	70.9	72.5	71.6	67.6	61.8	57.6	64.4
CA	SAN FRANCISCO AP	47769	49.4	52.4	54.0	56.2	58.7	61.4	62.8	63.6	63.9	61.0	54.7	49.5	57.3
CA	SAN FRANCISCO C.O.	47772	52.3	55.0	55.9	57.3	58.4	60.5	61.3	62.4	63.7	62.5	57.5	52.7	58.3
CA	SANTA BARBARA	47905	53.1	55.2	56.7	58.9	60.9	64.2	67.0	68.6	67.4	63.5	57.5	53.2	60.5
CA	SANTA MARIA	47946	51.6	53.1	53.8	55.5	57.8	60.9	63.5	64.2	63.9	61.1	55.5	51.6	57.7
CA	STOCKTON	48558	46.0	51.1	54.9	60.0	66.7	73.2	77.3	76.5	72.8	64.6	53.1	45.3	61.8
CO	ALAMOSA	50130	14.7	22.5	32.7	40.8	50.4	59.4	64.1	62.1	54.5	42.8	28.4	17.1	40.8
CO	COLORADO SPRINGS	51778	28.1	31.7	37.8	45.3	54.6	64.4	69.6	67.6	59.8	48.9	36.2	29.0	47.8
CO	DENVER	803017	29.2	33.2	39.6	47.6	57.2	67.6	73.4	71.7	62.4	51.0	37.5	30.3	50.1
CO	GRAND JUNCTION	53488	26.1	34.1	43.4	50.9	60.5	71.1	76.8	74.7	65.4	52.7	38.1	28.2	51.8
CO	PUEBLO	56740	29.3	34.6	41.8	49.9	59.7	69.8	75.4	73.5	64.8	52.4	38.4	30.3	51.7
CT	BRIDGEPORT	60806	29.9	31.9	39.5	48.9	59.0	68.0	74.0	73.1	65.7	54.7	45.1	35.1	52.1
CT	HARTFORD	63456	25.7	28.8	38.0	48.9	59.9	68.5	73.7	71.6	63.2	51.9	41.8	30.8	50.2
DC	WASHINGTON NAT'L AP	448906	34.9	38.1	46.5	56.1	65.6	74.5	79.2	77.4	70.5	58.8	48.7	39.5	57.5
DE	WILMINGTON	79595	31.5	34.2	42.7	52.4	62.5	71.5	76.6	75.0	67.7	55.8	45.9	36.4	54.4
FL	APALACHICOLA	80211	52.7	55.3	60.7	66.8	74.1	80.0	81.9	81.7	79.1	70.2	62.0	55.2	68.3
FL	DAYTONA BEACH	82158	58.4	60.0	64.7	68.9	74.8	79.7	81.7	81.5	79.9	74.0	67.0	60.8	71.0
FL	FORT MYERS	83186	64.9	66.0	69.9	73.6	78.8	82.2	83.0	83.1	82.1	77.5	71.7	66.4	74.9
FL	GAINESVILLE	83326	54.3	57.0	62.5	67.6	74.3	79.2	80.9	80.4	77.8	70.1	62.8	56.3	68.6
FL	JACKSONVILLE	84358	53.1	55.8	61.6	66.6	73.4	79.1	81.6	80.8	77.8	69.4	61.7	55.0	68.0
FL	KEY WEST	84570	70.3	70.8	73.8	77.0	80.7	83.4	84.5	84.4	83.4	80.2	76.3	72.0	78.1
FL	MIAMI	85663	68.1	69.1	72.4	75.7	79.6	82.4	83.7	83.6	82.4	78.8	74.4	69.9	76.7
FL	ORLANDO	86628	60.9	62.6	67.4	71.5	77.1	81.2	82.4	82.5	81.1	75.3	68.8	63.0	72.8
FL	PENSACOLA	86997	52.0	54.9	61.0	66.9	74.6	80.6	82.6	82.2	78.7	69.5	60.7	54.1	68.2
FL	TALLAHASSEE	88758	51.8	54.8	61.1	66.4	74.4	80.4	82.4	82.1	78.9	69.1	60.4	53.7	68.0
FL	TAMPA	88788	61.3	62.7	67.4	71.5	77.6	81.5	82.5	82.7	81.6	75.8	69.3	63.3	73.1
FL	VERO BEACH	89214	63.0	63.9	67.7	71.5	76.2	80.4	81.7	81.6	80.7	76.4	70.5	64.7	73.2
FL	WEST PALM BEACH	89525	66.2	67.2	70.6	73.8	78.2	81.2	82.5	82.8	81.7	78.1	73.1	68.3	75.3
GA	ATHENS	90435	42.2	46.0	53.5	60.9	69.1	76.3	79.8	78.4	72.6	61.8	52.7	44.8	61.5
GA	ATLANTA	90451	42.7	46.7	54.3	61.6	69.8	76.8	80.0	78.9	73.3	62.8	53.4	45.4	62.2
GA	AUGUSTA	90495	44.8	48.4	55.9	62.4	70.5	77.5	80.8	79.3	73.8	63.1	54.4	46.9	63.2
GA	COLUMBUS	92166	46.8	50.3	57.6	64.2	72.3	79.2	82.0	81.3	76.2	65.8	56.7	49.1	65.1
GA	MACON	95443	45.5	48.9	56.2	62.7	71.0	78.0	81.1	80.0	74.5	63.9	55.1	47.8	63.8
GA	SAVANNAH	97847	49.2	52.5	59.3	65.3	72.8	78.8	82.1	80.8	76.7	67.1	58.7	51.4	66.2

Appendix E, NOAA Monthly Mean Temperature Data (1971 to 2000)

WEATHER STATION			Monthly Mean Temperature (°F)												Annual
State	Name	COOP ID	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Mean (°F)
HI	HILO	511492	71.4	71.5	72.0	72.5	73.7	75.1	75.9	76.3	76.2	75.6	74.0	72.2	73.9
HI	HONOLULU	511919	73.0	73.0	74.3	75.6	77.2	79.5	80.8	81.8	81.5	80.2	77.7	74.8	77.5
HI	KAHULUI	512572	71.8	71.9	73.1	74.2	75.7	77.6	78.8	79.5	79.1	78.1	76.0	73.4	75.8
HI	LIHUE	515580	71.7	71.7	72.7	73.9	75.4	77.7	79.0	79.7	79.5	78.2	75.9	73.3	75.7
IA	DES MOINES	131063	20.4	26.6	38.4	50.6	61.9	71.4	76.1	73.9	65.1	52.8	37.9	24.9	50.0
IA	DUBUQUE	132367	17.0	23.1	34.8	47.5	59.1	68.3	72.3	70.0	61.8	50.4	35.7	22.5	46.9
IA	SIOUX CITY	137708	18.6	25.1	36.5	49.5	61.2	70.5	74.6	72.1	63.1	50.8	34.8	22.3	48.3
IA	WATERLOO	138706	16.1	22.6	35.0	47.8	60.2	69.9	73.6	71.2	62.6	50.2	35.1	21.6	47.2
ID	BOISE	101022	30.2	36.7	43.8	50.6	58.6	67.2	74.7	73.9	64.2	52.8	39.9	30.6	52.0
ID	LEWISTON	105241	33.7	38.4	44.7	51.1	58.5	65.8	73.5	73.4	63.8	51.6	40.4	33.9	52.4
ID	POCATELLO	107211	24.4	30.0	37.9	45.6	53.5	62.0	69.2	68.4	58.8	47.7	34.7	25.3	46.5
IL	CHICAGO	111549	22.0	27.0	37.3	47.8	58.7	68.2	73.3	71.7	63.8	52.1	39.3	27.4	49.1
IL	MOLINE	115751	21.1	26.9	38.7	50.5	61.7	71.2	75.3	73.2	65.0	53.0	39.1	26.4	50.2
IL	PEORIA	116711	22.5	28.2	39.8	51.2	61.9	71.1	75.1	73.1	65.4	53.4	40.1	27.8	50.8
IL	ROCKFORD	117382	19.0	24.7	36.1	47.9	59.6	68.8	72.9	70.9	62.8	51.0	37.2	24.4	48.0
IL	SPRINGFIELD	118179	25.1	30.6	41.8	52.8	63.6	72.6	76.3	74.2	67.0	55.5	42.3	30.3	52.7
IN	EVANSVILLE	122738	31.0	35.8	45.8	55.5	65.6	74.8	78.6	76.5	69.1	57.3	45.9	35.6	56.0
IN	FORT WAYNE	123037	23.6	27.3	38.1	49.0	60.4	69.7	73.4	71.1	64.1	52.4	40.6	29.0	49.9
IN	INDIANAPOLIS	124259	26.5	31.2	41.7	52.0	62.6	71.7	75.4	73.5	66.3	54.6	42.9	31.6	52.5
IN	SOUTH BEND	128187	23.4	27.3	37.5	48.3	59.6	69.0	73.0	71.0	63.4	52.1	40.1	28.7	49.5
KS	CONCORDIA	141767	26.6	32.4	42.5	52.8	63.0	73.4	79.1	77.0	68.0	56.0	40.8	30.2	53.5
KS	DODGE CITY	142164	30.1	36.0	44.3	53.9	63.8	74.3	79.8	78.2	69.3	57.1	42.4	33.1	55.2
KS	GOODLAND	143153	27.6	32.4	39.8	48.8	58.7	69.6	75.1	73.2	64.0	51.8	37.4	29.6	50.7
KS	TOPEKA	148167	27.2	33.4	44.2	54.5	64.4	73.9	78.4	76.7	68.1	56.6	42.6	31.4	54.3
KS	WICHITA	148830	30.2	36.3	45.9	55.3	65.0	75.5	81.0	79.8	70.8	58.6	44.2	33.6	56.4
KY	JACKSON	154202	33.9	37.9	47.1	56.3	64.1	71.4	75.0	73.8	67.9	57.5	47.7	38.3	55.9
KY	LEXINGTON	154746	32.0	36.4	45.6	54.6	63.8	72.2	76.1	74.8	68.0	56.6	45.9	36.3	55.2
KY	LOUISVILLE	154954	33.0	37.6	46.9	56.4	65.8	74.2	78.4	77.0	70.1	58.5	47.6	37.6	57.0
KY	PADUCAH	156110	32.9	38.1	47.6	57.0	65.9	74.5	78.2	76.2	69.1	58.0	46.8	36.9	56.8
KY	GREATER CINCINNATI AP	151855	29.7	34.1	43.9	53.7	63.7	72.0	76.3	74.5	67.4	55.7	44.7	34.6	54.2
LA	BATON ROUGE	160549	50.1	53.5	60.3	66.6	74.0	79.7	81.7	81.4	77.5	68.1	59.0	52.4	67.0
LA	LAKE CHARLES	165078	50.9	54.4	61.0	67.3	74.9	80.5	82.6	82.4	78.4	69.5	60.1	53.3	68.0
LA	NEW ORLEANS	166660	52.6	55.7	62.4	68.2	75.6	80.7	82.7	82.5	78.9	70.0	61.4	55.1	68.8
LA	SHREVEPORT	168440	46.4	51.2	58.5	65.2	73.0	79.9	83.4	82.9	77.0	66.7	56.1	48.4	65.7
MA	BLUE HILL	190736	26.0	28.3	36.3	46.3	57.0	65.7	71.6	69.9	62.1	51.6	41.8	31.2	49.0
MA	BOSTON	190770	29.3	31.5	38.9	48.3	58.5	68.0	73.9	72.3	64.7	54.1	44.9	34.8	51.6
MA	WORCESTER	199923	23.6	26.0	34.3	45.0	56.3	64.7	70.1	68.3	60.2	49.6	39.6	28.9	47.2
MD	BALTIMORE	180465	32.3	35.5	43.7	53.2	62.9	71.8	76.5	74.5	67.4	55.4	45.5	36.7	54.6

Appendix E, NOAA Monthly Mean Temperature Data (1971 to 2000)

WEATHER STATION			Monthly Mean Temperature (°F)												Annual
State	Name	COOP ID	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Mean (°F)
ME	CARIBOU	171175	9.5	13.0	24.6	38.1	51.6	60.8	65.6	63.4	53.8	42.8	30.6	16.4	39.2
ME	PORTLAND	176905	21.7	24.8	33.7	43.7	53.8	62.9	68.7	67.2	58.7	47.7	38.3	27.6	45.8
MI	ALPENA	200164	17.8	19.0	28.0	40.3	52.2	61.3	66.7	64.5	56.3	45.6	34.6	24.0	42.5
MI	DETROIT	202103	24.5	27.2	36.9	48.1	59.8	69.0	73.5	71.8	63.9	51.9	40.7	29.6	49.8
MI	FLINT	202846	21.3	23.8	33.7	45.4	57.1	66.2	70.6	68.5	60.7	49.2	38.1	26.7	46.8
MI	GRAND RAPIDS	203333	22.4	25.0	34.6	46.3	58.1	67.1	71.4	69.4	61.3	49.9	38.4	27.6	47.7
MI	HOUGHTON LAKE	203936	17.8	19.9	29.3	41.8	53.9	62.2	66.7	64.6	56.8	46.1	34.8	23.7	43.2
MI	LANSING	204641	21.6	24.0	33.9	45.5	57.1	66.2	70.3	68.4	60.5	49.2	38.0	26.9	46.8
MI	MARQUETTE	205184	11.5	14.8	23.7	36.4	50.3	59.3	64.4	62.3	53.5	42.5	28.9	17.2	38.7
MI	MUSKEGON	205712	23.5	25.4	34.0	44.9	56.1	64.9	69.9	68.5	60.5	49.7	38.7	28.6	47.1
MI	SAULT STE. MARIE	207366	13.2	15.6	24.9	38.4	51.3	58.6	63.9	63.3	54.8	44.4	32.4	20.2	40.1
MN	DULUTH	212248	8.4	14.8	25.4	39.0	51.8	59.9	65.5	63.7	54.7	43.5	28.0	14.0	39.1
MN	INTERNATIONAL FALLS	214026	2.7	10.9	23.6	39.3	53.3	61.6	66.1	63.8	53.2	41.6	24.4	8.5	37.5
MN	MINNEAPOLIS-ST.PAUL	215435	13.1	20.1	32.1	46.6	59.3	68.4	73.2	70.6	61.0	48.7	32.5	18.7	45.4
MN	ROCHESTER	217004	11.8	18.4	30.6	44.7	56.9	66.1	70.1	67.7	58.9	47.0	31.2	17.3	43.4
MN	SAINT CLOUD	217294	8.8	16.1	28.4	43.6	56.6	65.1	69.8	67.2	57.4	45.3	28.8	14.4	41.8
MO	COLUMBIA	231791	27.8	33.7	44.0	54.4	63.7	72.7	77.4	75.7	67.3	56.0	43.2	32.0	54.0
MO	KANSAS CITY	234358	26.9	33.0	43.8	54.4	64.3	73.6	78.5	76.6	68.1	56.8	42.7	31.3	54.2
MO	ST. LOUIS	237455	29.6	35.4	45.8	56.6	66.5	75.6	80.2	78.2	70.2	58.3	45.3	33.9	56.3
MO	SPRINGFIELD	237976	31.7	37.1	46.3	55.6	64.7	73.4	78.5	77.6	69.3	58.4	45.9	35.7	56.2
MS	JACKSON	224472	45.0	49.2	56.8	63.4	71.5	78.5	81.4	80.9	75.5	64.4	54.8	47.6	64.1
MS	MERIDIAN	225776	46.1	50.2	57.3	63.8	71.7	78.5	81.7	81.4	76.1	64.8	55.7	48.9	64.7
MS	TUPELO	229003	40.4	44.8	53.1	60.9	69.4	76.9	80.6	79.6	73.3	61.9	51.5	43.4	61.3
MT	BILLINGS	240807	24.0	29.8	37.0	46.1	55.7	65.2	72.0	70.9	59.5	48.1	34.1	26.1	47.4
MT	GLASGOW	243558	10.8	19.1	30.9	44.5	55.5	64.4	70.2	69.5	57.3	45.0	27.9	15.6	42.6
MT	GREAT FALLS	243751	21.7	26.4	33.4	42.6	51.5	60.0	66.2	65.6	55.4	45.5	32.3	24.3	43.8
MT	HAVRE	243996	14.6	21.9	32.5	44.3	54.5	62.7	68.3	67.6	56.3	44.6	29.1	19.0	43.0
MT	HELENA	244055	20.2	26.4	35.1	44.1	52.9	61.2	67.8	66.7	56.1	44.8	30.9	21.4	44.0
MT	KALISPELL	244558	21.4	26.8	34.9	43.4	51.3	57.7	63.5	63.2	53.1	41.9	30.9	23.1	42.6
MT	MISSOULA	245745	23.5	29.0	37.6	45.2	52.7	60.2	66.9	66.3	56.1	44.4	32.0	23.4	44.8
NC	ASHEVILLE	310300	35.8	39.0	46.3	54.1	62.0	69.2	73.0	71.8	65.7	55.2	46.4	39.0	54.8
NC	CAPE HATTERAS	311458	46.1	46.8	52.4	59.8	67.6	74.8	79.2	78.6	74.8	65.7	57.6	50.0	62.8
NC	CHARLOTTE	311690	41.7	45.2	52.8	60.9	69.0	76.5	80.3	78.9	72.7	61.7	52.3	44.4	61.4
NC	GREENSBORO-WNSTN-SALM-HGHPT	313630	37.7	41.2	49.1	57.6	65.8	73.6	77.9	76.2	69.8	58.5	49.2	41.0	58.2
NC	RALEIGH	317069	39.7	43.0	50.7	59.1	67.0	74.7	78.8	77.2	71.2	60.0	51.0	43.0	59.6
NC	WILMINGTON	319457	46.1	48.5	55.0	62.7	70.2	77.0	81.1	79.7	75.0	64.8	56.5	48.9	63.8
ND	BISMARCK	320819	10.2	18.1	29.7	43.3	56.0	64.7	70.4	69.0	57.7	45.2	28.0	15.2	42.3
ND	FARGO	322859	6.8	14.1	27.2	43.5	57.4	66.0	70.6	69.0	58.0	45.3	27.0	12.5	41.5

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State	Name	COOP ID	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Mean (°F)
ND	GRAND FORKS	323616	5.3	13.1	25.7	42.3	56.8	65.2	69.4	67.8	57.0	44.3	25.8	11.3	40.3
ND	WILLISTON	329425	8.0	16.8	28.7	42.5	54.6	63.7	69.3	68.3	56.1	43.6	25.6	13.0	40.9
NE	GRAND ISLAND	253395	22.4	28.2	38.3	49.9	60.6	71.1	75.8	73.6	64.4	52.0	36.4	25.6	49.9
NE	LINCOLN	254795	22.4	28.3	39.4	51.2	62.0	72.7	77.8	75.4	66.0	53.5	38.1	26.5	51.1
NE	NORFOLK	255995	20.4	26.4	37.0	49.1	60.3	70.1	74.8	72.7	63.4	51.0	35.1	23.7	48.7
NE	NORTH PLATTE	256065	23.2	29.4	38.0	48.1	58.3	68.4	74.3	72.6	62.4	49.7	34.6	25.7	48.7
NE	OMAHA EPPLEY AP	256255	21.7	28.0	39.3	51.4	62.2	72.2	76.7	74.5	65.4	53.2	38.0	25.6	50.7
NE	OMAHA (NORTH)	256260	22.4	28.5	39.8	52.0	62.3	71.5	75.6	74.0	65.7	53.9	38.4	26.2	50.9
NE	SCOTTSBLUFF	257665	24.5	30.0	37.3	46.2	56.8	67.2	73.0	70.9	60.5	47.8	34.0	25.7	47.9
NE	VALENTINE	258760	20.8	26.6	35.3	46.1	57.5	67.6	73.7	72.1	61.5	48.3	33.0	23.6	47.2
NH	CONCORD	271683	20.1	23.3	33.3	44.6	56.0	64.9	70.0	68.2	59.4	47.8	37.6	25.9	45.9
NH	MT. WASHINGTON	275639	5.2	6.6	13.6	22.9	35.6	44.4	48.7	47.6	40.4	30.2	20.6	10.1	27.2
NJ	ATLANTIC CITY AP	280311	32.1	34.2	41.8	50.6	60.5	69.7	75.3	73.5	66.3	55.1	45.9	36.8	53.5
NJ	ATLANTIC CITY C.O.	280325	35.2	36.9	43.3	51.4	60.5	69.4	75.2	74.8	68.9	58.5	49.0	40.2	55.3
NJ	NEWARK	286026	31.3	33.8	42.2	52.3	62.7	71.9	77.2	75.5	67.8	56.4	46.4	36.4	54.5
NM	ALBUQUERQUE	290234	35.7	41.4	48.1	55.6	64.7	74.8	78.5	76.1	69.1	57.3	44.4	36.1	56.8
NM	CLAYTON	291887	33.9	37.6	43.7	51.7	60.5	69.9	73.8	72.2	64.7	54.6	42.2	34.8	53.3
NM	ROSWELL	297610	40.0	45.7	52.9	60.5	69.6	78.0	80.8	78.9	72.0	61.4	48.9	40.7	60.8
NV	ELKO	262573	25.6	31.3	38.6	44.6	52.7	61.7	69.1	67.6	58.2	46.7	34.5	26.0	46.4
NV	ELY	262631	25.2	29.8	35.9	42.2	50.4	59.9	67.4	65.8	56.7	45.4	33.5	25.8	44.8
NV	LAS VEGAS	264436	47.0	52.2	58.3	66.0	75.4	85.6	91.2	89.3	81.3	68.7	55.0	47.0	68.1
NV	RENO	266779	33.6	38.5	43.3	48.6	56.4	64.7	71.3	69.9	62.4	52.0	40.9	33.6	51.3
NV	WINNEMUCCA	269171	30.1	36.1	41.1	46.7	55.2	64.3	72.0	69.9	60.3	48.8	37.4	29.6	49.3
NY	ALBANY	300042	22.2	25.0	35.0	46.6	58.1	66.3	71.1	69.0	60.6	49.3	39.2	28.0	47.6
NY	BINGHAMTON	300687	21.7	23.8	32.7	44.1	55.9	63.9	68.7	66.6	58.8	48.1	37.6	27.1	45.8
NY	BUFFALO	301012	24.5	25.9	34.3	45.3	57.0	65.8	70.8	69.1	61.5	50.7	40.2	29.8	48.0
NY	ISLIP	304130	30.9	32.4	39.8	49.1	59.2	68.5	74.6	73.1	65.8	54.3	44.9	35.7	52.4
NY	NEW YORK C.PARK	305801	32.1	34.6	42.5	52.5	62.6	71.2	76.5	75.1	67.5	56.6	47.1	37.3	54.6
NY	NEW YORK (JFK AP)	305803	31.8	33.5	40.9	50.1	59.7	68.8	74.8	74.1	67.2	56.5	46.8	37.2	53.5
NY	NEW YORK (LAGUARDIA AP)	305811	32.6	34.8	42.3	52.2	62.4	71.5	77.1	75.9	68.6	57.7	47.6	37.9	55.1
NY	ROCHESTER	307167	23.9	25.3	33.9	45.3	57.0	65.8	70.7	68.9	61.2	50.4	39.9	29.4	47.7
NY	SYRACUSE	308383	22.7	24.5	33.6	45.3	57.1	65.8	70.9	69.2	61.3	50.1	39.7	28.6	47.4
OH	AKRON	330058	25.2	28.3	37.7	48.1	58.8	67.5	71.8	70.3	63.0	51.6	41.1	30.7	49.5
OH	CLEVELAND	331657	25.7	28.4	37.5	47.6	58.5	67.5	71.9	70.2	63.3	52.2	41.8	31.1	49.7
OH	COLUMBUS	331786	28.3	32.0	42.0	52.0	62.6	71.2	75.1	73.5	66.5	54.7	43.7	33.5	52.9
OH	DAYTON	332075	26.3	30.3	40.2	50.6	61.2	70.2	74.3	72.3	65.1	53.5	42.2	31.4	51.5
OH	MANSFIELD	334865	24.3	27.3	36.7	47.2	58.0	66.8	71.0	69.3	62.6	51.5	40.5	29.6	48.8
OH	TOLEDO	338357	23.9	27.0	37.2	48.3	59.6	68.8	73.0	70.8	63.5	51.8	40.5	29.2	49.5

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State	Name	COOP ID	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Mean (°F)
OH	YOUNGSTOWN	339406	24.9	27.7	36.7	47.4	57.6	65.9	69.9	68.4	61.5	50.8	40.7	30.4	48.5
OK	OKLAHOMA CITY	346661	36.7	42.3	51.0	59.7	68.4	76.8	82.0	81.2	73.2	62.0	48.9	39.5	60.1
OK	TULSA	348992	36.4	42.0	51.4	60.8	69.3	78.0	83.5	82.2	73.5	62.6	49.7	39.7	60.8
OR	ASTORIA	350328	42.4	44.2	46.0	48.5	52.7	56.7	60.1	60.8	58.5	52.6	46.6	42.8	51.0
OR	BURNS	351175	24.4	30.0	37.0	43.0	50.9	58.1	65.9	64.2	55.0	44.4	32.7	24.9	44.2
OR	EUGENE	352709	39.8	42.8	46.3	49.8	54.8	60.2	66.2	66.4	61.7	52.6	44.7	39.5	52.1
OR	MEDFORD	355429	39.1	43.5	47.1	51.6	58.1	65.6	72.7	72.5	65.9	55.1	43.9	38.1	54.5
OR	PENDLETON	356546	33.8	38.7	45.1	51.0	58.1	65.4	72.6	72.0	63.4	52.3	41.2	33.9	52.3
OR	PORTLAND	356751	39.9	43.1	47.2	51.2	57.1	62.7	68.1	68.5	63.6	54.3	45.8	40.2	53.5
OR	SALEM	357500	40.3	43.0	46.5	50.0	55.6	61.2	66.8	67.0	62.2	52.9	45.2	40.2	52.6
OR	SEXTON SUMMIT	357698	37.5	38.6	39.6	43.4	49.9	56.5	63.7	64.2	60.1	51.3	40.5	37.3	48.6
PA	ALLENTOWN	360106	27.1	29.9	38.8	49.0	59.6	68.5	73.3	71.2	63.4	52.0	42.0	32.0	50.6
PA	ERIE	362682	26.9	28.2	36.5	46.8	58.1	67.4	72.1	70.9	64.0	53.3	42.9	32.7	50.0
PA	MIDDLETOWN/HARRISBURG INTL APT	363699	30.3	32.8	41.7	52.1	62.0	70.7	75.9	74.0	66.2	54.5	44.3	34.8	53.3
PA	PHILADELPHIA	366889	32.3	34.8	43.2	53.1	63.5	72.3	77.6	76.3	68.8	57.2	47.1	37.4	55.3
PA	PITTSBURGH	366993	27.5	30.5	39.8	49.9	60.0	68.4	72.6	71.0	64.0	52.5	42.3	32.5	51.0
PA	AVOCA	369705	26.3	28.9	37.9	48.7	59.6	67.5	72.1	70.3	62.5	51.5	41.5	31.4	49.9
PA	WILLIAMSPORT	369728	25.5	28.5	38.0	49.0	59.5	67.8	72.4	70.9	63.1	51.3	40.8	30.7	49.9
PR	SAN JUAN	668812	76.6	76.9	77.6	79.1	80.6	82.1	82.2	82.4	82.2	81.6	79.6	77.7	79.9
RI	PROVIDENCE	376698	28.7	30.9	38.8	48.6	58.7	67.6	73.3	71.9	64.0	53.0	43.8	33.8	51.1
SC	CHARLESTON AP	381544	47.9	50.7	57.7	64.2	72.1	78.2	81.7	80.5	76.1	66.2	58.0	50.5	65.3
SC	CHARLESTON C.O.	381549	49.8	52.4	58.7	65.9	73.5	79.4	82.8	81.6	77.6	68.5	60.5	52.8	67.0
SC	COLUMBIA	381939	44.6	47.9	55.4	63.2	71.6	78.5	82.0	80.3	74.7	63.7	54.7	47.0	63.6
SC	GREENVILLE-SPARTANBURG AP	383747	40.8	44.4	51.6	59.0	67.2	74.7	78.8	77.5	71.4	60.5	51.1	43.5	60.1
SD	ABERDEEN	390020	11.0	18.7	30.7	45.4	57.9	66.8	72.2	70.5	59.8	46.8	29.3	16.0	43.8
SD	HURON	394127	14.2	21.0	32.6	46.1	58.2	67.9	73.4	71.5	61.0	47.9	31.3	18.6	45.4
SD	RAPID CITY	396937	22.4	27.3	34.9	44.7	55.0	64.6	71.7	71.1	60.6	48.2	33.4	24.7	46.6
SD	SIOUX FALLS	397667	14.0	20.8	32.6	45.7	57.8	67.5	73.0	70.8	60.9	48.0	31.3	18.3	45.1
TN	BRISTOL-JHNSN CTY-KNGSPRT	401094	34.2	38.0	46.5	54.6	63.0	70.7	74.2	72.8	66.6	55.0	45.5	37.3	54.9
TN	CHATTANOOGA	401656	39.4	43.4	51.4	59.6	67.7	75.4	79.6	78.5	72.1	60.4	50.3	42.4	60.0
TN	KNOXVILLE	404950	37.6	41.8	49.7	57.8	66.0	73.8	77.7	76.9	70.8	58.8	49.0	40.9	58.4
TN	MEMPHIS	405954	39.9	44.9	53.5	62.1	70.6	78.7	82.5	81.2	74.8	63.8	52.3	43.3	62.4
TN	NASHVILLE	406402	36.8	41.3	50.1	58.5	67.1	75.1	79.1	77.9	71.3	59.9	49.3	40.5	58.9
TN	OAK RIDGE	406750	36.6	40.6	48.8	57.2	65.6	73.3	77.3	76.2	70.0	58.4	47.7	39.4	57.6
TX	ABILENE	410016	43.5	48.6	56.4	64.6	72.8	79.8	83.5	82.6	75.5	66.0	53.7	45.4	64.4
TX	AMARILLO	410211	35.8	40.6	47.9	56.2	65.2	74.3	78.2	76.3	69.1	58.2	45.1	37.0	57.0
TX	AUSTIN/CITY	410428	50.2	54.6	61.7	68.3	75.1	81.0	84.2	84.5	79.5	70.6	59.7	52.1	68.5
TX	AUSTIN/BERGSTROM	813904	48.1	52.6	59.9	67.1	74.7	80.1	82.8	82.1	77.5	68.6	57.8	49.8	66.8

Appendix E, NOAA Monthly Mean Temperature Data (1971 to 2000)

WEATHER STATION			Monthly Mean Temperature (°F)												Annual
State	Name	COOP ID	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Mean (°F)
TX	BROWNSVILLE	411136	59.6	62.7	68.8	73.8	79.3	82.7	83.9	84.0	81.0	75.0	67.7	61.1	73.3
TX	CORPUS CHRISTI	412015	56.1	59.5	66.0	71.5	77.5	81.9	83.8	83.9	80.8	73.8	65.1	58.1	71.5
TX	DALLAS-FORT WORTH	412242	44.1	49.4	57.4	65.0	73.1	80.9	85.0	84.4	77.5	67.2	55.1	46.7	65.5
TX	DALLAS-LOVE FIELD	412244	45.9	51.0	58.8	66.3	74.4	82.2	86.5	86.1	78.9	68.4	56.4	48.0	66.9
TX	DEL RIO	412360	51.3	56.1	63.8	70.6	77.7	82.9	85.3	85.1	80.0	71.1	60.1	52.4	69.7
TX	EL PASO	412797	45.1	50.5	57.0	64.6	73.7	82.1	83.3	81.1	75.4	64.9	52.7	45.4	64.7
TX	GALVESTON	413430	55.8	58.0	64.1	70.0	76.9	82.2	84.3	84.4	81.1	74.1	65.4	58.1	71.2
TX	HOUSTON	414300	51.8	55.4	62.3	68.5	75.8	81.3	83.6	83.3	78.9	70.4	60.9	53.7	68.8
TX	LUBBOCK	415411	38.1	43.3	51.2	60.0	69.2	77.1	79.8	78.0	70.9	60.7	48.1	39.7	59.7
TX	MIDLAND-ODESSA	415890	43.2	48.6	55.9	63.7	72.8	79.6	81.7	80.4	73.9	64.4	52.3	44.8	63.4
TX	PORT ARTHUR	417174	52.2	55.6	62.2	68.2	75.4	80.9	82.7	82.5	78.7	70.1	60.9	54.2	68.6
TX	SAN ANGELO	417943	44.9	49.7	57.2	65.0	73.1	79.2	82.4	81.3	74.8	65.4	54.0	46.4	64.5
TX	SAN ANTONIO	417945	50.3	54.7	62.1	68.6	75.8	81.5	84.3	84.2	79.4	70.7	60.0	52.4	68.7
TX	VICTORIA	419364	53.2	56.7	63.7	69.7	76.6	81.8	84.2	84.2	80.1	72.3	62.7	55.2	70.0
TX	WACO	419419	46.1	50.8	58.5	65.9	74.1	81.3	85.4	85.2	78.6	68.6	56.8	48.3	66.6
TX	WICHITA FALLS	419729	40.5	45.7	54.2	62.4	71.4	79.7	84.8	83.5	75.6	64.7	51.9	42.9	63.1
UT	MILFORD	425654	28.1	33.7	41.6	48.3	56.6	66.7	74.2	72.6	63.1	50.6	37.6	28.6	50.1
UT	SALT LAKE CITY	427598	29.2	34.5	43.1	50.0	58.8	69.0	77.0	75.6	65.0	52.5	39.6	30.2	52.0
VA	LYNCHBURG	445120	34.5	37.8	46.0	55.3	63.4	71.0	75.1	73.8	67.1	56.1	46.6	38.2	55.4
VA	NORFOLK	446139	40.1	42.0	49.0	57.4	66.3	74.5	79.1	77.4	72.1	61.1	52.3	44.2	59.6
VA	RICHMOND	447201	36.4	39.5	47.7	57.1	65.4	73.5	77.9	76.3	69.8	58.3	49.0	40.4	57.6
VA	ROANOKE	447285	35.8	39.1	47.2	56.1	64.1	71.9	76.2	74.7	67.7	56.6	47.3	39.1	56.3
VA	WASHINGTON DULLES AP	448903	31.7	34.8	43.4	53.1	62.3	70.9	75.7	74.4	67.3	55.0	45.2	36.0	54.2
VT	BURLINGTON	431081	18.0	19.9	30.7	43.5	56.5	65.6	70.6	68.2	59.4	47.7	37.1	24.8	45.2
WA	OLYMPIA	456114	38.1	40.5	43.6	47.4	53.3	58.2	62.8	63.3	58.3	49.7	42.4	38.0	49.7
WA	QUILLAYUTE	456858	40.6	42.2	43.8	46.7	51.2	54.9	58.6	59.3	56.5	50.1	44.2	40.6	49.1
WA	SEATTLE C.O.	457458	41.5	43.8	46.9	50.9	56.6	61.1	65.5	66.0	61.3	53.4	46.0	41.3	52.9
WA	SEATTLE SEA-TAC AP	457473	40.9	43.3	46.2	50.2	55.8	60.7	65.3	65.6	61.1	52.7	45.2	40.7	52.3
WA	SPOKANE	457938	27.3	32.5	39.5	46.5	54.4	61.6	68.6	68.6	59.2	47.2	34.9	27.2	47.3
WA	WALLA WALLA	458928	34.7	39.7	46.5	52.7	59.8	67.3	75.3	75.2	66.1	54.7	43.1	35.1	54.2
WA	YAKIMA	459465	29.1	35.2	42.5	48.7	56.2	62.9	69.1	68.3	60.0	48.6	37.0	28.8	48.9
WI	GREEN BAY	473269	15.6	20.5	31.3	44.2	56.4	65.4	69.9	67.5	58.8	47.4	34.0	21.2	44.4
WI	LA CROSSE	474370	15.9	22.6	34.6	48.4	60.6	69.6	74.0	71.6	62.7	50.6	35.5	21.8	47.3
WI	MADISON	474961	17.3	22.6	33.7	45.9	57.7	67.0	71.6	69.1	60.7	49.3	35.5	23.0	46.1
WI	MILWAUKEE	475479	20.7	25.4	34.9	45.2	56.1	66.3	72.0	70.6	63.0	51.4	38.4	26.2	47.5
WV	BECKLEY	460582	30.4	33.9	42.1	51.5	59.9	67.0	70.7	69.3	63.1	52.8	43.4	34.8	51.6
WV	CHARLESTON	461570	33.4	36.9	45.3	54.3	62.4	69.9	73.9	72.6	66.2	55.1	45.9	37.5	54.5
WV	ELKINS	462718	28.6	31.6	40.0	48.9	57.9	65.6	69.6	68.5	62.1	50.6	41.0	32.7	49.8

Appendix E, NOAA Monthly Mean Temperature Data (1971 to 2000)

WEATHER STATION			Monthly Mean Temperature (°F)												Annual
State	Name	COOP ID	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Mean (°F)
WV	HUNTINGTON	464393	32.7	36.8	45.9	55.2	63.6	71.3	75.3	73.9	66.9	55.6	45.9	37.1	55.0
WY	CASPER	481570	22.3	26.7	35.0	42.7	52.1	62.7	70.0	68.6	57.6	45.7	32.0	23.8	44.9
WY	CHEYENNE	481675	25.9	28.8	34.2	41.6	51.3	61.5	67.7	65.9	56.6	45.4	33.3	27.1	45.0
WY	LANDER	485390	20.3	25.6	35.5	43.9	53.4	63.7	70.9	69.4	58.7	46.4	30.3	21.3	45.0
WY	SHERIDAN	488155	21.3	26.9	35.3	43.9	52.5	61.6	68.8	68.2	57.1	45.1	31.0	22.4	44.6
GU	GUAM	914229	77.6	77.6	78.4	79.5	80.3	80.5	79.8	79.5	79.7	79.5	79.6	78.9	79.2
	JOHNSTON ISLAND, PC	914320	77.5	77.7	77.9	78.7	79.8	81.2	82.0	82.6	82.5	81.9	79.9	78.3	80.0
	KOROR, PC	914351	81.4	81.2	81.8	82.3	82.6	81.8	81.4	81.6	82.0	82.1	82.5	82.0	81.9
	KWAJALEIN, MARSHALL IS., PC	914375	81.6	81.8	82.3	82.2	82.4	82.2	82.1	82.3	82.3	82.4	82.1	81.9	82.1
	MAJURO, MARSHALL IS, PC	914460	80.8	81.1	81.2	81.1	81.3	81.2	81.1	81.4	81.5	81.5	81.4	80.9	81.2
	PAGO PAGO, AMER SAMOA, PC	914690	81.5	81.8	82.0	81.6	80.9	80.3	79.7	79.8	80.3	80.7	81.2	81.7	81.0
	POHNPEI, CAROLINE IS., PC	914751	80.8	81.1	81.4	81.2	81.2	81.0	80.7	80.7	80.7	80.7	81.0	80.9	81.0
	CHUUK, E. CAROLINE IS., PC	914111	81.5	81.3	81.6	81.8	81.9	81.6	81.4	80.9	81.3	81.4	82.1	81.5	81.5
	WAKE ISLAND, PC	914901	77.8	77.3	78.2	79.2	80.8	82.6	83.3	83.3	83.6	82.6	81.0	79.3	80.8
	YAP, W CAROLINE IS., PC	914951	80.1	80.3	80.8	81.5	81.7	81.0	80.6	80.4	80.6	80.7	80.9	80.6	80.8

Appendix F, Emergency Generator Statistical Analysis

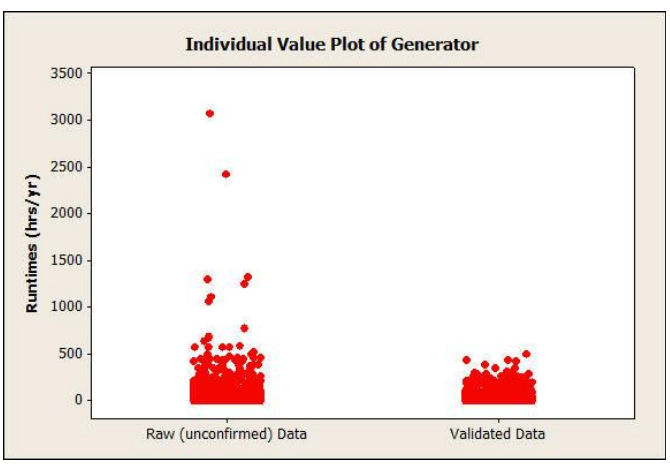
The Air Force has been recording runtime for their emergency generators for years in quantified historic Air Emission Inventory (AEI) data in formal hardcopy AEIs and the Air Program Information (APIMS). Using the historic AEI generator runtimes collected from the 1994 to 2010, factual-based inferences (i.e., statistically draw conclusions from available evidence) on Potential to Emit (PTE) and Likely to Emit (LTE) capacity rates scenarios can be derived to a relative degree of confidence (i.e., greater than 95% confidence). The emergency generator runtime data table (Table F-3) is at the end of the main body of this appendix given the large size of generator runtime datasets (5,546 raw unconfirmed values and 2,629 validated values).

Descriptive statistics were used to provide a first glance (big picture) and organization of the raw data. The purpose of descriptive statistics was to summarize or display data so a quick overview can be obtained. Summary descriptive statistics were applied (as discussed below) to identify anomalies and trend groupings in the data; and when present, were investigated for cause and taken into account. The summary statistics included individual value plots (line chart), histograms, mean, median, mode, range, variance, standard deviation, and probability distribution.

Individual Value Plots

The individual value plots (see Figure F-1) provide a simple straight-line plot of each generator runtime value relative to each other. The individual value plot on the left side of the figure shows the 5,546 raw unconfirmed runtime values (3,242 from APIMS and 2,304 from hardcopy AEIs) for all internal combustion engines that are suspected to be small generators. This raw data individual value plot was used to identify possible outliers and other values of interest, to illustrate characteristics of the data distribution (e.g. how the data is grouped or clustered), and to obtain a quick relative visual comparison of the datasets.

Figure F-1, Emergency Generator Individual Value Plots



Based on the potential outliers identified in the individual value plot of raw data, a comprehensive review was performed to validate each runtime value. Stationary Air Emissions Inventories (the original sources) were examined and several data points were eliminated from further statistical analysis. Runtimes values were primarily rejected for not meeting the definition of a small emergency generator (i.e., rejected if runtime was associated with a non-emergency, portable and/or > 600 hp generator). Additional runtimes were also rejected for: internal combustion engine other than a generator; no fuel type data available; redundant values (i.e., same value entered more than once); and/or the runtime value for two or more generators recorded as one.

Table F-1. Summary of Validated Emergency Generator Data

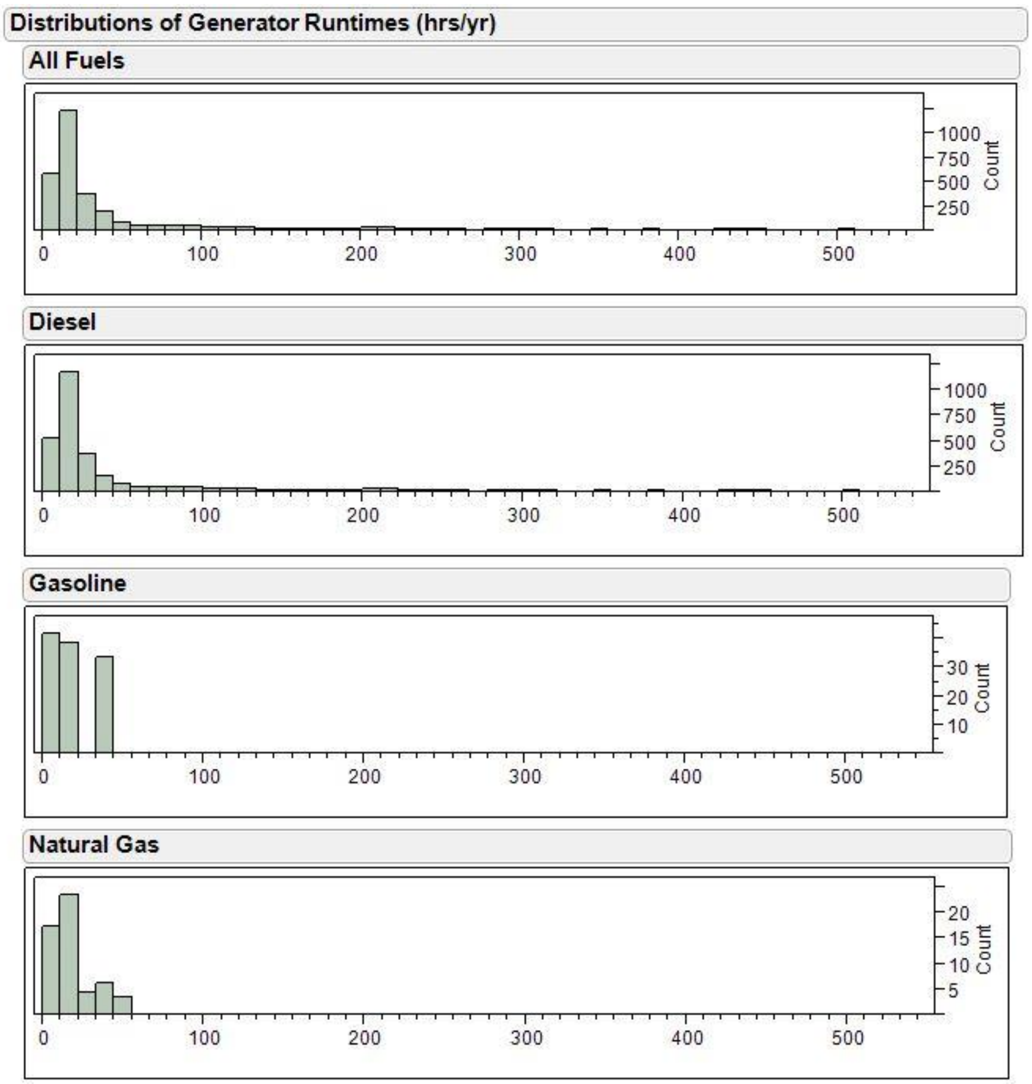
Base	Fuel Type	Power Rating (KW)	Rated Power (hp)	Count	Runtime (hr/yr)		
					Min	Avg	Max
Altus	diesel	5 to 350	7 to 460	139	1.1	71.0	443.8
Andrews	diesel	12 to 405	16 to 543	41	1.0	99.6	252.0
Buckley	diesel	3 to 400	4 to 535	157	1.0	22.1	250.9
	gasoline	3 to 80	4 to 107	21	1.0	5.7	15.8
	natural gas	60	80	12	1.8	8.2	15.4
Cannon	diesel	15 to 350	20 to 470	140	0.1	29.1	347.9
Columbus	diesel	5 to 125	6 to 268	253	1.1	23.3	260.1
	gasoline	4 to 440	5 to 591	7	2.2	10.3	16.9
Hill	diesel	13 to 427	17 to 573	221	0.4	17.4	500.0
	natural gas	11 to 200	15 to 268	21	8.5	19.5	36.1
Keesler	diesel	6 to 350	8 to 483	215	1.1	18.5	197.4
Kirtland	diesel	17 to 400	23 to 535	285	0.5	18.7	348.4
	gasoline	49	65	31	1.3	41.6	43.8
	natural gas	50 to 250	67 to 335	15	8.5	18.7	36.1
Luke	diesel	6 to 400	8 to 536	479	0.7	29.8	384.5
	gasoline	5 to 5.5	7 to 7.5	47	1.6	10.0	21.6
Patrick	diesel	6 to 350	8 to 470	119	5.4	31.6	445.6
Seymore Johnson	diesel	1 to 400	1 to 536	296	0.9	31.2	501.9
	gasoline	5	7	6	2.0	28.0	41.0
	natural gas	100	134	4	19.0	35.8	42.0
Sheppard	diesel	5 to 350	7 to 470	120	6.7	114.0	469.4

During this data validation process it was noted that many of the Stationary AEIs had erroneously included mobile generators and mislabeled non-emergency generators. Upon removing all runtimes associated with non-emergency and mobile generator from the dataset, no further outliers existed. The individual value plot for validated generators (shown on the right in Figure F-1) depicted the revised dataset with no outliers. Upon completion of data validation process, only 2,629 runtime values met the validation screening criteria.

Histograms

The histogram is a bar graph that shows frequency of data and was used to graphically summarize and display the distribution of generator runtime datasets. The histogram graphically shows the following: center (i.e., the location) of the data; spread (i.e., the scale) of the data; skewness of the data; presence of outliers; and presence of multiple modes in the data. The following figure (Figure F-2. Histograms for Emergency Generators) displays the general (i.e., all fuel types) and fuel-specific histograms for the emergency generators.

Figure F-2. Histograms for Emergency Generators



The histograms revealed:

- The diesel generator dataset was the largest (2,464 runtime values vs. 112 runtime values for gasoline and 53 runtime values for natural gas);
- The datasets for all fuel types of emergency generators are positively skewed with more than 50% of the values < 20 hrs/yr; and
- Diesel generators have the most variation in distribution of runtimes.

Based on the histograms, it appears that annual generator runtime is not fuel dependent. This is consistent with the backup power purpose of emergency generator. Therefore, all fuel types were included as the representative dataset for estimating emergency generator PTE and LTE.

Generator Runtime Analysis

Both SAS JMP and Mini Tab statistical software packages were used to evaluate all validated stationary emergency generator runtime data to obtain descriptive and inferential statically information (see Figure F-3, Generator Runtime Statistical Analysis Using JMP, and Figure F-4, Generator Runtime Statistical Analysis Using Mini Tab, for details). Both SAS JMP and Mini Tab provided two separate null hypotheses (i.e., Shapiro-Wilk from SAS JMP and Anderson-Darling from Mini Tab) for testing normal distribution.

Central tendency results show a mean (μ or$\bar{x}$) of 29.4 hrs per yr with a skewness of 4.45 and a kurtosis of 26.8, which indicates that the dataset's distribution is leptokurtic (an acute peak around the mean) skewness towards zero. While the mean is often used to report central tendency, it may not be appropriate for describing skewed distributions like this, because it is easily misinterpreted by providing an off-center and high-end biased.

The variance (s^2) shows spread or variability of about 1,726. A more useful and understandable measure is the square root of the variance or the standard deviation (s or σ). Standard deviation is about 41.5.

Normal distribution is a theoretical frequency distribution for a set of variable data, usually represented by a bell-shaped curve symmetrical about the mean. Normal distributions are symmetric with scores more concentrated in the middle than in the tails. They are defined by two parameters: the mean (μ) and the standard deviation (σ). Many kinds of behavioral data are approximated well by the normal distribution. Many statistical tests assume a normal distribution. Most of these tests work well even if the distribution is only approximately normal and in many cases as long as it does not deviate greatly from normality.

Two different Null Hypotheses (H_0) were used as goodness of fit tests: Anderson-Darling Test (performed in Mini Tab) and Shapiro-Wilk Normality Tests (performed in JMP). The formulated H_0 testing hypothesis was:

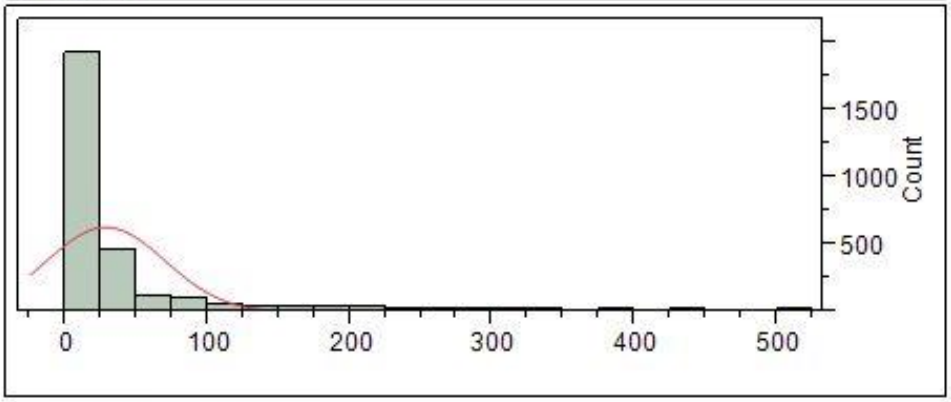
$$H_o = \text{the dataset is from a normal distribution}$$

A significance value (α) of 0.05 (for 95% confidence) was used for both tests. Given the p-values were smaller than the significance level; both tests indicate the null hypothesis should be rejected. Additionally, the Anderson-Darling statistic (A-Squared) was much greater than 1.035 for a normal distribution.

Figure F-3. Generator Runtime Statistical Analysis Using JMP

Generator Runtimes (hrs/yr)

All Fuels



Normal(28.1531,41.5399)

Moments

Mean	28.153146
Std Dev	41.539882
Std Err Mean	0.8101584
Upper 95% Mean	29.741759
Lower 95% Mean	26.564533
N	2629
Sum Wgt	2629
Sum	74014.62
Variance	1725.5618
Skewness	4.8664334
Kurtosis	31.902948
CV	147.5497
N Missing	0

Confidence Intervals

Parameter	Estimate	Lower CI	Upper CI	1-Alpha
Mean	28.15315	26.56453	29.74176	0.950
Std Dev	41.53988	40.44669	42.69425	0.950

Fitted Normal

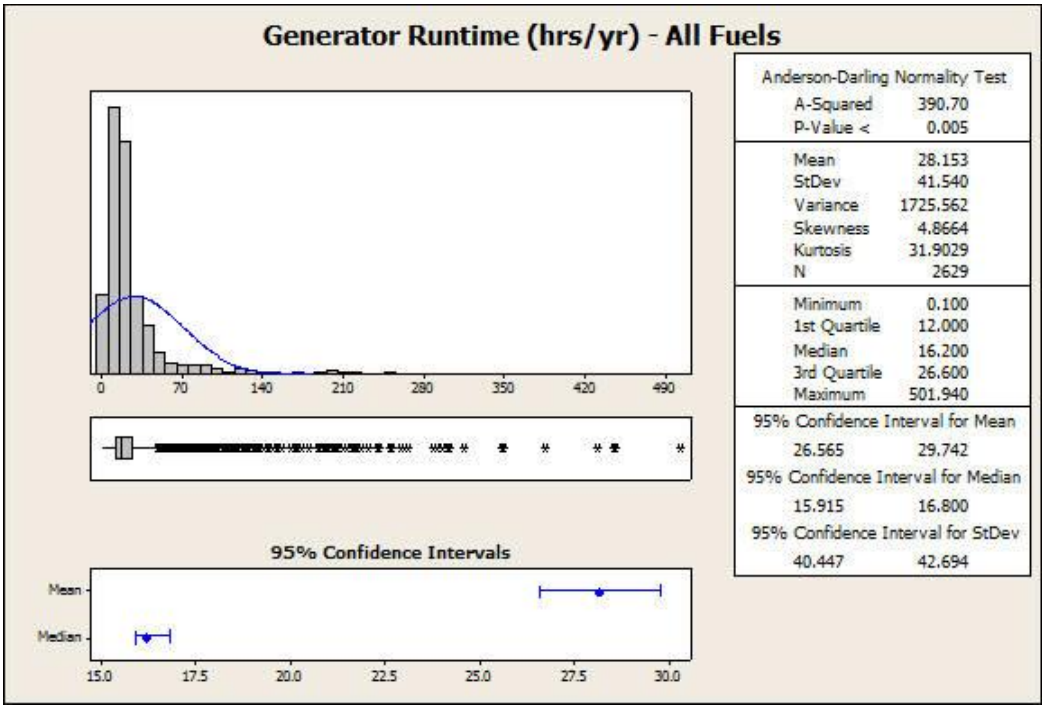
Goodness-of-Fit Test

KSL Test

D		Prob>D
0.270401	<	0.0100*

Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

Figure F-4. Generator Runtime Statistical Analysis Using Mini Tab



In performing the statistical analysis on the Air Force emergency generators there were several observations noted associated with the dataset that had a potential direct and/or impact on activity rates. The following observations were noted:

- The USAF stationary AEIs erroneously contains mobile generators and erroneously labels non-emergency generators as emergency generators. These errors inadvertently resulted in an over estimate of annual air emissions at many USAF facilities.
- The USAF primarily uses diesel emergency generators; however, the histograms indicate that annual generator runtime is not fuel related.
- The datasets for all fuel types of emergency generators are positively skewed towards zero, indicating that emergency backup power is usually for short durations.
- Given the Null Hypothesis was rejected, the tests confirmed the dataset for stationary emergency generator runtimes is not a normal distribution.
- The statistics indicate that the dataset is leptokurtic (very peaked) and skewed towards zero. Therefore, you have a higher probability than a normal distribution to have most of the values near the mean (approximately 28 hrs per yr).

Derived Activity Rates

The confidence intervals show the intervals in which a measurement (in this case annual generator runtimes) falls corresponding to a given probability. In other words, with a 95% confidence interval, we can be confident that 95% of the single annual generator runtime will fall within this estimated range of all generator runtimes.

With PTE effectively being an upper-boundary maximum that will not be exceeded, the confidence interval around the upper percentile is appropriate (not the confidence interval around the mean) to represent PTE. Since there is no maximum value associated with a continuous distribution (like a normal distribution), it is standard practice to settle for a confidence interval around a sufficiently high percentile that will exceed nearly all the population measurement. Generally, the upper 99th percentile is used, implying that at the most 1 in 100 measurements would ever exceed the PTE.

If the dataset is approximately normal, then the "68-95-99.7 rule" or the "empirical rule" can be applied to infer several confidence intervals. Based on the empirical rule, one standard deviation from the mean accounts for 68.27% of the values in the dataset; while two standard deviations from the mean account for 95.45%; and three standard deviations account for 99.73%.

PTE is a measure worst-case annual operating time; therefore, the upper confidence limit (UCL) of the dataset's 99th percentile or greater would provide a representative PTE for a specified confidence. Therefore, if the emergency generator dataset had an approximate normal distribution, PTE could be derived using the "empirical rule" at 99.73% (1 in 1,429 measurements) confidence at three standard deviations above the mean. Based on the Air Force's statistical analysis of emergency generators:

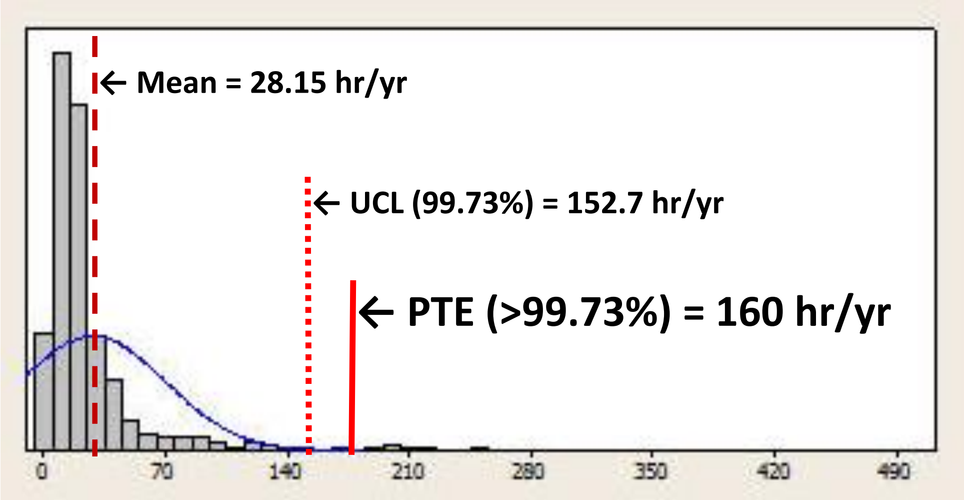
$$\boldsymbol{A(PTE_{Normal})} = \boldsymbol{\mu + 3\sigma} = 28.15 + (3 \times 41.54) = \boldsymbol{152.7\ hrs/yr}$$

Where:

μ = mean = 28.15 hrs/yr
σ = standard deviation = 41.54 hrs/yr
n = 2,629 measurements

The above 99.73% UCL assumes a normal distribution of the dataset and yields a PTE of approximately 153 hrs/yr runtime. However, the statistical analysis demonstrated that the generator runtime dataset was not a normal distribution and skewed toward zero.

Figure F-5, Emergency Generators Histogram and Confidence Intervals



The dataset is leptokurtic (very peaked) and skewed towards zero, giving a higher probability than a normal distribution to have most of the values near the mean (approximately 28 hrs per yr). Therefore, using the upper 99.73% UCL for a PTE value would be a conservative estimate of a worst case. Additional, for ease of use and to add a slight factor of safety, the Air Force recommends used a PTE value of ***160 hr/yr for all emergency generators***. For more details on the statistical analysis see Appendix F, Emergency Generator Statistical Analysis.

LTE represents the most likely or probable runtime for the emergency generators. The mean, at 28.2 hr/yr provides an Air Force-wide average and an indicator of the most likely runtime. However, it does not provide us with the confidence we desire to ensure acceptability to the regulatory community for use in NEPA evaluation. Therefore, the 95% upper confidence limit for the mean provides a better estimate. Using the confidence interval for the mean results in a LTE at 95% confidence would be approximately 30 hrs per yr.

Table F-2, Summary of Emergency Generator PTE & LTE Derived Activity Rates, provides an overview of LTE and PTE activity rates derived for emergency generator.

Table F-2, Emergency Generator PTE & LTE Derived Activity Rates

LTE (hrs/yr)			PTE (hrs/yr)		
Mean ($\bar{X}$)	Mean (95% UCL)	Recommended LTE	Maximum (99.73% UCL)	Maximum (>99.73% UCL)	Recommended PTE
28	30	**30**	111	153	**160**

Table F-3, Emergency Generator Runtime Data

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Columbus	1997	11	100	134.1	Diesel	16.70
Columbus	1997	142	80	107.3	Diesel	22.00
Columbus	1997	142	200	268.2	Diesel	24.50
Columbus	1997	208	6	8.0	Diesel	1.70
Columbus	1997	229	30	40.2	Diesel	33.90
Columbus	1997	268	30	40.2	Diesel	12.10
Columbus	1997	363	30	40.2	Diesel	20.30
Columbus	1997	385	25	33.5	Diesel	2.50
Columbus	1997	528	30	40.2	Diesel	21.70
Columbus	1997	604	200	268.2	Diesel	14.20
Columbus	1997	640	7.5	10.1	Diesel	15.00
Columbus	1997	724	60	80.5	Diesel	14.80
Columbus	1997	830	30	40.2	Diesel	13.50
Columbus	1997	843	125	167.6	Diesel	13.80
Columbus	1997	850	60	80.5	Diesel	15.20
Columbus	1997	865	40	53.6	Diesel	13.60
Columbus	1997	932	150	201.2	Diesel	13.10
Columbus	1997	1046	100	134.1	Diesel	13.40
Columbus	1997	1046	60	80.5	Diesel	260.10
Columbus	1997	1135	100	134.1	Diesel	16.20
Columbus	1997	1608	15	20.1	Diesel	12.30
Columbus	1997	1807	60	80.5	Diesel	203.30
Columbus	1997	1816	200	268.2	Diesel	12.40
Columbus	1997	1816	30	40.2	Diesel	13.80
Columbus	1997	1816	30	40.2	Diesel	14.10
Columbus	1997	1816	200	268.2	Diesel	14.40
Columbus	1997	1816	200	268.2	Diesel	15.20
Columbus	1997	1816	30	40.2	Diesel	21.20
Columbus	1997	1816	5	6.7	Diesel	22.90
Columbus	1997	1816	100	134.1	Diesel	28.10
Columbus	1997	1816	60	80.5	Diesel	46.60
Columbus	1997	1818	15	20.1	Diesel	14.80
Columbus	1997	1842	40	53.6	Diesel	13.60
Columbus	1997	1860	60	80.5	Diesel	121.20
Columbus	1997	1944	30	40.2	Diesel	52.50
Columbus	1997	1947	30	40.2	Diesel	75.30
Columbus	1997	2001	30	40.2	Diesel	13.40

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Columbus	1997	2002	30	40.2	Diesel	27.30
Columbus	1997	2003	30	40.2	Diesel	19.90
Columbus	1997	2004	30	40.2	Diesel	36.20
Columbus	1997	2010	50	67.1	Diesel	31.20
Columbus	1997	7222	30	40.2	Diesel	15.00
Columbus	1997	8672	30	40.2	Diesel	11.20
Columbus	1997	900*	60	80.5	Diesel	25.00
Columbus	2001	142	60	80.5	Diesel	13.20
Columbus	2001	208	7.5	10.1	Diesel	12.30
Columbus	2001	229	30	40.2	Diesel	58.50
Columbus	2001	268	30	40.2	Diesel	17.20
Columbus	2001	385	25	33.5	Diesel	73.30
Columbus	2001	528	30	40.2	Diesel	15.80
Columbus	2001	603	225	268.2	Diesel	25.90
Columbus	2001	640	7.5	10.1	Diesel	24.00
Columbus	2001	724	60	80.5	Diesel	18.00
Columbus	2001	830	30	40.2	Diesel	16.70
Columbus	2001	847	125	167.6	Diesel	117.10
Columbus	2001	850	60	80.5	Diesel	18.70
Columbus	2001	900	60	80.5	Diesel	12.90
Columbus	2001	932	150	201.2	Diesel	13.33
Columbus	2001	995	200	268.2	Diesel	17.78
Columbus	2001	1046	100	134.1	Diesel	8.89
Columbus	2001	1818	15	20.1	Diesel	15.10
Columbus	2001	1842	40	53.6	Diesel	18.20
Columbus	2001	1944	30	40.2	Diesel	11.10
Columbus	2001	1947	30	40.2	Diesel	99.40
Columbus	2001	2001	30	40.2	Diesel	11.50
Columbus	2001	2002	30	40.2	Diesel	13.30
Columbus	2001	2003	30	40.2	Diesel	124.00
Columbus	2001	2004	30	40.2	Diesel	10.80
Columbus	2001	2010	50	67.1	Diesel	111.30
Columbus	2001	7222	60	80.5	Diesel	33.30
Columbus	2001	8672	60	80.5	Diesel	25.40
Columbus	2001	160B	14	18.8	Diesel	116.10
Columbus	2001	1860(2048)	80	107.3	Diesel	18.50
Andrews	1994	1050	250	335.3	Diesel	144.00
Andrews	1994	1050	125	167.6	Diesel	212.00
Andrews	1994	1050	100	134.1	Diesel	212.00

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Andrews	1994	1050	75	100.6	Diesel	232.00
Andrews	1994	1075	310	415.7	Diesel	96.00
Andrews	1994	1220	150	201.2	Diesel	252.00
Andrews	1994	1221	15	20.1	Diesel	84.00
Andrews	1994	1223	30	40.2	Diesel	84.00
Andrews	1994	1280	210	281.6	Diesel	96.00
Andrews	1994	1281	100	134.1	Diesel	252.00
Andrews	1994	1287	60	80.5	Diesel	84.00
Andrews	1994	1288	200	268.2	Diesel	84.00
Andrews	1994	1429	75	100.6	Diesel	84.00
Andrews	1994	1535	150	201.2	Diesel	84.00
Andrews	1994	1539	350	469.4	Diesel	96.00
Andrews	1994	1684	30	40.2	Diesel	84.00
Andrews	1994	1684	75	100.6	Diesel	252.00
Andrews	1994	1732	60	80.5	Diesel	20.00
Andrews	1994	1732	150	201.2	Diesel	212.00
Andrews	1994	1840	60	80.5	Diesel	84.00
Andrews	1994	1845	35	46.9	Diesel	20.00
Andrews	1994	1918	60	80.5	Diesel	84.00
Andrews	1994	3014	400	536.4	Diesel	96.00
Andrews	1994	3409	125	167.6	Diesel	156.00
Andrews	1994	3464	125	167.6	Diesel	84.00
Andrews	1994	3465	60	80.5	Diesel	20.00
Andrews	1994	3617	30	40.2	Diesel	60.00
Andrews	1994	3621	12	16.1	Diesel	20.00
Andrews	1994	4016	30	40.2	Diesel	84.00
Andrews	1994	4705	30	40.2	Diesel	84.00
Andrews	1994	4863	15	20.1	Diesel	28.00
Andrews	1994	4972	110	147.5	Diesel	84.00
Andrews	1994	5014	15	20.1	Diesel	84.00
Andrews	1994	B-Wine	350	469.4	Diesel	166.50
Andrews	1994	B-Wine	350	469.4	Diesel	166.50
Andrews	2004	1075	400	536.4	Diesel	29.00
Andrews	2004	3014	405	543.1	Diesel	28.00
Andrews	2006	1075	400	536.4	Diesel	13.00
Andrews	2006	3014	405	543.1	Diesel	12.00
Andrews	2007	1075	400	536.4	Diesel	16.00
Andrews	2007	3014	405	543.1	Diesel	1.00
Buckley	1997	300	60	80.5	Diesel	11.10

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Buckley	1997	517	37	49.6	Diesel	14.41
Buckley	1997	600	40	53.6	Diesel	21.30
Buckley	1997	620	48.5	65.0	Diesel	5.59
Buckley	1997	700	30	40.2	Diesel	7.70
Buckley	1997	706	60	80.5	Diesel	6.00
Buckley	1997	801	60	80.5	Diesel	19.40
Buckley	1997	806	125	167.6	Diesel	23.90
Buckley	1997	850	150	201.2	Diesel	12.80
Buckley	1997	903	60	80.5	Diesel	3.10
Buckley	1997	937	100	134.1	Diesel	22.00
Buckley	1997	1607	20	26.8	Diesel	15.00
Buckley	1997	1619	33	44.3	Diesel	26.52
Buckley	1997	509 Generac	15	20.1	Diesel	5.60
Buckley	1997	509 Onan	20	26.8	Diesel	5.30
Buckley	1997	800 Cummins	60	80.5	Diesel	4.00
Buckley	1997	800 Freemont*	30	40.2	Diesel	3.80
Buckley	1997	905-1603	400	536.4	Diesel	61.00
Buckley	1997	931 removed	15	20.1	Diesel	21.13
Buckley	2001	1	80.0	107	Diesel	8.00
Buckley	2001	300	60.0	80	Diesel	17.30
Buckley	2001	442	35.0	47	Diesel	5.00
Buckley	2001	509	20.0	27	Diesel	49.50
Buckley	2001	517	37.0	50	Diesel	41.10
Buckley	2001	600	40.0	54	Diesel	8.40
Buckley	2001	620	48.5	65	Diesel	48.60
Buckley	2001	700	175.0	235	Diesel	24.00
Buckley	2001	706	55.0	80	Diesel	18.10
Buckley	2001	728	68.5	92	Diesel	18.00
Buckley	2001	728	68.5	92	Diesel	18.00
Buckley	2001	728	68.5	92	Diesel	18.00
Buckley	2001	800	60.0	80	Diesel	16.70
Buckley	2001	801	60.0	80	Diesel	3.40
Buckley	2001	806	125.0	168	Diesel	123.00
Buckley	2001	850	150.0	201	Diesel	27.80
Buckley	2001	937	100.0	134	Diesel	67.60
Buckley	2001	950	60.0	80	Diesel	67.60
Buckley	2001	1007	200.0	268	Diesel	5.00

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Buckley	2001	1007	200.0	268	Diesel	5.00
Buckley	2001	1007	200.0	268	Diesel	5.00
Buckley	2001	1007	200.0	268	Diesel	5.00
Buckley	2001	1603	400.0	536	Diesel	250.86
Buckley	2001	1607	15.0	20	Diesel	240.37
Buckley	2001	1619	33.0	44	Diesel	249.78
Buckley	2003	300	60.0	80	Diesel	15.60
Buckley	2003	509	20.0	27	Diesel	128.40
Buckley	2003	517	37.0	50	Diesel	34.80
Buckley	2003	600	40.0	54	Diesel	15.60
Buckley	2003	620	48.5	65	Diesel	39.60
Buckley	2003	700	175.0	235	Diesel	7.40
Buckley	2003	706	55.0	74	Diesel	2.20
Buckley	2003	728	68.5	92	Diesel	1.20
Buckley	2003	728	68.5	92	Diesel	1.20
Buckley	2003	800	60.0	80	Diesel	4.50
Buckley	2003	801	60.0	80	Diesel	11.50
Buckley	2003	806	125.0	168	Diesel	15.60
Buckley	2003	850	150.0	201	Diesel	13.00
Buckley	2003	937	100.0	134	Diesel	10.90
Buckley	2003	950	60.0	80	Diesel	13.20
Buckley	2003	1007	3.0	4	Diesel	3.60
Buckley	2003	1007	3.0	4	Diesel	11.10
Buckley	2003	1007	200.0	268	Diesel	18.00
Buckley	2003	1007	200.0	268	Diesel	19.20
Buckley	2003	1009	5.0	7	Diesel	1.00
Buckley	2003	1009	5.0	7	Diesel	1.00
Buckley	2003	1009	5.0	7	Diesel	13.00
Buckley	2003	1009	5.0	7	Diesel	13.00
Buckley	2003	1009	5.0	7	Diesel	22.70
Buckley	2003	1301	200.0	268	Diesel	52.00
Buckley	2003	1603	400.0	536	Diesel	37.30
Buckley	2003	1607	15.0	20	Diesel	24.00
Buckley	2003	1619	33.0	44	Diesel	16.80
Buckley	2008	300	60	80.5	Diesel	15.00
Buckley	2008	417	49.216134	66	Diesel	8.00
Buckley	2008	433	11.19	15	Diesel	4.00
Buckley	2008	509	20	26.8	Diesel	6.60
Buckley	2008	517	37	49.6	Diesel	13.40
Buckley	2008	600	40	53.6	Diesel	14.40

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Buckley	2008	620	40	53.6	Diesel	14.20
Buckley	2008	700	175	234.7	Diesel	16.10
Buckley	2008	706	60	80.5	Diesel	13.90
Buckley	2008	730	150	201.2	Diesel	16.80
Buckley	2008	800	35	8	Diesel	51.50
Buckley	2008	801	60	8	Diesel	16.10
Buckley	2008	806	125	167.6	Diesel	15.20
Buckley	2008	830	5	107.3	Diesel	6.00
Buckley	2008	850	5	134.1	Diesel	6.00
Buckley	2008	937	80	13.4	Diesel	14.00
Buckley	2008	950	80	107.3	Diesel	31.90
Buckley	2008	1005	20	26.8	Diesel	16.20
Buckley	2008	1030	250	335	Diesel	17.40
Buckley	2008	1530	230	308.4	Diesel	25.70
Buckley	2008	1603	400	536.4	Diesel	30.00
Buckley	2008	1607	16	21.5	Diesel	27.30
Buckley	2008	1619	33	44.3	Diesel	27.60
Buckley	2008	1007-269	200	268.2	Diesel	17.10
Buckley	2008	1007-E3	60	80.5	Diesel	103.80
Buckley	2008	1007-LC	6	8	Diesel	1.10
Buckley	2008	1007-LC	6	8	Diesel	1.10
Buckley	2008	1007-LC	6	8	Diesel	1.20
Buckley	2008	1007-LC	6	8	Diesel	1.70
Buckley	2008	1007-LC	6	8	Diesel	18.50
Buckley	2008	1007-LC	6	8	Diesel	25.50
Buckley	2008	1007-LC	6	8	Diesel	53.70
Buckley	2008	1302-M	10	4	Diesel	12.00
Buckley	2008	1302-M	3	13.4	Diesel	12.00
Buckley	2008	1302-M	3	13.4	Diesel	12.00
Buckley	2008	1302-M	10	13.4	Diesel	12.00
Buckley	2008	1302-M	10	80.5	Diesel	12.00
Buckley	2008	1302-M	10	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	10	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	30	40.2	Diesel	12.00
Buckley	2008	1302-M	10	13.4	Diesel	12.00
Buckley	2008	1302-M	13	17.4	Diesel	12.00
Buckley	2008	1302-M	13	17.4	Diesel	12.00
Buckley	2008	1302-M	13	17.4	Diesel	12.00
Buckley	2008	1302-M	13	17.4	Diesel	12.00
Buckley	2008	1302-M	13	17.4	Diesel	12.00
Buckley	2008	1302-M	30	40.2	Diesel	12.00
Buckley	2008	1302-M	30	40.2	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	30	40.2	Diesel	12.00
Buckley	2008	1302-M	30	40.2	Diesel	12.00
Buckley	2008	1302-M	30	40.2	Diesel	12.00
Buckley	2008	1302-M	30	40.2	Diesel	12.00
Buckley	2008	1302-M	30	40.2	Diesel	12.00
Buckley	2008	1302-M	30	40.2	Diesel	12.00
Buckley	2008	1302-M	30	40.2	Diesel	12.00
Buckley	2008	1302-M	30	40.2	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	60	80.5	Diesel	12.00
Buckley	2008	1302-M	30	40.2	Diesel	12.00
Buckley	2008	1302-M	100	4	Diesel	43.10
Buckley	2008	1302-Q	3	4	Diesel	12.00
Buckley	2008	1302-Q	3	4	Diesel	12.00

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Buckley	2008	444/445	35	46.9	Diesel	13.50
Cannon	1994		149.1	200	Diesel	3.60
Cannon	1994		149.1	200	Diesel	8.60
Cannon	1994		149.1	200	Diesel	9.40
Cannon	1994		201.3	270	Diesel	12.10
Cannon	1994		298.3	400	Diesel	18.00
Cannon	1994		149.1	200	Diesel	47.00
Cannon	2002	2	80	107.3	Diesel	124.20
Cannon	2002	10	150	201.2	Diesel	14.70
Cannon	2002	77	15	20.1	Diesel	16.20
Cannon	2002	116	300	402.3	Diesel	14.50
Cannon	2002	127	225.2	302	Diesel	2.10
Cannon	2002	127	238.6	320	Diesel	2.20
Cannon	2002	127	238.6	320	Diesel	2.30
Cannon	2002	130	60	80.5	Diesel	14.90
Cannon	2002	135	80	107.3	Diesel	33.20
Cannon	2002	160	147.7	198	Diesel	2.80
Cannon	2002	164	30	40.2	Diesel	11.60
Cannon	2002	197	172.3	231	Diesel	3.60
Cannon	2002	197	170.0	228	Diesel	3.60
Cannon	2002	197	172.3	231	Diesel	3.90
Cannon	2002	216	30	40.2	Diesel	13.60
Cannon	2002	338	250	335.3	Diesel	14.70
Cannon	2002	357	20	26.8	Diesel	12.10
Cannon	2002	381	100	134.1	Diesel	12.50
Cannon	2002	600	100	134.1	Diesel	29.50
Cannon	2002	682	30	40.2	Diesel	11.00
Cannon	2002	728	150	201.2	Diesel	217.70
Cannon	2002	772	250	335.3	Diesel	13.60
Cannon	2002	2282	60	80.5	Diesel	10.30
Cannon	2002	2300	25	33.5	Diesel	18.40
Cannon	2002	2302	30	40.2	Diesel	50.50
Cannon	2002	2326	164.1	220	Diesel	4.10
Cannon	2002	2340	15	20.1	Diesel	24.60
Cannon	2002	2360	80	107.3	Diesel	10.40
Cannon	2002	3025	15	20.1	Diesel	35.70
Cannon	2002	3050	25	33.5	Diesel	121.30
Cannon	2002	3060	15	20.1	Diesel	12.40
Cannon	2002	3114	100	134.1	Diesel	27.40

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Cannon	2002	3123	15	20.1	Diesel	51.70
Cannon	2002	3208	175.2	235	Diesel	1.40
Cannon	2002	3208	175.2	235	Diesel	2.70
Cannon	2002	3208	175.2	235	Diesel	2.70
Cannon	2002	4027	15	20.1	Diesel	15.50
Cannon	2002	4077	60	80.5	Diesel	25.60
Cannon	2002	4085	350	469.4	Diesel	38.40
Cannon	2002	5038	200	268.2	Diesel	12.00
Cannon	2002	9971	90	120.7	Diesel	12.90
Cannon	2002	9973	150	201.2	Diesel	13.10
Cannon	2002		200	268.2	Diesel	11.20
Cannon	2002		200	268.2	Diesel	14.00
Cannon	2002		100	134.1	Diesel	17.10
Cannon	2002		60	80.5	Diesel	17.80
Cannon	2002		60	80.5	Diesel	96.40
Cannon	2002		100	134.1	Diesel	112.30
Cannon	2002		30	40.2	Diesel	179.60
Cannon	2002		30	40.2	Diesel	221.40
Cannon	2002		30	40.2	Diesel	347.90
Cannon	2003	2	80	107.3	Diesel	43.00
Cannon	2003	10	150	201.2	Diesel	15.00
Cannon	2003	77	15	20.1	Diesel	16.00
Cannon	2003	127	238.6	320	Diesel	1.00
Cannon	2003	127	238.6	320	Diesel	2.00
Cannon	2003	127	225.2	302	Diesel	2.00
Cannon	2003	128	261.0	350	Diesel	17.00
Cannon	2003	130	60	80.5	Diesel	16.00
Cannon	2003	135	80	107.3	Diesel	24.00
Cannon	2003	160		198	Diesel	2.00
Cannon	2003	164	30	40.2	Diesel	66.00
Cannon	2003	197	172.3	231	Diesel	2.00
Cannon	2003	197	172.3	231	Diesel	2.00
Cannon	2003	197	170.0	228	Diesel	2.00
Cannon	2003	216	30	40.2	Diesel	12.00
Cannon	2003	338	250	335.3	Diesel	11.00
Cannon	2003	357	20	26.8	Diesel	52.00
Cannon	2003	381	100	134.1	Diesel	38.00
Cannon	2003	600	100	134.1	Diesel	9.00
Cannon	2003	682	30	40.2	Diesel	11.00

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Cannon	2003	728	277	371.5	Diesel	101.00
Cannon	2003	772	250	335.3	Diesel	14.00
Cannon	2003	2282	60	80.5	Diesel	9.00
Cannon	2003	2300	250	335.3	Diesel	28.00
Cannon	2003	2302	250	335.3	Diesel	76.00
Cannon	2003	2306	80	107.3	Diesel	72.00
Cannon	2003	2326	164.1	220	Diesel	3.00
Cannon	2003	2340	15	20.1	Diesel	20.00
Cannon	2003	3025	15	20.1	Diesel	6.00
Cannon	2003	3050	25	33.5	Diesel	15.00
Cannon	2003	3060	15	20.1	Diesel	9.00
Cannon	2003	3114	100	134.1	Diesel	28.00
Cannon	2003	3123	15	20.1	Diesel	16.00
Cannon	2003	3208	175.2	235	Diesel	1.00
Cannon	2003	3208	175.2	235	Diesel	1.00
Cannon	2003	3208	175.2	235	Diesel	1.00
Cannon	2003	4027	17	22.8	Diesel	11.00
Cannon	2003	4077	60	80.5	Diesel	6.00
Cannon	2003	4085	350	469.4	Diesel	6.00
Cannon	2003	5038	200	268.2	Diesel	12.00
Cannon	2003	9971	90	120.7	Diesel	11.00
Cannon	2003	9973	150	201.2	Diesel	12.00
Cannon	2004	2	80	107.3	Diesel	31.40
Cannon	2004	10	150	201.2	Diesel	54.80
Cannon	2004	77	15	20.1	Diesel	12.60
Cannon	2004	127	225.2	302	Diesel	0.20
Cannon	2004	127	238.6	320	Diesel	0.40
Cannon	2004	127	238.6	320	Diesel	0.80
Cannon	2004	130	60	80.5	Diesel	16.00
Cannon	2004	135	80	107.3	Diesel	54.30
Cannon	2004	160		198	Diesel	1.60
Cannon	2004	164	30	40.2	Diesel	9.00
Cannon	2004	197	170.0	228	Diesel	0.80
Cannon	2004	197	172.3	231	Diesel	1.10
Cannon	2004	197	172.3	231	Diesel	1.40
Cannon	2004	216	30	40.2	Diesel	17.50
Cannon	2004	338	250	335.3	Diesel	11.60
Cannon	2004	357	20	26.8	Diesel	33.30
Cannon	2004	381	100	134.1	Diesel	34.20

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Cannon	2004	600	100	134.1	Diesel	14.40
Cannon	2004	682	30	40.2	Diesel	20.20
Cannon	2004	728	277	371.5	Diesel	167.00
Cannon	2004	772	250	335.3	Diesel	67.40
Cannon	2004	2282	60	80.5	Diesel	36.00
Cannon	2004	2300	250	335.3	Diesel	40.60
Cannon	2004	2302	250	335.3	Diesel	39.40
Cannon	2004	2306	80	107.3	Diesel	48.00
Cannon	2004	2326	164.1	220	Diesel	1.60
Cannon	2004	2340	15	20.1	Diesel	194.50
Cannon	2004	3025	15	20.1	Diesel	6.00
Cannon	2004	3050	25	33.5	Diesel	31.30
Cannon	2004	3060	15	20.1	Diesel	37.50
Cannon	2004	3114	100	134.1	Diesel	22.00
Cannon	2004	3123	15	20.1	Diesel	12.10
Cannon	2004	3208	175.2	235	Diesel	0.10
Cannon	2004	3208	175.2	235	Diesel	0.30
Cannon	2004	3208	175.2	235	Diesel	4.70
Cannon	2004	4027	17	22.8	Diesel	20.50
Cannon	2004	4077	60	80.5	Diesel	6.00
Cannon	2004	4085	350	469.4	Diesel	6.00
Cannon	2004	5038	200	268.2	Diesel	13.00
Cannon	2004	9971	90	120.7	Diesel	12.60
Cannon	2004	9973	150	201.2	Diesel	14.50
Kirtland	2001	1013	99.9	134	Diesel	18.20
Kirtland	2001	1017	155.1	208	Diesel	21.60
Kirtland	2001	20449	199.9	268	Diesel	16.10
Kirtland	2001	20676	364.7	489	Diesel	58.60
Kirtland	2001	20676	275.2	369	Diesel	78.10
Kirtland	2001	20754	299.8	402	Diesel	25.70
Kirtland	2001	26038	299.8	402	Diesel	6.50
Kirtland	2001	66004	149.9	201	Diesel	50.00
Kirtland	2001	00403	216.3	290	Diesel	3.90
Kirtland	2001	00472	350.5	470	Diesel	17.70
Kirtland	2001	00758	253.5	340	Diesel	4.60
Kirtland	2001	00758	253.5	340	Diesel	5.40
Kirtland	2001	00758	253.5	340	Diesel	5.70
Kirtland	2001	00758	253.5	340	Diesel	6.10
Kirtland	2001	01021	253.5	340	Diesel	8.80

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Kirtland	2001	01021	253.5	340	Diesel	9.70
Kirtland	2001	01021	253.5	340	Diesel	12.40
Kirtland	2001	01021	253.5	340	Diesel	13.50
Kirtland	2001	20370	249.8	335	Diesel	13.50
Kirtland	2001	20604	99.9	134	Diesel	21.60
Kirtland	2001	20678	199.9	268	Diesel	9.20
Kirtland	2001	20678	199.9	268	Diesel	12.00
Kirtland	2001	20678	199.9	268	Diesel	13.00
Kirtland	2001	20678	99.9	134	Diesel	20.80
Kirtland	2001	20678	99.9	134	Diesel	59.70
Kirtland	2001	20793	253.5	340	Diesel	27.50
Kirtland	2001	66013	310.2	416	Diesel	7.10
Kirtland	2001	Radar	175.2	235	Diesel	26.60
Kirtland	2002	20449	199.9	268	Diesel	16.10
Kirtland	2002	20676	275.2	369	Diesel	34.60
Kirtland	2002	20676	140.9	189	Diesel	43.20
Kirtland	2002	20754	299.8	402	Diesel	23.60
Kirtland	2002	66004	149.9	201	Diesel	29.20
Kirtland	2002	00472	350.5	470	Diesel	26.40
Kirtland	2002	00758	253.5	340	Diesel	2.96
Kirtland	2002	00758	253.5	340	Diesel	4.15
Kirtland	2002	00758	253.5	340	Diesel	5.47
Kirtland	2002	00758	253.5	340	Diesel	60.80
Kirtland	2002	01013	99.9	134	Diesel	9.64
Kirtland	2002	01017	155.1	208	Diesel	20.80
Kirtland	2002	01021	253.5	340	Diesel	5.30
Kirtland	2002	01021	253.5	340	Diesel	5.30
Kirtland	2002	01021	253.5	340	Diesel	6.06
Kirtland	2002	01021	253.5	340	Diesel	14.10
Kirtland	2002	20370	249.8	335	Diesel	20.80
Kirtland	2002	20604	99.9	134	Diesel	31.70
Kirtland	2002	20678	199.9	268	Diesel	5.40
Kirtland	2002	20678	199.9	268	Diesel	8.50
Kirtland	2002	20678	199.9	268	Diesel	15.70
Kirtland	2002	20678	99.9	134	Diesel	22.40
Kirtland	2002	20793	216.3	290	Diesel	8.27
Kirtland	2002	66013	310.2	416	Diesel	34.30
Kirtland	2002	Radar	175.2	235	Diesel	18.42
Kirtland	2003	19129	154.4	207	Diesel	24.30

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Kirtland	2003	19131	126.8	170	Diesel	14.50
Kirtland	2003	19132	206.6	277	Diesel	18.60
Kirtland	2003	20449	199.9	268	Diesel	12.50
Kirtland	2003	20676	364.7	489	Diesel	18.40
Kirtland	2003	20754	299.8	402	Diesel	144.60
Kirtland	2003	26038	299.8	402	Diesel	52.10
Kirtland	2003	66004	149.9	201	Diesel	85.00
Kirtland	2003	00291	244.6	328	Diesel	48.40
Kirtland	2003	00758	253.5	340	Diesel	3.80
Kirtland	2003	00758	253.5	340	Diesel	4.10
Kirtland	2003	00758	253.5	340	Diesel	5.80
Kirtland	2003	00758	253.5	340	Diesel	5.90
Kirtland	2003	01013	99.9	134	Diesel	10.40
Kirtland	2003	01017	155.1	208	Diesel	11.40
Kirtland	2003	01021	253.5	340	Diesel	4.40
Kirtland	2003	01021	253.5	340	Diesel	4.60
Kirtland	2003	01021	253.5	340	Diesel	4.80
Kirtland	2003	01021	253.5	340	Diesel	4.90
Kirtland	2003	20370	199.9	268	Diesel	13.20
Kirtland	2003	20604	99.9	134	Diesel	56.70
Kirtland	2003	20678	99.9	134	Diesel	11.40
Kirtland	2003	20678	199.9	268	Diesel	37.70
Kirtland	2003	20678	99.9	134	Diesel	65.00
Kirtland	2003	20678	199.9	268	Diesel	348.40
Kirtland	2003	20793	253.5	340	Diesel	13.70
Kirtland	2003	66013	310.2	416	Diesel	53.70
Kirtland	2003	66071	99.9	134	Diesel	52.00
Kirtland	2003	Flightline	48.5	65	Diesel	43.80
Kirtland	2003	Radar	175.2	235	Diesel	16.00
Kirtland	2004	20183	126.8	170	Diesel	31.10
Kirtland	2004	20449	199.9	268	Diesel	14.10
Kirtland	2004	20550	324.4	435	Diesel	27.10
Kirtland	2004	20676	364.7	489	Diesel	5.00
Kirtland	2004	20754	299.8	402	Diesel	3.00
Kirtland	2004	26038	299.8	402	Diesel	6.20
Kirtland	2004	30110	206.6	277	Diesel	45.20
Kirtland	2004	66004	149.9	201	Diesel	36.10
Kirtland	2004	66071	154.4	207	Diesel	16.10
Kirtland	2004	00291	244.6	328	Diesel	47.70

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Kirtland	2004	00758	253.5	340	Diesel	2.40
Kirtland	2004	00758	253.5	340	Diesel	3.60
Kirtland	2004	00758	253.5	340	Diesel	3.70
Kirtland	2004	00758	253.5	340	Diesel	3.90
Kirtland	2004	01013	99.9	134	Diesel	4.70
Kirtland	2004	01017	155.1	208	Diesel	7.70
Kirtland	2004	01021	253.5	340	Diesel	3.30
Kirtland	2004	01021	253.5	340	Diesel	3.70
Kirtland	2004	01021	253.5	340	Diesel	3.70
Kirtland	2004	01021	253.5	340	Diesel	4.10
Kirtland	2004	20370	199.9	268	Diesel	13.10
Kirtland	2004	20604	99.9	134	Diesel	9.90
Kirtland	2004	20678	199.9	268	Diesel	2.30
Kirtland	2004	20678	199.9	268	Diesel	2.30
Kirtland	2004	20678	99.9	134	Diesel	4.50
Kirtland	2004	20678	99.9	134	Diesel	9.00
Kirtland	2004	20793	253.5	340	Diesel	2.30
Kirtland	2004	66013	310.2	416	Diesel	40.30
Kirtland	2004	66071	99.9	134	Diesel	239.40
Kirtland	2004	Flightline	48.5	65	Diesel	43.80
Kirtland	2004	Radar	175.2	235	Diesel	12.00
Kirtland	2005	334	76.1	102	Diesel	15.90
Kirtland	2005	1038	17.2	23	Diesel	15.20
Kirtland	2005	20180	35.0	47	Diesel	38.20
Kirtland	2005	20183	126.8	170	Diesel	12.00
Kirtland	2005	20220	29.8	40	Diesel	13.10
Kirtland	2005	20362	59.7	80	Diesel	11.50
Kirtland	2005	20420	59.7	80	Diesel	14.50
Kirtland	2005	20449	199.9	268	Diesel	10.30
Kirtland	2005	20452	17.2	23	Diesel	14.40
Kirtland	2005	20550	324.4	435	Diesel	19.60
Kirtland	2005	20676	364.7	489	Diesel	10.40
Kirtland	2005	20754	299.8	402	Diesel	41.80
Kirtland	2005	20760	59.7	80	Diesel	17.10
Kirtland	2005	26038	299.8	402	Diesel	6.20
Kirtland	2005	30110	206.6	277	Diesel	25.20
Kirtland	2005	66071	154.4	207	Diesel	12.80
Kirtland	2005	00472	29.8	40	Diesel	2.60
Kirtland	2005	00758	253.5	340	Diesel	5.10

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Kirtland	2005	00758	253.5	340	Diesel	5.20
Kirtland	2005	00758	253.5	340	Diesel	5.70
Kirtland	2005	00758	253.5	340	Diesel	6.00
Kirtland	2005	01013	99.9	134	Diesel	9.50
Kirtland	2005	01017	155.1	208	Diesel	10.50
Kirtland	2005	01021	253.5	340	Diesel	4.70
Kirtland	2005	01021	253.5	340	Diesel	5.10
Kirtland	2005	01021	253.5	340	Diesel	5.20
Kirtland	2005	01021	253.5	340	Diesel	11.70
Kirtland	2005	1004	79.8	107	Diesel	17.10
Kirtland	2005	1047	50.7	68	Diesel	0.50
Kirtland	2005	20217	59.7	80	Diesel	15.50
Kirtland	2005	20370	249.8	335	Diesel	13.10
Kirtland	2005	20684	99.9	134	Diesel	11.60
Kirtland	2005	20793	253.5	340	Diesel	2.70
Kirtland	2005	29010	59.7	80	Diesel	13.30
Kirtland	2005	30158	59.7	80	Diesel	17.80
Kirtland	2005	498	79.8	107	Diesel	20.40
Kirtland	2005	638	29.8	40	Diesel	16.80
Kirtland	2005	66013	310.2	416	Diesel	43.80
Kirtland	2005	Echo Site	25.4	34	Diesel	18.00
Kirtland	2005	Flightline	25.4	34	Diesel	13.40
Kirtland	2005	Radar	175.2	235	Diesel	13.90
Kirtland	2006	334	76.1	102	Diesel	14.00
Kirtland	2006	472	350.5	470	Diesel	6.60
Kirtland	2006	498	79.8	107	Diesel	11.30
Kirtland	2006	638	29.8	40	Diesel	16.50
Kirtland	2006	758	253.5	340	Diesel	3.20
Kirtland	2006	758	253.5	340	Diesel	3.70
Kirtland	2006	758	253.5	340	Diesel	3.70
Kirtland	2006	758	253.5	340	Diesel	3.90
Kirtland	2006	1004	79.8	107	Diesel	13.70
Kirtland	2006	1013	99.9	134	Diesel	8.80
Kirtland	2006	1017	155.1	208	Diesel	10.00
Kirtland	2006	1021	253.5	340	Diesel	4.80
Kirtland	2006	1021	253.5	340	Diesel	5.70
Kirtland	2006	1021	253.5	340	Diesel	6.30
Kirtland	2006	1021	253.5	340	Diesel	7.80
Kirtland	2006	1038	17.2	23	Diesel	33.40

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Kirtland	2006	1044	29.8	40	Diesel	6.00
Kirtland	2006	1047	50.7	68	Diesel	6.00
Kirtland	2006	20180	35.0	47	Diesel	25.60
Kirtland	2006	20183	126.8	170	Diesel	19.40
Kirtland	2006	20217	59.7	80	Diesel	9.40
Kirtland	2006	20220	29.8	40	Diesel	9.10
Kirtland	2006	20362	59.7	80	Diesel	10.90
Kirtland	2006	20370	249.8	335	Diesel	9.40
Kirtland	2006	20374	283.4	380	Diesel	49.90
Kirtland	2006	20420	59.7	80	Diesel	8.50
Kirtland	2006	20449	199.9	268	Diesel	11.50
Kirtland	2006	20452	17.2	23	Diesel	12.30
Kirtland	2006	20550	324.4	435	Diesel	19.40
Kirtland	2006	20604	99.9	134	Diesel	13.80
Kirtland	2006	20684	99.9	134	Diesel	9.20
Kirtland	2006	20760	59.7	80	Diesel	9.80
Kirtland	2006	23900	399.0	535	Diesel	4.90
Kirtland	2006	26025	206.6	277	Diesel	6.00
Kirtland	2006	26038	299.8	402	Diesel	16.40
Kirtland	2006	29010	59.7	80	Diesel	25.70
Kirtland	2006	30110	206.6	277	Diesel	22.90
Kirtland	2006	30158	59.7	80	Diesel	31.30
Kirtland	2006	66013	310.2	416	Diesel	33.70
Kirtland	2006	66071	154.4	207	Diesel	23.90
Kirtland	2006	230676	364.7	489	Diesel	11.80
Kirtland	2006	Echo Site	25.4	34	Diesel	15.00
Kirtland	2006	Flightline	25.4	34	Diesel	15.00
Kirtland	2006	Radar	175.2	235	Diesel	16.00
Kirtland	2007	334	76.1	102	Diesel	12.10
Kirtland	2007	472	350.5	470	Diesel	10.80
Kirtland	2007	498	79.8	107	Diesel	10.20
Kirtland	2007	638	29.8	40	Diesel	15.00
Kirtland	2007	758	253.5	340	Diesel	1.50
Kirtland	2007	758	253.5	340	Diesel	2.50
Kirtland	2007	758	253.5	340	Diesel	2.60
Kirtland	2007	758	253.5	340	Diesel	2.70
Kirtland	2007	1004	79.8	107	Diesel	17.50
Kirtland	2007	1013	99.9	134	Diesel	24.40
Kirtland	2007	1017	155.1	208	Diesel	20.80

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Kirtland	2007	1021	253.5	340	Diesel	3.20
Kirtland	2007	1021	253.5	340	Diesel	4.00
Kirtland	2007	1021	253.5	340	Diesel	4.00
Kirtland	2007	1021	253.5	340	Diesel	6.80
Kirtland	2007	1037	73.8	99	Diesel	24.30
Kirtland	2007	1038	17.2	23	Diesel	13.00
Kirtland	2007	1044	29.8	40	Diesel	7.40
Kirtland	2007	1047	50.7	68	Diesel	16.30
Kirtland	2007	20180	35.0	47	Diesel	29.90
Kirtland	2007	20183	126.8	170	Diesel	15.00
Kirtland	2007	20217	59.7	80	Diesel	10.10
Kirtland	2007	20220	29.8	40	Diesel	7.90
Kirtland	2007	20362	59.7	80	Diesel	13.90
Kirtland	2007	20370	249.8	335	Diesel	8.50
Kirtland	2007	20374	283.4	380	Diesel	14.40
Kirtland	2007	20420	59.7	80	Diesel	9.30
Kirtland	2007	20449	199.9	268	Diesel	8.90
Kirtland	2007	20452	17.2	23	Diesel	12.80
Kirtland	2007	20550	324.4	435	Diesel	24.90
Kirtland	2007	20604	99.9	134	Diesel	45.80
Kirtland	2007	20684	99.9	134	Diesel	0.90
Kirtland	2007	20760	59.7	80	Diesel	10.50
Kirtland	2007	26038	299.8	402	Diesel	38.40
Kirtland	2007	29010	59.7	80	Diesel	13.90
Kirtland	2007	30110	206.6	277	Diesel	43.60
Kirtland	2007	30158	59.7	80	Diesel	63.70
Kirtland	2007	66013	310.2	416	Diesel	12.60
Kirtland	2007	66071	154.4	207	Diesel	35.40
Kirtland	2007	230676	364.7	489	Diesel	11.70
Kirtland	2007	Echo Site	25.4	34	Diesel	12.00
Kirtland	2007	Flightline	25.4	34	Diesel	12.00
Kirtland	2007	Radar	175.2	235	Diesel	12.00
Kirtland	2008	334	76.1	102	Diesel	11.70
Kirtland	2008	472	350.5	470	Diesel	13.00
Kirtland	2008	498	79.8	107	Diesel	12.20
Kirtland	2008	638	29.8	40	Diesel	28.60
Kirtland	2008	758	253.5	340	Diesel	1.90
Kirtland	2008	758	253.5	340	Diesel	4.50
Kirtland	2008	758	253.5	340	Diesel	6.30

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Kirtland	2008	758	253.5	340	Diesel	6.90
Kirtland	2008	1004	79.8	107	Diesel	11.80
Kirtland	2008	1017	155.1	208	Diesel	11.90
Kirtland	2008	1021	253.5	340	Diesel	3.00
Kirtland	2008	1021	253.5	340	Diesel	4.00
Kirtland	2008	1021	253.5	340	Diesel	4.40
Kirtland	2008	1021	253.5	340	Diesel	4.70
Kirtland	2008	1037	73.8	99	Diesel	8.80
Kirtland	2008	1038	17.2	23	Diesel	12.90
Kirtland	2008	1044	29.8	40	Diesel	12.90
Kirtland	2008	1047	50.7	68	Diesel	42.70
Kirtland	2008	20180	35.0	47	Diesel	27.90
Kirtland	2008	20183	126.8	170	Diesel	15.40
Kirtland	2008	20217	59.7	80	Diesel	11.00
Kirtland	2008	20220	29.8	40	Diesel	9.90
Kirtland	2008	20362	59.7	80	Diesel	13.50
Kirtland	2008	20370	249.8	335	Diesel	17.40
Kirtland	2008	20374	283.4	380	Diesel	20.40
Kirtland	2008	20420	59.7	80	Diesel	10.40
Kirtland	2008	20449	199.9	268	Diesel	5.10
Kirtland	2008	20452	17.2	23	Diesel	8.70
Kirtland	2008	20550	324.4	435	Diesel	20.20
Kirtland	2008	20604	59.7	80	Diesel	6.40
Kirtland	2008	20604	99.9	134	Diesel	11.00
Kirtland	2008	20676	364.7	489	Diesel	17.30
Kirtland	2008	20684	48.9	65.6	Diesel	6.30
Kirtland	2008	20760	59.7	80	Diesel	20.60
Kirtland	2008	26038	299.8	402	Diesel	12.50
Kirtland	2008	29010	59.7	80	Diesel	34.20
Kirtland	2008	30110	206.6	277	Diesel	21.50
Kirtland	2008	30158	59.7	80	Diesel	18.40
Kirtland	2008	66013	310.2	416	Diesel	19.00
Kirtland	2008	66071	154.4	207	Diesel	28.50
Kirtland	2008	Echo Site	25.4	34	Diesel	17.00
Kirtland	2008	Flightline	25.4	34	Diesel	12.50
Kirtland	2008	Radar	175.2	235	Diesel	15.00
Luke	1994	11	60	80.5	Diesel	14.50
Luke	1994	176	100	134.1	Diesel	12.90
Luke	1994	179	15	20.1	Diesel	16.50

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Luke	1994	284	60	80.5	Diesel	18.90
Luke	1994	310	60	80.5	Diesel	57.10
Luke	1994	316	100	134.1	Diesel	16.50
Luke	1994	321	100	134.1	Diesel	14.30
Luke	1994	328	30	40.2	Diesel	14.60
Luke	1994	343	100	134.1	Diesel	15.30
Luke	1994	360	30	40.2	Diesel	13.40
Luke	1994	450	45	60.3	Diesel	12.00
Luke	1994	453	250	335.3	Diesel	51.20
Luke	1994	793	100	134.1	Diesel	19.90
Luke	1994	901	60	80.5	Diesel	4.90
Luke	1994	952	250	335.3	Diesel	28.60
Luke	1994	955	50	67.1	Diesel	25.70
Luke	1994	961	20	26.8	Diesel	20.90
Luke	1994	979	125	167.6	Diesel	28.10
Luke	1994	1001	20	26.8	Diesel	26.00
Luke	1994	1002	10	13.4	Diesel	23.40
Luke	1994	1040	50	67.1	Diesel	28.50
Luke	1994	1047	15	20.1	Diesel	14.80
Luke	1994	1049	30	40.2	Diesel	22.00
Luke	1994	1074	60	80.5	Diesel	13.80
Luke	1994	1079	25	33.5	Diesel	29.60
Luke	1994	1086	15	20.1	Diesel	15.60
Luke	1994	1234	30	40.2	Diesel	37.00
Luke	1994	1365	20	26.8	Diesel	13.70
Luke	1994	1379	80	107.3	Diesel	33.80
Luke	1994	1380	15	20.1	Diesel	15.60
Luke	1994	1385	60	80.5	Diesel	34.60
Luke	1994	2102	12	16.1	Diesel	22.50
Luke	1994	5102	30	40.2	Diesel	18.50
Luke	1994	5106	30	40.2	Diesel	24.60
Luke	1996	11	60	80.5	Diesel	28.30
Luke	1996	122	705	945.4	Diesel	15.00
Luke	1996	176	100	134.1	Diesel	8.30
Luke	1996	179	15	20.1	Diesel	28.90
Luke	1996	284	60	80.5	Diesel	29.10
Luke	1996	310	60	80.5	Diesel	91.50
Luke	1996	316	100	134.1	Diesel	25.00
Luke	1996	321	100	134.1	Diesel	11.90

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Luke	1996	328	30	40.2	Diesel	25.40
Luke	1996	343	100	134.1	Diesel	30.10
Luke	1996	360	30	40.2	Diesel	22.90
Luke	1996	450	45	60.3	Diesel	29.70
Luke	1996	453	250	335.3	Diesel	32.80
Luke	1996	793	100	134.1	Diesel	91.70
Luke	1996	815	400	536.4	Diesel	0.70
Luke	1996	901	60	80.5	Diesel	28.10
Luke	1996	910	15	20.1	Diesel	6.10
Luke	1996	927	50	67.1	Diesel	21.40
Luke	1996	952	250	335.3	Diesel	121.20
Luke	1996	955	50	67.1	Diesel	21.80
Luke	1996	961	20	26.8	Diesel	29.00
Luke	1996	969	6	8.0	Diesel	43.10
Luke	1996	979	125	167.6	Diesel	29.80
Luke	1996	1001	20	26.8	Diesel	37.50
Luke	1996	1002	15	20.1	Diesel	38.90
Luke	1996	1013	400	536.4	Diesel	9.50
Luke	1996	1034	60	80.5	Diesel	69.30
Luke	1996	1036	15	20.1	Diesel	12.80
Luke	1996	1040	50	67.1	Diesel	166.90
Luke	1996	1041	30	40.2	Diesel	24.00
Luke	1996	1047	15	20.1	Diesel	11.60
Luke	1996	1056	15	20.1	Diesel	8.90
Luke	1996	1057	15	20.1	Diesel	1.60
Luke	1996	1074	60	80.5	Diesel	15.40
Luke	1996	1076	15	20.1	Diesel	48.80
Luke	1996	1079	25	33.5	Diesel	35.90
Luke	1996	1086	15	20.1	Diesel	11.20
Luke	1996	1234	30	40.2	Diesel	30.40
Luke	1996	1365	20	26.8	Diesel	29.70
Luke	1996	1379	80	107.3	Diesel	53.00
Luke	1996	1380	15	20.1	Diesel	53.70
Luke	1996	1385	100	134.1	Diesel	14.40
Luke	1996	1550	25	33.5	Diesel	10.20
Luke	1996	1550	200	268.2	Diesel	38.00
Luke	1996	2102	12	16.1	Diesel	27.80
Luke	1996	5102	30	40.2	Diesel	51.40
Luke	1996	5106	30	40.2	Diesel	111.10

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Luke	1998	11	60	80.5	Diesel	11.10
Luke	1998	122	7.5	10.1	Diesel	11.50
Luke	1998	176	100	134.1	Diesel	9.70
Luke	1998	179	15	20.1	Diesel	13.00
Luke	1998	284	60	80.5	Diesel	13.50
Luke	1998	310	60	80.5	Diesel	22.80
Luke	1998	316	100	134.1	Diesel	13.80
Luke	1998	321	100	134.1	Diesel	13.30
Luke	1998	328	30	40.2	Diesel	17.40
Luke	1998	343	100	134.1	Diesel	13.40
Luke	1998	450	45	60.3	Diesel	19.80
Luke	1998	453	250	335.3	Diesel	29.60
Luke	1998	793	100	134.1	Diesel	16.80
Luke	1998	815	200	368.2	Diesel	14.80
Luke	1998	901	60	80.5	Diesel	17.00
Luke	1998	910	15	20.1	Diesel	25.50
Luke	1998	927	50	67.1	Diesel	10.60
Luke	1998	952	250	335.3	Diesel	30.60
Luke	1998	955	50	67.1	Diesel	19.70
Luke	1998	961	20	26.8	Diesel	14.50
Luke	1998	969	6	8.0	Diesel	13.00
Luke	1998	979	125	167.6	Diesel	123.20
Luke	1998	1002	15	20.1	Diesel	20.30
Luke	1998	1013	400	536.4	Diesel	8.00
Luke	1998	1034	60	80.5	Diesel	9.70
Luke	1998	1040	50	67.1	Diesel	37.60
Luke	1998	1047	15	20.1	Diesel	15.30
Luke	1998	1049	30	40.2	Diesel	26.10
Luke	1998	1056	15	20.1	Diesel	10.60
Luke	1998	1057	15	20.1	Diesel	48.50
Luke	1998	1074	60	80.5	Diesel	14.60
Luke	1998	1079	25	33.5	Diesel	20.80
Luke	1998	1086	15	20.1	Diesel	14.60
Luke	1998	1234	30	40.2	Diesel	17.30
Luke	1998	1365	20	26.8	Diesel	15.00
Luke	1998	1379	80	107.3	Diesel	107.70
Luke	1998	1380	15	20.1	Diesel	14.40
Luke	1998	1387	200	268.2	Diesel	21.10
Luke	1998	1550	25	33.5	Diesel	12.00

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Luke	1998	2104	15	20.1	Diesel	14.80
Luke	1998	2105	15	20.1	Diesel	13.80
Luke	1998	5102	30	40.2	Diesel	38.10
Luke	1998	5106	30	40.2	Diesel	77.70
Luke	2002	11	60	80.5	Diesel	14.60
Luke	2002	176	100	134.1	Diesel	12.30
Luke	2002	179	125	167.6	Diesel	14.10
Luke	2002	210	15	20.1	Diesel	13.20
Luke	2002	284	60	80.5	Diesel	13.90
Luke	2002	310	125	167.6	Diesel	123.60
Luke	2002	316	100	134.1	Diesel	12.20
Luke	2002	321	350	469.4	Diesel	12.10
Luke	2002	328	30	40.2	Diesel	15.20
Luke	2002	343	100	134.1	Diesel	13.20
Luke	2002	450	45	60.3	Diesel	19.60
Luke	2002	453	250	335.3	Diesel	14.30
Luke	2002	793	100	134.1	Diesel	28.40
Luke	2002	815	200	268.2	Diesel	13.90
Luke	2002	901	60	80.5	Diesel	20.80
Luke	2002	927	50	67.1	Diesel	22.80
Luke	2002	952	250	335.3	Diesel	20.60
Luke	2002	961	20	26.8	Diesel	17.20
Luke	2002	969	60	80.5	Diesel	23.00
Luke	2002	979	125	167.6	Diesel	25.20
Luke	2002	988	350	469.4	Diesel	18.40
Luke	2002	1002	15	20.1	Diesel	20.70
Luke	2002	1013	400	536.4	Diesel	12.90
Luke	2002	1034	60	80.5	Diesel	134.00
Luke	2002	1040	50	67.1	Diesel	12.90
Luke	2002	1047	15	20.1	Diesel	15.50
Luke	2002	1049	30	40.2	Diesel	16.30
Luke	2002	1056	15	20.1	Diesel	15.20
Luke	2002	1057	15	20.1	Diesel	15.90
Luke	2002	1074	60	80.5	Diesel	57.40
Luke	2002	1086	15	20.1	Diesel	12.00
Luke	2002	1216	175	234.7	Diesel	19.50
Luke	2002	1365	20	26.8	Diesel	12.30
Luke	2002	1379	80	107.3	Diesel	14.30
Luke	2002	1380	15	20.1	Diesel	15.80

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Luke	2002	1387	200	268.2	Diesel	14.80
Luke	2002	1550	25	33.5	Diesel	18.60
Luke	2002	2104	15	20.1	Diesel	15.30
Luke	2002	2105	15	230.1	Diesel	13.60
Luke	2003	11	60	80.5	Diesel	12.60
Luke	2003	176	100	134.1	Diesel	13.20
Luke	2003	179	125	167.6	Diesel	29.70
Luke	2003	284	60	80.5	Diesel	9.10
Luke	2003	310	125	167.6	Diesel	105.90
Luke	2003	316	100	134.1	Diesel	13.20
Luke	2003	321	350	469.4	Diesel	12.20
Luke	2003	328	30	40.2	Diesel	11.40
Luke	2003	343	100	134.1	Diesel	13.60
Luke	2003	450	45	60.3	Diesel	18.60
Luke	2003	453	250	335.3	Diesel	22.30
Luke	2003	793	100	134.1	Diesel	12.90
Luke	2003	815	200	268.2	Diesel	13.30
Luke	2003	901	60	80.5	Diesel	12.10
Luke	2003	910	15	20.1	Diesel	14.00
Luke	2003	927	50	67.1	Diesel	13.60
Luke	2003	952	250	335.3	Diesel	13.50
Luke	2003	961	20	26.8	Diesel	6.40
Luke	2003	969	60	80.5	Diesel	11.50
Luke	2003	979	125	167.6	Diesel	14.20
Luke	2003	988	350	469.4	Diesel	16.70
Luke	2003	1002	15	20.1	Diesel	13.10
Luke	2003	1013	400	536.4	Diesel	13.30
Luke	2003	1034	60	80.5	Diesel	73.20
Luke	2003	1040	50	67.1	Diesel	19.70
Luke	2003	1047	15	20.1	Diesel	15.50
Luke	2003	1049	30	40.2	Diesel	24.00
Luke	2003	1056	15	20.1	Diesel	11.70
Luke	2003	1057	15	20.1	Diesel	17.30
Luke	2003	1074	60	80.5	Diesel	62.50
Luke	2003	1086	15	20.1	Diesel	14.50
Luke	2003	1216	175	234.7	Diesel	10.80
Luke	2003	1365	20	26.8	Diesel	23.40
Luke	2003	1379	80	107.3	Diesel	35.00
Luke	2003	1380	15	20.1	Diesel	23.40

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Luke	2003	1387	200	268.2	Diesel	13.20
Luke	2003	1550	25	33.5	Diesel	14.00
Luke	2003	2104	15	20.1	Diesel	13.00
Luke	2003	2105	15	230.1	Diesel	13.30
Luke	2004	11	60	80.5	Diesel	24.60
Luke	2004	176	100	134.1	Diesel	17.30
Luke	2004	179	125	167.6	Diesel	19.10
Luke	2004	310	125	167.6	Diesel	133.10
Luke	2004	316	100	134.1	Diesel	6.30
Luke	2004	321	350	469.4	Diesel	18.10
Luke	2004	328	30	40.2	Diesel	24.10
Luke	2004	343	100	134.1	Diesel	18.40
Luke	2004	450	45	60.3	Diesel	23.60
Luke	2004	453	250	335.3	Diesel	19.60
Luke	2004	793	100	134.1	Diesel	16.90
Luke	2004	815	200	268.2	Diesel	53.60
Luke	2004	901	60	80.5	Diesel	19.80
Luke	2004	910	15	20.1	Diesel	14.60
Luke	2004	927	50	67.1	Diesel	17.80
Luke	2004	952	250	335.3	Diesel	18.20
Luke	2004	961	40	26.8	Diesel	4.90
Luke	2004	961	50	67.1	Diesel	11.10
Luke	2004	969	60	80.5	Diesel	4.90
Luke	2004	979	125	167.6	Diesel	11.10
Luke	2004	988	350	469.4	Diesel	17.40
Luke	2004	1002	15	20.1	Diesel	39.70
Luke	2004	1013	400	536.4	Diesel	19.40
Luke	2004	1032	135	181.0	Diesel	51.50
Luke	2004	1034	60	80.5	Diesel	23.60
Luke	2004	1040	50	67.1	Diesel	15.40
Luke	2004	1047	15	20.1	Diesel	51.10
Luke	2004	1049	30	40.2	Diesel	22.20
Luke	2004	1056	15	20.1	Diesel	220.50
Luke	2004	1057	15	20.1	Diesel	24.60
Luke	2004	1074	60	80.5	Diesel	220.50
Luke	2004	1086	15	20.1	Diesel	144.50
Luke	2004	1216	175	234.7	Diesel	18.80
Luke	2004	1365	20	26.8	Diesel	117.40
Luke	2004	1379	80	107.3	Diesel	17.70

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Luke	2004	1380	15	20.1	Diesel	51.50
Luke	2004	1387	200	268.2	Diesel	20.90
Luke	2004	1550	25	33.5	Diesel	9.10
Luke	2004	2104	15	20.1	Diesel	137.70
Luke	2004	2105	15	230.1	Diesel	19.90
Luke	2005	11	60	80.5	Diesel	22.00
Luke	2005	50	45	60.4	Diesel	22.00
Luke	2005	122	250	335.3	Diesel	54.50
Luke	2005	176	100	134.1	Diesel	16.00
Luke	2005	179	125	167.6	Diesel	15.30
Luke	2005	310	125	167.6	Diesel	19.90
Luke	2005	321	350	469.4	Diesel	16.70
Luke	2005	328	30	40.2	Diesel	17.80
Luke	2005	343	100	134.1	Diesel	15.40
Luke	2005	453	250	335.3	Diesel	22.60
Luke	2005	793	100	134.1	Diesel	27.00
Luke	2005	815	200	268.2	Diesel	15.20
Luke	2005	857	50	67.1	Diesel	2.30
Luke	2005	885	100	134.1	Diesel	10.00
Luke	2005	901	60	80.5	Diesel	19.90
Luke	2005	910	15	20.1	Diesel	35.00
Luke	2005	927	50	67.1	Diesel	20.50
Luke	2005	952	250	335.3	Diesel	17.60
Luke	2005	961	50	67.5	Diesel	22.90
Luke	2005	969	60	80.5	Diesel	29.30
Luke	2005	979	125	167.6	Diesel	28.30
Luke	2005	988	350	469.4	Diesel	23.20
Luke	2005	1002	15	20.1	Diesel	20.50
Luke	2005	1013	400	536.4	Diesel	7.30
Luke	2005	1032	135	181.0	Diesel	23.90
Luke	2005	1034	60	80.5	Diesel	93.00
Luke	2005	1040	50	67.1	Diesel	18.70
Luke	2005	1047	15	20.1	Diesel	17.10
Luke	2005	1049	30	40.2	Diesel	20.10
Luke	2005	1056	15	20.1	Diesel	291.70
Luke	2005	1057	15	20.1	Diesel	21.60
Luke	2005	1074	60	80.5	Diesel	70.30
Luke	2005	1153	100	134.1	Diesel	6.50
Luke	2005	1216	175	234.7	Diesel	16.20

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Luke	2005	1365	20	26.8	Diesel	14.50
Luke	2005	1380	15	20.1	Diesel	21.60
Luke	2005	1387	200	268.2	Diesel	32.70
Luke	2005	1550	25	33.5	Diesel	12.00
Luke	2005	2104	15	20.1	Diesel	15.40
Luke	2005	2105	15	20.1	Diesel	32.90
Luke	2005	2303	50	67.1	Diesel	1.40
Luke	2006	11	60	80.5	Diesel	50.10
Luke	2006	122	250	335.3	Diesel	49.90
Luke	2006	176	100	134.1	Diesel	18.00
Luke	2006	179	125	167.6	Diesel	20.90
Luke	2006	310	125	167.6	Diesel	56.40
Luke	2006	321	350	469.4	Diesel	17.90
Luke	2006	328	30	40.2	Diesel	23.70
Luke	2006	343	100	134.1	Diesel	22.30
Luke	2006	450	45	60.3	Diesel	38.00
Luke	2006	453	250	335.3	Diesel	38.70
Luke	2006	793	100	134.1	Diesel	17.60
Luke	2006	815	200	268.2	Diesel	22.80
Luke	2006	857	50	67.5	Diesel	12.70
Luke	2006	885	100	134.1	Diesel	18.90
Luke	2006	901	60	80.5	Diesel	41.90
Luke	2006	910	15	20.1	Diesel	27.50
Luke	2006	927	50	67.1	Diesel	18.40
Luke	2006	952	250	335.3	Diesel	36.60
Luke	2006	961	20	26.8	Diesel	23.20
Luke	2006	969	60	80.5	Diesel	21.70
Luke	2006	979	125	167.6	Diesel	22.10
Luke	2006	991	350	469.4	Diesel	19.90
Luke	2006	1002	15	20.1	Diesel	20.40
Luke	2006	1013	400	536.4	Diesel	13.80
Luke	2006	1032	135	181.0	Diesel	24.70
Luke	2006	1034	60	80.5	Diesel	123.30
Luke	2006	1040	50	67.1	Diesel	34.20
Luke	2006	1047	15	20.1	Diesel	20.90
Luke	2006	1049	30	40.2	Diesel	45.10
Luke	2006	1056	15	20.1	Diesel	169.00
Luke	2006	1057	15	20.1	Diesel	41.30
Luke	2006	1074	60	80.5	Diesel	57.40

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Luke	2006	1153	100	134.1	Diesel	20.40
Luke	2006	1216	175	234.7	Diesel	130.50
Luke	2006	1365	20	26.8	Diesel	36.60
Luke	2006	1380	15	20.1	Diesel	40.60
Luke	2006	1387	200	268.2	Diesel	21.80
Luke	2006	1550	25	33.5	Diesel	12.00
Luke	2006	2105	15	20.1	Diesel	36.90
Luke	2006	2303	50	67.1	Diesel	14.10
Luke	2006	2502	15	20.1	Diesel	16.40
Seymore Johnson	1997	1701	30	80	Diesel	14.67
Seymore Johnson	1997	2130	125	134	Diesel	9.13
Seymore Johnson	1997	2205	12	16	Diesel	42.85
Seymore Johnson	1997	2311	30	80	Diesel	38.51
Seymore Johnson	1997	2331	12	16	Diesel	23.63
Seymore Johnson	1997	2904	60	80	Diesel	9.33
Seymore Johnson	1997	3000	12	16	Diesel	3.18
Seymore Johnson	1997	3401	60	80	Diesel	16.22
Seymore Johnson	1997	3722	50	67	Diesel	5.15
Seymore Johnson	1997	4506	350	469	Diesel	11.29
Seymore Johnson	1997	4507	33	44	Diesel	7.50
Seymore Johnson	1997	4517	12	20	Diesel	11.87
Seymore Johnson	1997	4551	150	134	Diesel	11.73
Seymore Johnson	1997	4552	100	134	Diesel	22.37
Seymore Johnson	1997	4555	30	40	Diesel	63.87
Seymore Johnson	1997	4600	30	80	Diesel	5.04
Seymore Johnson	1997	4712	12	20	Diesel	6.50
Seymore Johnson	1997	4735	50	67	Diesel	3.99
Seymore Johnson	1997	4741	100	134	Diesel	7.17
Seymore Johnson	1997	4745	100	101	Diesel	13.80
Seymore Johnson	1997	4760	60	80	Diesel	3.96
Seymore Johnson	1997	4850	150	201	Diesel	62.68
Seymore Johnson	1997	4901	100	134	Diesel	9.92
Seymore Johnson	1997	5050	12	16	Diesel	6.05
Seymore Johnson	1997	5400	30	80	Diesel	5.20
Seymore Johnson	1997	10309	12	16	Diesel	4.70
Seymore Johnson	1997	10312	10	13	Diesel	48.06
Seymore Johnson	1997	10373	10	40	Diesel	153.08
Seymore Johnson	1997	10433	20	27	Diesel	12.95
Seymore Johnson	1997	10434	20	27	Diesel	7.26
Seymore Johnson	1997	10444	10	13	Diesel	144.00

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Seymore Johnson	1997	4002-1	214	287	Diesel	9.50
Seymore Johnson	1997	4002-2	214	287	Diesel	9.50
Seymore Johnson	1997	4002-3	214	287	Diesel	9.50
Seymore Johnson	1997	4002-4	214	287	Diesel	9.50
Seymore Johnson	1997	4511-1	214	287	Diesel	24.00
Seymore Johnson	1997	4511-2	214	287	Diesel	27.00
Seymore Johnson	1997	4511-3	214	287	Diesel	12.00
Seymore Johnson	1998	10	100	134.1	Diesel	28.98
Seymore Johnson	1998	1701	29.8	40	Diesel	501.94
Seymore Johnson	1998	2130	124.5	167	Diesel	15.18
Seymore Johnson	1998	2205	11.9	16	Diesel	15.92
Seymore Johnson	1998	2311	29.8	40	Diesel	203.03
Seymore Johnson	1998	2325	30	40.2	Diesel	64.00
Seymore Johnson	1998	2331	11.9	16	Diesel	88.94
Seymore Johnson	1998	2816	80	107.3	Diesel	1.13
Seymore Johnson	1998	2904	59.7	80	Diesel	14.03
Seymore Johnson	1998	3000	11.9	16	Diesel	18.44
Seymore Johnson	1998	3401	99.9	134	Diesel	4.23
Seymore Johnson	1998	3722	200	268.2	Diesel	10.05
Seymore Johnson	1998	3722	50.0	67	Diesel	5.60
Seymore Johnson	1998	4506	349.7	469	Diesel	15.85
Seymore Johnson	1998	4507	20.1	27	Diesel	0.89
Seymore Johnson	1998	4513	80	107.3	Diesel	1.13
Seymore Johnson	1998	4517	11.9	16	Diesel	10.06
Seymore Johnson	1998	4551	149.9	201	Diesel	2.34
Seymore Johnson	1998	4552	99.9	134	Diesel	14.53
Seymore Johnson	1998	4555	29.8	40	Diesel	135.24
Seymore Johnson	1998	4600	29.8	40	Diesel	31.05
Seymore Johnson	1998	4712	11.9	16	Diesel	8.04
Seymore Johnson	1998	4735	50.0	67	Diesel	3.90
Seymore Johnson	1998	4741	99.9	134	Diesel	6.91
Seymore Johnson	1998	4745	99.2	133	Diesel	95.04
Seymore Johnson	1998	4760	59.7	80	Diesel	21.00
Seymore Johnson	1998	4850	149.9	201	Diesel	122.94
Seymore Johnson	1998	4901	99.9	134	Diesel	79.93
Seymore Johnson	1998	4953	398.2	534	Diesel	4.02
Seymore Johnson	1998	5004	80	107.3	Diesel	1.13
Seymore Johnson	1998	5050	11.9	16	Diesel	62.81
Seymore Johnson	1998	10309	11.9	16	Diesel	51.13

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Seymore Johnson	1998	10312	11.9	16	Diesel	11.15
Seymore Johnson	1998	10373	9.7	13	Diesel	68.93
Seymore Johnson	1998	10433	20.1	27	Diesel	50.13
Seymore Johnson	1998	10434	20.1	27	Diesel	72.12
Seymore Johnson	1998	10444	9.7	13	Diesel	189.58
Seymore Johnson	1999	10	63	84	Diesel	46.00
Seymore Johnson	1999	1701	20	27	Diesel	21.60
Seymore Johnson	1999	2130	47	63	Diesel	35.20
Seymore Johnson	1999	2205	10	13	Diesel	80.40
Seymore Johnson	1999	2311	16	21	Diesel	42.50
Seymore Johnson	1999	2325	13	17	Diesel	147.70
Seymore Johnson	1999	2331	7	9	Diesel	151.60
Seymore Johnson	1999	2816	7	9	Diesel	27.10
Seymore Johnson	1999	2904	31	42	Diesel	22.60
Seymore Johnson	1999	3000	6	8	Diesel	22.00
Seymore Johnson	1999	3401	52	70	Diesel	26.00
Seymore Johnson	1999	3722	16	21	Diesel	28.20
Seymore Johnson	1999	4012	7	9	Diesel	15.60
Seymore Johnson	1999	4408	2	3	Diesel	14.70
Seymore Johnson	1999	4506	241	323	Diesel	15.50
Seymore Johnson	1999	4507	9	12	Diesel	22.70
Seymore Johnson	1999	4513	10	13	Diesel	23.70
Seymore Johnson	1999	4517	7	9	Diesel	13.50
Seymore Johnson	1999	4551	50	67	Diesel	12.20
Seymore Johnson	1999	4552	54	72	Diesel	12.00
Seymore Johnson	1999	4555	20	27	Diesel	109.10
Seymore Johnson	1999	4600	18	24	Diesel	25.10
Seymore Johnson	1999	4712	7	9	Diesel	38.00
Seymore Johnson	1999	4735	15	20	Diesel	11.90
Seymore Johnson	1999	4741	38	51	Diesel	10.00
Seymore Johnson	1999	4745	60	80	Diesel	18.10
Seymore Johnson	1999	4750	71	95	Diesel	25.70
Seymore Johnson	1999	4760	18	24	Diesel	22.80
Seymore Johnson	1999	4901	50	67	Diesel	32.50
Seymore Johnson	1999	4957	390	523	Diesel	14.10
Seymore Johnson	1999	5004	30	40	Diesel	39.90
Seymore Johnson	1999	5004	6	8	Diesel	38.00
Seymore Johnson	1999	5050	6	8	Diesel	32.40
Seymore Johnson	1999	10309	5	7	Diesel	12.80
Seymore Johnson	1999	10312	7	9	Diesel	19.00

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Seymore Johnson	1999	10373	8.6	12	Diesel	40.00
Seymore Johnson	1999	10444	6	8	Diesel	17.50
Seymore Johnson	1999	10447	7	9	Diesel	25.70
Seymore Johnson	1999	10448	5	7	Diesel	24.20
Seymore Johnson	1999	2800-1	225	302	Diesel	36.20
Seymore Johnson	1999	2800-2	225	302	Diesel	35.00
Seymore Johnson	2000	2130	13	17	Diesel	14.90
Seymore Johnson	2000	2205	9	12	Diesel	20.50
Seymore Johnson	2000	2311	18	24	Diesel	20.00
Seymore Johnson	2000	2325	11	15	Diesel	17.20
Seymore Johnson	2000	2331	6	8	Diesel	16.50
Seymore Johnson	2000	2816	9	12	Diesel	21.50
Seymore Johnson	2000	2904	14	19	Diesel	14.20
Seymore Johnson	2000	3000	7	9	Diesel	15.00
Seymore Johnson	2000	3401	48	64	Diesel	13.90
Seymore Johnson	2000	3650	236	316	Diesel	25.30
Seymore Johnson	2000	3722	19	25	Diesel	22.80
Seymore Johnson	2000	4012	13	17	Diesel	21.60
Seymore Johnson	2000	4408	7	9	Diesel	21.00
Seymore Johnson	2000	4506	163	219	Diesel	16.40
Seymore Johnson	2000	4507	13.5	18	Diesel	15.70
Seymore Johnson	2000	4513	10	13	Diesel	17.80
Seymore Johnson	2000	4517	1	1	Diesel	14.60
Seymore Johnson	2000	4551	138	185	Diesel	75.90
Seymore Johnson	2000	4552	49	66	Diesel	10.00
Seymore Johnson	2000	4555	22.5	30	Diesel	296.10
Seymore Johnson	2000	4600	22	30	Diesel	15.00
Seymore Johnson	2000	4712	7	9	Diesel	12.90
Seymore Johnson	2000	4735	8.6	12	Diesel	12.90
Seymore Johnson	2000	4741	33	44	Diesel	17.60
Seymore Johnson	2000	4745	33	44	Diesel	15.90
Seymore Johnson	2000	4750	58	78	Diesel	18.30
Seymore Johnson	2000	4760	15	20	Diesel	18.70
Seymore Johnson	2000	4901	45	60	Diesel	13.80
Seymore Johnson	2000	4957	189	253	Diesel	18.10
Seymore Johnson	2000	5004	7	9	Diesel	23.90
Seymore Johnson	2000	5050	8	11	Diesel	12.90
Seymore Johnson	2000	10309	9	12	Diesel	22.50
Seymore Johnson	2000	10312	5	7	Diesel	11.60
Seymore Johnson	2000	10447	17	23	Diesel	14.60

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Seymore Johnson	2000	10448	7	9	Diesel	14.20
Seymore Johnson	2000	10373-old	5.6	12	Diesel	40.00
Seymore Johnson	2000	10444-new	9.2	12	Diesel	10.90
Seymore Johnson	2000	10444-old	6	8	Diesel	17.50
Seymore Johnson	2000	13073-new	5.6	8	Diesel	16.00
Seymore Johnson	2000	1701-new	16	24	Diesel	19.30
Seymore Johnson	2000	1701-old	20	27	Diesel	21.60
Seymore Johnson	2001	2130	13	17	Diesel	26.30
Seymore Johnson	2001	2205	9	12	Diesel	29.00
Seymore Johnson	2001	2311	18	24	Diesel	35.60
Seymore Johnson	2001	2325	11	15	Diesel	29.60
Seymore Johnson	2001	2331	6	8	Diesel	12.40
Seymore Johnson	2001	2816	9	12	Diesel	3.80
Seymore Johnson	2001	2904	14	19	Diesel	15.00
Seymore Johnson	2001	3000	7	9	Diesel	12.20
Seymore Johnson	2001	3401	48	64	Diesel	13.70
Seymore Johnson	2001	3650	236	316	Diesel	11.60
Seymore Johnson	2001	3722	19	25	Diesel	14.80
Seymore Johnson	2001	4012	13	17	Diesel	12.50
Seymore Johnson	2001	4408	7	9	Diesel	16.20
Seymore Johnson	2001	4506	163	219	Diesel	12.10
Seymore Johnson	2001	4507	13.5	18	Diesel	24.50
Seymore Johnson	2001	4513	10	13	Diesel	15.60
Seymore Johnson	2001	4517	1	1	Diesel	13.50
Seymore Johnson	2001	4551	138	185	Diesel	17.20
Seymore Johnson	2001	4552	49	66	Diesel	19.50
Seymore Johnson	2001	4555	22.5	30	Diesel	30.20
Seymore Johnson	2001	4600	22	30	Diesel	24.30
Seymore Johnson	2001	4712	7	9	Diesel	15.00
Seymore Johnson	2001	4735	8.6	12	Diesel	13.20
Seymore Johnson	2001	4741	33	44	Diesel	7.30
Seymore Johnson	2001	4745	33	44	Diesel	16.30
Seymore Johnson	2001	4750	58	78	Diesel	16.20
Seymore Johnson	2001	4760	15	20	Diesel	11.90
Seymore Johnson	2001	4901	45	60	Diesel	13.40
Seymore Johnson	2001	4957	189	235	Diesel	13.00
Seymore Johnson	2001	5004	7	9	Diesel	12.00
Seymore Johnson	2001	5050	8	11	Diesel	21.30
Seymore Johnson	2001	10309	9	12	Diesel	20.10
Seymore Johnson	2001	10312	5	7	Diesel	12.60

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Seymore Johnson	2001	10447	17	23	Diesel	56.00
Seymore Johnson	2001	10448	7	9	Diesel	19.10
Seymore Johnson	2001	10373-new	5.6	8	Diesel	17.70
Seymore Johnson	2001	10444-new	9.2	12	Diesel	16.00
Seymore Johnson	2001	1701-new	18	24	Diesel	33.70
Seymore Johnson	2002	1701	60	80	Diesel	20.10
Seymore Johnson	2002	2130	125	168	Diesel	22.20
Seymore Johnson	2002	2205	28	37	Diesel	37.80
Seymore Johnson	2002	2311	25	34	Diesel	17.50
Seymore Johnson	2002	2325	30	40	Diesel	28.30
Seymore Johnson	2002	2331	11.5	15	Diesel	35.80
Seymore Johnson	2002	2816	40	54	Diesel	9.20
Seymore Johnson	2002	2904	60	80	Diesel	21.30
Seymore Johnson	2002	3401	100	134	Diesel	22.10
Seymore Johnson	2002	3425	60	80	Diesel	25.80
Seymore Johnson	2002	3650	400	536	Diesel	20.10
Seymore Johnson	2002	3722	50	67	Diesel	22.70
Seymore Johnson	2002	4002	254	340	Diesel	11.50
Seymore Johnson	2002	4002	254	340	Diesel	11.00
Seymore Johnson	2002	4002	254	340	Diesel	11.00
Seymore Johnson	2002	4002	254	340	Diesel	11.00
Seymore Johnson	2002	4012	100	134	Diesel	17.70
Seymore Johnson	2002	4408	60	80	Diesel	16.70
Seymore Johnson	2002	4506	350	469	Diesel	18.90
Seymore Johnson	2002	4507	20	27	Diesel	21.00
Seymore Johnson	2002	4511	207	277	Diesel	10.50
Seymore Johnson	2002	4511	207	277	Diesel	10.50
Seymore Johnson	2002	4511	207	277	Diesel	9.50
Seymore Johnson	2002	4513	80	107	Diesel	14.10
Seymore Johnson	2002	4517	12	16	Diesel	34.10
Seymore Johnson	2002	4551	150	201	Diesel	14.60
Seymore Johnson	2002	4552	100	134	Diesel	15.70
Seymore Johnson	2002	4555	30	40	Diesel	23.90
Seymore Johnson	2002	4600	30	40	Diesel	20.20
Seymore Johnson	2002	4712	12	16	Diesel	20.20
Seymore Johnson	2002	4735	50	67	Diesel	13.70
Seymore Johnson	2002	4741	60	80	Diesel	7.50
Seymore Johnson	2002	4745	100	134	Diesel	23.20
Seymore Johnson	2002	4750	150	201	Diesel	21.10
Seymore Johnson	2002	4760	60	80	Diesel	28.70

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Seymore Johnson	2002	4901	100	134	Diesel	18.60
Seymore Johnson	2002	4957	400	536	Diesel	21.60
Seymore Johnson	2002	5004	80	107	Diesel	24.90
Seymore Johnson	2002	5006	11.5	15	Diesel	26.70
Seymore Johnson	2002	5050	11.5	15	Diesel	22.20
Seymore Johnson	2002	10309	15	20	Diesel	17.80
Seymore Johnson	2002	10312	12	16	Diesel	15.10
Seymore Johnson	2002	10373	12	16	Diesel	26.60
Seymore Johnson	2002	10447	15	20	Diesel	25.60
Seymore Johnson	2002	10448	15	20	Diesel	22.50
Seymore Johnson	2003	1	50	65	Diesel	97.50
Seymore Johnson	2003	2	50	65	Diesel	97.50
Seymore Johnson	2003	3	50	65	Diesel	97.50
Seymore Johnson	2003	4	50	65	Diesel	97.50
Seymore Johnson	2003	5	50	65	Diesel	97.50
Seymore Johnson	2003	6	50	65	Diesel	97.50
Seymore Johnson	2003	7	50	65	Diesel	97.50
Seymore Johnson	2003	8	50	65	Diesel	97.50
Seymore Johnson	2003	1701	60	80	Diesel	16.60
Seymore Johnson	2003	2130	125	168	Diesel	76.60
Seymore Johnson	2003	2205	28	37	Diesel	22.90
Seymore Johnson	2003	2205	33	44	Diesel	7.70
Seymore Johnson	2003	2311	25	34	Diesel	42.30
Seymore Johnson	2003	2325	30	40	Diesel	218.80
Seymore Johnson	2003	2331	11.5	15	Diesel	23.50
Seymore Johnson	2003	2816	40	54	Diesel	26.90
Seymore Johnson	2003	2904	60	80	Diesel	15.90
Seymore Johnson	2003	3401	100	134	Diesel	9.40
Seymore Johnson	2003	3425	60	80	Diesel	15.80
Seymore Johnson	2003	3650	400	536	Diesel	30.70
Seymore Johnson	2003	3722	50	67	Diesel	32.40
Seymore Johnson	2003	4002	254	340	Diesel	17.50
Seymore Johnson	2003	4002	254	340	Diesel	13.00
Seymore Johnson	2003	4002	254	340	Diesel	12.50
Seymore Johnson	2003	4002	254	340	Diesel	12.00
Seymore Johnson	2003	4012	100	134	Diesel	29.00
Seymore Johnson	2003	4408	60	80	Diesel	23.90
Seymore Johnson	2003	4506	350	469	Diesel	26.70
Seymore Johnson	2003	4507	20	27	Diesel	16.30
Seymore Johnson	2003	4511	207	277	Diesel	97.50

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Seymore Johnson	2003	4511	207	277	Diesel	14.50
Seymore Johnson	2003	4511	207	277	Diesel	13.50
Seymore Johnson	2003	4513	80	107	Diesel	13.60
Seymore Johnson	2003	4517	12	16	Diesel	27.90
Seymore Johnson	2003	4551	150	201	Diesel	73.10
Seymore Johnson	2003	4552	100	134	Diesel	74.30
Seymore Johnson	2003	4555	30	40	Diesel	65.80
Seymore Johnson	2003	4600	30	40	Diesel	27.00
Seymore Johnson	2003	4712	12	16	Diesel	38.80
Seymore Johnson	2003	4735	50	67	Diesel	15.50
Seymore Johnson	2003	4741	60	80	Diesel	28.70
Seymore Johnson	2003	4745	100	134	Diesel	34.70
Seymore Johnson	2003	4750	150	201	Diesel	36.50
Seymore Johnson	2003	4760	60	80	Diesel	26.40
Seymore Johnson	2003	4901	100	134	Diesel	7.90
Seymore Johnson	2003	4901	80	107	Diesel	5.60
Seymore Johnson	2003	4957	400	536	Diesel	15.50
Seymore Johnson	2003	5004	80	107	Diesel	16.90
Seymore Johnson	2003	5006	11.5	15	Diesel	29.50
Seymore Johnson	2003	5050	11.5	15	Diesel	35.20
Seymore Johnson	2003	10309	15	20	Diesel	7.20
Seymore Johnson	2003	10312	12	16	Diesel	8.80
Seymore Johnson	2003	10373	12	16	Diesel	15.40
Seymore Johnson	2003	10444	12	16	Diesel	24.50
Seymore Johnson	2003	10447	15	20	Diesel	18.10
Seymore Johnson	2003	10448	15	20	Diesel	17.00
Sheppard	1997	120	20.0	26.8	Diesel	10.40
Sheppard	1997	151	32.0	42.9	Diesel	19.00
Sheppard	1997	237	37.0	49.6	Diesel	16.00
Sheppard	1997	430	30.0	40.2	Diesel	25.00
Sheppard	1997	558	40.0	53.6	Diesel	22.00
Sheppard	1997	845	100.0	134.1	Diesel	18.00
Sheppard	1997	1013	99.9	134	Diesel	14.00
Sheppard	1997	1093	30.0	40.2	Diesel	12.00
Sheppard	1997	1096	100.0	134.1	Diesel	13.00
Sheppard	1997	1200	260.3	349	Diesel	18.00
Sheppard	1997	1215	100.0	134.1	Diesel	21.00
Sheppard	1997	1360	60.0	80.5	Diesel	44.00
Sheppard	1997	1810	60.0	80.5	Diesel	17.00
Sheppard	1997	1813	30.0	40.2	Diesel	15.00

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Sheppard	1997	1912	30.0	40.2	Diesel	15.00
Sheppard	1997	2001	30.0	40.2	Diesel	14.00
Sheppard	1997	2008	30.0	40.2	Diesel	57.00
Sheppard	1997	2012	100	134.1	Diesel	11.00
Sheppard	1997	2012	250	335.3	Diesel	300.00
Sheppard	1997	2012	250	335.3	Diesel	350.00
Sheppard	1997	2014	60	80.5	Diesel	2.00
Sheppard	1997	2014	100	134.1	Diesel	2.00
Sheppard	1997	2014	60	80.5	Diesel	3.00
Sheppard	1997	2014	60	80.5	Diesel	45.00
Sheppard	1997	2014	60	80.5	Diesel	56.40
Sheppard	1997	2562	15.0	20.1	Diesel	14.00
Sheppard	1997	12522	45.0	60.3	Diesel	64.00
Sheppard	1997	11537-4	40.0	53.6	Diesel	13.00
Sheppard	1997	11538-3	40.0	53.6	Diesel	11.00
Sheppard	1997	11539-2	40.0	53.6	Diesel	13.00
Sheppard	1997	11540-1	40.0	53.6	Diesel	14.00
Sheppard	1997	11543-5	50.0	67.1	Diesel	13.00
Sheppard	1997	11544-6	50.0	67.1	Diesel	11.00
Sheppard	1997	1202-1	235.2	315.4	Diesel	22.00
Sheppard	1997	1202-2	235.0	315.1	Diesel	21.00
Sheppard	1997	1202-3	235.0	315.1	Diesel	41.00
Sheppard	1997	2559-56	350.0	469.4	Diesel	77.00
Sheppard	1997	MEP-005a	30.0	40.2	Diesel	20.00
Sheppard	1997	MEP-006a	60.0	80.5	Diesel	39.00
Sheppard	1997	MEP-007a	100.0	134.1	Diesel	13.00
Sheppard	1997	MEP-009b-1	200.0	268.2	Diesel	12.00
Sheppard	1997	MEP-009b-2	200.0	268.2	Diesel	13.00
Sheppard	1997	MEP-009b-3	200.0	268.2	Diesel	13.00
Sheppard	1997	MEP-009b-4	200.0	268.2	Diesel	14.00
Sheppard	1997	MEP-802a	5.0	6.7	Diesel	87.00
Sheppard	1999	120	20.0	26.8	Diesel	23.50
Sheppard	1999	151	32.0	42.9	Diesel	25.80
Sheppard	1999	237	36.9	49.5	Diesel	22.50
Sheppard	1999	430	30.0	40.2	Diesel	25.70
Sheppard	1999	558	40.0	53.6	Diesel	25.40
Sheppard	1999	845	100.0	134.1	Diesel	8.70

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Sheppard	1999	1093	30.0	40.2	Diesel	30.80
Sheppard	1999	1095	100.0	134.1	Diesel	32.00
Sheppard	1999	1200	260.3	349	Diesel	26.70
Sheppard	1999	1215	100.0	134.1	Diesel	30.10
Sheppard	1999	1360	60.1	80.6	Diesel	24.70
Sheppard	1999	1810	60.1	80.6	Diesel	67.60
Sheppard	1999	1813	30.0	40.2	Diesel	22.80
Sheppard	1999	1912	30.0	40.2	Diesel	30.30
Sheppard	1999	2006	30.0	40.2	Diesel	25.30
Sheppard	1999	2320	150.0	201.2	Diesel	42.10
Sheppard	1999	11545	35.0	46.9	Diesel	40.90
Sheppard	1999	11546	35.0	46.9	Diesel	31.20
Sheppard	1999	12522	45.0	60.3	Diesel	32.20
Sheppard	1999	1043-42	5.0	6.7	Diesel	42.30
Sheppard	1999	11537-4	40.0	53.6	Diesel	88.10
Sheppard	1999	11538-3	40.0	53.6	Diesel	25.30
Sheppard	1999	11539-2	40.0	53.6	Diesel	25.60
Sheppard	1999	11540-1	40.0	53.6	Diesel	28.00
Sheppard	1999	11543-5	50.0	67.1	Diesel	25.10
Sheppard	1999	11544-6	50.0	67.1	Diesel	25.10
Sheppard	1999	1202-1	235.2	315.4	Diesel	29.40
Sheppard	1999	1202-2	235.0	315.1	Diesel	23.80
Sheppard	1999	1202-3	235.0	315.1	Diesel	27.20
Sheppard	1999	1403-34	196.7	263.82	Diesel	20.00
Sheppard	1999	1403-35	200.0	268.2	Diesel	22.80
Sheppard	1999	1403-36	200.0	268.2	Diesel	127.00
Sheppard	1999	1403-37	200.0	268.2	Diesel	28.20
Sheppard	1999	1403-38	100.0	134.1	Diesel	20.60
Sheppard	1999	1403-39	60.0	80.5	Diesel	58.20
Sheppard	1999	1403-40	30.0	40.2	Diesel	41.20
Sheppard	1999	1403-43	5.0	6.7	Diesel	21.30
Sheppard	1999	1403-44	5.0	6.7	Diesel	15.90
Sheppard	1999	1403-49	6.0	8.1	Diesel	24.30
Sheppard	1999	1403-50	6.0	8.1	Diesel	6.20
Sheppard	1999	2559-58	350.0	469.4	Diesel	27.80
Sheppard	1999	55502-45	20.0	26.8	Diesel	6.00
Sheppard	1999	55602-46	35.0	46.9	Diesel	25.00
Sheppard	2007	120	25	33.525	Diesel	25.30
Sheppard	2007	130	35	46.935	Diesel	41.00

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Sheppard	2007	152	35	46.935	Diesel	29.00
Sheppard	2007	237	100	134.1	Diesel	41.10
Sheppard	2007	845	100	134.1	Diesel	27.10
Sheppard	2007	986	600	804.6	Diesel	29.90
Sheppard	2007	1014	100	134.1	Diesel	25.80
Sheppard	2007	1065	40	53.64	Diesel	66.50
Sheppard	2007	1093	35	46.935	Diesel	24.80
Sheppard	2007	1200	250	335.25	Diesel	33.20
Sheppard	2007	1215	30	40.23	Diesel	35.90
Sheppard	2007	1402	7.5	10.0575	Diesel	22.60
Sheppard	2007	1810	60	80.46	Diesel	26.20
Sheppard	2007	1813	40	53.64	Diesel	25.90
Sheppard	2007	1912	20	26.82	Diesel	26.30
Sheppard	2007	2008	20	26.82	Diesel	94.00
Sheppard	2007	2118	60	80.46	Diesel	26.40
Sheppard	2007	2320	150	201.15	Diesel	26.40
Sheppard	2007	2520	20	26.82	Diesel	22.70
Sheppard	2007	2559	230	308.43	Diesel	27.50
Sheppard	2007	11531	25	33.525	Diesel	15.80
Sheppard	2007	11532	25	33.525	Diesel	17.60
Sheppard	2007	11537	40	53.64	Diesel	16.30
Sheppard	2007	11538	40	53.64	Diesel	17.30
Sheppard	2007	11539	40	53.64	Diesel	16.80
Sheppard	2007	11540	40	53.64	Diesel	17.30
Sheppard	2007	11543	40	53.64	Diesel	18.70
Sheppard	2007	11544	40	53.64	Diesel	17.00
Sheppard	2007	12522	60	80.46	Diesel	8.10
Sheppard	2007	55502	20	26.82	Diesel	15.10
Sheppard	2007	55603	30	40.23	Diesel	14.30
Sheppard	2007	1202-1	230	308.43	Diesel	37.50
Sheppard	2007	1202-2	230	308.43	Diesel	38.10
Sheppard	2007	1202-3	230	308.43	Diesel	36.70
Buckley	2004	430	3.3	4	Gasoline	12.00
Buckley	2004	430	5.5	7	Gasoline	12.00
Buckley	2004	1009	5.0	7	Gasoline	2.10
Buckley	2005	1	80.0	107.3	Gasoline	15.80
Buckley	2005	433	3.3	4.4	Gasoline	6.00
Buckley	2005	433	5.5	7.4	Gasoline	6.00
Buckley	2005	1007	8.0	10.7	Gasoline	2.50

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Buckley	2005	1007	8.0	10.7	Gasoline	2.50
Buckley	2005	1007	8.0	10.7	Gasoline	2.50
Buckley	2005	1007	8.0	10.7	Gasoline	2.50
Buckley	2005	831/1009	5.0	6.7	Gasoline	6.00
Buckley	2005	831/1009	5.0	6.7	Gasoline	6.00
Buckley	2006	1	80.0	107.3	Gasoline	13.90
Buckley	2006	433	3.3	4.4	Gasoline	6.00
Buckley	2006	433	5.5	7.4	Gasoline	6.00
Buckley	2006	465	5.0	6.7	Gasoline	1.00
Buckley	2006	465	3.5	4.7	Gasoline	5.00
Buckley	2006	1007	8.0	10.7	Gasoline	3.15
Buckley	2006	1007	8.0	10.7	Gasoline	3.15
Buckley	2006	1007	8.0	10.7	Gasoline	3.15
Buckley	2006	1007	8.0	10.7	Gasoline	3.15
Kirtland	2001	Flightline	48.5	65	Gasoline	43.80
Kirtland	2001	Flightline	48.5	65	Gasoline	43.80
Kirtland	2001	Flightline	48.5	65	Gasoline	43.80
Kirtland	2001	Flightline	48.5	65	Gasoline	43.80
Kirtland	2002	Flightline	48.5	65	Gasoline	43.80
Kirtland	2002	Flightline	48.5	65	Gasoline	43.80
Kirtland	2002	Flightline	48.5	65	Gasoline	43.80
Kirtland	2002	Flightline	48.5	65	Gasoline	43.80
Kirtland	2003	Flightline	48.5	65	Gasoline	43.80
Kirtland	2003	Flightline	48.5	65	Gasoline	43.80
Kirtland	2003	Flightline	48.5	65	Gasoline	43.80
Kirtland	2004	Flightline	48.5	65	Gasoline	43.80
Kirtland	2004	Flightline	48.5	65	Gasoline	43.80
Kirtland	2004	Flightline	48.5	65	Gasoline	43.80
Kirtland	2005	Flightline	48.5	65	Gasoline	18.00
Kirtland	2005	Flightline	48.5	65	Gasoline	43.80
Kirtland	2005	Flightline	48.5	65	Gasoline	43.80
Kirtland	2005	Flightline	48.5	65	Gasoline	43.80
Kirtland	2006	Flightline	48.5	65	Gasoline	43.80
Kirtland	2006	Flightline	48.5	65	Gasoline	43.80
Kirtland	2006	Flightline	48.5	65	Gasoline	43.80
Kirtland	2006	Flightline	48.5	65	Gasoline	43.80
Kirtland	2007	Flightline	48.5	65	Gasoline	43.80
Kirtland	2007	Flightline	48.5	65	Gasoline	43.80
Kirtland	2007	Flightline	48.5	65	Gasoline	43.80

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Kirtland	2007	Flightline	48.5	65	Gasoline	43.80
Kirtland	2008	20643	65.6	88	Gasoline	1.30
Kirtland	2008	Flightline	48.5	65	Gasoline	43.80
Kirtland	2008	Flightline	48.5	65	Gasoline	43.80
Kirtland	2008	Flightline	48.5	65	Gasoline	43.80
Kirtland	2008	Flightline	48.5	65	Gasoline	43.80
Seymore Johnson	1997	2150	5	6.7	Gasoline	41.00
Seymore Johnson	1997	2150	5	6.7	Gasoline	41.00
Seymore Johnson	1998	2150	5	6.7	Gasoline	41.00
Seymore Johnson	1998	2150	5	6.7	Gasoline	41.00
Seymore Johnson	2000	2150	5	7	Gasoline	2.00
Seymore Johnson	2000	2150	5	7	Gasoline	2.00
Luke	1998	318	5	6.7	Mogas	4.00
Luke	1998	318	5	6.7	Mogas	4.00
Luke	1998	318	5	6.7	Mogas	4.00
Luke	1998	318	5	6.7	Mogas	4.00
Luke	1998	360	5	6.7	Mogas	4.00
Luke	2002	360	5	6.7	Mogas	12.00
Luke	2002	360	5	6.7	Mogas	12.00
Luke	2002	360	5	6.7	Mogas	12.00
Luke	2002	360	5	6.7	Mogas	12.00
Luke	2002	360	5	6.7	Mogas	12.00
Luke	2002	360	5.5	7.4	Mogas	12.00
Luke	2003	360	5	6.7	Mogas	12.00
Luke	2003	360	5	6.7	Mogas	12.00
Luke	2003	360	5	6.7	Mogas	12.00
Luke	2003	360	5	6.7	Mogas	12.00
Luke	2003	360	5	6.7	Mogas	12.00
Luke	2003	360	5.5	7.4	Mogas	12.00
Luke	2004	360	5	6.7	Mogas	12.00
Luke	2004	360	5	6.7	Mogas	12.00
Luke	2004	360	5	6.7	Mogas	12.00
Luke	2004	360	5	6.7	Mogas	12.00
Luke	2004	360	5	6.7	Mogas	12.00
Luke	2004	360	5.5	7.4	Mogas	12.00
Luke	2005	360	5	6.7	Mogas	11.00
Luke	2005	360	5	6.7	Mogas	11.00
Luke	2005	360	5	6.7	Mogas	11.00
Luke	2005	360	5	6.7	Mogas	11.00

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Luke	2005	360	5	6.7	Mogas	11.00
Luke	2005	360	5.5	7.4	Mogas	11.00
Luke	2006	360	5	6.7	Mogas	12.60
Luke	2006	360	5	6.7	Mogas	12.70
Luke	2006	360	5	6.7	Mogas	12.70
Luke	2006	360	5	6.7	Mogas	12.80
Luke	2006	360	5	6.7	Mogas	12.90
Luke	2006	360	5.5	7.4	Mogas	21.60
Buckley	2004	912/914	60.0	80	Natural Gas	9.60
Buckley	2004	913/915	60.0	80	Natural Gas	15.40
Buckley	2005	912/914[b]	60	80.5	Natural Gas	4.10
Buckley	2005	913/915[b]	60	80.5	Natural Gas	4.40
Buckley	2005	914[c]	60	80.5	Natural Gas	1.80
Buckley	2005	915[c]	60	80.5	Natural Gas	1.90
Buckley	2006	912	60	80.5	Natural Gas	9.20
Buckley	2006	913	60	80.5	Natural Gas	9.60
Buckley	2006	914	60	80.5	Natural Gas	9.80
Buckley	2006	915	60	80.5	Natural Gas	9.00
Buckley	2006	916	60	80.5	Natural Gas	14.20
Buckley	2006	917	60	80.5	Natural Gas	9.00
Kirtland	2002	00327	244.6	328	Natural Gas	20.10
Kirtland	2003	00327	249.8	335	Natural Gas	16.00
Kirtland	2004	00327	249.8	335	Natural Gas	12.00
Kirtland	2005	900	50.0	67	Natural Gas	23.00
Kirtland	2005	25952	50.0	67	Natural Gas	24.60
Kirtland	2005	00327	244.6	328	Natural Gas	18.00
Kirtland	2006	327	244.6	328	Natural Gas	20.00
Kirtland	2006	900	50.0	67	Natural Gas	8.50
Kirtland	2006	2592	50.0	67	Natural Gas	13.50
Kirtland	2007	327	244.6	328	Natural Gas	12.00
Kirtland	2007	900	50.0	67	Natural Gas	17.80
Kirtland	2007	2592	50.0	67	Natural Gas	28.00
Kirtland	2008	327	244.6	328	Natural Gas	15.50
Kirtland	2008	900	50.0	67	Natural Gas	15.30
Kirtland	2008	2592	50.0	67	Natural Gas	36.10
Seymore Johnson	1997	2401	100	134.1	Natural Gas	41.00
Seymore Johnson	1998	2401	100	134.1	Natural Gas	41.00
Seymore Johnson	1999	2401	100	134	Natural Gas	42.00
Seymore Johnson	2000	2401	100	134	Natural Gas	19.00

Base	Year	Engines Location	Power Rating (kW)	Rated Power, PP (hp)	Fuel Type	Run Time (hr/yr)
Andrews	1994	703	15	20.1	Propane	60.00

Appendix G, Fire Pump Statistical Analysis

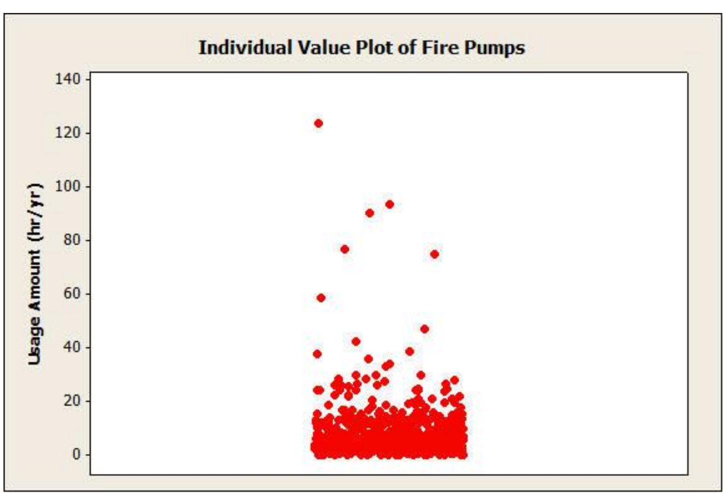
The Air Force has been recording runtime for their fire pumps for years in quantified historic Air Emission Inventory (AEI) data in formal hardcopy AEIs and the Air Program Information (APIMS). Using the historic AEI fire pump runtimes collected from the 1994 to 2010, factual-based inferences (i.e., statistically drawn conclusions from available evidence) on Potential to Emit (PTE) and Likely to Emit (LTE) capacity rates scenarios can be derived to a relative degree of confidence (i.e., greater than 95% confidence). The fire pump runtime data table (Table G-3) is at the end of the main body of this appendix given the large size of fire pump runtime datasets (811 validated values).

Descriptive statistics were used to provide a first glance (big picture) and organization of the raw data. The purpose of descriptive statistics was to summarize or display data so a quick overview can be obtained. Summary descriptive statistics were applied (as discussed below) to identify anomalies and trend groupings in the data; and when present, were investigated for cause and taken into account. The summary statistics included individual value plots (line chart), histograms, mean, median, mode, range, variance, standard deviation, and probability distribution.

Individual Value Plots

The individual value plots (see Figure G-1) provide a simple straight-line plot of each fire pump runtime value relative to each other. The individual value plot on the left side of the figure shows the 5,546 raw unconfirmed runtime values (3,242 from APIMS and 2,304 from hardcopy AEIs) for all internal combustion engines that are suspected to be small fire pumps. This raw data individual value plot was used to identify possible outliers and other values of interest, illustrate characteristics of the data distribution (e.g. how the data is grouped or clustered), and to obtain a quick relative visual comparison of the datasets.

Figure G-1, Fire Pump Individual Value Plots

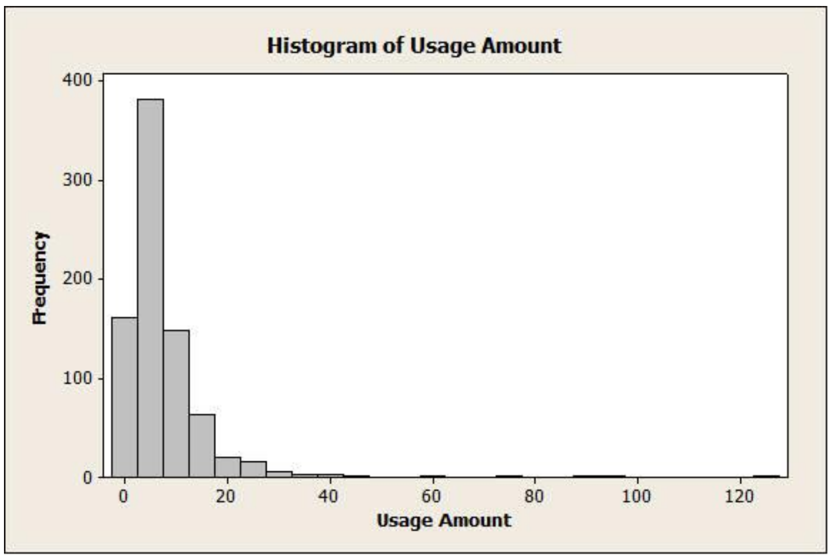


Based on the lack of descriptions of runtimes, all potential outliers were assumed valid and included in the validated runtime dataset. Stationary AEIs (the original sources) were examined and no data points were eliminated from further statistical analysis.

Histograms

The histogram is a bar graph that shows frequency of data and was used to graphically summarize and display the distribution of fire pump runtime datasets. The histogram graphically shows the following: center (i.e., the location) of the data; spread (i.e., the scale) of the data; skewness of the data; presence of outliers; and presence of multiple modes in the data. The following figure (Figure G-2. Histograms for Fire pumps) displays the histogram for the fire pumps.

Figure G-2. Histograms for Fire pumps



The histograms revealed the datasets for fire pump runtimes (usage amount):

- More than 50% of the values < 6 hrs/yr;
- Positively skewed toward zero; and
- The dataset's distribution is leptokurtic (an acute peak around the mean).

Fire Pump Runtime Analysis

The Mini Tab statistical software package was used to evaluate all validated stationary fire pump runtime data to obtain descriptive and inferential statistical information (see Figure G-3, Fire Pump Runtime Statistical Analysis. Mini Tab provided a null hypotheses (i.e., Anderson-Darling) for testing normal distribution.

Central tendency results show a mean (μ or$\bar{x}$) of 7.76 hrs per yr with a skewness of 5.91 and a kurtosis of 53.1, which indicates that the dataset's distribution is leptokurtic (an acute peak around the mean) skewness towards zero. While the mean is often used to report central tendency, it may not be appropriate for describing skewed distributions like this, because it is easily misinterpreted by providing an off-center and high-end biased.

The variance (s^2) shows spread or variability of about 87.4. A more useful and understandable measure is the square root of the variance or the standard deviation (s or σ). Standard deviation is about 9.35.

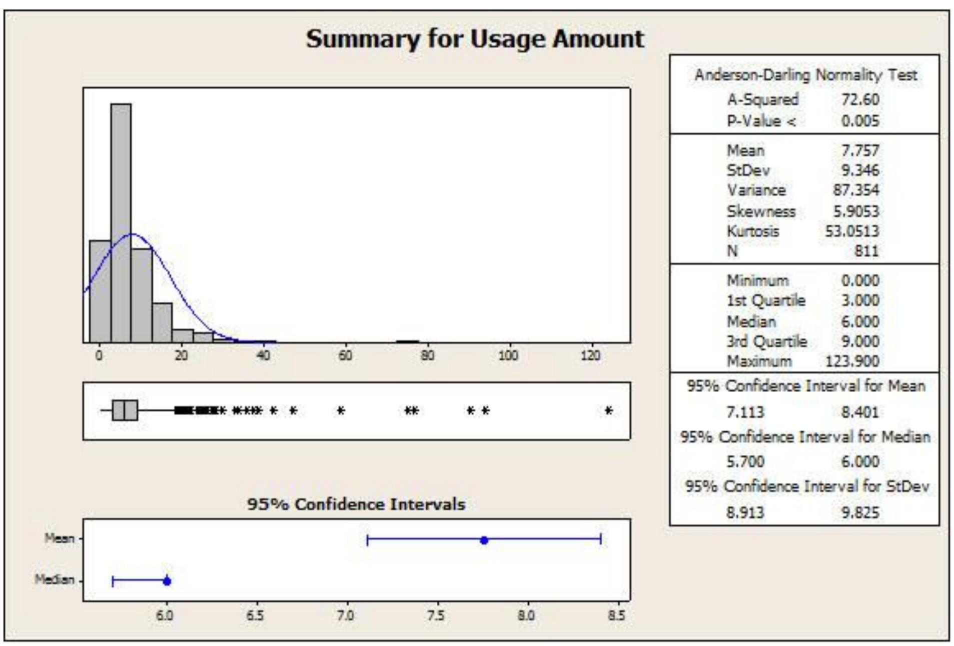
Normal distribution is a theoretical frequency distribution for a set of variable data, usually represented by a bell-shaped curve symmetrical about the mean. Normal distributions are symmetric with scores more concentrated in the middle than in the tails. They are defined by two parameters: the mean (μ) and the standard deviation (σ). Many kinds of behavioral data are approximated well by the normal distribution. Many statistical tests assume a normal distribution. Most of these tests work well even if the distribution is only approximately normal and in many cases as long as it does not deviate greatly from normality.

The Anderson-Darling Null Hypotheses (H_0) test was used as a goodness of fit test. The formulated H_0 testing hypothesis was:

$$H_o = \text{the dataset is from a normal distribution}$$

A significance value (α) of 0.05 (for 95% confidence) was used for both tests. Given the p-values were smaller than the significance level; the test indicated the null hypothesis should be rejected. Additionally, the Anderson-Darling statistic (A-Squared) was much greater than 1.035 for a normal distribution.

Figure G-3. Fire pump Runtime Statistical Analysis



In performing the statistical analysis on the Air Force fire pumps, there were several observations noted associated with the dataset that had a potential direct and/or impact on activity rates. The following observations were noted:

- The USAF stationary AEIs include runtimes that were physically impossible given the emergency use only nature (except for a short tests cycle each month and maintenance) of fire pumps and the maximum capacity of the water reservoir the pumps are supplied with water.
- Given the Null Hypothesis was rejected; the tests confirmed the dataset for stationary fire pump runtimes is not a normal distribution.
- The statistics indicate that the dataset is leptokurtic (very peaked) and skewed towards zero. Therefore, you have a higher probability than a normal distribution to have most of the values near the mean (approximately 7.8 hrs per yr).

DERIVED ACTIVITY RATES

The confidence intervals show the intervals in which a measurement (in this case annual fire pump runtimes) falls corresponding to a given probability. In other words, with a 95% confidence interval, we can be confident that 95% of the single annual fire pump runtime will fall within this estimated range of all fire pump runtimes.

With PTE effectively being an upper-boundary maximum that will not be exceeded, the confidence interval around the upper percentile is appropriate (not the confidence interval around the mean) to represent PTE. Since there is no maximum value associated with a continuous distribution (like a normal distribution), it is standard practice to settle for a confidence interval around a sufficiently high percentile that will exceed nearly all the population measurement. Generally, the upper 99^{th} percentile is used, implying that at the most 1 in 100 measurements would ever exceed the PTE.

If the dataset is approximately normal, then the "68-95-99.7 rule" or the “empirical rule" can be applied to infer several confidence intervals. Based on the empirical rule, one standard deviation from the mean accounts for 68.27% of the values in the dataset; while two standard deviations from the mean account for 95.45%; and three standard deviations account for 99.73%.

PTE is a measure worst-case annual operating time; therefore, the upper confidence limit (UCL) of the dataset’s 99^{th} percentile or greater would provide a representative PTE for a specified confidence. Therefore, if the fire pump dataset had an approximate normal distribution, PTE could be derived using the “empirical rule" at 99.73% (1 in 1,429 measurements) confidence at three standard deviations above the mean. Based on the Air Force’s statistical analysis of fire pumps:

$$\boldsymbol{A(PTE_{Normal})} = \boldsymbol{\mu + 3\sigma} = 7.76 + (3 \times 9.35) = \mathbf{35.8}\ \boldsymbol{hrs/yr}$$

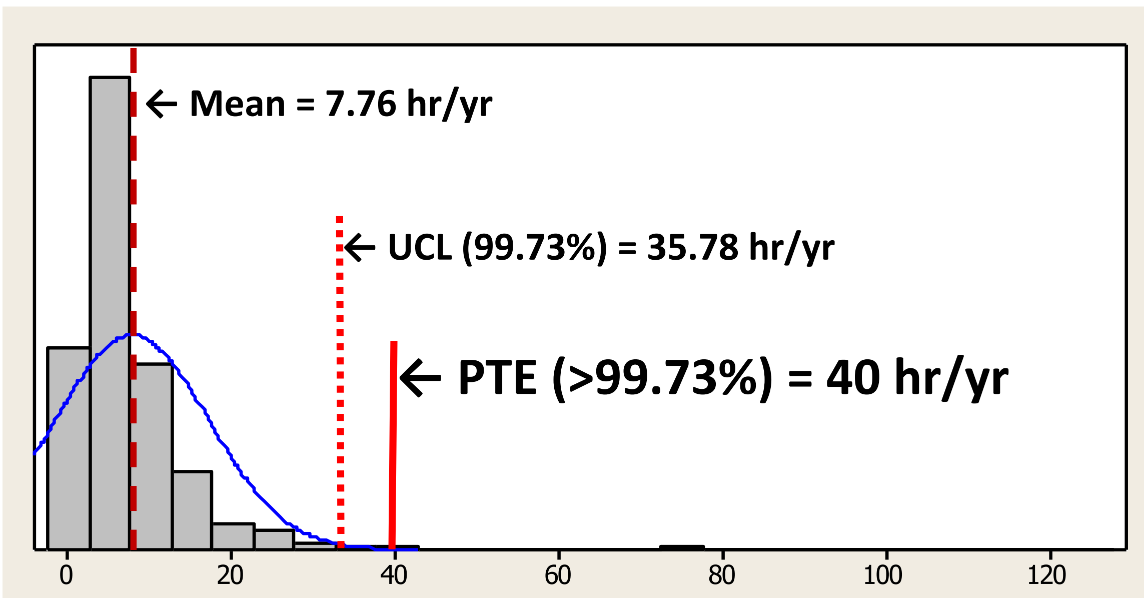
Where:

μ = mean = 7.757 hrs/yr
σ = standard deviation = 9.346 hrs/yr
n = 811 measurements

The above 99.73% UCL assumes a normal distribution of the dataset and yields a PTE of approximately 36 hrs/yr runtime. However, the statistical analysis demonstrated that the fire pump runtime dataset was not a normal distribution and skewed toward zero.

The dataset is leptokurtic (very peaked) and skewed towards zero, giving a higher probability than a normal distribution to have most of the values near the mean (approximately 8 hrs per yr). Therefore, using the upper 99.73% UCL for a PTE value would be a conservative estimate of a worst case. Additional, for ease of use and to add a slight factor of safety, the Air Force recommends used a PTE value of ***40 hr/yr for all fire pumps***. For more details on the statistical analysis see Figure G-3, Fire pump Runtime Statistical Analysis.

Figure G-4, Fire pumps Histogram and Confidence Intervals



LTE represents the most likely or probable runtime for the fire pumps. The mean, at 7.8 hr/yr provides an Air Force-wide average and an indicator of the most likely runtime. However, it does not provide us with the confidence we desire to ensure acceptability to the regulatory community for use in NEPA evaluation. Therefore, the 95% upper confidence limit for the mean provides a better estimate. Using the confidence interval for the mean results in a LTE at 95% confidence would be 8.4 hrs per or approximately 9 hrs per yr.

Table G-1, Fire pump PTE & LTE Derived Activity Rates, provides an overview of LTE and PTE activity rates derived for fire pump.

Table G-1, Fire pump PTE & LTE Derived Activity Rates

LTE (hrs/yr)			PTE (hrs/yr)	
Mean (X̄)	Mean (95% UCL)	Recommended LTE	Maximum (99.73% UCL)	Maximum (>99.73% UCL)
8	8	**9**	26	36

Table G-2, Fire pump Runtime Data

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Beale AFB	640298	2010	13.40
Beale AFB	640298	2011	7.60
Beale AFB	640298	2012	19.70
Beale AFB	640299	2010	14.00
Beale AFB	640299	2011	8.60
Beale AFB	640299	2012	15.90
Beale AFB	640300	2010	15.70
Beale AFB	640300	2011	11.20
Beale AFB	640300	2012	19.50
Beale AFB	640310	2010	1.60
Beale AFB	640310	2011	2.20
Beale AFB	640310	2012	1.60
Cannon AFB	647128	2012	2.80
Cannon AFB	647126	2012	2.80
Cannon AFB	647131	2012	2.20
Cannon AFB	647133	2012	2.40
Cannon AFB	647134	2012	2.40
Cannon AFB	647136	2012	2.60
Cannon AFB	647138	2012	2.60
Cannon AFB	647137	2012	0.50
Cannon AFB	647129	2012	2.20
Cannon AFB	647132	2012	2.50
Davis-Monthan AFB	643676	2010	12.10
Davis-Monthan AFB	643635	2010	12.61
Davis-Monthan AFB	643639	2010	10.10
Davis-Monthan AFB	643640	2010	6.10
Davis-Monthan AFB	643639	2012	12.50
Davis-Monthan AFB	643640	2012	7.90
Davis-Monthan AFB	652447	2012	9.00
Davis-Monthan AFB	652448	2012	9.40
Davis-Monthan AFB	646151	2012	12.00
Davis-Monthan AFB	646152	2012	12.30
Eielson AFB	2570	2001	7.00
Eielson AFB	2570	2011	2.40
Eielson AFB	2584	2001	9.00
Eielson AFB	2584	1/31/20112	2.40
Eielson AFB	2588	2001	8.00
Eielson AFB	2590	2001	9.00
Eielson AFB	2590	2011	2.50

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Eielson AFB	2592	2001	10.00
Eielson AFB	2592	2011	2.40
Eielson AFB	2594	2001	5.00
Eielson AFB	2594	2011	2.40
Eielson AFB	2596	2001	8.00
Eielson AFB	2596	2011	2.40
Eielson AFB	2598	2001	9.00
Eielson AFB	2598	2011	0.40
Eielson AFB	2600	2001	6.00
Eielson AFB	2600	2011	42.20
Eielson AFB	2602	2001	6.00
Eielson AFB	2602	2011	123.90
Eielson AFB	2604	2001	8.00
Eielson AFB	2604	2011	2.40
Eielson AFB	2606	2001	2.00
Eielson AFB	2606	2011	2.20
Eielson AFB	2608	2001	7.00
Eielson AFB	2608	2011	2.40
Eielson AFB	2610	2001	6.00
Eielson AFB	2610	2011	2.40
Eielson AFB	612838	2011	47.00
Eielson AFB	612845	2011	2.40
Eielson AFB	612846	2011	2.40
Eielson AFB	624127	2007	12.00
Eielson AFB	624131	2007	12.00
Eielson AFB	624132	2007	12.00
Eielson AFB	624133	2007	12.00
Eielson AFB	624134	2007	0.00
Eielson AFB	624135	2007	12.00
Eielson AFB	628187	2011	7.90
Eielson AFB	640629	2011	2.50
Eielson AFB	640630	2011	2.50
Ellsworth AFB	1480	2002	3.90
Ellsworth AFB	1481	2002	5.50
Ellsworth AFB	1481	2007	2.90
Ellsworth AFB	1483	2002	7.00
Ellsworth AFB	1483	2007	0.00
Ellsworth AFB	1483	2008	17.00
Ellsworth AFB	1484	2002	6.10
Ellsworth AFB	1484	2007	8.22
Ellsworth AFB	1484	2008	2.00
Ellsworth AFB	1485	2002	4.50

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Ellsworth AFB	1485	2007	4.94
Ellsworth AFB	1486	2002	6.30
Ellsworth AFB	1486	2007	6.94
Ellsworth AFB	1487	2002	14.20
Ellsworth AFB	1487	2007	7.50
Fairchild AFB	642376	2007	0.15
Fairchild AFB	642376	2008	14.40
Fairchild AFB	642376	2009	1.93
Fairchild AFB	642376	2010	2.24
Fairchild AFB	642377	2007	3.55
Fairchild AFB	642377	2008	0.55
Fairchild AFB	642377	2009	14.07
Fairchild AFB	642377	2011	3.54
Fairchild AFB	642377	2012	2.25
F.E. Warren AFB	175422	2010	18.80
F.E. Warren AFB	175422	2011	15.60
F.E. Warren AFB	175422	2012	17.70
Hill AFB	179	2002	3.00
Hill AFB	179	2003	3.00
Hill AFB	191	2002	13.00
Hill AFB	191	2003	13.00
Hill AFB	191	2004	13.00
Hill AFB	191	2005	11.00
Hill AFB	191	2006	12.00
Hill AFB	191	2007	13.00
Hill AFB	191	2008	12.00
Hill AFB	191	2009	17.00
Hill AFB	191	2010	11.40
Hill AFB	191	2011	12.70
Hill AFB	191	2012	13.00
Hill AFB	191	2013	10.00
Hill AFB	192	2002	9.00
Hill AFB	192	2003	7.00
Hill AFB	192	2004	7.00
Hill AFB	192	2005	6.00
Hill AFB	192	2006	5.00
Hill AFB	192	2007	5.00
Hill AFB	192	2008	6.00
Hill AFB	192	2009	3.00
Hill AFB	192	2010	5.00
Hill AFB	192	2011	5.20
Hill AFB	192	2012	4.00

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Hill AFB	192	11/31/2013	3.00
Hill AFB	221	2002	2.50
Hill AFB	221	2003	0.50
Hill AFB	221	2004	4.00
Hill AFB	221	2005	4.00
Hill AFB	221	2006	3.50
Hill AFB	257	2002	1.00
Hill AFB	257	2003	5.10
Hill AFB	257	2004	4.00
Hill AFB	257	2005	6.00
Hill AFB	257	2006	6.00
Hill AFB	257	2007	4.00
Hill AFB	257	2008	4.00
Hill AFB	257	2009	4.00
Hill AFB	257	2010	4.00
Hill AFB	257	2011	6.20
Hill AFB	257	2012	5.00
Hill AFB	257	2013	5.00
Hill AFB	258	2002	1.00
Hill AFB	258	2003	4.00
Hill AFB	258	2004	5.00
Hill AFB	258	2005	6.00
Hill AFB	258	2006	6.00
Hill AFB	258	2007	3.00
Hill AFB	258	2008	4.00
Hill AFB	258	2009	4.00
Hill AFB	258	2010	5.00
Hill AFB	258	2011	6.00
Hill AFB	258	2012	6.00
Hill AFB	258	2013	4.00
Hill AFB	261	2002	1.50
Hill AFB	261	2003	1.50
Hill AFB	261	2004	3.00
Hill AFB	261	2005	2.60
Hill AFB	261	2006	4.90
Hill AFB	261	2007	2.90
Hill AFB	261	2008	3.40
Hill AFB	261	2009	3.90
Hill AFB	261	2010	2.80
Hill AFB	261	2011	4.20
Hill AFB	261	2012	3.90
Hill AFB	261	2013	2.90

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Hill AFB	262	2002	9.00
Hill AFB	262	2003	11.90
Hill AFB	262	2004	13.50
Hill AFB	262	2005	5.80
Hill AFB	262	2006	6.10
Hill AFB	262	2007	6.50
Hill AFB	262	2008	6.20
Hill AFB	262	2009	4.50
Hill AFB	262	2010	5.70
Hill AFB	262	2011	6.60
Hill AFB	262	2012	6.30
Hill AFB	262	2013	4.70
Hill AFB	263	2002	6.30
Hill AFB	263	2003	10.20
Hill AFB	263	2004	10.24
Hill AFB	263	2005	6.27
Hill AFB	263	2006	8.48
Hill AFB	263	2007	5.95
Hill AFB	263	2008	6.50
Hill AFB	263	2009	6.70
Hill AFB	263	2010	5.10
Hill AFB	263	2011	6.80
Hill AFB	263	2012	6.40
Hill AFB	263	2013	5.30
Hill AFB	264	2002	7.90
Hill AFB	264	2003	9.40
Hill AFB	264	2004	10.88
Hill AFB	264	2005	6.50
Hill AFB	264	2006	7.85
Hill AFB	264	2007	5.84
Hill AFB	264	2008	5.70
Hill AFB	264	2009	4.60
Hill AFB	264	2010	7.90
Hill AFB	264	2011	6.30
Hill AFB	264	2012	6.00
Hill AFB	264	2013	5.20
Hill AFB	265	2002	8.70
Hill AFB	265	2003	10.15
Hill AFB	265	2004	11.10
Hill AFB	265	2005	5.25
Hill AFB	265	2006	6.64
Hill AFB	265	2007	4.15

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Hill AFB	265	2008	3.20
Hill AFB	265	2009	4.50
Hill AFB	265	2010	6.80
Hill AFB	265	2011	8.40
Hill AFB	265	2012	6.60
Hill AFB	265	2013	6.10
Hill AFB	266	2002	7.10
Hill AFB	266	2003	9.70
Hill AFB	266	2004	10.60
Hill AFB	266	2005	5.42
Hill AFB	266	2006	7.12
Hill AFB	266	2007	6.02
Hill AFB	266	2008	5.70
Hill AFB	266	2009	4.60
Hill AFB	266	2010	5.90
Hill AFB	266	2011	7.70
Hill AFB	266	2012	6.30
Hill AFB	266	2013	5.90
Hill AFB	267	2002	8.20
Hill AFB	267	2003	10.10
Hill AFB	267	2004	10.61
Hill AFB	267	2005	5.74
Hill AFB	267	2006	8.68
Hill AFB	267	2007	6.18
Hill AFB	267	2008	5.30
Hill AFB	267	2009	4.60
Hill AFB	267	2010	5.60
Hill AFB	267	2011	6.40
Hill AFB	267	2012	6.10
Hill AFB	267	2013	5.20
Hill AFB	179	2003	0.40
Hill AFB	191	2002	10.30
Hill AFB	191	2003	1.10
Hill AFB	191	2004	7.60
Hill AFB	191	2005	13.60
Hill AFB	191	2006	5.80
Hill AFB	191	2007	10.50
Hill AFB	191	2008	0.70
Hill AFB	192	2002	19.40
Hill AFB	192	2003	2.10
Hill AFB	192	2004	2.60
Hill AFB	192	2005	9.90

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Hill AFB	192	2006	3.60
Hill AFB	192	2007	36.00
Hill AFB	257	2003	1.90
Hill AFB	257	2006	1.00
Hill AFB	257	2007	0.40
Hill AFB	261	2006	2.30
Hill AFB	261	2007	0.60
Hill AFB	262	2003	3.60
Hill AFB	262	2004	1.20
Hill AFB	263	2003	1.91
Hill AFB	263	2004	5.20
Hill AFB	263	2006	0.38
Hill AFB	264	2003	3.20
Hill AFB	264	2004	5.31
Hill AFB	264	2006	1.70
Hill AFB	265	2003	2.50
Hill AFB	265	2004	6.40
Hill AFB	265	2006	0.42
Hill AFB	265	2011	1.80
Hill AFB	266	2003	1.90
Hill AFB	266	2004	5.90
Hill AFB	266	2006	0.49
Hill AFB	267	2003	2.00
Hill AFB	267	2004	6.10
Hill AFB	267	2005	0.20
Hill AFB	267	2006	1.76
Holloman AFB	615798	2011	0.50
Holloman AFB	615798	2012	3.60
Holloman AFB	615798	2013	0.60
Homestead ARB	170159	2010	30.00
Homestead ARB	170159	2011	26.00
Homestead ARB	170159	2012	12.00
Homestead ARB	170180	2010	34.00
Homestead ARB	170180	2011	30.00
Homestead ARB	170180	2012	12.00
Homestead ARB	170181	2010	33.00
Homestead ARB	170181	2011	30.00
Homestead ARB	170181	2012	12.00
Homestead ARB	170185	2010	0.00
Homestead ARB	170185	2011	26.00
Kadena AB	5780	2009	2.00
Kadena AB	5780	2011	2.00

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Kadena AB	5781	2009	2.40
Kadena AB	5781	2011	2.40
Kadena AB	5782	2009	2.60
Kadena AB	5782	2011	2.60
Kadena AB	5783	2009	1.20
Kadena AB	5783	2011	1.20
Kadena AB	5784	2009	1.20
Kadena AB	5784	2011	1.20
Kadena AB	5785	2009	1.20
Kadena AB	5785	2011	1.20
Kadena AB	5786	2009	1.20
Kadena AB	5786	2011	1.20
Kadena AB	5787	2009	1.20
Kadena AB	5787	2011	1.20
Kadena AB	5788	2009	0.00
Kadena AB	5788	2011	0.00
Kadena AB	5789	2009	2.40
Kadena AB	5789	2011	2.40
Kadena AB	5790	2009	2.00
Kadena AB	5790	2011	2.00
Kadena AB	5791	2009	1.20
Kadena AB	5791	2011	1.20
Kadena AB	5792	2009	0.10
Kadena AB	5792	2011	0.10
Kadena AB	5793	2009	1.00
Kadena AB	5793	2011	1.00
Kadena AB	5794	2009	1.00
Kadena AB	5794	2011	1.00
Kadena AB	5796	2009	2.00
Kadena AB	5796	2011	2.00
Kadena AB	5797	2009	2.20
Kadena AB	5797	2011	2.20
Kadena AB	5798	2009	1.60
Kadena AB	5798	2011	1.60
Kadena AB	5799	2009	2.00
Kadena AB	5799	2011	2.00
Kadena AB	5800	2009	2.00
Kadena AB	5800	2011	2.00
Kadena AB	5801	2009	2.40
Kadena AB	5801	2011	2.40
Kadena AB	5802	2009	1.60
Kadena AB	5802	2011	1.60

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Kadena AB	5803	2009	1.70
Kadena AB	5803	2011	1.70
Kadena AB	5804	2009	1.00
Kadena AB	5804	2011	1.00
Kadena AB	5805	2009	0.00
Kadena AB	5805	2011	0.00
Kadena AB	5806	2009	1.00
Kadena AB	5806	2011	1.00
Kadena AB	5807	2009	1.00
Kadena AB	5807	2011	1.00
Kadena AB	5808	2009	1.00
Kadena AB	5808	2011	1.00
Kadena AB	5809	2009	2.40
Kadena AB	5809	2011	2.40
Kadena AB	5810	2009	0.00
Kadena AB	5810	2011	0.00
Kadena AB	5811	2009	2.40
Kadena AB	5811	2011	2.40
Kadena AB	5812	2009	2.40
Kadena AB	5812	2011	2.40
Kadena AB	5813	2009	2.60
Kadena AB	5813	2011	2.60
Kadena AB	5814	2009	2.40
Kadena AB	5814	2011	2.40
Keesler AFB	160191	2011	6.30
Keesler AFB	160191	2012	5.60
Kirtland AFB	144	2000	15.60
Kirtland AFB	144	2001	9.70
Kirtland AFB	144	2002	5.30
Kirtland AFB	144	2003	4.90
Kirtland AFB	144	2004	4.10
Kirtland AFB	144	2005	4.70
Kirtland AFB	144	2006	6.30
Kirtland AFB	144	2007	4.00
Kirtland AFB	144	2008	4.00
Kirtland AFB	144	2009	5.50
Kirtland AFB	144	2010	5.50
Kirtland AFB	144	2011	5.50
Kirtland AFB	144	2012	3.50
Kirtland AFB	144	2013	5.60
Kirtland AFB	147	2000	7.56
Kirtland AFB	147	2001	12.40

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Kirtland AFB	147	2002	0.65
Kirtland AFB	147	2002	14.05
Kirtland AFB	147	2003	4.80
Kirtland AFB	147	2004	3.30
Kirtland AFB	147	2005	11.70
Kirtland AFB	147	2006	7.80
Kirtland AFB	147	2007	6.80
Kirtland AFB	147	2008	3.00
Kirtland AFB	147	2009	4.50
Kirtland AFB	147	2010	5.50
Kirtland AFB	147	2011	5.50
Kirtland AFB	147	2012	3.30
Kirtland AFB	147	2013	3.80
Kirtland AFB	149	2000	7.68
Kirtland AFB	149	2001	8.80
Kirtland AFB	149	2002	5.30
Kirtland AFB	149	2003	4.40
Kirtland AFB	149	2004	3.70
Kirtland AFB	149	2005	5.20
Kirtland AFB	149	2006	5.70
Kirtland AFB	149	2007	4.00
Kirtland AFB	149	2008	4.40
Kirtland AFB	149	2009	5.50
Kirtland AFB	149	2010	5.50
Kirtland AFB	149	2011	5.50
Kirtland AFB	149	2012	6.70
Kirtland AFB	149	2013	3.60
Kirtland AFB	151	2000	14.49
Kirtland AFB	151	2001	13.50
Kirtland AFB	151	2002	6.06
Kirtland AFB	151	2003	4.60
Kirtland AFB	151	2004	3.70
Kirtland AFB	151	2005	5.10
Kirtland AFB	151	2006	4.80
Kirtland AFB	151	2007	3.20
Kirtland AFB	151	2008	4.70
Kirtland AFB	151	2009	5.50
Kirtland AFB	151	2010	5.50
Kirtland AFB	151	2011	5.00
Kirtland AFB	151	2012	7.60
Kirtland AFB	151	2013	3.10
Kirtland AFB	152	2000	9.12

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Kirtland AFB	152	2001	6.14
Kirtland AFB	152	2002	6.08
Kirtland AFB	152	2003	5.91
Kirtland AFB	152	2004	3.85
Kirtland AFB	152	2005	5.98
Kirtland AFB	152	2006	3.21
Kirtland AFB	152	2007	2.59
Kirtland AFB	152	2008	1.90
Kirtland AFB	152	2009	2.50
Kirtland AFB	152	2010	6.00
Kirtland AFB	152	2011	5.00
Kirtland AFB	152	2012	2.70
Kirtland AFB	152	2013	0.50
Kirtland AFB	153	2000	8.52
Kirtland AFB	153	2001	5.66
Kirtland AFB	153	2002	5.47
Kirtland AFB	153	2003	3.84
Kirtland AFB	153	2004	3.65
Kirtland AFB	153	2005	5.67
Kirtland AFB	153	2006	3.87
Kirtland AFB	153	2007	2.50
Kirtland AFB	153	2008	6.34
Kirtland AFB	153	2009	6.00
Kirtland AFB	153	2010	5.91
Kirtland AFB	153	2011	6.00
Kirtland AFB	153	2012	7.50
Kirtland AFB	153	2013	6.00
Kirtland AFB	154	2000	8.28
Kirtland AFB	154	2001	4.56
Kirtland AFB	154	2002	2.96
Kirtland AFB	154	2003	5.84
Kirtland AFB	154	2004	3.58
Kirtland AFB	154	2005	5.16
Kirtland AFB	154	2006	3.65
Kirtland AFB	154	2007	1.50
Kirtland AFB	154	2008	6.93
Kirtland AFB	154	2009	6.00
Kirtland AFB	154	2010	6.00
Kirtland AFB	154	2011	6.75
Kirtland AFB	154	2012	8.00
Kirtland AFB	154	2013	6.00
Kirtland AFB	155	2000	7.08

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Kirtland AFB	155	2001	5.39
Kirtland AFB	155	2002	4.15
Kirtland AFB	155	2003	4.10
Kirtland AFB	155	2004	2.39
Kirtland AFB	155	2005	5.05
Kirtland AFB	155	2006	3.67
Kirtland AFB	155	2007	2.70
Kirtland AFB	155	2008	4.50
Kirtland AFB	155	2009	5.65
Kirtland AFB	155	2010	5.90
Kirtland AFB	155	2011	8.50
Kirtland AFB	155	2012	5.00
Kirtland AFB	155	2013	5.50
Kirtland AFB	165	2000	18.70
Kirtland AFB	165	2001	24.10
Kirtland AFB	165	2002	26.40
Kirtland AFB	165	2003	23.80
Kirtland AFB	165	2004	28.00
Kirtland AFB	165	2005	21.00
Kirtland AFB	165	2006	24.10
Kirtland AFB	165	2007	19.50
Kirtland AFB	165	2008	15.70
Kirtland AFB	165	2009	11.50
Kirtland AFB	165	2010	8.60
Kirtland AFB	165	2011	3.80
Kirtland AFB	165	2012	8.30
Kirtland AFB	165	2013	2.30
Kirtland AFB	248	2000	15.20
Kirtland AFB	248	2001	24.70
Kirtland AFB	248	2002	28.20
Kirtland AFB	248	2003	26.40
Kirtland AFB	248	2004	26.10
Kirtland AFB	248	2005	24.50
Kirtland AFB	248	2006	22.40
Kirtland AFB	248	2007	22.20
Kirtland AFB	248	2008	20.70
Kirtland AFB	248	2009	10.50
Kirtland AFB	248	2010	8.90
Kirtland AFB	248	2011	4.00
Kirtland AFB	248	2012	6.90
Kirtland AFB	248	2013	2.30
Lackland AFB	835	2002	5.40

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Lackland AFB	835	2003	8.40
Lackland AFB	835	2004	12.00
Lackland AFB	835	2005	0.50
Lackland AFB	835	2005	5.83
Lackland AFB	835	2006	4.10
Lackland AFB	835	2007	13.20
Lackland AFB	835	2009	3.60
Lackland AFB	836	2002	2.60
Lackland AFB	836	2003	7.60
Lackland AFB	836	2004	7.20
Lackland AFB	836	2005	6.00
Lackland AFB	836	2006	3.30
Lackland AFB	836	2007	3.60
Lackland AFB	836	2009	3.60
Lackland AFB	902	2001	3.00
Lackland AFB	902	2002	7.50
Lackland AFB	902	2003	6.00
Lackland AFB	902	2004	6.00
Lackland AFB	902	2005	6.00
Lackland AFB	902	2006	13.20
Lackland AFB	902	2007	13.20
Lackland AFB	902	2008	14.04
Lackland AFB	902	2009	3.60
Lackland AFB	902	2010	5.80
Lackland AFB	902	2011	76.90
Lackland AFB	902	2012	28.30
Lackland AFB	903	2001	3.00
Lackland AFB	903	2002	7.70
Lackland AFB	903	2003	12.00
Lackland AFB	903	2004	6.00
Lackland AFB	903	2005	6.00
Lackland AFB	903	2006	6.00
Lackland AFB	903	2007	6.00
Lackland AFB	903	2008	6.00
Lackland AFB	903	2009	3.60
Lackland AFB	903	2010	0.10
Lackland AFB	903	2011	93.80
Lackland AFB	903	2012	25.40
Lackland AFB	916	2001	3.00
Lackland AFB	916	2002	3.50
Lackland AFB	916	2003	6.00
Lackland AFB	916	2004	6.00

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Lackland AFB	916	2005	6.00
Lackland AFB	916	2006	6.00
Lackland AFB	916	2007	6.00
Lackland AFB	916	2008	6.00
Lackland AFB	916	2009	3.72
Lackland AFB	916	2010	1.60
Lackland AFB	916	2011	90.20
Lackland AFB	916	2012	37.50
Lackland AFB	601102	2003	3.60
Lackland AFB	601102	2004	3.60
Lackland AFB	601102	2005	6.00
Lackland AFB	601102	2006	3.60
Lackland AFB	601102	2007	3.60
Lackland AFB	601102	2009	3.36
Lackland AFB	601102	2012	3.60
March AFB	612476	2012	4.40
March AFB	612476	2013	7.40
March AFB	612477	2012	6.90
March AFB	612477	2013	8.60
McConnell AFB	648706	2012	7
McConnell AFB	648707	2012	6
McConnell AFB	648708	2012	5
McConnell AFB	648709	2012	6
McConnell AFB	648710	2012	3
McConnell AFB	648711	2012	3
Macdill AFB	159342	2011	7.90
Macdill AFB	159342	2012	8.80
Macdill AFB	159342	2013	8.20
Macdill AFB	159345	2012	10.20
Macdill AFB	159346	2012	9.80
Macdill AFB	644555	2012	11.20
JB MDL	613990	2009	1.50
JB MDL	613990	2010	14.30
JB MDL	613990	2011	5.90
JB MDL	613990	2012	8.00
JB MDL	613990	2013	5.10
JB MDL	613991	2009	1.50
JB MDL	613991	2010	3.90
JB MDL	613991	2011	5.00
JB MDL	613991	2012	6.60
JB MDL	613991	2013	4.00
JB MDL	613993	2009	1.50

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
JB MDL	613993	2010	4.20
JB MDL	613993	2011	4.20
JB MDL	613993	2012	4.90
JB MDL	613993	2013	3.90
JB MDL	647396	2011	4.00
JB MDL	647396	2012	2.10
JB MDL	647396	2013	1.00
JB MDL	647397	2011	2.00
JB MDL	647397	2012	1.80
JB MDL	647397	2013	0.70
JB MDL	647398	2011	2.00
JB MDL	647398	2012	2.50
JB MDL	647398	2013	7.20
JB MDL	647399	2011	3.00
JB MDL	647399	2012	2.60
JB MDL	647399	2013	4.60
JB MDL	647400	2011	1.00
JB MDL	647400	2012	1.60
JB MDL	647400	2013	0.40
JB MDL	647403	2011	1.00
JB MDL	647403	2012	4.30
JB MDL	647403	2013	2.00
Malmstrom AFB	634387	2010	13.80
Malmstrom AFB	634388	2010	13.20
Malmstrom AFB	634389	2010	12.80
Maxwell AFB	3580	2001	10.30
Maxwell AFB	3580	2002	24.00
Maxwell AFB	3580	2003	12.30
Maxwell AFB	3580	2004	3.20
Maxwell AFB	3580	2005	14.60
Maxwell AFB	3580	2006	14.40
Maxwell AFB	3580	2007	21.20
Maxwell AFB	3580	2008	14.00
Maxwell AFB	3580	2010	10.00
Maxwell AFB	3580	2011	6.90
Maxwell AFB	3580	2012	7.20
Maxwell AFB	3581	2001	10.20
Maxwell AFB	3581	2002	24.00
Maxwell AFB	3581	2003	13.30
Maxwell AFB	3581	2004	1.90
Maxwell AFB	3581	2005	10.20
Maxwell AFB	3581	2006	12.40

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Maxwell AFB	3581	2007	16.40
Maxwell AFB	3594	2001	6.00
Maxwell AFB	3594	2002	24.00
Maxwell AFB	3594	2003	5.00
Maxwell AFB	3594	2004	0.00
Maxwell AFB	3595	2001	5.40
Maxwell AFB	3595	2002	24.00
Maxwell AFB	3595	2003	5.00
Maxwell AFB	3595	2004	1.00
Mountain Home AFB	753	2001	10.40
Mountain Home AFB	753	2002	12.00
Mountain Home AFB	753	2003	7.80
Mountain Home AFB	753	2004	6.60
Mountain Home AFB	753	2005	7.00
Mountain Home AFB	753	2006	7.70
Mountain Home AFB	753	2007	3.20
Mountain Home AFB	753	2008	7.80
Mountain Home AFB	753	2009	5.70
Mountain Home AFB	753	2010	6.40
Mountain Home AFB	753	2011	6.40
Mountain Home AFB	753	2012	8.80
Mountain Home AFB	843	2000	12.00
Mountain Home AFB	843	2001	9.20
Mountain Home AFB	843	2002	5.70
Mountain Home AFB	843	2003	6.80
Mountain Home AFB	843	2004	6.20
Mountain Home AFB	843	2005	4.70
Mountain Home AFB	843	2006	7.10
Mountain Home AFB	843	2007	0.20
Mountain Home AFB	843	2008	12.60
Mountain Home AFB	843	2009	6.20
Mountain Home AFB	843	2010	6.30
Mountain Home AFB	843	2011	6.30
Mountain Home AFB	843	2012	7.80
Mountain Home AFB	844	2000	12.00
Mountain Home AFB	844	2001	8.70
Mountain Home AFB	844	2002	5.50
Mountain Home AFB	844	2003	6.20
Mountain Home AFB	844	2004	6.20
Mountain Home AFB	844	2005	6.50
Mountain Home AFB	844	2006	6.80
Mountain Home AFB	844	2007	0.10

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Mountain Home AFB	844	2008	6.50
Mountain Home AFB	844	2009	6.20
Mountain Home AFB	844	2010	5.80
Mountain Home AFB	844	2011	6.30
Mountain Home AFB	844	2012	7.50
Mountain Home AFB	845	2000	12.00
Mountain Home AFB	845	2001	7.70
Mountain Home AFB	845	2002	5.50
Mountain Home AFB	845	2003	6.10
Mountain Home AFB	845	2004	6.00
Mountain Home AFB	845	2005	7.30
Mountain Home AFB	845	2006	6.20
Mountain Home AFB	845	2007	0.20
Mountain Home AFB	845	2008	6.50
Mountain Home AFB	845	2009	5.80
Mountain Home AFB	845	2010	5.80
Mountain Home AFB	845	2011	6.30
Mountain Home AFB	845	2012	7.10
Mountain Home AFB	846	2000	12.00
Mountain Home AFB	846	2001	8.80
Mountain Home AFB	846	2002	6.50
Mountain Home AFB	846	2003	8.30
Mountain Home AFB	846	2004	8.50
Mountain Home AFB	846	2005	58.70
Mountain Home AFB	846	2006	5.30
Mountain Home AFB	846	2007	6.50
Mountain Home AFB	846	2008	7.80
Mountain Home AFB	846	2009	9.30
Mountain Home AFB	846	2010	6.50
Mountain Home AFB	846	2011	6.50
Mountain Home AFB	846	2012	6.90
Mountain Home AFB	847	2000	21.00
Mountain Home AFB	847	2001	8.70
Mountain Home AFB	847	2002	6.20
Mountain Home AFB	847	2004	6.10
Mountain Home AFB	847	2005	27.30
Mountain Home AFB	847	2006	1.00
Mountain Home AFB	847	2007	2.30
Mountain Home AFB	847	2009	3.70
Mountain Home AFB	847	2010	6.60
Mountain Home AFB	847	2011	7.00
Mountain Home AFB	847	2012	6.60

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Mountain Home AFB	847	2003	14.60
Mountain Home AFB	848	2000	22.00
Mountain Home AFB	848	2001	8.80
Mountain Home AFB	848	2002	6.50
Mountain Home AFB	848	2003	6.70
Mountain Home AFB	848	2004	2.60
Mountain Home AFB	848	2005	22.20
Mountain Home AFB	848	2006	1.20
Mountain Home AFB	848	2007	1.50
Mountain Home AFB	848	2008	2.20
Mountain Home AFB	848	2010	2.20
Mountain Home AFB	848	2011	5.80
Mountain Home AFB	848	2012	18.80
Mountain Home AFB	849	2000	12.00
Mountain Home AFB	849	2001	8.40
Mountain Home AFB	849	2002	6.30
Mountain Home AFB	849	2003	6.40
Mountain Home AFB	849	2004	6.40
Mountain Home AFB	849	2005	6.60
Mountain Home AFB	849	2006	5.60
Mountain Home AFB	849	2007	5.20
Mountain Home AFB	849	2008	5.90
Mountain Home AFB	849	2009	6.30
Mountain Home AFB	849	2010	5.60
Mountain Home AFB	849	2011	6.70
Mountain Home AFB	849	2012	7.10
Niagara Falls ARB	171194	2009	2.72
Niagara Falls ARB	171194	2010	2.72
Niagara Falls ARB	171194	2011	11.00
Niagara Falls ARB	171194	2012	7.00
Niagara Falls ARB	171195	2009	2.72
Niagara Falls ARB	171195	2010	2.72
Niagara Falls ARB	171195	2011	7.00
Niagara Falls ARB	171195	2012	7.00
Niagara Falls ARB	171196	2009	2.72
Niagara Falls ARB	171196	2010	2.72
Niagara Falls ARB	171196	2011	7.00
Niagara Falls ARB	171196	2012	7.00
Pittsburgh IAP	122	2007	75.20
Pittsburgh IAP	122	2011	1.10
Pittsburgh IAP	122	2012	2.00
Pittsburgh IAP	123	2007	38.60

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Pittsburgh IAP	123	2011	1.20
Pittsburgh IAP	123	2012	3.40
Pittsburgh IAP	124	2007	10.80
Pittsburgh IAP	124	2011	1.20
Pittsburgh IAP	124	2012	4.60
Seymour Johnson AFB	720	2002	11.00
Seymour Johnson AFB	720	2003	17.00
Seymour Johnson AFB	720	2004	12.50
Seymour Johnson AFB	720	2009	12.00
Seymour Johnson AFB	720	2010	12.00
Seymour Johnson AFB	720	2011	12.00
Seymour Johnson AFB	720	2012	15.00
Seymour Johnson AFB	721	2002	11.00
Seymour Johnson AFB	721	2003	13.00
Seymour Johnson AFB	721	2004	18.00
Seymour Johnson AFB	721	2009	16.50
Seymour Johnson AFB	721	2010	12.00
Seymour Johnson AFB	721	2011	9.70
Seymour Johnson AFB	723	2002	11.50
Seymour Johnson AFB	723	2003	12.00
Seymour Johnson AFB	723	2004	14.00
Seymour Johnson AFB	723	2009	22.00
Seymour Johnson AFB	723	2010	12.00
Seymour Johnson AFB	723	2011	14.50
Seymour Johnson AFB	723	2012	13.00
Seymour Johnson AFB	724	2002	10.50
Seymour Johnson AFB	724	2003	17.50
Seymour Johnson AFB	724	2004	11.50
Seymour Johnson AFB	724	2009	14.50
Seymour Johnson AFB	724	2010	12.00
Seymour Johnson AFB	724	2011	10.50
Seymour Johnson AFB	724	2012	12.50
Seymour Johnson AFB	725	2002	9.50
Seymour Johnson AFB	725	2003	14.50
Seymour Johnson AFB	725	2004	10.00
Seymour Johnson AFB	725	2009	13.00
Seymour Johnson AFB	725	2011	12.00
Seymour Johnson AFB	726	2002	10.50
Seymour Johnson AFB	726	2003	13.50
Seymour Johnson AFB	726	2004	13.50
Seymour Johnson AFB	726	2009	19.00
Seymour Johnson AFB	726	2010	12.00

Base Name	Unique ID	Usage Date	Usage Amount (hr/yr)
Seymour Johnson AFB	726	2011	13.00
Seymour Johnson AFB	726	2012	10.00
Tucson IAP	613311	2008	1.20
Tucson IAP	613311	2009	6.90
Tucson IAP	613311	2010	15.40
Tucson IAP	613311	2011	7.80
Tucson IAP	613311	2012	9.60
Whiteman AFB	617864	2011	16.80
Whiteman AFB	617864	2012	8.10
Whiteman AFB	617864	2013	7.60
Whiteman AFB	618084	2011	17.00
Whiteman AFB	618084	2012	16.10
Whiteman AFB	618084	2013	13.20
Whiteman AFB	625307	2011	17.00
Whiteman AFB	625307	2012	15.30
Whiteman AFB	625307	2013	10.60