



# **Electric Service Reliability Reporting Plan of Avista Utilities**

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## **Chapter 1 – Introduction**

Avista’s Electric Service Reliability Report details the annual results, from the prior calendar year, of the Company’s overall electric reliability performance as required by WAC 480-100-393 and 480-100-398.

### **Executive Summary**

The executive summary will provide highlights of the service reliability information included in the report.

### **Background**

Per WAC 480-100-398, Avista must submit an annual electric service reliability report to the Commission at least once per year. Avista elected to submit its annual report, known as its Electric Service Reliability Report, on or before April 30<sup>th</sup> of each year. This date allows the Company time to finalize results from the prior calendar year and put the report together. As detailed in WAC 480-100-398, the contents of the report must include the following, at minimum:

*(1) The report must be consistent with the electric service reliability monitoring and reporting plan filed under WAC [480-100-393](#). As set forth in the plan, in an identified year, baseline reliability statistics must be established and reported. In subsequent years, new reliability statistics must be compared to the baseline reliability statistics and to reliability statistics from all intervening years. The utility must maintain historical reliability information necessary to show trends for a minimum of seven years.*

*(2) The report must address any changes that the utility may make in the collection of data and calculation of reliability information after initial baselines are set. The utility must explain why the changes occurred and explain how the change is expected to affect comparisons of the newer and older information. Additionally, to the extent practical, the utility must quantify the effect of such changes on the comparability of new reliability statistics to baseline reliability statistics.*

*(3) The report must identify the utility's geographic areas of greatest reliability concern, explain their causes, and explain how the utility plans to address them.*

*(4) The report must identify the total number of customer complaints about reliability and power quality made to the utility during the year and must distinguish between complaints about sustained interruptions and power quality. The report must also identify complaints that were made about major events.*

### **Results of Avista’s Electric Service Reliability**

This section will provide a summary of the results the electric reliability results for the prior calendar year. The following table is an example of the summarized results that will be included.

<b>Index</b>	<b>2008-2013 Average</b> (Excluding Major Events)	<b>2005 Baseline</b>	<b>Reliability Target</b> (Ave + 2 Standard Deviations)	<b>2014 Results</b> (Excluding Major Events)
SAIFI	1.24	0.97	1.61	1.11
MAIFI	3.12	3.58	4.89	2.2
SAIDI	149	108	200	139
CAIDI	120	112	138	125

## Appendices

Appendix A: Definitions

Appendix B: Electric Index Calculations

Appendix C: Customer Reliability Complaints

Appendix D: SAIFI and SAIDI Historical Summary

## **Chapter 2 – Electric Service Reliability**

In this section the Company will provide a brief overview of reliability for the year and explain any changes or significant events that occurred.

### **Data Collection and Calculation Changes**

WAC 480-100-398(2) requires the Company to report changes made in data collection or calculation of reliability information after initial baselines are set. This section addresses any changes that the Company has made to data collection or calculations and provides the supporting rationale for these changes.

### **Baseline Statistics**

WAC 480-100-393 (3)(b) requires the establishment of baseline reliability statistics. The Company’s baseline statistics will be included in the report and compare the reporting year data to the baseline year of 2005 and years in between. As required, the Company will also calculate a statistical target, which is based on the average value for the reliability statistic over a time period and adding two standard deviations for that mean. Year to year variations in reliability performance will typically fall below this target, however, any exceedance of the target does not represent a “failure” in reliability performance or provide a basis for any regulatory or other action.

### **System Indices**

The System Indices (or “Measures” or “Statistics”) section shows indices for Avista’s Washington and Idaho (“system”) electric service territory for a given year or the average for a given range of years. Each chart will show eight years of data along with the baseline reliability statistic. The reliability target described above is also listed for each index.

The service reliability results reported by the Company are adjusted by removing the outages associated with Major Event Days (or “MEDs”), as defined in Appendix A.

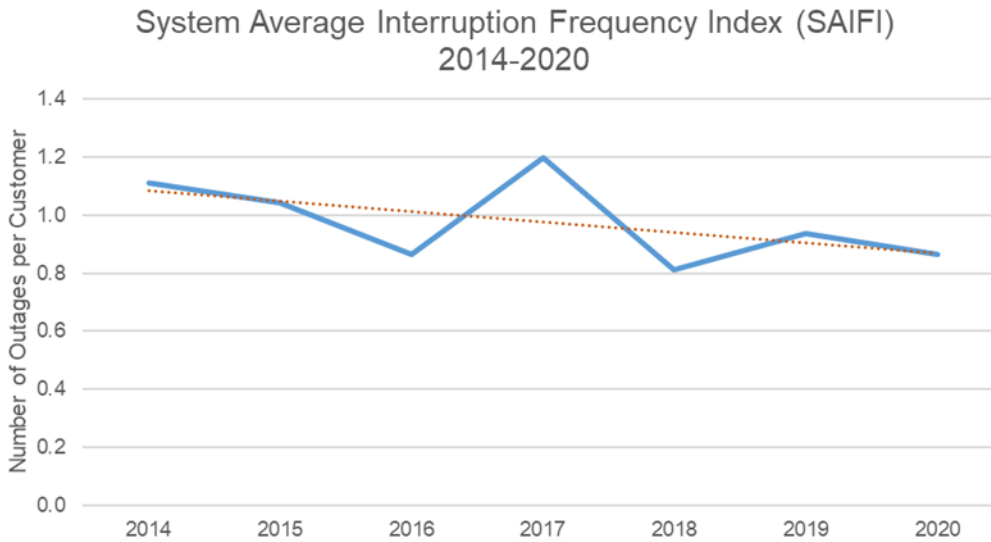
Following are examples of the charts included for each system index.

**Table – Example Reliability Index Values**

<b>Index</b>	<b>2008-2013 Average</b> <small>(Excluding Major Events)</small>	<b>2005 Baseline</b>	<b>Reliability Target</b> <small>(Ave + 2 Standard Deviations)</small>
SAIFI	1.24	0.97	1.61
MAIFI	3.12	3.58	4.89
SAIDI	149	108	200
CAIDI	120	112	138

The Company may also present tabular data for each reliability index in the form of tables or charts, as shown in the example below.

**Chart - SAIFI - Sustained Interruptions / Customer**



**Reports by Operations Area**

Avista also reports service reliability statistics for each of its individual operations areas, which are listed along with their respective abbreviation code, below.

CDC	Coeur d’Alene	LCC	Lewiston-Clarkston
COC	Colville	OTC	Othello
DAC	Davenport	PAC	Palouse
DPC	Deer Park	SAC	Sandpoint
GRC	Grangeville	SPC	Spokane
KEC	Kellogg/ St. Maries		

**Major Event Days**

As noted above, outage events that are significant enough to exceed the threshold defined for “Major Events” are excluded from Avista’s standard reporting. These major events are tracked by “Major Event Day” as defined in the IEEE Guide for Electric Power Distribution Reliability Indices, IEEE P1366-2012, which reference is provided in Appendix A. The Company uses the process defined in IEEE P1366 to calculate the threshold value (of T<sub>MED</sub>) used to determine MEDs. As noted earlier, Avista’s comparison of current-year and average service reliability with baseline statistics is performed on index values determined without MEDs.

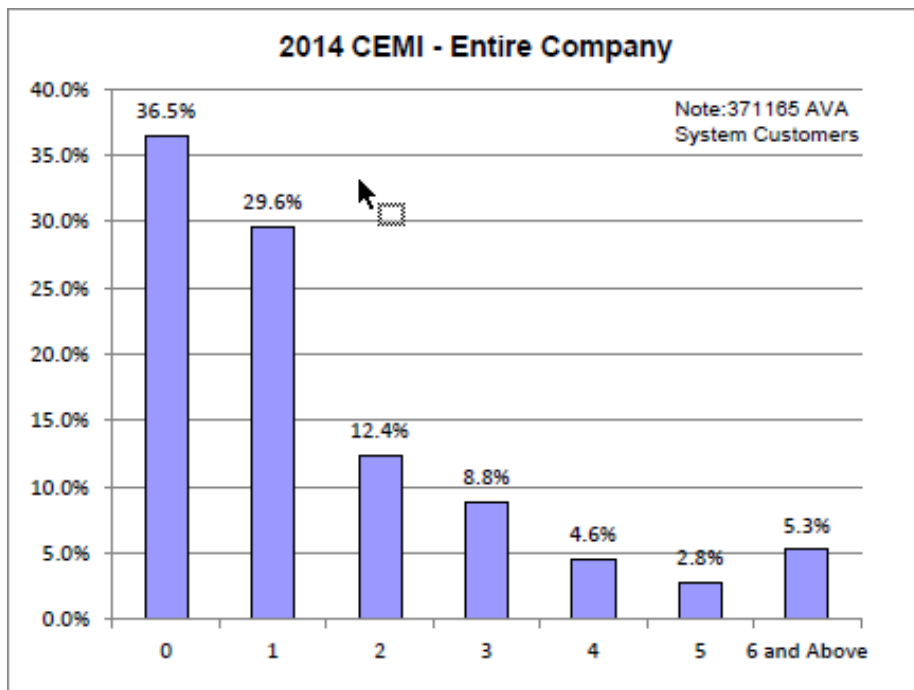
The Company will include a list of the MEDs that occurred during the year as shown in the following example.

Major Event Days	SAIDI (Customer-Minutes)	Cause
2014 Major Event Day Threshold	8.72	
July 23, 2014	92.95	Wind
July 24, 2014	35.66	Wind
August 2, 2014	121.05	Wind
August 3, 2014	38.52	Wind
August 12, 2014	9.84	Wind

### Customers Experiencing Multiple Interruptions

The IEEE Standard 1366P-2003 provides for the analysis of data associated with customers who experience multiple sustained interruptions. This section of the report will provide the results for CEMI<sub>n</sub> and an explanation of the results. Charts showing the results will be provided to support the applicable discussion, similar to the example below.

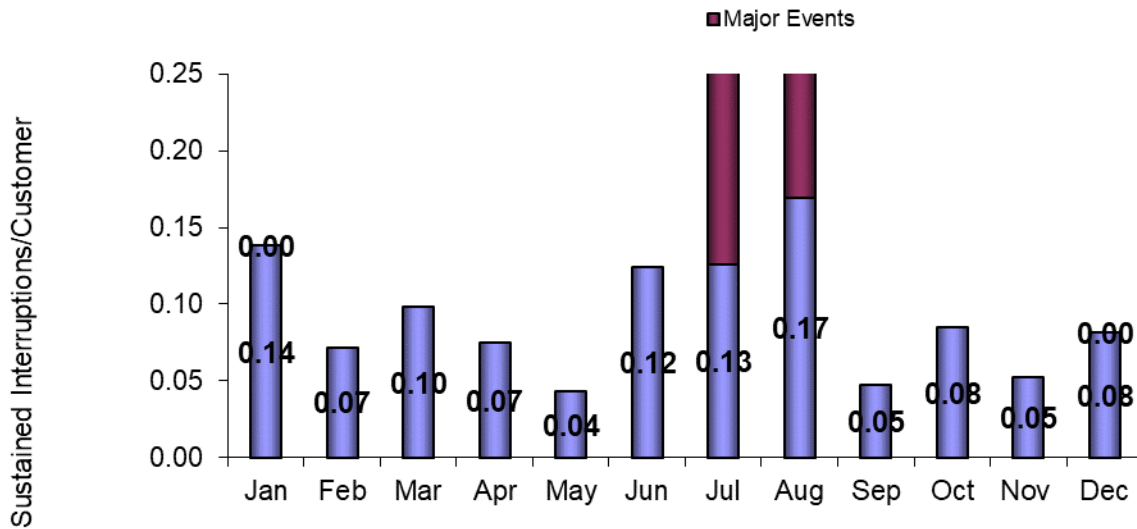
**Chart 5.1 - Avista Service Territory - CEMI<sub>n</sub>**



### Monthly Indices

Avista may choose from time to time to present reliability statistics on its system by month in order to show the monthly variation in system results for the year. An example of the charts that may be included is provided below.

**Chart – SAIFI – Sustained Interruptions / Customer by Month**



### Sustained Interruption Causes

This section will provide further explanation and detail on the causes, or “reasons,” of sustained interruptions on our system for the year. The following table is an example that shows outage causes by Operations Area.

**Table - % SAIFI per Cause by Office**

Reason	CDC	COC	DAC	GRC	KEC	LCC	OTC	PAC	SAC	SPC	DPC	All
ANIMAL	12.0%	5.0%	3.1%	8.4%	2.5%	3.2%	1.5%	6.3%	1.4%	6.2%	0.7%	5.4%
MISC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
POLE FIRE	1.8%	7.6%	0.5%	10.4%	0.1%	10.1%	8.4%	4.4%	0.2%	10.7%	40.6%	8.1%
WEATHER	14.1%	24.4%	47.8%	13.7%	35.0%	11.0%	13.4%	9.9%	20.0%	16.5%	13.7%	19.9%
UNKNOWN	17.1%	4.8%	9.1%	3.4%	21.6%	1.2%	8.5%	12.1%	11.4%	10.6%	0.4%	10.3%
TREE	11.2%	10.8%	4.1%	7.6%	14.3%	6.9%	0.5%	16.5%	36.7%	3.2%	1.9%	9.4%
PUBLIC	20.2%	8.2%	2.7%	9.9%	5.9%	11.2%	1.4%	20.7%	6.7%	4.1%	15.5%	10.0%
COMPANY	2.3%	0.0%	4.7%	0.0%	0.2%	17.7%	4.5%	4.0%	0.0%	8.4%	0.0%	4.0%
EQUIP OH	5.0%	24.9%	24.5%	11.2%	16.2%	10.4%	49.7%	10.6%	18.6%	27.3%	21.5%	19.8%
EQUIP UG	0.1%	0.2%	0.1%	0.8%	0.4%	11.8%	0.0%	1.6%	0.4%	2.5%	4.4%	1.7%
EQUIPSUB	8.0%	0.0%	0.0%	0.0%	0.0%	11.9%	0.0%	6.5%	0.1%	0.0%	0.0%	2.3%
PLANNED	8.2%	14.1%	3.5%	34.6%	3.8%	4.7%	12.1%	7.4%	4.6%	10.6%	1.3%	9.0%

### Interruption Subreasons

Information may be provided from time to time on the various “subreasons” that are included under the main reason categories. This information provides a more-granular understanding of outage sources, which can be useful in some instances for understanding patterns in reliability performance. Further, the Company uses cause information to analyze past outages and, if possible, reduce the frequency and duration of future



outages. Subreasons information may be provided in a table similar to the following example for the animal reason.

<b>Reason</b>	<b>Proposed (Changes Only)</b>	<b>Subreason</b>	<b>Proposed (Changes Only)</b>	<b>Definition</b>
ANIMAL		Bird Squirrel Underground		Outages caused by animal contacts. Specific animal called out in sub category.

## Momentary Interruption Causes

The cause for many momentary interruptions is unknown because faults are often temporary and the cause is often undetectable even after the line is patrolled. As a result, very few momentary outages are investigated to the point of a physical patrol of the line.<sup>1</sup> Momentary outages are recorded using our SCADA system (System Control and Data Acquisition). On average, about 88% of Avista’s customers are served from SCADA controlled stations. The following table is an example of the information that may be included in this section from time to time, as shown by Operations Area, or as summarized by Urban, Suburban and Rural feeders.

**Table - % MAIFI per Cause by Office**

Reason	COC	DAC	DPC	LCC - WA	OTC	PAC - WA	SPC	All Offices
ANIMAL	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
COMPANY	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EQUIPMENT	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%	0.0%
PUBLIC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%
TREE	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
UNDETERMINED	0.0%	47.8%	28.6%	16.2%	57.9%	43.4%	22.0%	35.6%
WEATHER	0.0%	37.2%	48.4%	0.2%	27.8%	37.7%	53.2%	25.8%
EQUIPMENT OH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	25.8%
EQUIPMENT UG	0.0%	0.0%	0.0%	0.0%	2.7%	0.0%	0.0%	0.0%
PLANNED	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
UNKNOWN	100.0%	14.8%	15.6%	83.7%	11.5%	15.3%	18.0%	12.9%
FORCED	0.0%	0.0%	7.4%	0.0%	0.0%	3.6%	2.7%	0.0%

## Areas of Concern

The Areas of Concern section will include a discussion of the area or areas in our system where our customers experience the greatest preponderance of reliability issues for the year. The discussion will include predominant reasons for the observed reliability performance, what measures can be reasonably and cost-effectively taken, along with work plans intended to improve the reliability in these areas of greatest concern.

<sup>1</sup> Many of Avista’s rural feeders require over 40 of patrol time for a two-person field crew to inspect the entire feeder.  
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## **Other Reliability Measures and Targets**

In this section of the report the Company may discuss from time to time various reliability measures and targets being considered that over time could become part of Avista's overall reliability strategy. Along with these measures and targets the Company may also discuss the relevance and importance of these measures as well as work that is planned to better achieve them in the long term. In conjunction with these reports Avista may also discuss the relevance and impact that other programs are having on our customers' service reliability (e.g. Wildfire Resiliency program).

## **Appendix A - Definitions**

*"Baseline reliability statistic"* – Avista will compare its reliability statistics to the year 2005.

*"Commission Complaint"* – When a customer is not satisfied with the Company as it relates to Electric Reliability and files a complaint directly with the Commission.

*"Customer Complaint"* - When a customer is not satisfied with the Company as it relates to Electric Reliability and makes a complaint directly to a Company representative.

*"Electric Service Reliability"* - The continuity of electric service experienced by retail customers.

*"Full-system"* - All equipment and lines necessary to serve retail customers whether for the purpose of generation, transmission, distribution or individual service.

*"Interruption Cause Code"* – Used to describe the cause of an interruption (i.e., animal, tree, public, etc...).

*"Major Event"* – Designates an event that exceeds reasonable design and or operation limits of the electric power system. A Major Event includes at least one Major Event Day (MED).

*"Major Event Day"* – A day in which the daily system SAIDI exceeds a threshold value,  $T_{MED}$ . For the purposes of calculating daily system SAIDI, any interruption that spans multiple calendar days is accrued to the day on which the interruption began. Statistically, days having a daily system SAIDI greater than  $T_{MED}$  are days on which the energy delivery system experienced stresses beyond that normally expected (such as severe weather). Activities that occur on major event days should be separately analyzed and reported.

*"Momentary Event Interruption"* – An interruption(s) of duration 5 minutes or less. Each event consists of one trip and one reclose operation that occur within 5 minutes. For example, if an interrupting device operates three times and then holds, this would be counted as three events with the number of customers affected as three times the  $N_i$ .

*"Power Quality"* – Characteristics of electricity, primarily voltage and frequency, that must meet certain specifications for safe, adequate and efficient operations.

*"Reliability Statistic"* – Standard Statistics measures and calculation methods are per the IEEE Standard 1366-2003 (or latest version) Titled "IEEE Guide for Electric Power Distribution Reliability Indices". Same as Reliability Indices.

*"Reliability Target"* - A statistical method was developed in 2004 for baseline statistics. The method is defined as the average over a specific timeframe and 2 times the standard deviation. For 95% of the time, the Reliability Statistic should be below the target.

*"Sustained Interruption"* - An interruption lasting longer than 5 minutes.

## Appendix B – IEEE Reliability Index Calculations

### SAIFI – System Average Interruption Frequency Index

- The average number of sustained interruptions per customer
- = 
$$\frac{\text{The number of customers which had *sustained interruptions*}}{\text{Total number of customers served}}$$
- = 
$$\frac{\sum N_i}{N_T}$$

### MAIFI<sub>E</sub> – Momentary Average Interruption Event Frequency Index

- The average number of momentary interruption events per customer
- = 
$$\frac{\text{The number of customers which had *momentary interruption events*}}{\text{Total number of customers served}}$$
- = 
$$\frac{\sum ID_E N_i}{N_T}$$
- MAIFI can be calculated by one of two methods. Using the number of momentary interruptions or the number momentary events. This report calculates MAIFI<sub>E</sub> using momentary events. The event includes all momentary interruptions occurring within 5 minutes of the first interruption. For example, when an automatic interrupting device opens and then recloses two, or three times before it remains closed, it is considered a single event.

### SAIDI – System Average Interruption Duration Index

- Average sustained outage time per customer
- = 
$$\frac{\text{Outage duration multiplied by the customers effected for all *sustained interruptions*}}{\text{Total number of customers served}}$$
- = 
$$\frac{\sum r_i N_i}{N_T}$$

### CAIDI – Customer Average Interruption Duration Index

- Average restoration time
- = 
$$\frac{\text{Outage duration multiplied by the customers effected for all *sustained interruptions*}}{\text{The number of customers which had *sustained interruptions*}}$$
- = 
$$\frac{\sum r_i N_i}{\sum N_i}$$

### Quantities

$i$  = An interruption event;

$r_i$  = Restoration time for each interruption event;

$T$  = Total;

$ID_E$  = Number of interrupting device events;

$N_i$  = Number of interrupted customers for each interruption event during the reporting period;

$N_T$  = Total number of customers served for the area being indexed;

**CEMI<sub>n</sub> – Customers Experiencing Multiple Sustained Interruptions more than n.**

- CEMI<sub>n</sub>
- =  $\frac{\text{Total Number of Customers that experience more than } n \text{ sustained interruptions}}{\text{Total Number of Customers Served}}$
- =  $\frac{CN_{(k>n)}}{N_T}$

**CEMSMI<sub>n</sub> – Customers experiencing multiple sustained interruption and momentary interruption events.**

- CEMSMIn
- =  $\frac{\text{Total Number of Customers experiencing more than } n \text{ interruptions}}{\text{Total Number of Customers Served}}$
- =  $\frac{CNT_{(k>n)}}{N_T}$

**MED - Major Event Day**

A major event day is a day in which the daily system SAIDI exceeds a threshold value. Its purpose is to allow major events to be studied separately from daily operation, and in the process, to better reveal trends in daily operation that would be hidden by the large statistical effect of major events.

T<sub>MED</sub> is calculated (taken from the IEEE 1366-2003 Standard)

The major event day identification threshold value, T<sub>MED</sub>, is calculated at the end of each reporting period (typically one year) for use during the next reporting period as follows:

- Collect values of daily SAIDI for five sequential years ending on the last day of the last complete reporting period. If fewer than five years of historical data are available, use all available historical data until five years of historical data are available.
- Only those days that have a SAIDI/Day value will be used to calculate the T<sub>MED</sub> (do not include days that did not have any interruptions).
- Take the natural logarithm (ln) of each daily SAIDI value in the data set.
- Find a(Alpha), the average of the logarithms (also known as the log-average) of the data set.
- Find b(Beta), the standard deviation of the logarithms (also known as the log-standard deviation) of the data set.
- Compute the major event day threshold, TMED, using equation (25).

$$T_{MED} = e^{a + 2.5 b} \quad (25)$$

- Any day with daily SAIDI greater than the threshold value TMED that occurs during the subsequent reporting period is classified as a major event day. Activities that occur on days classified as major event days should be separately analyzed and reported.

When an event has reached the threshold to constitute a MED described in subpart (f) above, all outage incidents associated with the MED will be flagged in the Company's Outage Management Tool. As the Company further assesses damage in the field while making repairs, new subsequent outage incidents that were a result of the MED may be created as more accurate information is made available. The subsequent incidents will be flagged and included as part of original outage event and MED.

## **Appendix C - Customer Reliability Complaints**

### **Commission Complaints**

Commission Complaints are complaints received by the Washington Utilities and Transportation Commission specifically related to the Company's SQM Program, power quality, electric reliability, or Major Events.

<b>Customer / Feeder</b>	<b>Complaint</b>	<b>Complaint Category</b>	<b>Resolution</b>

### **Customer Complaints**

Customer Complaints are complaints received by the Company specifically related to the Company's SQM Program, power quality, electric reliability, or Major Events.

<b>Office /State /Feeder</b>	<b>Complaint</b>	<b>Complaint Category</b>	<b>Resolution</b>

## Appendix D – SAIFI and SAIDI Historical Summary

Avista’s SAIFI Performance by Measurement by Year, as provided in the example, below.

Year	Calendar Year	Annual IEEE SAIFI Excluding Daily Results over TMED	Annual Total SAIFI Results: All Minutes w/o Exclusion	Annual Total SAIFI Results Excluding 2006	Total SAIFI 5-Year Rolling Annual Average Excluding 2006	
1	2004	1.01	1.13	1.13	1.13	
2	2005	0.97	1.17	1.17	1.15	Baseline
3	2006	1.29	1.91			
4	2007	1.14	1.40	1.40	1.23	
5	2008	1.40	1.60	1.60	1.33	
6	2009	1.52	1.52	1.52	1.36	
7	2010	1.23	1.49	1.49	1.44	
8	2011	1.08	1.08	1.08	1.42	
9	2012	1.14	1.25	1.25	1.39	
10	2013	1.05	1.21	1.21	1.31	
11	2014	1.11	1.56	1.56	1.32	
		1.17				Target

Avista's SAIDI Performance by Measurement by Year, as provided in the example, below.

Year	Calendar Year	Annual IEEE SAIDI Excluding Daily Results over T <sub>MED</sub>	Annual Total SAIDI Results: All Minutes w/o Exclusion	Annual Total SAIDI Results Excluding 2006	Total SAIDI 5-Year Rolling Annual Average Excluding 2006	
1	2004	126	172	172	172	
2	2005	108	176	176	174	Baseline
3	2006	143	374			
4	2007	132	209	209	186	
5	2008	159	227	227	196	
6	2009	193	193	193	195	
7	2010	146	236	236	208	
8	2011	118	118	118	197	
9	2012	138	163	163	187	
10	2013	138	199	199	182	
11	2014	139	437	437	231	
		144				Target