ROCKY MOUNTAIN POWER
A DIVISION OF PACIFICORP

1407 W. North Temple
Salt Lake City, Utah 84116

February 14, 2023

VIA ELECTRONIC FILING

Public Service Commission of Utah
Heber M. Wells Building, 4th Floor
160 East 300 South
Salt Lake City, UT 84114

Attn: Gary Widerburg
Commission Administrator

Re: **Docket 23-035-05 – Rocky Mountain Power's Power Quality Report for 2022**

PacifiCorp d/b/a Rocky Mountain Power ("the Company") hereby submits for filing its Power Quality Report ("PQ Report") to the Public Service Commission of Utah ("Commission"). The report attached herein contains power quality data in the template that was approved in correspondence from the Commission dated November 1, 2022 in Docket No. 22-035-34. The reporting period is January through December 2022.

Questions may be directed to Jana Saba at (801) 220-2823.

Very truly yours,

Joelle Steward
Senior Vice President, Regulation and Customer & Community Solutions

cc: Service List: Docket No. 22-035-34

Rocky Mountain Power

2022 Utah Power Quality Report

Voltage Sag Analysis for Utah's Transmission System

PacifiCorp Power Quality Engineering
1-31-2023

Contents

Glossary

CE – Product marking indicating Conformité Européenne, conforming to European Union standards for health and safety of electrical components.

Company – Represents the entity PacifiCorp d.b.a Rocky Mountain Power

IEC – International Electrotechnical Commission

IEEE – Institute of Electrical and Electronics Engineers

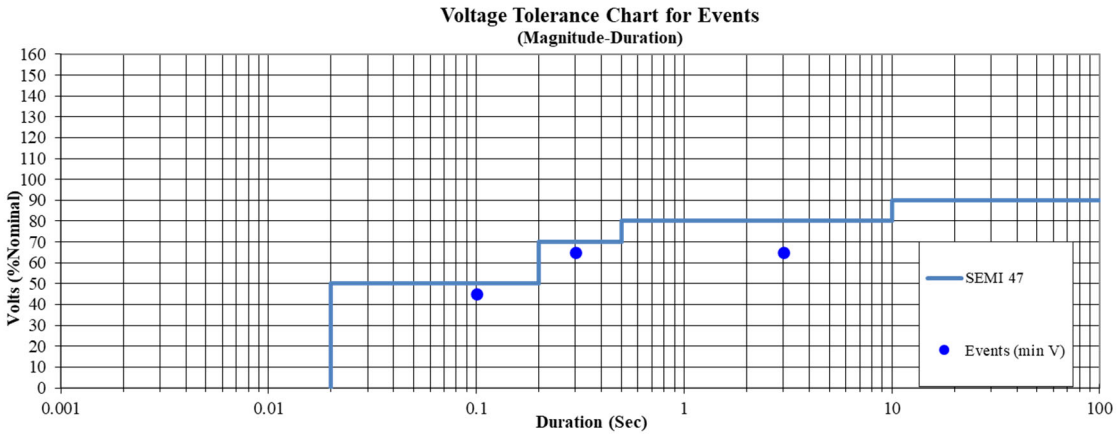
ITE – Information technology equipment

kV – kilovolt

Monitor – Device with a primary purpose to measure system values at an increased sampling rate to determine utility and customer compliance with Company power quality standards

Meter – Device with a primary purpose of recording energy use by a customer with ancillary power quality monitoring capabilities.

SEMI-F47 Curve – A voltage sag ride-through curve developed by the semiconductor manufacturing industry to ensure that control and manufacturing equipment would not require operator intervention in the event of a voltage sag. Implementation of the ride-through curve requirements to applicable control equipment ensures that equipment drop-off is not a result of control terminal sensitivity but determined by the equipment's operational limitations and safety requirements of the attached load.



UL – Underwriters Laboratories certification of safety for electrical equipment

Voltage sag – A short duration reduction in voltage. The severity of a voltage sag is defined by how deep the voltage is reduced as a percentage of its normal operating value, and the duration of the voltage reduction. Voltage sags are typically caused by short-circuit or fault conditions on the electric power system.

VFD – Variable Frequency Drive

Power Quality Introduction

Report Scope

This report identifies the quantity and sources of voltage disturbances, primarily voltage sags, observed at 46-345 kV Company substations. This report includes data collected during 2022. Subsequent reports will be provided on an annual basis and include the prior year's data. The report utilizes existing power quality monitors located within transmission substations in various locations throughout Utah. Any future deployment of power quality monitoring devices will be incorporated into this report going forward.

Customer Ride-Through Capability

Customers are encouraged to be able to ride through less severe voltage sags. The Company recommends customers utilize the SEMI-F47 curve as a guideline to determine the voltage sag ride-through parameters of their equipment. Events below the SEMI-F47 curve will likely cause customers' equipment to shut off, whereas customers are encouraged to ride through events occurring above the curve. Voltage sag events occurring below the SEMI-F47 curve during the data collection period are identified in this report.

The Company has found that the items in the bullet list below are common methods customers have utilized to mitigate the impact of voltage sags. These identified methods are examples of actions taken by customers, however a detailed analysis of a customer's systems and processes is typically required to enable voltage sag resilience.

- **UL & CE Listed –** Equipment with both markings are tested to IEC power quality standards and have improved ride-through capabilities
- **Update Ice Cube Relays –** Update from electromechanical styled relays to solid state
- **Ferroresonant Transformer –** Low voltage transformers that can maintain voltage during sags
- **Static Transfer Switch –** Provides and unaffected source in the event of an outage
- **VFD Settings –** Configuration of the VFD controllers can expand the allowable operation window

Power Quality Monitor Locations

Monitoring locations selected for this report are located at Company transmission substations. Monitor data availability at each location is not guaranteed as power quality monitors may have communication issues, hardware/software reset needs and monitor failure.

The meter types used by the Company on its transmission system are Electro Industries' Nexus 1252 and Nexus 1500.

Table 1 Power Quality monitoring locations on the Company transmission network

PQView Name	Substation	Circuit	Area	kV
118th XFMR 1 [NXS_138_SUB]	118th South	Bank 1	Jordan Valley	138.00
Ben Lomond CB107 [NXS_138_SUB]	Ben Lomond	CB107	Ogden	138.00
Blundell Unit 1 [ION_46_SUB]	Blundell	CB 21	Milford	46.00
Brigham City [ION_138_SUB]			Brigham City	138.00
Camp Williams SVC [NXS_345_SUB]	Camp Williams	SVC	Jordan Valley	345.00
Enterprise Valley [ION_138_SUB]	Enterprise Valley	7D36	Enterprise	138.00
Homestead Knoll [NXS_138_REV]	Homestead Knoll	7C3	SLC Metro	138.00
Horseshoe CB133 [NXS_138_SUB]	Horseshoe	CB133	Tooele	138.00
Lakeside Unit 1 [ION_138_SUB]	Dynamo	XFMR 1	Provo	138.00
Lakeside Unit 2 [ION_138_SUB]	Dynamo	XFMR 2	Provo	138.00
Lakeside Unit 3 [ION_138_SUB]	Dynamo	XFMR 3	Provo	138.00
McCracken Station [ION_69_SUB]	McCracken	Abajo CB64	Moab	69.00
Mountain View CB112 [NXS_138_SUB]	Mountain View	CB112	Jordan Valley	138.00
Navajo Utility [ION_138_SUB]	Bluff	CB61	Bluff	138.00
Old Field [ION_46_SUB]	Old Field		Holden	46.00
Oquirrh CB143 [NXS_138_SUB]	Oquirrh	CB143	Jordan Valley	138.00
Purgatory [ION_138_SUB]	Purgatory Flat	XFMR 2	Hurricane	138.00
Red Butte-St George [ION_138_REV]	Red Butte	CB 162	St George	138.00
Resolute Natural [ION_138_SUB]	Bluff	CB61	Bluff	138.00
Riverdale CB133 [NXS_138_SUB]	Riverdale	CB133	Ogden	138.00
Skunk Ridge CB41 [NXS_46_SUB]	Skunk Ridge	CB41	Tooele	46.00
Spanish Fork Wind [ION_46_SUB]	Spanish Fork Wind	Bus	Spanish Fork Canyon	46.00
Terminal CB101 [NXS_138_SUB]	Terminal	CB101	SLC Metro	138.00
Upalco-Pariette [ION_69_REV]	Upalco	CB 6962	Vernal	69.00
Wasatch Springs CB51 [NXS_46_SUB]	Wasatch Springs	CB51	SLC Metro	46.00
Wheelon CB112 [NXS_138_SUB]	Wheelon	CB112	Tremonton	138.00

The power quality monitors on the transmission network are plotted in Figure 1:

- 34.5 kV < Green Marker < 69 kV
- 69 kV <= Blue Marker < 138 kV
- 138 kV <= Yellow Marker < 345 kV
- 345 kV <= Red Marker < 750 kV

Figure 1 Power quality monitor locations for the state of Utah.

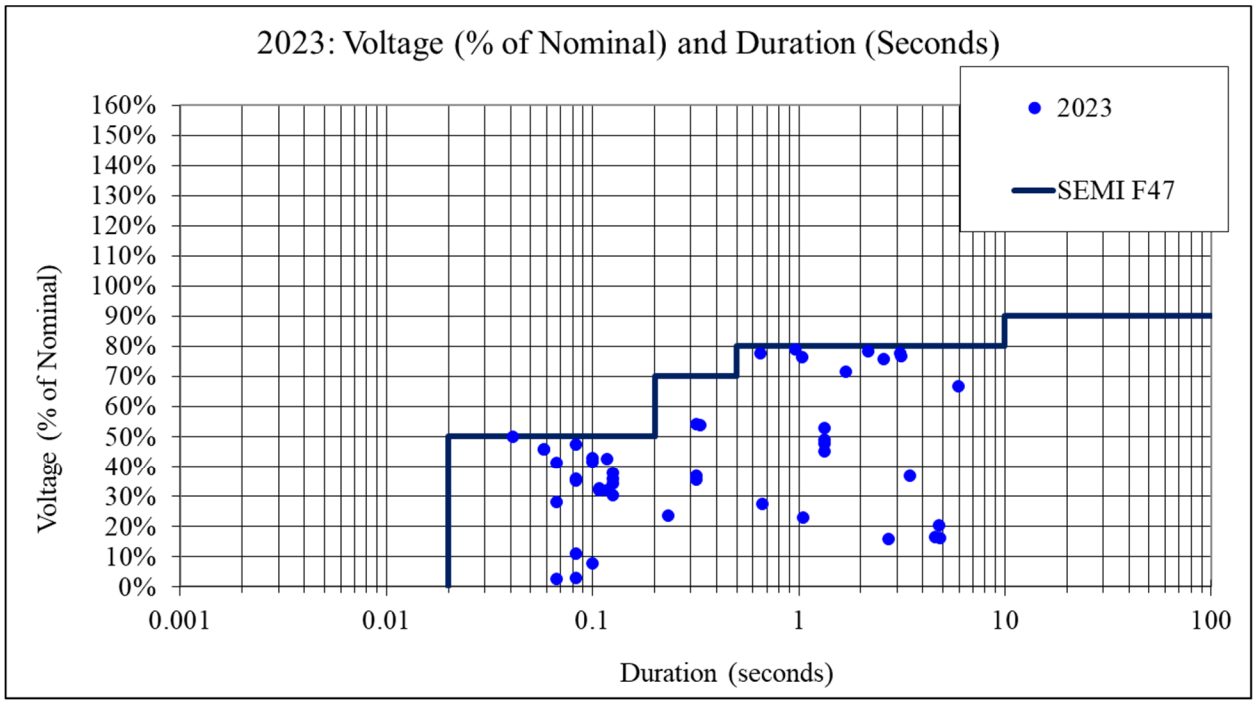
Voltage Sag Event Summary

The results of voltage monitoring during 2022 are included in this section. Each monitor samples the voltage on a regular basis. In addition, monitors capture system events where the voltage deviates outside of 90 to 110 percent of its normal operating voltage.

Table 2 lists each monitor location, its voltage class and the number of voltage sag events that took place at that monitor location and were below the SEMI-F47 curve. Figure 2 scales the number of events that occurred at each location for a geographic representation of where voltage sag events are taking place.

Voltage levels reported from Company monitors may vary from customer monitoring systems due to variables that include the distance of the fault from the customers' monitors as compared to the distance to the Company's monitors.

It should be noted, a fault condition can trigger a voltage sag event at more than one meter location and is indicated in the Meters Impacted column of Table 3. The Meter Event Grand Total in Table 2 represents the number of sag events as measured by all available meters and the Event Cause Grand Total (Table 2) represents the consolidated events represented in Table 3.

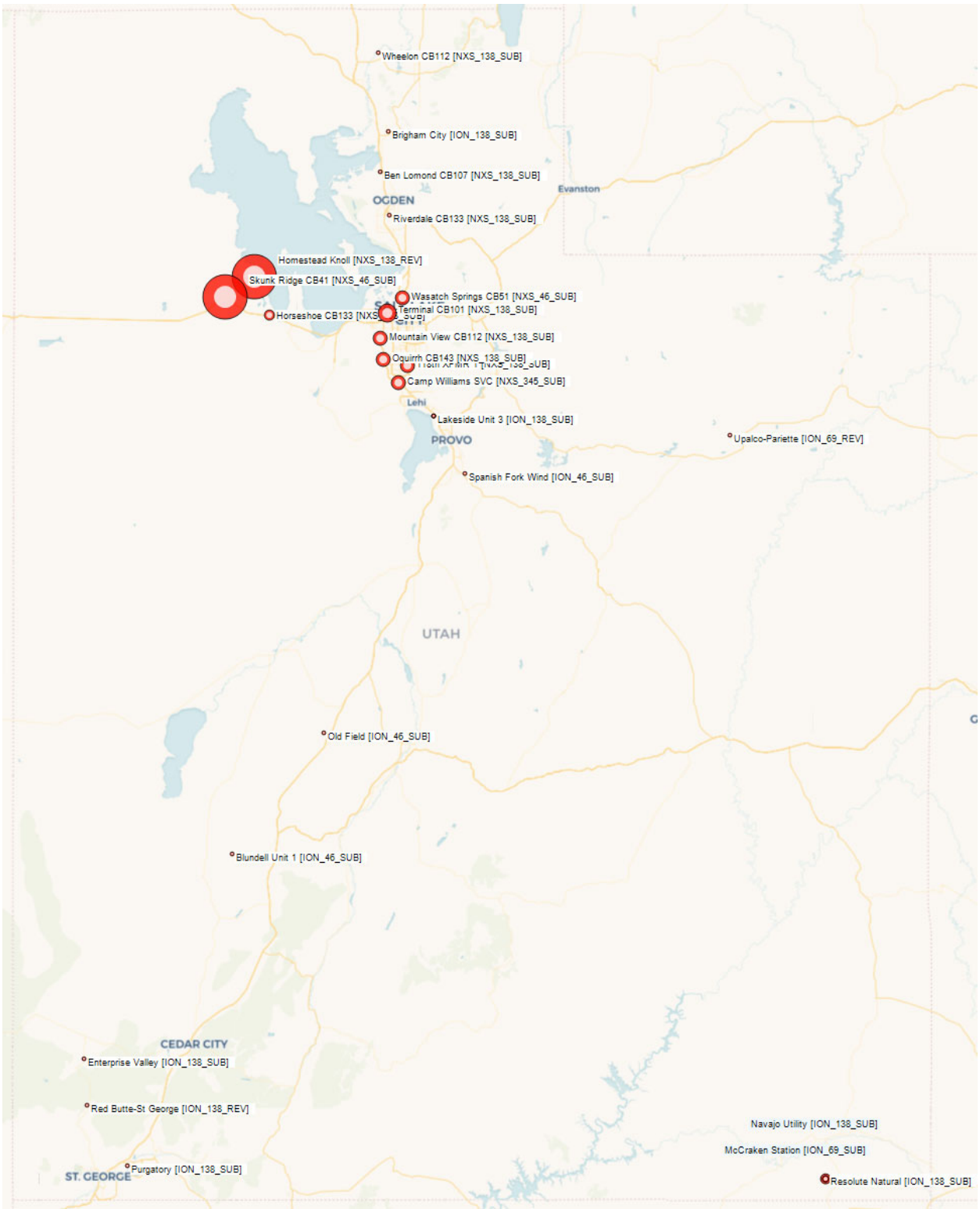


Voltage Sag Event Site Index

Table 2 Quantity of Voltage Sag Events Below the SEMI-F47 Line

Meter Location	Event Below the SEMI-F47 Curve
118th South	3
Camp Williams	3
Homestead Knoll	11
Horseshoe	2
McCracken	2
Mountain View	3
Navajo Utility	1
Oquirrh	3
Resolute Natural	1
Skunk Ridge	11
Terminal	4
Wasatch Springs	3
Meter Event Grand Total	49
Event Cause Grand Total	37

Voltage Sag Event Site Map



Voltage Sag Event Categorization

Power quality events captured by the Company are typically associated with faults (short circuit) in the transmission network. Tracking events to identify patterns in system issues can provide preventative maintenance and system improvement recommendations. If a Company system fault occurred at the time of a recorded event, it is assigned a category and short description in Table 3.

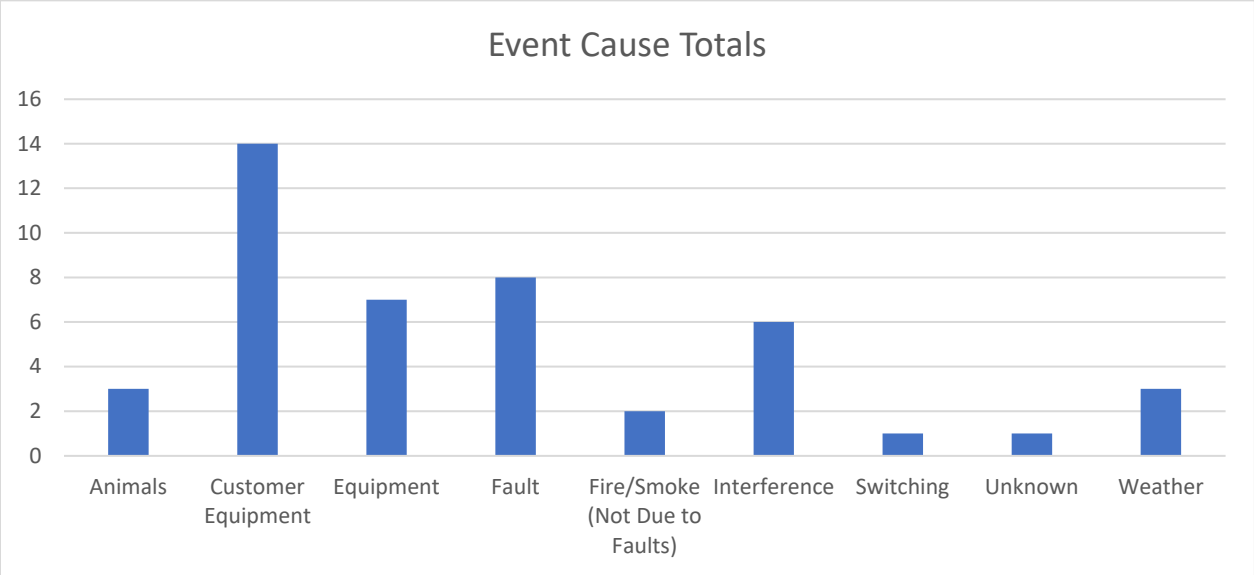
Several events were recorded by the monitors but did not have a corresponding Company system fault. Those items are categorized as "Other" in the table below and their origins are unknown.

Table 3 Voltage Sag Event Information

Operation Time	Meters Impacted	Location	Event kV	Cause Code	Equipment Impacted	Investigation Notes
1/3/22 5:17 PM	Terminal	Camp Williams-Mona #1	345	Weather	Unknown	1023-2022; L-G fault 10.26 miles from Mona
1/3/22 5:20 PM	Terminal	Camp Williams-Mona #1	345	Weather	Unknown	1023-2022; L-G fault 10.26 miles from Mona
1/10/22 5:32 PM	118th South	118th South	138	Fault	Unknown	1100-2022; L-G fault
1/19/22 12:20 AM	Homestead Knoll	Homestead Knoll	138	Customer Equipment		Failed equipment start
1/21/22 3:18 AM	Skunk Ridge	Homestead Knoll	138	Customer Equipment	Insulator	11502022; Insulator tracking on customer secondary
2/6/22 9:52 AM	Terminal, Oquirrh	Oquirrh-Tooele	138	Interference	Static Line	1220-2022; Private plane contacted static line
2/6/22 10:13 AM	Terminal, Oquirrh	Oquirrh-Tooele	138	Interference	Static Line	1220-2022; Private plane contacted static line
2/16/22 3:55 AM	Camp Williams	Ben Lomond-Terminal #1	345	Fault	Insulator	1272-2022; Trip & reclose 3.88 miles from Terminal.
2/16/22 9:36 AM	Homestead Knoll, Skunk Ridge	Homestead Knoll	138	Customer Equipment	Reactor	Harmonic filter failure caused prolonged voltage disturbance
3/6/22 7:56 AM	Camp Williams	Ben Lomond - Terminal #2	345	Fault	Unknown	14142022; Trip & reclose
3/18/22 6:54 AM	Homestead Knoll	Homestead Knoll-Rowley	138	Animals	Insulator	1501-2022; Bird contamination structure 288
3/23/22 10:33 AM	Homestead Knoll	Homestead Knoll	138	Customer Equipment		Equipment startup
3/24/22 9:38 AM	Homestead Knoll	Homestead Knoll	138	Customer Equipment		Equipment startup
3/31/22 8:26 AM	Skunk Ridge	Skunk Ridge CB41	46	Animals	Cross Arm	1586-2022; Bird nest found on structure 173
4/15/22 3:40 AM	Camp Williams	Camp Williams	345	Switching	Breaker	Load in-rush, no fault operation
4/17/22 8:28 AM	Homestead Knoll	Homestead Knoll-Rowley	138	Animals	Insulator	1745-2022; Avian activity suspected. Insulators replaced prior.

4/17/22 9:15 AM	Homestead Knoll	Homestead Knoll	138	Customer Equipment		Equipment startup
4/25/22 10:53 PM	Homestead Knoll	Homestead Knoll CB 7C3	138	Equipment	Insulator	1865-2022; Flashed insulator on structure 285
5/4/22 8:01 AM	Skunk Ridge	Horseshoe-Lakeside-Skunk Ridge	46	Fault	Trip & Reclose	1944-2022; Trip and reclose
6/2/22 2:30 AM	Homestead Knoll, Skunk Ridge	Homestead Knoll CB 7C3	138	Customer Equipment	Transformer	Fault on secondary of customer transformer cleared by customer protection
6/6/22 8:55 PM	Mountain View	Mountain View-Oquirrh	138	Fault	Insulator	2207-2022; Flash marks on structure 91
6/17/22 4:51 PM	Homestead Knoll	Horseshoe-Terminal	138	Fire/Smoke (Not Due to Faults)		2346-2022; Fire in vicinity caused trip and reclose disabled.
6/17/22 4:57 PM	Homestead Knoll	Horseshoe-Terminal	138	Fire/Smoke (Not Due to Faults)		2346-2022; Fire in vicinity caused trip and reclose disabled.
6/20/22 10:09 AM	Skunk Ridge	Skunk Ridge CB41	46	Customer Equipment	Reactor	Customer capacitor failure due to harmonic bursts originating from a transmission customer. Harmonic magnitudes have been addressed and have ongoing monitoring.
7/28/22 9:56 AM	Wasatch Springs	Gadsby-Wasatch Springs	46	Equipment	Recloser	2831-2022; Relay mis operation due to damaged communication cable.
8/2/22 1:45 AM	Skunk Ridge	Horseshoe-Lakeside-Skunkridge	46	Fault	Trip & Reclose	2919-2022; Variable frequency drive failed due to harmonic content. Harmonic magnitudes have been reduced and are monitored
8/2/22 2:19 AM	Skunk Ridge	Horseshoe-Lakeside-Skunkridge	46	Fault	Trip & Reclose	2919-2022; Weather suspected but unable to confirm
9/14/22 7:27 PM	Skunk Ridge	Skunk Ridge CB41	46	Weather	Unknown	2922-2022; Vaisala data indicates lightning strikes along CB 41
9/24/22 4:23 AM	Mountain View	Mountain View-Oquirrh	138	Interference	Structure	3420-2022; Mylar balloons found
9/29/22 4:23 AM	Wasatch Springs	Wasatch CB 51	46	Fault	Trip & Reclose	3448-2022; A-ground fault with Chevron CB 51 operating on zone 2
11/6/22 10:29 PM	Mountain View, 118th South, Oquirrh	90th South	345	Equipment	Transformer	3744-2022; Bank #4 center bushing failure
11/7/22 6:02 AM	Wasatch Springs	Fifth West	138	Interference	Lightning Arrester	3755-2022; Mylar balloons recovered

						from lightning arrester
11/7/22 6:10 AM	118th South	90th South	138	Equipment	Jumper	3895-2022; Jumper failure from CB L107 with West bus differential locked out bus.
11/29/22 5:34 PM	McCracken	Other Municipality	69	Unknown	Unknown	Transmission interconnect of another municipality. Event cleared by other municipality equipment.
12/2/22 11:30 AM	Horseshoe, Skunk Ridge	Homestead Knoll CB 7C3	138	Customer Equipment	Insulator	3952-2022; Line to ground fault on secondary.
12/2/22 11:38 AM	Horseshoe, Skunk Ridge	Homestead Knoll CB 7C3	138	Customer Equipment	Insulator	3952-2022; Requested second attempt to restore power.
12/7/22 9:32 AM	Resolute Natural, McCracken, Navajo Utility	Four Corners-Pinto	345	Equipment	Switch	3960-2022; Fault on switch 392A



CERTIFICATE OF SERVICE

Docket No. 22-035-34

I hereby certify that on February 14, 2023, a true and correct copy of the foregoing was served by electronic mail to the following:

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