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# **Outage Data File Format for the ISO** **Availability Performance Monitoring System**

Summary Outage Data and Detailed Outage Data

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## **2.1 Purpose**

This procedure details the formats utilized to compile outage data related to Availability Measures and ensures that the data files are compatible with the statistical package, Minitab.

## **2.2 Scope**

The Summary and Detail Outage data file formats described herein were developed by the ISO and PTOs to be used by all PTOs subject to the ISO Transmission Maintenance Standards. The data contained in Table 1 summarizes the raw (or detailed) data contained in Table 2.

## **2.3 Summary Outage Data File Format (See Table 1)**

**2.3.1.** The data for each voltage class may be confined to a separate data file or combined to a single file for smaller data sets. The voltage class, if applicable, and PTO will be incorporated into the file name. The file name will identify, in order: the PTO, the voltage class and the year (e.g. PGAE\_Summary\_115\_2013.xls or SCE\_Summary\_2013.xls).

**2.3.2.** Data files will be Microsoft Excel 97-2003 Worksheet files (\*.xls).

**2.3.3.** Each data file will contain six (6) columns in the following order and title (including spaces and appropriate lower/upper case): Transmission Owner, Transmission Line ID, Volt Class, Year, Annual Outage Frequency, and Annual Outage Duration.

**Note:** Except for anomalies, handled by the PTO and the ISO, each Transmission Line Circuit (Transmission Line ID) will be identified with a unique name that matches the name used in the ISO Transmission Register (Register). Individual Transmission Line Circuit names will be consistent throughout the calendar years for which outage data is provided (i.e. if the Register has “#1” then it should remain as such and not take on another alias like “1”). Whenever a Transmission Line Circuit reconfiguration occurs refer to TCA Article 4.1.1(Note 2) of Appendix C for calculation of any

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affected Transmission Line Circuit’s in service time and allocation of outage frequency and duration.

**2.3.4.** Individual text records may be up to thirty-one (31) alphanumeric characters including underscores ( \_ ) but will contain no spaces. Because of this limit, the ISO or PTO’s may use Transmission Line Circuit numbers. If used the PTO must supply a cross-reference table for the actual Transmission Line Circuit names.

**2.3.5.** Each row in the file will correspond to data for one Transmission Line Circuit for a single calendar year, hereafter referred to as a ‘Transmission Line Circuit-year.’

**2.3.6.** For the valid Summary Outage set of data submitted by an incoming PTO for years prior to becoming a PTO, such data for each Transmission Line Circuit is restricted to a maximum of the most recent eleven (11) calendar year period or to the calendar years within this period that the Transmission Line Circuit is in operation. For example, a Transmission Line Circuit that is in operation for eight (8) calendar years will have eight (8) Transmission Line Circuit-years and eight (8) rows of data.

The valid Summary Outage set of data provided by the PTO for years prior to becoming a PTO will establish the initial Control Chart limits. All calendar years of valid Summary Outage data captured by the ISO and PTO after becoming a PTO that is compliant with the testing criteria described in Section 4.2.3 of Appendix C of the TCA will be added to the first set of valid Summary Outage data reconciled by the ISO and PTO to recalculate the Control Chart limits annually. This will be done until a minimum of ten calendar years of valid Summary Outage data has been captured by the ISO and PTO after becoming a PTO. For those first ten years where valid Control Chart annual data points are captured after a PTO becomes a PTO, only those annual points will be used to compare against Control Chart limits in determining triggered tests.

After the first ten calendar years of valid Summary Outage data has been obtained while a PTO is under ISO Operational Control, begin using only

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that data to calculate the Control Chart limits. Data excluded in this manner will only be the data captured prior to the PTO’s first calendar year under ISO Operational Control. Although after the first ten or more years have passed and excluded data is not used to calculate the Control Chart limits this excluded data still needs to be plotted on the Control Charts to provide trending values for at least the fifteen most current annual points (includes valid annual points obtained before or after the ISO was in Operational Control). The first ten calendar years of valid Summary Outage data obtained by the ISO and PTO for only those years while under ISO Operational Control will be used in its entirety to establish Control Chart limits regardless of whether any of the yearly data within those ten calendar years of valid data triggered any tests. When this stage of using only data obtained by the ISO and PTO while under ISO Operational Control to establish Control Chart limits is reached the first ten Control Chart annual points for those years will not be used to see if tests are triggered for future years. Also, after this stage is reached, all subsequent calendar years of valid Summary Outage data captured and compliant with the testing criteria described in Section 4.2.3 of Appendix C of the TCA will be used to recalculate Control Chart limits.

Valid data is defined as Transmission Line Circuit forced outage data as specified in ISO Procedure 5 (Classifying Forced Outages) which is verified by the ISO and reconciled with the PTO, and does not skew the Control Chart limits.

**2.3.7.** Frequency and duration in minutes for each Transmission Line Circuit-year are the cumulative totals. If a Transmission Line Circuit has no outages for a particular calendar year then the frequency and duration is zero. An outage lasting less than one minute that qualifies as a single forced outage will be rolled up from the detailed data as a one minute duration forced outage before it is summed with other detailed forced outages. For treatment of multiple forced outages within a one minute span see Article 4.1.1 of the ISO Transmission Maintenance Standards. All outages in the Detailed Outage data will be rounded up to nearest full minute before it is

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summed with the other detailed forced outages and rolled up into the Summary Data.

**2.3.8.** No explanatory comments, summary statistics or empty rows in the data file are allowed.

**Table 1**  
**(Summary Data Rolled Up From Table 2)**

Transmission Owner	Transmission Line ID	Volt Class	Year	Annual Outage Frequency	Annual Outage Duration
PTO	#1	115	1987	0	0
PTO	#1	115	1988	0	0
PTO	#1	115	1989	0	0
PTO	#1	115	1990	2	14
PTO	#1	115	1991	1	4230
PTO	#1	115	1992	3	135
PTO	#1	115	1993	0	0
PTO	#1	115	1994	1	55
PTO	#1	115	1995	0	0
PTO	#1	115	1996	1	240
PTO	#1	115	1997	0	0
PTO	#2	115	1990	1	6
PTO	#2	115	1991	2	4450
PTO	#2	115	1992	2	81
PTO	#2	115	1993	0	0
PTO	#2	115	1994	0	0
PTO	#2	115	1995	0	0
PTO	#2	115	1996	0	0
PTO	#2	115	1997	0	0

**2.4 Detailed Outage Data File Format (See Table 2)**

**2.4.1.** The data for each PTO will be confined to a separate data file. The PTO will be incorporated into the file name. The file name will identify the

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PTO first and then designate the time frame the Detailed Outage Data has been collected, (e.g.PGAE\_Detail\_2013.xls.).

**2.4.2.** Data files will be Microsoft Excel 97-2003 Worksheet files (\*.xls).

**2.4.3.** Each data file will contain fourteen (14) columns: Transmission Owner, Transmission Line Circuit (Name or ID number), Voltage Class, Normal Voltage, Outage Class (Forced (F), Forced Excluded (X), Forced Capped (C), and No Outage (N)), Outage Start Date (MM/DD/YYYY), Outage Start Time (HR/MIN), Construction Type (Overhead (0), Underground (1), Combination (2)), Outage Duration (in whole minutes), Outage End Date, Outage End Time, Primary Cause, Secondary Cause, and Comments.

**Note 1:** Except for anomalies, handled by the PTO and the ISO, each Transmission Line Circuit will be identified with a unique name that matches the name used in the ISO Transmission Register (Register). Individual Transmission Line Circuit names shall be consistent throughout the calendar years for which outage data is provided (i.e. if the Register has “#1” then it should remain as such and not take on another alias like “1”). Whenever a Transmission Line Circuit reconfiguration occurs refer to TCA Article 4.1.1(Note 2) of Appendix C for calculation of any affected Transmission Line Circuit’s in-service time and allocation of outage frequency and duration.

**2.4.4.** Column labels and individual text records may be up to thirty-one (31) alphanumeric characters including underscores (\_) but will contain no spaces. Because of this limit, the ISO and PTO’s may use Transmission Line Circuit numbers. If used the PTO shall supply a cross-reference table for the actual Transmission Line Circuit names. These restrictions are unnecessary for the individual text records for the “Comments” column.

**2.4.5.** Each row in the file shall correspond to data for one outage on a single Transmission Line Circuit. Within a calendar year, several rows of data may exist for a single Transmission Line Circuit; however, only one row (zero outage) will exist for a single Transmission Line Circuit not having any

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outages within a calendar year. Existing Transmission Line Circuits not having any outages during the calendar year must have records entered into the detailed outage file as zero to ensure that all data is available to calculate Index 3 (Proportion of Transmission Line Circuits with No Outages).

**2.4.6.** Duration in minutes (in whole minutes) for each outage on a single Transmission Line Circuit shall be shown. There are no cumulative totals. If a Transmission Line Circuit has no outages for a particular calendar year then the duration is zero. A single momentary outage less than one (1) minute in duration and occurring at least one (1) minute before or after another outage will roll up into the Summary Outage Data file as one (1) outage with a one (1) minute duration. All outages recorded in the Detailed Outage data will be rounded up to nearest full minute before it is summed with other detailed forced outages and rolled up into the Summary Data.

**2.4.7.** Empty rows in the data file are not allowed.

**2.4.8.** The ISO will use the Primary and Secondary Cause Codes in Section 2.5 and 2.6 when reconciling Detailed Outage Data with the PTO.



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## 2.5 “Primary Cause” List

The Primary Cause Codes denoted below are the designations used by the ISO to capture initiating causes for outages. The successful collaboration of the ISO and each PTO allows outage analysis findings to focus on the frequency of meaningful initiating events and over time the Availability Measure for frequency may be reduced.

<b><u>PRIMARY CAUSE CODE</u></b>	<b><u>DESCRIPTION</u></b>	<b><u>EXAMPLE</u></b>
AIR	Aircraft	Airplane, helicopter, drone or crop duster in conductor or structures.
ANIM	Animal Contact	Birds, squirrels, rats.
CB	Circuit Breaker Trouble	Compressor, air leak, gas leak, oil leak, low pressure.
CNTM	Contamination	Cement dust, debris, or smoke residue on insulators, flashed insulators due to fog, hot/dead washing.
DIST	System Disturbance	Frequency instability, system low frequency automatic load shedding, line tripped due to RAS, loss of load diversity, open for voltage control, overload.
FIRE	Fire	Fire under lines, fire in communication cabinets, fire adjacent to equipment.
GEN	Generation Trouble	Boiler tube leak, steam leak, kelp removal, gears stripped, low water wall pressure, oil leak.
LATE	Late Notification	Not meeting ISO Protocol as defined in ISO Procedure 5.
LIGT	Lightning	Flashed insulators due to lightning, lightning damaged transmission equipment, CB tripped due to lightning.
LEQP	Line Equipment	Line equipment repair or replacement (structure, wire, insulators, hardware).
MB	Mylar Balloon	Fault resulting from, or the forced outage to remove, a Mylar balloon.

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ND	Natural Disasters	Earthquakes, floods.
OPER	Operation Error	Failure to remove grounds, incorrect Maintenance Procedure, turn wrong switch, untimely synchronization, failure to cut over appropriate relays.
OTHER	Other	Foreign utility faulted, opened for foreign utility work, customer fault, tripped by foreign utility personnel, opened at request of public authorities, vandalism.
PROT	Protection	Incorrect or undesirable relay operation, source line interrupted, loss of relay operation.
SEQP	Other Substation Equipment Trouble	Terminal work, maintenance or test caused, opened for switching to repair station equipment, replaced insulators, power transformer failed.
SCHD	Scheduled Outage	Meets ISO Protocol.
UNKN	Unknown	Not known.
UC	Utility Contact	Utility crane contact line, loose bond wire, rigging equipment failed, hot washed insulator flashed, contacted by adjacent transmission line, utility personnel contacted facilities.
VEGA	Vegetation	Weeds, plants, tree or limb.
VEH	Vehicles	Facilities damaged by non company vehicles.
WEAT	Weather	Ice loading, rain, wind, snow.

## 2.6 “Secondary Cause” List

The Secondary Cause Codes denoted below are the designations used by the ISO to capture other causes for outages. As a supplement to the Primary Cause Code list, this list will assist outage analysis as to what combination of components (if any) sustained the duration of an outage where a primary cause has been established (i.e. “Primary Cause” is aircraft and conductor is the “Secondary

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Cause”). This analysis may provide an area where successful collaboration by the PTO’s data entry would allow the ISO to focus on component modifications that may improve the duration measure on Availability (i.e. installation of aerial markers on the conductor). The measure for the duration of outages may eventually be reduced because of this MAINTENANCE PROCEDURES Procedure No. 2 Version No. 4 Outage Data File Format for the ISO Approved Date 07/17/2014 Effective Date 07/17/2014 Page 10 of 12 field of information. Furthermore future studies in conjunction with the Primary Cause field, where frequency reduction is the main objective, might provide an overall improvement in Availability.

The “Secondary Cause” column should be populated with standard terminology from the “Secondary Cause” list displayed below. If the final determination for the “Secondary Cause” is consistent, it may provide value during outage analysis.

<u>SECONDARY CAUSE CODE</u>	<u>SECONDARY CAUSE</u>	<u>EXAMPLE</u>
ARRS	Arrestors	
AUX	Station Auxiliary Equipment	Any equipment making the transition from the power side to the control and relay side like CT's, PT's, CCVT's, freestanding PT's, metering, station service, air compressors, low voltage ac system.
BATT	Battery Systems	Chargers, batteries, uninterruptible power supplies.
BUSH	Bushings	
CB	Circuit Breakers/Circuit Switches	Oil, vacuum, air, etc.
COMM	Communication Facilities	Any communication equipment that is not 100% dedicated to control or relay (i.e. on site emergency radio equipment).
COND	Conductor, Shield Wire, and Splices	Station and line including station bus.
RELY	Control and Relay System	Relays, test block, wiring, SCADA, RAS, and any



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		communication equipment that is 100%
DC	Direct Current Transmission	Includes all components making up the station and line Direct Current System.
DISC	Disconnects	
ENCR	Encroachments/Unauthorized Attachments	Garages, trees, swimming pools, antennas, communication cable.
GUYS	Guys and Anchors	Station and Line.
HDWR	Hardware, Fittings, and Accessories	Shackles, yokes, clevises, links, clamps, dampers, dead-end connectors, spacers, and terminal pads.
INSL	Insulators	Station and line insulators.
LS	Line Switches	Line (motor operator manual).
NONE	None	No Equipment damage, no equipment failure, or outages are momentary.
OTHER	Other	Other equipment or duration causing elements not listed under current Secondary Cause list.
PROC	Work Procedure/Human Error	Not removing grounds.
REAC	Reactive Devices	Shunt and series capacitors, synchronous condensers, tertiary reactor, etc.
REG	Regulator	
STRU	Structures/Foundation	Station and line: wood poles, lattice steel, tubular steel, concrete poles, and associated foundations.
UG	Underground Transmission Components	All components making up the system including cable, potheads, arrestors,
UNKN	Unknown	Not known.

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Table 2  
(Detailed Data for Table 1)

Owner	Line_ID	Volt_Class	Normal_Volt	Outage_Class*	Out_Start_Date	Out_Start_Time	Const_Type	DUR_(Min)	Out_End_Date	Out_End_Time	Primary_Cause	Secondary_Cause	Comments
PTO	#1	115	138	N	1/1/87	0:00:01	0	0.0	1/1/87	0:00:01	NONE	NONE	Zero outage
PTO	#1	115	138	N	1/1/88	0:00:01	0	0.0	1/1/88	0:00:01	NONE	NONE	Zero outage
PTO	#1	115	138	N	1/1/89	0:00:01	0	0.0	1/1/89	0:00:01	NONE	NONE	Zero outage
PTO	#1	115	138	F	1/4/90	13:13:00	0	13.0	1/4/90	13:26:00	LEQP	STRU	Crossarm
PTO	#1	115	138	X	1/4/90	14:13:00	0	205.0	1/4/90	17:38:00	ND	STRU	Earthquake
PTO	#1	115	138	F	3/5/90	9:09:00	0	0.1	3/5/90	9:09:05	LIGT	NONE	Flashover
PTO	#1	115	138	F	3/5/90	9:09:10	0	0.1	3/5/90	9:09:15	LIGT	NONE	Flashover
PTO	#1	115	138	F	3/5/90	9:09:20	0	0.1	3/5/90	9:09:25	LIGT	NONE	Flashover
PTO	#1	115	138	F	3/5/90	9:09:26	0	0.1	3/5/90	9:09:35	LIGT	NONE	Flashover
PTO	#1	115	138	X	4/5/90	9:09:20	0	0.1	4/5/90	9:09:25	DIST	RELY	Foreign Utility
PTO	#1	115	138	X	4/5/90	9:09:26	0	0.1	4/5/90	9:09:35	DIST	RELY	Foreign Utility
PTO	#1	115	138	C	4/6/91	13:13:00	0	13165.0	4/15/91	16:38:00	OTHR	STRU	Sabotage
PTO	#1	115	138	F	2/6/92	3:03:05	0	50.0	2/6/92	3:53:05	UC	COND	Crane
PTO	#1	115	138	F	4/6/92	3:03:05	0	50.0	4/6/92	3:53:05	VEH	STRU	Vehicle
PTO	#1	115	138	F	12/6/92	3:03:05	0	35.0	12/6/92	3:38:05	VEGA	COND	Tree
PTO	#1	115	138	N	1/1/93	0:00:01	0	0.0	1/1/93	0:00:01	NONE	NONE	Zero outage
PTO	#1	115	138	F	1/4/94	15:17:00	0	55.0	1/4/94	16:12:00	UNKN	NONE	Patrolled
PTO	#1	115	115	N	1/1/95	0:00:01	0	0.0	1/1/95	0:00:01	NONE	NONE	Zero outage
PTO	#1	115	115	F	6/8/96	16:38:00	0	240.0	6/8/96	20:38:00	OTHR	INSL	Gunshot
PTO	#1	115	115	N	1/1/97	0:00:01	0	0.0	1/1/97	0:00:01	NONE	NONE	Zero outage
PTO	#2	115	115	F	3/6/90	9:09:00	0	0.1	3/6/90	9:09:05	PROT	NONE	Test
PTO	#2	115	115	F	3/6/90	9:10:04	0	4.9	3/6/90	9:14:59	CNTM	INSL	Foggy
PTO	#2	115	115	F	6/8/91	16:38:00	0	420.0	6/8/91	23:38:00	NUC	COND	Kite
PTO	#2	115	115	F	8/18/91	11:38:00	0	4030.0	8/21/91	6:48:00	AIR	COND	"B" Phase
PTO	#2	115	115	F	2/6/92	0:18:00	0	0.5	2/6/92	0:18:30	CNTM	INSL	Flashover
PTO	#2	115	115	F	2/6/92	0:19:31	0	80.0	2/6/92	1:39:31	LATE	NONE	Insulator Wash

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PTO	#2	115	115	N	1/1/93	0:00:01	0	0.0	1/1/93	0:00:01	NONE	NONE	Zero Outage
PTO	#2	115	115	N	1/1/94	0:00:01	0	0.0	1/1/94	0:00:01	NONE	NONE	Zero Outage
PTO	#2	115	115	N	1/1/95	0:00:01	0	0.0	1/1/95	0:00:01	NONE	NONE	Zero Outage
PTO	#2	115	115	N	1/1/96	0:00:01	0	0.0	1/1/96	0:00:01	NONE	NONE	Zero Outage
PTO	#2	115	115	N	1/1/97	0:00:01	0	0.0	1/1/97	0:00:01	NONE	NONE	Zero Outage

\* C = Capped

F = Forced

N = None

X = Excluded