

# Reliability Champion Guidebook



Proven Behaviors to Increase Performance Results



# Introduction

Entergy's customers are demanding greater reliability than ever before; therefore, it is critical to understand the cause of line outages and line outage prevention.

This Reliability Champion Guidebook is a supplement resource to reinforce what line supervisors were taught in reliability behavior training. Use this guidebook as a quick reference on the reporting tools and cultural behavior changes needed to improve distribution line reliability.

The key behaviors line supervisors should demonstrate to be a reliability champion are illustrated throughout this guidebook.

## KEY BEHAVIORS OF A RELIABILITY CHAMPION

1. Be a full-time reliability champion team player – use reliability champion language and recognize top reliability champion performers in your group.
2. Expect your teams to identify and repair items that have degraded and fall into the R1 criteria on each and every job.
3. Fully leverage the reliability champion reporting tools to identify highest benefit improvement opportunities.
4. Determine the root cause of every outage, and use the correct causal codes on all trouble tickets.
5. Hold weekly face-to-face reliability team meetings to reinforce reliability champion behaviors and training, review outage and performance reports, and celebrate reliability champion performance leaders.



# Table of Contents

## **RELIABILITY METRICS**

Metric Definitions	1
Metric Calculations	2

## **RELIABILITY PROGRAMS**

Asset Management Programs	3
R1: Key Actions	4
Reliability Meetings	5
Reliability Report Basics	6
Reliability Reports	7

## **OUTAGE ROOT CAUSE**

Data Scrubbing	9
Causal Codes	10

RELIABILITY METRICS

# Metrics Definitions

<b>CUSTOMER INTERRUPTIONS</b>	<b>CI</b>	Total customers interrupted.
<b>OUTAGE DURATION</b>		Time customers' power was interrupted in minutes.
<b>CUSTOMER MINUTES</b>	<b>CM</b>	CIs x Outage Duration = CMs
<b>SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX</b>	<b>SAIFI</b>	CIs / Customers Served = SAIFI
<b>SYSTEM AVERAGE INTERRUPTION DURATION INDEX</b>	<b>SAIDI</b>	CMs / Customers Served = SAIDI
<b>AVERAGE OUTAGE DURATION</b>	<b>CAIDI</b>	Average outage duration for any given customer.

### CUSTOMER INTERRUPTIONS

CI refers to the number of customers who experienced the interruption. Listed as TOTAL\_CUSTOMERS\_AFFECTED in AMFM/DFM.

### OUTAGE DURATION

Outage duration refers to the number of minutes a customer's power was interrupted for any given outage. Only outages greater than 5 minutes count in reliability metrics. Listed as TOTAL\_DURATION\_MINUTES in AMFM/DFM.

### CUSTOMER MINUTES

CM refers to the total number of minutes all customers' power was interrupted, calculated by multiplying the total number of customer interruptions by the total of outage duration minutes. Listed as ACTUAL\_CUSTOMER\_MINUTES in AMFM/DFM.

### SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX

SAIFI is a reliability indicator of the average number of interruptions a customer would experience, calculated by dividing the total customer interruptions by the total number of customers served by that network.

### SYSTEM AVERAGE INTERRUPTION DURATION INDEX

SAIDI is a reliability indicator of the average outage duration for each customer served, calculated by dividing the total customer interruption minutes by the total number of customers served by that network.

### AVERAGE OUTAGE DURATION

The average outage duration is a reliability index of the weighted average outage duration that any given customer would experience. Sometimes referred to as Customer Average Interruption Duration Index or CAIDI, it can also be viewed as the average restoration time.

RELIABILITY METRICS

# Metric Calculations



**KEY BEHAVIOR:** Know what effect metrics have on SAIFI goals by understanding report terminology. This will help you understand what problems need to be addressed to improve your network’s reliability.

**5,000 CUSTOMERS IN NETWORK**

3,000 on Feeder A – 3 outages  
1,000 on Feeder B – 1 outage  
1,000 on Feeder C – no outage

	Outage 1 feeder A breaker	Outage 2 feeder A recloser	Outage 3 feeder A breaker	Outage 4 feeder b line fuse	<b>SUMMARY 4 outages</b>
<b>CUSTOMER INTERRUPTIONS</b>	3,000	1,000	3,000	500	<b>7,500 CIs</b>
<b>OUTAGE DURATION</b>	60 minutes	120 minutes	100 minutes	500 minutes	<b>113 minutes average duration</b>
<b>CUSTOMER INTERRUPTION MINUTES</b>	180,000	120,000	300,000	250,000	<b>850,000 CMs</b>

Calculations

**Customer Interruptions / Customers Served = SAIFI**

**7,500 CIs / 5,000 Customers Served = 1.5 SAIFI**

**Customer Interruption Minutes / Customers Served = SAIDI**

**850,000 CMs / 5,000 Customers Served = 170 SAIDI**



It’s like every customer experienced **1.5** interruptions and **170** interruption minutes.

## RELIABILITY PROGRAMS

# Asset Management Programs



**KEY BEHAVIOR:** Identify and repair items that have degraded and fall into the R1 criteria.

### FOCUS DEVICES

The FOCUS program quarterly identifies the devices with the highest customer interruptions and flags them for replacement. Prioritization is done using a jurisdictionally-based algorithm of two-year outage data to select devices (breakers, reclosers, line fuses, sectionalizers).

Along with network knowledge, the identified devices are then selected for inspection based on the FOCUS ranking and inspected by trained reliability servicemen. Inspection findings are reviewed by work management and discussed with field representatives to develop the most cost-effective reliability improvement plan.

All devices worked since 2011 under FOCUS have had two or fewer outages subsequent to the work.

### BACKBONE PROGRAM

The backbone is the section of the feeder from the feeder breaker to the first protective device. The Backbone program ensures this most critical portion of any feeder is inspected regardless of past performance.

Backbone is a jurisdictionally-based, proactive approach to address potential reliability concerns, and is currently on a 12-year average cycle.



**FOCUS** and **Backbone** follow the same visual inspection and review process to determine the best cost-effective reliability improvement plan.

### R1: BUILD IT RIGHT THE FIRST TIME

R1 is a strategic proactive approach to improving reliability every time a crew performs primary work by taking corrective action on issues known to cause outages or lead to a higher probability of an outage by addressing components that are deteriorating but have not already failed.

Designers, engineers and crew members working on a job should distinguish between failure and signs of degradation. Failed items must be repaired immediately using the established failure programs.

## RELIABILITY PROGRAMS

# R1: Key Actions

### ENSURE STRUCTURE BIL IS 300KV BIL OR HIGHER:

- Remove all bare ground wire above neutral.
- Remove all line arresters (not protecting equipment).
- Install proper length guy strain insulators (96-inch minimum).
- Retrofit all transformers to current standards.
- Install bushing animal guards.
- Replace combination switches and locate new arrester to load side of equipment fuse switch.
- Install continuous Hendrix ground wire in shielded lines (minimum 3 feet above primary and 3 feet below cross arm braces).



### CORRECT ALL VISIBLE DAMAGE:

- Replace missing or repair existing pole grounds.
- Replace all flashed or broken porcelain insulators.
- Replace broken cross arms and braces.
- Replace corroded guys and anchors.
- Repair damaged jumpers and connections.
- Replace deteriorating fiberglass standoffs (tracking, burned, missing paint and moss growth).
- Missing neutral – install minimum one span either side of pole being worked with driven ground rods at all poles. If significant neutral missing, consult work management.
- Replace all expoxilators and Heatherlite deadend insulators, regardless of condition. In Arkansas, replace LAPP insulators mounted horizontally, especially on larger conductors.
- Any other visible damage.

### ENSURE STRUCTURE SPACING IS MAXIMIZED (REDUCE CROWDING):

- Check for clearance issues.
- Reposition primary conductors to achieve optimal spacing.
- Check for slack or excessive sag to reduce conductor slap issues.
- Replace anchors and guys as needed.
- Remove all idle equipment, materials, etc., from pole.
- Move street lights from the primary zone.

### VEGETATION AND VINE REMOVAL:

- Trim any limb that could potentially cause an outage before the next trim cycle if the work can be done in 30 minutes or less. If trimming will take longer than 30 minutes, document the location and required needs for submission to your supervisor.
- Remove any vines growing up pole (spray or cut at base).

## RELIABILITY PROGRAMS

# Reliability Meetings



**KEY BEHAVIOR:** Hold weekly face-to-face network meetings to drive supervisor ownership of reliability behaviors, build local reliability culture, and foster communications and accountability.

### ATTENDEES

REQUIRED

- Supervisor (leads meeting)
- Utility foremen or operation coordinator
- Reliability servicemen
- Field engineer
- Contract compliance operation coordinator
- Vegetation representative

OPTIONAL

- Design representative
- Customer service representative
- Work management
- Planning person

### RECOMMENDED AGENDA

- Short trainings.
- Lessons learned.
- Best practices discussion.
- Action item review.
- Review previous week's outages and team performance using available reliability reports.
- Review current work plan projects status.
- Identify opportunities to address reliability issues as part of large jobs.



## RELIABILITY PROGRAMS

# Reliability Report Basics



**KEY BEHAVIOR:** Review these reports regularly so you don't miss key elements that can help you improve.

### NAVIGATING TO REPORTS







Reports available on the utility performance and analytic website allow you to monitor feeder performance in your network or local office. To navigate to the site, go to the utility home page and select customer operations support and then click on the following menu options:

#### NAVIGATION PATH

- ⇒ Customer Operations Support
  - ⇒ Audit and Compliance
    - ⇒ Utility Performance and Analytics
      - ⇒ Customer Service Region Reporting

### READING REPORTS

Reports are color-coded so you can see at a glance if performance is improving or decreasing, and if you are hitting your target goals.

 <b>BELOW TARGET</b>	 <b>DECREASING PERFORMANCE</b>
 <b>MINIMUM</b>	 <b>INCREASING PERFORMANCE</b>
 <b>TARGET</b>	
 <b>MAXIMUM</b>	

### ACRONYMS

**DLIN** – Distribution line

**TLIN** – Transmission line

**DSUB** – Distribution substation

**TSUB** – Transmission substation

**Customer View** – Includes outages on all four systems (*listed above*) but excludes major storm events and outages caused by load or voltage shed.

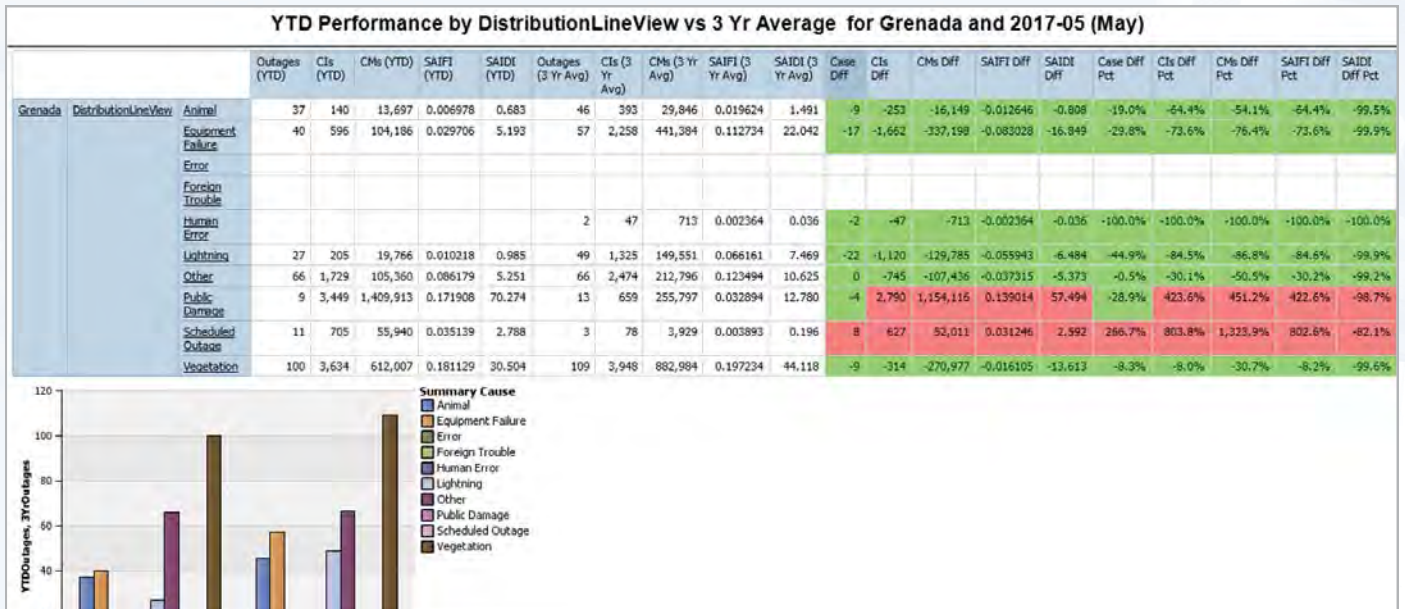
RELIABILITY PROGRAMS

# Reliability Reports



**KEY BEHAVIOR:** Review the Network Reliability Report at reliability meetings to show reliability results for your network.

## NETWORK RELIABILITY BY CAUSE



## RELIABILITY PROGRAMS

# Reliability Reports

### DAILY RELIABILITY

Displays year-to-date CIs and CMs along with minimum, target and maximum goals. Displays actual results for outage count (cases), CIs, CMs, SAIFI, SAIDI and average duration with color coding to indicate goal achievement status. The previous year's numbers through the previous day's numbers are also listed, allowing a quick comparison to last year.

#### WHY IS THIS REPORT IMPORTANT?

You can view your network's color-coded goal achievement status for the key reliability metrics as well as the details for the previous day's outages.

### CUSTOMER INTERRUPTIONS TO HIT YEAR-END TARGETS

Actual year-to-date daily average CIs are shown in the daily average column. The daily CIs needed for the remainder of the year to achieve your year-end goals are also shown.

#### WHY IS THIS REPORT IMPORTANT?

Allows you to focus on the remainder of the year.

#### HOW OFTEN SHOULD YOU RUN THE REPORT?

Bi-weekly or monthly.

### HISTORICAL RELIABILITY

Displays CIs, CMs, SAIFI, SAIDI and average duration (CAIDI). Actual year-to-date results are color-coded based on goal achievement.

#### WHY IS THIS REPORT IMPORTANT?

Allows you to quickly review your network's goal achievement status.

#### HOW OFTEN SHOULD YOU RUN THE REPORT?

Review at reliability meetings (at least bi-weekly) to keep the team informed of your network's goal achievement status.

### NETWORK RELIABILITY BY CAUSE

Current year and previous year data is shown for each cause category along with color-coded columns indicating which causes have improved or worsened.

#### WHY IS THIS REPORT IMPORTANT?

Displays reliability results for all your feeders, allowing you to identify the best and worst feeders so you can prioritize reliability improvement work.

#### HOW OFTEN SHOULD YOU RUN THE REPORT?

Bi-weekly so you always know which feeders are your best and worst.

### FEEDER RELIABILITY

Displays CIs and other key reliability metrics through yesterday for each feeder, grouped by substation.

#### WHY IS THIS REPORT IMPORTANT?

Displays reliability results for all your feeders, allowing you to identify the best and worst feeders so you can prioritize reliability improvement work.

#### HOW OFTEN SHOULD YOU RUN THE REPORT?

Bi-weekly so you always know which feeders are your best and worst.

## OUTAGE ROOT CAUSE

# Data Scrubbing



**KEY BEHAVIOR:** Examine trouble tickets and correct misinformation to ensure reports are accurate.

### USE A QUESTIONING ATTITUDE WHEN REVIEWING OUTAGE CASES

Data scrubbing helps you ensure your customer interruption numbers are correct.

#### How to run AM/FM DFM:

1. Go to Start > All Programs > Distribution Apps > AM/FM DFM.
2. Click Reports in the top tool bar.
3. Select Outage Management as the report category and Outages by Trouble Case as the report name.
4. Select your Distribution Region, Network and Service Request Type (LGTS for lights out cases).
5. Click Date Search from the tool bar and enter your dates.
6. Click Execute from the tool bar then click Sort from the tool bar to filter by device type.
7. Click and drag to open area in the sort window and click OK.

### EXAMINE KEY AREAS IN TROUBLE CASES

Review the information to ensure everything matches and is correct.

**Device Type**  
Is the correct device identified?  
Does it match the other info?

**Cause of Trouble**  
Has the root cause been identified?

**Remarks**  
Do remarks match the other info?

**Total Customers Affected**  
Does the number match the other information?  
Does it match with Device Type and Cause of Trouble?

**Total Duration Minutes**  
How long was the outage?

Update Date	Username	Department	Reason	Status	Approved/
06/14/17 07:03	KKOON	DOC	CUSTOMER COUNT WRONG	Completed - Approved Change	KKOON

## OUTAGE ROOT CAUSE

# Causal Codes



**KEY BEHAVIOR:** Determine the root cause of an outage and enter the correct causal code.

### REVIEW CAUSAL CODES FROM OUTAGE REPORTS DAILY

Causal codes identify what caused an outage to help you understand what is happening on your network feeder.

Case ID	LO	Substation	Feeder	System Affected	Device ID	Device Type	Field Personnel	First Call Date/Time	Trouble Clear Date/Time	Total Phases	Affected Phases	Customer Calls	Cause of Trouble
1270408994	VICKSBURG	VICKSBURG/OPENWOOD	SD03	DLIN	894737	TFUS	ALAN SCOTT	Apr 19, 2017 7:48:00 AM	Apr 19, 2017 8:40:38 AM	B	B	0	Scheduled Interruption
1270409302	VICKSBURG	VICKSBURG/WEST	SE06	DLIN	5770849	LFUS	forbe2	Apr 19, 2017 8:07:00 AM	Apr 19, 2017 9:00:29 AM	C	C	2	Inspected Unknown
1270411620	VICKSBURG	VICKSBURG/OPENWOOD	SD03	DLIN	FE399	LFUS	ALAN SCOTT	Apr 19, 2017 8:07:00 AM	Apr 19, 2017 10:10:49 AM	B	B	0	Scheduled Interruption
1270411652	VICKSBURG	VICKSBURG/OPENWOOD	SD03	DLIN	781249	TFUS	ALAN SCOTT	Apr 19, 2017 9:23:00 AM	Apr 19, 2017 10:10:36 AM	C	C	0	Scheduled Interruption

**Cause of Trouble**

Scheduled Interruption

Inspected Unknown

Scheduled Interruption

Scheduled Interruption

### SELECT THE CORRECT CODE

Selecting the right causal code is key to identifying the main problem affecting reliability. Codes are displayed by the system affected, installation type and device type, so only those matching the outage criteria are shown.

The screenshot shows a software interface for a case. The 'Cause Code' section is highlighted with a red box and contains the following options:

- Vegetation
- Animal
- Lightning
- Equipment Failure
- Conductor Failure
- Human Factors
- Other
- Overload
- Error

**Cause Code :**

- Vegetation
- Animal
- Lightning
- Equipment Failure
- Conductor Failure
- Human Factors
- Other
- Overload
- Error

Vine Growing into Line  
Tree On Line Outside R.O.W.  
Tree/Limb Growing Inside R.O.W.  
Overhanging Limb

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