



TEXAS A&M UNIVERSITY

Engineering

Operator Justification for De-energizing Electric Circuits for Wildfire Prevention - Utilization of Objective Electrical Criteria

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2018 was the **worst wildfire year in US history**

- Cost: billions of dollars
- Communities disrupted
- Lives were lost!



Orange County Register



Haaretz

A Chaotic World in California

Public Safety Power Shutoff (PSPS)

De-energize circuits on “Red Flag” days to prevent electric power-line fire ignition

When do you de-energize a circuit?

Answer: Red Flag Days

Environmental and Ground Conditions:

- High wind
- Low humidity
- High temperature
- Heavy Fuel Load
- Fuel Desiccation
- Low Soil Moisture

What is missing?

Electrical data not even considered!
Is the circuit electrically healthy?

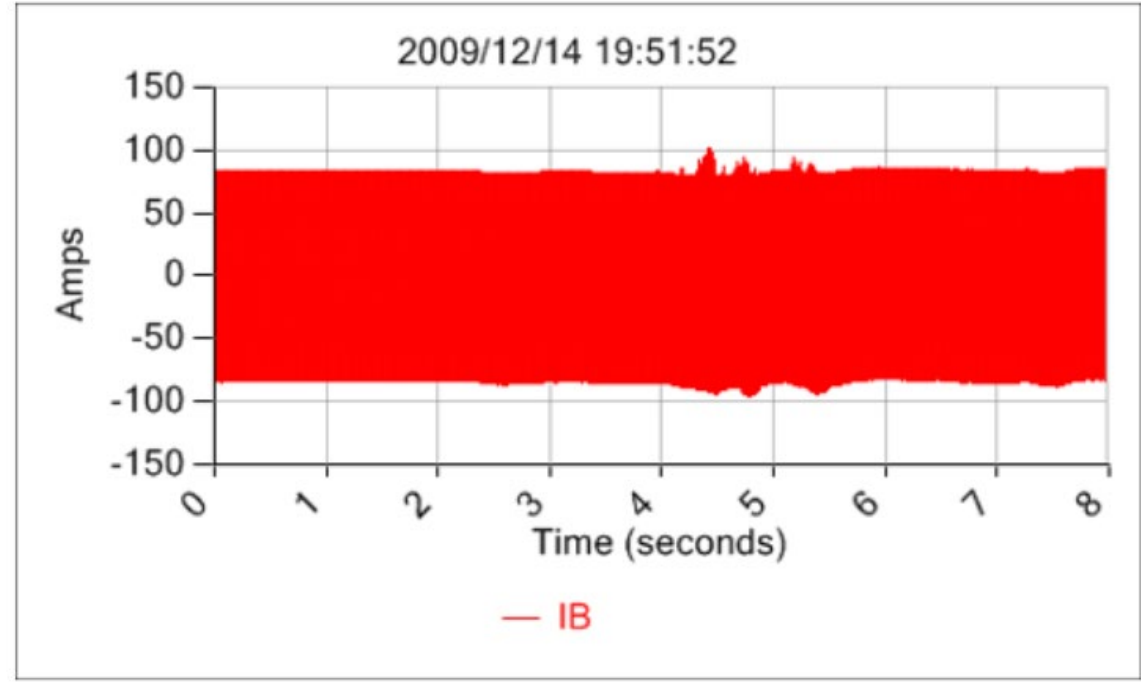
How Do Power Lines Cause Fires?



What caused this fire? Line is down arcing



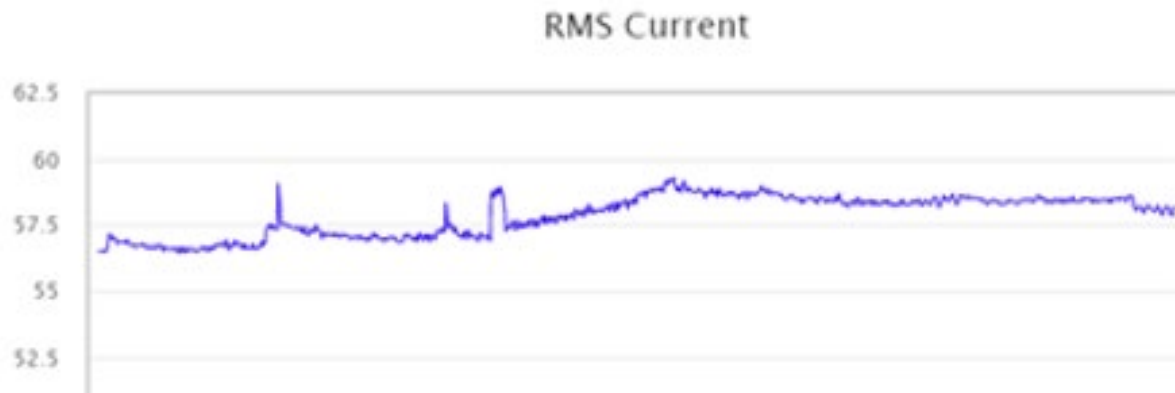
Series Arcing in Fused Disconnect Switch



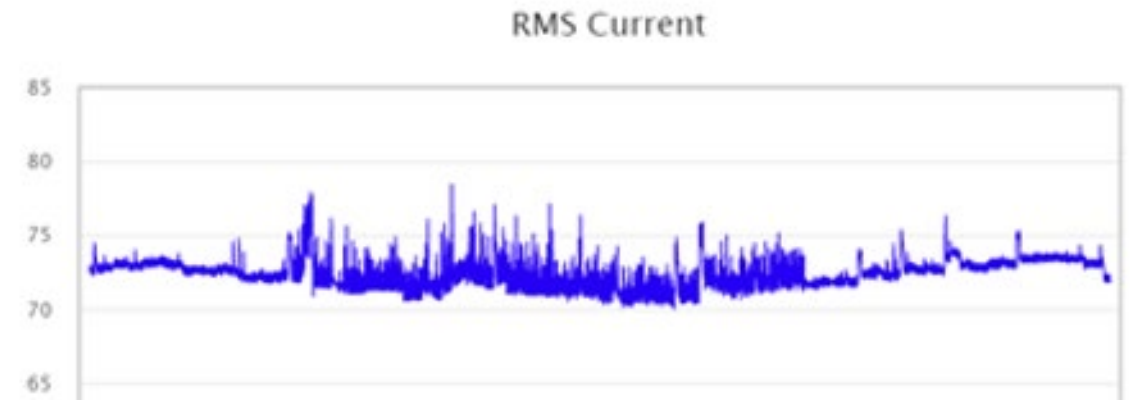
Arced 2333 times in
21 days



Arcing clamp → Line Down → FIRE




12-sec DFA record, RMS current, early in event



60-sec, DFA record, RMS current, late in event

Arcing recorded for 101 minutes before failure.
Fire ignited switch dropped burning pieces

DFA Reported Arcing Switch

Expand	Substation	Circuit	Event Type	Phases	Comments	Count	Last Occurred
			Probable failure of switch or clamp	B	Estimated kVA capacity beyond switch/clamp: 31 kVA 80% likelihood switch; 20% likelihood clamp	919 transients (101 minutes)	2019-06-08 10:46:45

If you receive this notice of a failing switch arcing on a high fire risk day – **DEENERGIZE THE CIRCUIT!**

DFA Alert and Database

Expand	Substation	Circuit	Event Type	Phases	Comments	Count	Last Occurred
			Probable failure of switch or clamp	B	Estimated kVA capacity beyond switch/clamp: 31 kVA 80% likelihood switch; 20% likelihood clamp	919 transients (101 minutes)	2019-06-08 10:46:45

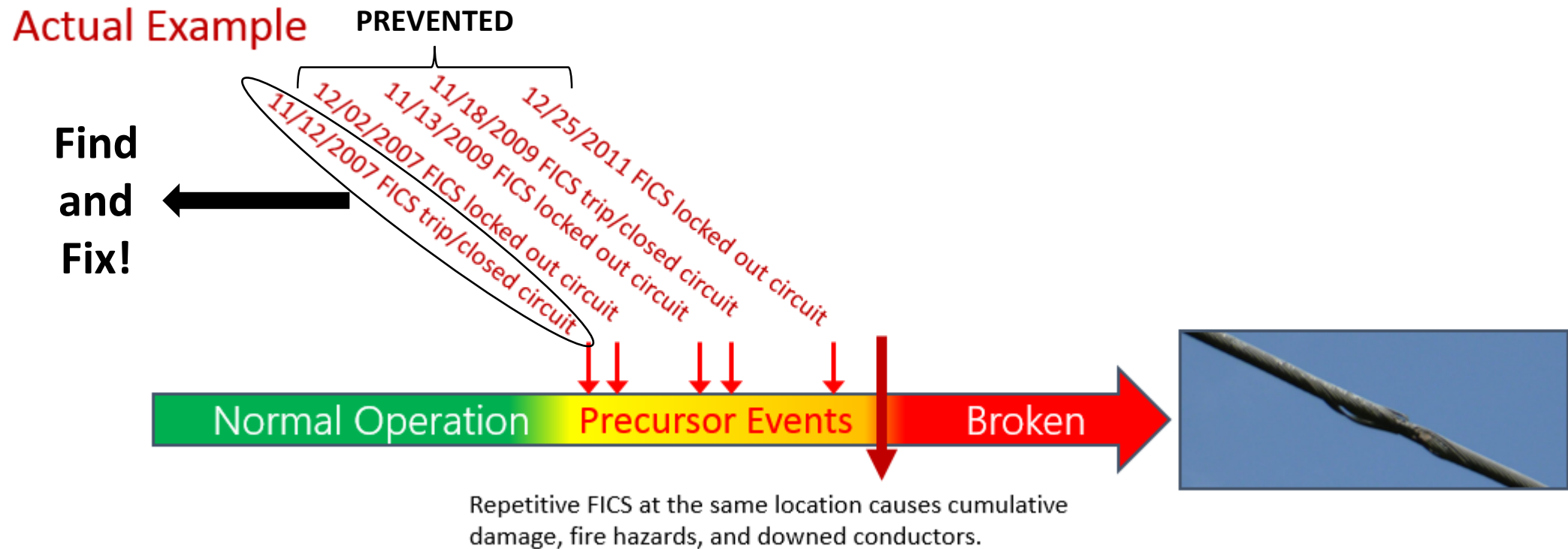
Export

Show entries

Search:

Event Type	Phases	Phase A Amps	Phase B Amps	Phase C Amps	Transients	Last Occurred	Gr
Probable failure of switch or clamp(S)	B	1	26	3	8	2019-06-08 10:46:45	
Probable failure of switch or clamp(S)	B	6	23	5	9	2019-06-08 10:46:18	
Probable failure of switch or clamp(S)	B	7	26	4	11	2019-06-08 10:44:55	
Probable failure of switch or clamp(S)	B	4	25	3	38	2019-06-08 10:44:05	
Probable failure of switch or clamp(C)	B	2	19	2	1	2019-06-08 10:43:46	
Probable failure of switch or clamp(I)	B	4	19	5	4	2019-06-08 10:43:18	
Probable failure of switch or clamp(S)	B	5	33	4	32	2019-06-08 10:42:18	
Probable failure of switch or clamp(S)	B	5	31	6	19	2019-06-08 10:41:18	
Probable failure of switch or clamp(S)	B	4	28	5	32	2019-06-08 10:40:19	
Probable failure of switch or clamp(I)	B	2	14	6	4	2019-06-08 10:39:57	

Conductor Clash





Recommendations:

DFA technology offers a transformational tool for operators to improve reliability and safety while preventing many wildfire ignitions

Conclusions:

We need deep situational awareness of the health of circuits at all times, most importantly when there is a high risk of fires.

We can improve the resilience of circuits by implementing condition based maintenance using real-time diagnostic data.

DFA technology offers a transformational tool for operators to improve reliability and safety while preventing many wildfire ignitions

Arcing conditions below protection levels represent a fault and could justify deenergizing circuits on non red-flag days.

DFA – A New Tool for Utilities

DFA technology represents a paradigm shift in distribution operations.

- Proactive
- Predictive; repetitive faults
- Diagnostic; operational problems
- Situational awareness; real-time health assessment
- Visibility of all circuit activity and conditions
- Actionable recommendations to operators
- Operator knowledge (not data!)