

Open-Phase Detection Field Validation Test

Robert F. Arritt, P.E.
EPRI

Wayne Johnson
EPRI

NRC Public Meeting
June 4, 2014

EPRI Open Phase Detection

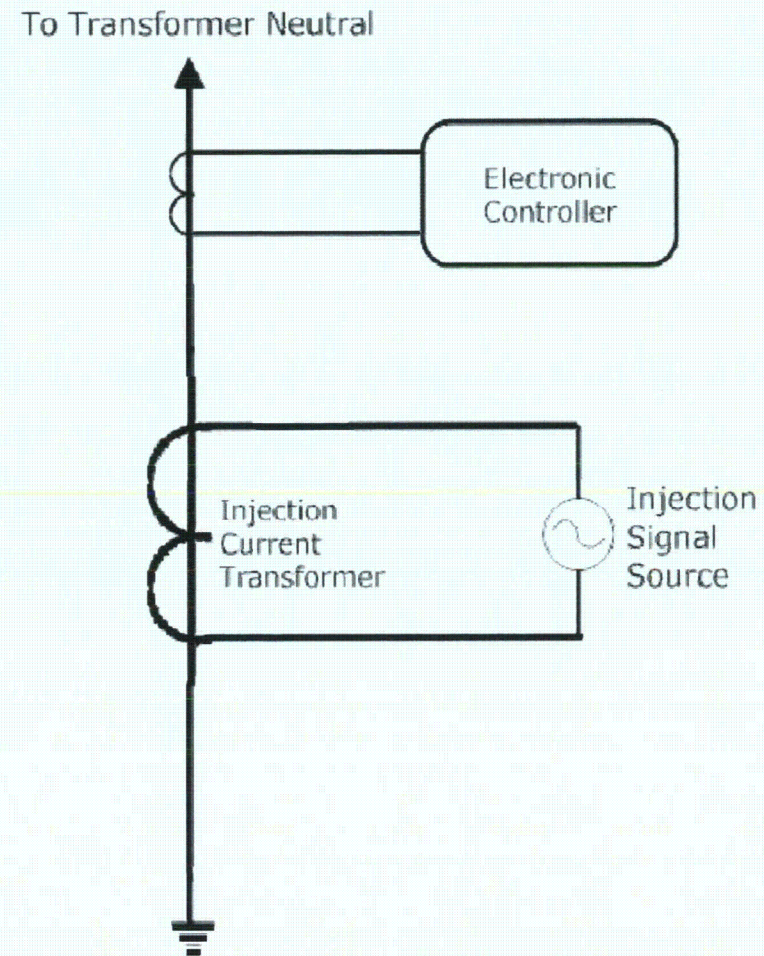
- EPRI has been a contributor to the analysis of the open phase issue since 2012
- Developed three publicly available reports related to this issue
 - *EPRI 1025772, Analysis of Station Auxiliary Transformer Response to Open Phase Conditions*
 - *EPRI 1026484, Development and Analysis of an Open-Phase Detection Scheme*
 - *EPRI 3002000764, Development and Analysis of an Open Phase Detection Scheme for Various Configurations of Auxiliary Transformers*

EPRI Open Phase Detection

- Two additional reports to be released in 2014
 - *EPRI 3002003256, Development and Analysis of a Double Open Phase Detection Scheme for Various Configurations of Auxiliary Transformers*
 - *EPRI XXX, Open-Phase Detection Method*
- Open Phase Detection prototype development
 - Webcast to present lab results November 2013
 - Lab demonstration of completed prototype April 2014
 - Field tested in May 2014

EPRI Open-Phase Detection

- Combines neutral detection with neutral injection to provide a robust/secure detection system.
 - Provides both passive and active protection
 - Active protection is the preferred method over passive only protection
 - Allows for a fail safe and redundant detection design
 - Allows for a system test scheme to monitor all major system components
 - Only requires monitoring of a change in signal level



EPRI Open Phase Detection

- EPRI OPD method
 - Takes advantage of known transformer characteristics
 - Based on computer modeling and verified by lab testing
 - The method has been found to be suitable for loaded and unloaded transformers



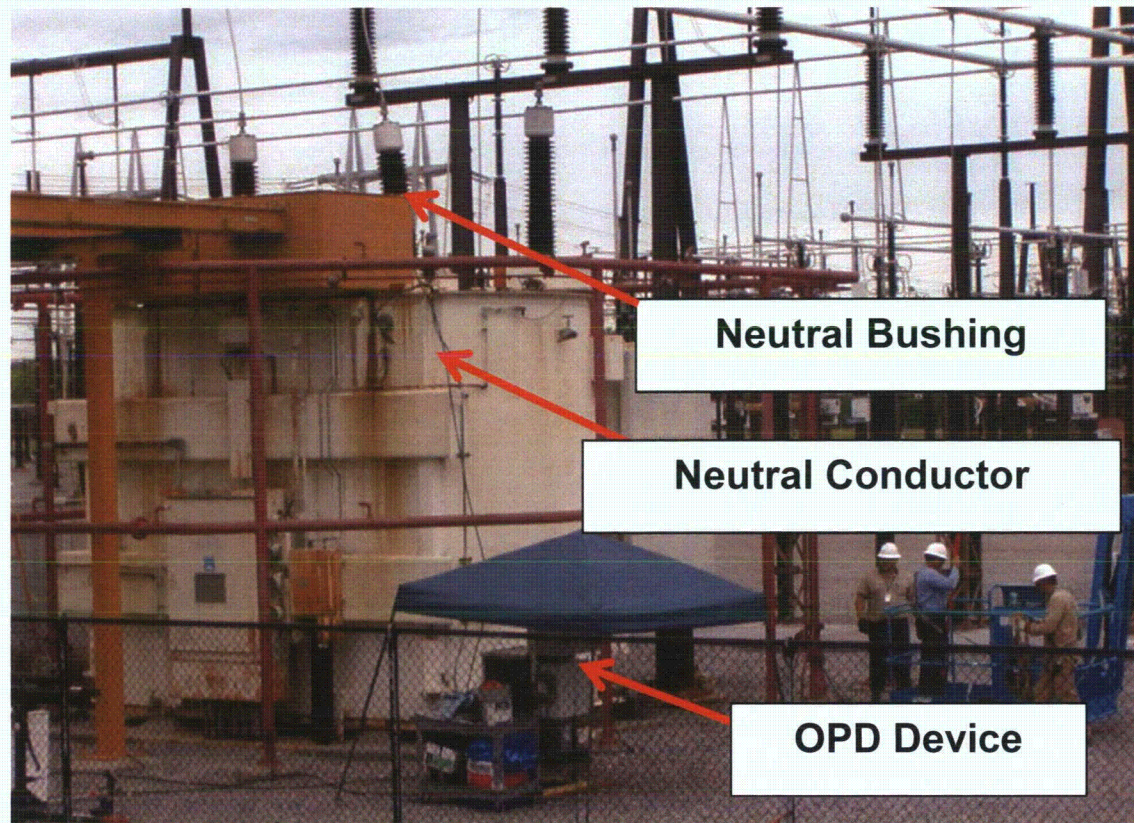
EPRI Open Phase Detection

- Design requires limited prior knowledge of plant electrical system
- Monitoring is based on a change in signal level
 - Absolute values not needed
 - Only had nameplate data and simple configuration information for TVA field test



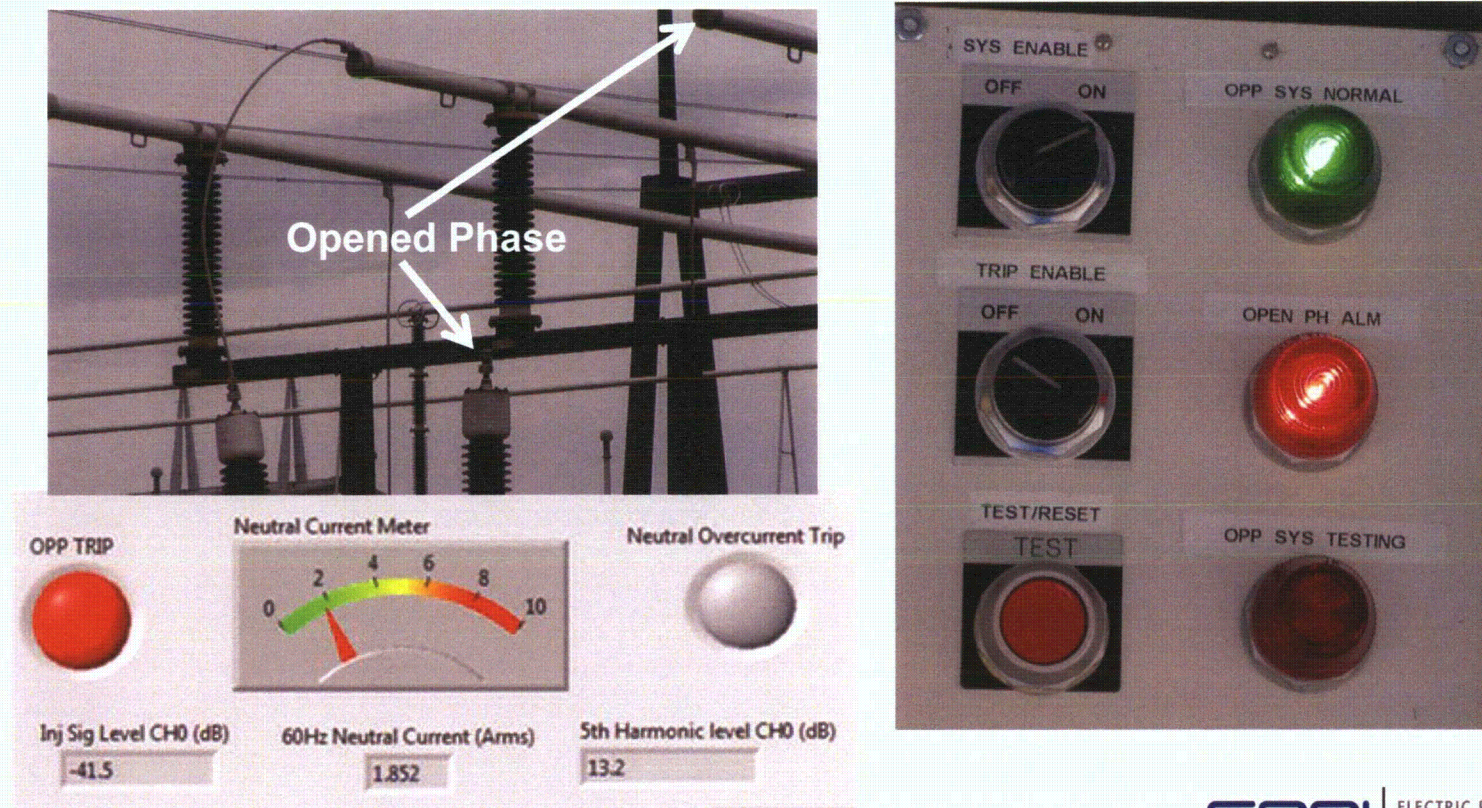
Field Demonstration

- EPRI OPD system requires connection to transformer neutral with no other changes to the SAT and switchyard



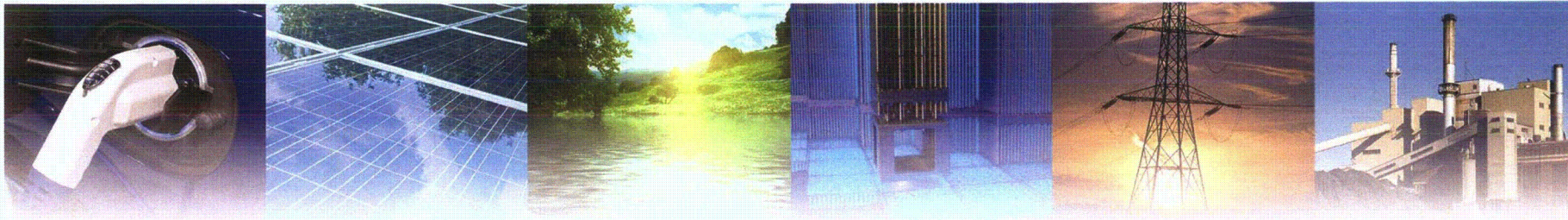
Field Demonstration – Successful Detection

- EPRI OPD system performed as predicted
- Successfully detected an open-phase event under all conditions – no-load and loaded conditions



Development Schedule

- Construct prototype ✓
- Laboratory demonstration of prototype ✓
- Choose a representative field test site ✓
- Complete field testing ✓
- Complete licensing
 - Transition to commercial entity to bring product to market for our members
 - Meets present NRC schedule for implementation



Together...Shaping the Future of Electricity
