

# Addendum for Category 1a Events

October 21, 2015

This addendum is intended to be used as a guide in determining event categories for Category 1a events. Your comments are welcomed and appreciated. Please provide comments to [nercea@nerc.net](mailto:nercea@nerc.net).

## Category 1a

**An unexpected outage, contrary to design, of three or more Bulk Electric System (BES) Facilities caused by a common disturbance<sup>1</sup>.**

### Facilities

A Facility is defined in the NERC Glossary as; "A set of electrical equipment that operates as a single BES Element (e.g., a line, a generator, a shunt compensator, transformer, etc.)".

### Element

An element is defined in the NERC Glossary as; "Any electrical device with terminals that may be connected to other electrical devices such as a generator, transformer, circuit breaker, bus section, or transmission line. An element may be comprised of one or more components."

For the purposes of categorizing events for the Event Analysis process, a facility is a BES line, BES generator or BES transformer.

Circuit breakers and busses are impactful because they outage lines and transformers. Therefore, circuit breakers and busses do not need to be included as their impact will be captured by lines and transformers that are outaged due to either the circuit breakers opening, busses being de-energized, or both. If a shunt device is impactful, an event involving their outage should qualify as a 2c (voltage excursion) event. Therefore, shunt and series devices are not included as facilities for categorizing events. Exceptions to these assumptions may be encountered. When that happens, information and participation, may be requested by the Regional Entity (RE) even though it may be a non-qualified event.

The emphasis on determining if a facility is outaged or not, is if that facility can still provide a path for BES power flows. Outaged facilities that cease to provide a path for power flows reduce the power flow capability of the BES. The ability of the BES to transmit and deliver power can be impacted if three or more facilities are outaged simultaneously. The intent of the Event Analysis Process (EAP) is to capture those events that result in an outage of three or more facilities, contrary to design<sup>2</sup>, that cease to provide paths for power flow or cease to deliver generation, and to learn how to possibly prevent similar events in the

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<sup>1</sup> NERC Disturbance as defined in the Glossary of Terms is: 1. An unplanned event that produces an abnormal system condition. 2. Any perturbation to the electric system. 3. The unexpected change in ACE that is caused by the sudden failure of generation or interruption of load.

<sup>2</sup> Contrary to design does not apply to each individual element but rather to the three elements as a whole. If a scheme is designed to trip three elements for a single fault, that is as designed. If a single line fault results in the faulted line tripping along with two other lines misoperating and tripping, that is three elements outaged due to a common disturbance, contrary to design. That would be a qualified event.

future.

## **Lines**

### **Radial Lines**

Radial lines do not qualify as BES facilities

### **Two terminal Lines**

If either terminal is opened, the line cannot transmit power. Therefore, the line is considered outaged.

### **Three terminal lines (and greater)**

If the terminal that opened, disconnected BES facilities from the line, the line is considered outaged. For example;

1. A three terminal line has a terminal trip during an event that is only radially connected to load. The line would not be considered outaged for just that terminal opening.
2. A three terminal line has a terminal trip during an event that is connected to a 100MW BES generating plant. The line would be considered outaged if just that line terminal opened. (A generator only trip is a generator outage, not a line outage.)
3. A three terminal line has a terminal trip during an event that is connected to a BES substation. The line would be considered outaged if just that terminal opened.

## **Generators**

A generator is considered outaged if it is no longer able to supply its energy to the grid.

## **Transformers**

A transformer is considered outaged if either the primary side or secondary side is disconnected from the grid. In other words, if the transformer is not able to transmit power through it due to any of its intended disconnect devices being open, the transformer is considered outaged. Disconnection of a tertiary winding only, is not considered as a transformer outage.

## **Contrary to design, Unintended**

### **General**

If a bus experiences a fault and the bus differential outages five lines connected to the bus to clear the fault, those five outages are intended actions by design in response to an electrical fault. Therefore, they would not be considered in the determination of three or more facilities outaged. The bus would be counted as a single facility outaged. If a remote line end over trips due to the bus fault, that is a facility that is counted.

### **Breaker Failures**

The AC Substation Equipment Task Force (ACSETF) Report identified substation circuit breaker failures as a leading cause of multiple outages. The report recommended that circuit breaker failure data be collected through the EA process to facilitate identification of trends with regards to circuit breaker failures. In response to this recommendation, circuit breaker failures are considered not as intended. Circuit breaker failures include fail to trip, slow to trip and internal fault/failure. Therefore, facilities that are tripped due to breaker failure are counted as facilities outaged in determining categorization.

### **Protection System Misoperations**

Protection system misoperations are considered contrary to design. Facilities that are outaged due to protection system misoperations would be included in the determination of category. Incorrect protection settings are included in protection system misoperations.

### **Human Error**

The Event Analysis Process strives to learn from events and offer Lessons Learned to prevent like occurrences in the future. Technician error, inadequate job scoping and planning, work procedures that may need improvement, other situations that present an opportunity for improvement, etc. are all situations we can learn from. Human error events are a good source of those Lessons Learned and the industry could benefit from analyzing those types of events. Therefore, facilities outaged due to human error<sup>3</sup> are included in the count to determine category.

### **Remedial Action Scheme<sup>4</sup>**

If an event includes facilities that are outaged due to intended actions that were either part of a documented operating procedure or a Remedial Action Scheme (RAS), those outages are not included in the determination of three or more facilities outaged. As indicated previously, the Event Analysis Process aims to capture events and learn how to possibly prevent some of them in the future. If an event results in three or more facilities outaged, but those outages were intended actions that were either part of a documented operating procedure or a RAS, there isn't much to learn from those events. If the intent is to learn from events and possibly prevent similar events in the future, planned and intentional actions do not present anything that would be beneficial for future prevention. The RAS operation should be reviewed by the entity to ensure that all elements of the operation were as designed and intended.

If an event results in significantly more generation tripped than the RAS was designed or studied for, that event will be considered as a Categorized event based on the amount of generation tripped. The reasoning for this is that if more generation is tripped than what was planned for, then the entire event would be considered contrary to design.

### **RAS Unintended/Misoperation**

If an RAS misoperates due to an input to the RAS providing a signal in error, the RAS is considered to have misoperated. The reasoning is that all components (inputs, outputs, communication channels, relays, plc's, etc.) comprise the RAS as a whole system. Any component of the RAS that causes it to misoperate/unintentionally operate, comprises a misoperation of the RAS system and would be considered a Category 1c event.

### **Category 2 and higher MW thresholds**

For the higher category events where the threshold for a Category is a defined amount of generation, load or islanding. Generation and Load Losses or Islanding due to intended actions that were part of an RAS will be counted as Losses or Islanding MW in determination of meeting that threshold. UFLS and UVLS are not

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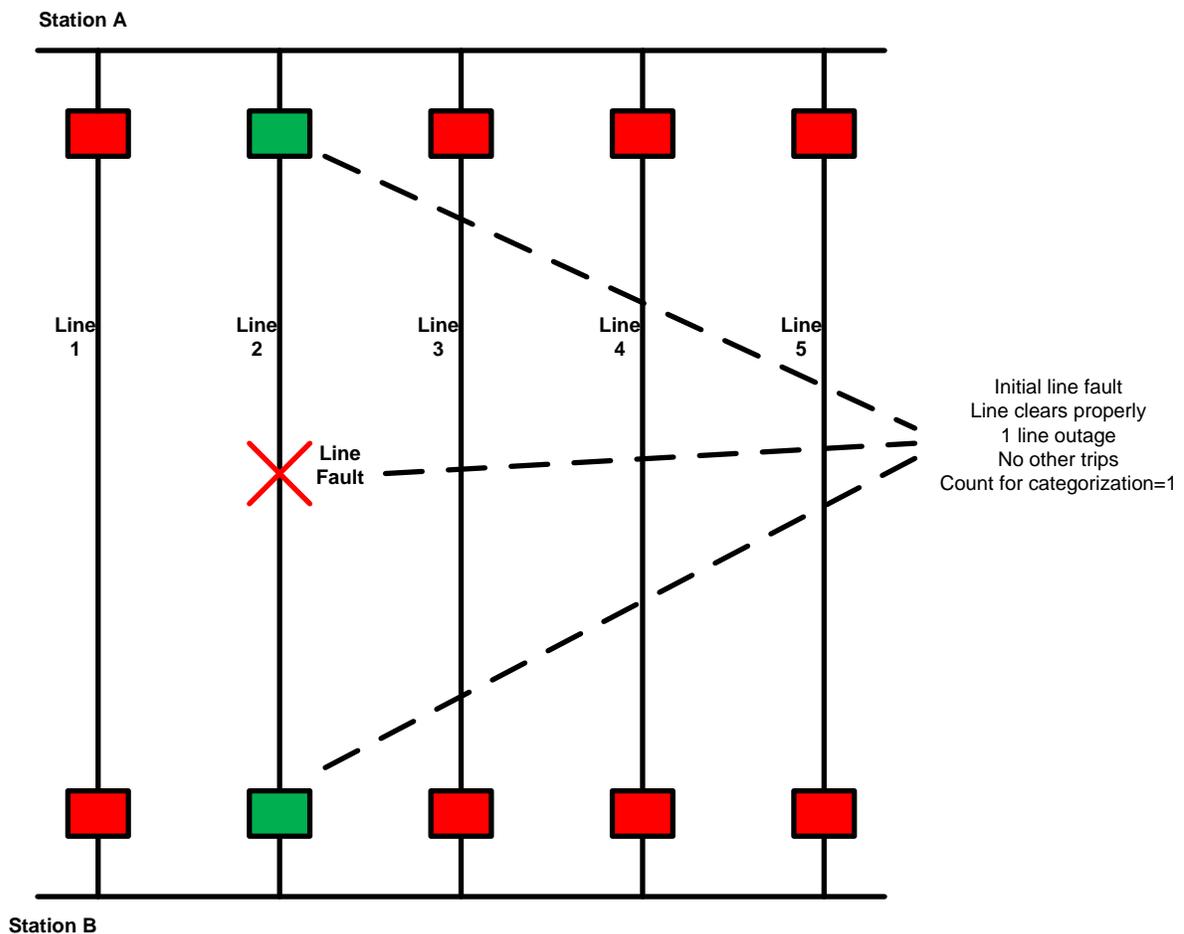
<sup>3</sup> On site human error and as left human error are both included

<sup>4</sup> Formerly also known as Special Protection System (SPS)

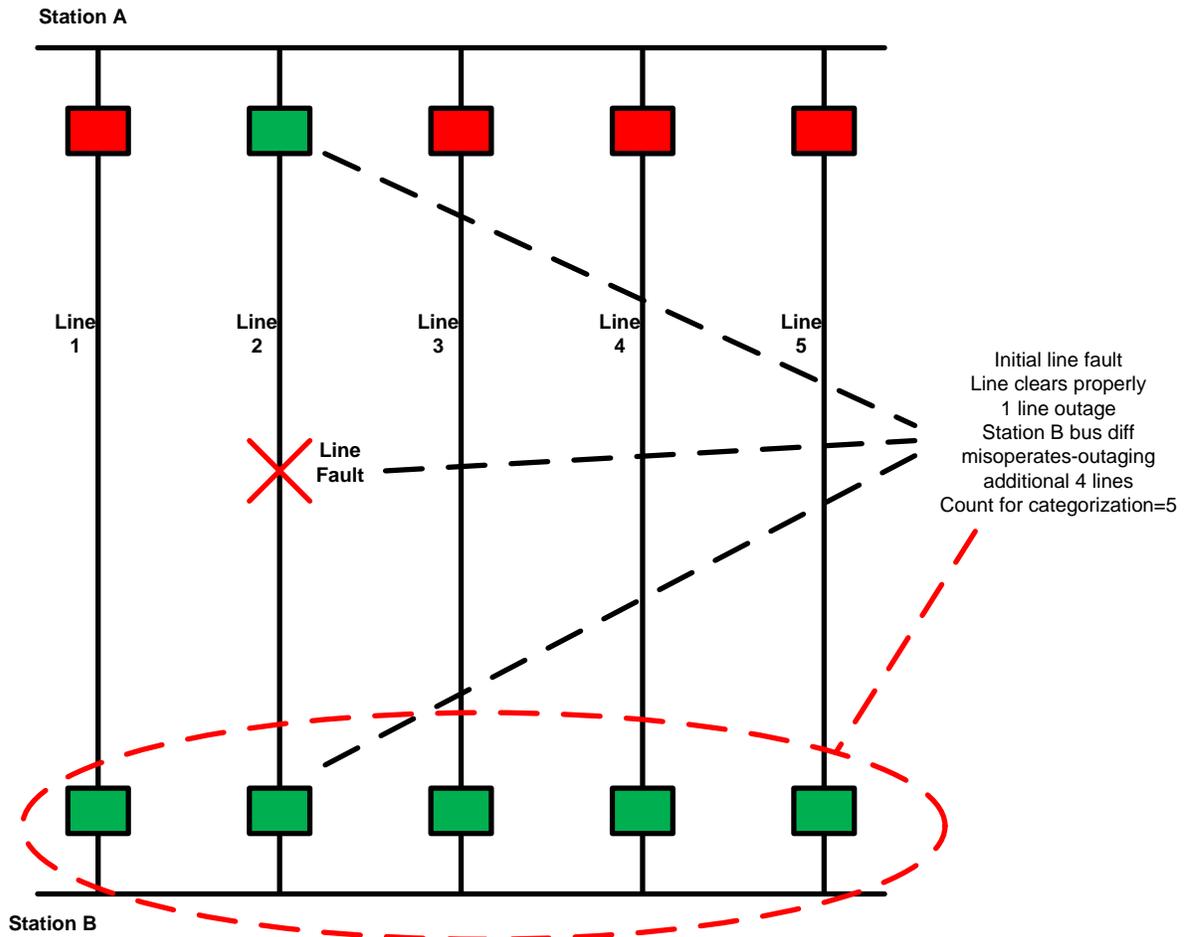
considered a RAS. Load and Generation losses associated with UFLS and UVLS will be counted towards the MW thresholds for event categorization.

The amount of Generation MW lost counted towards event categorization is the amount of MW that were being generated when the generator breaker was opened. (MW due to runback before tripping are not included)

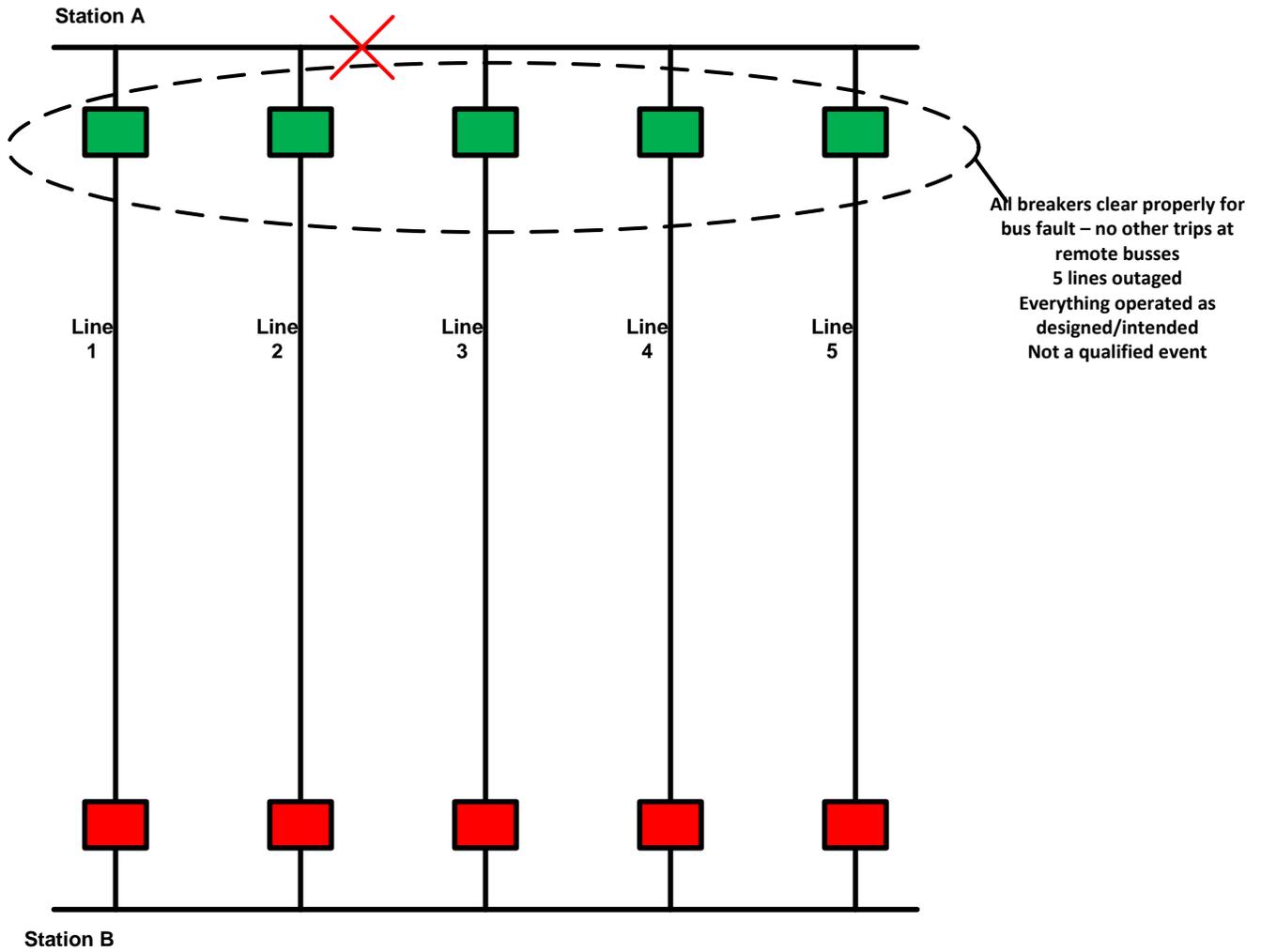
### Examples



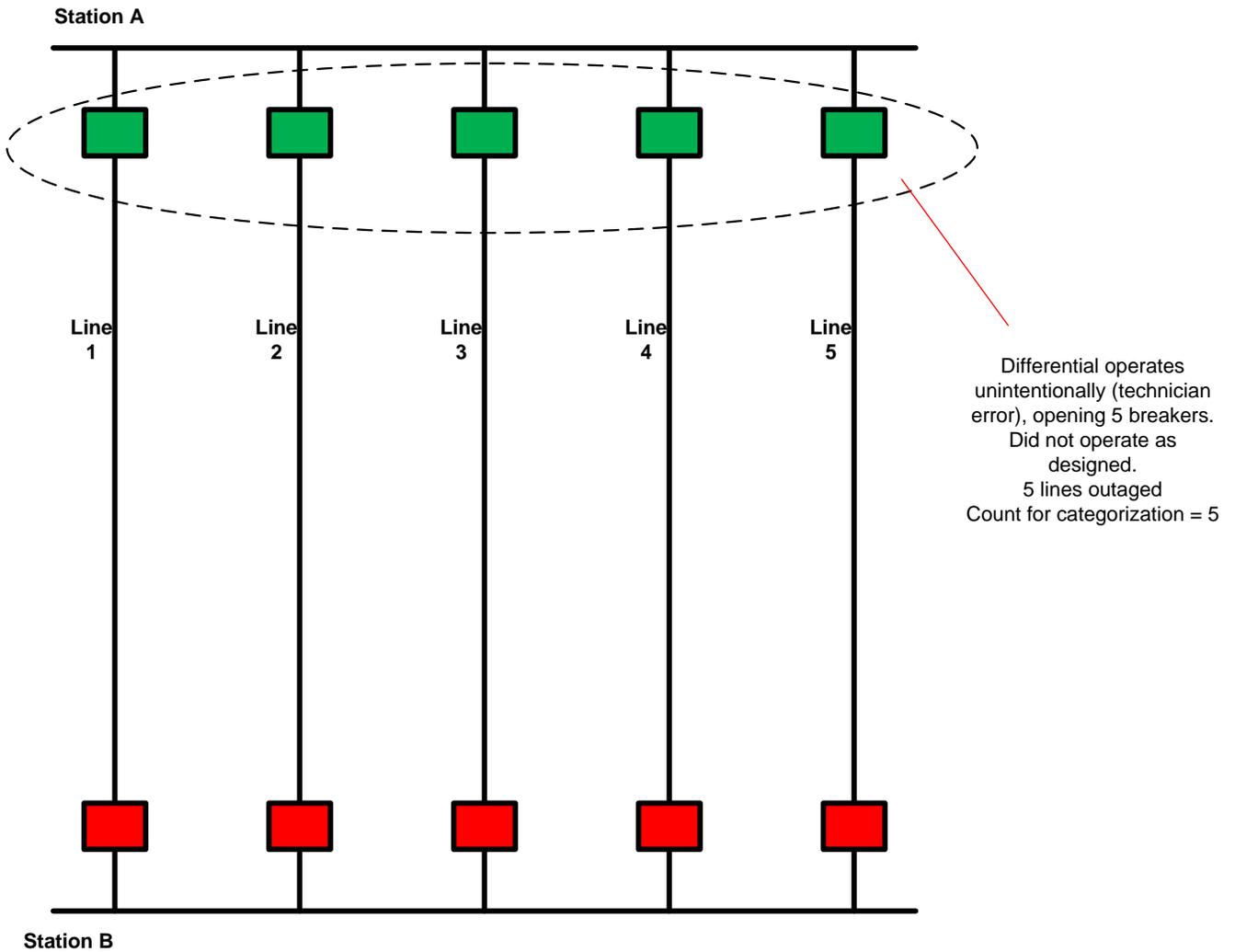
**Example 1 - Non Qualified Event**



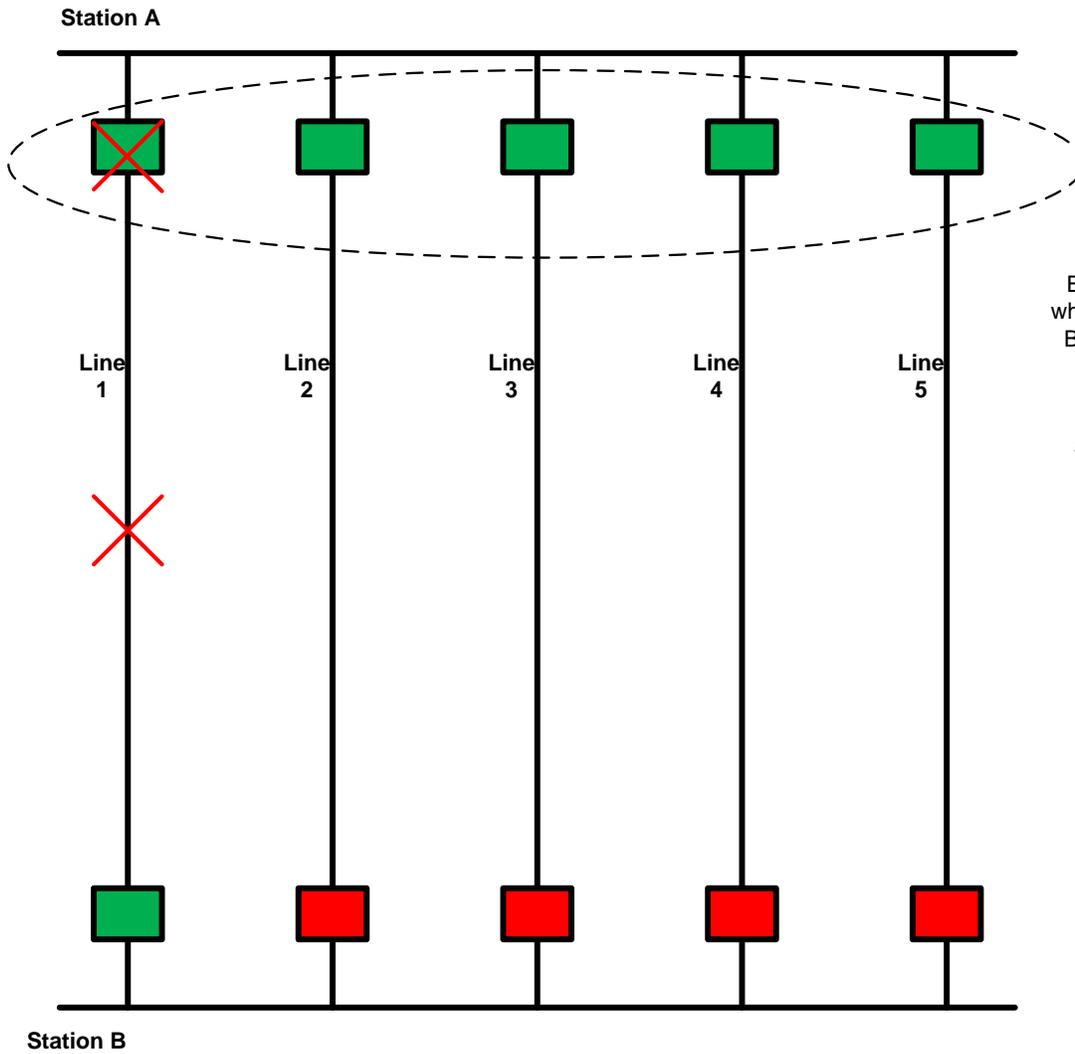
Example 2 – Qualified Event



**Example 3 - Non Qualified Event**

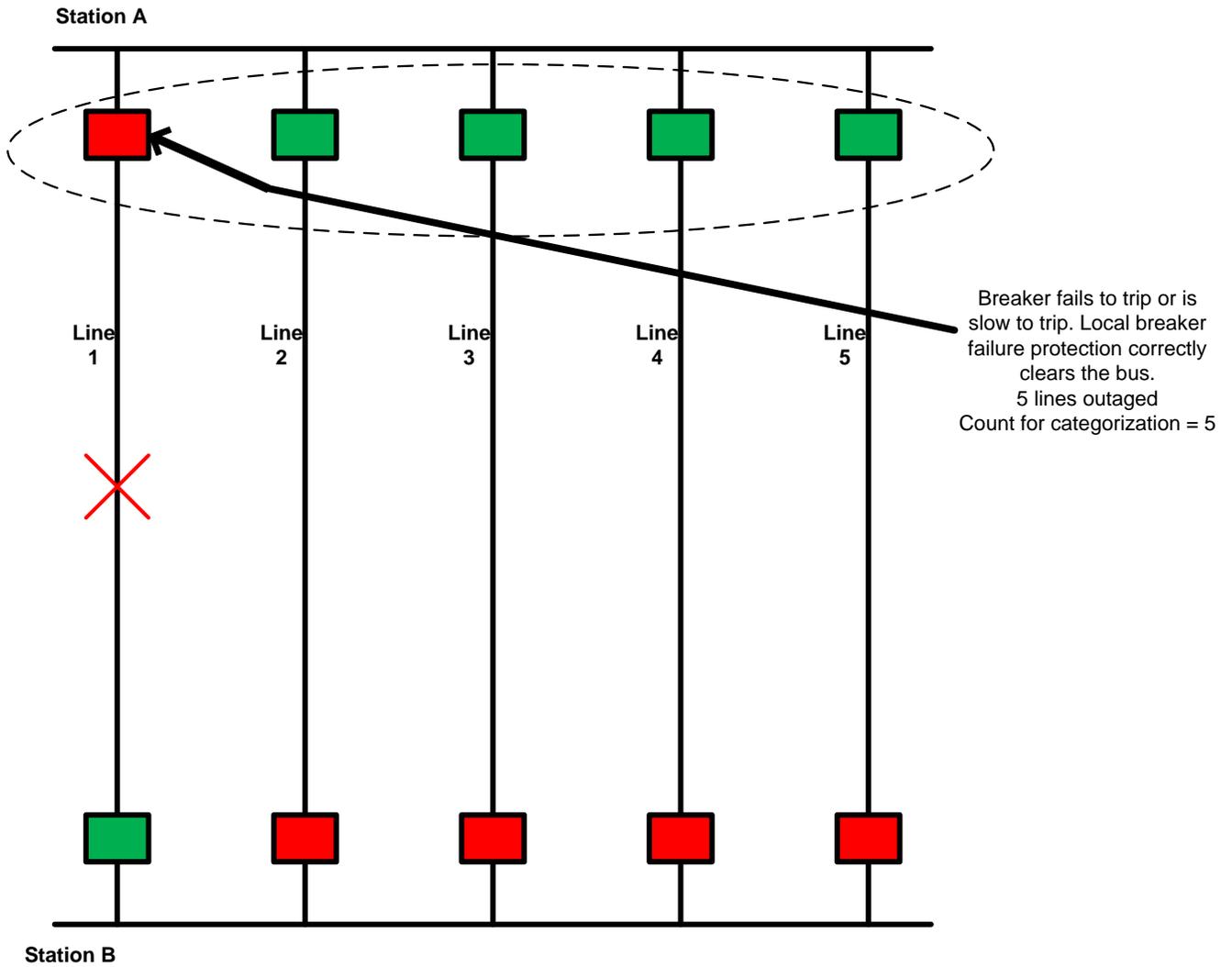


**Example 4 – Unintentional Bus Trip – Qualified Event**

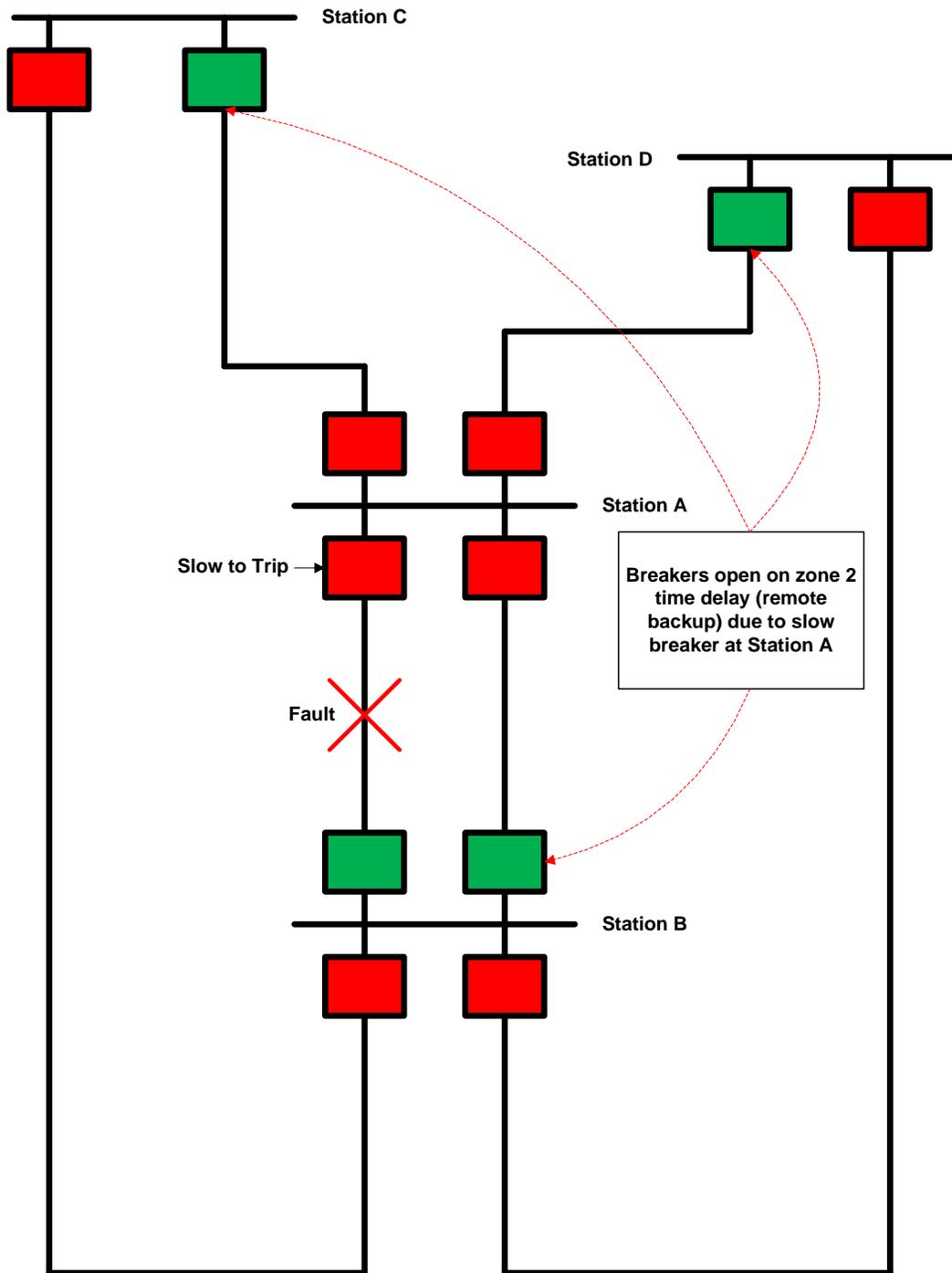


Breaker faults internally while interrupting line fault.  
 Bus differential correctly operates for breaker internal fault.  
 5 lines outaged  
 Since it was a breaker failure  
 It is a qualified event

**Example 5 – Qualified Event**

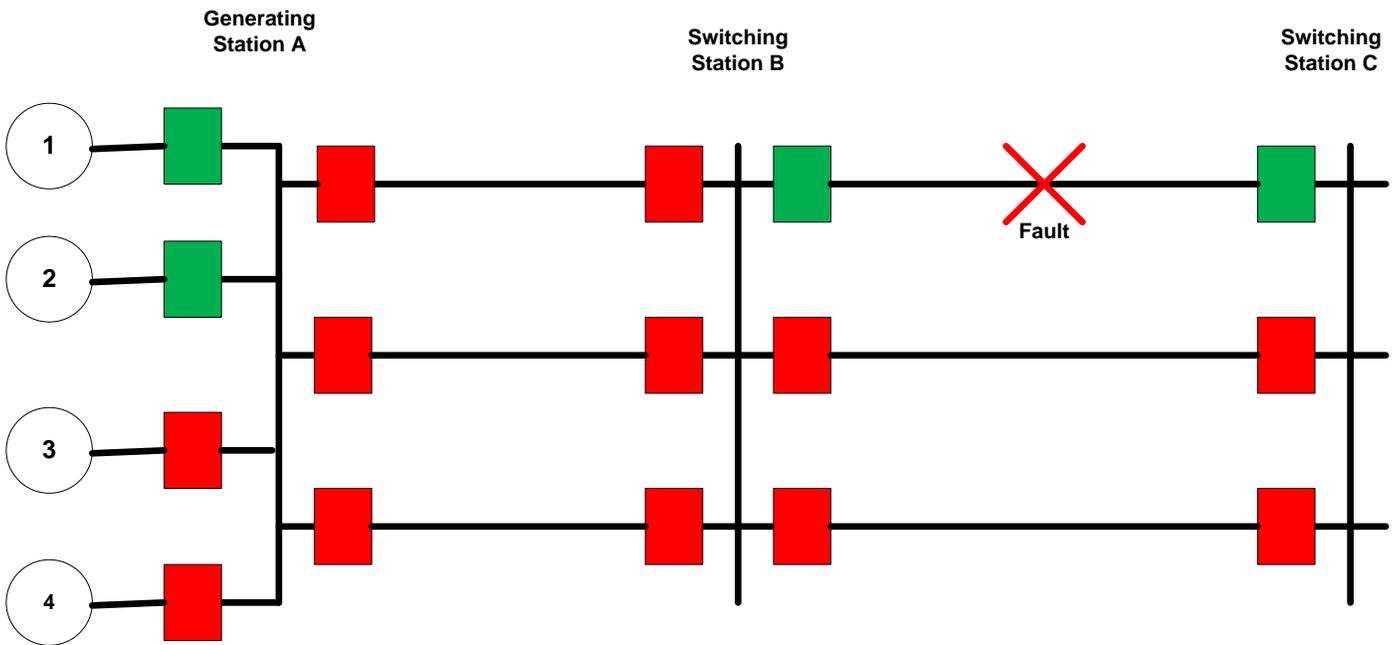


Example 6 – Qualified Event



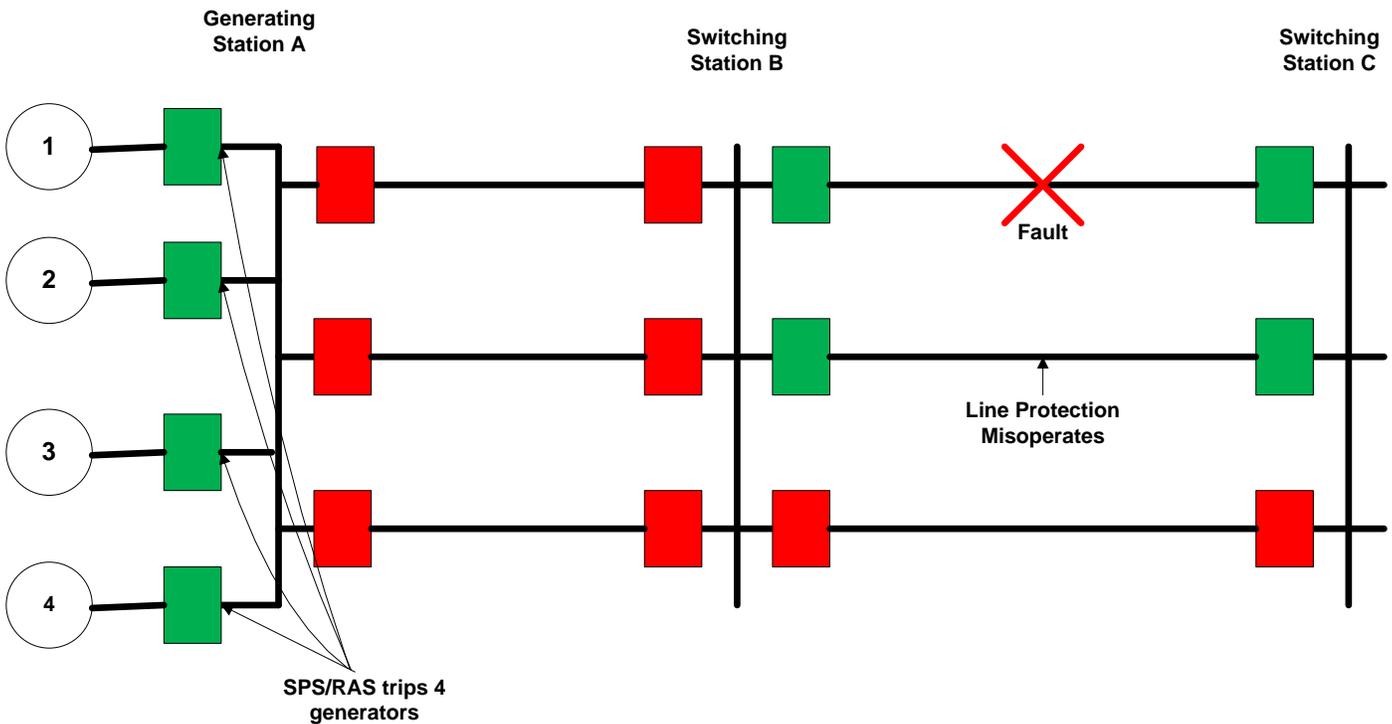
**Example 7 – Qualified Event**

- Station A breaker is slow to trip/fails to trip for line fault. (Breaker did not operate as intended) Breakers at Stations B, C and D open on remote backup (Zone 2 time delay).
- Four lines outaged.
- Count for categorization = Four.



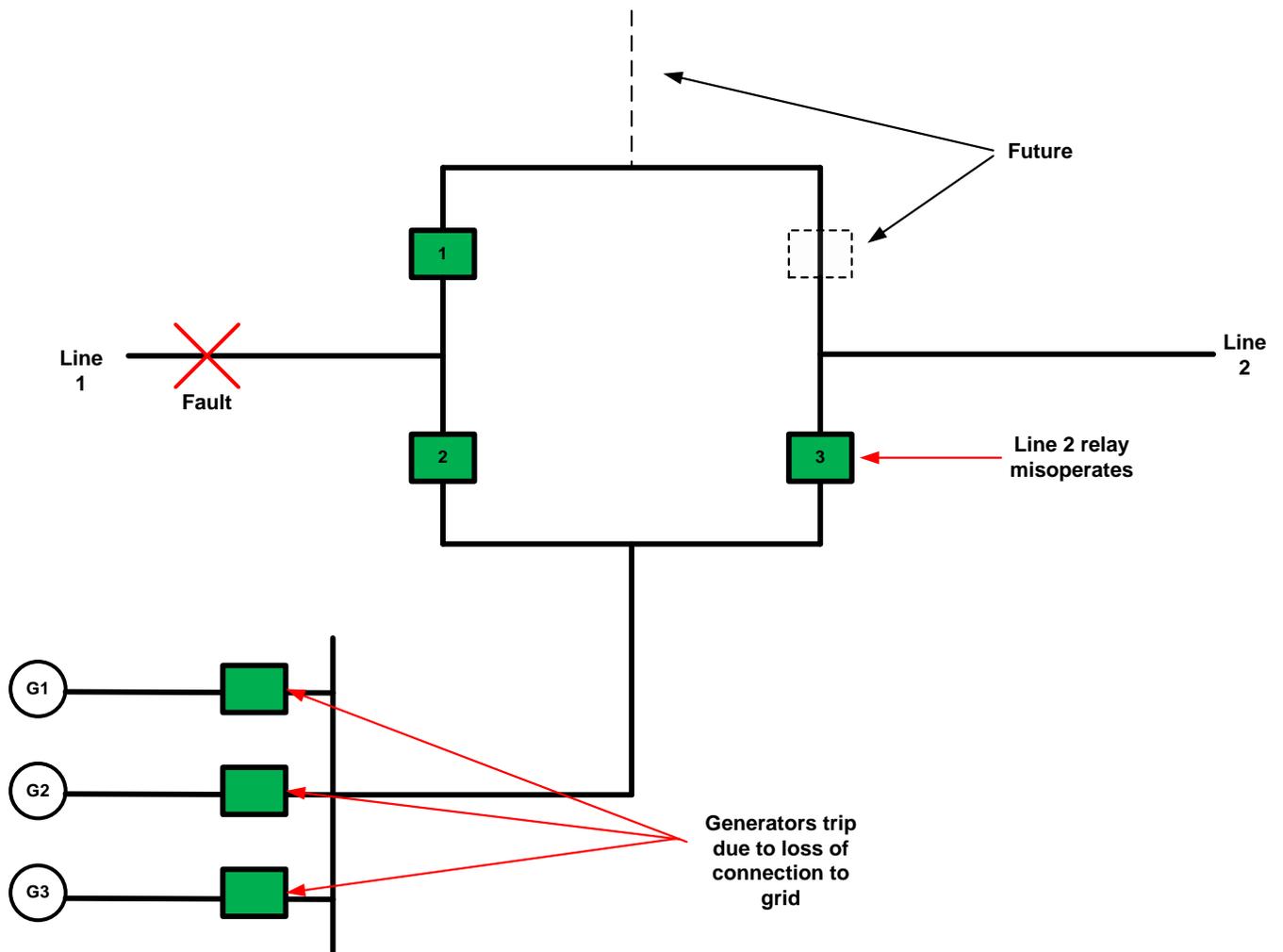
**Example 8 – Non Qualified Event**

- Breakers open at Switching Station B and C for initial line fault.
- RAS trips Generators 1 and 2 at Generating Station A.
- One line outaged
- Two generators outaged
- Everything operates as designed.
- Not a qualified event.



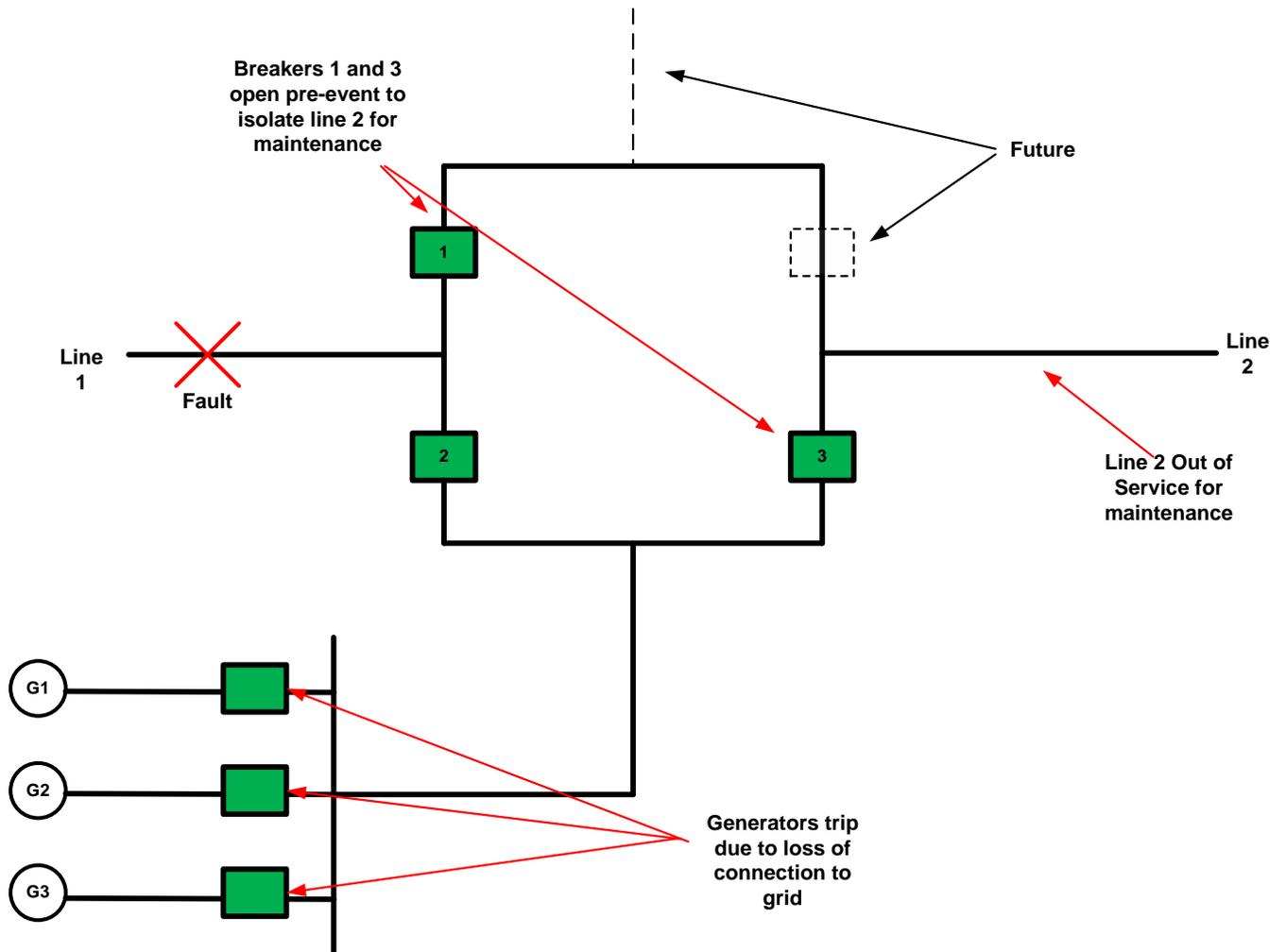
### Example 9 – Qualified Event

- Breakers open at Switching Station B and C for initial line fault. RAS correctly trips 2 generators for single line trip. Second line misoperates. RAS correctly trips 2 additional generators for 2 lines out.
- Two lines outaged
- Four generators outaged
- Count for categorization = six
- Event consists of a single line fault resulting in six elements being outaged. It was not intended by design for 6 elements (> 3) to be outaged for a single fault (common disturbance). Therefore, this would be a qualified event. (for reference see footnote 2)



### Example 10 - Qualified Event

- Initial line fault on Line 1 – breakers 1 and 2 open correctly
- Line 2 relay misoperates opening breaker 3
- G1, G2 and G3 trip due to isolation from grid
- 5 elements outaged due to a single disturbance not by design = qualified event



**Example 11 – Non Qualified event**

- Line 2 OOS for maintenance pre-event
- Initial fault on Line 1
- Breaker 2 opens correctly
- G1, G2 and G3 trip due to isolation from grid
- Four elements outaged due to a single disturbance by design = non-qualified event