



Canada's National Laboratory for Particle  
and Nuclear Physics

# TRIUMF Failure Investigation Tool

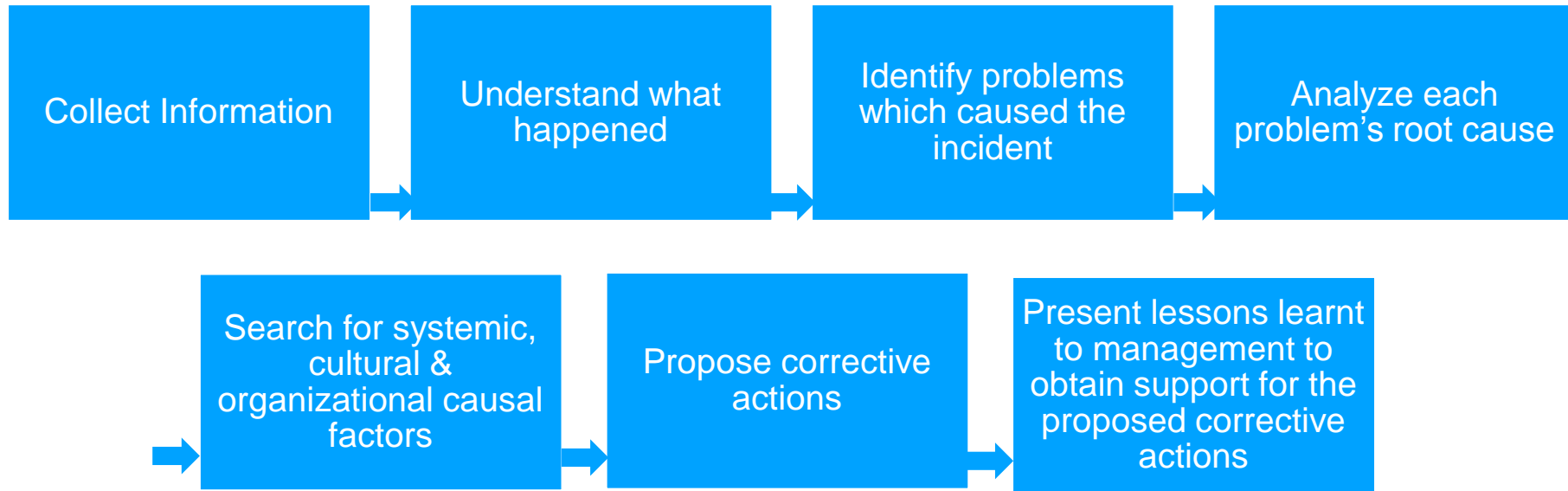
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October 17, 2017



- Introduce TapRoot®
- Incident investigation:
  - Mild consequences
  - Moderate consequences
- Summary

- Incident investigation system:
  - Human errors
  - Equipment failure
  
- Helps solve problems:
  - Reactively
  - Proactively



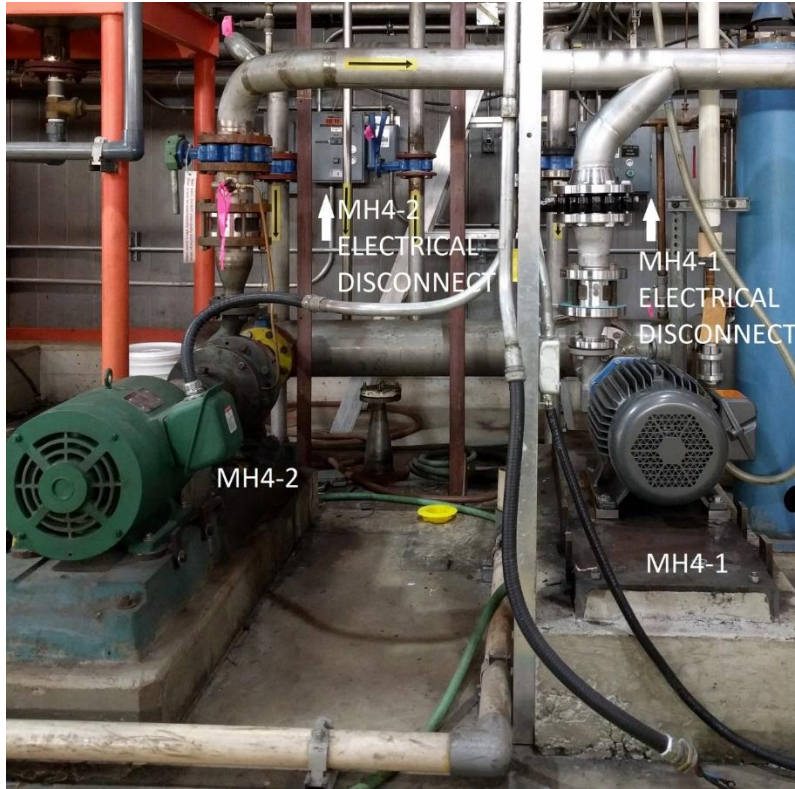
- 1) Your root cause analysis is only as good as the information you collect
- 2) Your knowledge (not only the lack of it) can get in the way of a good root cause analysis
- 3) You have to understand what happened before you can understand why it happened
- 4) Interviews are NOT about asking questions

- 5) You can't solve all human performance problems with discipline, training, and procedures
- 6) Often, people can't see effective corrective actions even if they can find the root causes
- 7) All investigations are NOT equal (some investigation steps can't be skipped)

0) Incident: safety lock applied to a water pump electrical disconnect was cut in error by somebody other than the lock owner

Steps 1 -4:

## Water pumps





11) Parts are ready

12) Water is shut off

13) PG supervisor leaves for the day before work is completed. Mechanical Services (MS) group leader takes over work coordination

15) Keys are handed over

- 17) Work finished, system brought to operations conditions
- 18) the MS group leader gives the 2 keys to an attendant to remove the lock
- 19) MS and PG supervisor communicate and PG advises MS to cut the padlock



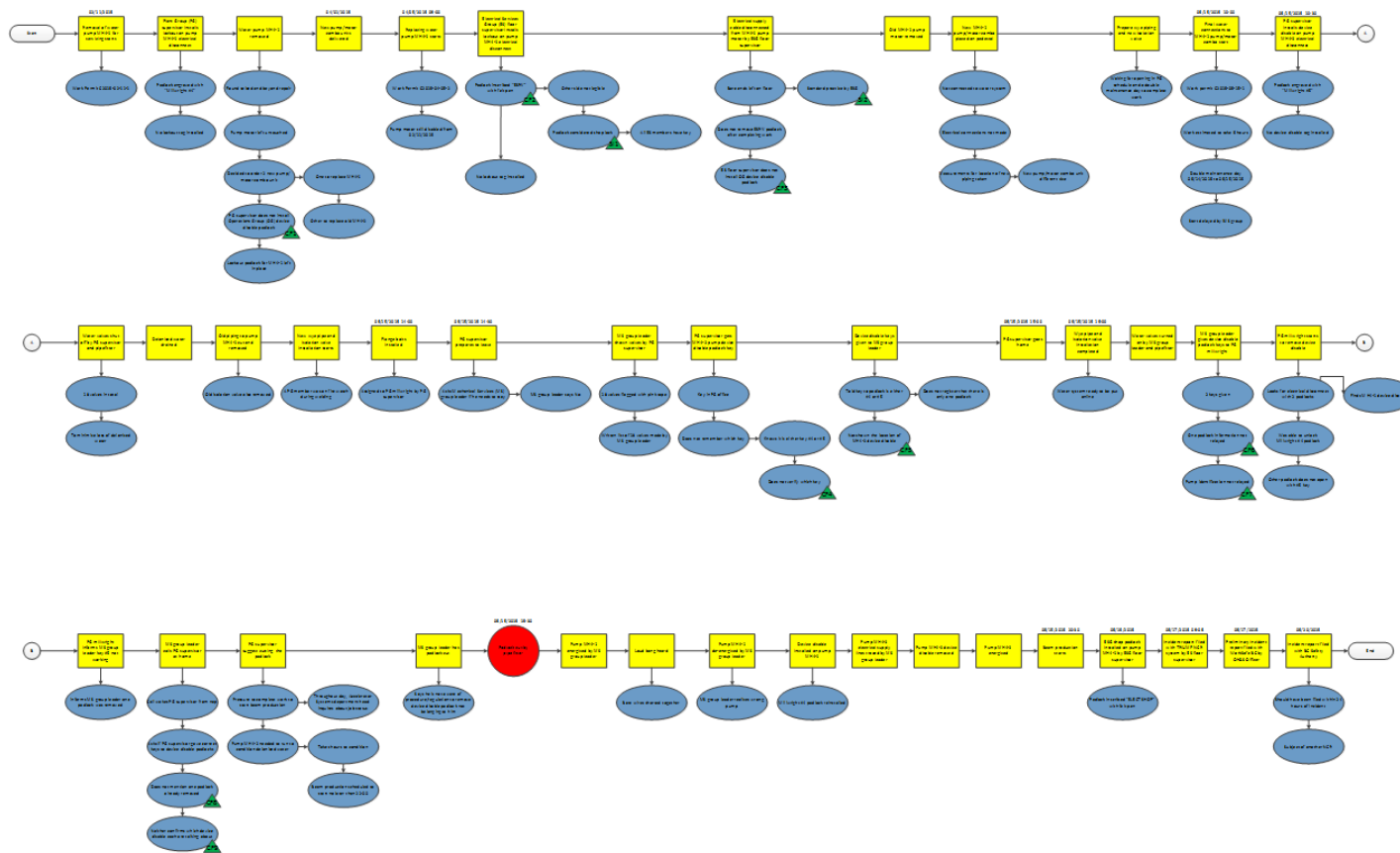


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## Cutting a Device Disable Padlock NCR 9057/9079

Violeta Toma and Hubert Hui 2016-07-12 Rev.9



- Workers (PG & ES) unaware of site lock-out procedure for multi-shift lock-out
- Use of personal lock for a multi-shift lock
- Padlocks hand inscribed, hard to read
- PG supervisor didn't check which key he needs to hand to MS supervisor
- PG supervisor didn't show MS supervisor the lock-out location
- MS supervisor didn't tell attendant that he must remove one lock-out only
- MS supervisor didn't tell attendant the name of the pump to be re-connected

- Attendant doesn't relay that a padlock was already removed
- Attendant doesn't ask which pump to re-connect



- a) Training Programme and policy/procedure
  - I. Multi-shift lock-out
  - II. Padlock label
- b) Clear policies & procedures
- c) Audits and Evaluations
- d) Inforce policy on lock-out through internal audits and disciplinary actions when applicable
- e) Timely communication of policies and procedures



- Ensure policies on Lock-out and on Device Disable are consistent
- Group training plans to reference above policies when appropriate
- Policy should be revised to include the acceptable methods of marking a lockout/disable padlock
- All TRIUMF groups using shop padlocks as part of multi-shift device disables should be made aware of current policy and change all shop padlocks to padlocks from Operations Group

- Although not required by WorkSafe BC, BC Safety Authority or BC Electrical Code, it would be best practice for any electrical wiring that has been made safe (de-energised and device disable installed) and disconnected from a device to also have the device end wires be covered appropriately
- Group supervisors to schedule periodic discussion sessions on policies and procedures and invite subject matter experts able to answer questions as needed

- TapRoot dos and don'ts:
- Don't assume
- Ask “what happened” not “why”
- Expect more than one root cause
- Human error is just the starting point of a root cause analysis
- Search for root causes that can be fixed





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Thank You!  
Merci!

Questions?

