

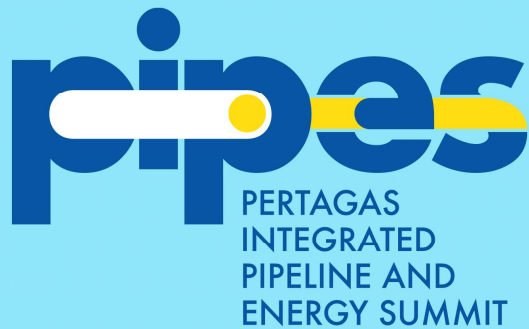


# Loss of Primary Containment (LOPC) KP 50,039 at Grissik Singapore Pipeline

Root Cause Analysis (RCA), Repair Method  
and Way forward

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# Background

- TGI performed digging verification at KP 50,039 section Grissik – Sakernan, Grissik – Singapore pipeline as part of follow up on routine inspection maintenance CIPS DCVG survey.
- Due to the pipeline under ground, excavation work has been carried out on the Grissik Singapore Pipeline, Grissik Sakernan section at KP 50,039, Senawar Jaya Village, Bayung Lencir District, Musi Banyuasin Regency, South Sumatra Province.
- During the excavation work at a depth of about 130 cm (or about 30 cm before the top of pipe), a gas was detected through the Gas Detector by the Authorized Gas Tester (AGT) personnel. Subsequently, the activity was suspended and TGI barricaded the location for access control.

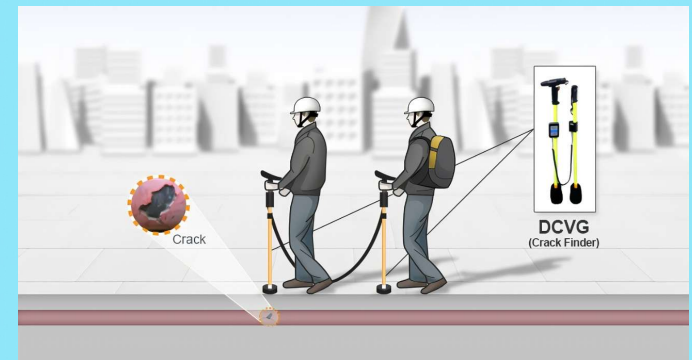


Illustration for DCVG to find coating damage

# Defect Identification

## Defect observation :

- Gouge (Mechanical damage)
- Defect length  $\pm 46$  cm and width  $\pm 4$  cm
- Pipeline coating was damaged along the gouge area
- Gas leak originated from gouge area
- Defect found was in axial orientation and the defect already penetrate to the pipe wall





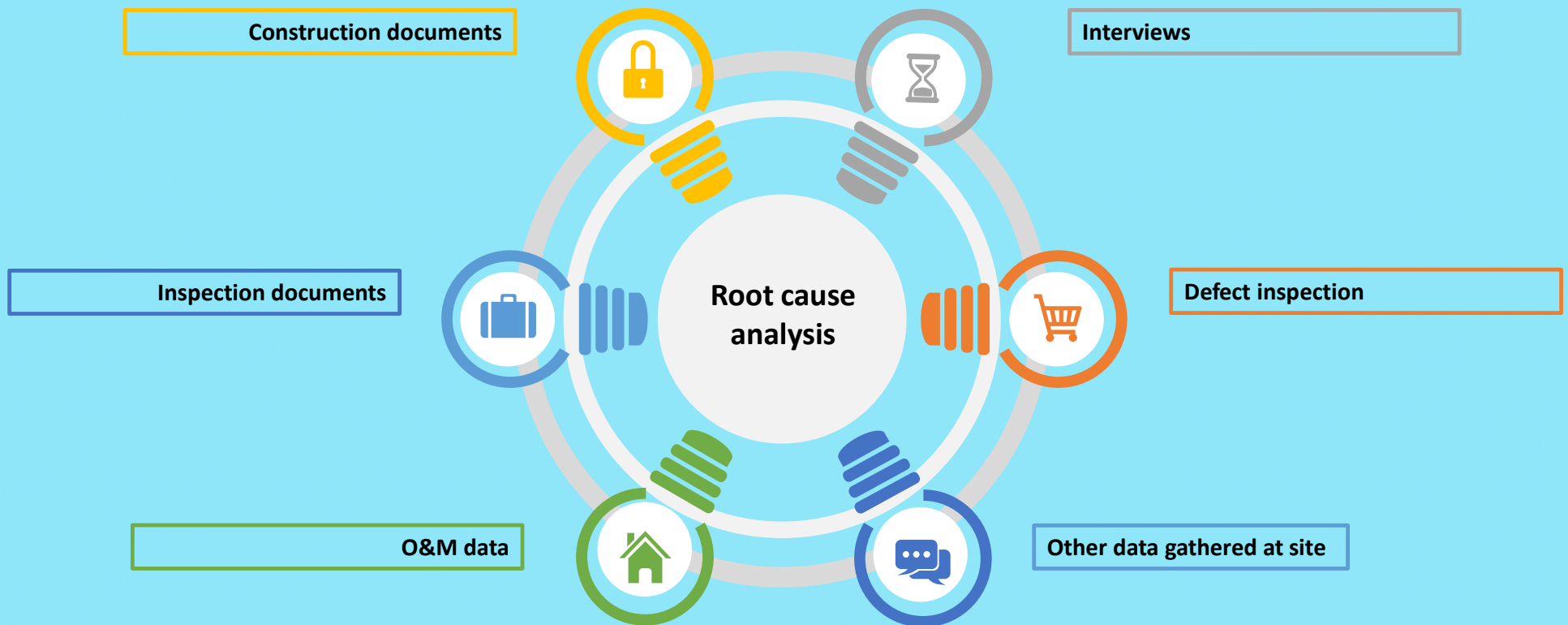
# Repair Method



## Action Taken:

- Installation leak clamp
- No gas interruption during installation
- No leak detected was clamp installed. Monitoring 24 hour and 48 hour post installation and no leak was detected

# Root Cause Analysis - Data Gathering



# Root Cause Analysis – Result

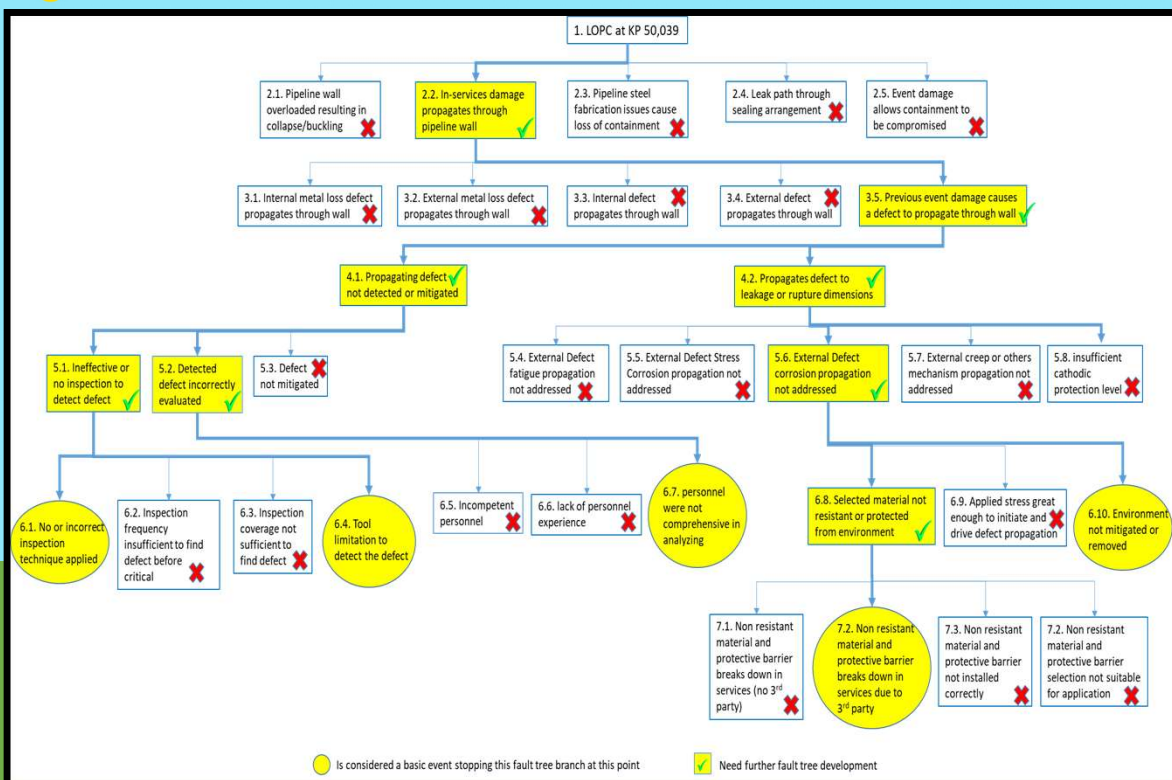
## Gouge - Mechanical damage



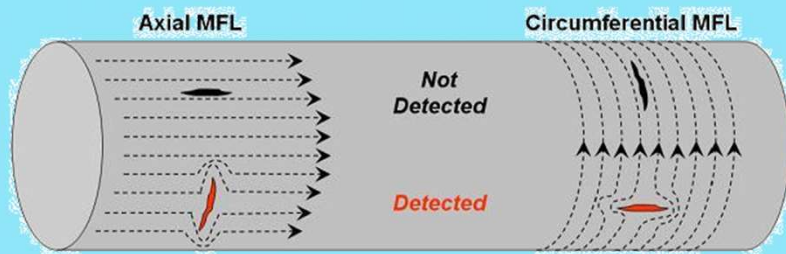
The intelligent pigging (SHR+MFL) was conducted year 2021, however the tool couldn't measure the defect, due to :

- Defect was below their tool specification therefore not categorize as defect.
- Defect orientation is in axial direction, the intelligent pigging which TGI run has capability to detect circumferential defect direction which based on TGI historical incident.

At some point 3LPE damage and pipeline metal was exposed to environment causing localized corrosion. The corrosion propagate through pipe wall.



# Inspection Tools Selection Process



Typical intelligent pigging configuration



Based on history defect and leak, all crack defect happened in grith weld, therefore in 2021 – 2022 TGI perform Intelligent pigging which intents to detect defect crack in circumferential orientation. An ILI Axial MFL SHR+ perform for both Grissik Duri and Grissik Singapore pipeline.



Based on the defect found in KP 50,039 which in axial orientation therefore TGI need to find other method or other type of Intelligent pigging which suitable to detect such defect and can be applied for 28 inch pipeline.



# Inspection Tools Selection Process

## Phonon Diagnostic Technique X

Disadvantages :

1. Need direct contact to the pipeline
2. Need to perform digging to all weld location which suspected
3. Range reading cover max 1 km
4. No track record used

Advantages :

Loss of metal of corrosive origin (extensive anomaly), single and group pits, cracks, stress-corrosion cracking and others

## Phased Array Ultrasonic Test (PAUT) X

Disadvantages :

1. Need direct contact to the pipeline
2. Need to perform digging to all weld location which suspected

Advantages :

1. Can detect crack in the weld and pipe body
2. Have been use world wide

## Metal Magnetic Memory (MMM) X

Disadvantages :

1. Can't differential the type of defect
2. Can't measure the defect

Advantages :

1. Used to find hot spot area which stress acquired in the pipeline system
2. Good for fast screening strain and stress

## Intelligent Pigging with UT technology X

Disadvantages :

Not suitable for gas pipeline, due to it need media (such as water) for the inspection.

Advantages :

Can detect crack in the weld and pipe body

## Intelligent Pigging with Electro Magnetic Acoustic Transducer (EMAT) ✓

Disadvantages :

1. Price expensive compare to standard/enhance MFL ILI tool
2. Need to combine with MFL to get better result.

Advantages :

1. Can detect crack (depend on tool orientation for detect different crack)
2. Available speed control unit.
3. Available tool size 28" for axial crack detection
4. Local company representative available

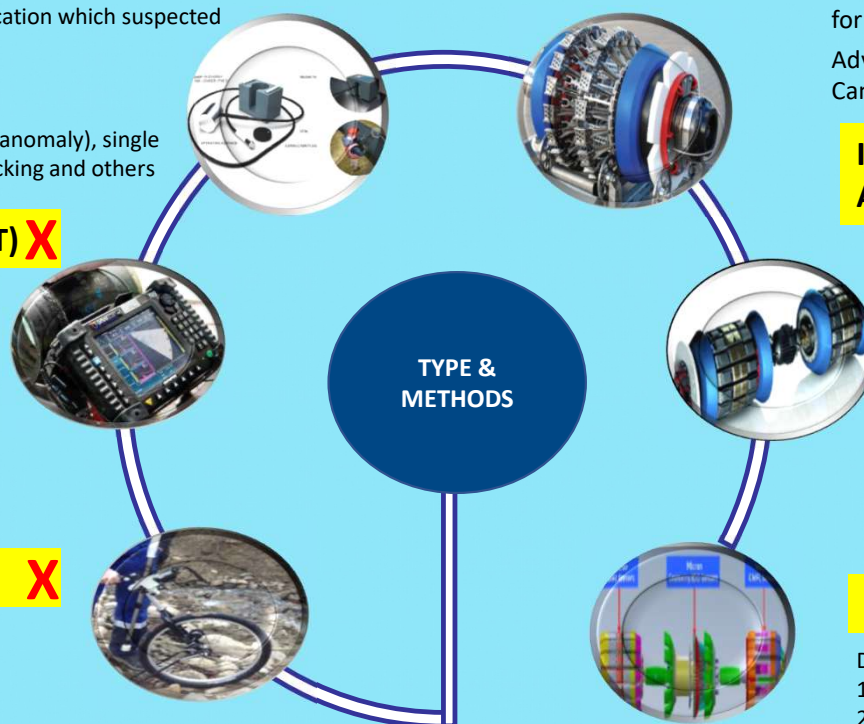
## Micron Intelligent Pigging tech X

Disadvantages :

1. Price expensive compare to standard/enhance MFL
2. Current diameter only up to 16"

Advantages :

1. It can detect crack
2. Local company representative available



# Inspection Tools Selection Process

ILI EMAT is a non-destructive inspection (NDI) technology used for detecting defects such as cracks, corrosion, and delamination inside pipelines. It utilizes **electromagnetic acoustic transducers (EMATs)** to generate and receive ultrasonic waves **without requiring a liquid couplant**.



## Advantages of EMAT over Traditional Ultrasonic Inspection

- ☑ **No Couplant Needed** – Works in dry conditions.
- ☑ **Effective on Rough or Coated Surfaces** – Unlike conventional UT, which requires smooth surfaces.
- ☑ **Capable of Inspecting Moving Pipelines** – Ideal for inline pipeline inspections.
- ☑ **Sensitive to Surface and Subsurface Defects** – Provides a detailed assessment of structural integrity

## How it work??

Generation of Ultrasonic Waves via Electromagnetic Induction



Propagation of Ultrasonic Waves in the Pipe Wall

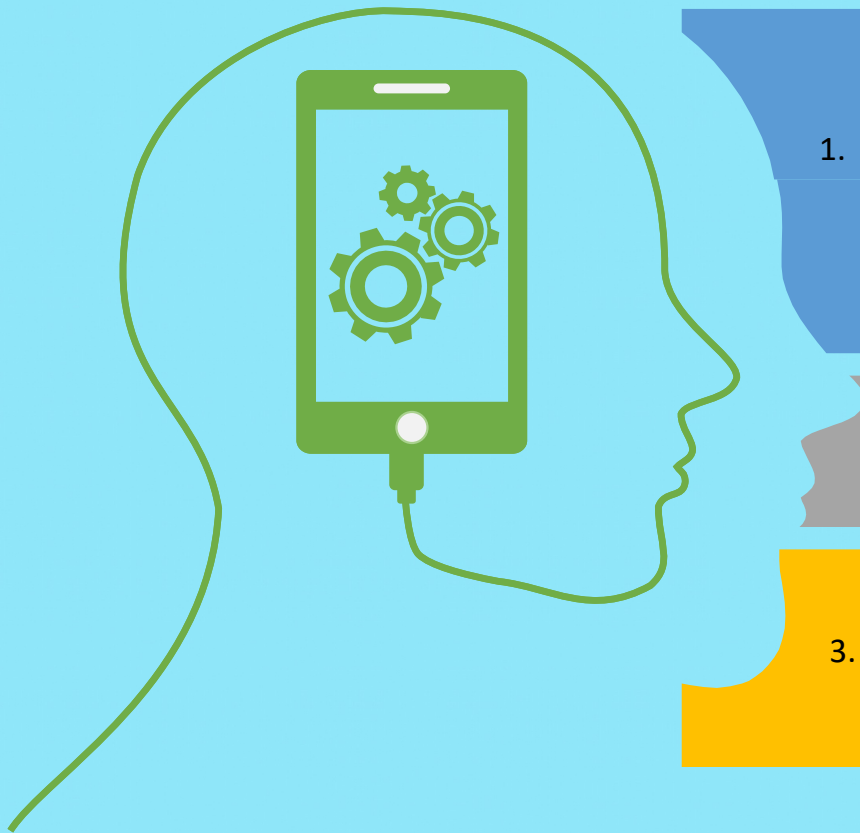


Detection of Defects



Data Processing and Analysis

# Way Forward



1. Communicate with previous ILI Principal to take a look into detail again the previous result which may have similar defect.

2. Perform permanent repair by Installing welded sleeve over clamp

3. Perform 28" EMAT tool for axial and/or circumferential defect detection



# TERIMA KASIH

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