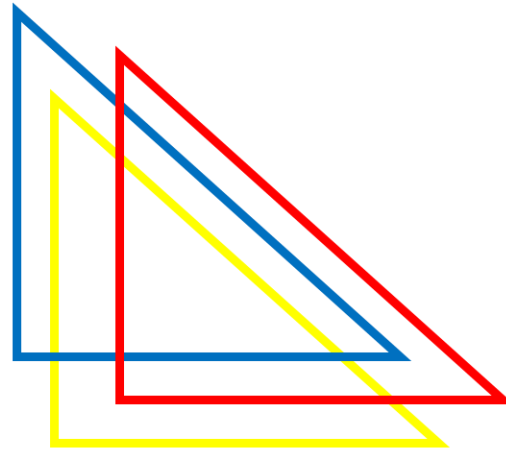


# ADDRESSING THE HIGH NUMBER OF OCCURRENCES IN THE SOUTH AFRICAN RAILWAY INDUSTRY: A HUMAN FACTORS/ ERGONOMICS SOLUTION



**SMART ERGONOMICS**

**Presented by:**

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**1 October 2019**

**Devonvale Golf & Wine Estate, Stellenbosch**

# OVERVIEW

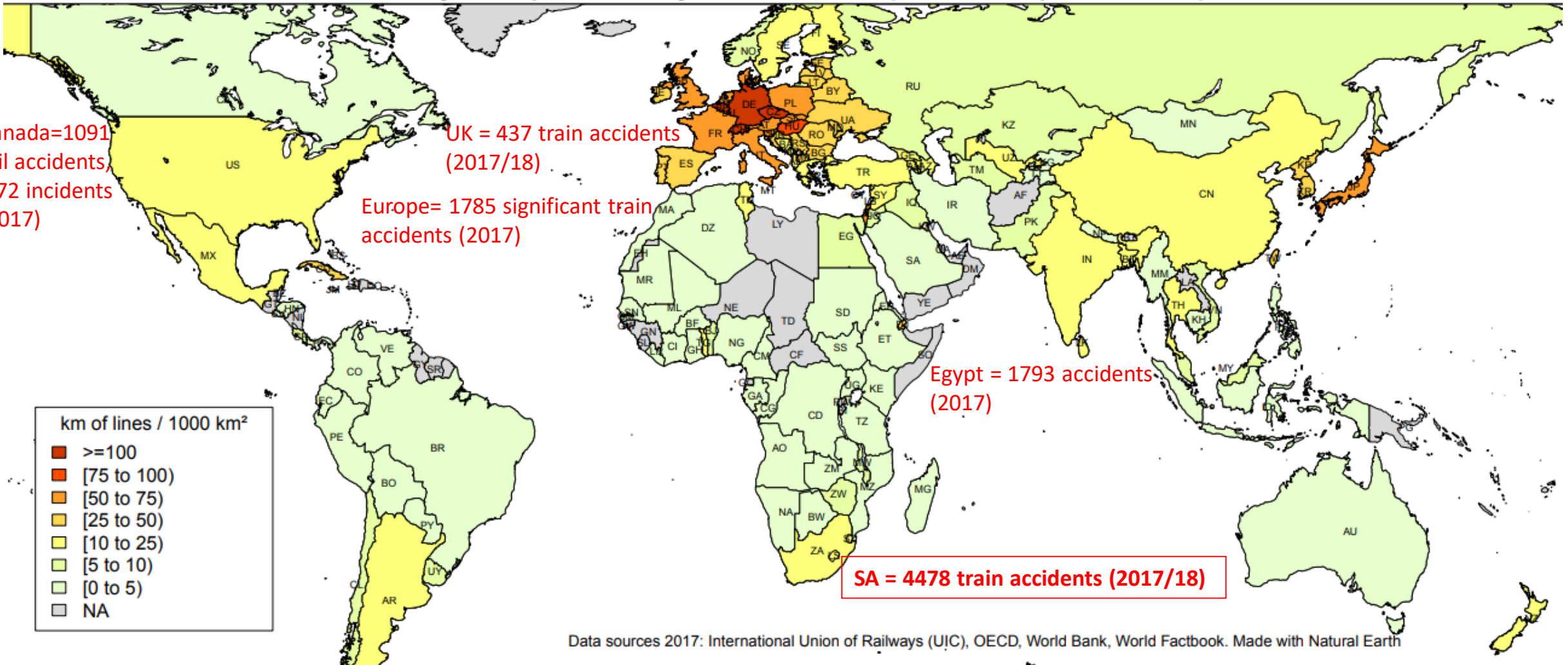


- Occurrence statistics
- Contribution of human factors/ ergonomics (HF/E) deficiencies in railway occurrences
- HF/E in the South African railway industry
- Proposed HF/E solution aimed at reducing occurrences
- Conclusions & invitation to railway stakeholders

# OCCURRENCE STATISTICS



**Railway Transport: Density of the Network (km of lines per 1000 km<sup>2</sup>)**



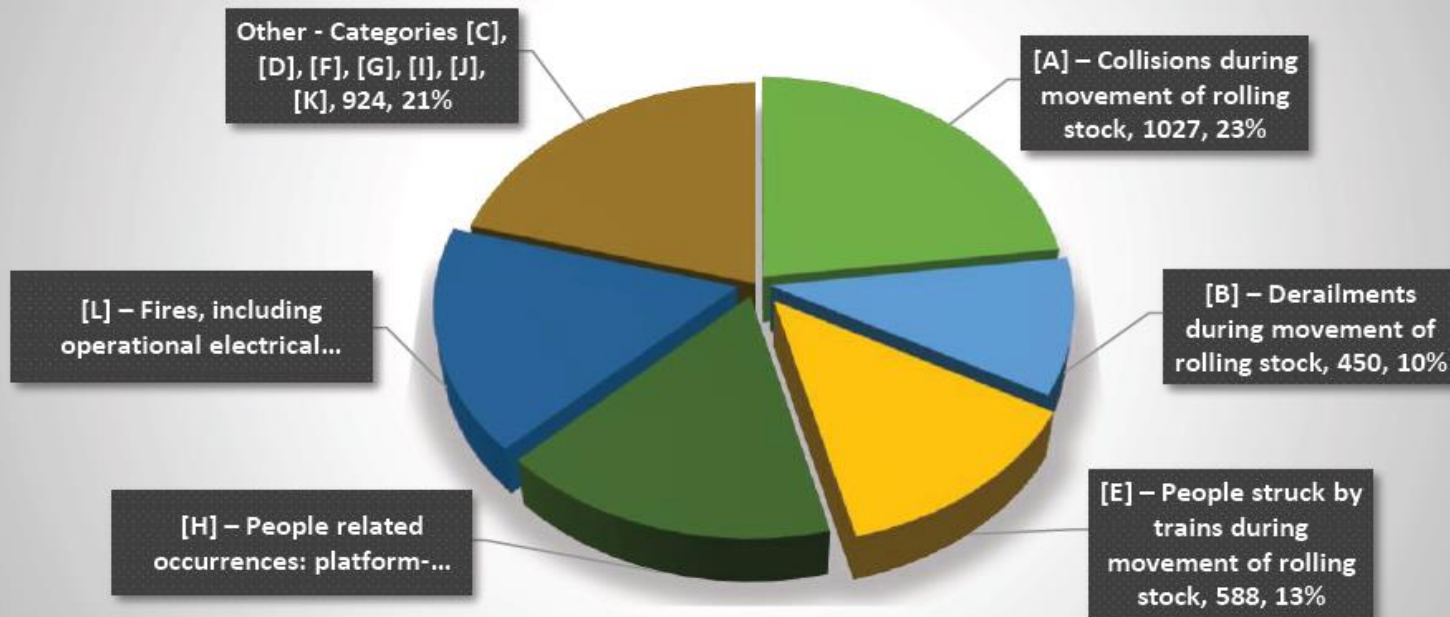
Data sources 2017: International Union of Railways (UIC), OECD, World Bank, World Factbook. Made with Natural Earth

# OCCURRENCE STATISTICS

## SA RAILWAY INDUSTRY 2017/18

(RSR state of safety 2017/18 report)

### Top 5 operational occurrences for 2017/18



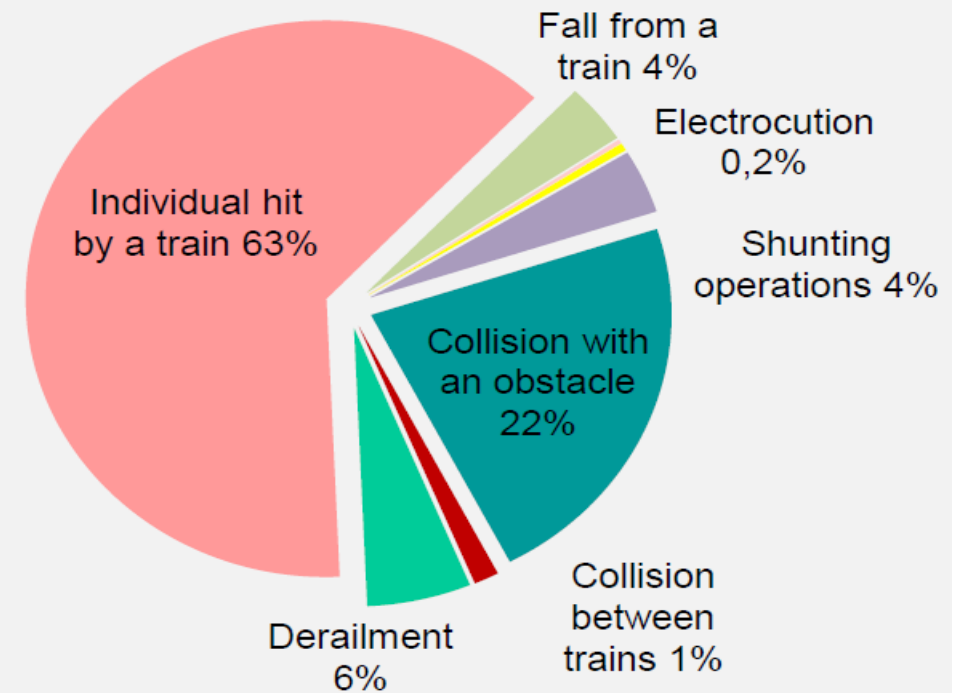
SA: Top 3 categories with highest number of occurrences:

- Collisions 23%. (91% = collisions with an obstacle on running line, 1% = collisions between trains)
- People struck by trains (13%)
- Fires (16.6% & Platform-train interface occurrences (16.6%))

## EUROPEAN RAILWAY INDUSTRY 2017

(UIC safety 2018 report)

### 2017



Europe: Top 3 categories

- People struck by trains (63%),
- Collision with obstacle (22%)
- Derailments (6%)

# OCCURRENCE STATISTICS



**SA RAILWAY OCCURRENCE STATISTICS ARE SOME OF THE HIGHEST WHEN COMPARED TO AVAILABLE STATISTICS FROM AROUND THE WORLD!**

- Risk profiles in SA vs Europe vs Canada and other countries/regions are different = causal factors for occurrences are likely also different
- Interventions will only be effective if they address the risk factors
- Do we understand and are we effectively managing the risk factors that contribute to occurrences within the SA railway industry?
  - Have we identified the risk factors?
  - Have we measured the risk factors?
  - Are we monitoring the risk factors?
  - Can we use empirical data of risk factors and occurrences to predict and/or model occurrences?

## COST OF OCCURRENCES

The collective cost of railway occurrences is high

- Harm to people and loss of lives
- Economic repercussions that are borne by workers, railway operators, communities and the SA economy at large

## INTERVENTIONS?

- Urgent need to reduce occurrences and make railways safer
- Need focussed interventions to be developed and implemented with the view of arresting the high number of occurrences
- **Interventions should be underpinned by empirical evidence of risk factors and contributory factors**

# OCCURRENCE CAUSAL FACTORS

## SA RAILWAY INDUSTRY 2016/17

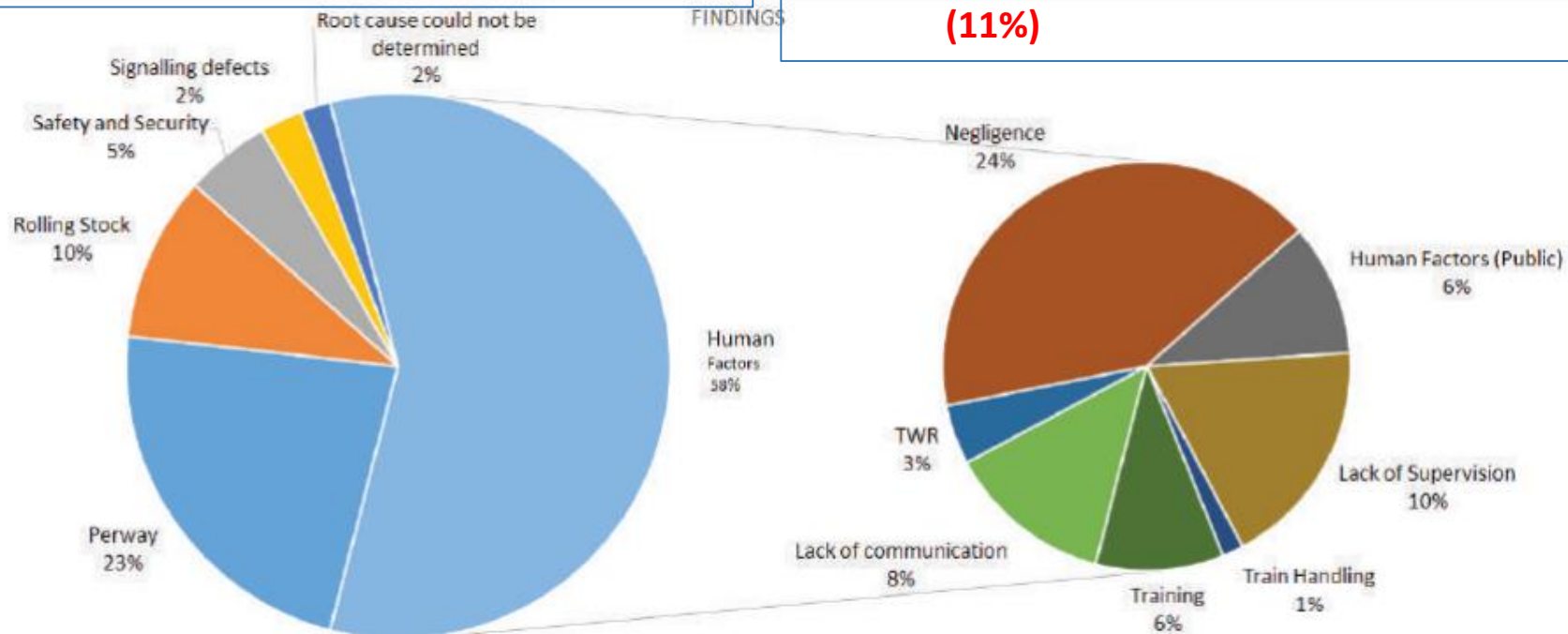
(RSR state of safety 2016/17 report)

- “Close to **60%** of all occurrences investigated by the RSR were because of a **human factor-related** root cause”.
- No comprehensive methodology on how the human factors root causes were identified and classified is available
- No further tracking of the identified human factors contributory causes in subsequent years

## SA RAILWAY INDUSTRY 2017/18

(RSR state of safety 2017/18 report)

- Contribution of HF factors not quantified in 2017/18 report
- HF contributory factors continued to feature as contributory factors in the report
- What is the status of HF contribution to occurrences in 2018/19?
  - **66.7% contribution of human factors elements to occurrences-non-adherence to SOPs (21%) and negligence (11%)**



# OCCURRENCE CAUSAL FACTORS



## SA RAILWAY INDUSTRY 2016/17

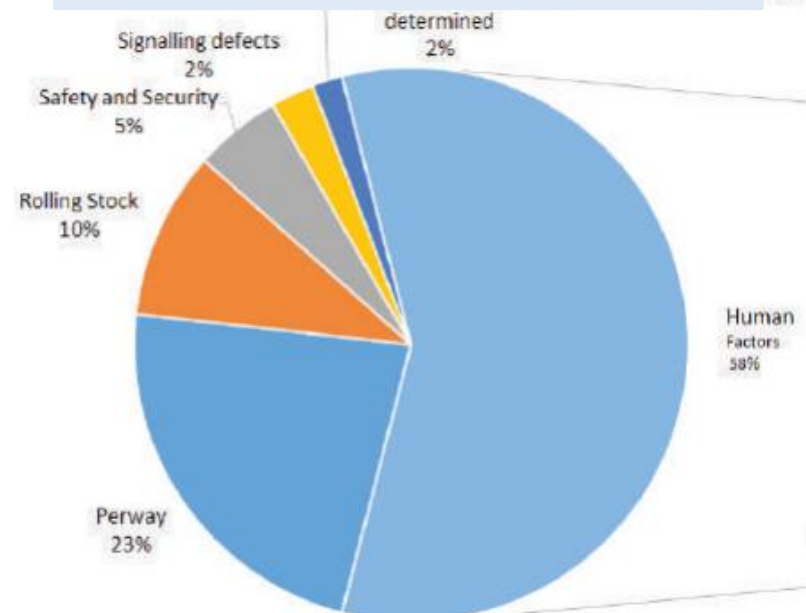
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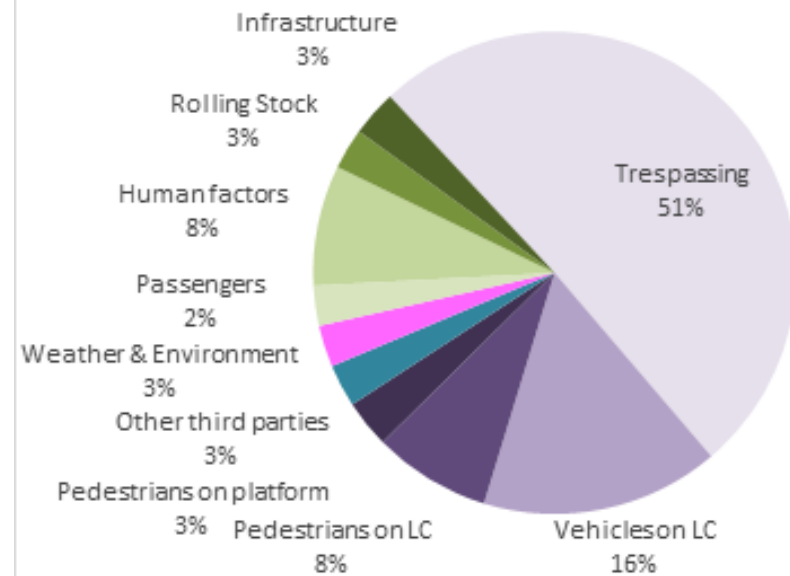
## US & EUROPEAN RAILWAY INDUSTRIES

- **8% = Human Factors** = biggest contributor to the internal factors in the European railway industry (UIC safety 2018 report)
- **38%** of train accidents that occurred were **caused by human factors** related factors in the US (National Rail Safety Action Plan Final Report 2005-2008, Federal Railroad Administration)

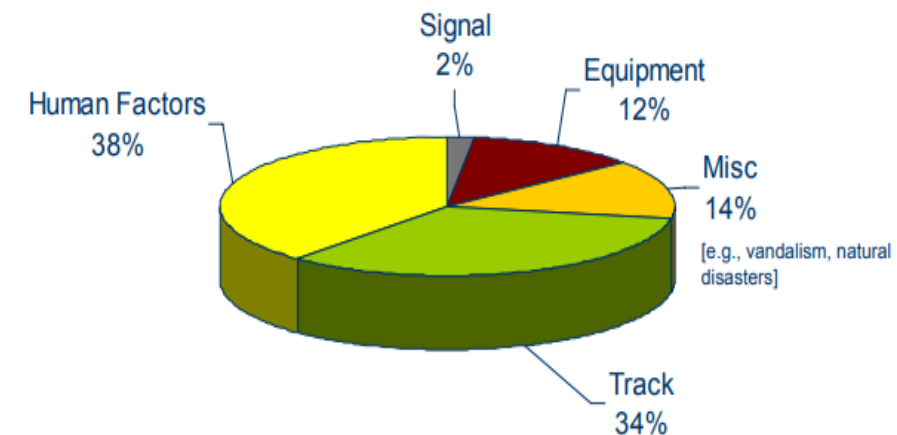
### South Africa (60-66.7%)



### Europe (8%)



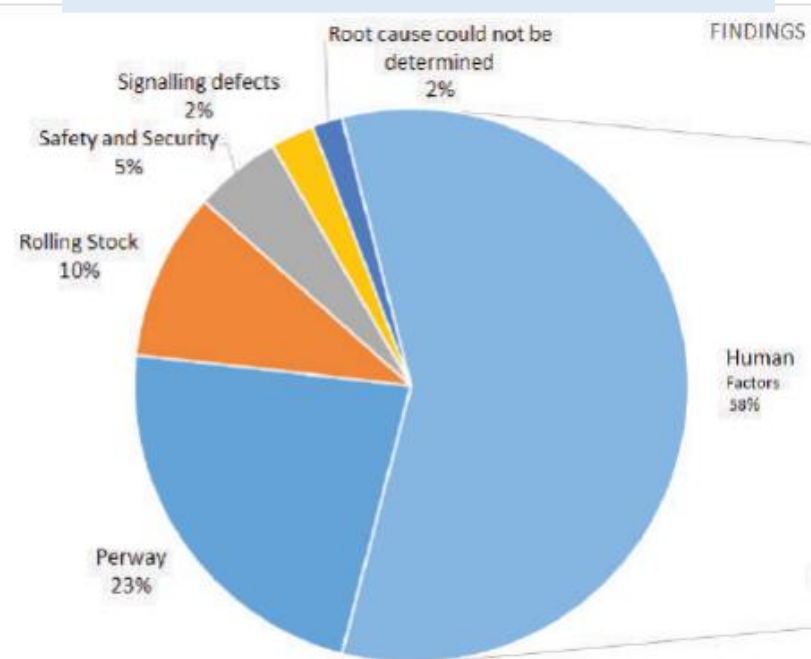
### USA (38%)



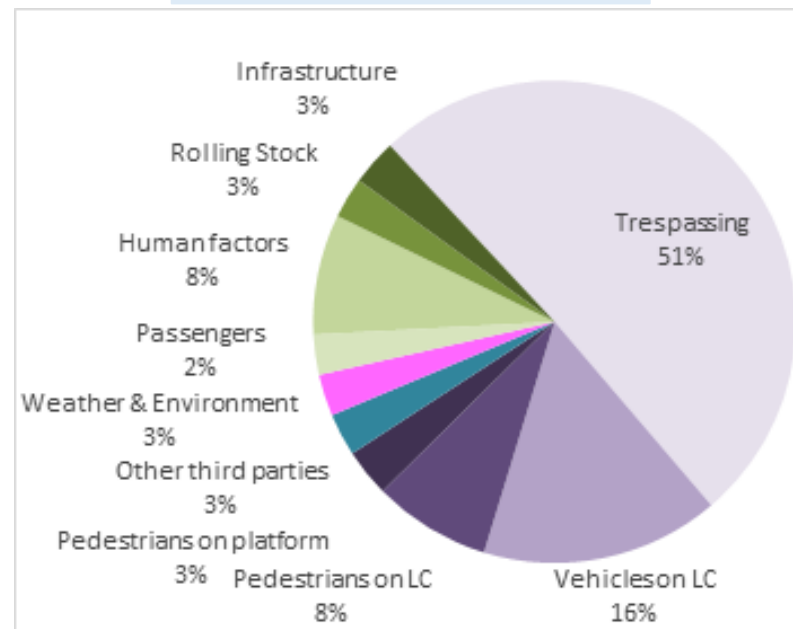
2002-2007 Values Preliminary

# OCCURRENCE CAUSAL FACTORS

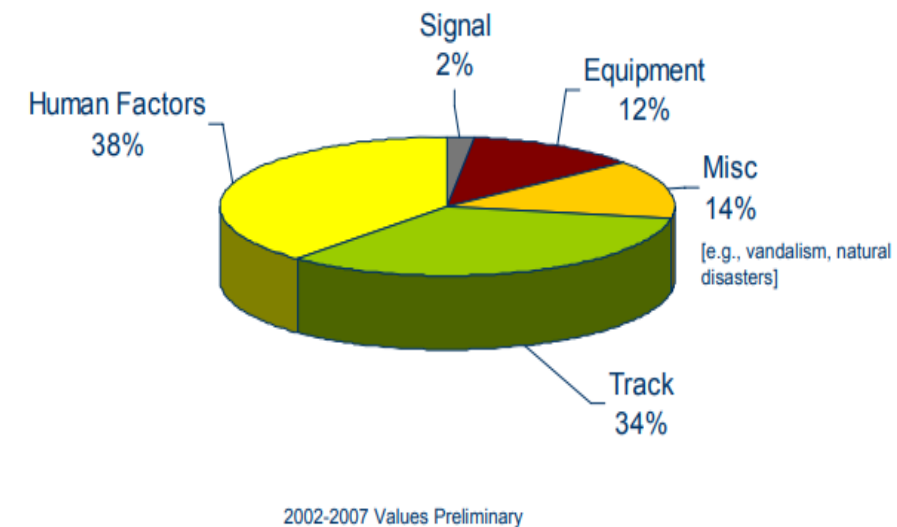
## South Africa (60-66.7%)



## Europe (8%)



## USA (38%)



- 8% vs. 38% vs. 60-66.7% human factors contributory factors to occurrences = huge variance
- Variance could be attributed to
  - Different identification & classification methods used to delineate HF contributory factors
  - Differences in railway system complexity and technologies used
  - Different levels of integration and implementation of HF in Europe vs SA
- **HUMAN FACTORS/ ERGONOMICS RELATED CAUSES PLAY A ROLE IN RAILWAY OCCURRENCES.**
- **HOW BIG IS THIS ROLE IN THE SA RAILWAY INDUSTRY?**



# HF/E IN THE SA RAILWAY INDUSTRY



## HF/E LEGISLATIVE REQUIREMENTS FOR RAILWAY OPERATORS

- Human Factors Management in railway operations is legislated in SA
  - Occupational Health & Safety Act 85 of 1993
  - NRSR Act 16 of 2002
  - SMS determination requirements for railway safety permit (Government Gazette No. 41632)
  - Human factors management standard (SANS 3000-4: 2011)
  - Fatigue management standard (RSR 00-4-1)
  - Occurrence management standard (RSR 00-3)

## COMPLIANCE TO HF/E LEGISLATIVE REQUIREMENTS BY RAILWAY OPERATORS

- Verification audits conducted by the RSR suggest that compliance levels are variable
- More explicit HF/E requirements included in the SMS Determination (e.g. fitness for duty, workload) = Gaps in terms of comprehensive HF/E policies and procedures as well as integration of HF/E into SMS are revealed

# HF/E IN THE SA RAILWAY INDUSTRY



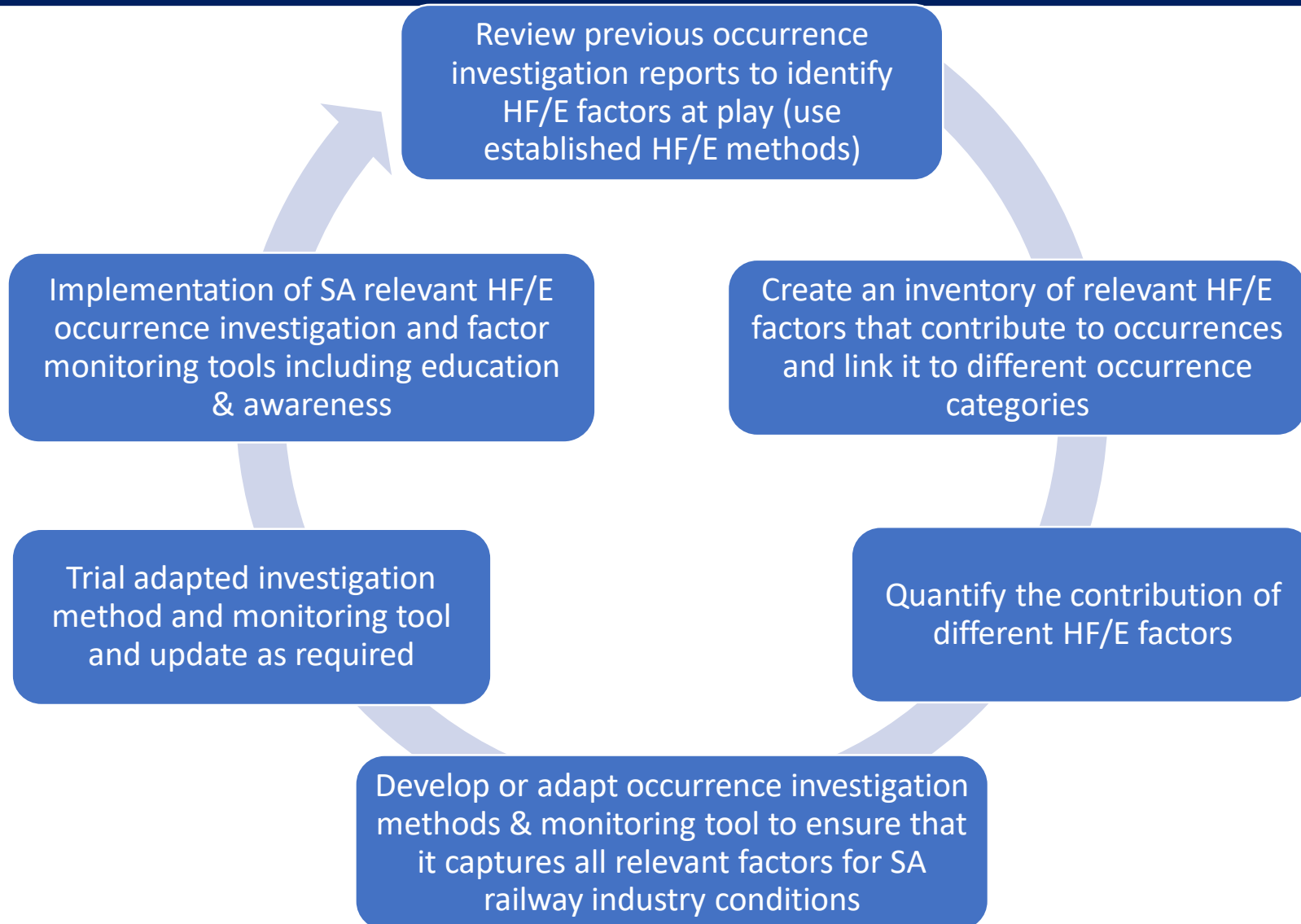
## IDENTIFICATION OF HF/E CONTRIBUTORY FACTORS

- Legislative framework requires that operators identify all contributory factors = includes HF/E related factors
- Occurrence investigations predominantly do not adequately identify all HF/E related contributory causes
- Tendency is to focus on personnel behaviour at the point when the occurrence happened vs looking at the system failures
- Operator interventions usually worker focussed (discipline/ fire the worker/ send for training) instead of fixing the system failures = recurrence is high

Occurrence	Description	Suggested interventions
Averted collision	<ul style="list-style-type: none"> <li>• The TCO had <b>forgotten</b> that train A was leaving depot/station on the same line from the opposite direction and set the points for the movement of the train in the wrong direction</li> <li>• The TCO was distracted due to <b>performing many authorizations at the same time</b>.</li> <li>• The TCO <b>also had to operate for the failed train to go to yard B</b>. At the same time she was operating for other train movements from the station.</li> <li>• The TCO authorised the train A ... and had <b>forgotten about train B that was leaving the station on the same line</b> from the opposite direction.</li> <li>• The TCO reported that she did not protect the train movement when authorising train A and that <b>reminders</b> (magnetic strips and caps placed on the CTC to indicate the position of trains and where occupations are occurring) could have <b>helped to remember where the trains were</b></li> </ul>	<p>The train operator's management must ensure that there is <u>compliance to the Train Working Rules</u>, General Instructions and operational safety norms and standards.</p> <p><u>Supervision</u> must be provided to ensure safe working of trains during abnormal conditions.</p> <p>The train operator's management should ensure that all personnel engaged in the working of trains in the CTC are <u>inducted in the local operating instructions</u>.</p> <p><u>Supervision</u> of the first independent shifts for employees from RPL training is performed as required.</p>

- Interventions do not adequately address the pertinent HF/E risks (averted collision example: fatigue, workload not addressed)
- No industry guidelines for operators and the Regulator on how to identify or classify HF/E related factors
- No comprehensive (making use of established HF/E methods) railway industry-wide study on HF/E contributory factors has been done in SA

# PROPOSED HF/E SOLUTION



# CONCLUSION



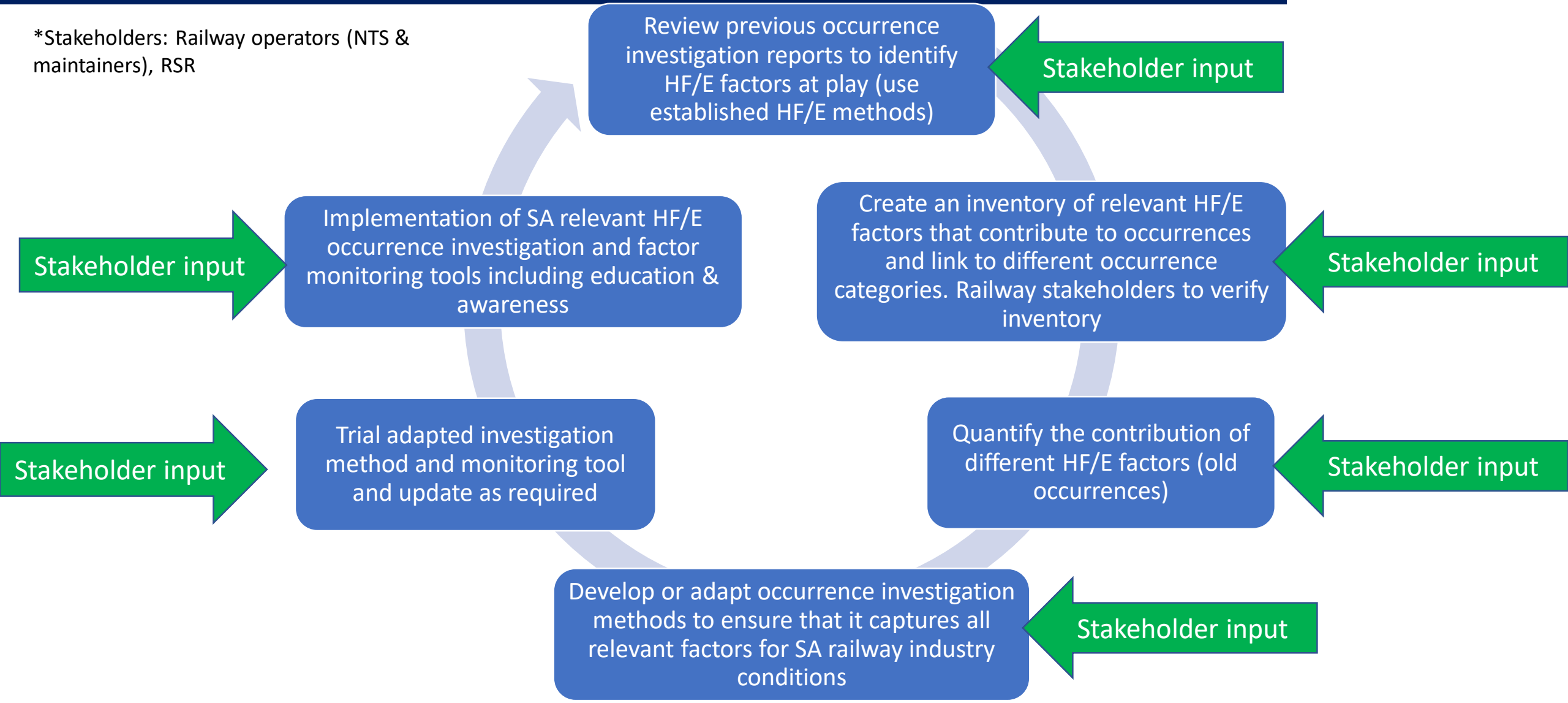
- HF/E factors contribute to railway occurrences
- Currently in SA we do not know which HF/E factors are critical in terms of their contribution to occurrences in the various categories. Risk is that unmanaged HF/E risk factors will continue contributing to already high occurrences
- Management of HF/E risk factors requires effective identification, quantification, monitoring of risk factors within operator organisations, from the Regulator, and the entire railway industry
- Requires collaborative and participatory approach with all railway stakeholders

# RAILWAY STAKEHOLDERS\*

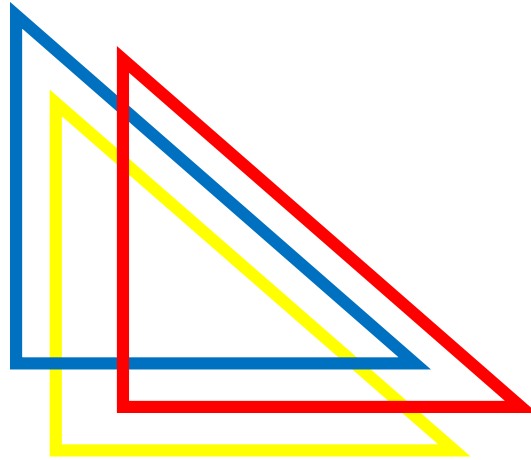
## INVITATION TO PARTICIPATE



\*Stakeholders: Railway operators (NTS & maintainers), RSR



# THANK YOU FOR YOUR ATTENTION



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