

**Methodology to
build Key
Performance
Indicators (KPIs):
for industrial or
occupational
safety?
How to build
efficient KPIs?**

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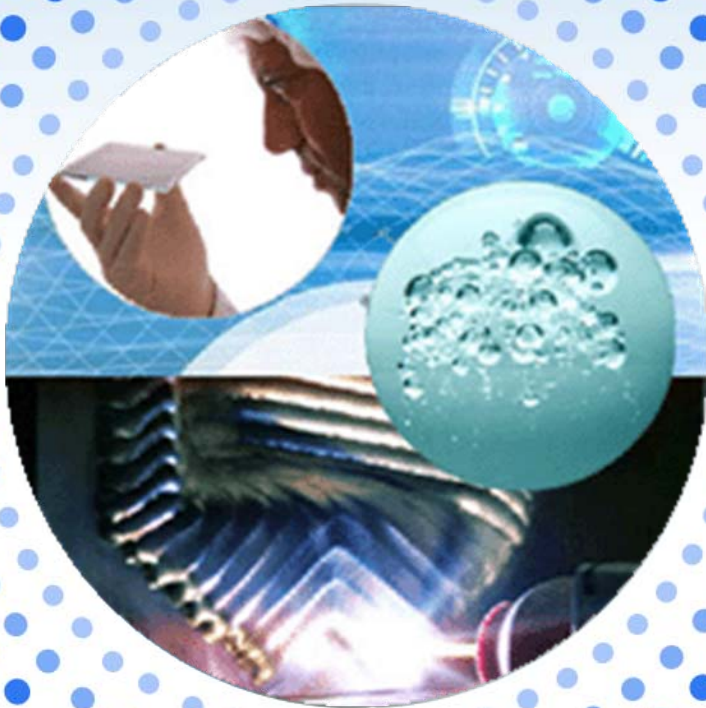




Table of contents

- ⊙ Scope for KPIs (iNTEg Risk)
- ⊙ Occupational safety or/and industrial safety?
 - Characterization
 - Indicators
- ⊙ State of art on indicators
 - Their use to make diagnosis and prediction, indicators in the nuclear field
 - Efficient features for indicators (T, H, O)
 - Reference to AIEA conclusions
- ⊙ Conclusion: Advantages and drawbacks of indicators



KPIs: proposal for scope

◎ Key

- Relevant clue

◎ Performance

- Operation and/or **Process safety** and/or *Occupational safety*
- *Our point of view: (Process) safety and not (only) operation*

◎ Indicator

- Making sense regarding SAFETY
- A set of indicators or One global indicator ???



Indicators for Safety or for Availability ?

- ⊙ **Performance: set of properties defining system functioning but not its safety (availability, efficiency, profitability, productivity, ...)**

KPIs : Safety or Performance ???

- ⊙ **Indicators are different ...**
 - **Easier to make an “availability” diagnosis rather than a safety “diagnosis”**
 - **The day before a major accident some “performance indicators” could be “green” (e.g. BP refinery at Texas City)**
- ⊙ **... but could overlap**
 - **Organisational factors could have effects both on safety and performance**



Occupational Safety or/and Industrial Safety?

- ⊙ The iNTeg-Risk project => performance indicators
- ⊙ Occupational Safety [Hopkins 2000, Baker Panel 2007] => individual safety
 - Refers to individuals
 - Accidents such as falls, trips, crushing, electrocution, vehicle accidents...
- ⊙ Industrial Safety => process safety
 - Refers to the process, the different types of hazards, the incidents linked to the process
 - With potential damages to the plant (including employees) and to the environment
 - And possible generation of multiple fatalities or diseases
- ⊙ Presence of an effective **Personal** SMS does not ensure systematically an effective **Process** SMS
 - Managing one does not mean managing the other one: e.g. Texas City



Lagging and Leading Indicators

- ◎ **Reactive** monitoring: use of **lagging** indicators
 - Failures in use ⇔ Operational feedback
- ◎ **Active** monitoring: use of **leading** indicators
 - Measures of safety activity or failures revealed by safety activity ⇔ **NEW vision** for Operational feedback

	Lead	Lag
Personal SMS		BP Texas City, Exxon Longford
Process SMS	Challenge for iNTEg Risk	DC 10 Ermenonville

Dimensional of Indicator Space



State of art on indicators

◎ 2 complementary aims:

- For appraisal, overview

→ picture of a function (technical, social, economical,...) = **DIAGNOSIS**

- To allow forecast (sensible extrapolation)

→ trend, evolution = **PROGNOSIS**

⇒ Use in numerous fields of activities : health, criminality, economics, social satisfaction, road security...

◎ Lessons to be learned:

- Global indicators → large samples

- Specific indicators → small samples

- Indicators must be built according to an 'ad hoc' method in order to fulfill a precise goal

- Indicators are not « **self understandable** »

- They **need to be analyzed, interpreted**



Lessons learned in the nuclear field

- ⇒ An additional fundamental aim : to detect damages to safety and to in depth defense as soon as possible
- A shared knowledge data base for global indicators (AIEA, NRC, ...): Reactor Automatic Shutdowns; Number of Safety related Events; Fortuitous Unavailability Rate; Outages; Radiation protection (Dosimetry); ...

Moreover : indicators could be related to

- A specific issue (e.g. life cycle management)
- A Risk informed approach
- The Organizational context



What about the past experiences in indicators?

- ⊙ A trend to multiply indicators
- ⊙ Interpretation difficulties
- ⊙ Necessity to know the ‘models’ leading to safety degradation (causality data)
- ⊙ Lessons do not seem to be learned from the past (towards use of indicators)
 - ⊙ **Back and forth behavior**
 - ⊙ *However, indicators are very useful, or even, mandatory*



Efficient features for indicators (T,H,O) (1/3)

Example from Nichols and Marcus (University of Minnesota,1990) : « It is important to prevent accidents and radioactive release: So, it is intended that indicators forecasting potential problems should be developed before they occur. »

- ⊙ **Theoretical and methodological questions complement one another**
 - **Data collection**
 - **Treatment**
 - **Analysis**

Knowing that:

- **The number of indicators increases => impact on data collection, treatment and analysis**
 - **Uncertainties => uncertainty, bias or mistake on the conclusions**
- ⊙ **Necessity to be objective**



Efficient features for indicators (T,H,O) (2/3)

Scientific features

Mandatory

- Validity (measure of the defined criterion)
- Accuracy, reliability (reproducibility)
- Robustness (stability in relation to inopportune or untimely changes)

Trade-off dimension

- Simple in use
- Transparency
- Cost-effectiveness
- Sensibility (ability to detect **small** changes)
- Relevant balance between specific and generic
 - Two pitfalls to avoid:
 - To focus on indicator in forgetting the “real life”
 - To take account of the overall situation in forgetting specific changes “here and now”



Efficient features for indicators (T,H,O) (3/3)

◎ Practical Features

- Simplicity and easiness of implementation and use
- Convenience for drafting results
- Allowing a reliable, sound and with no bias interpretation

Scientific **and** Practical **features give implicit ways for building indicators**



Reference to AEIA conclusions

- ⊙ **Necessity for a set of indicators ...**
- ⊙ **... that can not be used solely.**
- ⊙ **Importance to reach an equilibrium between leading and lagging indicators**
- ⊙ **Importance of the engineer judgment and calculation tools**
- ⊙ **Assessment using quantitative indicators AND periodic qualitative analysis**
- ⊙ **Opinions and approaches lead in the different countries are significantly different → Need for harmonization**
- ⊙ **Need for indicators according to the public, the citizen**
- ⊙ **Need to ensure that these indicators are transparent and understandable AND not submitted to manipulations**



Conclusion: Advantages and drawbacks of indicators

Built using the previously defined features...

Indicators are:

- ⊙ Way to make objective intuitions and observations
- ⊙ Possibility to provide organizations with early warnings
- ⊙ But « The map is not the field ». The indicator is only a tool.
- ⊙ Though indicators seem to be useful, not to say essential as they give a global and “expurgated” picture of the situation
- ⊙ One can always wonder if certain risks and malfunctioning could not be detected through this indicators mechanism
- ⊙ Have to be completed with others tools: safety audit, organisational analysis...