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**18-19 SEPTEMBER 2019**  
ISTANA HOTEL, KUALA LUMPUR  
MALAYSIA

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## Smart HAZOP – Innovate & Digitalize



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# Disclaimer



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# HAZOP Review



- Hazard and Operability (HAZOP) review is a commonly applied **hazard identification methodology** in the process industries
- The primary objective is to identify the Safety, Health, Environment (**SHE**) **hazards** and **operability concerns**
- The methodology is in-use for more than **50 years**



# Case for Action



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- The HAZOP review provides the **opportunity** to identify the SHE hazards so that adequate control measures can be put in place
  - **Team** based brainstorming activity
  - Quality depends on the **team members knowledge, skills and work experiences**
  - Challenge for the organizations to **retain** team members with right knowledge, skill-set and experience in each discipline/role



# Case for Action



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- The existing work process is not robust enough to codify the lessons learnt from the **past process safety incidents/near misses**
  - **Relies** on the team members knowledge to incorporate the learnings
- The HAZOP review duration may range between a couple of hours and multiple weeks, depending on the scope
  - **Time consuming activity** with multiple people involved
  - For a longer duration, there is a potential to have **fatigue** which may potentially affect the **quality**





# Innovation

- With the application knowledge and experience gained over the last 50 years, it is possible to **codify the requirements into a software**
- With the advanced software capabilities and by embracing innovative ideas, there is a possibility to **automatically complete the HAZOP** review using a software
- It is time for '**Smart HAZOP**'





# Smart HAZOP



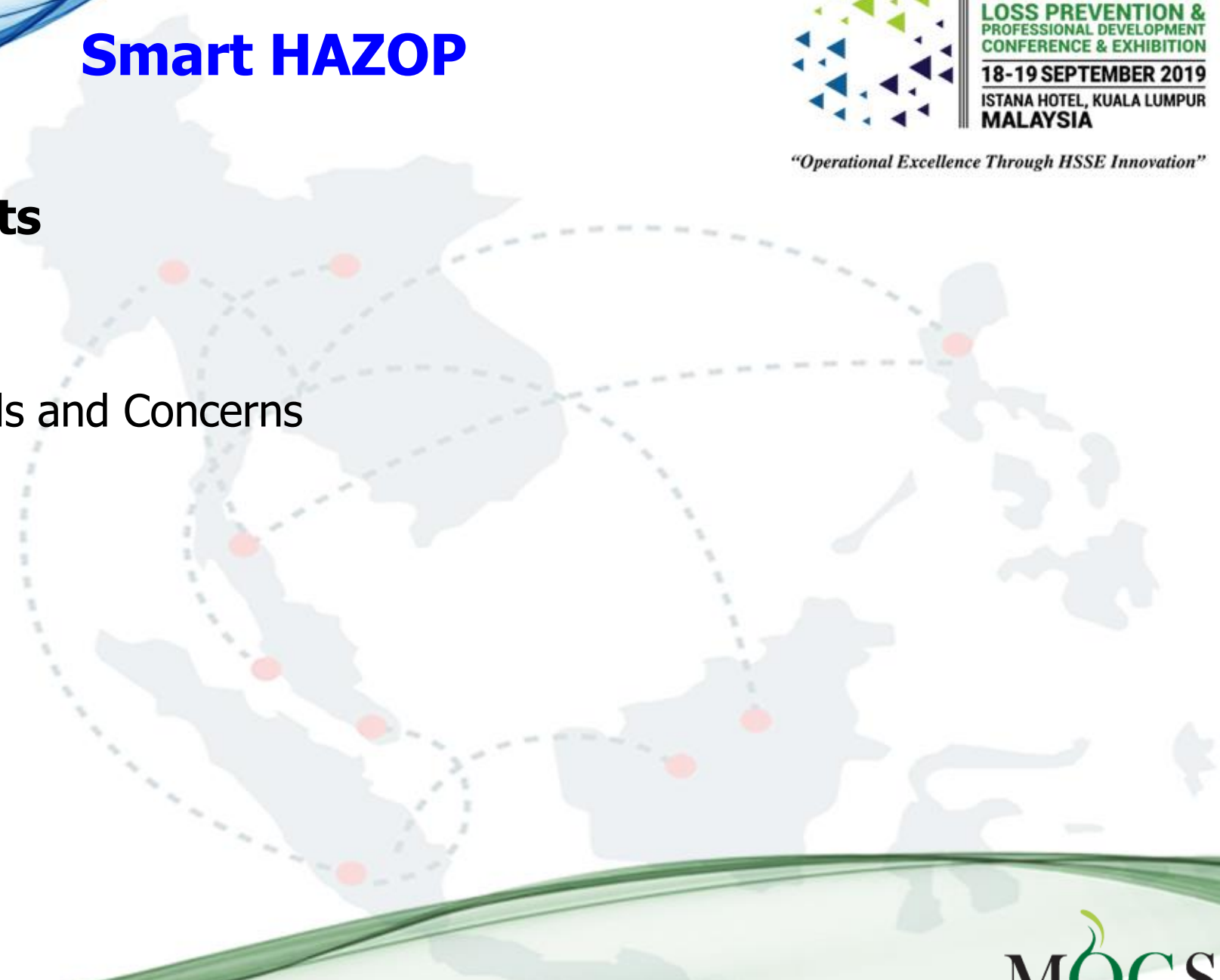
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- **Critical Components**

- Base Documents
- Software
- Grouping of Hazards and Concerns

- **Methodology**

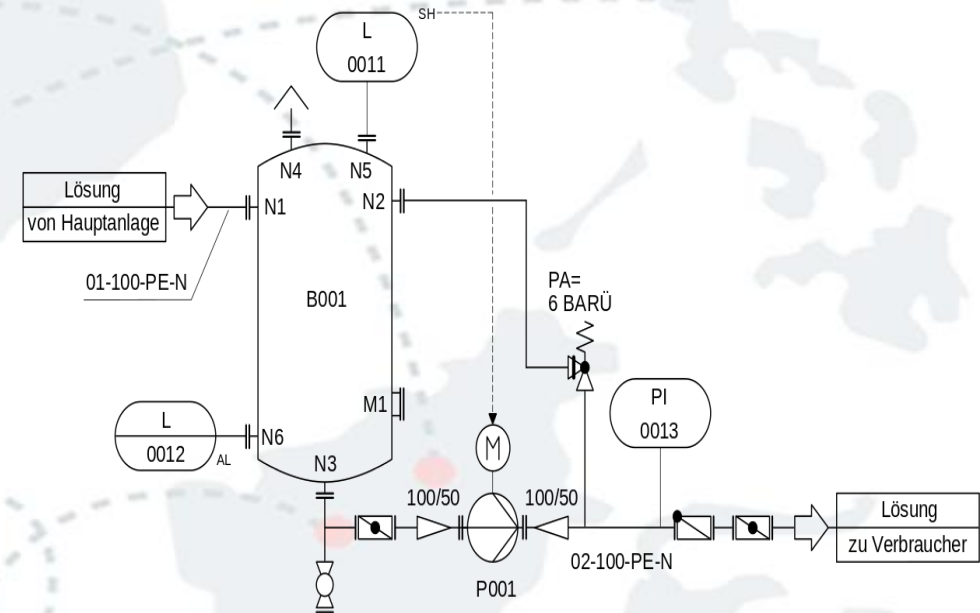


# Base Documents



- The **critical information** required for the HAZOP review can be found in the
  - Piping & Instrumentation Diagrams (**P&IDs**) and
  - **Plot Plans**
- The P&IDs and the Plot Plans will be used as the **base documents** in the Smart HAZOP
  - Similar to conventional HAZOP

	B001	P001
Benennung	Pufferbehälter	Nachspeisepumpe
Technische Daten	D = 1000 H = 3000 V = 2,4 m <sup>3</sup>	Q = 5 m <sup>3</sup> /h dp = 2,5 bar
Zulässiger Überdruck	10 bar	10 bar
Zulässige Temperatur	50 °C	50 °C





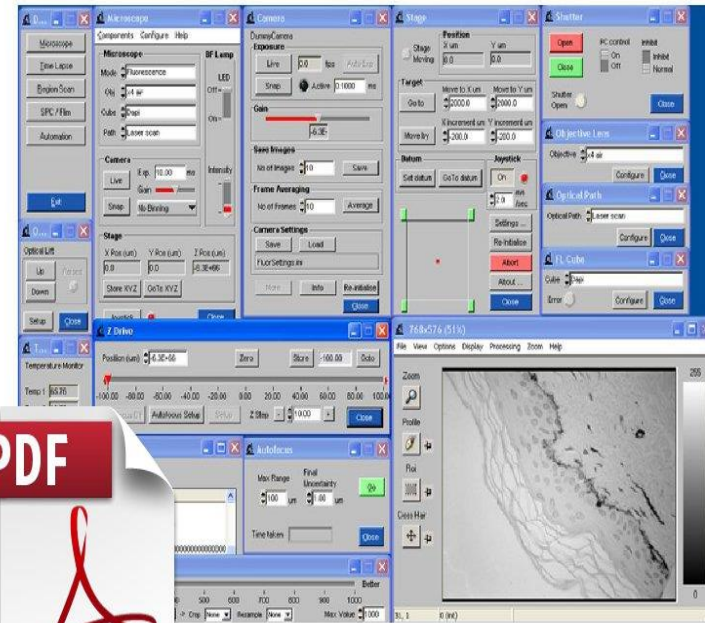
# Software



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- A software system with **advanced technical capabilities** is required for the Smart HAZOP
- The software should be able to transfer the **critical information** from the base documents to a **virtual interactive platform** where the review takes place
- The interactive platform should be able to hold a **database** of information and be able to perform the required **algorithms** and **complete** the HAZOP review



# Grouping



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- The **SHE hazards** and the **operability concerns** that could be possibly present in any process facility can be grouped into:
  - Equipment (e.g. compressor, fired heater)
  - Process Material (e.g. flammable, cryogenic)
  - Process Technology (e.g. runaway reaction)
  - Hazardous Inventory (e.g. storage quantity)
  - Siting & Layout (e.g. atmospheric vent discharge)
  - Activity (e.g. routine, non-routine)
- A **comprehensive database** should be developed for each of the above groups and included in the software





# Methodology



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- The software **transfers** the facility details from the base documents to the **virtual interactive environment**
  - The **User** defines the 'HAZOP Node'
- The software **compares** the pre-loaded database against the facility **design details** and **completes** the HAZOP review with a 'click of a button'
- If a gap is identified, the **software suggests** the appropriate recommendation/s





# Discussion

- The HAZOP review is one of the **critical tools** that provides the handle to the process industries to **identify** the SHE hazards so that the hazards can be **managed properly**
- It is important to ensure that the **rigor** of the HAZOP review is not affected by the **variations** in the team members knowledge, skills and work experiences
- With the application knowledge and experience that has been gained by the industry practioners over the last 50 years, there is a possibility to **automate the HAZOP review**

# Summary



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- **Smart HAZOP** has the potential to enable us to:
  - **Automatically complete** the HAZOP review and develop recommendations of higher technical quality
  - **Codify the lessons learnt** from the past process safety incidents/near misses so that the hazards and the concerns can be addressed, and similar events can be **prevented** from occurring again in the future
  - Significantly improve the work process **efficiency through automation**

**SMART**



# Acknowledgements



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- Thanks to all my friends, colleagues, ex-colleagues and the **HAZOP review team members** with whom I had great interactions while chairing the HAZOP reviews for the past 14 years
- Thanks to **Creative Commons** for making the pictures (used in this presentation) publicly available for use







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**Thanks and Questions**

