BILFINGER TEBODIN

WE MAKE PHA STUDIES WORK

EPSC Presentation

Online | December 2021

HAZOPPOSAURUS REX

The extinction of the group facilitated HAZOP sessions?

Bilfinger
Leading international service provider

Positioning	Leading service provider for the process industry
Range of services	Solutions across the entire lifecycle of an industrial plant
Employees	About 36,000
Revenue 2020	€3,5 billion

Making sure our clients can concentrate on what they do best: their core business.

Bilfinger Tebodin
Life cycle approach

Services

- Design & Engineering
- Project Management
- Procurement
- Construction Management
- Consultancy

Markets

- Industrial
- Food & beverage
- Energy
- Chemical
- Infrastructure
- Pharma

Bilfinger Tebodin Consultancy

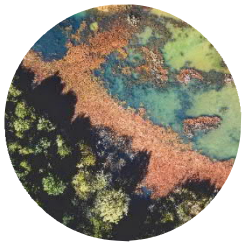
Accelerator for a future proof & sustainable success

ASSET MANAGEMENT

INDUSTRIAL EMISSIONS

FIRE & EXTERNAL SAFETY

TECHNICAL SAFETY



INDUSTRIAL SUSTAINABILITY

HSE MANAGEMENT

ENVIRONMENTAL MANAGEMENT

SOIL

Let’s meet the presenter: Maarten Vriezen

Studies

- MSc. Mechanical Engineering
- Master of Business Administration *(ongoing)*

Bilfinger Tebodin

- 16 years
- Netherlands, United Arab Emirates, United Kingdom
- Tech. Safety - Consultant, Management, Business Development
- Program manager Digitalization

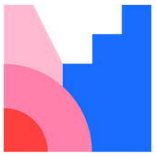
Technical safety

- PHA: SWIFT, HAZID, HAZOP, LOPA, SIL, FMECA, AM, Bow tie
- Markets: Energy, Chemicals, Food, Pharma, Industrial

Let’s meet the audience …

Which type of company do you represent?

- Industrial asset owner
- Service provider
- Governmental authority
- Technical supplier
- Other …



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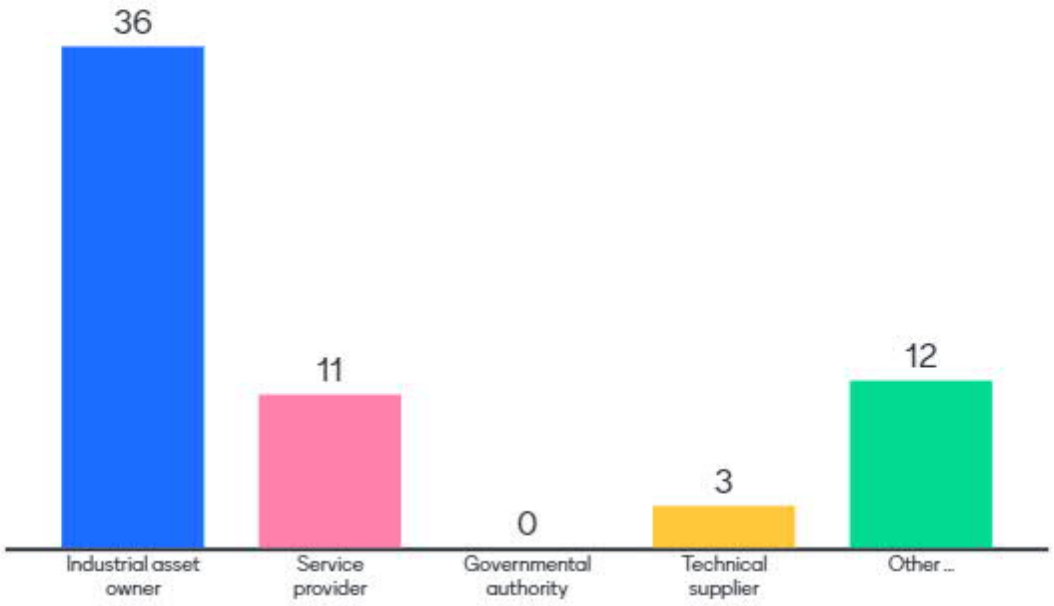
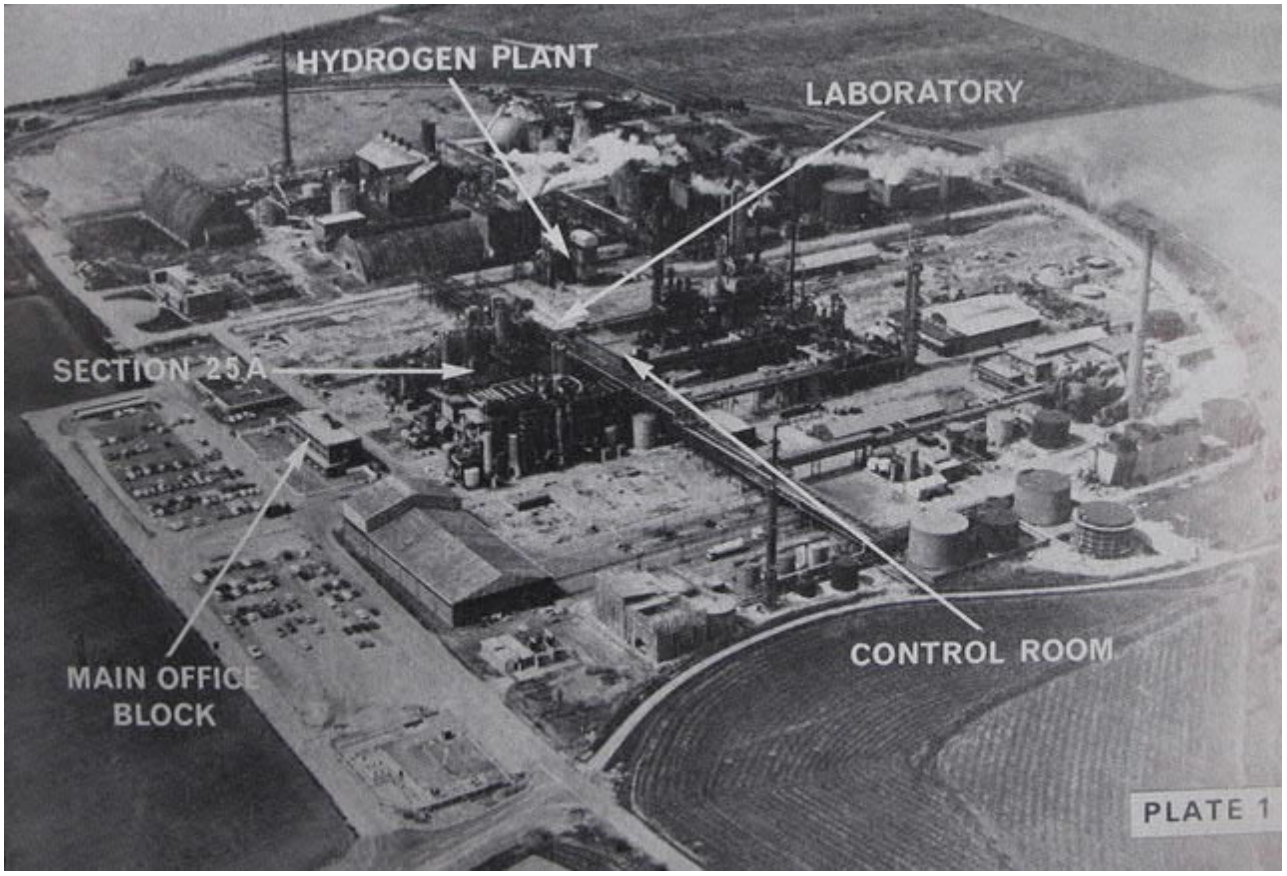
Which type of company do you represent?



Agenda

1. History – Hazoposaurus Rex
2. Current – Green HAZOP
3. Future – Automated HAZOP(?)

History - HAZOP



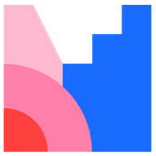
- 1960s Development by ICI
- 1974 Flixborough disaster as accelerator
- IEC 61882 and company standards
- CHAZOP, HFHAZOP

History - PHA

- PHA Landscape: SWIFT, LOPA, SIL
- Multidisciplinary brainstorm session
- Different software applications: PHA Pro & Works, Excel, SIAS
- Technical & human caused scenarios
- Green- and brownfield & revalidation

How important do you consider the following functions for a successful PHA session?

1. Scenario identification & risk evaluation
2. Review of P&IDs and other design documents
3. Compliance with company standards & authority regulations: Ensuring that risks are acceptable / tolerable
4. Bringing the project team together, to talk about issues (also not HAZOP related)
5. Increase understanding of processes, design and operation (especially for junior employees)
6. Alignment between disciplines (like operations & engineering)
7. Discussing / brainstorming about scenarios and risks
8. Generation of input for O&M plans



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P.M.N. Outcome of mentimeter

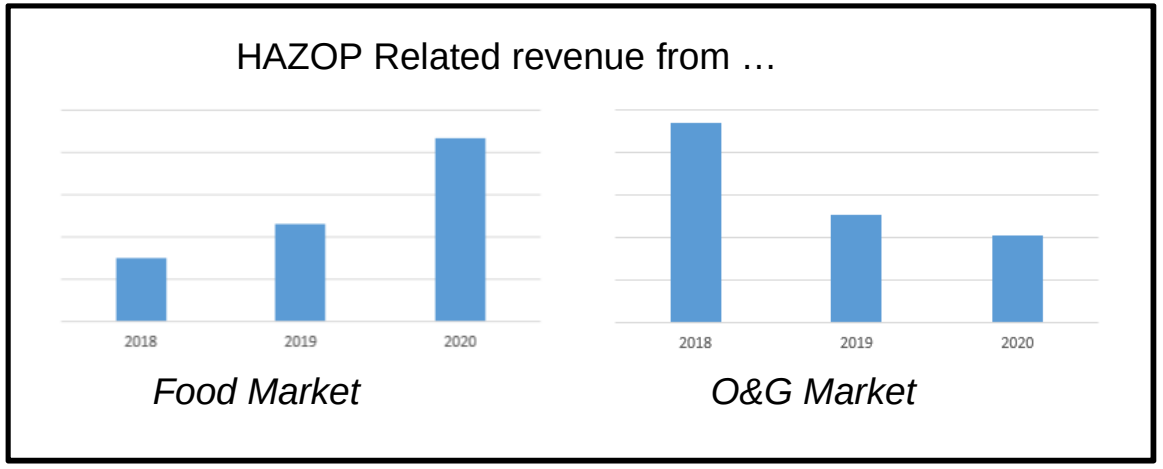
How important do you consider the following functions for a successful PHA session?

Current situation in the industry

- Data era
  - AI & ML are generating opportunities
  - Software developments
  - More interest from market
- Smaller teams at sites
- New process safety risks due to IoT
- Increase in revalidation PHA

Current situation inside Bilfinger (1)

- Average of ~150 HAZOPs per year
- Average of ~9,000 hours PHA session per year
- Trend: Increase in requests more than one type PHA
- Trend: Increase in food and decrease in O&G
- No corona dip in PHA studies



Current situation inside Bilfinger (2)

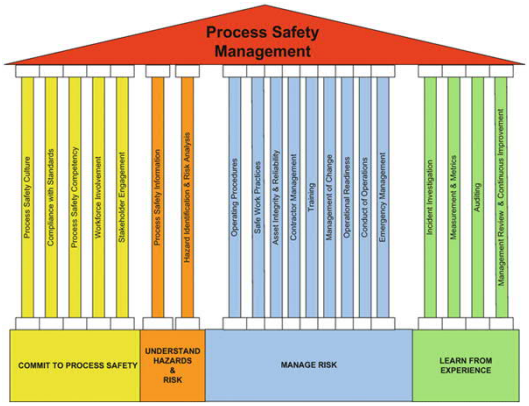
- COVID as step stone for Green HAZOP
- Tools for improvement Green HAZOP
- PHA sessions became more flexible and international
- New service development

The challenge

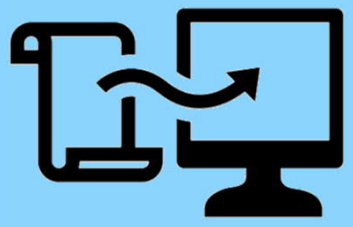
- More data is available & data analytics advances
- ~9,000 hours of session, requiring highly occupied staff

How can we help?

- Focus: Hazard Identification & Risk Analysis pillar (HIRA)
- Digitalizing HAZOP data & our expertise



Small side step on digitalizing …



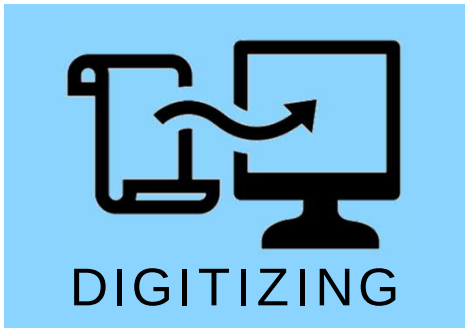
DIGITIZING

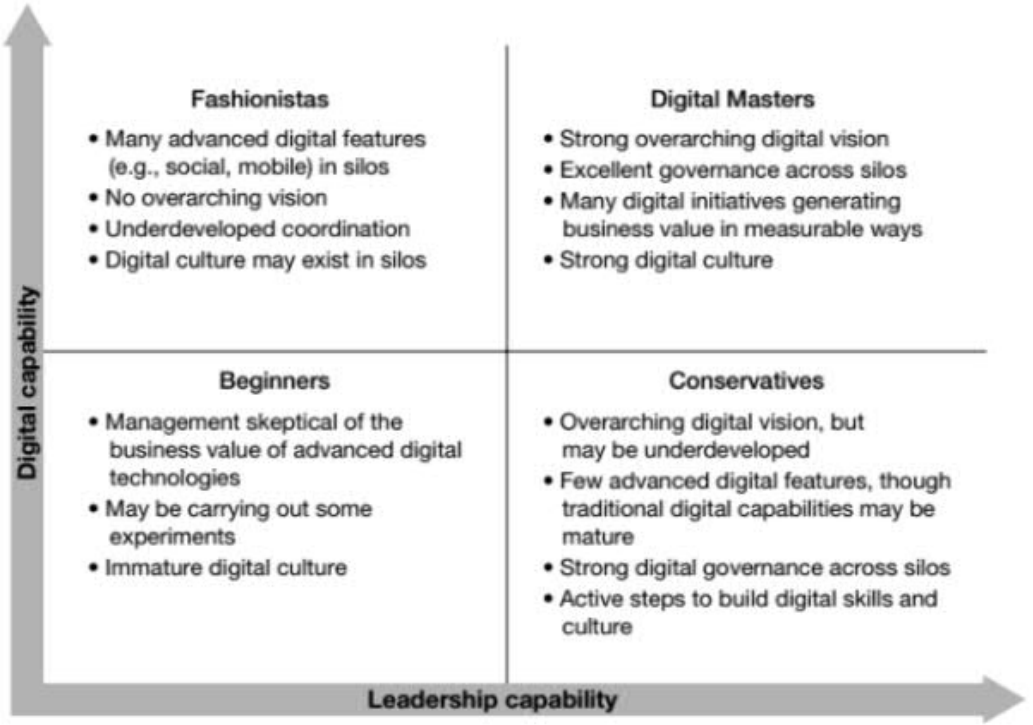
- Replacing analogue in-field indicators by digital
- Replacing paper inspection forms by tablets
- Making processes (e.g. PTW) digital instead of paper

DIGITALIZING

- Connecting process and maintenance data
- Data driven decision making

Small side step on digitalizing …

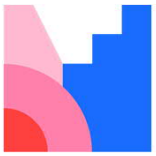




Source: George Westerman, Claire Calméjane, Didier Bonnet, Patrick Ferraris, and Andrew McAfee, "Digital Transformation: A Roadmap for Billion-Dollar Organizations," Capgemini Consulting and MIT Center for Digital Business, November 2011.

What is the level of digital maturity with respect to process safety in your organization?

- Beginner (low digital & leadership)
- Conservative (low digital & high leadership)
- Fashionistas (high digital & low leadership)
- Digital masters (high digital & leadership)



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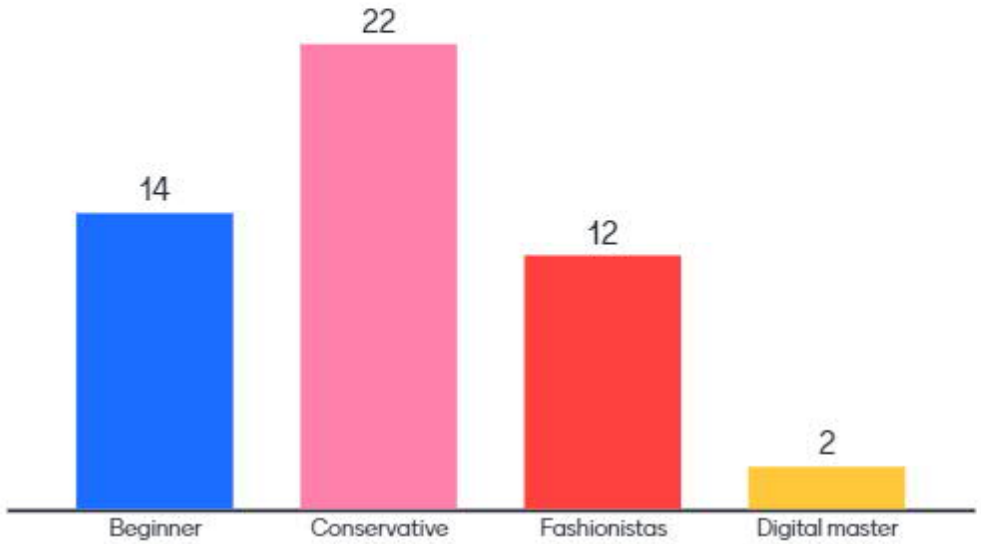
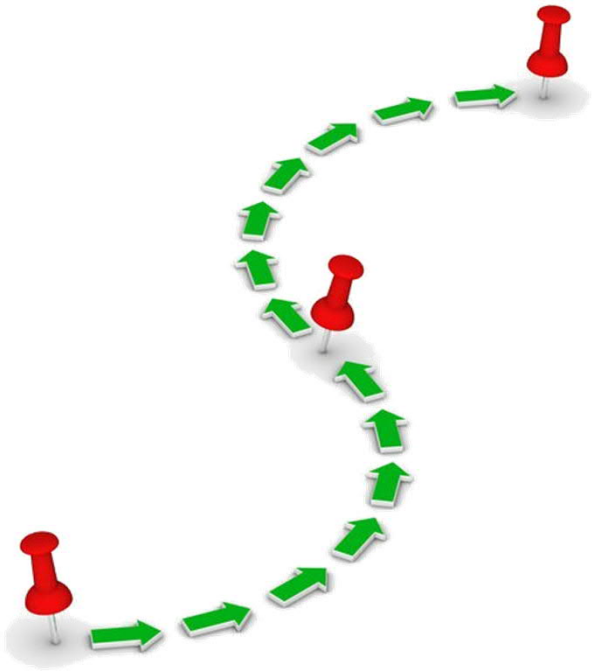
What is the level of digital maturity with respect to process safety in your organization?



The challenge

Digitalizing HAZOP data & our expertise

1. Optimizing current workshops
2. Data driven scenario development
3. Automation of the HAZOP



Optimizing current workshops

- Development of libraries
  - Pre-population of worksheets
  - Supporting sessions
- Connecting BIM & PHA software
- +1 hr pre-work = -1 hr session
- More efficient & focus on the not-standard scenarios

Equipment classification list

Rev.	Medium code	Equipment number	Description	Diagram
	-	A.1.1.X001	Barley Milling Packaged unit	3143001
	MBA	A.1.1B001	Barley Silo	3143001
	MASH	A.1.1B002	Mashing Tun	3143001
	MASH	A.1.1B002R001	Disk agitator	3143001
	WRT	A.1.1F001	Lauter Tun	3143001
	MASH	A.1.1P001	Mash pump	3143001
	WRT	A.1.1P002	Wort pump	3143001
	MBA	A.1.1X001	Rotary valve feeder	3143001
	BR	A.1.2B001	Brew Kettle	3143002
	BR	A.1.2B001R001	Disk agitator	3143002
	Water	A.1.2P001	Centrifugal pump	3143002
	BR	A.1.2P002	Centrifugal pump	3143002
	Water	A.1.2W001	Plate-type heat exchanger	3143002

Data driven scenario development

- 2,000+ HAZOP reports & Company standards
- Benchmarking:
  - Safeguards, risk profile
  - Company, market
- Supporting scenario development
- Considerations:
  - NDA
  - Data cleaning > 80%

90% of the market uses a TRV for thermal expansion scenarios.

70% of the entities considers a flange leakage of chemical X as a potential fatal scenario

Automation of the HAZOP

- HAZOP Scenarios by algorithm (e.g. in Pyhton)
- Combining libraries, design data, MOC and incidents
- Automation of activities
- Supervision remains required
- Scenario connection with O&M Plans

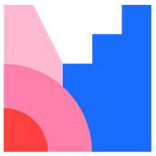
To what extent can HAZOP automation be useful / credible in your eyes?

1. Not at all: HAZOP studies should always be executed from scratch

2. ~50% Prefilled sheets by the facilitator, based on available site-specific HAZOPs

3. ~80% Prefilled sheets by an algorithm, based on available HAZOPs

4. Full automated, all scenarios generated by algorithm



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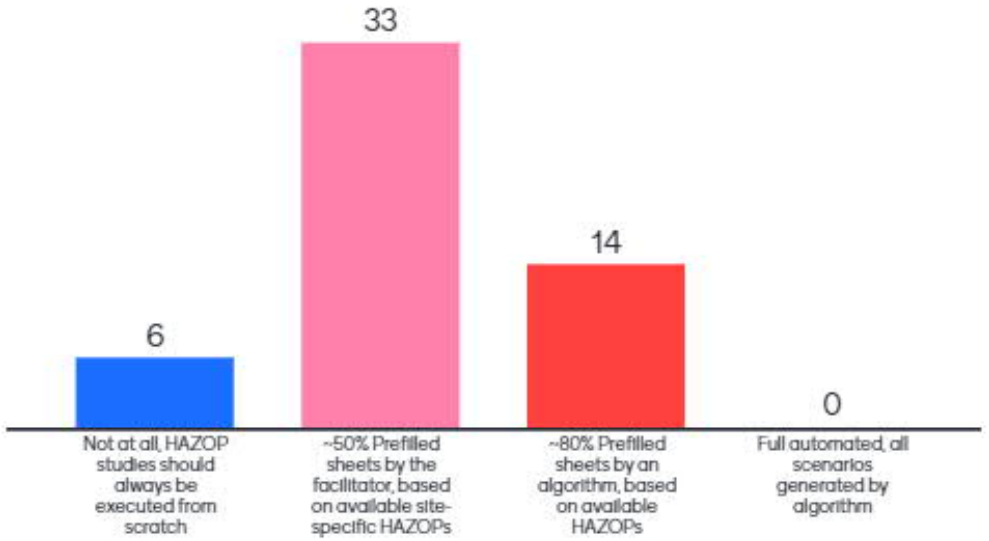
BILFINGER

To what extent can HAZOP automation be useful / credible in your eyes?



Some considerations

- Darwinist character of the HAZOP
- Scenarios caused by technical or human failure
- Group sessions have multiple purposes
- HAZOP uses human expertise and data
- Revalidation HAZOP studies

The extinction of the group facilitated HAZOP sessions?

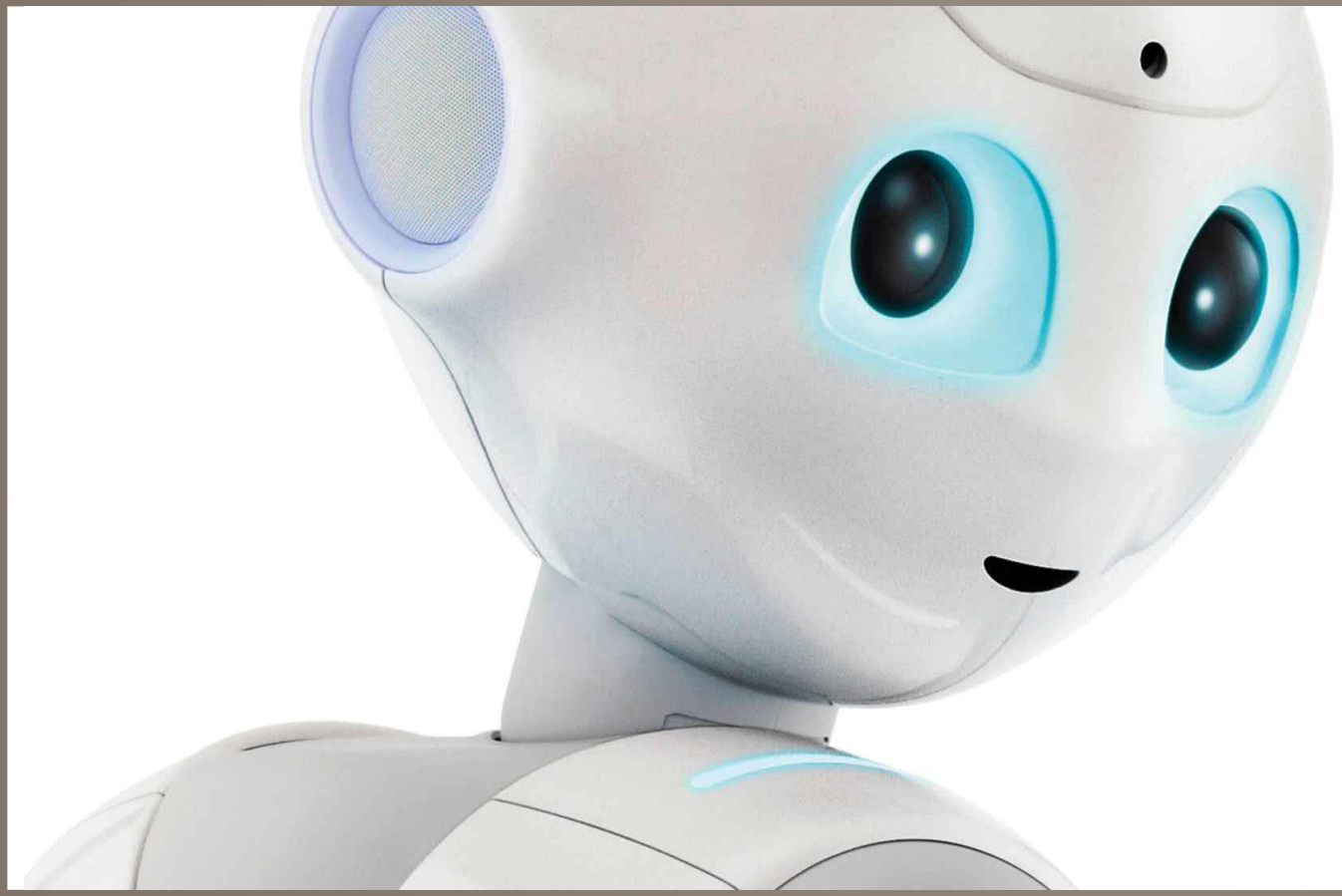
Short term

- HAZOP will move with trends
- Library improvements
- Brief simple sessions remain online

Long term

- Technical causes will be automated
- Workshops will be significantly reduced
- Human factor risks, training & alignment

For discussion



“Taking the human risk factor, training and alignment out of the HAZOP workshop leaves a HAZOP that can be fully automated.”

Thank you for your attention

Any questions, please contact

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