



#### HAZOP+

## Your plant's <u>safety</u>, <u>efficiency</u> and <u>ecological viability</u> are crucial for its sustainability in an

increasingly complex and demanding competitive environment.



### HAZOP + OPEX4.0 = HAZOP+

#### HAZOP

- A deep Process Analysis method used for Process Safety
- Results in recognition of safety gaps and determination of corresponding risk reducing measures
- deepest and most resource intensive analysis of a plant after its original design process, during its utilization life



#### • OPEX4.0

- Many companies have a systematic
   OPEX (Operational Excellence) process,
   which is used to optimize yields, utility
   usage, minimize unplanned downtime,
   and other parameters with cost impact
- In OPEX4.0 the optimization of operating parameters is based on data centered methods and AI for the Interpretation of the operating data.

HAZOP+

- Combines a HAZOP study with an OPEX4.0 project, realizing synergies between the two





### HAZOP+ workflow

- HAZOP study performed by experienced TÜV SÜD experts
  - Using the unfavorable run periods identified in the data analys for systematic discussion of plant operation
- OPEX4.0 performed by partner atlan-tec Systems
  - Using the favorable run periods identified in the data analysis
  - Optimization of operating parameters using Machine Learning
- Certification of optimization according VDI 3714\* by TÜV SÜD experts

\*VDI3714: German engineering guideline for the optimal execution of big data projects



### HAZOP+: identifies new correlations & synergies ...



Safety Reviews (HAZOP) and data driven Process Parameter Optimization (OPEX4.0) are coordinated for the use of synergies, but nevertheless always performed seperately.

### Preparation of Documents and Data

- Both studies benefit from efficient and target oriented document preparation
- For both studies updated design documents and operating data are needed (e.g., P&IDs, control schemes, time sequence/trends of process parameters, List of undesired events, etc.)
  - Synergy in the preparation of data and documents regarding time & effort
  - Good preparation leads to efficient execution and reduced costs
- An assessment of 'Industry 4.0 Readiness' can support the preparation phase:
  - SIRI assessment of TÜV SÜD (online or offline)
  - Industry 4.0 readiness assessment of ats (online)





### Execution of HAZOP+ Projects

Preparation - Required documents - Necessary updates - Data (from DCS, LIMS)	Analysis -HAZOP study -Data- & AI- based analysis of operation	Implementation -HAZOP action items -Optimisations	Follow up & Finetuning
<ul> <li>P&amp;ID, Control scheme, plot plan, equipment data,</li> <li>Plant upsets, repairs, incidents,</li> <li>Operating parameter data from DCS, LIMS, optimally from several years</li> <li>Simulation results (if available)</li> </ul>	<ul> <li>HAZOP: Review of all P&amp;IDs, Check of all safety devices (SIL, PSVs,)</li> <li>OPEX 4.0: <ul> <li>Analysis of process parameters</li> <li>Determining good and bad run periods</li> <li>Formation of models</li> </ul> </li> <li>Synergies: <ul> <li>Safe limits of optimisation</li> <li>Including plant upsets and 'bad' run periods in the HAZOP study</li> </ul> </li> </ul>	<ul> <li>Safety measures, resulting from HAZOP</li> <li>Optimized setpoints of relevant control loops         <ul> <li>Offline, Operator input</li> <li>Closed loop: AI feeds optimized setpoints directly to DCS</li> </ul> </li> <li>Certification of the Optimization according VDI3714 through TÜV SÜD</li> </ul>	<ul> <li>Follow up on HAZOP measures/action items</li> <li>Further optimisation of operating parameters, based on continuously updated statistical models of the AI</li> </ul>



### The basic principle of OPEX 4.0

#### **Your PROCESS**



#### Historical Process Parameter DATA (from DCS: P, T, F, L, Q,..; from Lab)









# PROCESS MODELS = DIGITAL TWIN → OPTIMIZER (e.g. towards minimal cost) Neural network technology



ADVANCED BIG DATA ANALYTICS with our smart, data-driven solutions



### Optimization of operating parameters using Machine Learning





### **Optimization Example: Multistage Reactor: PVA**

#### Challenge:

- A multistage process converts raw materials into a product

- Quality fluctuations are caused by unknown fluctuations in the raw material

#### • Process Optimisation:

- The ANN model, trained with example data, predicts yield and quality

- The real time optimizer finds the best setpoints for key control loops

- Quality issues are quickly recognized and fixed, based on prediction and optimization

• OPEX 4.0:

- Process stability increased by factor 10
- Economics: 5% reduction in manuf. costs





### Summary

**Goal of HAZOP+** is a safe plant, running at stabile conditions with optimized economic performance

- Target function of optimization 'minimized costs' or 'maximized Ebit/hr'

#### Synergies of HAZOP and OPEX 4.0

- <u>Efficient preparation</u> of data & documents (P&IDs, functional plans, operating data, etc.)
   Strong overlap of required data & documents
- <u>Improved quality of HAZOP</u> study through systematic use of the operational data from the optimization project
   'Bad' operating periods and plant upsets show the actual problems, which often cause safety incidents
- <u>More room for operational optimization and reduced risk of optimization</u> through exactly calibrated safety limits resulting from the new HAZOP study

Safety limits are fixed in awareness of the optimization effort, not more conservative than needed

<u>Certification of optimization project</u> according VDI German engineering guideline
 Certification of optimization projects according to the VDI/VDE-GMA 3714 standard through TÜV SÜD experts

### Family of AI applications by atlan-tec systems and TÜV SÜD

#### OPEX4.0

- Data based, automated, continuous optimization of a plant's operating/process parameters by means of Al/Machine Learning towards an economical optimum (e.g. 'minimized costs/ton')
- OPEX4.0 projects follow the recommendations of VDI/VDE-GMA guideline 3714 (execution of big data projects in production), ensuring a systematic, transparent and structured project workflow
- Projects can be certified by TÜV SÜD experts

#### HAZOP +

- Synergistic combination of HAZOP and OPEX4.0

#### AMAIS

- Asset Monitoring based on permanently installed condition sensors (e.g. for corrosion, erosion, vibrations, fouling,..)
- Evaluation of sensor data by AI, visualization on a dashboard
- Connecting asset integrity data with process data for identification of correlations and better decision making







### Questions? Talk to us!

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