inprocess

simulation · knowledge · profit

Beyond Optimize

Supporting the development of plant operators' competence

14 October, 2021

Supporting the development of plant operators' competence

inprocess

Simulation · Knowledge · Profit

Inprocess in brief

independent from any provider (process simulator or ICSS)

our **core business** is Process Simulation

keen to **share its knowledge** with clients

2006 est. in Barcelona by domain experts	**54 countries** worldwide presence	**50+** simulation engineers
250+ years experience	**350+** executed projects	**330+** training courses

Inprocess Solutions & Services

Lifecycle Modelling and Operator Training Simulators

Process Simulation Studies

Professional Development & Training

Applications and Software Products

Agenda

- Introduction
- CRODA's Operation Plant challenges
- What's Training? Poor training vs efficient training
- Operator learning path
- Aspen HYSYS ® Simulation based Training: OTS
- Learning Platform
- Benefits and Conclusions

Introduction

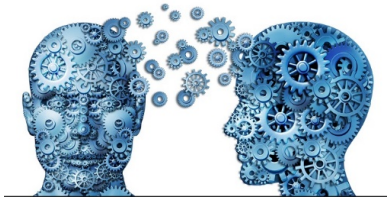
Challenge: Standardizing both CRODA's working procedures and the way operators learn how to apply them

Solution: Inprocess' Simulation based Training OTS with Aspen HYSYS along with a customized Learning Platform.

Benefits: Customizable training paths, Aspen HYSYS simulation based effective learning, good track of CRODA operator's learning curve from HR and Management

CRODA's Operation Challenges

- Batch processes → single trains can produce a huge variety of products
- Standard procedures, but many degrees of freedom: ambient conditions, changing recipes…
- Difficult to keep standard procedures up-to-date and available for immediate training when required
- Training material from different sources, levels, languages, depth…
- Senior personnel is retiring: deep knowledge loss



What's Training?

- Usual way of training is learn by doing with supervision from a senior operator
- Hard for HR and Management to evaluate and understand the level of competence of each operator
- How to train efficiently and keep track of the learning curve of each operator?

Classic training

Consequences of poor training

- Checklist operation → Operator only needs to confirm the actions with no need to understand the reasoning behind

- When problems occur junior operators:
  - Struggle to understand what's wrong and the solution

- Lack of competence:
  - Slow reaction time, less efficiency, variability in quality standards for each product, difficulty to improve/innovate or report to Top Management

- Safety - Production concerns

Effective training

- **Reduced training time:** it's critical to use it in the most effective way
- **Dynamic** simulation-based training along with customized training programs
- Each **operator** has specific needs:
- **Training platform** can tailor learning paths providing a solution flexible and efficient.

STUDY
- Theory
- Procedures
- Safety
- Best practices

EXECUTE
- Exams
- Tests
- OTS
- ITOP

COLLECT
- Evaluation
- Ask your doubts
- Re-do the learning path

LEARN
- Discuss results with instructor
- Suggest Improvements
- Report learned lessons

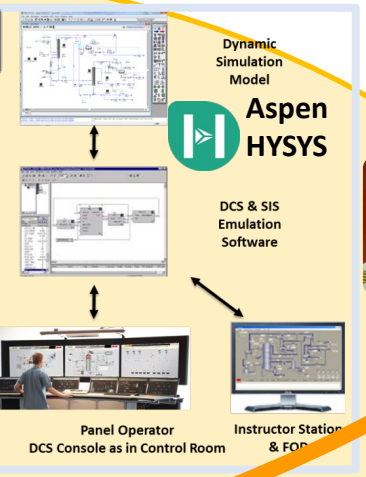
Operator learning path

> Tell me and I forget,
> Show me and I may remember,
> Involve me and I understand
>
> *Benjamin Franklin*
> Scientist and statesman

Learning environment

Dynamic model based

OTS



ITOP

Operator

Skilled Operator

Safety

Control

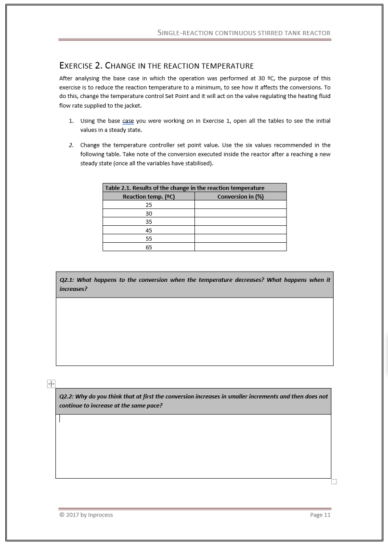
Products and Processes

Equipment

Fundamentals

Simulation based training: ITOP

- ITOP flexible training program combines:
  - Theory sessions (based on texts and slides)
  - Interactive and practical sessions (based on first-principles dynamic simulations with Aspen HYSYS)
  - With simulated models & HMI students learn by doing.
- ITOP lessons are used to instruct students on the laws and principles that rule the behaviour of unit operations and their real dynamic response to perturbations.


SINGLE-REACTION CONTINUOUS STIRRED TANK REACTOR

EXERCISE 2. CHANGE IN THE REACTION TEMPERATURE

After analysing the base case in which the operation was performed at 30 ºC, the purpose of this exercise is to reduce the reaction temperature to a minimum, to see how it affects the conversions. To do this, change the temperature control Set Point and it will act on the valve regulating the heating fluid flow rate supplied to the jacket.

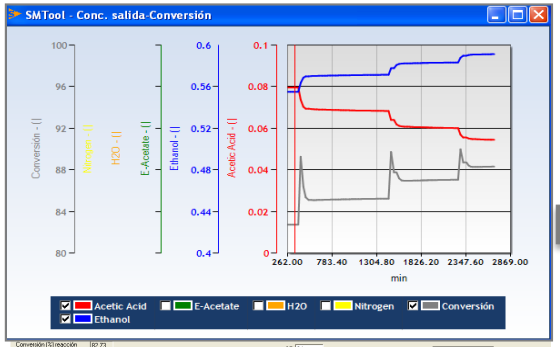
1. Using the base case you were working on in Exercise 1, open all the tables to see the initial values in a steady state.
2. Change the temperature controller set point value. Use the six values recommended in the following table. Take note of the conversion executed inside the reactor after a reaching a new steady state (once all the variables have stabilised).

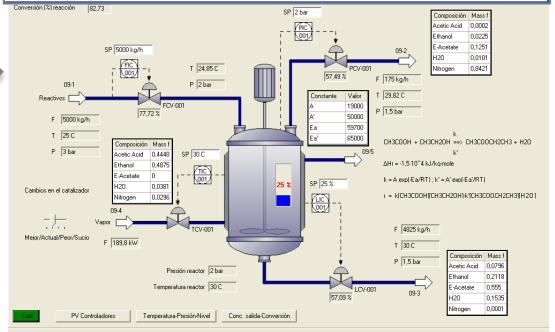
Table 2.1. Results of the change in the reaction temperature

Reaction temp. (ºC)	Conversion in (%)
25	
30	
35	
45	
55	
65	

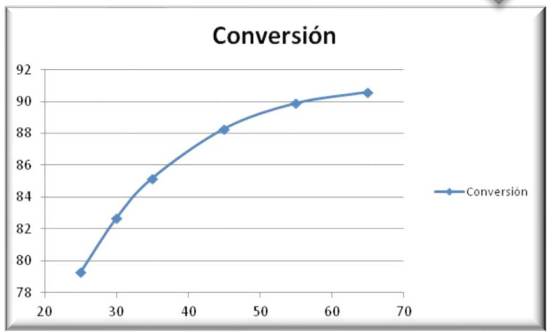
Q2.1: What happens to the conversion when the temperature decreases? What happens when it increases?

Q2.2: Why do you think that at first the conversion increases in smaller increments and then does not continue to increase at the same pace?

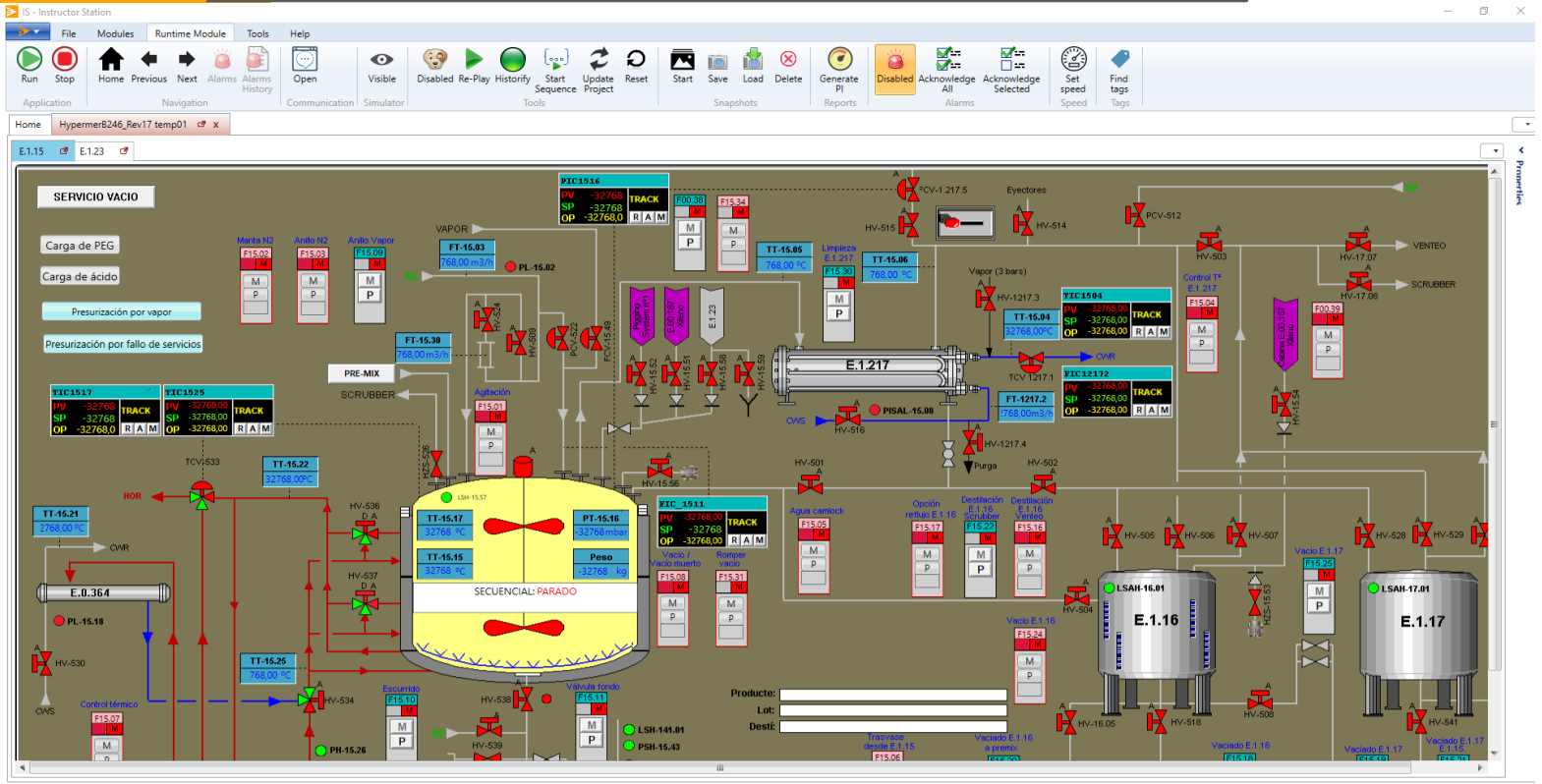




Reaction Temp	Conversion
C	%
25	79.3
30	82.7
35	85.2
45	88.3
55	89.9
65	90.6



Simulation based training: OTS



Operators can be trained on a learning environment almost equal to real control room with all the real life functionalities, using developed screens along with a simulated model of the plant with **Aspen HYSYS Dynamics**.

Simulation based training: OTS

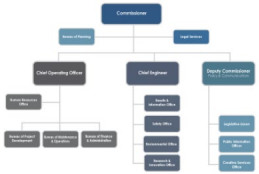
Some benefits of OTS training:

- **Close to real life environment**
  - Lessons and mechanics learnt are directly usable at control room,
  - Knowledge and understanding improving along with efficiency in panel operation.

- **Training from anywhere and when required. HR can organize the trainings focused on Productions needs.**

- **Use of the Aspen HYSYS Dynamic model for further development. Increase of value of the simulation tool**
  - Test / train other scenarios.
  - New sequences of actions (especially in batch type processes).
  - Change of products (the same production line can handle several kinds of products)…

Learning Platform concepts



Master Material

1 to n

1 to n

EN v.X

TH v.Y

CT v.X

...

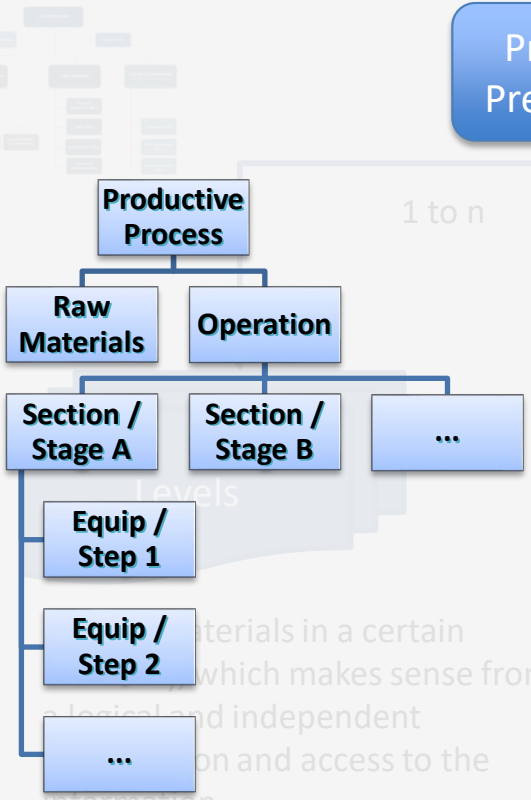
Levels

Itineraries

Groups Materials in a certain hierarchy, which makes sense from a logical and independent presentation and access to the information

Groups Materials in a certain order, which makes sense from a training point of view

Learning Platform concepts



Process A Pre-Heating

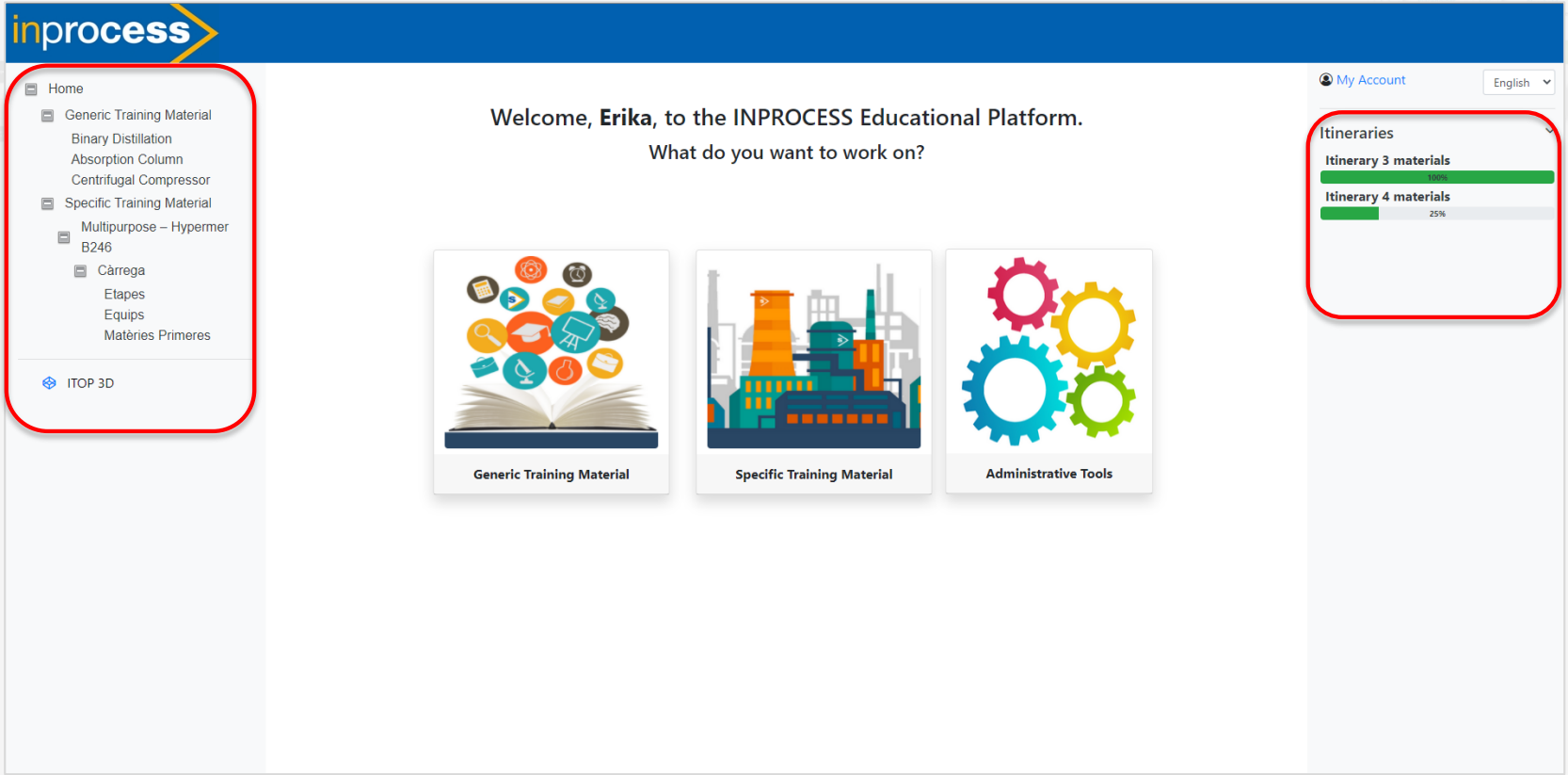
Component 1 safety sheet

Junior Operator Process A

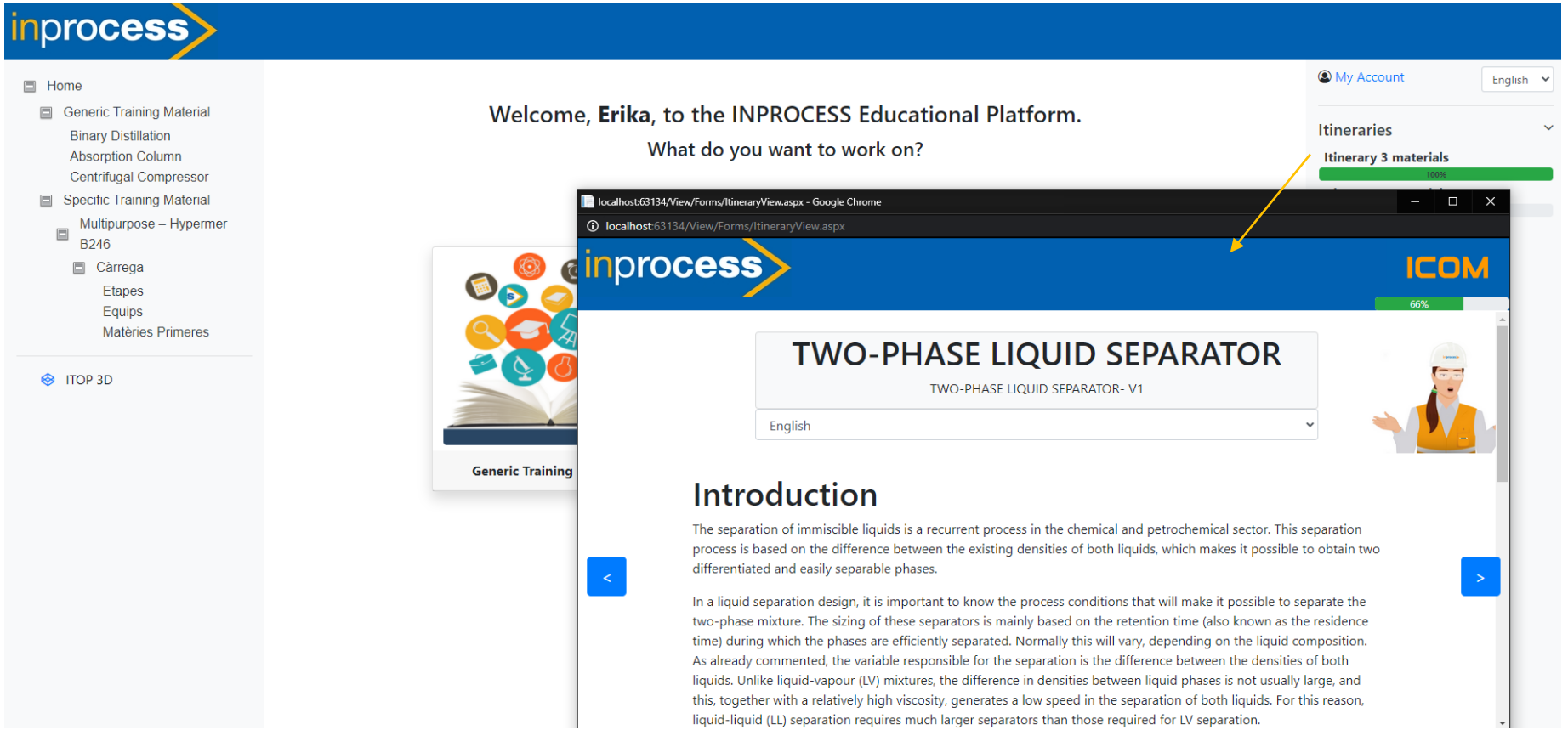
Senior Operator Process A

Shift Supervisor

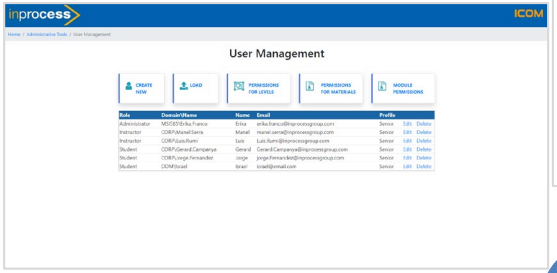
Learning Platform concepts

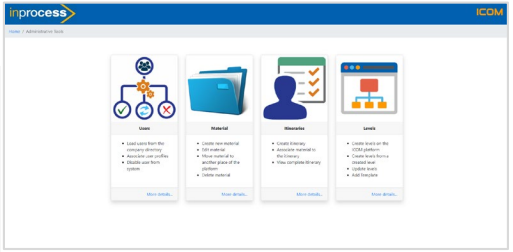


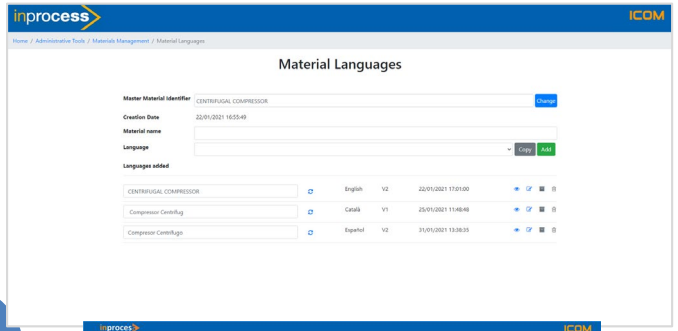
Learning Platform concepts

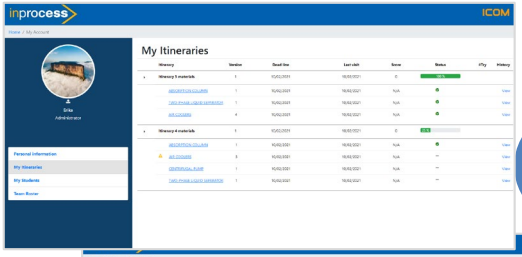


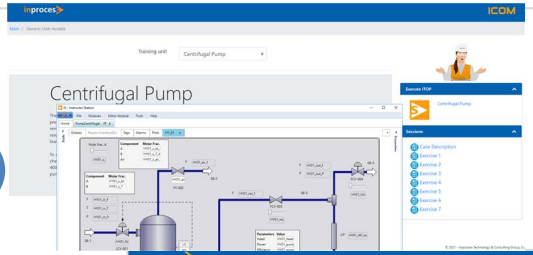
Learning Platform concepts

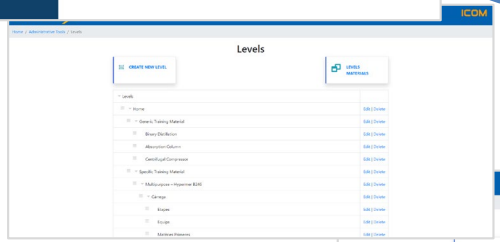


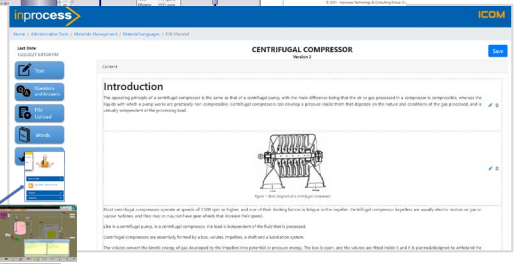


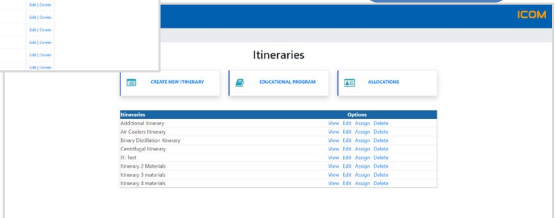


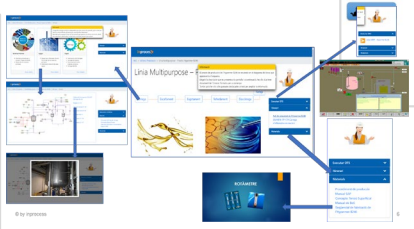


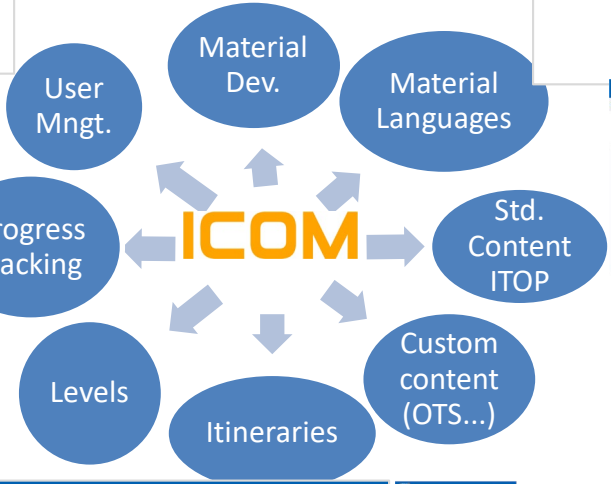




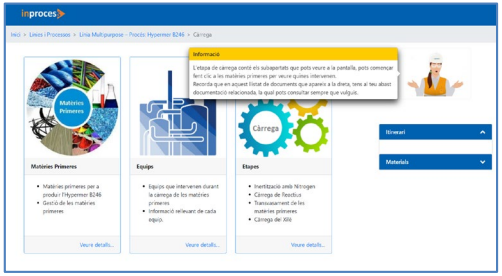


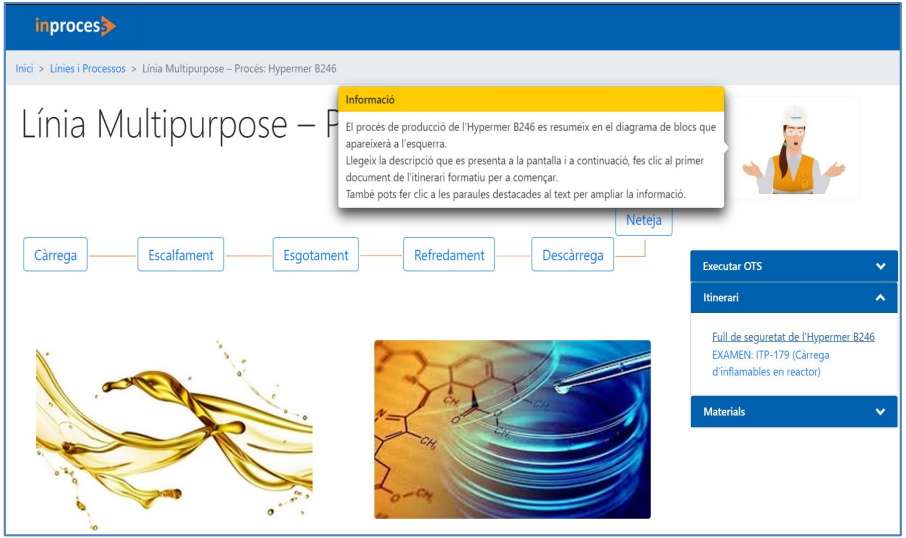


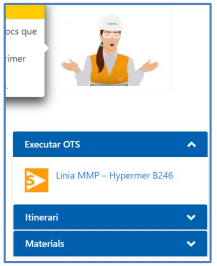


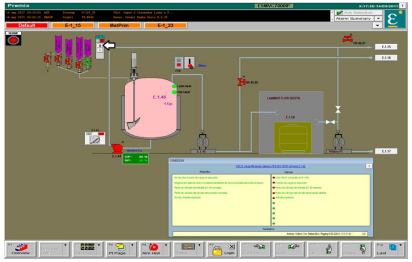


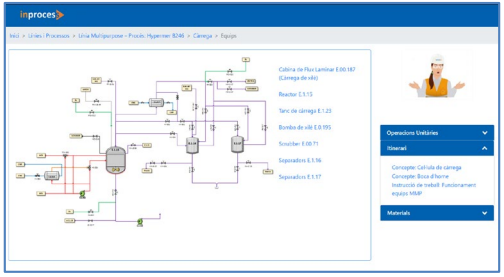
Customized content

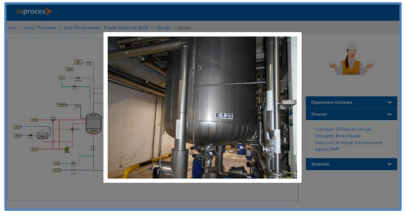












Benefits

Learning Environment

OPERATION

- Product information
- Manual Procedures
- How to operate
- Fundamentals of chemicals and equipment

OTS

- Control room operation
- Close to real plant scenarios
- Further study of different control logic or other scenarios, procedures or products

Safety

- Critical parameters
- Possible dangers
- PPE's need and use

HR and Management

COMPETENCE ACHIEVEMENT

- Best practices
- Time to finish the learning path
- Evaluation
- Instructor Feedback
- Seniority of the operator
- Skills acquired
- Demonstrated knowledge

Plant Operation

DAILY PLANNING

- Shift organization
- Available operators
- Task distribution
- Production needs
- Shift organization
- Adaptation to production needs

OPERATIONS IMPROVEMENT

- Procedures Improvement
- Plant Monitoring
- Debottlenecking
- Faster Plant troubleshooting
- Increased efficiency
- Homogeneous procedures
- Higher quality production

Direct Benefits

5 Shifts: 70 operators have already used the platform

4 new employees already trained up to date.

8 new learning paths created and uploaded. **New training** material created

Trainings created on a production basis schedule. **Higher flexibility** achieved.

Homogeneous repository: Old training material and documentation organized in the platform.

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Thank you!

Any question?

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