

A photograph of an industrial facility at night, featuring a complex network of pipes, walkways, and tall distillation columns. The scene is illuminated by bright yellow lights, creating a high-contrast, industrial atmosphere. The sky is a deep blue, and the overall image has a blue color cast.

Modular design asks for a *different* approach of safety in design

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Agenda

- ◆ Introduction Fluor
- ◆ What is Engineering
 - From stick built design ...
 - ...to Modular Design
- ◆ Modular Design asks for different design approach
 - Less equipment spacing
 - Accessibility
 - Fire protection
- ◆ Conclusion

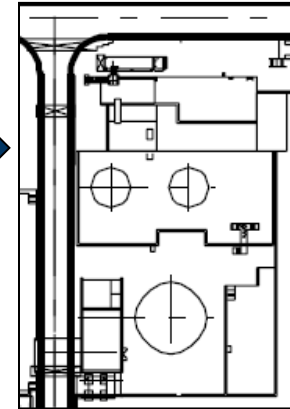
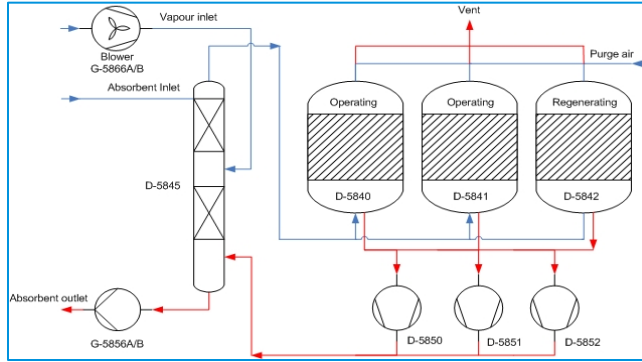
Fluor: a passion to build



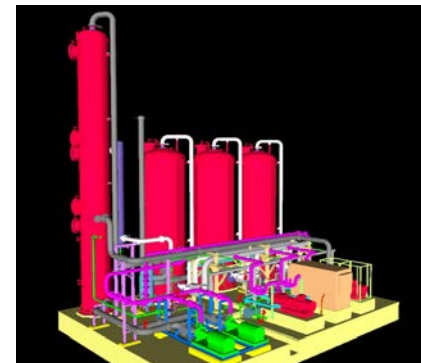
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We design, engineer and build your facility



2-dimensional layout



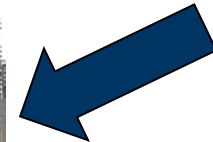
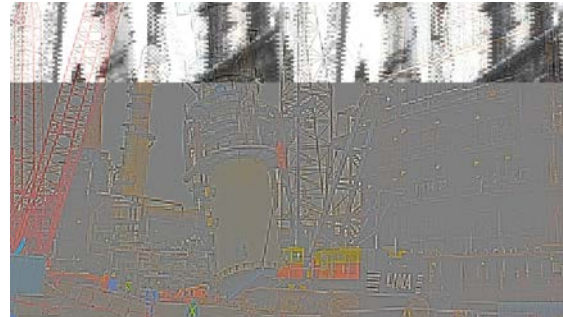
3-dimensional model



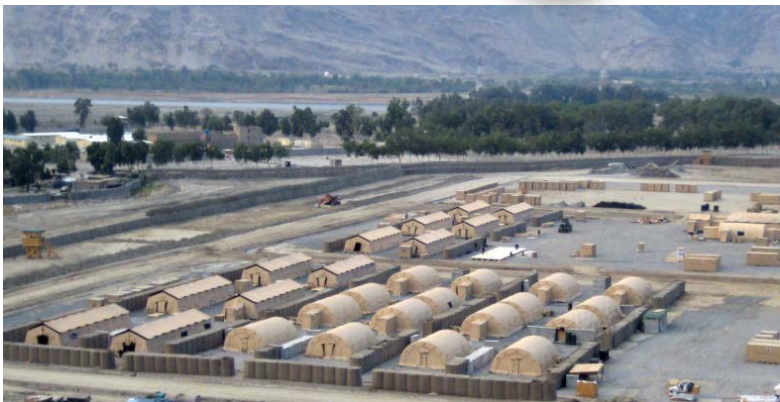
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Stick built - Facility is built at site



Stick built - Facility is built at site



Modular design – construct at yard, transport to site



Create
SAFE & CONTROLLED
work environment

**PLUG
& PLAY**

Modular Design impacts Safety in Design

Modular Design is a Compact Design



Same rules and standards

- Less equipment spacing
- Accessibility
- Fire protection

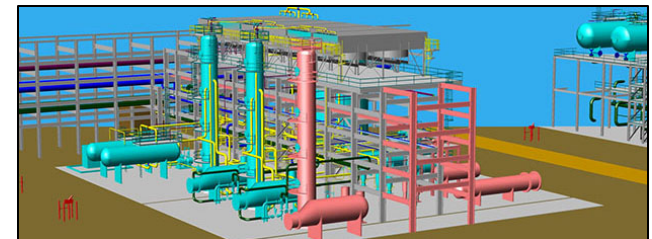
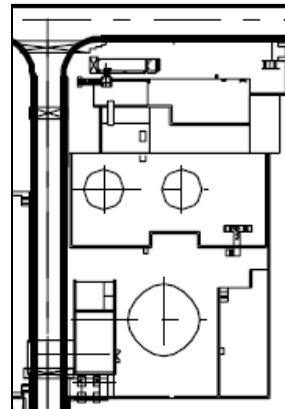
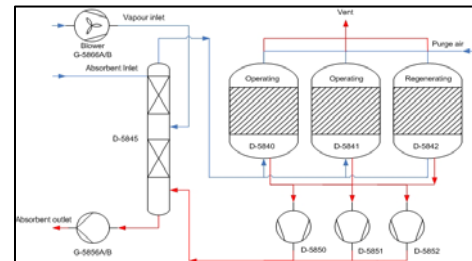
what is done and **when** in the design is **DIFFERENT**

Safety in Design in Engineering Phases

CONCEPTUAL PHASE

ENGINEERING PHASE

DETAILED ENGINEERING PHASE



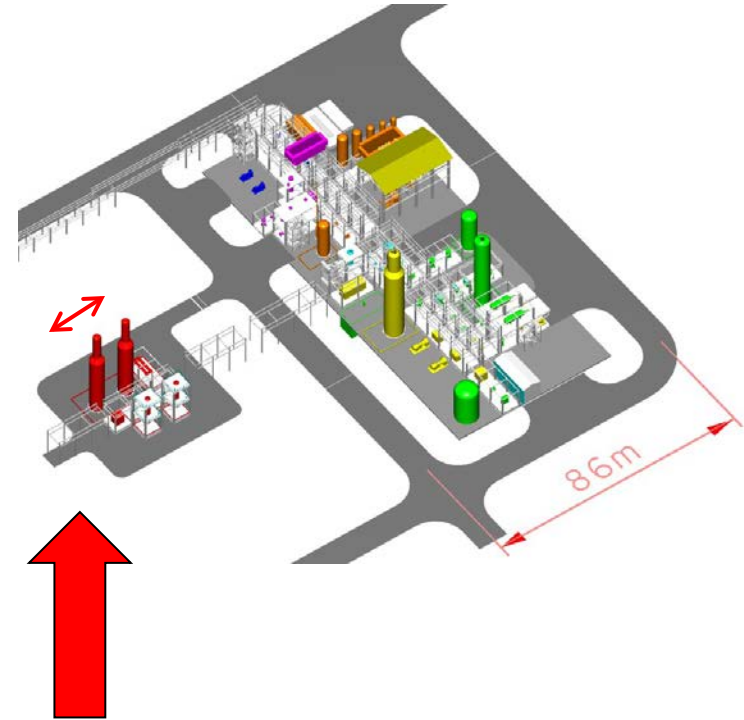
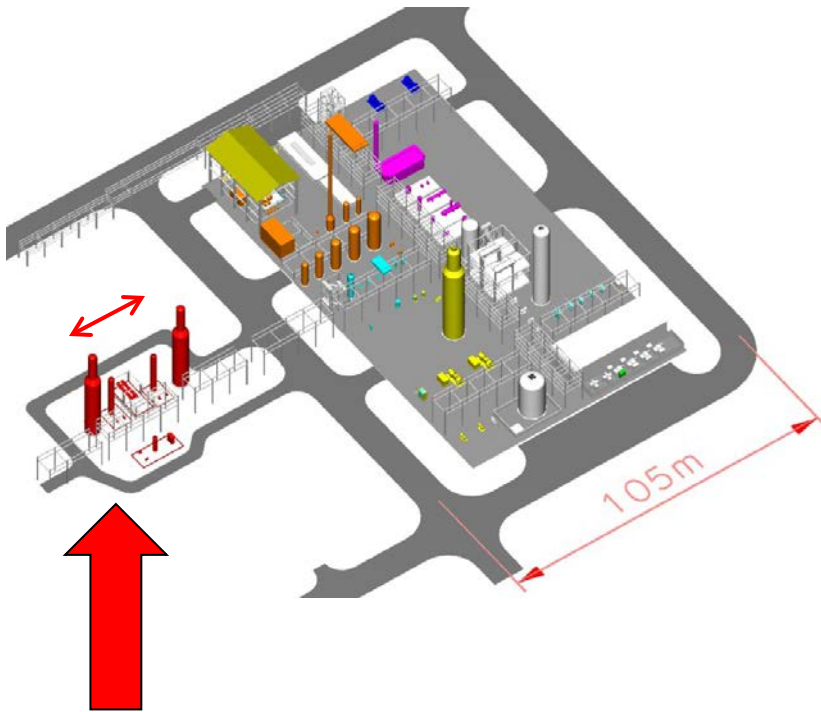
- Identify hazards
- General safety approach

- Equipment spacing 2D layout
- Firefighting approach

- Escape routes in 3D model
- Firefighting equipment & layout

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Example 1: Less equipment spacing

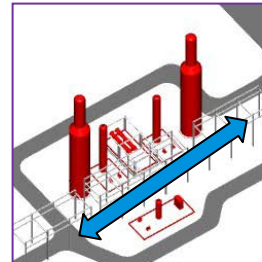


Example 1: Less equipment spacing

Modular Design is a compact design

- ◆ Equipment spacing

Extra protective systems:



Automatic spray systems



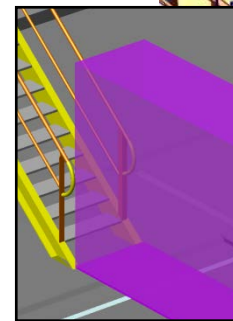
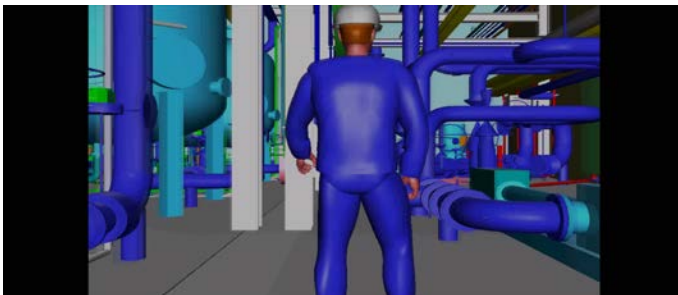
Fireproofing



Fire & Gas detection systems

Example 2: Accessibility

- ◆ In a module may be more steel:
 - obstruction for operator
- ◆ A module has levels:
 - More time to get out of structure



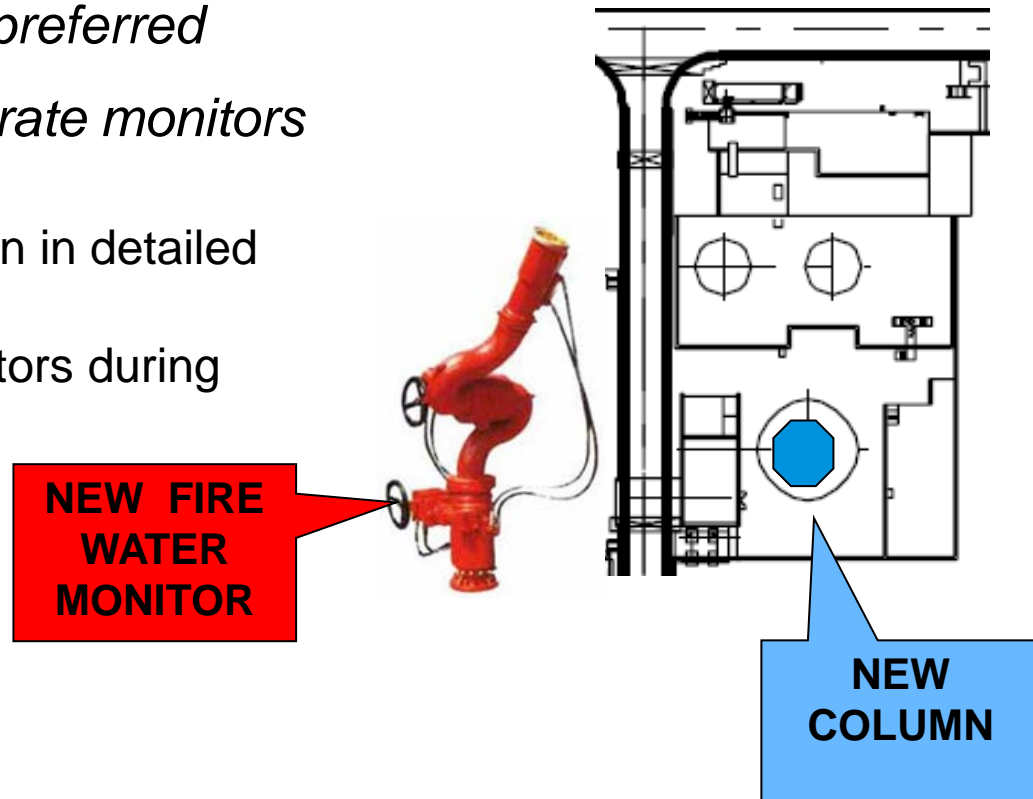
Example 3: Firefighting Stick Built Design

- ◆ firefighting approach developed in engineering phase 2D layout:

Fire water monitors preferred

Fire brigade will operate monitors

- Type and location in detailed design
- Installation monitors during construction

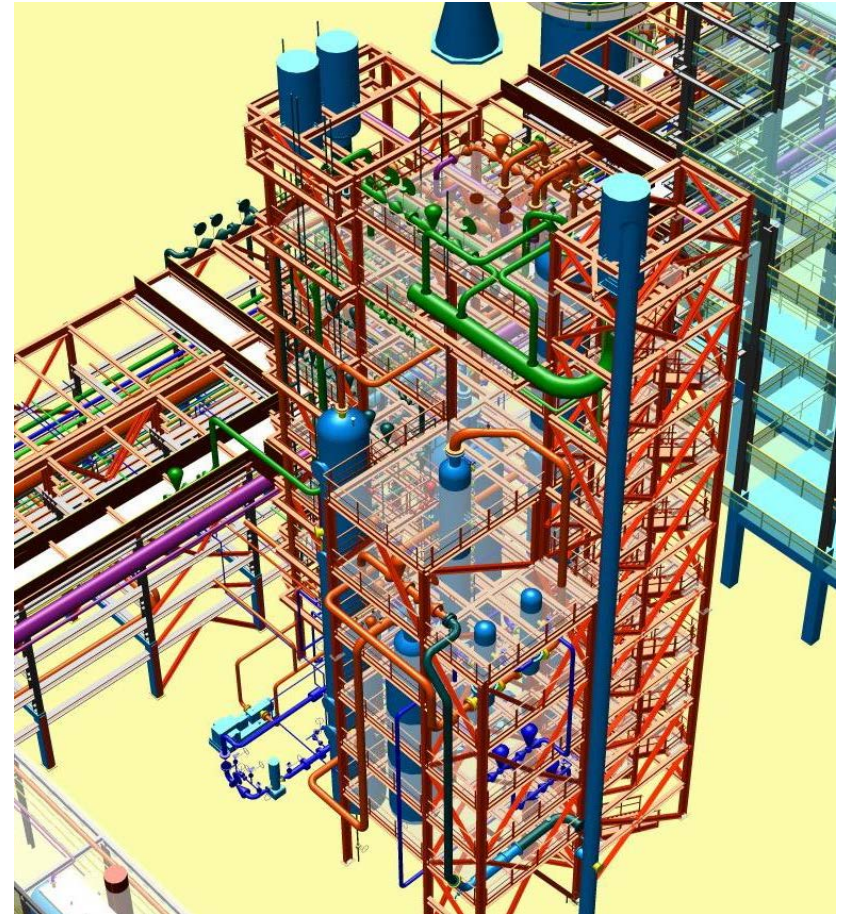


Example 3: Firefighting Modular Design

- ◆ Column in compact structure
 - monitor can not cover column
 - Fire brigade not to access the module
- ◆ Automatic spray systems



- ◆ Integrated in design
- ◆ Built in module at yard

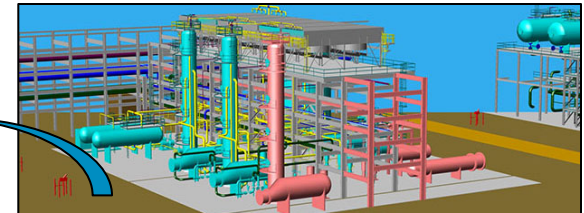
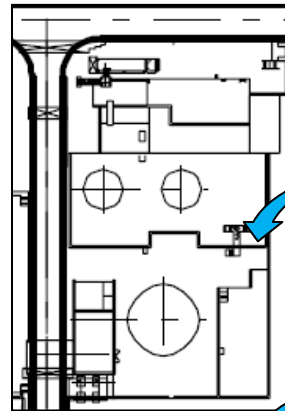
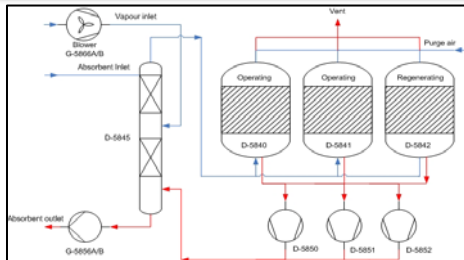


Different approach **Safety** in Design

**CONCEPTUAL
PHASE**

**ENGINEERING
PHASE**

**DETAILED ENGINEERING
PHASE**



- General safety approach

- Equipment spacing **3D** layout
- Firefighting approach

- Escape routes in 3D model
- Firefighting equipment & layout

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Conclusion

- ◆ Modular Design is a great concept!
- ◆ Modular design requires a different approach for safety in design
 - Equipment spacing
 - Accessible facility
 - Adequate Fire fighting design



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or look at www.fluor.com