



# **Data Centric Configuration Management: Challenges, Progress, and Insights from the Nuclear Power Industry**

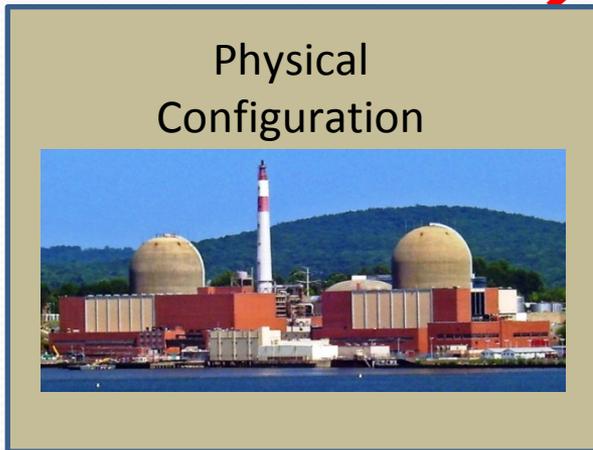
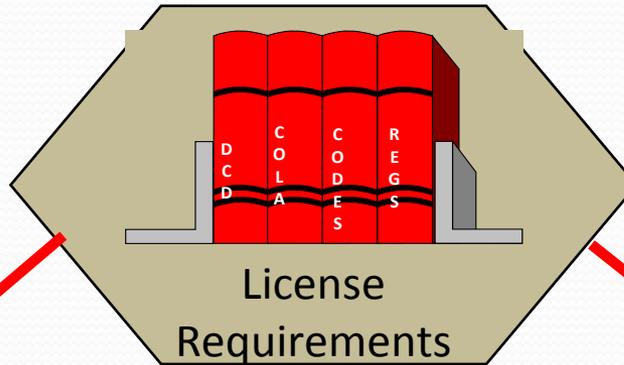
**Bob Renuart**

**NIST Model Based Enterprise Summit**

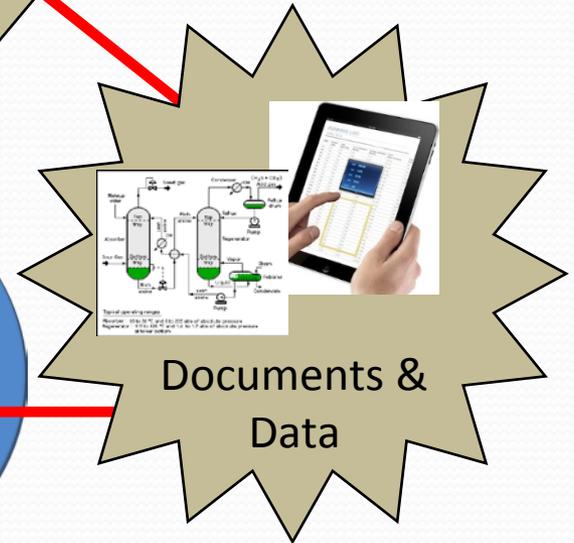
**December 16, 2014**

# Configuration Management

What Must be There



What is Actually There

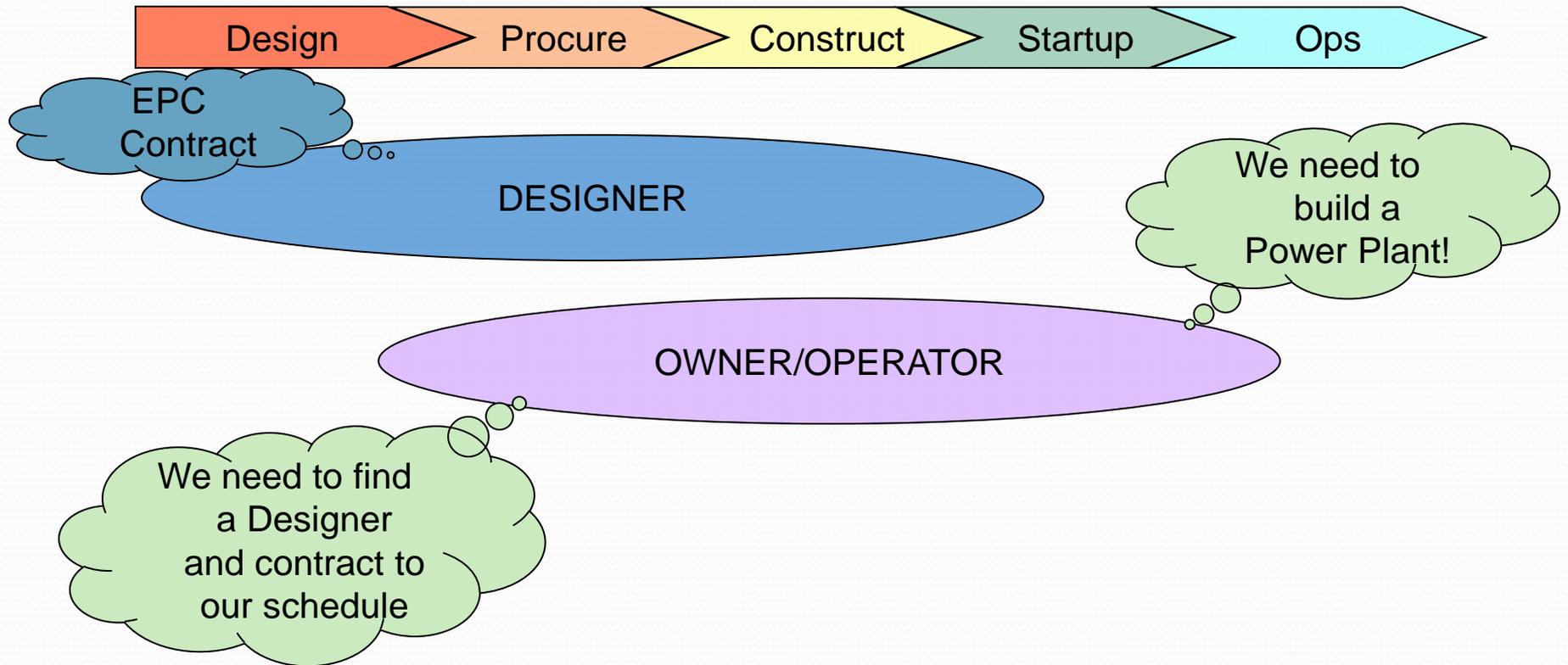


What We Say is There

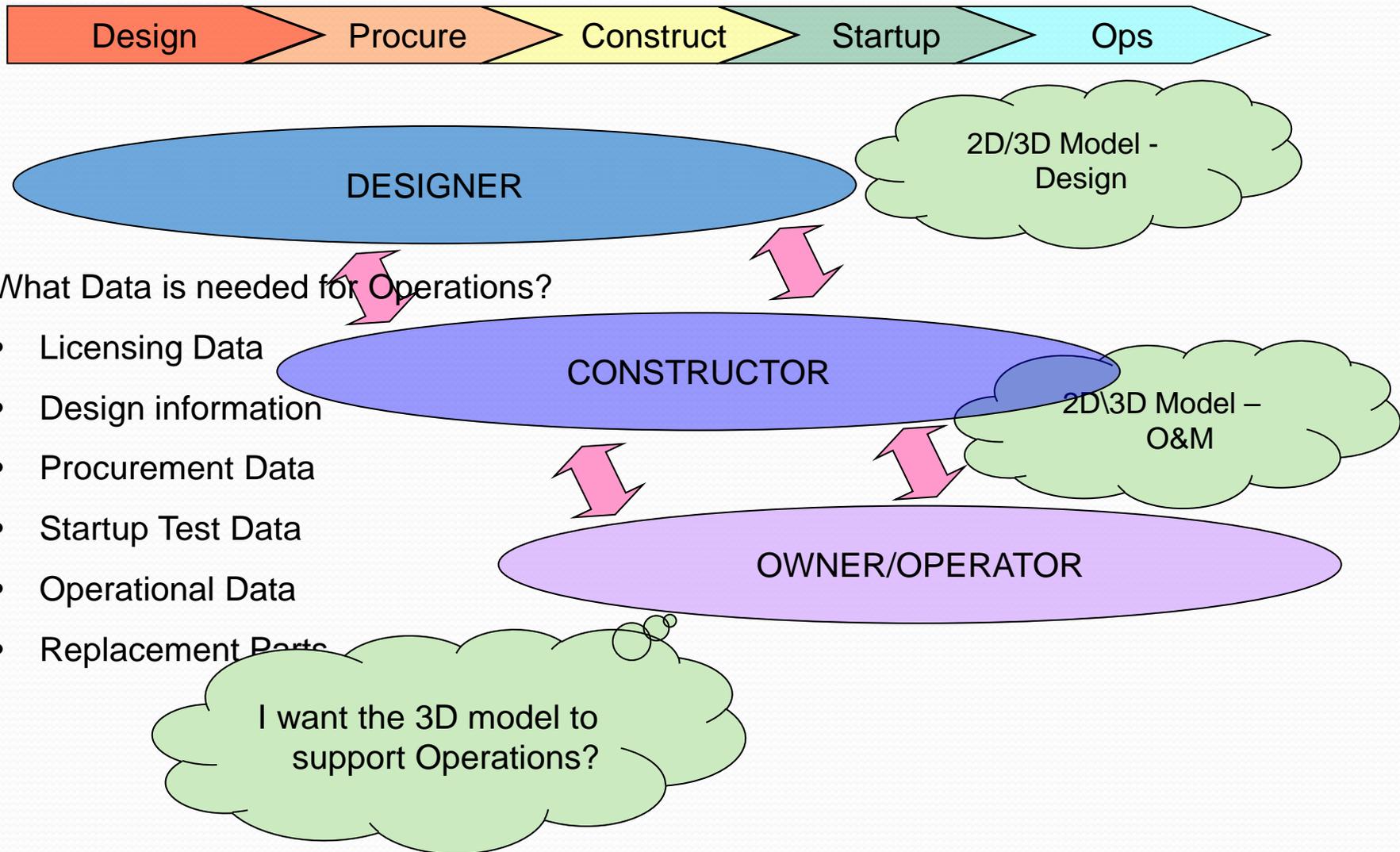
# Data-Centric CM Challenge

- Decisions are made on **data**, not **documents**. Data needed to make routine plant decisions should be centralized, change controlled, and easily accessible.
- The Nuclear Industry needs a **standard** that will provide direction on what data we should include.
- Today a typical Operating Plant has upwards of **20 siloed databases** that contain operational critical data maintained with different levels of change control.
- A recent EPRI study estimated that there is an opportunity **benefit of \$8B** for the remaining life of 100 operating plants and up to **\$1B for the 4 new build plants** in the US to move from primarily document-centric to data-centric CM.

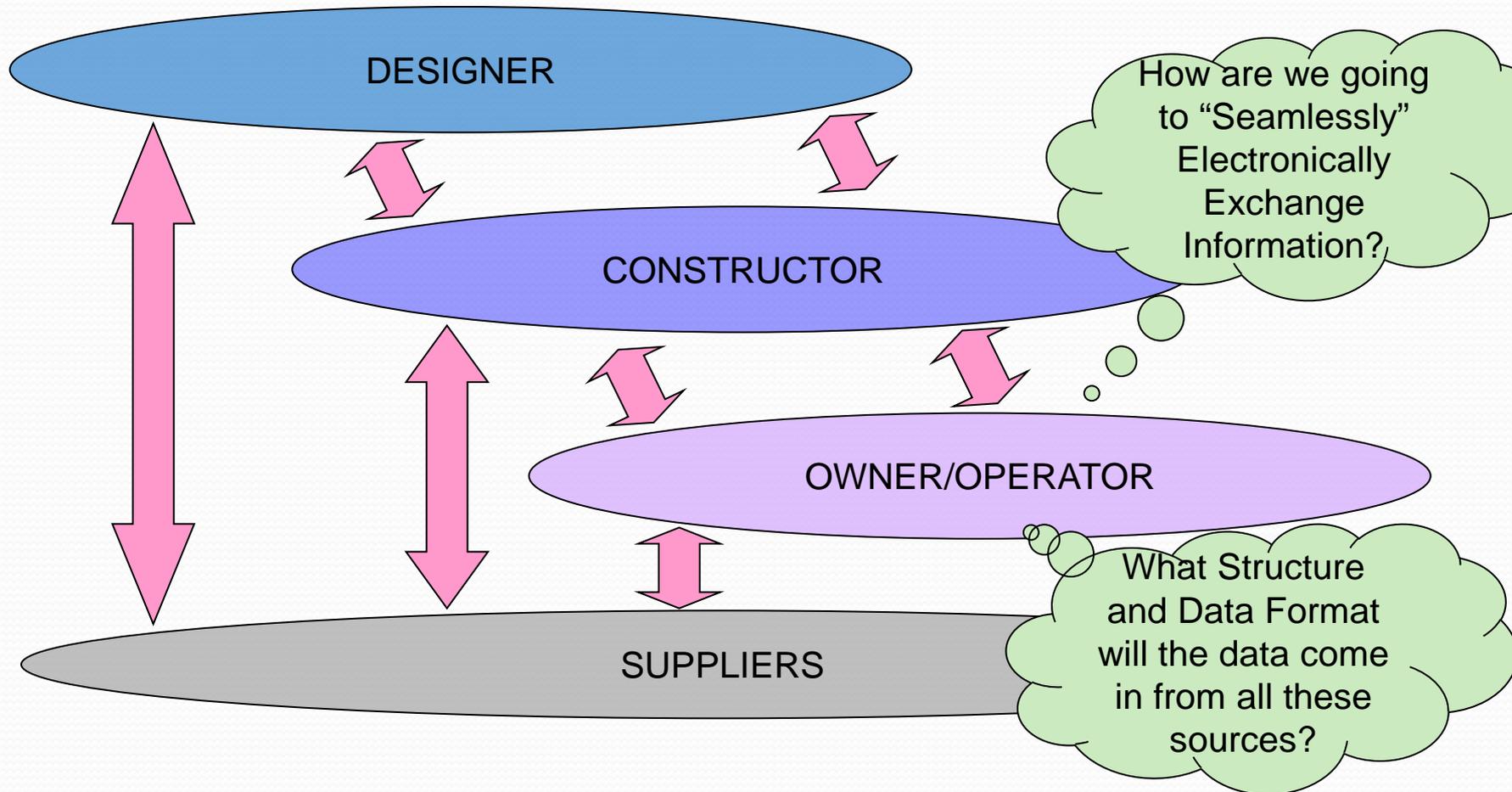
# Information Turnover and Interoperability Challenge



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# Information Turnover and Interoperability Challenge



# EPRI Recommended Best Practices for the Next New Plant Orders

- Define **Information Turnover Requirements Early**, as part of the Designer and Constructor Contracts
  - EPRI Report 1019221, “New Nuclear Power Plant Information Handover Guide”
  - NISTIR 7259, “Capital Facilities Information Handover Guide”
- Leverage Industry **Data Standards** to Exchange Data with the Designer and Constructor
  - Begin with ISO 15926 for process industries
  - Supplement with the EPRI Plant Information Model for Nuclear
- Contractually, require Suppliers to deliver Equipment Specifications in the **same Electronic Format** as asked for.
- Finally run a **Pilot Turnover** well before Startup Testing to ensure the Owner Expectations will be met.

# EPRI Plant Information Model (PIM) Lifecycle

**Requirements  
(Requirement  
Number)**

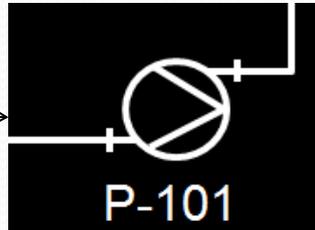


***Design Basis  
requirements  
embedded in  
~12,000 pp of  
Licensing  
Documents***

# EPRI Plant Information Model (PIM) Lifecycle

**Requirements  
(Requirement  
Number)**

**Engineered Item  
(TAG Number)**



***Design Basis  
requirements  
embedded in  
~12,000 pp of  
Licensing  
Documents***

***Component,  
System, Location  
Properties  
Specifications  
Eng Drawings***

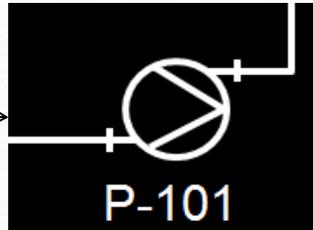
# EPRI Plant Information Model (PIM) Lifecycle

**Requirements  
(Requirement  
Number)**



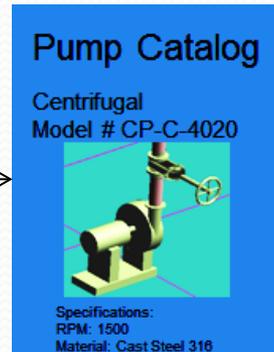
*Design Basis  
requirements  
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**Engineered Item  
(TAG Number)**



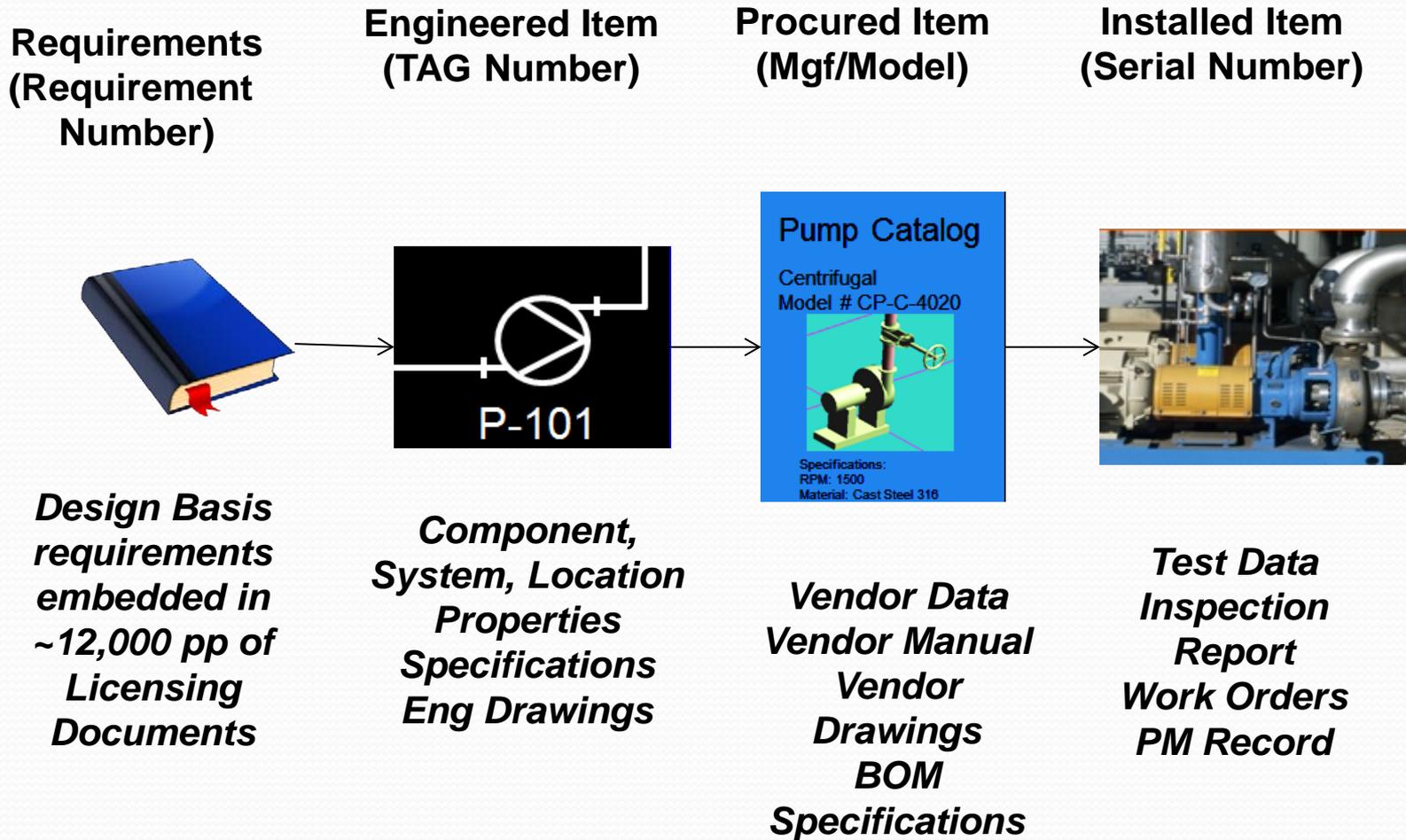
*Component,  
System, Location  
Properties  
Specifications  
Eng Drawings*

**Procured Item  
(Mgf/Model)**



*Vendor Data  
Vendor Manual  
Vendor  
Drawings  
BOM  
Specifications*

# EPRI Plant Information Model (PIM) Lifecycle



# EPRI Plant Information Model (PIM) Lifecycle

**Commitments  
(Commitment  
Number)**

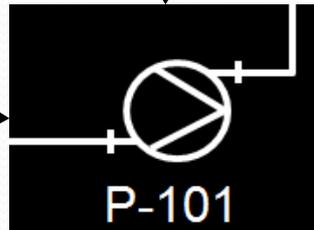
**Engineered Item  
(TAG Number)**

**Procured Item  
(Mgf/Model)**

**Installed Item  
(Serial Number)**

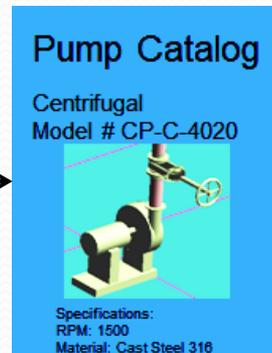


*Design Basis  
requirements  
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Licensing  
Documents*



*Component,  
System, Location  
Properties  
Specifications  
Eng Drawings*

The Tag Number is related to the  
Asset Serial Number



*Vendor Data  
Vendor Manual  
Vendor  
Drawings  
BOM  
Specifications*



*Test Data  
Inspection  
Report  
Work Orders  
PM Record*

# Properties in an Object-Relationship Model

## Environmental Qualification

- Qualification Method
- EQ Zone Rating



## License Application

### Requirement



## CCS Pump Sizing Calculation

### Design Pump Properties

- Design Disch Press
- Design Flowrate
- Design NPSH



Flow Diagram



## Inservice Test Program

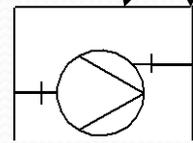
- Test Frequency
- Test Method
- Test Parameters
- Alert, Action Limits

## Room Properties

- Normal Temp, Humid
- Accident Temp, Humid
- Rad Levels



**Location:**  
Aux Building  
Bldg 12  
Level 5  
Room 12561



CCS Pump

VS2-CCS-MP-01A



Gould  
Model CP-C-4020



Division 1

- Serial 6791
- Test Results**
- Discharge Press
  - Flowrate

Serial 6792



Division 2

Serial 6793



Spare:

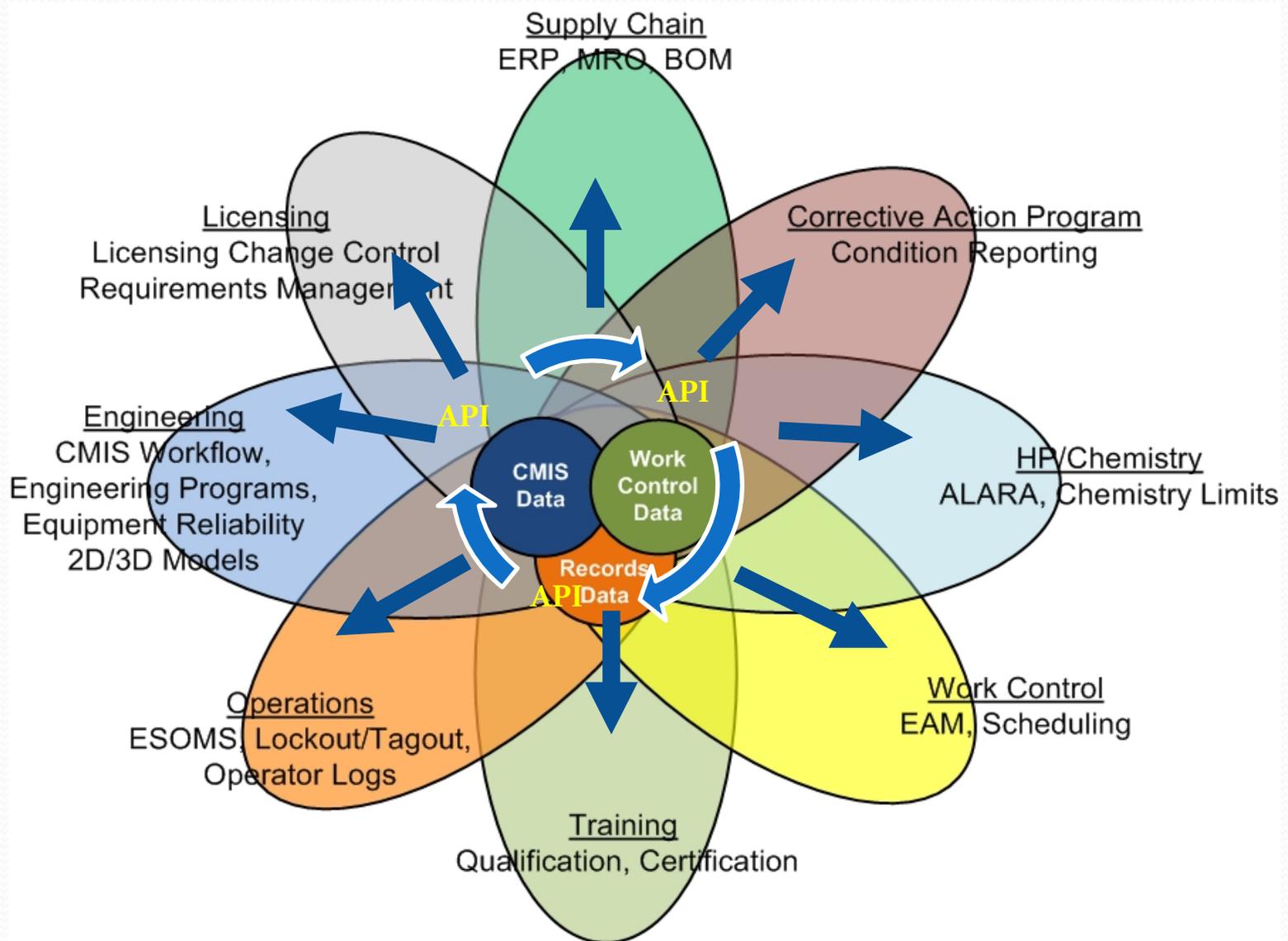
## Wall, Ceiling, Floor Properties

- Fire Barrier
- Shield Wall
- Missile Shield



- Purchased Pump Properties**
- Vendor Model Disch Press
  - Vendor Model Flowrate
  - Vendor Model NPSH

# Data Centralization



# Use Cases for EPRI PIM during Design and Construction

- Control Design Margins as the design changes
- Manage Requirements and Conduct more thorough Design Impact Reviews.
- Manage Design Inputs that change often during Design
- Manage Unverified Assumptions –Understand the chaining Impact of a Design Document with a UVA that may be holding up issuing it for Construction

# Use Cases for EPRI PIM During Operations

- Modern Plant Lifecycle Management (PLM) Systems are Data Driven
- Access to Licensing Requirements and Current Test Data Trends to Support Operability Determinations
- Conduct Design Impact Reviews to support Plant Changes
- Trend Data to support Regulatory Driven Inspection and Test Programs.
- Access the Data via the 3D Model in Electronic Workflow Processes

# **Future Vision – 2030 with 40-50 Westinghouse AP1000 Reactors Operational around the World**

- Construction Experience: Overlay 3D Laser Scans of Manufactured Modules in the 3D Model to identify out of tolerance connections before Site Delivery
- Maintenance Experience: Preventive Maintenance Schedule Development and Adjustment based on Fleet Maintenance Trends
- Operational Experience: Fleet data history to manage Parts Inventory and Obsolescence
- Fleet data to update Probabilistic Risk Models

# Additional Information

- Robert Renuart – [renuartconsulting@gmail.com](mailto:renuartconsulting@gmail.com)
- [www.cmbg.org](http://www.cmbg.org) – Nuclear Industry CM Benchmarking Group
- EPRI New Nuclear Power Plant Information Handover Guide -  
<http://www.epri.com/search/Pages/results.aspx?k=Information%20Handover>
- EPRI Elements of Pre-Operational and Operational Configuration Management for a New Nuclear Facility  
<http://www.epri.com/search/Pages/results.aspx?k=New%20Plant%20configuration%20management>