AABC Commissioning Group

AIA Provider Number 50111116

Commissioning of cGMP and Laboratory Systems

Course Number: CXENERGY1731

Michael Conway, CxA
exp U.S. Services Inc.

April 27, 2017

Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Copyright Materials

Course Description

This presentation will focus on commissioning unique systems associated with pharmaceutical, Bio-Technology and Manufacturing facilities. This presentation will emphasize the importance of the commissioning process for FDA regulated systems and environments – from installation verification and start-up, to operational verification and turnover packages – all steps must be completed and documented to follow the conditions required of these critical applications.

Learning Objectives

At the end of the this course, participants will be able to:

1. Explain what cGMP means, how it's regulated, and where it's relevant.

2. Describe how commissioning fits into the workflow of designing, constructing, and operating validated systems.

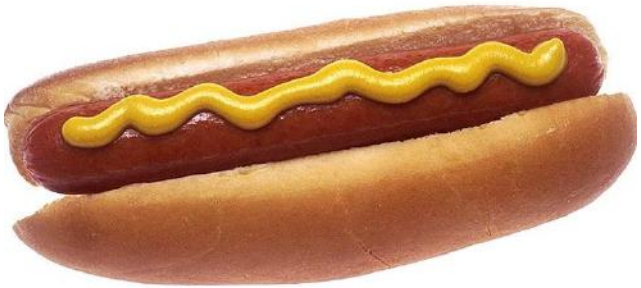
3. Give examples of functional testing procedures for systems unique to laboratory environments.

4. Recognize opportunities to provide commissioning services for non-traditional systems.

Let's talk **c**urrent **G**ood **M**anufacturing **P**ractices (cGMP)

- Products regulated by the US Food and Drug Administration (FDA) must adhere to current Good Manufacturing Practices (cGMP).
- cGMP assures proper design, monitoring, and control of manufacturing processes and facilities.
- "Current" GMP is required. What was the gold standard 20 years ago may be less than adequate now. Using current technology and systems is required.
- The FDA conducts audits/inspections of regulated facilities to ensure quality compliance.

Examples of Good Manufacturing Practices (GMP) regulated sectors…



Food

Medical Devices

Drugs

Ingestible Products (cosmetics, etc.)

Hold on, I'm a Commissioner…Why do I care??

- Equipment and environments determined as GMP require a different commissioning process than the guidelines set forth by ACG, ASHRAE, LEED, etc.

- Commissioning is a critical step in a larger quality control process. For certain GMP systems, commissioning is a precursor to further verifications called Qualification and Validation.

- Document, Document, Document!! Following Good Documentation Practices (GPD) is required…

Good Documentation Practices (GDP)

- All GMP documentation must follow GDP. GDP requirements are typically detailed in a Standard Operating Procedure (SOP), provided by the owner.

- GDP ensures identity, authenticity and accuracy of documented records.

- Highlights:
  - All entries are dated and initialed
  - Use blue or black non-bleed ink
  - No blank spaces allowed on documents
  - Entry or document errors must be crossed out, adjusted, initialed and dated.

Item	Test	Method	Acceptance Criteria	Result	Pass OR Fail	Initial/Date
1	Noise	Verify by inspection and test	Noise level does not exceed ~~80dBA~~ 79dBA	Noise Level does not exceed 79 dBA	Pass	ET 21 MAR 14

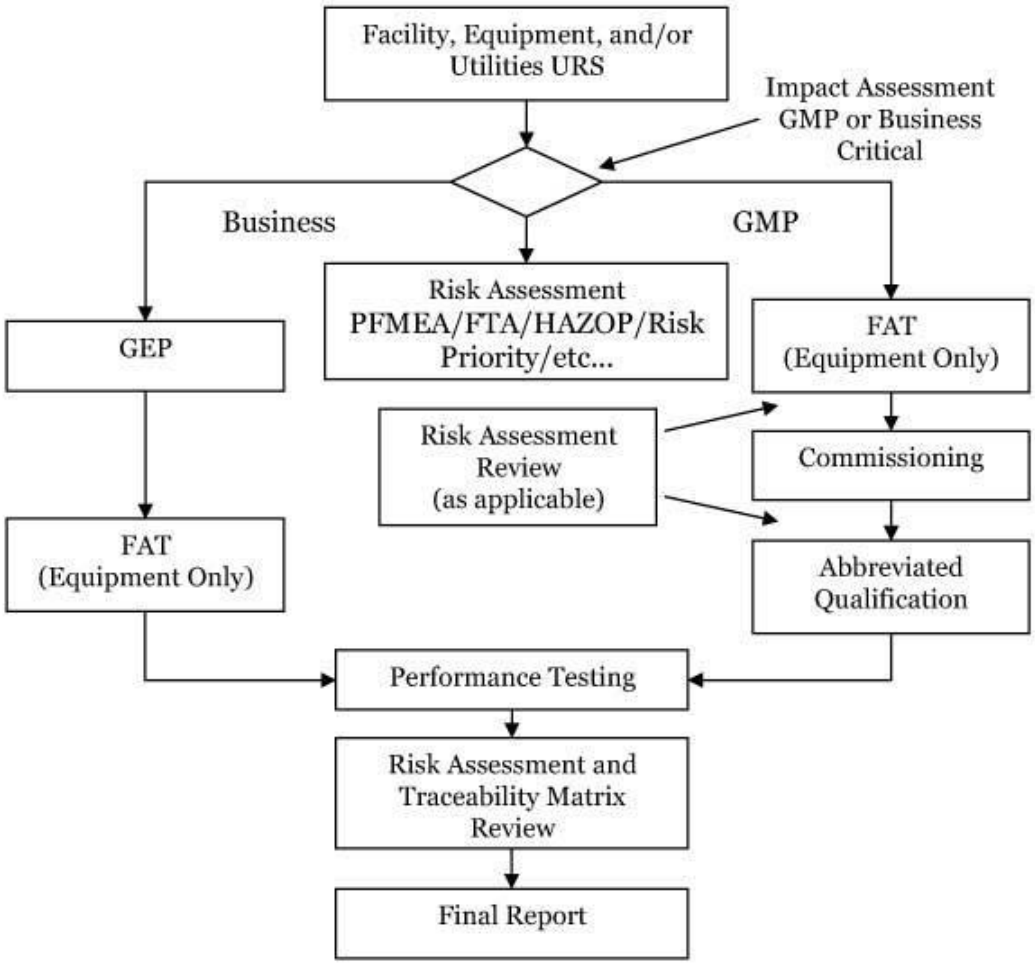
ET 21 MAR 14

Site Impact Assessment (SIA)

Direct Impact??

Indirect Impact??

No Impact??



Real World Commissioning Example
GMP Air Handling Unit – AHU-105

Impact Assessment:

- AHU-105 serves a storage warehouse which holds GMP product for distribution.

- Based on the SIA, it has been identified that the space temperature DIRECTLY affects the product. The product must be stored between 65°F and 90°F.

- Based on the SIA, it has been identified that the AHU serving the space INDIRECTLY impacts the temperature of the product. Although this is the primary source of conditioned air, the room does not require that this be functioning in order to maintain the temperature range of the stored product.

Real World Commissioning Example
GMP Air Handling Unit – AHU-105

User Requirements Specification (URS)

- The User Requirements Specification (URS) is created by the owner/design team and serves as the combined Basis of Design (BOD) and Owners Project Requirements (OPR) for a single piece of equipment or system.

- AHU-105 URS Highlights:
  - Supply and return fans are 100% redundant, provided with individual VFDs. Unit has 25% spare capacity.

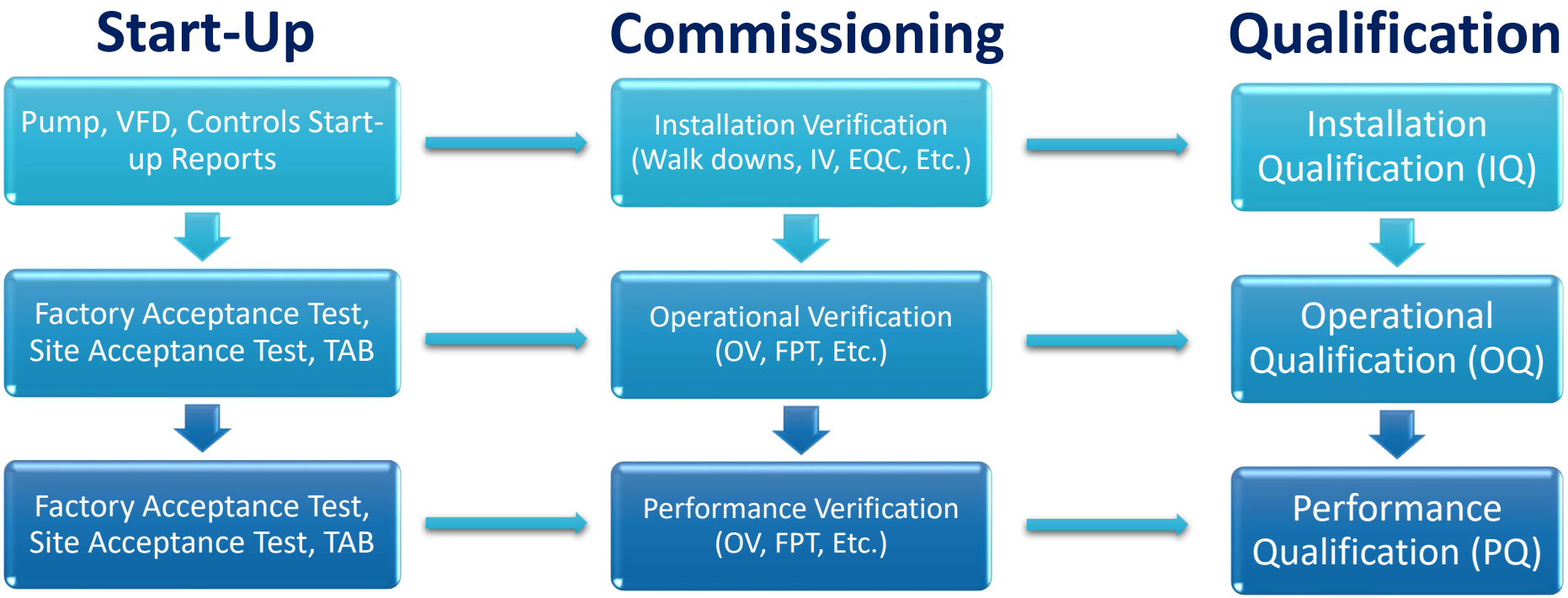
  - Hearing protection is required if sound levels exceed 80 dB at 5 feet from equipment (AHU and condensing unit).

  - Space humidity control will be provided for personnel comfort, however this has No Impact on the the stored product

  - Commissioning documentation will be leveraged into Qualification, requiring that it meets GMP/GDP standards.

Real World Commissioning Example
GMP Air Handling Unit – AHU-105

"Leveraging" Commissioning into Qualification



Real World Commissioning Example
GMP Air Handling Unit – AHU-105

Commissioning Protocol Format:

Item	Test	Method	Acceptance Criteria	Result	Pass OR Fail	Initial/Date
`1	Noise	Verify by inspection and test	Noise level does not exceed ~~80dBA~~ 79dBA	Noise Level does not exceed 79 dBA	Pass	ET 21 MAR 14

ET 21 MAR 14

Case Study: Pharmaceutical Client
GMP Cold Room Lessons Learned

- The DX cooling system staged compressors to maintain cold room temperature. Temperature dead band was adjusted down at the control panel to prevent temperature spikes in the room.

- Data logger temperature probes were placed in small glycol bottles, which provided a thermal buffer to smooth rapid fluctuations in temperature due to compressor cycling, door openings, etc. This is good practice for temperature monitoring of freezers and cold rooms.

- As part of the installation verification, ensure the cold room is properly sealed at all penetrations. Focus on the door construction, mounting and gaskets to ensure no air infiltration.

Case Study: Neuroscience Lab
Solvent Delivery & Waste - Overview

Bio-Safety Cabinet

Solvent Room

Process Control Panel

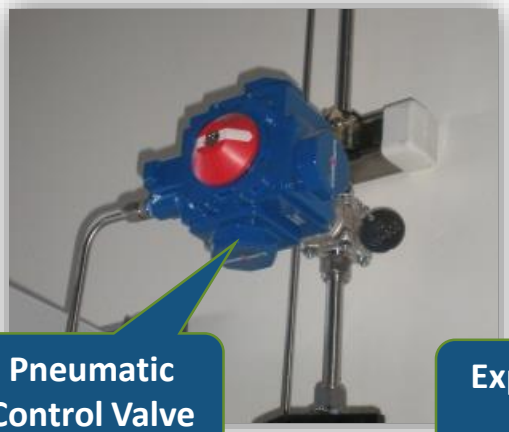
CONTINUING EDUCATION AIA

Case Study: Neuroscience Lab
Solvent Delivery & Waste Controls

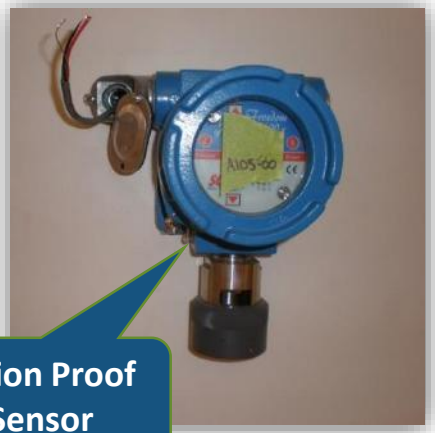
Pneumatic Changeover Valve Manifold

Pneumatic Diaphragm Pump

HMI



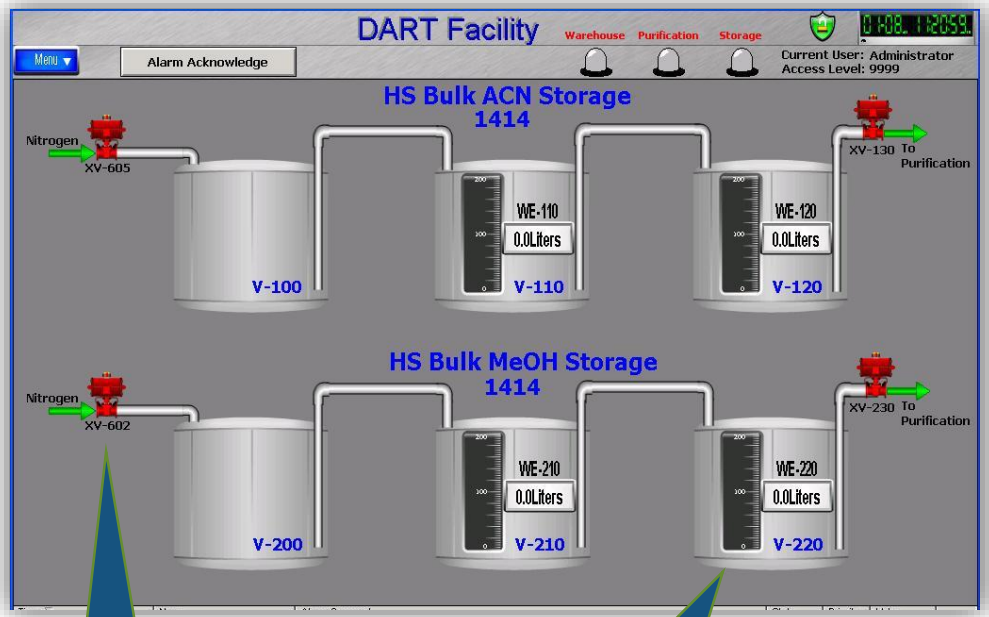
Pneumatic Control Valve

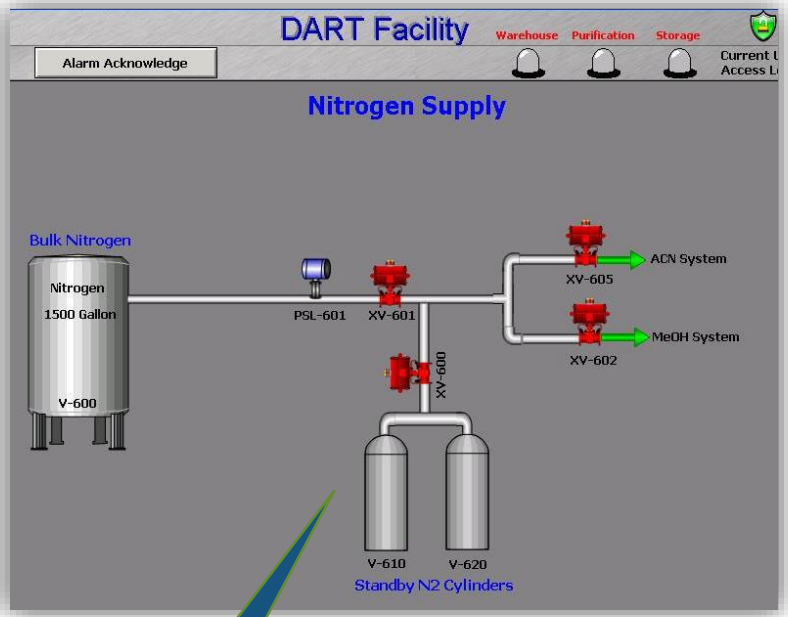


Explosion Proof O2 Sensor

CONTINUING EDUCATION AIA

Case Study: Neuroscience Lab
Bulk Solvent Storage and Supply



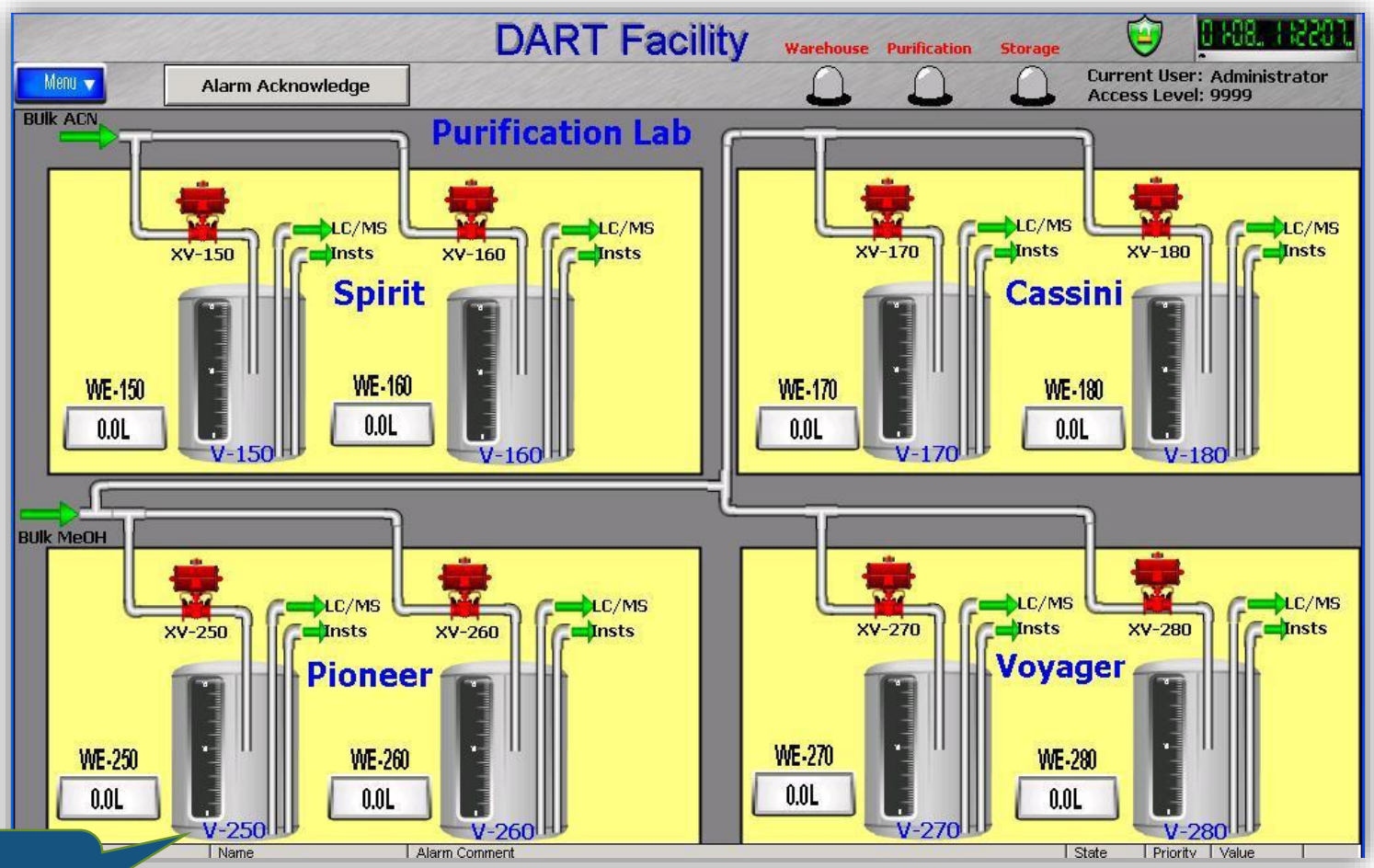


Nitrogen pressurizes solvent supply

Weight scales are used to notify Facilities when tanks are low

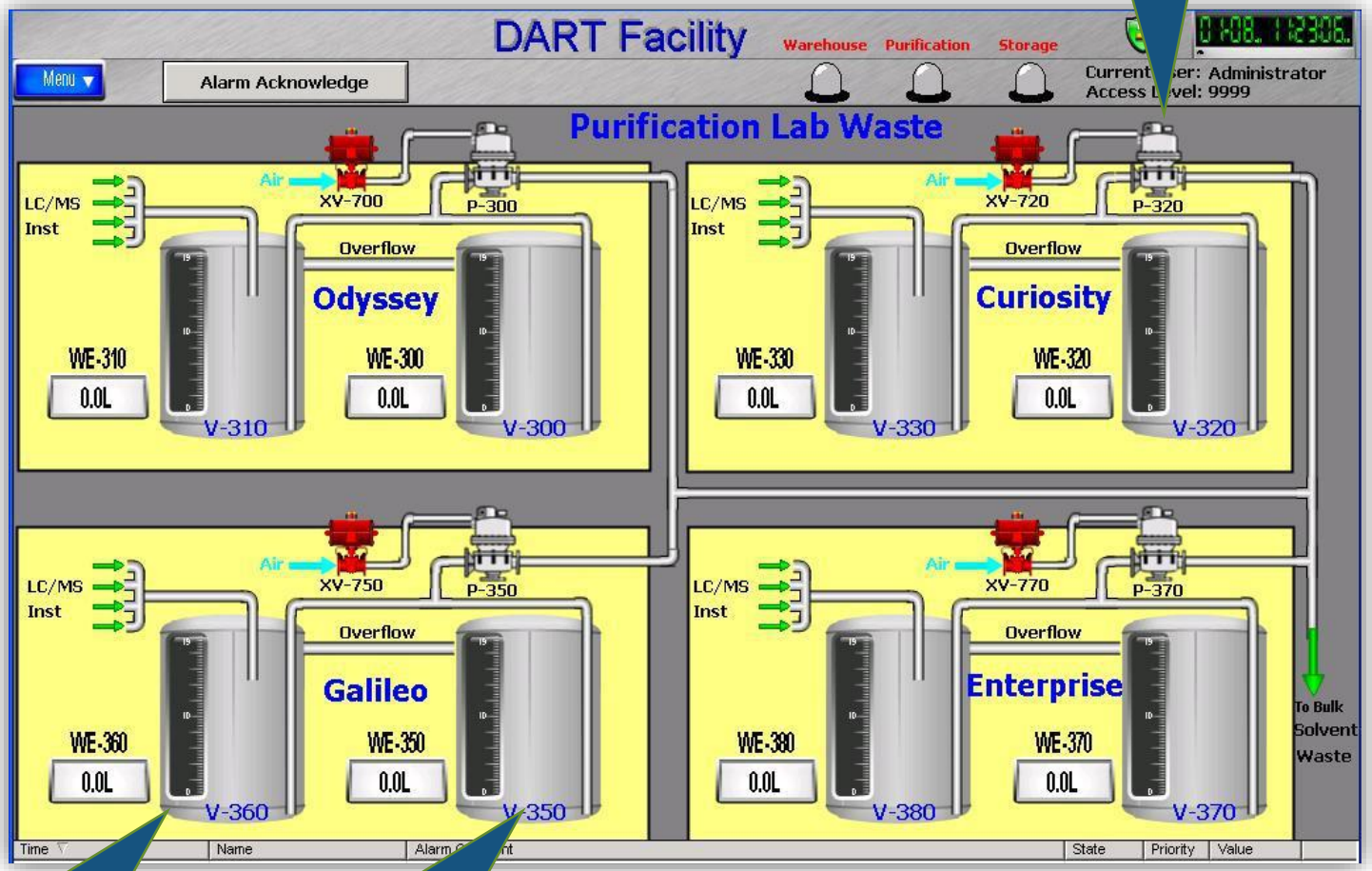
Backup Nitrogen Tanks

Case Study: Neuroscience Lab
Secondary Solvent Storage



Secondary Storage Tanks

Case Study: Neuroscience Lab Secondary Waste Containment

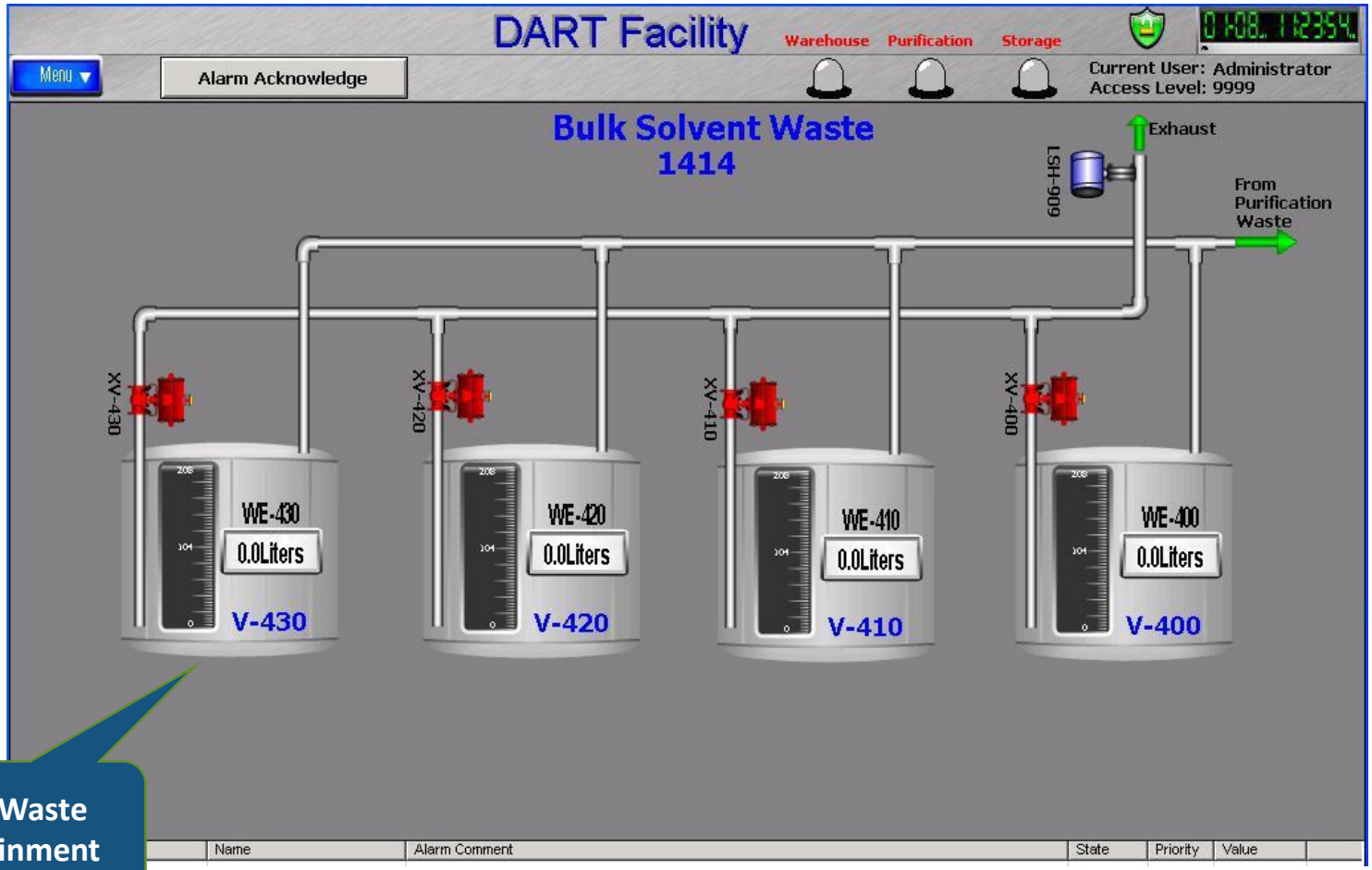


Diaphragm Pump

Primary Waste Containment

Backup Waste Containment

Case Study: Neuroscience Lab
Bulk Solvent Waste Containment



Bulk Waste Containment

Case Study: Neuroscience Lab
Solvent System Lessons Learned

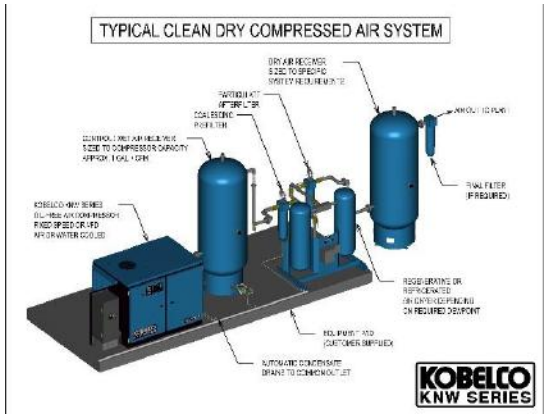
- Commissioning was executed using water, not solvents. These liquids have different weights per liter, which affected the PLC weight scale programming. Temporary programming should be coordinated for Cx.

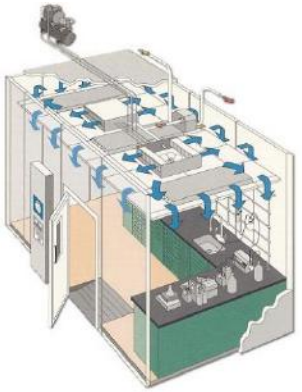
- Balancing flow of the diaphragm pumps was difficult. Ensure adjustable pressure reducing valves (PRVs) are installed at the compressed air connection to each pump for field adjustment.

- A networked leak detection system was used for this project. Multiple leak sensors were daisy-chained together, which communicated back to a main control panel. Issues with network connections and speed were identified during Cx. Recommend individual PLC inputs for each leak detection sensor.

- Pneumatic changeover manifold assemblies leaked air, causing actuators to not open/close 100%. Plastic connections should not be used, recommend hard piped connections (copper) at air distribution manifold.

Broaden Your Horizons…





This concludes The American Institute of Architects
Continuing Education Systems Course

Michael Conway

1 (858) 597-0555

Michael.Conway@exp.com