

1. Project Overview

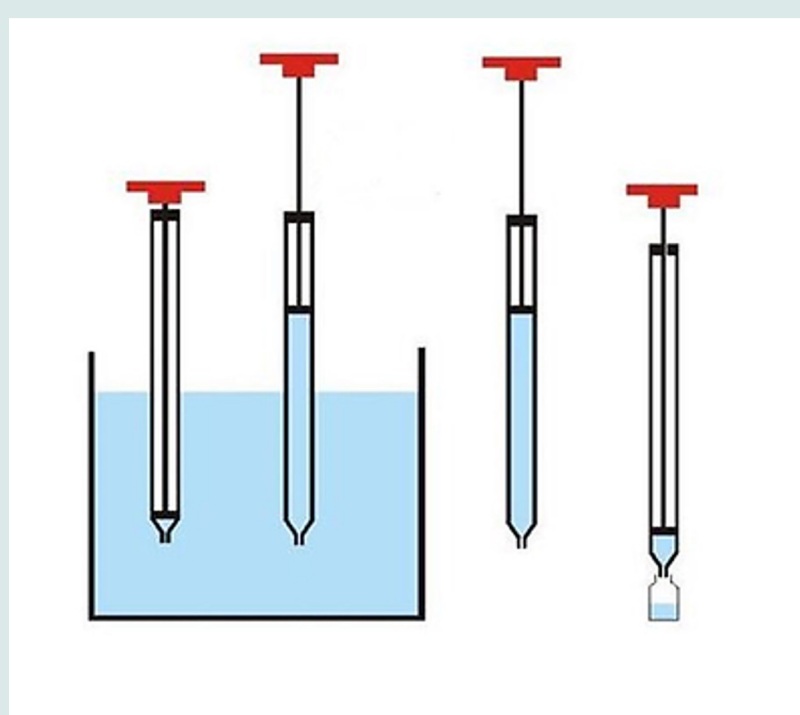
Goal: Design a process for storing, distributing, and managing waste of bulk chemicals

Motivation: Providing a reliable CIP process to improve Merck's production schedule and eliminates the risk of cross contamination.

Challenges: Defining key process parameters, creating safe sampling procedures, determining the impacts of sizing and equipment reliability and completing a cost analysis.

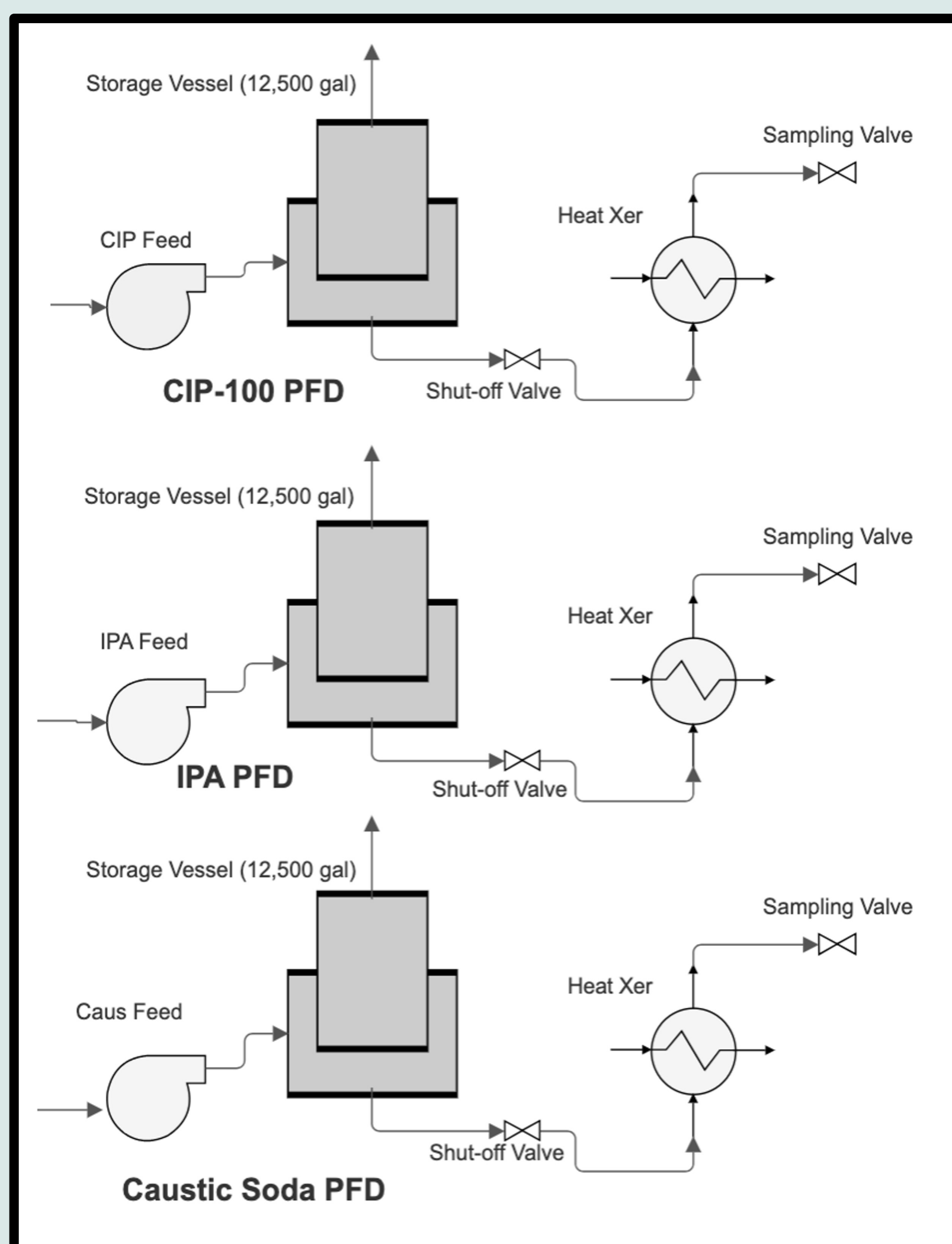
2. Sampling

- Initial sampling is direct from delivery containers to confirming chemical concentration and purity before accepting
- Mobile gantries and fall arrest systems increase safety during tanker sampling
- Routine Risk Assessment Process, sampling thief, and Proper PPE used with each testing
- Confirmation of chemicals completed by a 3rd party lab

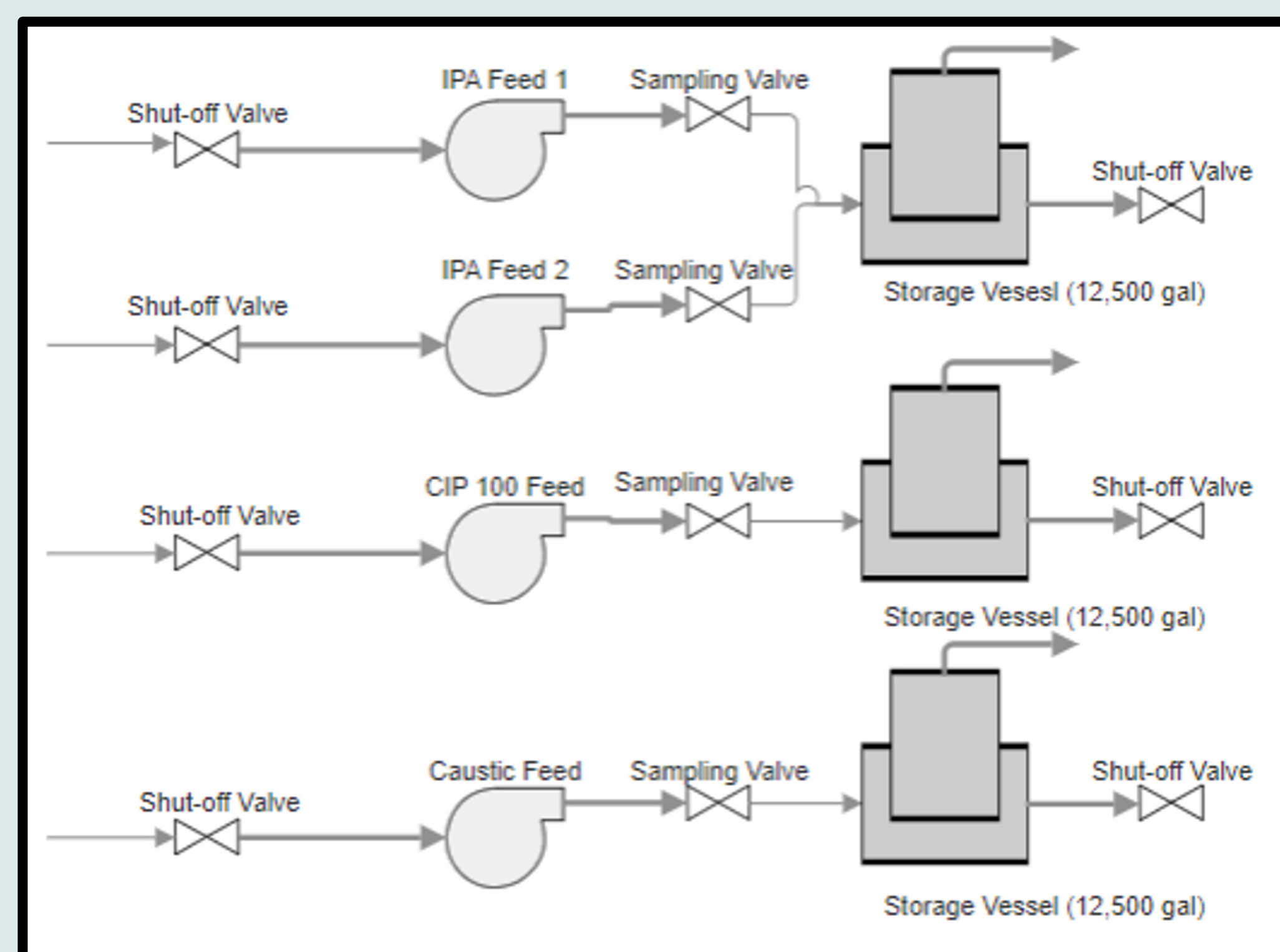


3. Process Flow Diagrams

Storage & Delivery



Waste Management



4. Sustainable Waste Management

Disposal and Reclamation Techniques:

Incineration: For volume and toxicity reduction

Chemical Treatment: Used to neutralize and stabilize waste

Using Specialized Facilities and Services:

Outsourcing waste management services to improve sustainable waste handling practices using methods such as chemical and hazardous waste disposal, secure landfill operations, and innovative recycling solutions.

5. Environmental Safety Features

- Routine Risk Assessment Protocols**
- PPE:** Basic manufacturing, Sampling, and Hazardous waste.
- Safeguards:**
- Storage tanks are placed outside with a roof, walls, and when necessary moats for environmental protection
- SDS's made available to emergency responders
- Detailed training for operators
- Alarm systems

6. Projected Financial Analysis

$$COM_d = 0.18FCI + 2.73C_{OL} + 1.23(C_{UT} + C_{WT} + C_{RM})$$

Cost Category	Cost (USD)
Capital Investment	4,190,000
Raw Materials	3,565,000
Utilities	7,500
Labor Cost	840,000
Waste management	2,304,000

$$COM_d = \$10,275,495$$

Annual Cost = \$6,085,495

7. Conclusion

- The overall delivery system would succeed in real life context.
- Specific process instrumentation is needed to show true system efficiency and correct process parameters.
- An in-house lab for sample testing would minimize downtime and costs.

8. Acknowledgements

We'd like to thank Merck and our mentors Katherine Bieler, Donald Grosse, Jill Grzelak, and Emily Tavernaro!