



Solvent Distribution Improvement

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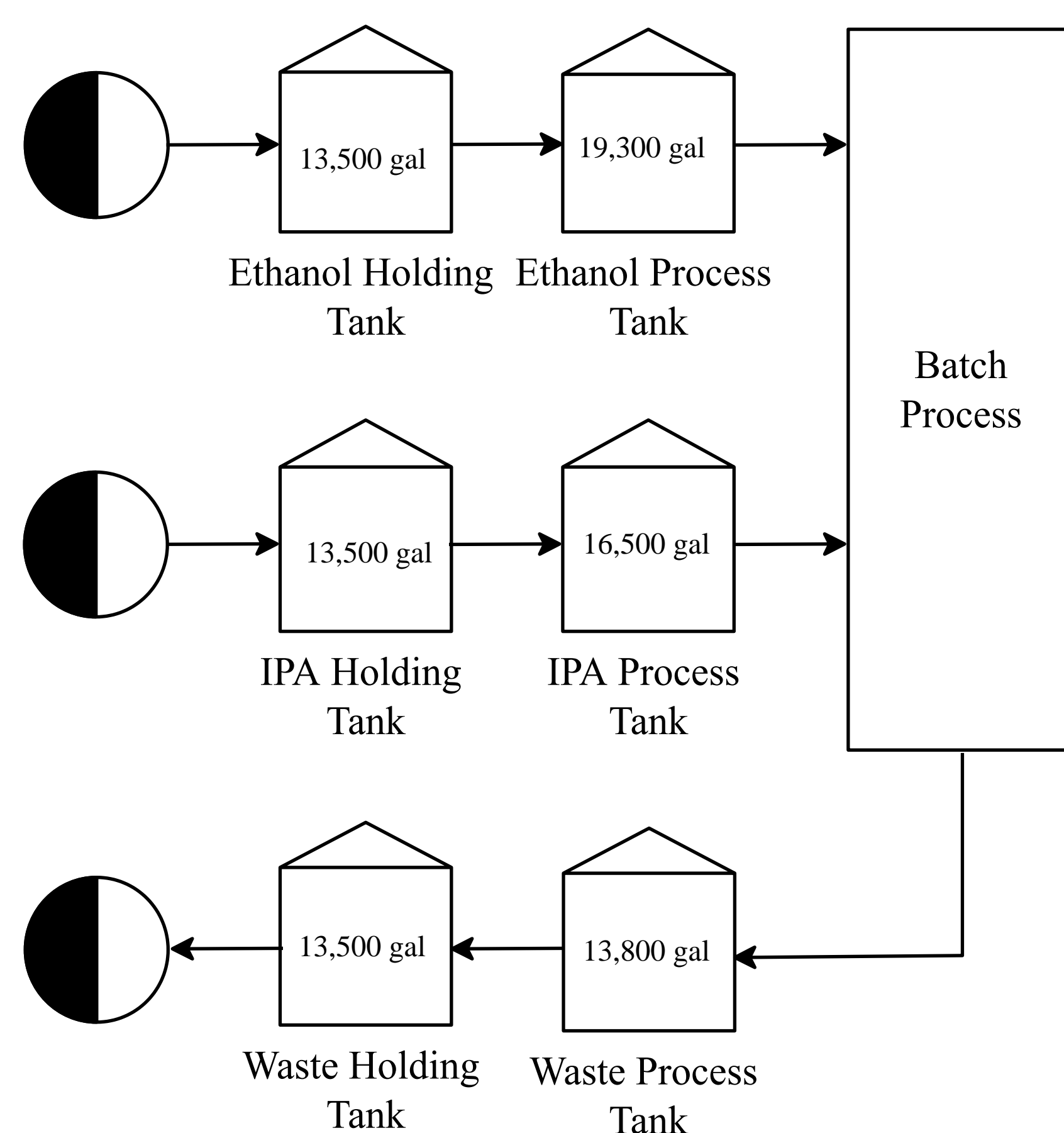


Introduction

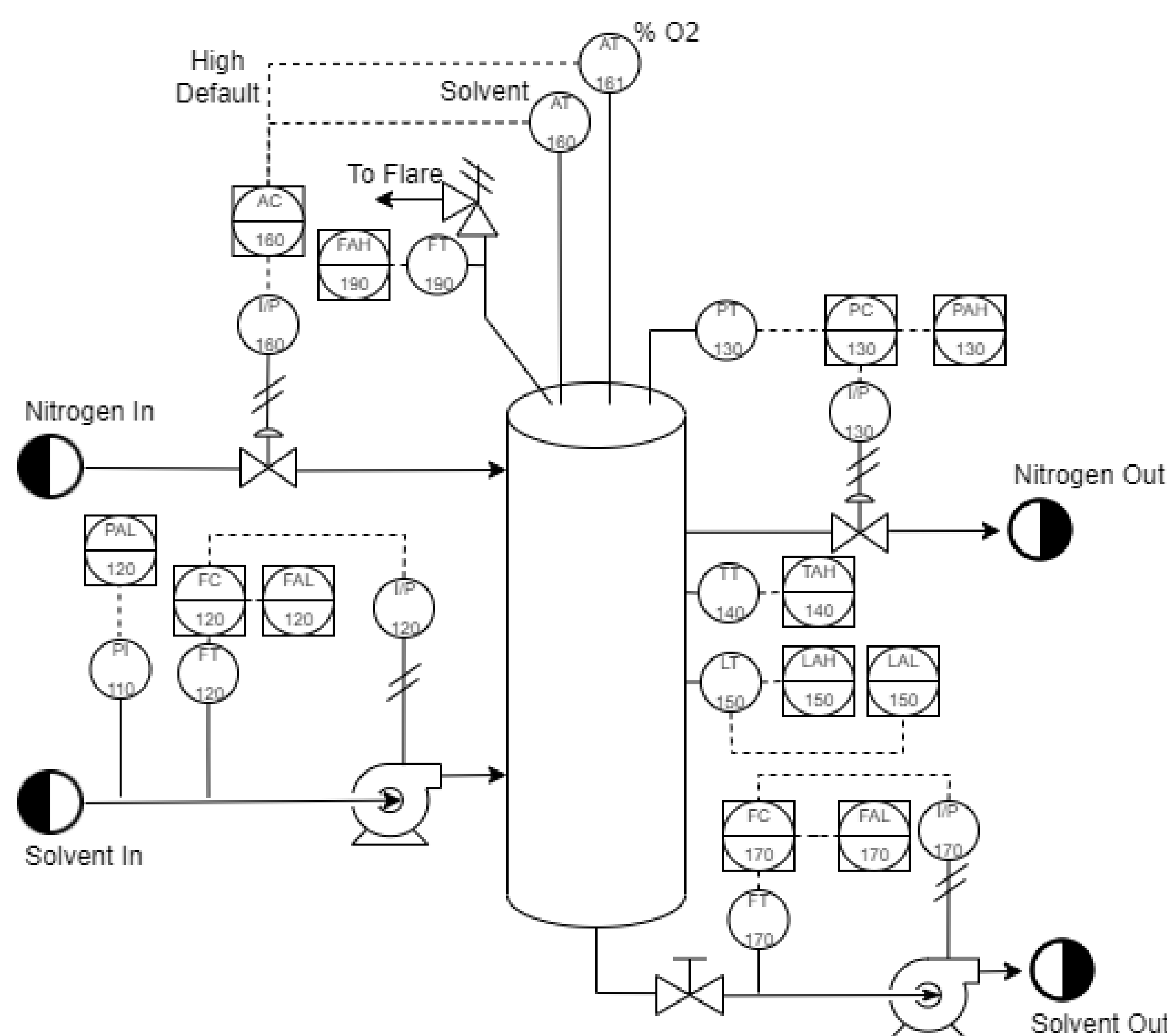
The purpose of this project was to design a novel solvent transfer system to replace an existing process at the Pfizer Kalamazoo plant. The solvents being transferred are isopropyl alcohol (IPA) and ethanol. The current process involves the transfer of 350-gallon chemical totes that contain the solvents and waste in a congested area, which poses safety, ergonomic, and logistical issues.

After conducting a safety analysis, mapping streams, and reviewing several options to replace the existing process, it was determined that bulk storage tanks would be the most suitable option to improve the process. The designed system involves using two tanks for each of the solvents; with the first being a holding tank that allows for quality tests to be conducted. Both an economic and safety analysis were performed to compare the new process to the existing one.

Process Flow Diagram

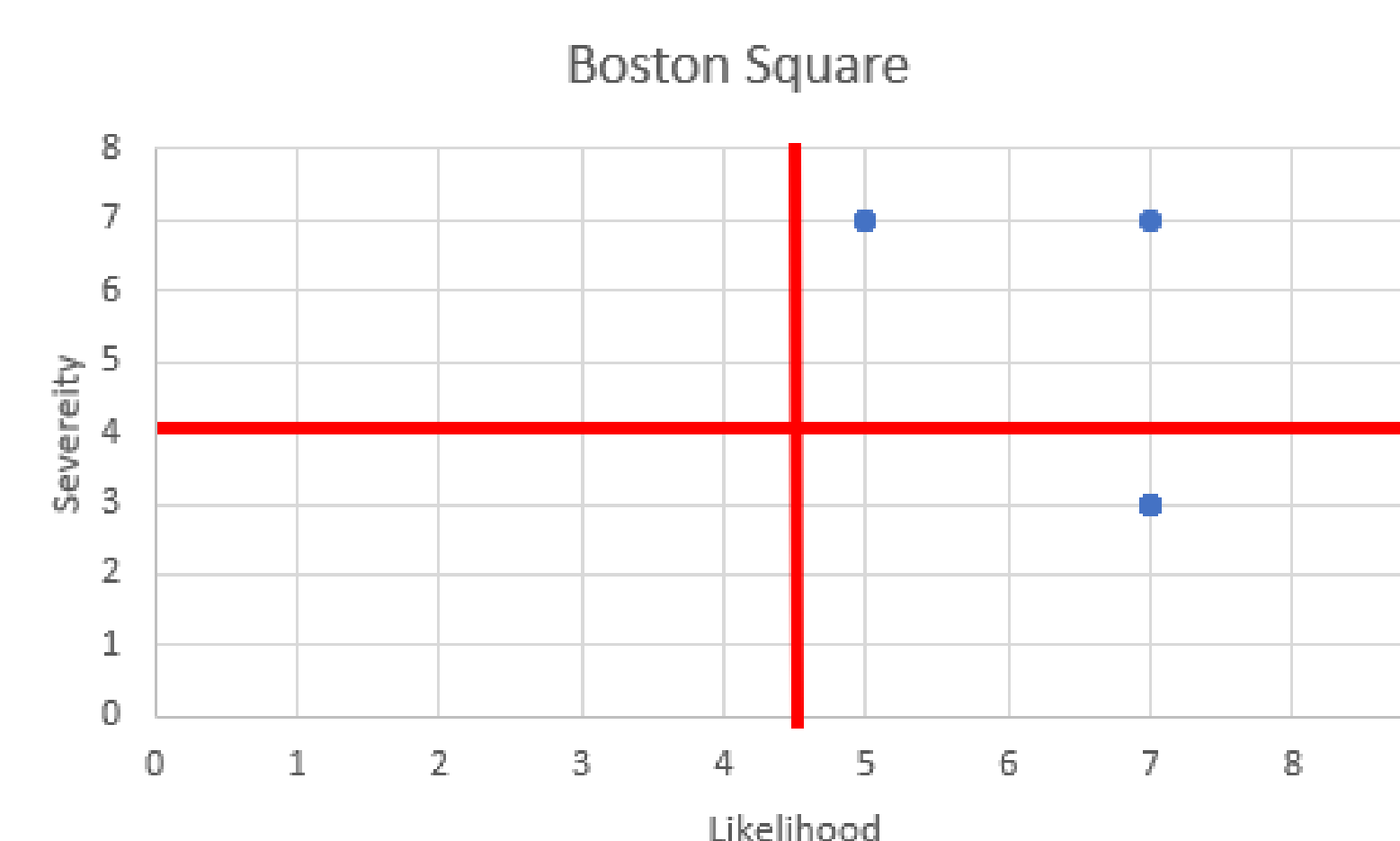


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Safety

- Four design options considered: an outdoor transfer station, larger tanks, smaller transfer totes, or improvements on the current process.
- FMEA was performed on all available options
- Outdoor transfer station was chosen, lowest overall safety risk
- HAZOP was performed on this process.
- This showed that most incidents have high severity but low likelihood.
- Controls were implemented to further decrease both severity and likelihood.
- The Boston Square below shows the results of the HAZOP.



Equipment

Equipment	Model
Level Meter	Ultrasonic ULS
Pressure Meter	VEGBAR 81
Flow Meter	Emmerson F100S Coriolis
Pump	Wilden Pro-Flo AODD

Economics

Tank	Cost
Ethanol Holding	\$61,500
Ethanol Process	\$76,200
IPA Holding	\$61,500
IPA Process	\$69,400
Waste Holding	\$61,500
Waste Process	\$62,500
Total	\$392,600

- The total base cost of the 6 storage tanks is \$392,600.
- The total capital investment is estimated at \$1.9 million.
 - Lang factor of 5

References

Garrett, Donald E. *Chemical Engineering Economics*. Van Nostrand Reinhold, 1989.
 "Micro Motion." Emerson, <https://www.emerson.com>
 Wilden Aodd Pump, 1" Pro-flo, clamped stainless steel, NPT w/PTFE. 02-12446: Wilden P2/SSPPP/TWS/TF/STF/2000 AODD Pump 1" (25 mm) Stainless Steel | Wilden Store. (n.d.). Retrieved April 21, 2022, from <https://wildenstore.psgdover.com/>