

Design, Installation, and Calibration of MURR's Pool Coolant Gamma Monitor

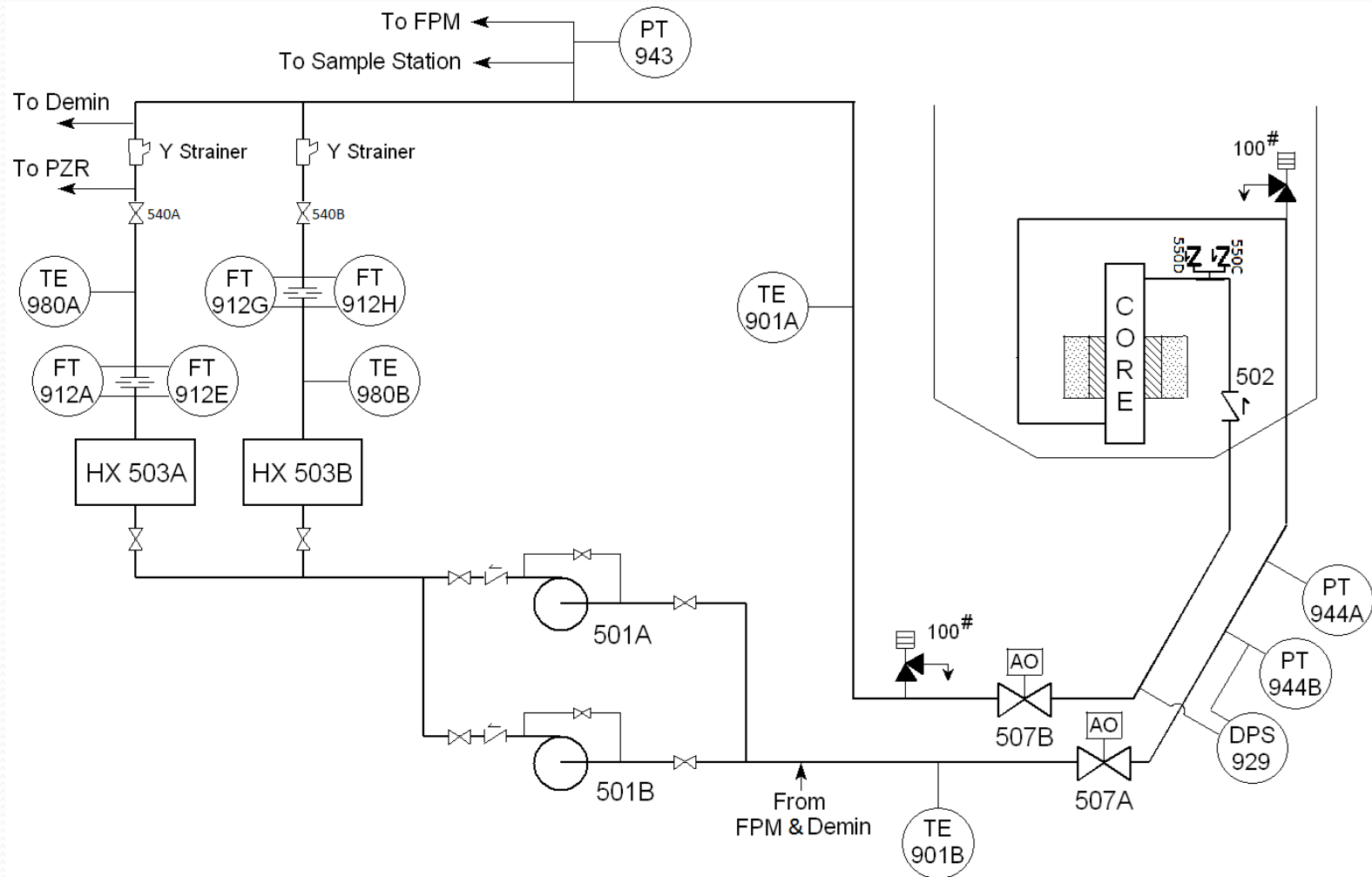


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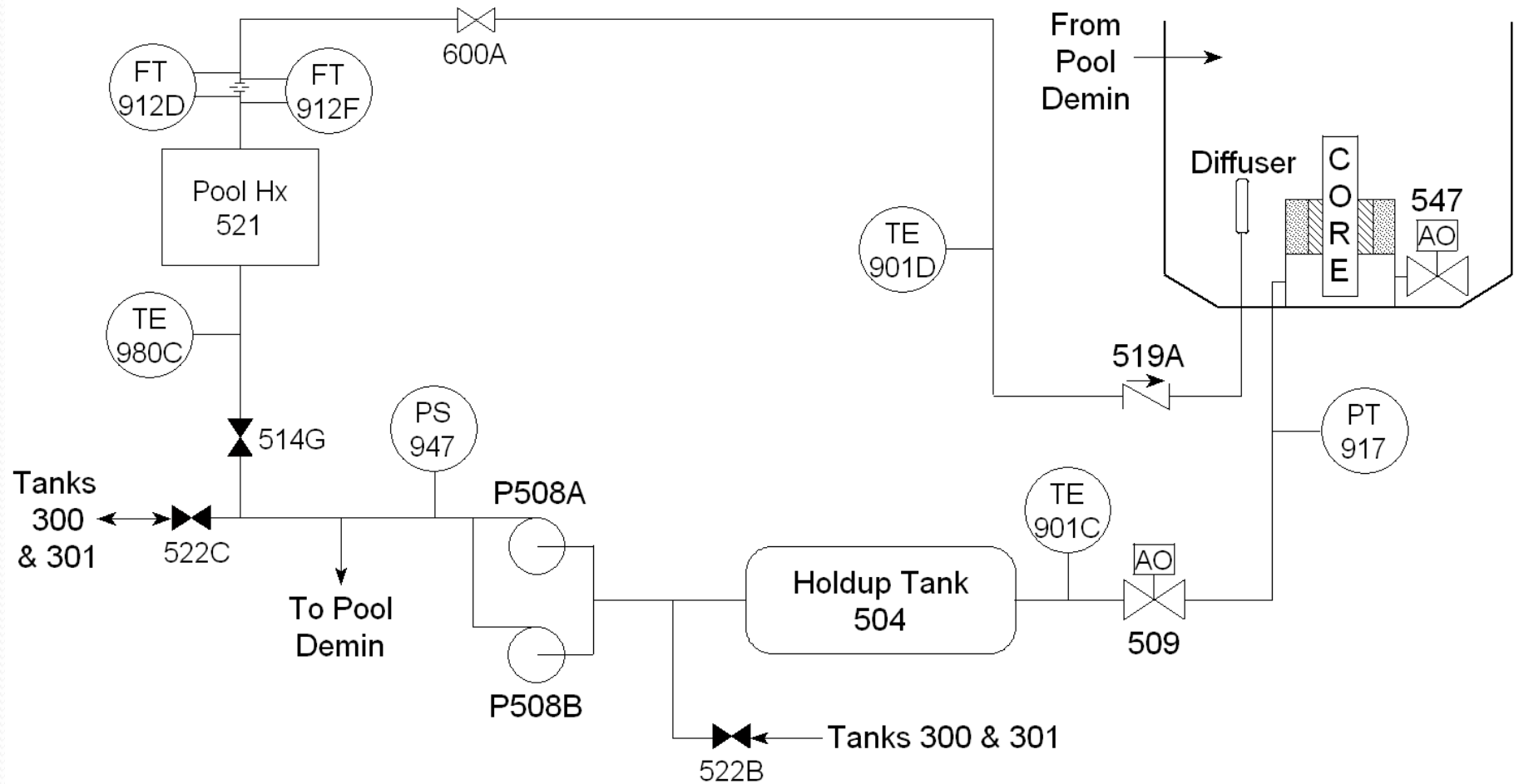
Introduction

- MURR Pool Coolant System Overview
- Purpose of the Pool Coolant Gamma Monitor
- Radiological Design Bases
- Flow Design Bases
- New Pool Coolant Gamma Monitor Location
- 10CFR50.59 Screen and Modification Record
- Initial Calibration Procedure

MURR Primary Coolant System



MURR Pool Coolant System



Purpose of Pool Coolant Monitor

- General: Detect activity leaking from experiments in pool.
- Specific: Detect I-131 from leaking U-235 fueled experiments which may contain up to 70 Curies of I-131.
- Therefore, three of the four MCA windows will be open for wide ranges of radioactivity. One MCA window will be centered on the 364 keV gamma from I-131.
- Pool Monitor will alarm on high I-131 activity and low sampling flow rate.

Radiological Bases – For Small Leak, Not Catastrophic Failure

- #1. Max. Hypothetical Evaporation at 10 times Minimum Detectable Concentration (small leak in can) for 10 minutes of inhalation gives Reactor Operators less than 1 mRem CEDE. (Very conservative calculations give Operators 0.53 mREM CDE and only 0.016 mRem CEDE.
- #2. Pool Monitor shall overlap the existing MURR Automatic Containment Isolation system set a 50 mR/hr at pool bridge. (This would occur at ~25% I-131 release.)

Radiological Bases (con't)

- From Basis #1, MDC set at 0.4 Bq/mL I-131. Therefore, alarm setpoint is 4 Bq/mL I-131.
- From Basis #1, Pool Monitor shall detect leak within 7 minutes of leak to allow Operators to have only 10 minutes of I-131 inhalation.
- From Basis #2, Automatic Containment Isolation occurs at ~ 6100 Bq/ml I-131.
- Therefore, the Pool Coolant Gamma Monitor shall have indication from 0.4 Bq/mL up to 5×10^4 Bq/mL to have one decade overlap with Automatic Containment Isolation.

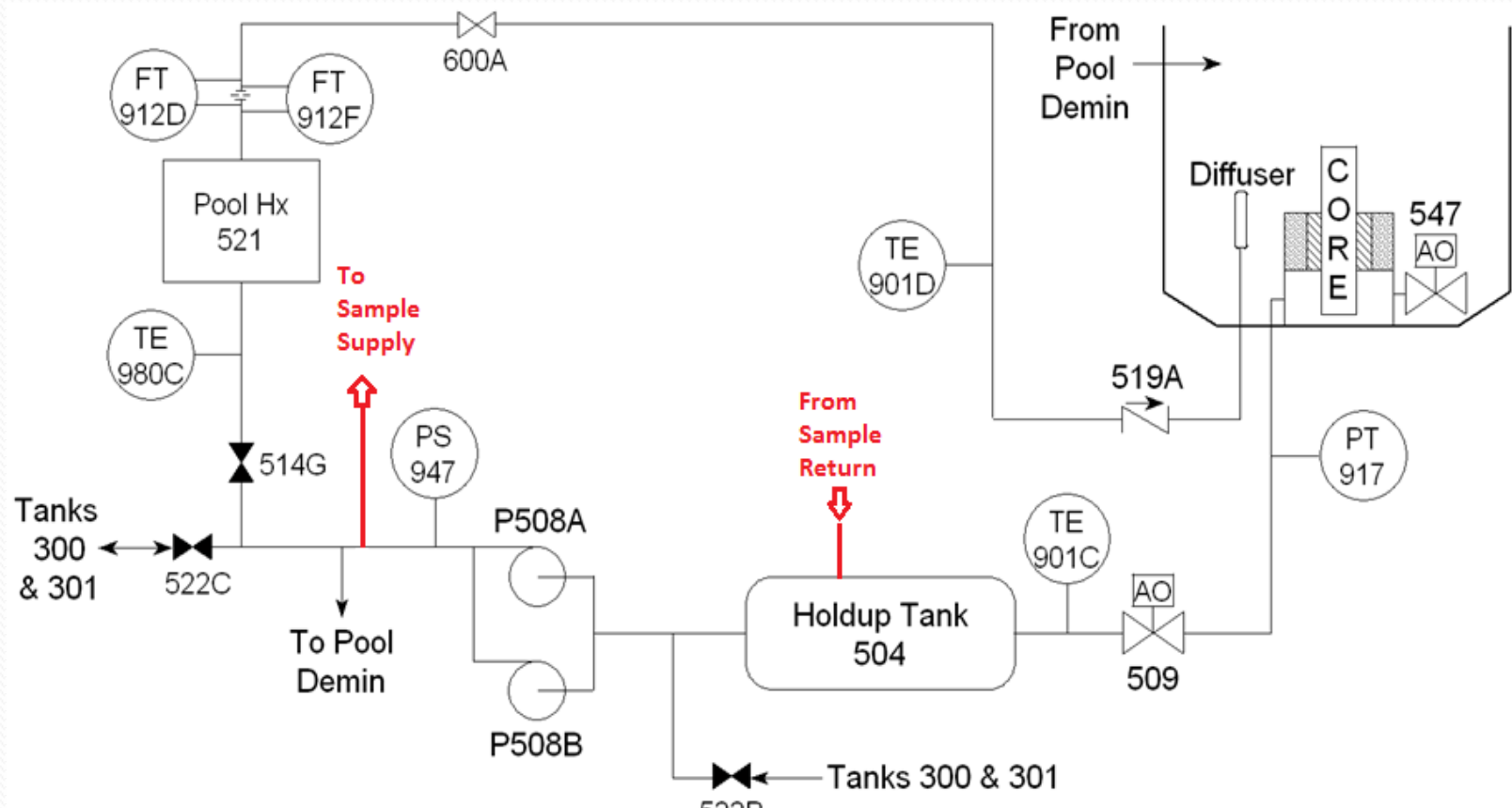
Flow Design Bases

- #1. To obtain an MDC of 0.4 Bq/mL I-131, N-16 from irradiated pool water must be decayed to minimize background radiation rate. Therefore, the Pool Coolant Monitor will be connected after the 6000-gallon Pool Holdup Tank to allow 42 N-16 half-lives of decay (5 minutes).
- #2. To obtain a maximum of 7 minutes of Pool Coolant Monitor detection time, the sample flow rate must be high enough to allow 90% of the 2.7-liter detector volume to change out in less than one minute.

Flow Design Bases (con't)

- From flow bases #1 and #2, an ideal flow rate of 2.0 gpm is obtained.
- Since the existing Pool Coolant system differential pressure of 50 psid will be used to drive sampling water, 1/2" diameter piping has been chosen for the Pool Coolant Monitor. The sample supply will come from the Pool Coolant Pump Discharge Header, and the sample return will go back to the Pool Coolant Holdup Tank.

Pool Coolant Gamma Monitor Location



50.59 Screen and Modification Record

- Easily Screens Out
- However, Modification Record is quite lengthy. Preliminary Modification Record has taken about 45 man-hours to prepare.
 - HSR review is lengthy because Pool Coolant System is mentioned multiple places.
 - 5 existing procedures are being revised.
 - 1 print is revised, and 1 print is being created.
 - 5 new procedures/sequences are being written.
 - Long Form Startup Checklist and Routine Patrol affected.

Initial Calibration Procedure

- Must use I-131 solution for initial calibration using 2.7 liters of solution for every calibration point.
- Calibrating Pool Monitor over 6 decades. Each decade has a calibration point. (Start by mixing 5 mCi of I-131 in solution.)
- I-131 solution is not ideal for periodic calibration.
- Initial calibration procedure will tie detector count rate from calibrated I-131 solutions to count rate obtained from calibrated Ba-133 sealed sources. Initial calibration procedure currently has 225 steps and will take all day to complete!
- All semi-annual calibrations after the initial calibration will use only Ba-133 sources.

Conclusion

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Questions or Comments?



THANK YOU!