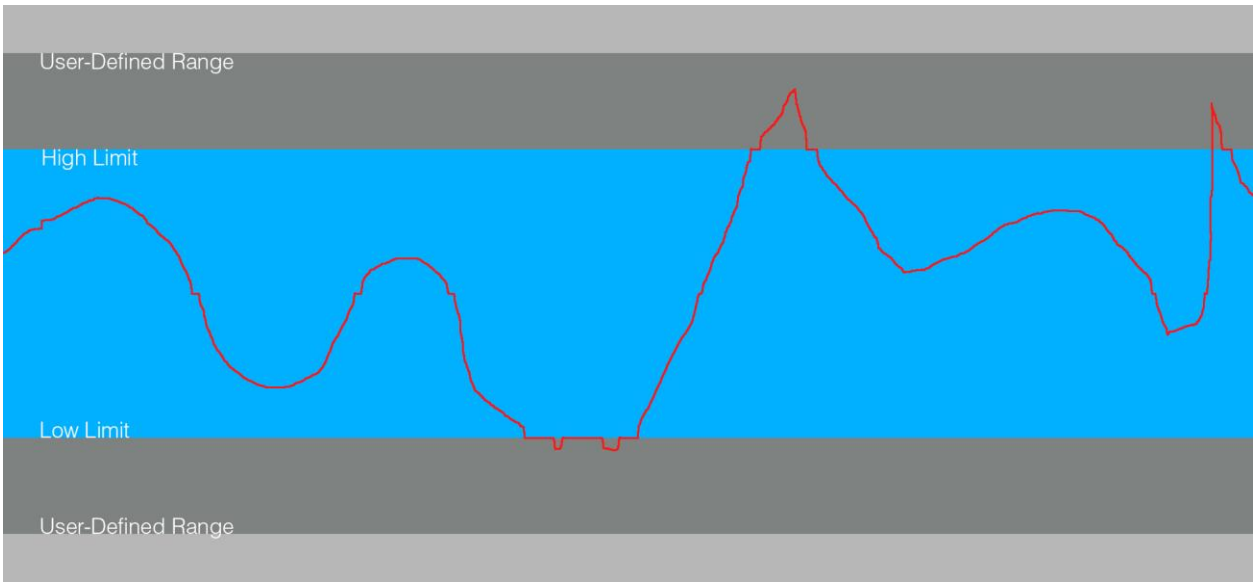
POWER OPTIMIZATION CENTER

Alarm Reduction Proposal

Alarm Set Point Modifications and Delay Applications

Alarm Reduction Philosophy:

The idea of these efforts was to automate the process of identifying and eliminating those alarms deemed as nuisance alarms – as human review would prove too consumptive of resources. Two separate applications were deployed to ensure an effective effort was made. The first pass was to review the past few days of operational data for all alarms targeted. This data is parsed to uncover the absolute maximum and minimum value for each alarm tag during this time period. These values will be titled the "local min" and "local max". Once these values have been populated, they are compared to the alarm set points established for each tag. Those alarm tags with local mins or maxes exceeding the established alarm set points are flagged and extracted – as to indicate an alarm was received in EWS. The idea of this flagged list is to determine just how far outside of the alarm set points the local mins and maxes fell. It is very common that tag values fall just outside of the established limits, generating nuisance alarms. A review therefore, is performed based on a user-defined acceptable range. That is to say, if tag values exceed alarm set point values yet are within a user-defined range, say 10%, the set points should therefore be modified accordingly to wrap the local mins and maxes within the newly-defined alarm set points.



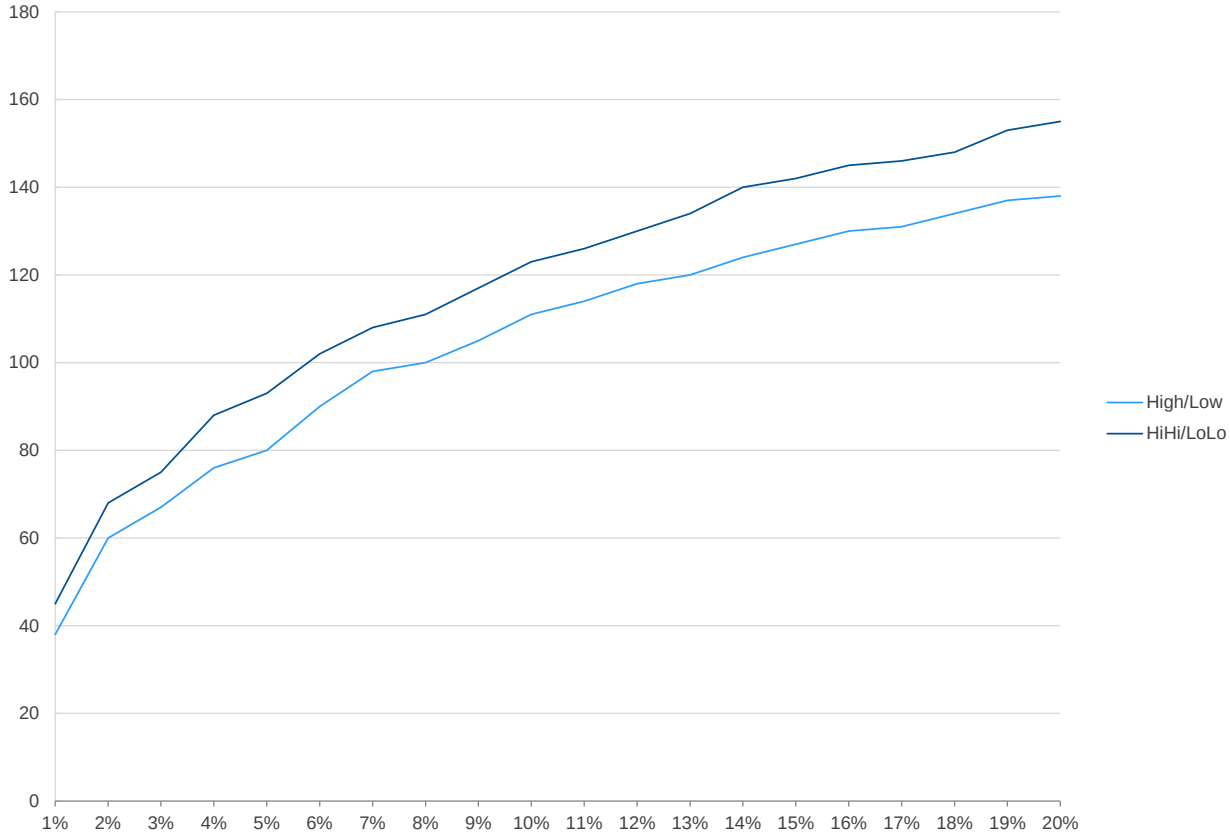
This approach works well not only with HiHi and LoLo alarms, but has also been developed to identify those tags with which the local min or max only exceeds the High or Low alarm set point but does not exceed the HiHi or LoLo alarm set point. Furthermore, this method works to flag tags where delay values have been added but are no longer valuable.

Examples

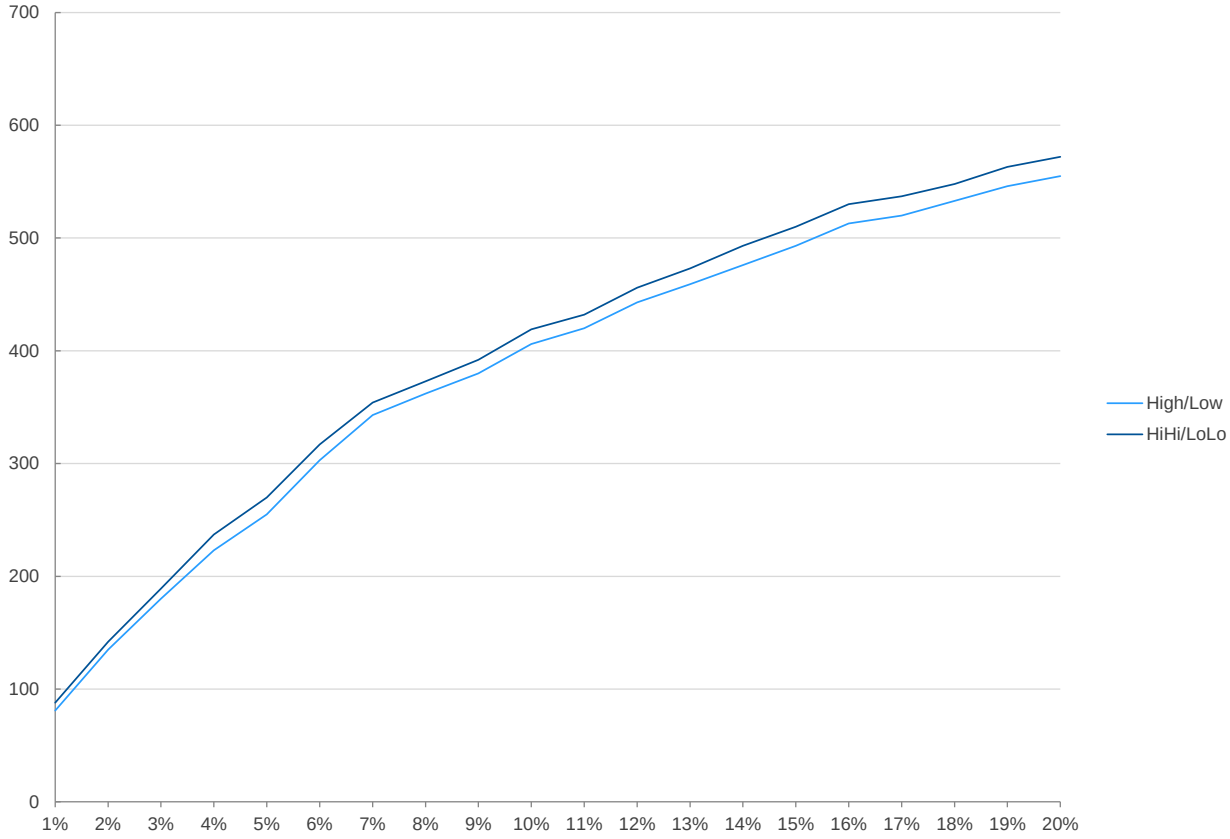
DCS_XX1_BM_1H-BOWL_MILL_MTR_IB_BRG_T-Alm	GT(180)	GT(160)~GT(165)
DCS_XX3_TA_1ST_STAGE_PRESS-Alm	LT(1400)	LT(1600)~LT(1500)
DCS_XX2_SR_MOD-B_PACKING_PMP_A_AMP-Alm	LT(45)+60m~LT(42)	

The following page depicts the number of alarm tags which could be prevented from generating nuisance alarms based on the user-defined range. It should be noted that these graphs depict the number of tags, not the number of alarms reduced. The actual number of alarms may be much higher based on alarms entering and exiting alarm states numerous times. The graphs depict consequences of applying this method to HiHi/LoLo, High/Low, and both sets, with and without delays. These graphs are only for those tags within the Luminant fleet.

Delay Tags Preserved

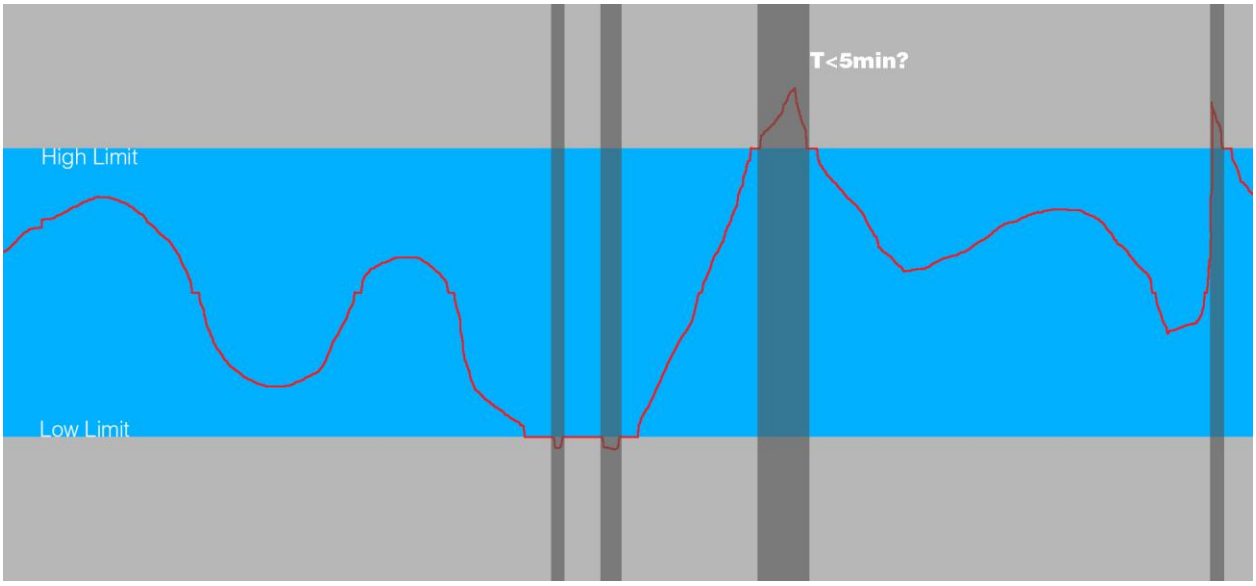


Delay Tags Modified



The second methodology for alarm reduction is the deployment of appropriate delays. Many tags experience signal noise which can create nuisance alarms. This is especially true during unit shutdown and startup. These noise spikes typically have been filtered out by increasing alarm set points. This is not a sustainable practice – as it establishes alarm set points much higher than the standard operating range. This generates alarm set points which will only catch the most severe of events.

To determine appropriate delays, 24 hours of raw PI data is required, for each tag to be analyzed. This typically is anywhere from 100 to 20,000 data samples per individual point. Once this data is collected, the period between each sample is estimated based on the number of samples within the 24 hour period. The system then determines the longest time frame within this sample data that the signal exceeded alarm set points. User-defined values were established at a maximum of a five minute delay for High/Low alarms and a maximum of a two minute delay for HiHi/LoLo alarms. This process is configurable to apply to only High/Low alarms just as the alarm set point modification process. If delays are generated for HiHi/LoLo alarms, the user also has the ability to generate a tertiary alarm, set just above the local max or min with no delay appended.



Case Study

Previous Day EWS Alarms: 24 June 2016 (Friday)

For the 24 hour period, between the *(name redacted)* and *(name redacted)* fleets, 2108 alarms were received. By applying both methodologies, 740 of those alarms could have been eliminated. The offending tags that would have been eliminated can been seen listed below.

XXX_DCS_XX6_TA_HS_TURB_BEARING_4_OIL_DRAIN_TEMP-Alm	68
XXX_DCS_XX6_TA_HS_TURB_BEARING_6_OIL_DRAIN_TEMP-Alm	67
XXX_DCS_XX7_FW_6_FWH_WATER_LEVEL-Alm	50
XXX_DCS_XX7_TA_TURB_HOTWELL_A_TEMP-Alm	45
VM_XX1_TA_HP/IP_BRG_1Y_OA-Alm	34
VM_XX1_DE_B-ID_BSTR_FAN_OB_VEL_OA-Alm	25
XXX_DCS_XX2_BM_4_PULV_WORM_DRIVE_OUTER_BEARING_TEMP-Alm	20
XXX_DCS_XX6_BM_3_PULV_TOTAL_AIR_FLOW-Alm	20
XXX_DCS_XX7_BM_5_PULV_LUBE_OIL_SUPPLY_TEMP-Alm	19
DCS_XX1_FW_FWH_7A-B_LEVEL-Alm	16
XXX_DCS_XX5_FW_BFPT_FIRST_STAGE_PRESS-Alm	14
XXX_DCS_XX5_GA_LS_MAIN_EXCITER_FIELD_VOLTAGE-Alm	11
DCS_XX2_MS_TEMP-Alm	10
DCS_XX2_SR_ABSORBER_D_T200_TOWER_ DENSITY-Alm	9
DCS_XX4_FW_4-FWH_NORM_DRN_POS-alm	8
XXX_DCS_XX5_BA_BLR_MAIN_STEAM_LINE_TEMP-Alm	8
XXX_DCS_XX5_FW_6A_FWH_OUTLET_TEMP-Alm	8
DCS_XX2_FGD_SR_MOD-D_T300_Sump_Level-Alm	7
DCS_XX3_FGD_DE_A_RH_Fan_Disch_Temp-Alm	6
GP_XX5_BA_5A_AIRHEATER_CLEANLINESS-Alm	6
XXX_DCS_XX5_FW_5A_FWH_OUTLET_TEMP-Alm	6
XXX_DCS_XX5_FW_TURB_BFP_GOVERNOR_VALVE_POSITION_DEMAND-Alm	6
XXX_DCS_XX6_BA_BLR_NOX-Alm	6
DCS_XX4_FGD_SR_REACTION_TANK_A_LEVEL-Alm	5
DCS_XX3_SR_ABS_A_RECYCLE_PUMP_A_MOTOR_IB_BRG_T-Alm	5
DCS_XX3_SR_ABSORBER_A_T300_TOWER_ DENSITY-Alm	4
DCS_XX3_TA_TURBINE_1ST_STAGE_PRESSURE-Alm	4
DCS_XX2_TA_LP2_TURB_EXHAUST_HOOD_TEMP_GEN_END-Alm	4
XXX_DCS_XX5_FW_2_FWH_OUTLET_DRAIN_TEMP-Alm	4
XXX_DCS_XX7_BM_4_PULV_LUBE_OIL_SUPPLY_TEMP-Alm	4
XXX_DCS_XX6_FW_TURB_BFP_LOW_PRESS_STEAM_INLET_TEMP-Alm	4
XXX_DCS_XX1_FW_7A_FWH_WATER_LEVEL_B-Alm	4
DCS_XX2_TA_TURB_CRIT_COLD_RH_TE12_DRN_TEMP-Alm	3
DCS_XX1_FW_6-FWH_NORM_DRN_POS-alm	3
DCS_XX2_TA_LP1_TURB_EXHAUST_HOOD_TEMP_GEN_END-Alm	3
DCS_XX3_SR_ABSORBER_B_AFT_PH-Alm	3
DCS_XX1_SR_ABSORBER_SUMP_PH-1-Alm	3
DCS_XX1_SR_ABSORBER_SUMP_PH-2-Alm	3

DCS_XX4_FGD_SR_REACTION_TANK_B_LEVEL-Alm	3
DCS_XX1_BA_WATERWALL_AVERAGE_TEMPERATURE-Alm	3
VM_XX1_TA_HP/IP_BRG_1Y_1xAMP-Alm	3
GP_XX1.Q.IMB.C01.A-Alm	3
GP_XX3.Q.FTF.L1A.M-Alm	3
DCS_XX2_FGD_SR_MOD-D_T200_Sump_Level-Alm	3
DCS_XX2_DE_A_STACK_REHEAT_FAN_OB_BRG_T-Alm	3
XXX_DCS_XX6_CD_MAIN_COND_HOTWELL_LEVEL-Alm	3
XXX_DCS_XX2_BA_BLR_MAIN_STEAM_LINE_TEMP-Alm	3
XX_GP_XX6_TA_HP_TURBINE_EFFICIENCY-Alm	3
XXX_DCS_XX2_DE_A_ID_FAN_OUTBOARD_BEARING_VIB_Y-Alm	3
DCS_XX2_CD_DEAERATOR_STORAGE_TANK_LEVEL-Alm	2
DCS_XX2_MS_PRESS-Alm	2
DCS_XX2_FGD_SR_MOD-A_T200_Sump_Level-Alm	2
DCS_XX2_EH_MAIN_TURB_EHC_FLUID_PRESS-Alm	2
DCS_XX2_CO_COND-A_BACK_PRESS-Alm	2
DCS_XX1_DE_B_STACK_REHEAT_FAN_MTR_OB_BRG_T-Alm	2
DCS_XX1_BM_G_MILL_OUTLET_TEMP_2-Alm	2
AMS_XX4_BA_45_Raw_Signal-Alm	2
DCS_XX2_CEMS_CO_EMISSIONS-Alm	2
DCS_XX1_TA_BRG_1_HORIZONTAL-Alm	2
DCS_XX3_SR_ABSORBER_B_SUMP_PH-1-Alm	2
DCS_XX3_SR_ABSORBER_A_T200_TOWER_ DENSITY-Alm	2
DCS_XX3_FGD_SR_MOD-D_T300_Sump_Level-Alm	2
DCS_XX3_SR_ABSORBER_D_T200_TOWER_ DENSITY-Alm	2
DCS_XX3_CW_3C-CIRC_WTR_PMP_MTR_OB_BRG_T-Alm	2
DCS_XX2_FWH_7B_LP_NORMAL_LEVEL_VALVE_POSITION_FEEDBACK-Alm	2
DCS_XX2_FW_FWH_6B-A_LEVEL-alm	2
XXX_DCS_XX1_TA_TURB_HOT_REHEAT_STEAM_TEMP-Alm	2
XXX_DCS_XX7_FW_1A_FWH_OUTLET_TEMP-Alm	2
XXX_DCS_XX2_BM_D_PULV_TOTAL_AIR_FLOW-Alm	2
XXX_DCS_XX1_BA_BLR_MAIN_STEAM_LINE_TEMP-Alm	2
XX_GP_XX7_BA_AIR_TO_FUEL_RATIO_DEVIATION-Alm	2
XXX_DCS_XX6_TA_HS_TURB_LUBE_OIL_COOLER_OIL_DISCHARGE_TEMP-Alm	2
XXX_DCS_XX7_BA_BLR_CARBON_MONOXIDE-Alm	2
XXX_DCS_XX5_BA_BLR_NOX-Alm	2
XXX_DCS_XX2_DE_A_ID_FAN_MOTOR_AMPS-Alm	2
XXX_DCS_XX2_DE_B_ID_FAN_MOTOR_AMPS-Alm	2
VM_XX1_TA_SPEED-Alm	1
DCS_XX1_FWH_7A_LP_NORMAL_LEVEL_VALVE_POSITION_FEEDBACK-Alm	1
DCS_XX1_FWH_7B_LP_NORMAL_LEVEL_VALVE_POSITION_FEEDBACK-Alm	1
DCS_XX2_SR_ABSORBER_A_AFT_PH-Alm	1
DCS_XX2_SR_ABSORBER_B_AFT_PH-Alm	1
DCS_XX2_SR_ABSORBER_C_AFT_PH-Alm	1
DCS_XX2_SR_ABSORBER_D_AFT_T300_PH-Alm	1
DCS_XX2_SR_ABSORBER_D_T300_TOWER_ DENSITY-Alm	1
DCS_XX2_SR_MOD-B_PACKING_PMP_A_AMP-Alm	1

DCS_XX3_CD_DEAERATOR_STORAGE_TANK_LEVEL-Alm	1
DCS_XX3_DE_DID_FAN_MTR_IB_BRG_T-Alm	1
DCS_XX3_MS_TEMP-Alm	1
DCS_XX1_RS_CCI_Hot_Reheat_Cation_Conductivity-Alm	1
DCS_XX2_BM_2C-BOWL_MILL_MTR_IB_BRG_T-Alm	1
DCS_XX3_CO_3C-COOL_WTR_PMP_MTR_IB_BRG_T-Alm	1
DCS_XX1_TA_LP1_BRG4_T-Alm	1
DCS_XX3_TA_1ST_STAGE_PRESS-Alm	1
DCS_XX2_EL_MAIN_TRANSF_Carbon_Dioxide-Alm	1
GP_XX1.Q.CRZ.TG0.A-Alm	1
GP_XX3.Q.CRZ.TG0.A-Alm	1
DCS_XX1_1A_SCR_SOOTBLOWER_STEAM_TEMPERATURE_C-Alm	1
DCS_XX1_1B_SCR_SOOTBLOWER_STEAM_TEMPERATURE_C-Alm	1
DCS_XX3_SO2_TOWER_B_REMOVAL-Alm	1
DCS_XX2_FGD_SR_ABSORBER_INLET_FLUE_GAS_TEMP_1-Alm	1
DCS_XX2_FGD_SR_ABSORBER_INLET_FLUE_GAS_TEMP_2-Alm	1
DCS_XX2_FGD_SR_ABSORBER_INLET_FLUE_GAS_TEMP_3-Alm	1
VM_XX1_FW_BFP_BFP_SPEED-Alm	1
DCS_XX1_FW_BFP_LUBE_OIL_TEMPERATURE-Alm	1
AMS_XX5_BA_5B_21_Raw_Signal-Alm	1
DCS_XX3_FW_BFP_B_INBOARD_SEAL_WATER_OUTLET_TEMPERATURE-Alm	1
GP_XX3.Q.CGA.TK0.A-Alm	1
GP_XX1.Q.CGA.TK0.A-Alm	1
DCS_XX5_CD_CONDENSATE_STORAGE_TANK_1_LVL-Alm	1
DCS_XX2_BM_D_PULV_LUBE_OIL_TEMP-Alm	1
DCS_XX2_BM_H_PULV_LUBE_OIL_TEMP-Alm	1
DCS_XX2_FW_6-FWH_NORM_DRN_POS-alm	1
GP_XX3.Q.PGP.AF0.A-Alm	1
GP_XX3.V.PGP.AF0.A-Alm	1
GP_XX2.V.PGP.AF0.A-Alm	1
GP_XX5.Q.AGA.M7E.M-Alm	1
GP_XX1.Q.IJG.L00.A-Alm	1
DCS_XX2_COND_HOTWELL_LEVEL-Alm	1
GP_XX3.Q.FTF.HEA.M-Alm	1
DCS_XX1_COND_HOTWELL_1_LEVEL-Alm	1
DCS_XX1_COND_HOTWELL_2_LEVEL-Alm	1
DCS_XX1_DE_B_STACK_REHEAT_FAN_MTR_IB_BRG_T-Alm	1
DCS_XX1_BM_G_MILL_OUTLET_TEMP_1-Alm	1
DCS_XX1_DE_TOTAL_BOILER_AIR_FLOW-Alm	1
DCS_XX1_BM_1B_BOWL_MILL_MTR_IB_BRG_T-Alm	1
DCS_XX1_BM_1H-BOWL_MILL_MTR_IB_BRG_T-Alm	1
DCS_XX1_FW_FWH_6A-A_LEVEL-alm	1
DCS_XX1_IF_WB_WINDBOX_TO_FURNANCE_DP-Alm	1
DCS_XX2_CO_COND-B_BACK_PRESS-Alm	1
DCS_XX2_CO_COND-A_VACUUM-Alm	1
DCS_XX2_CO_COND-B_VACUUM-Alm	1
DCS_XX2_DE_2A-ID_FAN_BRG_IB-REL_VIB-Alm	1

DCS_XX2_DE_2D-ID_FAN_BRG_OB-SEIS_VIB-Alm	1
DCS_XX2_EH_MAIN_TURB_EHC_FLUID_LEVEL-Alm	1
DCS_XX2_EH_MAIN_TURB_EHC_FLUID_TEMP-Alm	1
DCS_XX1_SR_MOD-D_PACKING_PMP_B_GBOX_T-Alm	1
DCS_XX2_COND_HOTWELL_A_LEVEL-Alm	1
DCS_XX2_FW_FWH_1B-A_LEVEL-alm	1
DCS_XX2_FW_FWH_6A-A_LEVEL-alm	1
DCS_XX2_FW_FWH_6A-C_LEVEL-alm	1
DCS_XX2_FGD_SR_MOD-B_AFT_Level-Alm	1
DCS_XX2_DE_A_STACK_REHEAT_FAN_AMP-Alm	1
DCS_XX1_SR_ABSORBER_A_T300_TOWER_ DENSITY-Alm	1
DCS_XX1_SR_ABSORBER_B_AFT_PH-Alm	1
DCS_XX2_EH_TURB_MEDIAN_EH_PRESS_1-Alm	1
DCS_XX2_EH_TURB_MEDIAN_EH_PRESS_2-Alm	1
VM_XX2_FW_A_BFP_PMP_IB_X_OA-Alm	1
VM_XX2_DE_A_ID_FAN_OB_SEIS_OA-Alm	1
VM_XX2_DE_C_ID_FAN_OB_SEIS_1xAMP-Alm	1
VM_XX2_GA_GEN_BRG_10X_1xAMP-Alm	1
VM_XX2_GA_GEN_BRG_10Y_1xAMP-Alm	1
VM_XX2_GA_GEN_BRG_9Y_1xAMP-Alm	1
VM_XX2_TA_HP_BRG_2X_1xAMP-Alm	1
DCS_XX2_FW_FWH_6B-B_LEVEL-alm	1
DCS_XX2_FW_FWH_6B-C_LEVEL-alm	1
DCS_XX3_BM_D_MILL_OUTLET_TEMP_1-Alm	1
DCS_XX3_BM_D_MILL_OUTLET_TEMP_2-Alm	1
DCS_XX3_DE_3A-FD_FAN_BRG_OB-SEIS_VIB-Alm	1
DCS_XX2_FW_BFP_SUCTION_FLOW_1-Alm	1
DCS_XX1_FW_BFP_A_CONTROL_OIL_PRESS_1-Alm	1
DCS_XX1_FW_FWH_6A-B_LEVEL-alm	1
DCS_XX2_DE_2A-ID_FAN_BRG_OB-REL_VIB-Alm	1
DCS_XX1_TA_TURBINE_1ST_STAGE_PRESSURE-Alm	1
DCS_XX2_FW_FWH_6A-B_LEVEL-alm	1
DCS_XX2_BA_FURNACE_PRESSURE-Alm	1
VM_XX2_DE_A_ID_FAN_IB_SEIS_1xAMP-Alm	1
VM_XX2_DE_A_ID_FAN_IB_SEIS_OA-Alm	1
VM_XX2_DE_A_ID_FAN_OB_SEIS_1xAMP-Alm	1
XXX_DCS_XX8_TA_TURB_BEARING_6_VIB_Y-Alm	1
XX_GP_XX1_FW_FWH_8A_TEMP_RISE_DEVIATION-Alm	1
XX_GP_XX1_FW_FWH_8A_TTD_DEVIATION-Alm	1
XX_GP_XX6_FW_FWH_6B_DCA_DEVIATION-Alm	1
XXX_DCS_XX8_GA_GEN_H2_GAS_PRESS-Alm	1
XXX_DCS_XX1_FW_8B_FWH_WATER_LEVEL_B-Alm	1
XXX_DCS_XX8_BA_BOILER_FURNACE_PRESS_A-Alm	1
XXX_DCS_XX2_FW_1B_FWH_WATER_LEVEL_A-Alm	1
XXX_DCS_XX2_FW_2B_FWH_WATER_LEVEL_A-Alm	1
XXX_DCS_XX2_FW_2B_FWH_WATER_LEVEL_B-Alm	1
XXX_DCS_XX5_CD_AUX_COND_HOTWELL_LEVEL-Alm	1

XXX_DCS_XX56_CEMS_STACK_NOX_EMISSIONS_1HR-Alm	1
XX_GP_XX5_AP_2_AH_X_RATIO_DEVIATION-Alm	1
XX_GP_XX6_AP_2_AH_X_RATIO_DEVIATION-Alm	1
XXX_DCS_XX2_CW_1_CIRCULATING_WATER_PUMP_AMPS-Alm	1
XXX_DCS_XX7_CD_MAIN_COND_HOTWELL_LEVEL-Alm	1
XXX_DCS_XX6_BM_1_PULV_TOTAL_AIR_FLOW-Alm	1
XXX_DCS_XX2_TA_TURB_HOT_REHEAT_STEAM_TEMP-Alm	1
XXX_DCS_XX7_GA_LS_GEN_COLD_H2_GAS_TEMP_2-Alm	1
XXX_DCS_XX5_FW_7A_FWH_OUTLET_TEMP-Alm	1
XXX_DCS_XX5_DE_1_ID_FAN_INBOARD_BEARING_METAL_TEMP-Alm	1
XXX_DCS_XX8_TA_TURB_BEARING_6_VIB_X-Alm	1
XXX_DCS_XX8_TA_TURB_BEARING_7_VIB_X-Alm	1
XXX_DCS_XX1_GA_GEN_FAN_DP-Alm	1
XXX_DCS_XX1_FW_7B_FWH_WATER_LEVEL_B-Alm	1
XXX_DCS_XX1_FW_8A_FWH_WATER_LEVEL-Alm	1
XXX_DCS_XX1_FW_8B_FWH_WATER_LEVEL_A-Alm	1
XXX_DCS_XX2_BA_BLR_FURNACE_PRESS_B-Alm	1
XXX_DCS_XX2_BA_BLR_FURNACE_PRESS_C-Alm	1
XXX_DCS_XX2_DE_APH_B_PRIMARY_AIR_DP-Alm	1
XXX_DCS_XX2_DE_APH_A_PRIMARY_AIR_DP-Alm	1
XXX_DCS_XX7_CD_MAIN_COND_CONDENSER_BACK_PRESS-Alm	1
XXX_DCS_XX5_HD_5A_FWH_EMERGENCY_DRAIN_VALVE_FEEDBACK-Alm	1
XXX_DCS_XX2_DE_A_ID_FAN_INBOARD_BEARING_VIB_Y-Alm	1
XXX_DCS_XX7_FW_7_FWH_WATER_LEVEL-Alm	1
XXX_DCS_XX7_FW_7_FWH_WATER_LEVEL_B-Alm	1