Taganito HPAL Nickel Corporation	ENVIRONMENT MONITORING DCS Manual				
	Document Title				
	Department	Production	Revision No.	Document No.	Page
	Section	Process AB	**03**	**TNH-200-103-007**	**1 of 21**
	Area	Common			

HISTORY of REVISION

Rev. No.	Effective Date	Revised Page (s)	Description	Prepared by	Checked by	Noted by	Approved by
01	18-Apr-2013		New	ANJK	DJN HM	ON	FM
02	1-May-2015	12-14	VI. DCS Emergency Shutdown Added Automatic Plant Shutdown Sequence description, which is newly installed upon H2S smell incident happened on 5-July-2013.	HM	HM	ME	MK
03		7-11 11-13 15-16 16 16-17 21	Description for additional 35 units of boundary gas detectors Update H2S Gas detector PVHI values from 4 ppm to 5 ppm Description for additional pH probes for Culvert 11,12 & 13 Description for new Oil Leak Detectors (3 units) Description for new actuated valves (5 units)to prevent disposal of substandard ditch water to siltation ponds Updated Environment Monitoring DCS Graphics	DJN	TY	ME	MK

Prepared by	**Checked by**	**Noted by**	**Approved by**
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Contents

I. General Description

This graphics contains the schematic diagram of the plant site plot plan wherein the graphical locations of the monitoring devices such pH meters and Carbon Dioxide and H_2S Gas Detectors are reflected in the graphics. Additionally, the actual measured values of these environment monitoring instruments are displayed in this screen.

The gas detectors are equipped with process alarms that are triggered once PVHI value (H2S, CO2 and Methanol gas) is reached or PVLO value (O2 gas) is reached. Whenever these alarms are triggered, the text color of the measured value will change into RED, the instrument graphics will light up and blink, and, audible alarm in DCS will sound in order to alert the DCS operator. Additionally beacon and horn system are activated in the field to warn the field operators there is possible gas leak in their area.

The graphics also contains special link buttons, De-Zn/MS and H2S area buttons. These two link buttons blinks whenever H2S detectors in De-Zn, MS and H2S area alarm. If clicked, buttons lead you to MS ENVIRONMENT or H2S ENVIRONMENT DCS graphics.

The pH probes/meters are also equipped with process alarms that are triggered once PVLO and PVHI values are reached. Once these alarms are triggered, the text color of the measured value will change into RED, the instrument graphics will light up and blink, and, audible alarm in DCS will sound in order to alert the DCS operator regarding the abnormalities so that he/she can acknowledge the alarm.

Acknowledge and Reset buttons for the alarms are also provided in this graphics. The common acknowledge (ACK) button (000HS901) is used by the DCS operator to acknowledge the alarm and silence the audible alarms/horns in the DCS room and in the field. However, the alarm beacon shall remain lighted until the alarm has been reset by common reset (RESET) button (000HS902). The RESET button will only function when the normal parameter value has been restored.

Wind speed and direction which is measured by the wind vane and anemometer installed in the roof of CB is also found in this screen. The latter values are very helpful especially in determining the area of gas leak. Also shortcut link to the Graphics Overview, MS and H_2S Environment graphics are present in this screen.

Table 1-1: Monitoring Devices legend.

SYMBOL	GROUP DESCRIPTION	No. OF INST.	ALARM	DCS ROOM			FIELD ALARM	
				BEACON	HORN	DCS ALARM	BEACON	HORN
	H2S (Plant Boundaries)	43	PVHI	✓	✓	✓	✓	✓
	H2S (Inside Plant)	17	PVHI	✓	✓	✓	✓	✓
	CO2	6	PVHI	✓	✓	✓	✓	✓
	O2	1	PVLO	✓	✓	✓	✓	✓
	METHANOL	1	PVHI	✓	✓	✓	✓	✓
	pH	16	PVLO/ PVHI	✓	✓	✓	N/A	N/A
	Oil Leak Detector	3	xx	✓	✓	✓		

The additional three oil detectors are not yet online and still under the Engineering Section projects. Thus in the DCS, its alarm is not yet active. The additional graphics is in preparation for the additional project.

II. Important Monitoring Items

1. Controllers' Description

None

2. Instruments' Description

1) H2S Gas Detectors at Plant Site Boundaries

(1) "H1 (101AI907)": H2S Gas Detector at Ore Preparation – Diversion Road

This boundary H2S gas detector measures H2S gas concentration of ambient air at Ore Preparation – Diversion Road area. This gas detector is equipped with beacon (101XA907) and horn (101XA908) system that is attached to a pole.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(2) "H2 (101AI901)": H2S Gas Detector at Plant Site to Pier Site Road

This boundary H2S gas detector measures H2S gas concentration of ambient air at Plant Site to Pier Site Road area. This gas detector is equipped with beacon (101XA901) and horn (101XA902) system that is attached to a pole.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(3) "H3 (101AI909)": H2S Gas Detector at Ore Preparation – Guard House

This boundary H2S gas detector measures H2S gas concentration of ambient air at Ore Preparation – Guard House area. This gas detector is equipped with beacon (101XA909) and horn (101XA910) system that is attached to the entrance gate.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(4) "H4 (101AI903)": H2S Gas Detector at Pier Site

This boundary H2S gas detector measures H2S gas concentration of ambient air at Pier Site area. This gas detector is equipped with beacon (101XA903) and horn (101XA904) system that is attached to a pole.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(5) "H5 (101AI905)": H2S Gas Detector at North Avenue at Coal Yard

This boundary H2S gas detector measures H2S gas concentration of ambient air at Coal Yard Access Road area. This gas detector is equipped with beacon (101XA905) and horn (101XA906) system that is attached to a lighting pole.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(6) "H6 (106AI931)": H2S Gas Detector at South Avenue near CCD/MS Expansion Area

This boundary H2S gas detector measures H2S gas concentration of ambient air at Riverside Road near CCD/MS Expansion area. This gas detector is equipped with beacon (106XA931) and horn (106XA932) system that is located around the pH meter.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(7) "H7 (111AI943)": H2S Gas Detector at No. 3 Siltation Pond

This boundary H2S gas detector measures H2S gas concentration of ambient air at Southwest Siltation Pond near limestone area. This gas detector is equipped with beacon (111XA943) and horn (111XA944) system that is attached to a lighting pole.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(8) "H8 (112AI901)": H2S Gas Detector at Water Intake Pond Area

This boundary H2S gas detector measures H2S gas concentration of ambient air at Water Intake Pond area. This gas detector is equipped with beacon (112XA901) and horn (112XA902) system that is attached to a pole.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(9) "H26 (101AI911)": H2S Gas Detector at Culvert 13

This boundary H2S gas detector measures H2S gas concentration of ambient air around Culvert 13.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(10) "H27 (101AI913)": H2S Gas Detector at Culvert 12

This boundary H2S gas detector measures H2S gas concentration of ambient air around Culvert 12.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(11) "H28 (101AI915)": H2S Gas Detector at South of Culvert 13

This boundary H2S gas detector measures H2S gas concentration of ambient air south of Culvert 13.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(12) "H29 (101AI917)": H2S Gas Detector at Northeast of Ore Prep. Area – Drum Washer

This boundary H2S gas detector measures H2S gas concentration of ambient air at northeast of Ore Prep. Area – Drum Washer side.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(13) "H30 (101AI919)": H2S Gas Detector – 1 at Northeast Wall of Plant Site

This boundary H2S gas detector measures H2S gas concentration of ambient air at northeast wall of Plant site.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(14) "H31 (101AI921)": H2S Gas Detector – 2 at Northeast Wall of Plant Site

This boundary H2S gas detector measures H2S gas concentration of ambient air at northeast wall of Plant Site.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(15) "H32 (101AI923)": H2S Gas Detector – 3 at Northeast Wall of Plant Site

This boundary H2S gas detector measures H2S gas concentration of ambient air at northeast wall of Plant Site.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(16) "H33 (101AI925)": H2S Gas Detector near Northwest Corner of Coal Yard

This boundary H2S gas detector measures H2S gas concentration of ambient air at northwest corner of Coal Yard.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(17) "H34 (101AI927)": H2S Gas Detector – 1 at 101/201BC05

This boundary H2S gas detector measures H2S gas concentration of ambient air at 101/201BC05 top portion.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(18) "H35 (101AI929)": H2S Gas Detector – 2 at 101/201BC05

This boundary H2S gas detector measures H2S gas concentration of ambient air at 101/201BC05 middle portion (near the steel support).
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(19) "H36 (101AI951)": H2S Gas Detector – 1 at Northeast of Ore Prep. Area – Shelter

This boundary H2S gas detector measures H2S gas concentration of ambient air at northeast of Ore Prep. Area – Shelter area.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(20) "H37 (101AI953)": H2S Gas Detector – 2 at Northeast of Ore Prep. Area – Shelter

This boundary H2S gas detector measures H2S gas concentration of ambient air at northeast of Ore Prep. Area – Shelter area near the river.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(21) "H38 (101AI955)": H2S Gas Detector – 3 at 101/201BC05

This boundary H2S gas detector measures H2S gas concentration of ambient air at 101/201BC05 counter weight area.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(22) "H39 (101AI957)": H2S Gas Detector at West of Ore Prep. Area – Shelter

This boundary H2S gas detector measures H2S gas concentration of ambient air at west of Ore Prep. Area – Shelter area.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(23) "H40 (101AI959)": H2S Gas Detector – 4 at 101/201BC05

This boundary H2S gas detector measures H2S gas concentration of ambient air at 101/201BC05 middle portion (near the steel support at Drum Washer side).
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(24) "H41 (101AI961)": H2S Gas Detector – 1 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence near Ore Prep. foot bridge.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(25) "H42 (101AI963)": H2S Gas Detector – 2 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, southeast of Ore Building.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(26) "H43 (101AI965)": H2S Gas Detector – 3 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, south of Ore Building.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(27) "H44 (101AI967)": H2S Gas Detector – 4 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, south of 131PD01.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(28) "H45 (101AI969)": H2S Gas Detector – 5 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, south of 131TK01.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(29) "H46 (101AI971)": H2S Gas Detector – 6 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence south, of caustic storage tanks.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(30) "H47 (101AI973)": H2S Gas Detector – 7 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, southeast of CCD Area.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(31) "H48 (101AI975)": H2S Gas Detector – 8 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, south of CCD Area.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(32) "H49 (101AI977)": H2S Gas Detector – 9 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, southwest of CCD Area.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(33) "H50 (101AI979)": H2S Gas Detector – 10 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, southeast of CCD O/F Area.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(34) "H51 (101AI981)": H2S Gas Detector – 11 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, south of CCD O/F Area.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(35) "H52 (106AI933)": H2S Gas Detector – 12 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, southeast of Sulfur Storage Shelter.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(36) "H53 (106AI935)": H2S Gas Detector – 13 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, southeast of Sulfur Storage Shelter.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(37) "H54 (106AI937)": H2S Gas Detector – 14 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, south of Sulfur Storage Shelter.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(38) "H55 (106AI939)": H2S Gas Detector – 15 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, south of H2S Plant – Sulfur yard.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(39) "H56 (106AI941)": H2S Gas Detector – 16 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, south of H2 Plant.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(40) "H57 (106AI943)": H2S Gas Detector – 17 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, southwest of Methanol Tank.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(41) "H58 (112AI903)": H2S Gas Detector – 18 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, south of VSLC Limestone Storage Shelter.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(42) "H59 (112AI905)": H2S Gas Detector – 19 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, south of VSLC Laboratory/ Office.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

(43) "H60 (112AI907)": H2S Gas Detector – 20 at Riverside Fence

This boundary H2S gas detector measures H2S gas concentration of ambient air at riverside fence, south of Intake Water Pond.
(Operating Range: PVHI: 0.10 ppm; PVHH: 0.20 ppm)

2) H2S Gas Detectors Inside Plant Site

(1) "H9 (001AI401): H2S Gas Detector at Ore Preparation – Drum Washer Area

This H2S gas detector measures H2S gas concentration of ambient air at Ore Preparation – Drum Washer area. This gas detector is equipped with beacon (001XA401) and horn (001XA402) system that is attached to a rack support.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(2) "H10 (001AI201)": H2S Gas Detector at Ore Building/MCC

This H2S gas detector measures H2S gas concentration of ambient air at Ore Building/MCC area. This gas detector is equipped with beacon (001XA201) and horn (001XA202) system that is located near north-side entrance of the building.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(3) "H11 (001AI202): H2S Gas Detector at Chemical Warehouse

This H2S gas detector measures H2S gas concentration of ambient air at Chemical Warehouse area. This gas detector is equipped with beacon (001XA203) and horn (001XA204) system that is located near west-side entrance of the building.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(4) "H12 (103AI903)": H2S Gas Detector at HPAL Expansion Area

This H2S gas detector measures H2S gas concentration of ambient air at HPAL Expansion area. This gas detector is equipped with beacon (103XA923) and horn (103XA924) system that is located at common pipe rack in HPAL expansion area.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(5) "H13 (001AI003)": H2S Gas Detector at Boiler Plant

This H2S gas detector measures H2S gas concentration of ambient air at Boiler Plant area. This gas detector is equipped with beacon (001XA035) and horn (001XA036) system that is located near the east-side entrance of boiler plant.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(6) "H14 (001AI001)": H2S Gas Detector at Central Building

This H2S gas detector measures H2S gas concentration of ambient air at Central Building area. This gas detector is equipped with beacon (001XA031) and horn (001XA032) system that is located near the south-side entrance of CB.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(7) "H15 (001AI006)": H2S Gas Detector at General Office Building

This H2S gas detector measures H2S gas concentration of ambient air at General Office Building area. This gas detector is equipped with beacon (001XA041) and horn (001XA042) system that is located in the north-side of GOB.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(8) "H16 (001AI005)": H2S Gas Detector at Plant Site Office

This H2S gas detector measures H2S gas concentration of ambient air at Plant Site Office area. This gas detector is equipped with beacon (001XA039) and horn (001XA040) system that is located in the north-side of PSO.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(9) "H17 (001AI008)": H2S Gas Detector at Spare Parts Warehouse

This H2S gas detector measures H2S gas concentration of ambient air at Spare Parts Warehouse area. This gas detector is equipped with beacon (001XA045) and horn (001XA046) system that is located near the west north-side of the warehouse.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(10)"H18 (001AI007)": H2S Gas Detector at Workshop

This H2S gas detector measures H2S gas concentration of ambient air at Workshop area. This gas detector is equipped with beacon (001XA043) and horn (001XA044) system with the detector located near the east-side entrance of the building while the beacon and horn in the inside the building workshop.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(11)"H19 (001AI009)": H2S Gas Detector at Contractor Office

This H2S gas detector measures H2S gas concentration of ambient air at Contractor Office area. This gas detector is equipped with beacon (001XA047) and horn (001XA048) system that is located at the east-side of the gate of the contractor's office.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(12)"H20 (001AI104)": H2S Gas Detector at MS Product Warehouse

This H2S gas detector measures H2S gas concentration of ambient air at MS Product Warehouse area. This gas detector is equipped with beacon (001XA107) and horn (001XA108) system that is located near the west-side entrance of the warehouse.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(13)"H21 (001AI105)": H2S Gas Detector at MS/H2S Building/MCC

This H2S gas detector measures H2S gas concentration of ambient air at MS/H2S Building/MCC area. This gas detector is equipped with beacon (001XA109) and horn (001XA110) system that is located near the south-side entrance of the building.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(14)"H22 (001AI101)": H2S Gas Detector at Cooling Tower

This H2S gas detector measures H2S gas concentration of ambient air at Cooling Tower area. This gas detector is equipped with beacon (001XA101) and horn (001XA102) system that is located at the south-side of cooling tower (northwest-side of MS/H2S Building)
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(15)"H23 (001AI301)": H2S Gas Detector at Limestone Building/MCC

This H2S gas detector measures H2S gas concentration of ambient air at Limestone Building/MCC area. This gas detector is equipped with beacon (001XA301) and horn

(001XA302) system with the detector located at the south-side of the building while the beacon and horn in the east-side entrance of the building.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

(16)"H24 (001AI302)": H2S Gas Detector at Slaked Lime Building

This H2S gas detector measures H2S gas concentration of ambient air at Slaked Lime Building area. This gas detector is equipped with beacon (001XA303) and horn (001XA304) system with the detector located at the east-side of the building while the beacon and horn in the north-side entrance of the building.
(Operating Range: PVHI: 5 ppm; PVHH: 10 ppm)

3) CO2 Gas Detectors Inside Plant Site

(1) "C1 (108AI901)": CO2 Gas Detector at 108TK02

This CO2 gas detector measures CO2 gas concentration of ambient air around 108TK02 area. This gas detector and 108AI902 are connected to beacon (108XA921) and horn (108XA922) system that is located at common pipe rack-south side of FNTRL tanks.
(Operating Range: PVHI: 10000 ppm; PVHH: 15000 ppm)

(2) "C2 (108AI902)": CO2 Gas Detector at 108TK03

This CO2 gas detector measures CO2 gas concentration of ambient air around 108TK03 area. This gas detector and 108AI901 are connected to beacon (108XA921) and horn (108XA922) system that is located at common pipe rack-south side of FNTRL tanks.
(Operating Range: PVHI: 10000 ppm; PVHH: 15000 ppm)

(3) "C3 (103AI902)": CO2 Gas Detector at 203TK12

This CO2 gas detector measures CO2 gas concentration of ambient air around 203TK12 area. This gas detector and 103AI901 are connected to beacon (103XA921) and horn (103XA922) system that is located at pipe rack-north side of 203TK12.
(Operating Range: PVHI: 10000 ppm; PVHH: 15000 ppm)

(4) "C4 (103AI901)": CO2 Gas Detector at 103TK12

This CO2 gas detector measures CO2 gas concentration of ambient air around 103TK12 area. This gas detector and 103AI902 are connected to beacon (103XA921) and horn (103XA922) system that is located at pipe rack-north side of 203TK12.
(Operating Range: PVHI: 10000 ppm; PVHH: 15000 ppm)

(5) "C5 (104AI902)": CO2 Gas Detector at 104TK02

This CO2 gas detector measures CO2 gas concentration of ambient air around 104TK02 area. This gas detector and 104AI901 are connected to beacon (104XA921) and horn (104XA922) system that is located at the west side of 104TK01.
(Operating Range: PVHI: 10000 ppm; PVHH: 15000 ppm)

(6) "C6 (104AI901)": CO2 Gas Detector at 104TK01

This CO2 gas detector measures CO2 gas concentration of ambient air around 104TK01 area. This gas detector and 104AI902 are connected to beacon (104XA921) and horn (104XA922) system that is located at the west side of 104TK01.
(Operating Range: PVHI: 10000 ppm; PVHH: 15000 ppm)

4) O2 Gas Detector at Culvert-11

(1) "O1 (422AI051)": O2 Gas Detector at Culvert-11

This O2 gas detector measures O2 gas concentration of ambient air inside Culvert-11. This gas detector and 422AI052 are connected to beacon (422XA051) and horn (422XA052) system that is located at the area.
(Operating Range: PVLO: 19.5 %)

5) Methanol Gas Detector at Culvert-11

(1) "M1 (422AI052)": Methanol Gas Detector at Culvert-11

This Methanol gas detector measures methanol vapor/gas concentration of ambient air inside Culvert-11. This gas detector and 422AI051 are connected to beacon (422XA051) and horn (422XA052) system that is located at the area.
(Operating Range: PVHI: 600 ppm)

6) pH Probe/Meter Inside Plant Site

(1) "P1 (101AI941)": pH Probe/Meter at No.1 Siltation Pond

This pH probe/meter measures pH of water in the ditch going to the southeast siltation pond near Ore Building.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(2) "P2 (108AI931)": pH Probe/Meter at Chemical Warehouse Ditch

This pH probe/meter measures pH of water in the north-side ditch of Chemical Warehouse.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(3) "P3 (103AI932)": pH Probe/Meter at Hematite Recovery Area

This pH probe/meter measures pH of water in the south-side ditch of Hematite Recovery area.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(4) "P4 (103AI931)": pH Probe/Meter at HPAL Expansion Area

This pH probe/meter measures pH of water in the south-side ditch of HPAL Expansion area.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(5) "P5 (104AI931)": pH Probe/Meter at 102 HPAL Area

This pH probe/meter measures pH of water in the south-side ditch of HPAL 102 area.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(6) "P6 (102AI941)": pH Probe/Meter at Acid Area

This pH probe/meter measures pH of water in the east-side ditch of Acid area.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(7) "P7 (103AI933)": pH Probe/Meter at CCD Expansion Area

This pH probe/meter measures pH of water in the ditch of CCD Expansion area.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(8) "P8 (103AI934)": pH Probe/Meter at No. 2 Siltation Pond

This pH probe/meter measures pH of water in the ditch going to the south siltation pond near CCD area.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(9) "P9 (633AI931)": pH Probe/Meter at Laboratory Pit

This pH probe/meter measures pH of water in the Laboratory pit.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(10)"P10 (105AI931)": pH Probe/Meter at MS/DeZn Area

This pH probe/meter measures pH of water in the south-side ditch of MS/DeZn area.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(11)"P11 (109AI941)": pH Probe/Meter at H2S Plant

This pH probe/meter measures pH of water in the south-side ditch of H2S Plant.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(12)"P12 (111AI942)": pH Probe/Meter at No.3 Siltation Pond

This pH probe/meter measures pH of water in southwest siltation pond near Limestone area.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(13)"P13 (111AI941)": pH Probe/Meter at Slaked Lime Area

This pH probe/meter measures pH of water in the southwest-side ditch of Slaked Lime area.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(14)"P14 (416AI051)": pH Probe/Meter at Culvert 11

This pH probe/meter measures pH of water in the ditch located in Culvert 11.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(15)"P15 (416AI502)": pH Probe/Meter at Culvert 12

This pH probe/meter measures pH of water in the ditch located in Culvert 12.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

(16)"P16 (416AI053)": pH Probe/Meter at Culvert 13

This pH probe/meter measures pH of water in the ditch located in Culvert 13.
(Operating Range: PVLL: 6.5; PVLO: 7.0; PVHI: 8.5; PVHH: 9.0)

7) Oil Leak Detector

(1) "OL1 (101AT942)": Oil Leak Detector at Siltation Pond 1 (Ore Building Area)

This oil leak detector measures the presence of oil in the oil pit going to siltation pond 1 (Ore Building Area). The oil detector is not yet online and still not available. (Operating Range: PVHI: xx; PVHH: xx)

(2) "OL2 (103AT935)": Oil Leak Detector at Siltation Pond 2 (CCD Area)

This oil leak detector measures the presence of oil in the oil pit going to siltation pond 2 (CCD Area). The oil detector is not yet online and still not available. (Operating Range: PVHI: xx; PVHH: xx)

(3) "OL3 (111AT944)": Oil Leak Detector at Siltation Pond 2 (Limestone Area)

This oil leak detector measures the presence of oil in the oil pit going to siltation pond 3 (Limestone Area). The oil detector is not yet online and still not available. (Operating Range: PVHI: xx; PVHH: xx)

8) Wind Speed and Direction

(1) 002SI001: Wind Speed Indicator

This indicator shows the actual wind speed read by the anemometer installed at top of Central Building. The wind speed value gives DCS operator the idea how strong the wind inside the Plant.

(2) 002SI002: Wind Direction Indicator

This indicator shows the actual wind direction read by the wind vane installed at top of Central Building. The wind direction is very useful in determining the source of gas leakages.

3. Motors

None

4. Actuated Valves

1) 101KV942A: Motor Isolation Valve – 1 for Ditch going to Siltation Pond 1 (Ore Area)

This motor isolation valve is used to automatically stop ditch water discharge to Siltation Pond 1 (Ore Area) once there is upset in ditch water quality. The motor valve is triggered by 101AI941HH = 9.0, 101AI941 LL = 6.5 or 101AT942 oil leak detection. Once the ditch water quality returns to normal, the motor valve can be manually opened through DCS or through LCP at field. This valve is not yet online and still under construction.

2) 101KV942B: Motor Isolation Valve – 2 for Ditch going to Siltation Pond 1 (Ore Area)

This motor isolation valve is used to automatically stop ditch water discharge to Siltation Pond 1 (Ore Area) once there is upset in ditch water quality. The motor valve is triggered

by 101AI941HH = 9.0, 101AI941 LL = 6.5 or 101AT942 oil leak detection. Once the ditch water quality returns to normal, the motor valve can be manually opened through DCS or through LCP at field. This valve is not yet online and still under construction.

3) 103KV935A: Motor Isolation Valve – 1 for Ditch going to Siltation Pond 2 (CCD Area)

This motor isolation valve is used to automatically stop ditch water discharge to Siltation Pond 2 (CCD Area) once there is upset in ditch water quality. The motor valve is triggered by 103AI934 HH = 9.0, 109AI934 LL = 6.5 and 103AT935 oil leak detection. Once the ditch water quality returns to normal, the motor valve can be manually opened through DCS or through LCP at field. This valve is not yet online and still under construction.

4) 103KV935B: Motor Isolation Valve – 2 for Ditch going to Siltation Pond 2 (CCD Area)

This motor isolation valve is used to automatically stop ditch water discharge to Siltation Pond 2 (CCD Area) once there is upset in ditch water quality. The motor valve is triggered by 103AI934 HH = 9.0, 109AI934 LL = 6.5 and 103AT935 oil leak detection. Once the ditch water quality returns to normal, the motor valve can be manually opened through DCS or through LCP at field. This valve is not yet online and still under construction.

5) 111KV944: Motor Isolation Valve for Ditch going to Siltation Pond 3 (Limestone Area)

This motor isolation valve is used to automatically stop ditch water discharge to Siltation Pond 3 (Limestone Area) once there is upset in ditch water quality. The motor valve is triggered by 111AI942 HH = 9.0, 111AI942 LL = 6.5 and 111AT944 oil leak detection. Once the ditch water quality returns to normal, the motor valve can be manually opened through DCS or through LCP at field. This valve is not yet online and still under construction.

5. Switches

1) 000HS901: DCS Common Acknowledge Switch

The common acknowledge (ACK) button (000HS901) is used by the DCS operator to acknowledge the alarm and silence the audible alarms/horns in the DCS room and in the field. However, the alarm beacon shall remain lighted until the alarm has been reset.

Figure 2-1: 000HS901 – Common Acknowledge Switch

2) 000HS902: DCS Common Reset Switch

The common reset (RESET) button (000HS902) is used by the DCS operator to reset all the alarms in the DCS. This switch will only function when the alarm value has been restored to normal.

Figure 2-2: 000HS902 – Common Reset Switch

III. Interlocks/Controls

None

IV. Control Sequences

None

V. Alarms

None

VI. DCS Emergency Shutdown

(Refer to TNH-200-102 "ESD Manual" - II-1-5) MS Plant Shutdown 106-UZ-800)

To avoid environmental hazard caused by H2S gas leak/trouble, an automatic plant shutdown system is equipped. This shutdown system will activate once H2S Detectors around the plant registers a H2S concentration. Refer to ***Table 6-1*** for the plant shutdown system triggers/ functions/ actions.

In case a H2S detector is under maintenance, "MB" (Maintenance Bypass) function can be used (Refer to Fig 6-1) to avoid nonsense shutdown. The H2S concentration indication symbol can be targeted to show the face plate, which can select bypass "ON" or "OFF". This target is individually equipped on all H2S tags ; H1 ~ H60.

After "ON" is selected, immediately bypass timer count starts. Once timer indication becomes "0", automatically bypass function is released. The timer [min] is selective from the range ; 0 ~ 60 min.

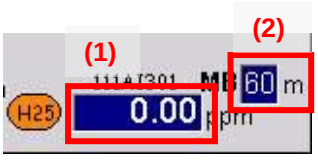
Table 6-1: Automatic plant shutdown system triggers / functions / actions

Case	Triggered H2S Detection						Action
	(a) Boundary (43)	Inside Plant					
		(b) General (17)		(c) DeZn/MS area (17)	(d) 109/209 Ground (10)	(e) 109/209 BW (20)	
		Special (3)	Other (14)				
1	0.1 ppm	5 ppm	5 ppm	5 ppm	5 ppm	5 ppm	OG "H2S Gas Detect Alarm High"
2	-	0.1 ppm	-	-	-	-	Annunciator - Patlite® (Red Beacon) Functions
3	3 out of 87					-	106XA550 (H2S Gas Detect) is triggered ,which results to 106UZ800 (MS Plant Shutdown)
	0.2 ppm	10 ppm	10 ppm	10 ppm	10 ppm		
4	2 out of 43 0.2ppm, 3 sec	-	-	-	-	-	106XA550 (H2S Gas Detect) is triggered ,which results to 106UZ800 (MS Plant Shutdown)
5	-	-	-	-	-	10 ppm Both detect	(1) 106XA550 (H2S Gas Detect) is triggered, which results to 106UZ800 (MS Plant Shutdown) (2) 109/209SIF153 a/b/c/d is triggered

Table 6-2: Tag group list

Group.	Area	Qty.	Tag	Location	Set point (ppm)
(a)	DeZn & MS	17	105AT904	105TK01	HH : 10.0 H : 5.0
			105AT901	105TK03	
			105AT902	105TK05	
			105AT910		
			105AT912	106VE01	
			106AT909	106VE02	
			106AT908	106VE03	
			106AT907	106VE04	
			106AT906	106VE05	
			106AT905	106VE05	
			106AT915		
			106AT904		
			106AT903		
			106AT902		
			106AT901		
			106AT911		
			106AT906		
(b)	H2S Area	10	109AT115	Sulfur Filter 2F	HH : 10.0 H : 5.0
			109AT116	Sulfur Filter GF	
			109AT212	109VE01 GF	
			109AT213	109BW03 GF	
			109AT214	109SR03 GF	
			109AT215	109VE05 GF	
			109AT216	109SR02 GF	
			109AT217	109HX22 GF	
			209AT212	209VE01 GF	
			209AT213	209BW03 GF	
(c)	Other Area	17	101AT401		HH : 10.0 H : 5.0
			001AT003		
			001AT001	HPAL(CB) entranse	
			001AT006		
			001AT005		
			001AT008		
			001AT007	Workshop West	
			001AT009	TJCP Office entranse	
			001AT104	Product Warehouse	
			001AT105	MS/H2S Substation	
			001AT101	Water Treatment area	
			001AT301	Limestone Substation	
			001AT302	VSLC shelter entranse	
			111AT301	Limestone South ditch	
			001AT201		H0 : 0.1
			001AT202		
			103AT903		

Group.	Area	Qty.	Tag	Location	Set point (ppm)
(d)	Boundary	43	112AT901	Water Intake	HH : 0.2 H : 0.1
			111AT943	Limestone Guard House	
			106AT931	South of DeZn area	
			101AT909	Main Gate Guard House	
			101AT907	Bridge of Ore Prep	
			101AT901	Culvert-12	
			101AT903	Culvert-11	
			101AT905	North of Coal Yard	
			101AT911		HH : 0.2 H : 0.1
			101AT913		
			101AT913		
			101AT917		
			101AT919		
			101AT921		
			101AT923		
			101AT925		
			101AT927		
			101AT929		
			101AT951		
			101AT953		
			101AT955		
			101AT957		
			101AT959		
			101AT961		
			101AT963		
			101AT965		
			101AT967		
			101AT969		
			101AT971		
			101AT973		
			101AT975		
			101AT977		
			106AT933		
			106AT935		
			106AT937		
			106AT939		
			106AT941		
			112AT903		
			112AT905		
			112AT907		
			112AT909		
			112AT911		
			112AT913		
(e)	H2S Building	20	109AT601A	109HX11AB	HH : 10.0 H : 5.0
			109AT601B	109BW02 Discharge	
			109AT602A	109VE02	
			109AT602B	109BW03 Discharge	
			109AT620A	109QC01	
			109AT621	109QC01	
			109AT622	109VE01	
			109AT615	109BW04AB Discharge	
			109AT616	109BW04AB Discharge	
			109AT620B	109BW01AB Discharge	
			209AT601A	209HX11AB	
			209AT601B	209BW02 Discharge	
			209AT602A	209VE02	
			209AT602B	209BW03 Discharge	
			209AT620A	209QC01	
			209AT621	209QC01	
			209AT622	209VE01	
			209AT615	209BW04AB Discharge	
			209AT616	209BW04AB Discharge	
			209AT620B	209BW01AB Discharge	



(1) Bypass selectable switch

(2) Bypass Timer

Fig 6-1: Maintenance bypass function

VII. Trend Graphs Grouping

None

Annex 1: ENVIRONMENT MONITORING DCS Graphics