Base Load Power Hub (BLPH)

Process Safety Cause & Effect Matrix

Document Number: 123A90-DDL-IN-CE-40000

Document Class: 1

04	11/02/2025	Accepted For Construction (AFC)	LCA	MGA	DLO
03	08/10/2024	Accepted For Construction (AFC)	LCA	MGA	DLO
02	12/06/2024	Accepted For Construction (AFC)	LCA	MGA	DLO
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Revision / Change Log

Rev.	Description
00	ISSUE FOR ACCEPTANCE (IFA)
01	ACCEPTED FOR CONSTRUCTION (AFC)
02	ACCEPTED FOR CONSTRUCTION (AFC)
03	ACCEPTED FOR CONSTRUCTION (AFC)
04	ACCEPTED FOR CONSTRUCTION (AFC)

HOLDS LIST

No.	Description
1.	
2.	
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5.	

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NOTES

1. Delay times are:

T1= 1439 min 55 sec
T2= 5 sec.
T3= 30 sec.
T4= 15 sec. (T4<T3)
T5= 24 hours (T1+ T2)

2. Abbreviation

CCR = CENTRAL CONTROL ROOM (ONSHORE)
OER = ONSHORE EQUIPMENT ROOM
ITER = OFFSHORE CONTROL ROOM
R = RESET
EL = EVENT LOG
F = FLASHING LIGHT INDICATION ON CAP
T = TIME DELAY

ASD=ABANDON
ESD=EMERGENCY SHUTDOWN
MOB= MAN OVERBORD
FGS=FIRE & GAS SYSTEM
HMI=HUMAN MACHINE INTERFACE
SIS=SAFETY INSTRUMENTED SYSTEM

PKG=PACKGE
UPS=Uninterruptible Power Supply
P&ID=Piping and Instrument Diagram
HVAC=Heating, Ventilation and Air Condition.
BLPH=Base Load Power Hub
ITER=Instrument & Telecoms Equipment Room

3. Digital Input/Output on SIS System TAGs legend:

Digital Output from SIS	Digital Input to Fire & Gas System
79-XS-001 (ASD activation)	79-XA-001 (ASD activation)
79-XS-002 (ESD-1D activation)	79-XA-002 (ESD-1D activation)
79-XS-003 (ESD-1 activation)	79-XA-003 (ESD-1 activation)
79-XS-004 (MOB activation)	79-XA-004 (MOB activation)
79-XS-005 (Loss on-shore communication)	

4. Digital Input/Output on SIS System TAGs legend:

Digital Output from FGS	Digital Input to SIS
70-XS-001 (ASD activation)	70-XA-001 (ASD activation)
70-XS-002 (ESD-1D activation)	70-XA-002 (ESD-1D activation)
70-XS-003 (S/D Electrolyzer)	70-XA-003 (S/D Electrolyzer)
70-XS-004 (Inhibit battery Charging B-300)	70-XA-004 (Inhibit battery Charging B-300)
70-XS-005 (H2 Open Area)	70-XA-005 (H2 Open Area)
70-XS-006 (H2/SMOKE B-100)	70-XA-006 (H2/SMOKE B-100)
70-XS-007 (H2/SMOKE B-200)	70-XA-007 (H2/SMOKE B-200)
70-XS-008 (Inhibit battery Charging B-100)	70-XA-008 (Inhibit battery Charging B-100)
70-XS-010 (H2/Smoke in water Treat.)	70-XA-010 (H2/Smoke in water Treat.)
70-XS-015 (H2/Smoke intake B-100)	70-XA-015 (H2/Smoke intake B-100)
70-XS-016 (H2/Smoke intake B-200)	70-XA-016 (H2/Smoke intake B-200)
70-XS-017 (H2/Smoke intake B-300)	70-XA-017 (H2/Smoke intake B-300)
70-XS-018 (H2/Smoke intake B-400)	70-XA-018 (H2/Smoke intake B-400)

5. Internal wiring isolation between SIS and Network cabinets.

79-XS-010 (ELECT. ISOLATION SOFT. CABLES COMMUNICATION CAT 6A)	CAT 6a Cables isolation

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CAUSE AND EFFECT CHARTS

ASD

CAUSE / EFFECT

ESD Level	DESCRIPTION	TAG NO.	FUNC.	By-Pass / Reset	P&ID NO.	NOTE	
							1
ASD	ASD ACTIVATION FROM FGS SYSTEM	70-XA-001				4	2
							3
ASD	FZ-01 ABANDON SHUTDOWN ACTIVATION PUSH BUTTON	950-ASD-01101		X		3	4
							5
ASD	FZ-03 ABANDON SHUTDOWN ACTIVATION PUSH BUTTON	950-ASD-03101		X		3	6
							7
ASD	FZ-04 ABANDON SHUTDOWN ACTIVATION PUSH BUTTON	950-ASD-04101		X		3	8
							9
ASD	FZ-06 ABANDON SHUTDOWN ACTIVATION PUSH BUTTON	950-ASD-06101		X		3	10
							11
ASD	FZ-07 ABANDON SHUTDOWN ACTIVATION PUSH BUTTON	950-ASD-07101		X		3	12
							13
							14
							15
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ALARM / INTERFACE								BATTERIES DISCONNECTED							PROCESS/POWER PACKAGES												INCOMING CIRCUIT BREAKERS POWER GENERATION								HVAC SYSTEM							ELECTRICAL ISOLATION UPS POWERS											

CAUSE AND EFFECT CHARTS

ESD-1D

CAUSE / EFFECT

ESD Level	DESCRIPTION	TAG NO.	FUNC.	By-Pass / Reset	P&ID NO.	NOTE	
ASD	ESD-1D ACTIVATION IN CASCADE FROM ASD						2
ESD-1D	LOW LOW PRESSURE ON NITROGEN MANIFOLD	64-PT-002	LO_LO	X	80027		4
ESD-1D	HIGH HIGH PRESSURE ON H2 STORAGE TANK V-25001A	25-PT-004	HI_HI	X	80015		6
ESD-1D	HIGH HIGH PRESSURE ON H2 STORAGE TANK V-25001B	25-PT-006	HI_HI	X	80016		8
ESD-1D	HIGH HIGH PRESSURE ON H2 STORAGE TANK V-25001C	25-PT-008	HI_HI	X	80017		10
ESD-1D	HIGH HIGH PRESSURE ON H2 STORAGE TANK V-25001D	25-PT-009	HI_HI	X	80018		12
ESD-1D	HIGH HIGH PRESSURE ON H2 STORAGE TANK V-25001E	25-PT-011	HI_HI	X	80019		14
ESD-1D	HIGH HIGH PRESSURE ON H2 STORAGE TANK V-25001F	25-PT-012	HI_HI	X	80020		16
ESD-1D	ESD-1D ACTIVATION FROM FGS SYSTEM	70-XA-002				3	18
ESD-1D	HYDROGEN CONFIRMED IN OPEN AREA FROM F&G SYSTEM (ISOLATE EQUIP. NOT SUITABLE FOR ZONE 1)	70-XA-005				3	20
ESD-1D	INHIBIT BATTERY CHARGING B-100	70-XA-008				3	22
ESD-1D	INHIBIT BATTERY CHARGING B-300	70-XA-004				3	24
ESD-1D	FZ-01 ESD-1D PUSH BUTTON ACTIVATION	950-ESDD-01101		X		2	26
ESD-1D	FZ-03 ESD-1D PUSH BUTTON ACTIVATION	950-ESDD-03101		X		2	28
ESD-1D	FZ-04 ESD-1D PUSH BUTTON ACTIVATION	950-ESDD-04101		X		2	30
ESD-1D	FZ-06 ESD-1D PUSH BUTTON ACTIVATION	950-ESDD-06101		X		2	32
ESD-1D	FZ-07 ESD-1D PUSH BUTTON ACTIVATION	950-ESDD-07101		X		2	34
ESD-1D	ESD-1D PUSH BUTTONS ONSHORE	950-ESDD-00001				2	36
ESD-1D	H2/SMOKE INSIDE B-100 (ELECT. ISOLATION) FROM FGS SYSTEM	70-XA-006				3	39
ESD-1D	H2/SMOKE INSIDE B-200 (ELECT. ISOLATION) FROM FGS SYSTEM	70-XA-007				3	41
ESD-1D	H2/SMOKE IN WATER TREATM. PKG (ELECT. ISOLATION) FROM FGS SYSTEM	70-XA-010				3	43
ESD-1D	LOSS OF ON-SHORE COMMUNICATION	79-XS-005					45
ESD-1	LOW LOW PRESSURE ON INSTRUMENT AIR MANIFOLD	63-PT-004	LO_LO	X	80027		47
	H2/SMOKE INTAKE B-100 FROM FGS SYTEM	70-XA-015				3	
	H2/SMOKE INTAKE B-200 FROM FGS SYSTEM	70-XA-016				3	
	H2/SMOKE INTAKE B-300 FROM FGS SYSTEM	70-XA-017				3	
	H2/SMOKE INTAKE B-400 FROM FGS SYSTEM	70-XA-018				3	

	ALARM / INTERFACE							DEPRESSURIZATION																HVAC SYSTEM			BATTERY INHIBITION (B-100 AND B-300)				ELECTRICAL ISOLATION UPS POWERS										PROCESS/POWER PACKAGES										INCOMING CIRCUIT BREAKERS POWER GENERATION											
To sheet						7		NOTE 3																							4																																			
P&ID									80015	80016	80017	80018	80019	80020	80014																												80011																									
DESCRIPTION	WORKSTATION HMIs - EVENT/ALARM					ESD-1 ACTIVATION		ESD-1D ACTIVATION TO FGS SYSTEM	OPEN 25-BDV-005 ON H2 STORAGE TANKS V-25001A	OPEN 25-BDV-007 ON H2 STORAGE TANKS V-25001B	OPEN 25-BDV-010 ON H2 STORAGE TANKS V-25001C	OPEN 25-BDV-013 ON H2 STORAGE TANKS V-25001D	OPEN 25-BDV-016 ON H2 STORAGE TANKS V-25001E	OPEN 25-BDV-019 ON H2 STORAGE TANKS V-25001F	OPEN 25-BDV-022 ON OUTLET H2 HEADER TO FUEL CELL PGK	SHUTDOWN HVAC SYSTEM OF B-100 (HV CONTAINER)	SHUTDOWN HVAC SYSTEM OF B-300 (UPS CONTAINER)	SHUTDOWN HVAC SYSTEM OF B-200 (LV CONTAINER)	SHUTDOWN HVAC SYSTEM OF B-400 (ITER CONTAINER)	INHIBIT. BATTERY CHARGING B-100	INHIBIT. BATTERY CHARGING B-300 AC UPS	INHIBIT. BATTERY CHARGING B-300 AC UPS UP-200F3 BATTERIES	INHIBIT. BATTERY CHARGING B-300 AC UPS UP-200F4 BATTERIES	ELECT. ISOLATION SOFT. CABLES COMMUNICATION CAT 6A	ELECT. ISOLATION UPS POWER UCP HVAC B-100	ELECT. ISOLATION UPS POWER UCP HVAC B-200	ELECT. ISOLATION UPS POWER UCP (INSTRUMENT AIR A-63000)	ELECT. ISOLATION UPS POWER UCP (NITROGEN A-64000)	ELECT. ISOLATION UPS POWER UCP (WATER TREAT. A-50000)	DISCONNECT DC UPS (B-100 CONTAINER)	SHUTDOWN ELECTROLYZER PACKAGE A-20000	SHUTDOWN BESS PACKAGE A-85000	SHUTDOWN SOLAR FARM PACKAGE	SHUTDOWN FUEL CELL PACKAGE A-80000	SHUTDOWN WATER TREATMENT PACKAGE A-50000	SHUTDOWN INSTRUMENT AIR PACKAGE A-63000	SHUTDOWN NITROGEN PACKAGE A-64000	OPEN BESS A-85000 INCOMING CIRCUIT BREAKERS	OPEN FUEL CELL A-80000 INCOMING CIRCUIT BREAKERS	OPEN SOLAR INCOMING CIRCUIT BREAKERS	OPEN WIND FARM INCOMING CIRCUIT BREAKERS	
ESD LEVEL									ESD-1D	ESD-1D	ESD-1D	ESD-1D	ESD-1D	ESD-1D	ESD-1D	ESD-1D	ESD-1D																																																				
ACTION																																																																			
TAG. NO.								79-XS-002	25-BDY-005	25-BDY-007	25-BDY-010	25-BDY-013	25-BDY-016	25-BDY-019	25-BDY-022	77-XS-001	77-XS-003	77-XS-002	77-XS-004	84-XS-009	84-XS-010	84-XS-011	79-XS-010	84-XS-004	84-XS-005	84-XS-003	84-XS-002	84-XS-001	84-XS-006	20-XS-001	85-XS-001	83-XS-001	80-XS-001	50-XS-001	63-XS-001	64-XS-001	82-XS-002	82-XS-003	82-XS-001	81-XS-001	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
1																		

CAUSE AND EFFECT CHARTS

ESD-1

CAUSE / EFFECT

ESD Level	DESCRIPTION	TAG NO.	FUNC.	By-Pass / Reset	P&ID NO 123A90-DDL-PR-PID-.	NOTE		TAG. NO.	ACTION	ESD LEVEL	DESCRIPTION	P&ID	To sheet
							1			1	WORKSTATION HMIs - EVENT/ALARM		
							2				ALARM ON CAP ONSHORE		
							3			PSD	PSD ACTIVATION		8
							4						
							5	79-XS-003		1	ESD-1 ACTIVATION TO FGS SYSTEM		NOTE 2
							6						
							7	20-XS-001			SHUTDOWN ELECTROLYZER PACKAGE A-20000	80011	
							8						
							9						
							10						
							11						
							12						
							13	80-XS-001		1	SHUTDOWN FUEL CELL PACKAGE A-80000	80012	
							14						
							15	50-XS-001		1	SHUTDOWN WATER TREATMENT PACKAGE A-50000	80022323/2	
							16						
							17						
							18						
							19						
							20						
							21	64-SDY-001		1	CLOSE 64-SDV-001 NITROGEN TO H2 STORAGE TANKS	80027	
							22						
							23	25-SDY-023			CLOSE 25-SDV-023 ON OUTLET H2 HEADER TO FUEL CELL PKG	80014	
							24						
							25	25-SDY-001			CLOSE 25-SDV-001 ON H2 HEADER TO STORAGE TANKS	80013	
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ESD-1D	ESD-1 ACTIVATION IN CASCADE FROM ESD-1D												
ESD-1	FZ-01 ESD-1 PUSH BUTTON ACTIVATION	950-ESD-01101		X		1							
ESD-1	FZ-03 ESD-1 PUSH BUTTON ACTIVATION	950-ESD-03101		X		1							
ESD-1	FZ-04 ESD-1 PUSH BUTTON ACTIVATION	950-ESD-04101		X		1							
ESD-1	FZ-06 ESD-1 PUSH BUTTON ACTIVATION	950-ESD-06101		X		1							
ESD-1	FZ-07 ESD-1 PUSH BUTTON ACTIVATION	950-ESD-07101		X		1							
ESD-1	ESD-1 PUSH BUTTONS ONSHORE	950-ESD-00001				1							
ESD-1	BESS ALARM THERMAL RUN AWAY	85-XA-004											

NOTES

1. THE FLASHING ALARM ON CAP ONSHORE IS A CUMULATIVE OF ALL ESD-1 PUSH BUTTONS ACTIVATION.

2. FGS AND SIS SYSTEM EXCHANGE DATA BETWEEN THEM BY USING THE Vnet/IP NETWORK. THIS IS IMPLEMENTED AS REDUNDANT SAFETY COMMUNICATION, APPROVED FOR SIL 3 LOOP.

HOLDS

1.T1= 1439 min 55 sec

2. T2= 5 sec.

3. T3= 30 sec.

4. T4= 15 sec. (T4<T3)

5. T5= 24 hours (T1+ T2)

Reference

Document Title	Document Number
Fire & Gas Cause & Effect Matrix	123A90-DDL-IN-CE-40002
Process Safety Cause and Effect Block Diagram	123A90-DDL-PR-DG-80000

LEGEND

CCR	CENTRAL CONTROL ROOM (ONSHORE)
OER	ONSHORE EQUIPMENT ROOM
ITER	OFFSHORE CONTROL ROOM
R	RESET
EL	EVENT LOG
F	FLASHING LIGHT INDICATION ON CAP
T	TIME DELAY

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Process Safety Cause & Effect Matrix

ESD-1: EMERGENCY SHUT DOWN WITHOUT DEPRESSURIZATION

Document Reference: **123A90-DDL-IN-CE-40000**

Rev: 04 Status: **AFC**

Contract No. **CW-I-WP4-2023-05**

CAUSE AND EFFECT CHARTS

PSD

CAUSE

EFFECT

PSD	DESCRIPTION	TAG NO.	FUNC.	By-Pass / Reset	P&ID NO 123A90-DDL-PR-PID-.	NOTE	
							1
ESD-1	PSD ACTIVATION IN CASCADE FROM ESD-1					Sh.7	2
							3
PSD	LOW PRESSURE ON NITROGEN MANIFOLD	64-PT-002	LO	X	80027		4
							5
PSD	LOW LOW PRESSURE ON OUTLET H2 HEADER TO FUEL CELL PACKAGE	80-PT-002	LO_LO	X	80012		6
							7
PSD	HIGH HIGH PRESSURE ON INLET H2 HEADER TO STORAGE TANKS	25-PT-002	HI_HI	X	80013		8
							9
PSD	HIGH HIGH PRESSURE ON OUTLET H2 HEADER TO FUEL CELL PACKAGE	80-PT-002	HI_HI	X	80012		10
							11
PSD	S/D ELECTROLYZER PKG FROM FGS SYSTEM FOR O2 CONFIRMED	70-XA-003				2	12
							13
PSD	HIGH LEVEL H2 VENT KO DRUM	43-LT-001	HI	X	80029		14
							15
	F&G UCP PANEL FAULT WATER TREATMENT PKG	50-XA-003					16
							17
	ELECTROLYZER PACKAGE CUMULATIVE CRITICAL FAULT	20-XA-003					18
							19
	FUEL CELL PACKAGE CUMULATIVE CRITICAL FAULT	80-XA-003					20
							21
	BESS PACKAGE CUMULATIVE CRITICAL FAULT	85-XA-003					22
							23
	INSTRUMENT PACKAGE CUMULATIVE CRITICAL FAULT	63-XA-003					24
							25
	NITROGEN PACKAGE CUMULATIVE CRITICAL FAULT	64-XA-003					26
							27
	HVAC PACKAGE CUMULATIVE CRITICAL FAULT B-100 (HV CONTAINER)	77-XA-001					28
							29
	HVAC PACKAGE CUMULATIVE CRITICAL FAULT B-200 (LV CONTAINER)	77-XA-002					30
							31
	HVAC PACKAGE CUMULATIVE CRITICAL FAULT B-300 (UPS CONTAINER)	77-XA-003					32
							33
	HVAC PACKAGE CUMULATIVE CRITICAL FAULT B-400 (ITER CONTAINER)	77-XA-004					34
							35
	NAVAIDS PACKAGE CUMULATIVE CRITICAL FAULT	72-XA-001					36
							37
	SOLAR PACKAGE CUMULATIVE CRITICAL FAULT					Note 1	38
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	TAG. NO.	ACTION	PSD	DESCRIPTION	P&ID	To sheet
				ALARM / INTERFACE		
				WORKSTATION HMIs - EVENT/ALARM		
				ALARM ON CAP ONSHORE		
				SHUT-DOWN VALVES		
7	25-SDY-001		PSD	CLOSE 25-SDV-001 ON H2 HEADER TO STORAGE TANKS	80013	
8	64-SDY-001		PSD	CLOSE 64-SDV-001 NITROGEN TO H2 STORAGE TANKS	80027	
9	25-SDY-023		PSD	CLOSE 25-SDV-023 ON OUTLET H2 HEADER TO FUEL CELL PACK	80014	
10				**PROCESS/POWER PACKAGES**		
11	50-XS-001		PSD	SHUTDOWN WATER TREATMENT PACKAGE A-50000	80022/23/2	
12	20-XS-001		PSD	SHUTDOWN ELECTROLYZER PACKAGE A-20000	80011	
13	80-XS-001		PSD	SHUTDOWN FUEL CELL PACKAGE A-80000	80012	
14	85-XS-001		PSD	SHUTDOWN BESS PACKAGE A-85000		
15	63-XS-001		PSD	SHUTDOWN INSTRUMENT AIR PACKAGE A-63000	80027	
16	64-XS-001		PSD	SHUTDOWN NITROGEN PACKAGE A-64000	80027	
17	83-XS-001			SHUTDOWN SOLAR (Note 1)		
18	83-XS-001A			SHUTDOWN SEAWATER LIFT PUMP P-50001A		
19	83-XS-001B			SHUTDOWN SEAWATER LIFT PUMP P-50001B		
20				**HVAC SYSTEM**		
21	77-XS-001			SHUTDOWN HVAC SYSTEM OF B-100 (HV CONTAINER)		
22	77-XS-002			SHUTDOWN HVAC SYSTEM OF B-200 (LV CONTAINER)		
23	77-XS-003			SHUTDOWN HVAC SYSTEM OF B-300 (UPS CONTAINER)		
24	77-XS-004			SHUTDOWN HVAC SYSTEM OF B-400 (ITER CONTAINER)		

NOTES

1. SERIAL SIGNALS THROUGH FIBER OPTIC CABLE.

2. FGS AND SIS SYSTEM EXCHANGE DATA BETWEEN THEM BY USING THE Vnet/IP NETWORK.
THIS IS IMPLEMENTED AS REDUNDANT SAFETY COMMUNICATION, APPROVED FOR SIL 3 LOOP.

HOLDS

1.T1= 1439 min 55 sec

2. T2= 5 sec.

3. T3= 30 sec.

4. T4= 15 sec. (T4<T3)

5. T5= 24 hours (T1+ T2)

Reference

Document Title	Document Number
Fire & Gas Cause & Effect Matrix	123A90-DDL-IN-CE-40002
Process Safety Cause and Effect Block Diagram	123A90-DDL-PR-DG-80000

LEGEND

CCR	CENTRAL CONTROL ROOM (ONSHORE)
OER	ONSHORE EQUIPMENT ROOM
ITER	OFFSHORE CONTROL ROOM
R	RESET
EL	EVENT LOG
F	FLASHING LIGHT INDICATION ON CAP
T	TIME DELAY

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04	11/02/2025	Accepted For Construction (AFC)	LCA	MGA	DLO

Process Safety Cause & Effect Matrix

PSD: PROCESS SHUT DOWN

Document Reference: **123A90-DDL-IN-CE-40000**

Rev: 04 Status: **AFC**

Contract No. **CW-I-WP4-2023-05**

Sheet 8 of 9

CAUSE AND EFFECT CHARTS

MOB PUSH BUTTONS

CAUSE / EFFECT

PSD	DESCRIPTION	TAG NO.	FUNC.	By-Pass / Reset	P&ID NO 123A90-DDL-PR-PID-.	NOTE		1	2	3	4	5	6
							1						
	FZ-01 MAN OVER BOARD ACTIVATION	950-MOB-01101		X		1	2	X	F		X		
							3						
	FZ-03 MAN OVER BOARD ACTIVATION	950-MOB-03101		X		1	4	X	F		X		
							5						
	FZ-04 MAN OVER BOARD ACTIVATION	950-MOB-04101		X		1	6	X	F		X		
							7						
	FZ-06 MAN OVER BOARD ACTIVATION	950-MOB-06101		X		1	8	X	F		X		
							9						
	FZ-07 MAN OVER BOARD ACTIVATION	950-MOB-07101		X		1	10	X	F		X		
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TAG. NO.												79-XS-004																																																																															
ACTION												ALARM																																																																																							
DESCRIPTION												MOB PUSH BUTTONS ALARM ACTIVATION TO FGS SYSTEM																																																																																						