

Mega – Cokers Commissioning Experience



October 2013
New Delhi, India

Raj Sharma
Coker Consultant

SAFETY TIME

- ▣ Safety First
- ▣ Awareness – key for successful startups



India- Emerging Coker Hub

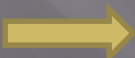
Emerging Cokers due to heavier Crude Blends

- Old Cokers at Digboi, Gauhati, Bongaigaon and Barauni
- New Cokers at Jamnagar (Reliance), Essar Oil, IOC-Panipat, Vadodara, Bina and Bhatinda.
- Proposed / Under construction Cokers at IOC- Paradeep, MRPL-Mangalore, Cochin and Chennai. →
- 2 Cokers at Reliance Jamnagar are having 8 coke drums each with capacity of 162000 and 175000 BPD. →

Mega cokers

- ▣ Mega cokers in India are 9MMTPA + capacity
- ▣ 8 Coke drums with single fractionator
- ▣ Commissioning was done phase wise based on construction progress. This earned extra revenue due to early startup of 4 drums.
- ▣ Part commissioning was a safety challenge as many common lines like CBD/pump drains/OWS/Fire water /DCS/Alarm system/Gas detector system/Utilities were common

Mega Coker -Early startup Plan

- ▣ Steps at early stage to achieve stage wise start up if required. Mega cokers have lot of flexibility
- ▣ 4 drums clubbed with independent Blow down system. So plant is 4+4 drums operability.
- ▣ Next each pair of coke drums with heater made an independent block. So total 4 blocks
- ▣ Gas plant was common with suitable turn down capability. All trays were designed for this load. 

Early startup plan

- ▣ Exhaustive positive isolation (Blind list) with proper Tags and administrative control.
- ▣ Additional isolation valves were provided to achieve positive isolation. Also these isolation valves at construction interphase were chain locked additionally and position logged every shift.
- ▣ All utilities were also provided with additional isolation valves with blinds including Flare header.

Early Startup/segregation

1. Whole area was hard-barricaded
2. Security person manned the gates with cards
3. Block 1 Area declared safety permit area
4. Construction area (block 4) was barricaded by GI sheet / Fire blankets up to coke drum platforms 
5. Live lines in non operating area were painted red & tagged. Valves were positive blinded and chain locked
6. Visible lights provided blockwise at each deck

Escape route /Assembly points

Escape routes

- *Existing escape routes reviewed in the new barricaded scenario and new escape route marked wherever applicable considering wind directions*
- *Minimum two gates considered for entry / exit*
- *Additional wind socks will be provided in prominent locations for easy identification of wind directions*

Assembly points

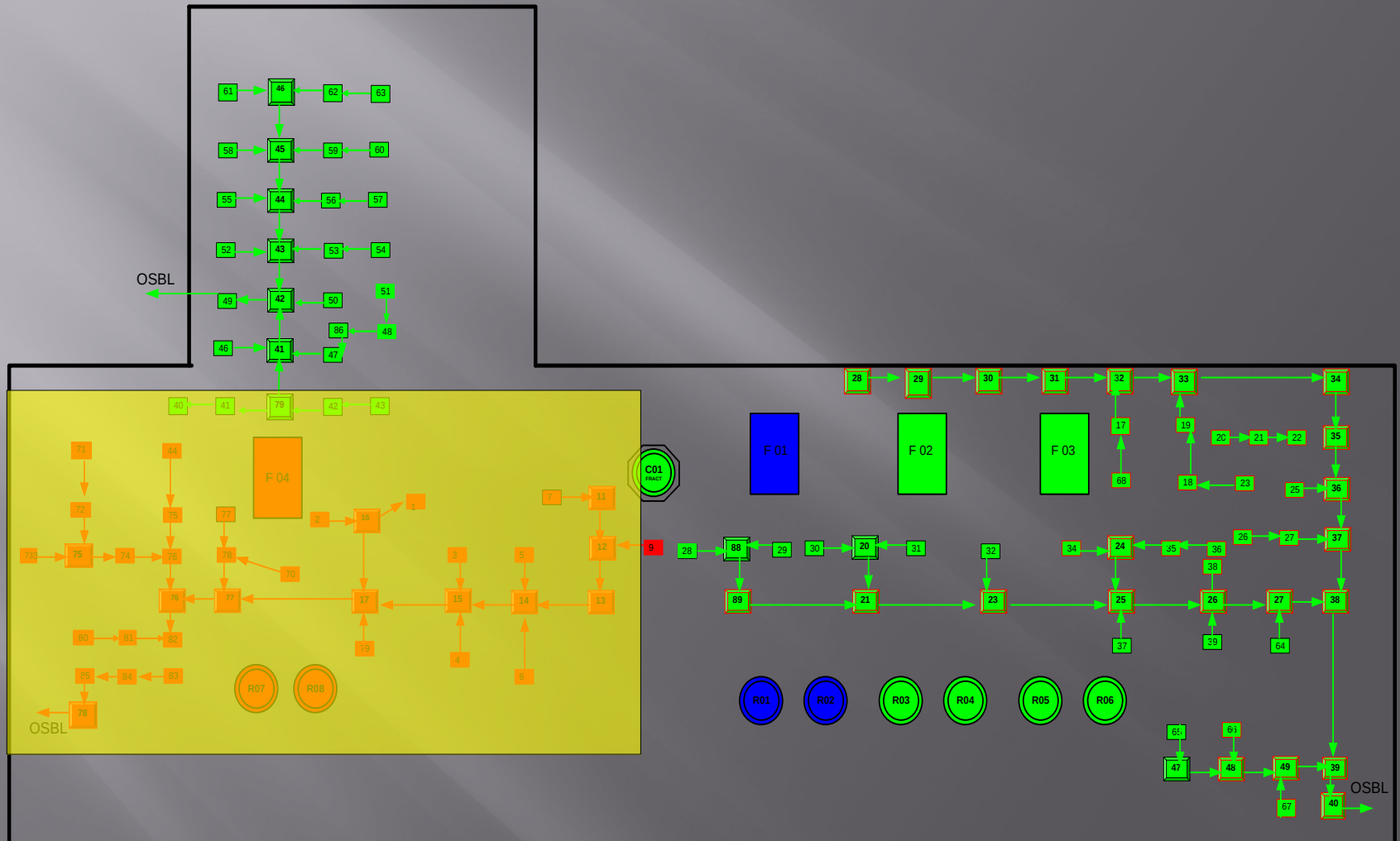
- *Additional assembly points provided at suitable locations for both construction and operation personnel*
- *Mock drills will be conducted to ensure rapid & orderly evacuation of people , in case of emergency*



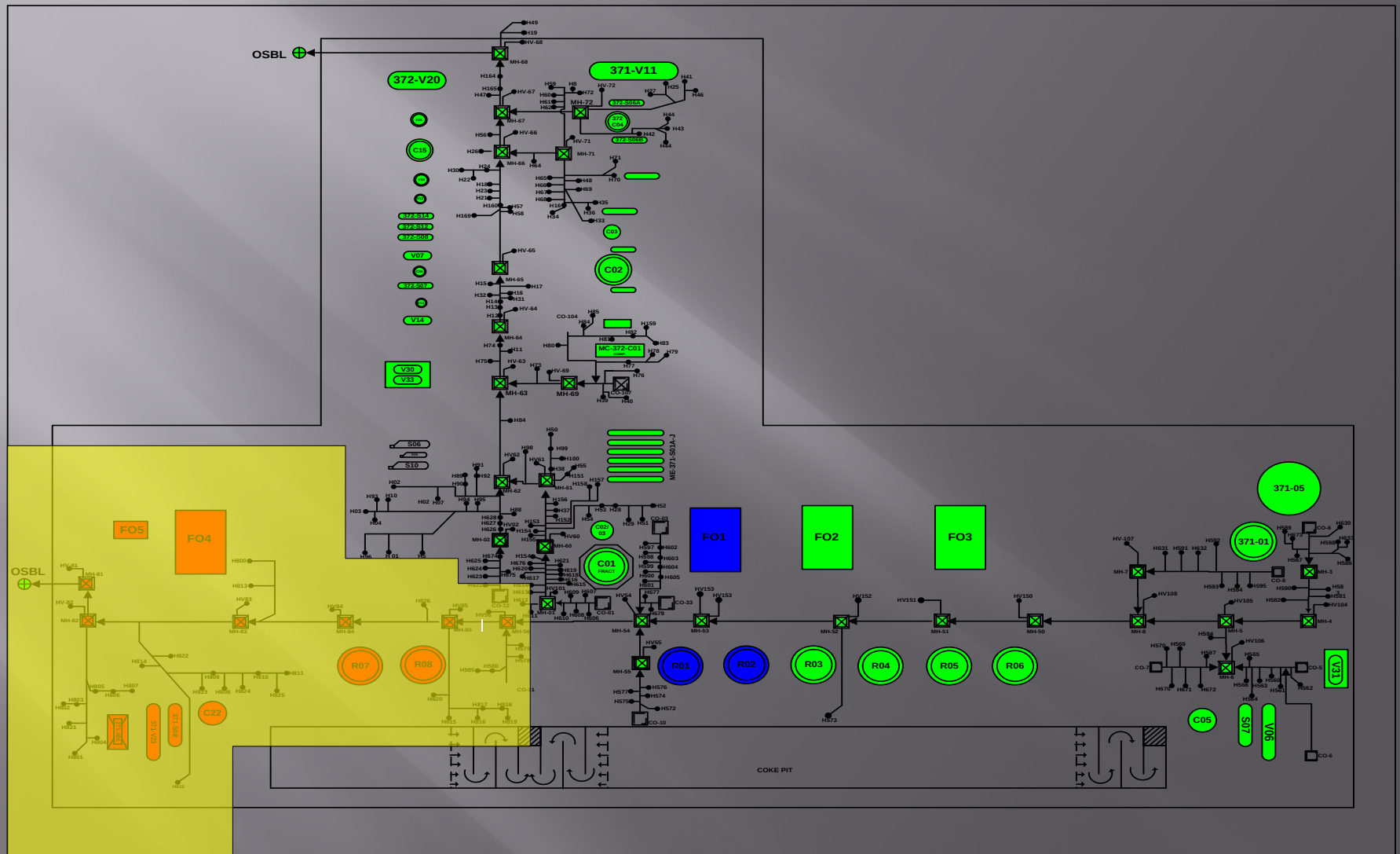
Early Startup-Segregation

UNDER GROUND SYSTEM

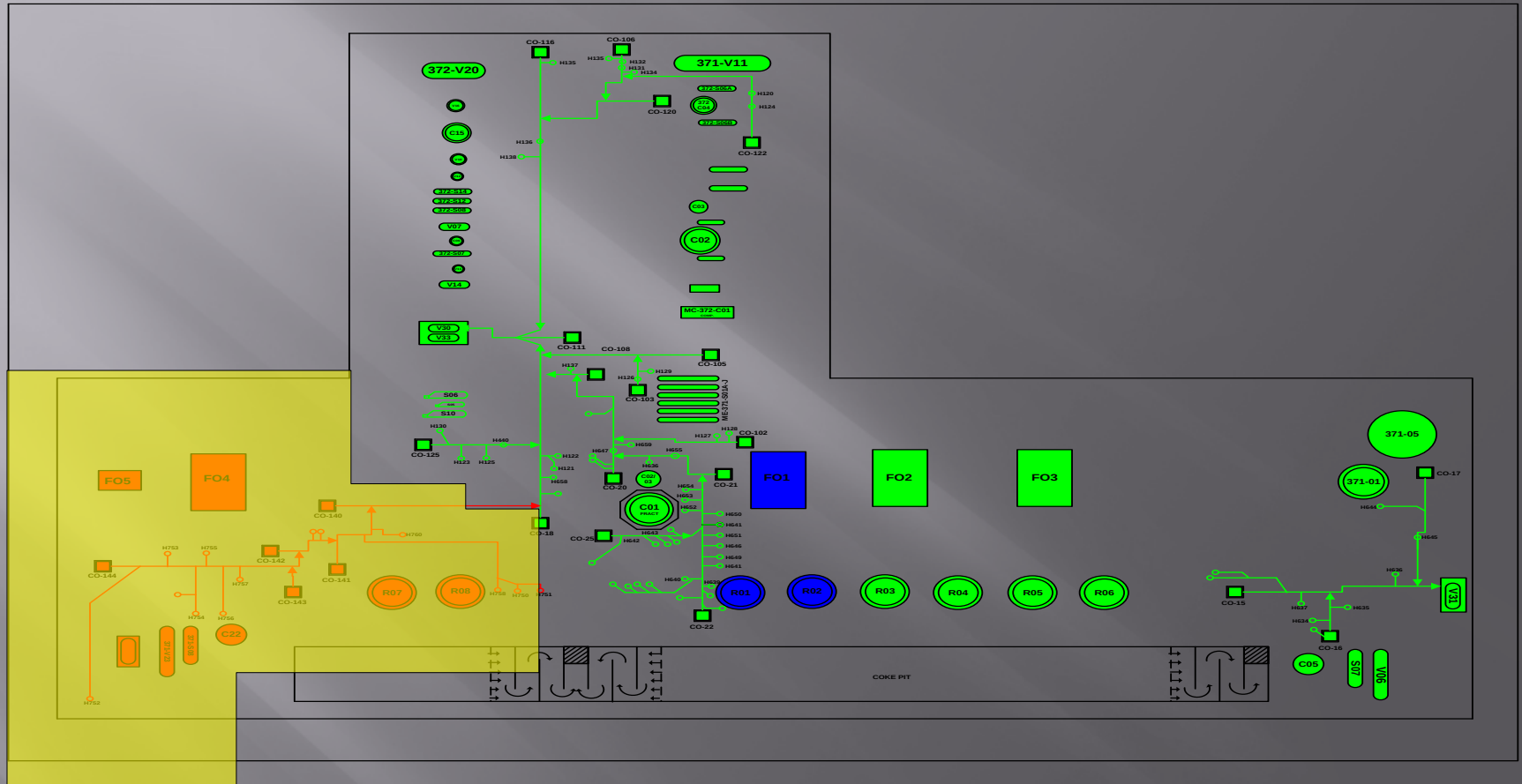
Storm Water System



Underground isolation: OWS



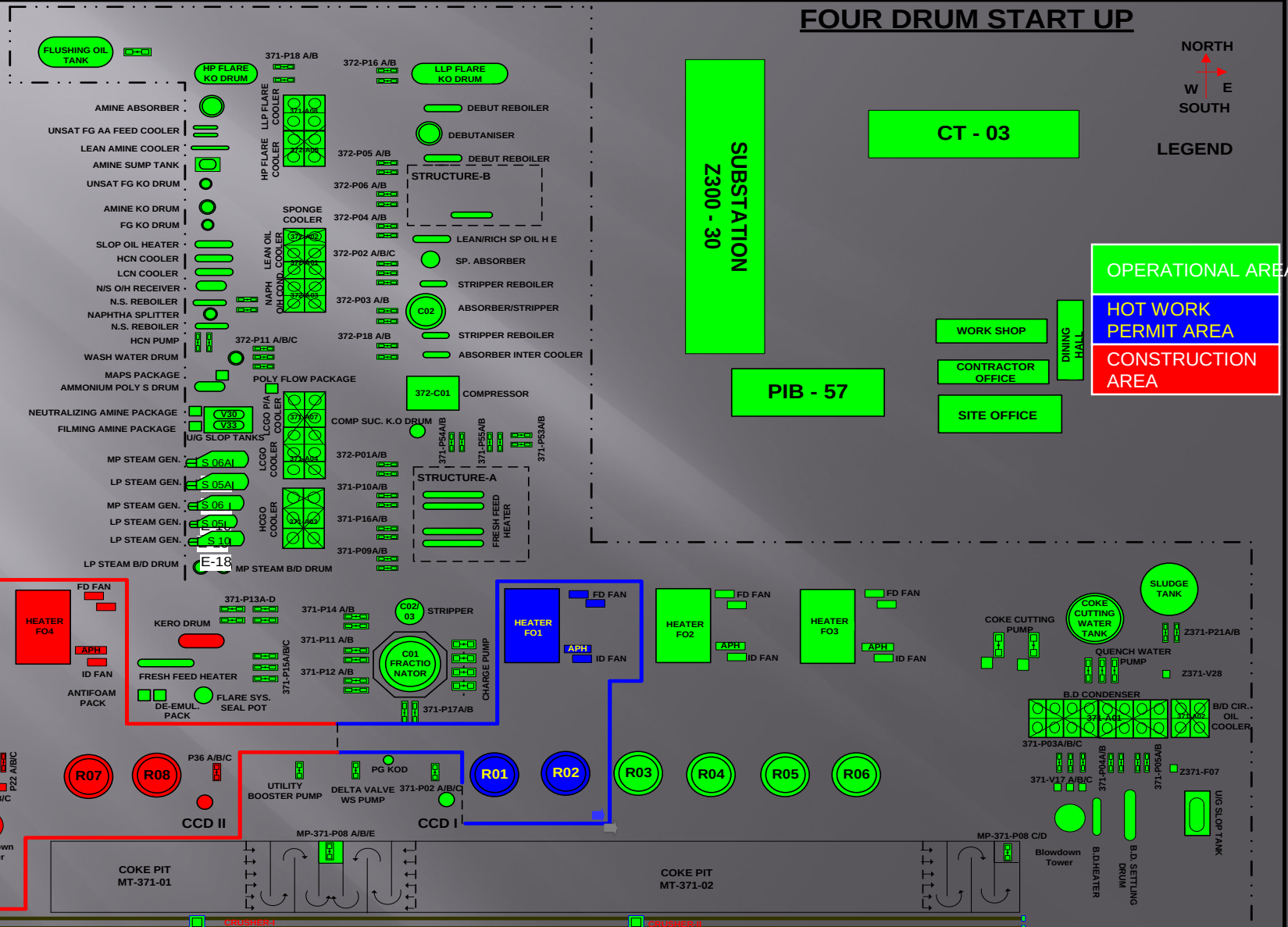
Underground CBD isoleted



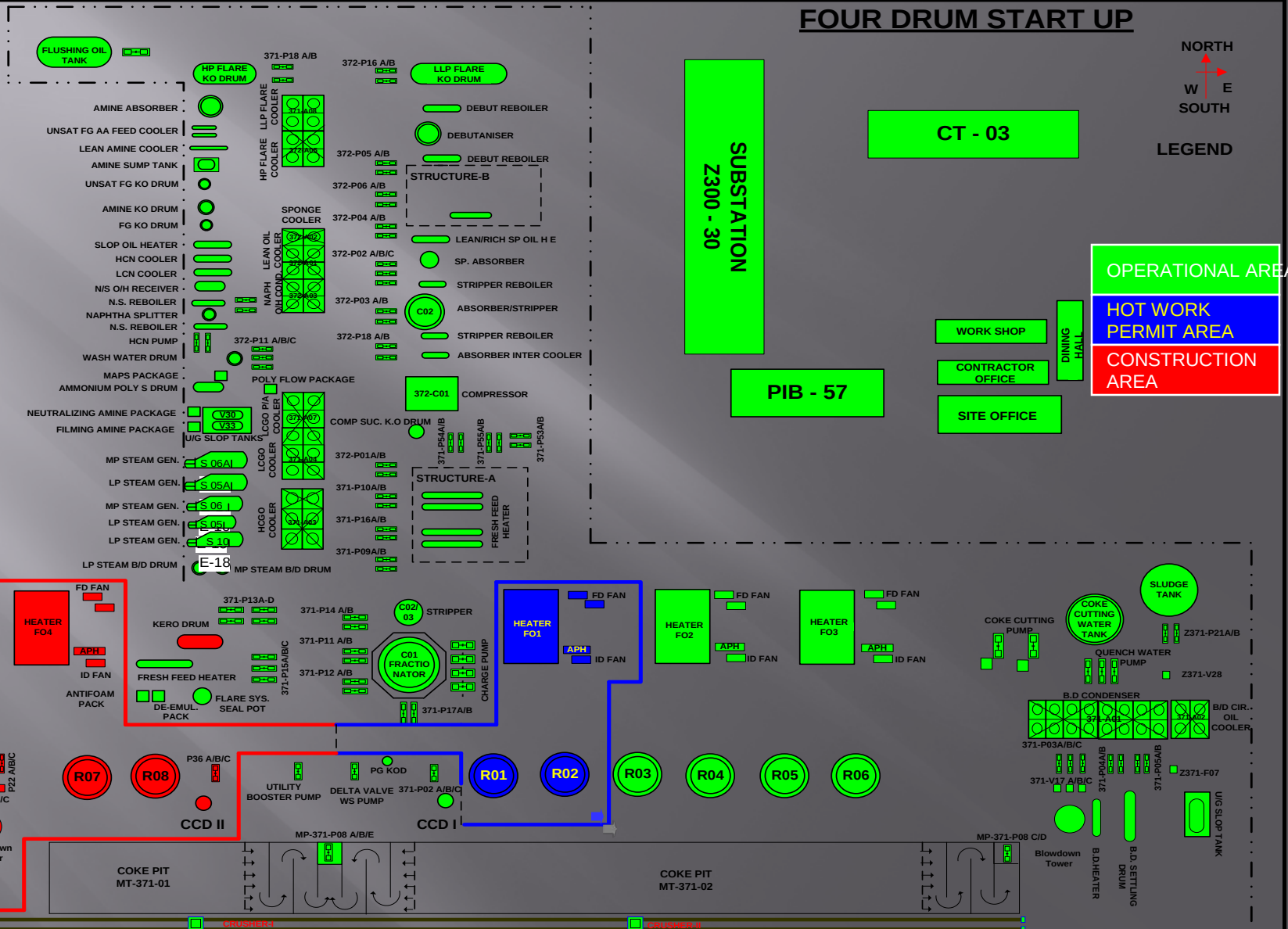
Early Start up- Segregation

ABOVE GROUND SYSTEM

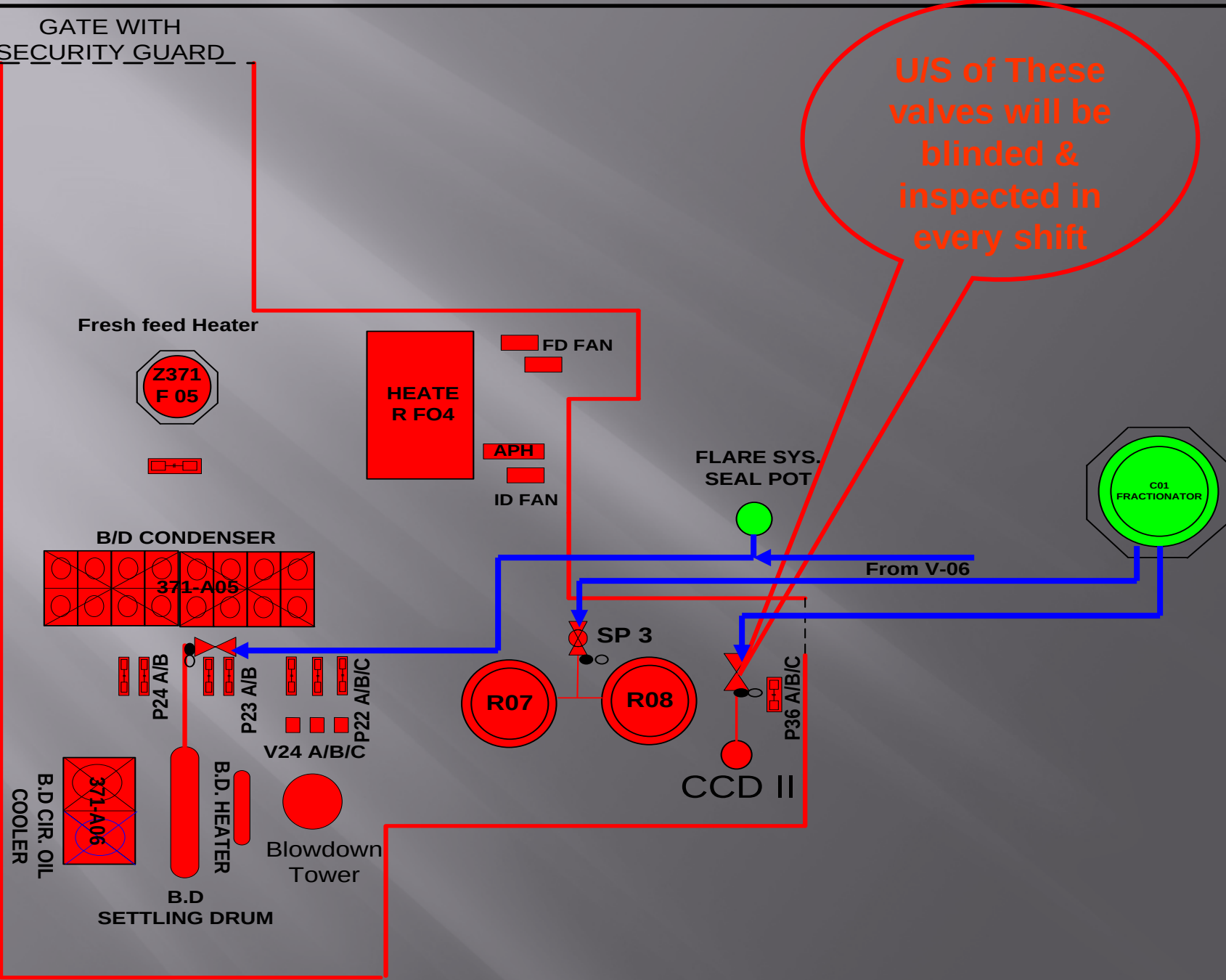
Above Ground System



Above Ground System



GATE WITH
SECURITY_GUARD_



HARD BARRICATED AREA

01 Oct 13

Raj Sharma

Segregation-continued

- ▣ DCS graphics were also divided in Blockwise along with DS alarms grouping.
- ▣ Since 4 drums startup was envisaged, underground piping was designed for such isolation facility.
- ▣ Physical barricading was engineered between 4 live coke drums and rest, both at coke drum structure(at all levels) and at grade plot.

Early Startup Plan

- ▣ Safety interlocks were designed blockwise to avoid interference. Specific inputs from outside (load shedding) were identified.
- ▣ Construction priority was given for systems in 4 drums, 2 drums and then last 2 drums
- ▣ 4 Drums started= 23rd January 2009
- ▣ Next 2 drums started= 16th May 2009
- ▣ Last 2 drums started = 23rd July 2009
- ▣ Extra Revenue earned= millions of Dollars

Major Focus

- ▣ Zero LTI- safety first during construction/Pre-comm/startup
- ▣ Zero fire – Fire free startup
- ▣ Zero flaring during startup –save money
- ▣ Zero/Minimum Recycle –Maximize thruput
- ▣ Zero /Minimum slops(generation-Reprocess)
- ▣ Zero sludge –Reprocess all
- ▣ Zero steam leak- Steam traps/flanges tightness

Start up Outline

- Methodology & Sequence –Define ,Microplan
- Focus - Project basis, P&IDs, Hazops, Manpower (Team coker),Training
- Expedite - Engineering
- Ensure -- Procurement in time
- Quality Assurance -Construction, Systemwise priority , Milestones, Critical Paths, 'S' Curve
- Essential- Proving – Precommissioning , RFSU
- Safety – PSSR, DCS, Startup
- Maximize –Revenue by operational excellence

Mega Coker - Essentials

- ▣ BuildingTeamCoker.Process/Operation/Maintenance. Organogram
- ▣ EPCO Team concept.
(Engg/Project/Construction/O&M.
Focus on Safety/Quality/schedule/operability
- ▣ Integration within and Other Refinery units/Upstream/downstream/Utilities Teams
- ▣ Define clear responsibility to each team member. Set defined targets for everyone.

Mega Coker - Essentials

- ▣ Select Process Licensor early

Assist Project group

- ▣ Process Package/Layout/PFD/P&ID/Hazops

Assist Engineering group

- ▣ EPC/Engineering/Equipment Data sheet/PDS
Model/ISOs review /Spools/Fabrication

Assist procurement group

- ▣ Equipment PR/Procurement/Vendor packages

Mega Coker - Essentials

Assist Construction group

- ▣ System-sub system- owners →
- ▣ Priority/Schedule/
Equipment preservation, Erection/QA, QC →
Alignment/Hydrotest loops/PMI →
- ▣ Mechanical completion/Check Lists/
Internals/Gaskets/Flushing/Cleaning/ →
- ▣ Steam blow/RFC →

Mega Coker - Essentials

▣ Operation preparedness.

Operating-manuals/SOP,SMP/Training manual/Safety manual
Communication/safety permit/shift /Licensor/manpower /op-shelters

DCS-system

Graphics, Alarm priority, Inter-connectivity

Operator Training/ on site/Simulator/validation/learning from incidents

System proving including vendor packages and instrumentation, safety interlocks

Mega Coker - Essentials

- ▣ PSSR-Include all systems like electrical sub station, PIB, safety systems like fire/gas detectors →
- ▣ Hydrocarbon-In/Refractory dryout/Circulation
- ▣ RFSU
- ▣ Commissioning/Feed Cut In/Product-out
- ▣ Stabilization/Test Run

Use learning from past Incidents

- ▣ Major startup Pitfalls →
- ▣ PMI – misses →
- ▣ Heater coke up, Heater tube failure/BMS failures/ Burner extinguish →
- ▣ Coke drum foam over- Level problems/Delays in Cycle,
- ▣ Fractionator upsets/level losses/Feed failures

Mega Cokers- Mega Problems

- ▣ Identify right block- measures
- ▣ Flange leakages/ opening-measures
- ▣ Wrong operation of coke drum-measures, valves-interlock/ Isolators →
- ▣ Power failure-Tarry drum →
- ▣ Utilities failure – Control fractionator temp
- ▣ Pump seal failures- seal selection, plan
- ▣ Pump failures due to strainer chock up-hot circulation-more time
- ▣ Compressor failures

Mega Cokers- Mega Problems

- ▣ Expansion loops fouling with other piping-measures taken
- ▣ Water hammers –steam headers
- ▣ Steam traps malfunctions-heater coke up
- ▣ Heater pass flow failures. Heater trips
- ▣ Coke drum cave in- shot coke problems
- ▣ Cutting tool jamming- experience manpower

Mega Cokers- Mega Problems

- ▣ Coke drum hot spot/ Blow over
- ▣ Fire at Blow down tower/ air coolers
- ▣ Fire-MOC-PMI misses
- ▣ Down stream units upsets- product storage-air cooler sudden expansion
- ▣ Gas/H₂S leakages
- ▣ Sampling errors
- ▣ Bad line breaks
- ▣ Coke drum cycle delays

Mega Cokers- Mega Problems

- ▣ Check valves in wrong direction
- ▣ Fire at coke drums- Safety valve blows
- ▣ Products going off specs. LPG, Naphtha
- ▣ Coke cutting Hose failures-Hose quality
- ▣ Instrument ferrules leakages- Hydrotest problems
- ▣ HPV/LPD vibration cracks- gusset support-engg standards  

COKER COMPLEX Commitment

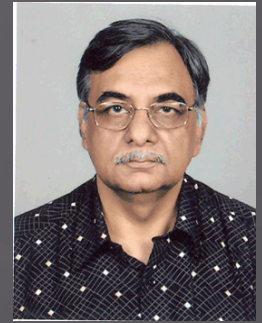


WE WILL MAKE IT HAPPEN ...

RAJ SHARMA

EX - SR. VP(OPERATIONS) RIL, KNPC, EIL
BE (CHEMICAL-IIT-ROORKEE), MTECH
(IIT-DELHI)

- Commissioned 5 Cokers in the world,
Including IOCL, KNPC & Reliance Jamnagar.
- Enhanced capacity by 140% - 175000bpd
- Reduced Coke drum cycle to 12 hrs



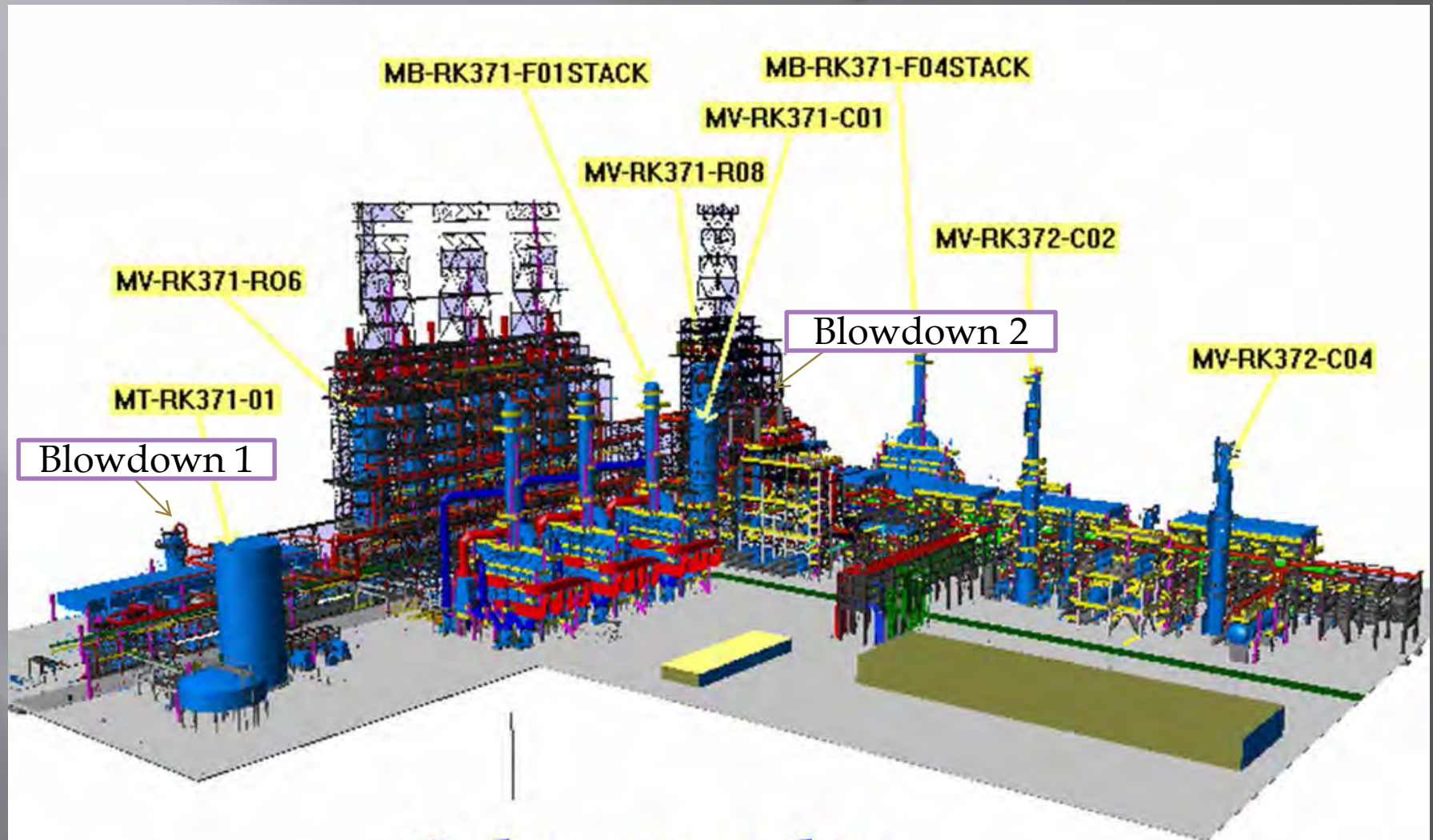
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INDIA - DELAYED COKERS AT GLANCE



Sl No	DISCRIPTION	LICENSOR	LOCATION	CAPACITY BPD	YEAR OF START	COKE DRUMS	Unheading System	Completion
(A)	INDIAN COKERS							
1	Reliance Industries Limited -- Coker 1	FWUSA	Jamnagar Gujrat	161000	1999	8	DELTA	1999
2	Reliance Industries Limited -- Coker 2	FWUSA	Jamnagar Gujrat	175000	2009	8	DELTA	2009
3	Essar Oil Limited	ABB LUMMUS	Jamnagar Gujrat	60000		6	DELTA	2010
4	IOC Baroda	ABB LUMMUS	Baroda Gujrat	71204	2010	4	ZIMMERMAN JENSON	2010
5	BPCL/Oman Petroleim-Joint venture	ABB LUMMUS	Bina M.P	60000	2010	4	ZIMMERMAN JENSON	2010
6	HPCL/Mittal	ABB LUMMUS	Bhatinda Punjab	60000	2012	4	ZIMMERMAN JENSON	2012
7	IOC Barauni - 2 Units	EIL	Baurani Bihar	30000	1984	2	MANUAL TROLLY	1985
8	IOC Bongaigaon	EIL	Bongaigaon Assam	30000	1981	2	MANUAL TROLLY	1980
9	IOC Bongaigaon	EIL	Bongaigaon Assam	30000	1990	2	MANUAL TROLLY	1990
10	IOC Assam	EIL	Assam	30000	1990	2	MANUAL TROLLY	1990
11	Oil India Limited	OLD	Assam Digboi	5000	1942	2	MANUAL TROLLY	1945
12	IOC Gauhati	EIL	Gahauti Assam	25000	1977	2	MANUAL TROLLY	1967
13	IOC Panipat	ABB LUMMUS	Panipat Haryana	60000	2005	4	HAAN & CLAY	2008
14	MRPL Manglore	ABB LUMMUS	Manglore Karnataka	60000		4	ZIMMERMAN JENSON	2014
15	BPCL Cochin	ABB LUMMUS	Cochin Kerala	60000		4	ZIMMERMAN JENSON	2015
16	IOC Paradeep Orissa	FWUK	Paradeep Orissa	74000		4	DELTA	2014
17	Chennai Petroleum	ABB LUMMUS	Chennai Tamilnadu	40000		2		2015
18	IOC Mathura	Projected	Uttar Pradesh					
19	IOC- Haldia	Projected	Bengal					

Coker Layout



Coker complex



PRE-START-UP SAFETY REVIEW CHECKLIST

DATE

Annexure1

PLANT

EQUIPMENT / SYSTEM

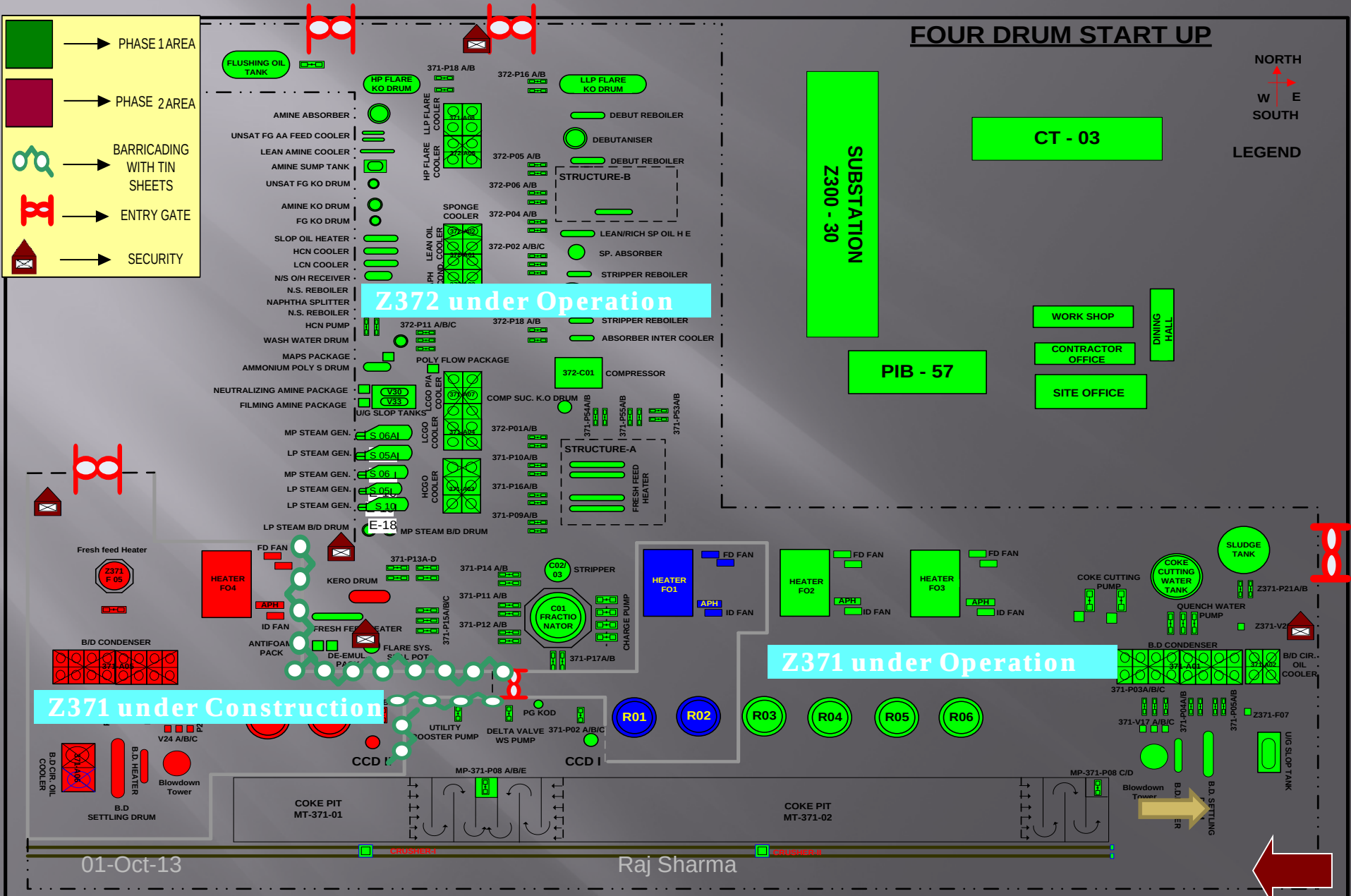
SR NO	DESCRIPTION	Supporting Documents	STATUS YES/NO	REMARKS
1.0	SAFETY AND HEALTH			
1.1	“General” Safety			
1.1.1	Has adequate and appropriate PPE (Personal Protective Equipment) been specified and provided in control room, field, SFE / FE porta cabin?	PSCL		
1.1.5	Are points of isolation clearly marked/labelled and readily accessible?	PSCL		
1.1.6	Have bump/trip hazards been identified and all sharp edges removed?	PSCL		
1.1.7	Has proper guarding, handrails/barriers, been provided to prevent falls?	PSCL		
1.1.8	Are Safety Showers and Eye Wash facilities provided, adequate & operational?	PSCL		
1.1.9	Has sufficient lighting been provided so that operation, servicing, maintenance and repair of the facility can be carried out safely?	PSCL		
1.1.10	Are display systems for providing operational instructions, safety warnings and emergency information provided and positioned so that they are clearly visible and easily read?	PSCL		



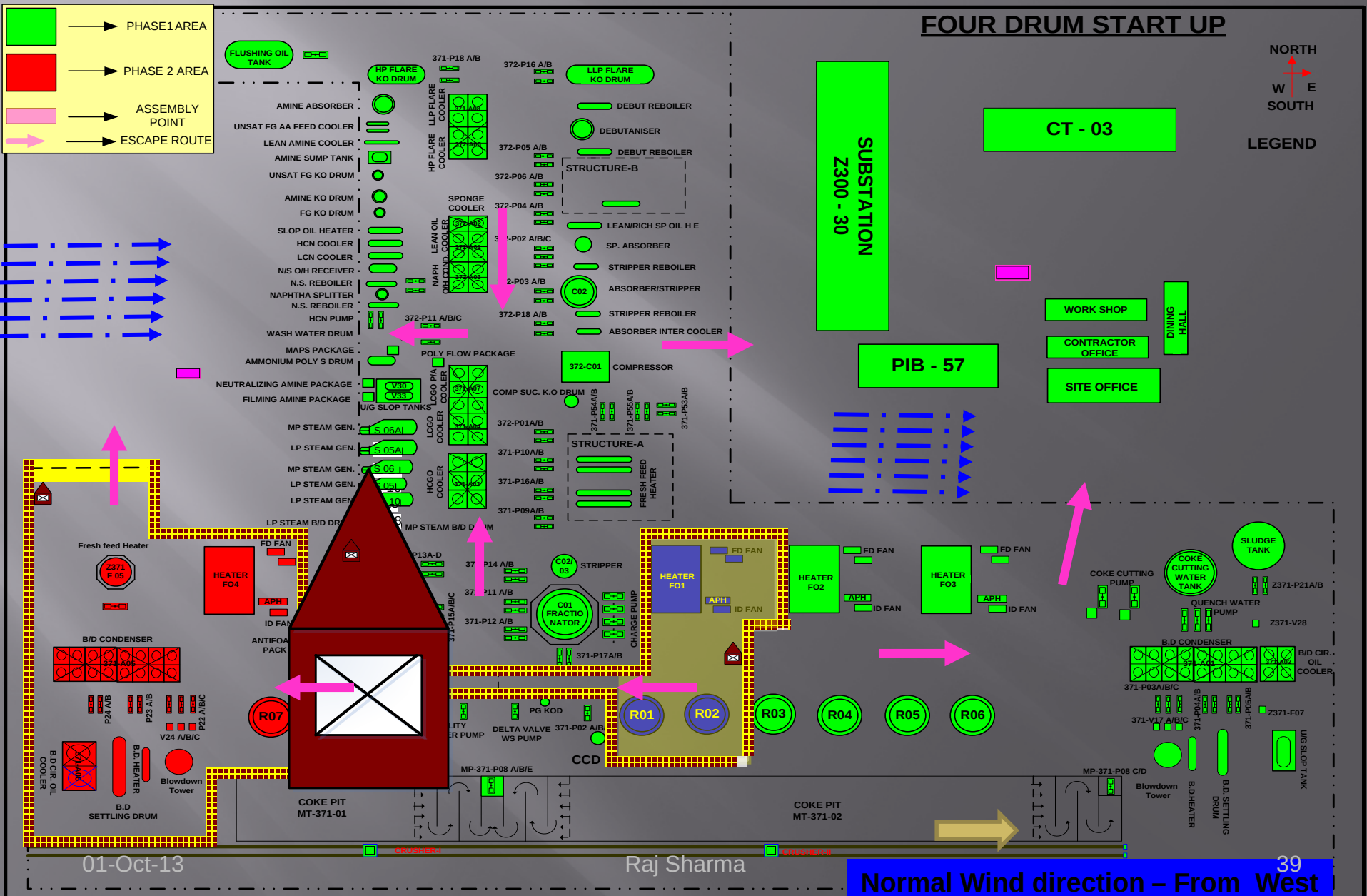




Early startup –entry control



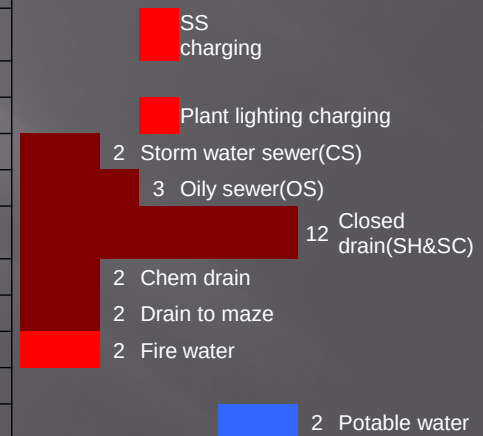
Escape route & Assembly points (Contd)



System Priority

Sys No.	System Description			
		PREREQUISITES		
		SYS REQD FROM CONST ON	RAW MATERIAL REDYNESS	FLUSHING BY
371-SO	Office space	01.03.07	NA	NA
371-SOA	Porta cabin			
371-SOB	Site office space			
371-SOC	CCR ofice			
371 C&T	Communication & Transportation	01.03.07	NA	NA
371 C&T-1	Telephone,Plant radio			
371 C&T-2	PC network			
371/372-ELE	Electricity	15.10.07	NA	NA
371/372-ELE-A	Electric sub station charging			
371/372-ELE-B	Emergency power generator			
371/372 LT	Plant lighting system	15.10.07	NA	NA
371-CS	Storm water sewer(CS)	10.10.07	NA	
371-OS	Oily sewer(OS)	10.10.07	NA	
371-SH	Closed drain(SH&SC)	10.10.07	NA	
371-CA	Chemical drain	10.10.08	NA	
371-CP	Coke pit / maze	10.10.07	NA	
371-WF	Fire water	10.10.07	NA	
371-WU	Utility water	01.11.07	NA	
371-WD	Potable water/Drinking water	20.10.07	NA	
371-WC	Cooling tower/ CT 3	10.12.07	NA	
371-WP	Process water	15.11.07	NA	
371-BFW	MP&LP BFW	20.01.08	NA	
371-BFW	HP BFW	20.02.08	NA	

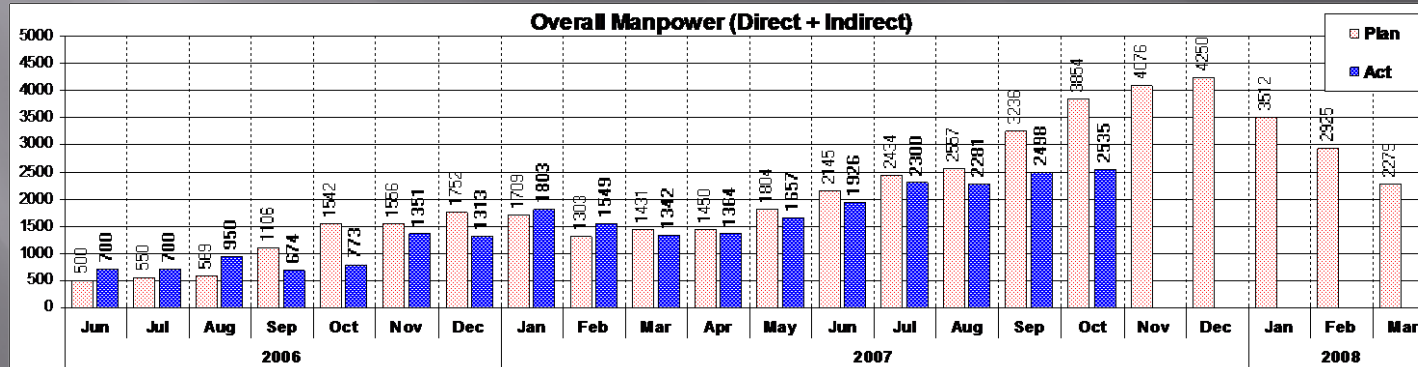
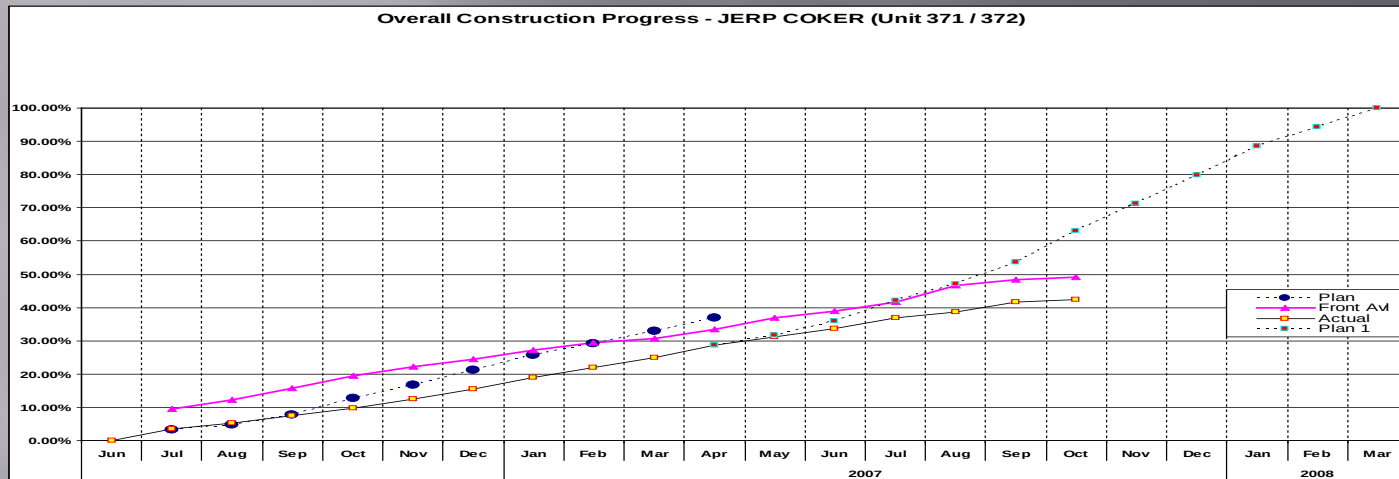
Oct'07
9 11 13 15 17 19 21 23 25 27 29 31



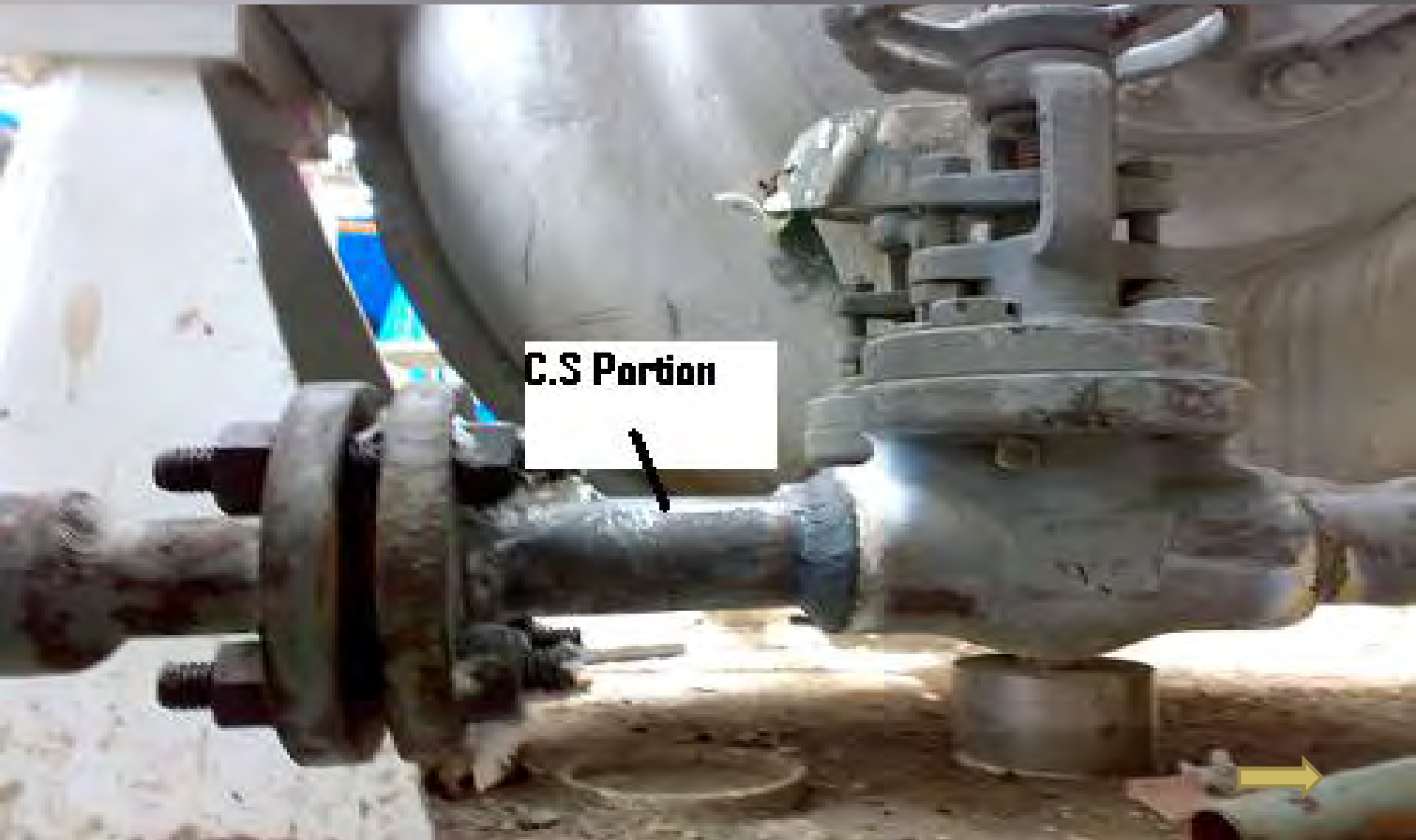
Avoid Pit-Falls



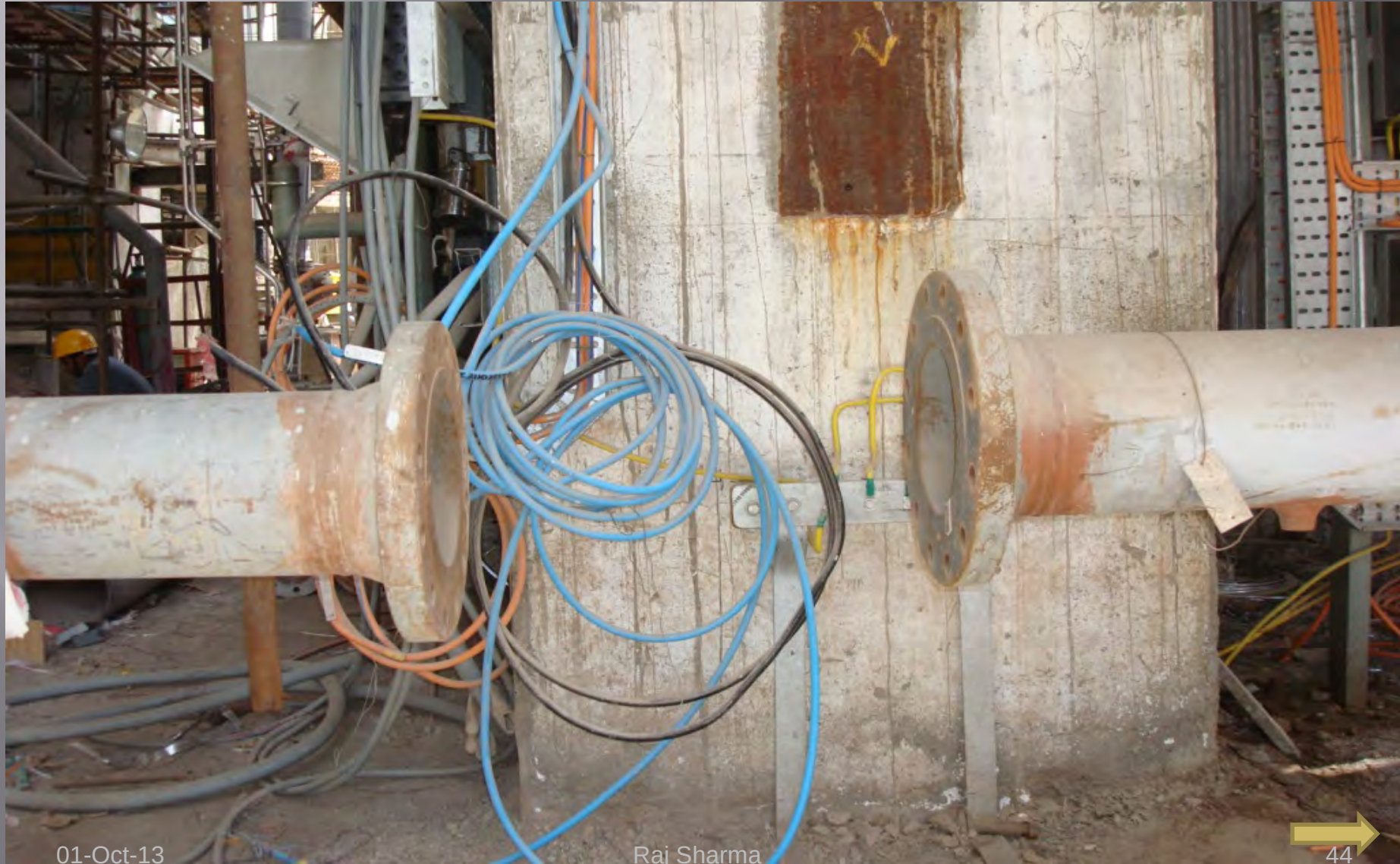
Expedite Construction



PMI- Audit



Flanges not aligned



01-Oct-13

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Misaligned flanges will result in leakage



Low Point Drains Need Valves



Low Point Drains Need Valves



Small bore pipe needs bracing for strength



The Right Gasket can be identified by color coding

Spiral Wound Gaskets

GASKET IDENTIFICATION GUIDE RING COLOR CODING

COLOR CODING FOR THE GASKETS YOU NEED. Gaskets are color coded to help expedite the selection and identity of the gasket you need. The color on the outside edge of the centering ring identifies both the winding and filler materials. The metallic winding material is designated by a solid color. The filler materials are designated by color stripes at equal intervals on the outside edge of the centering ring. Flexitallic color coding meets the industry standard for metal and filler materials listed in ASME B16.20.

METALLIC WINDING MATERIALS

The metallic winding material is designated by a solid color identification around the outside edge of the centering ring.



304 SS
Yellow



316L SS
Green



317L SS
Maroon



321 SS
Turquoise



347 SS
Blue



310 SS
No color



304L SS
No color



309 SS
No color



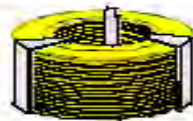
430 SS
No color



Alloy 20
Black



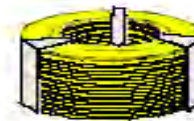
Titanium*
Purple



Incone® 800/825
Gold



Incoloy® 800/825
White



Incone® X750
No Color



Hastelloy® C276
Beige



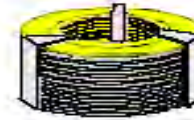
Hastelloy® B2
Brown



Nickel 200
Red



Zirconium
No color



Carbon Steel
Silver

The Right Gasket Will Fit Properly in The Right Flange



Proper nuts and bolts can be verified
with stamp



Fractionator - Inspection

Coke drum vapor inlet
nozzle

No provision for installation of Heat
shield



Fractionator wrong LT tapping



**LP TAPPING OF LG601 IN THE
DOWNCOMER OF TRAY NO 12**



HP TAPPING OF LG601 IN PAN 1



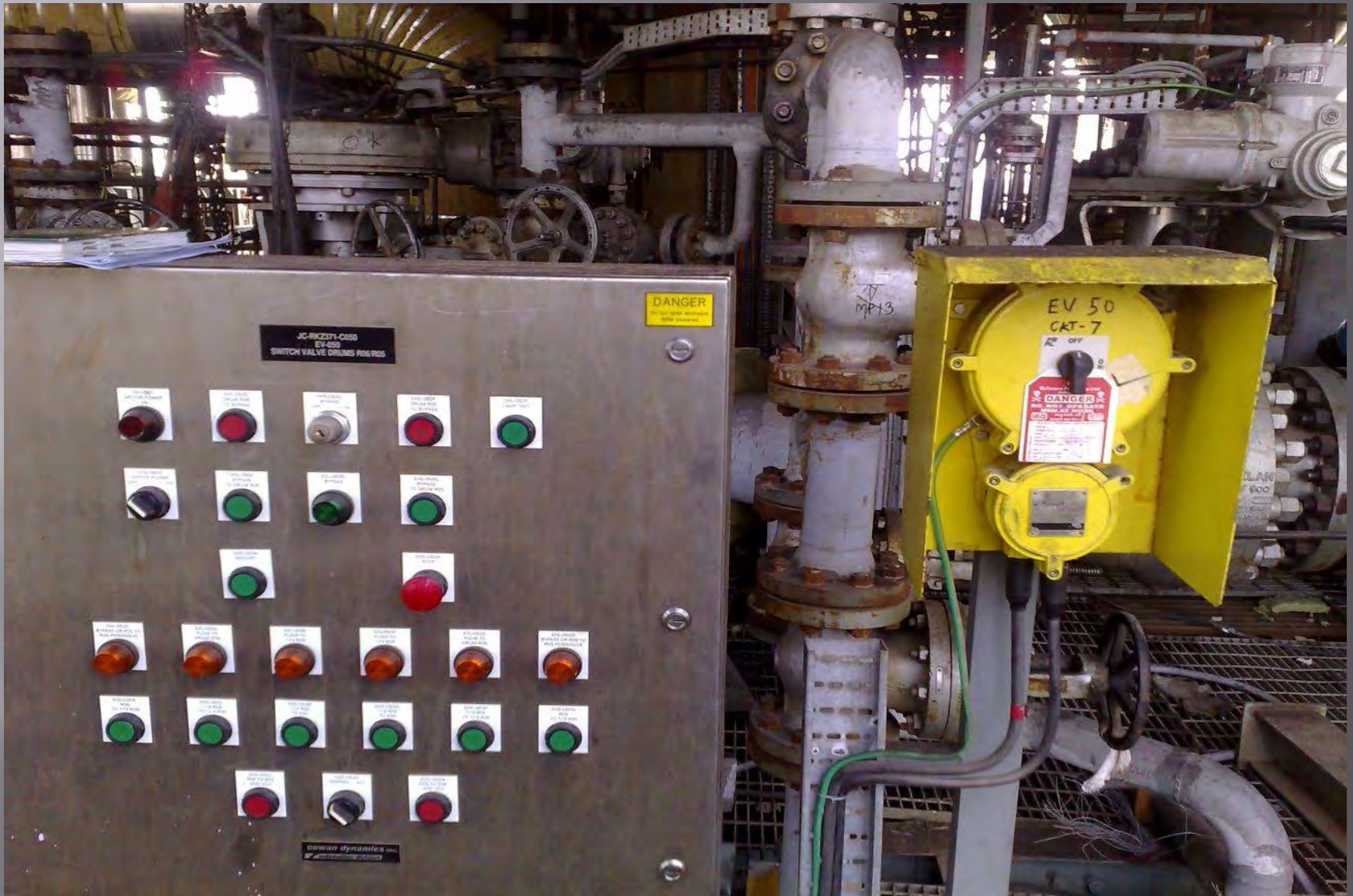
Debris in pipe line



POSITIVE MATERIAL IDENTIFICATION



Coke drum valve isolator



Tarry Coke drum



Heater- Overheated Tubes

