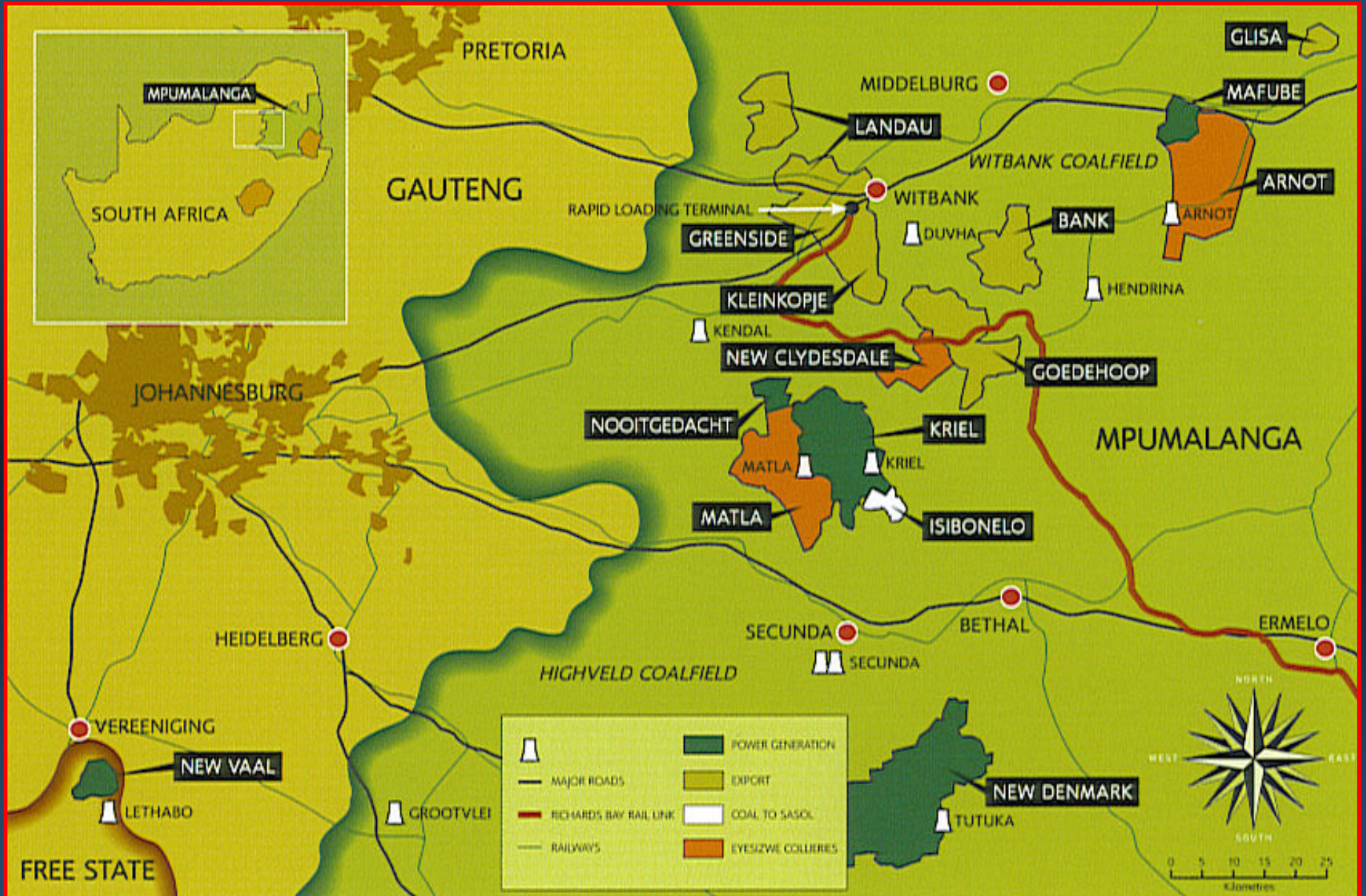




15A Tractor road

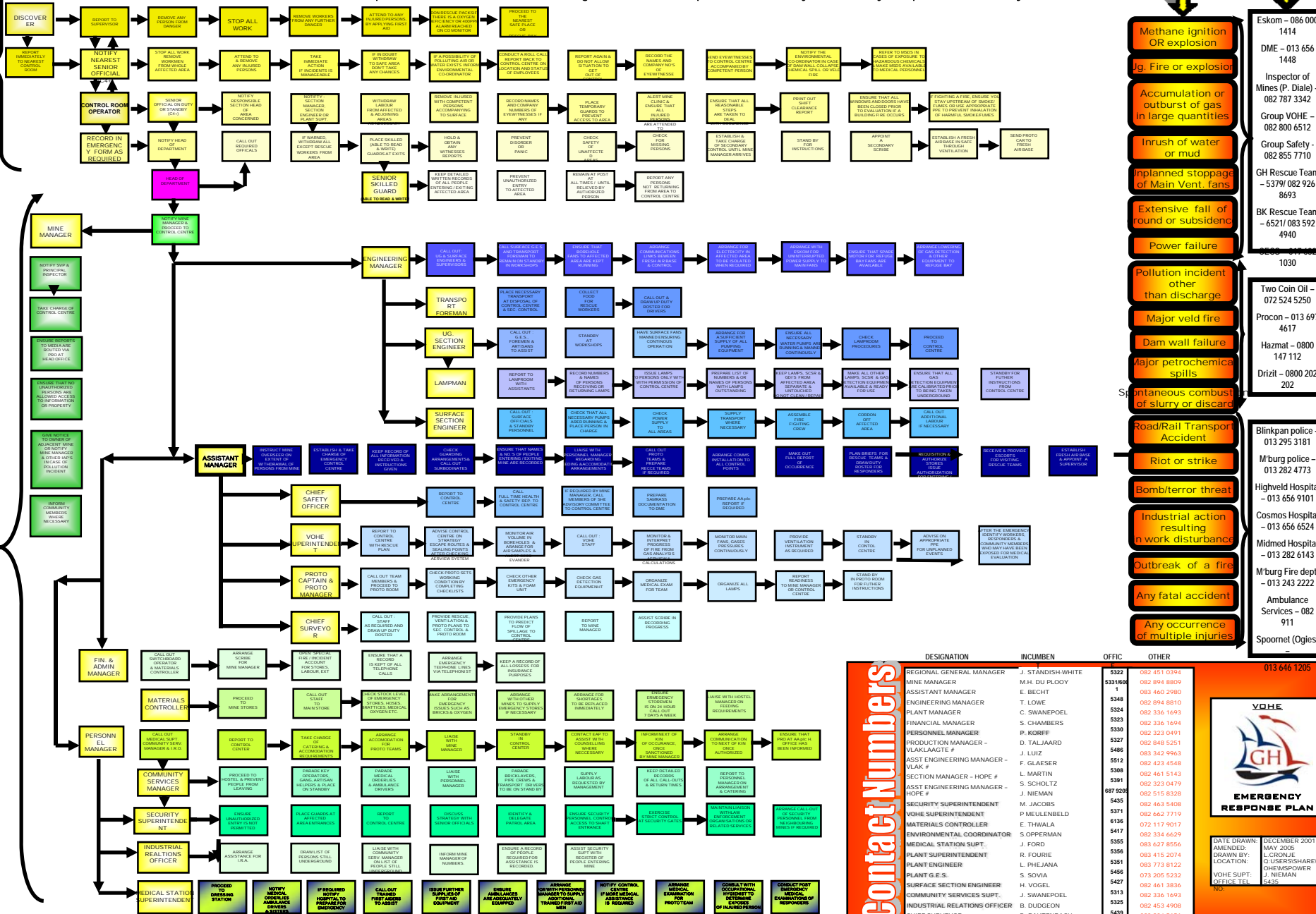


1. Detection
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8. Lessons learnt

- **00:03 Section 5/6 & 7/8 velocities alarmed**
- **Contacted standby electrician to check main surface fans**
- **01:00 electrician reported all in order**
- **Shiftboss and electrician underground to investigate ventilation**
- **02:00 shiftboss reported fire at B15A and air crossing collapsed**
- **District return Block 31 and 15 - 288m³/s**
- **Notified all personnel as per emergency flow-chart**
- **03:00 fire control established**

Emergency Response Plan

Please note that the sequence of duties set out below does not govern the order of Importance, since many activities may take place simultaneously.



- RECOGNISED EMERGENCY SITUATIONS ARE:**
- Methane Ignition OR explosion
 - Jg. Fire or explosion
 - Accumulation or outburst of gas in large quantities
 - Inrush of water or mud
 - Unplanned stoppage of Main Vent fans
 - Extensive fall of round or subsidence
 - Power failure
 - Pollution incident other than discharge
 - Major veld fire
 - Dam wall failure
 - Major petrochemical spills
 - Spontaneous combust of slurry or discard
 - Road/Rail Transport Accident
 - Riot or strike
 - Bomb/terror threat
 - Industrial action resulting in work disturbance
 - Outbreak of a fire
 - Any fatal accident
 - Any occurrence of multiple injuries
- EXTERNAL/COMMUNITY CONTACT NO.**
- Eskom - 086 000 1414
 - DME - 013 656 1448
 - Inspector of Mines (P. Diale) - 082 787 3342
 - Group VOHE - 082 800 6512
 - Group Safety - 082 855 7710
 - GH Rescue Team - 5379/082 926 8693
 - BK Rescue Team - 6521/083 592 4940
 - 1030
 - Two Coin Oil - 072 524 5250
 - Procon - 013 697 4617
 - Hazmat - 0800 147 112
 - Drizit - 0800 202 202
 - Blinkpan police - 013 295 3181
 - M'burg police - 013 282 4773
 - Highveld Hospital - 013 656 9101
 - Cosmos Hospital - 013 656 6524
 - Midmed Hospital - 013 282 6143
 - M'burg Fire dept. - 013 243 2222
 - Ambulance Services - 082 911
 - Spoornet (Ogies) - 013 646 1205

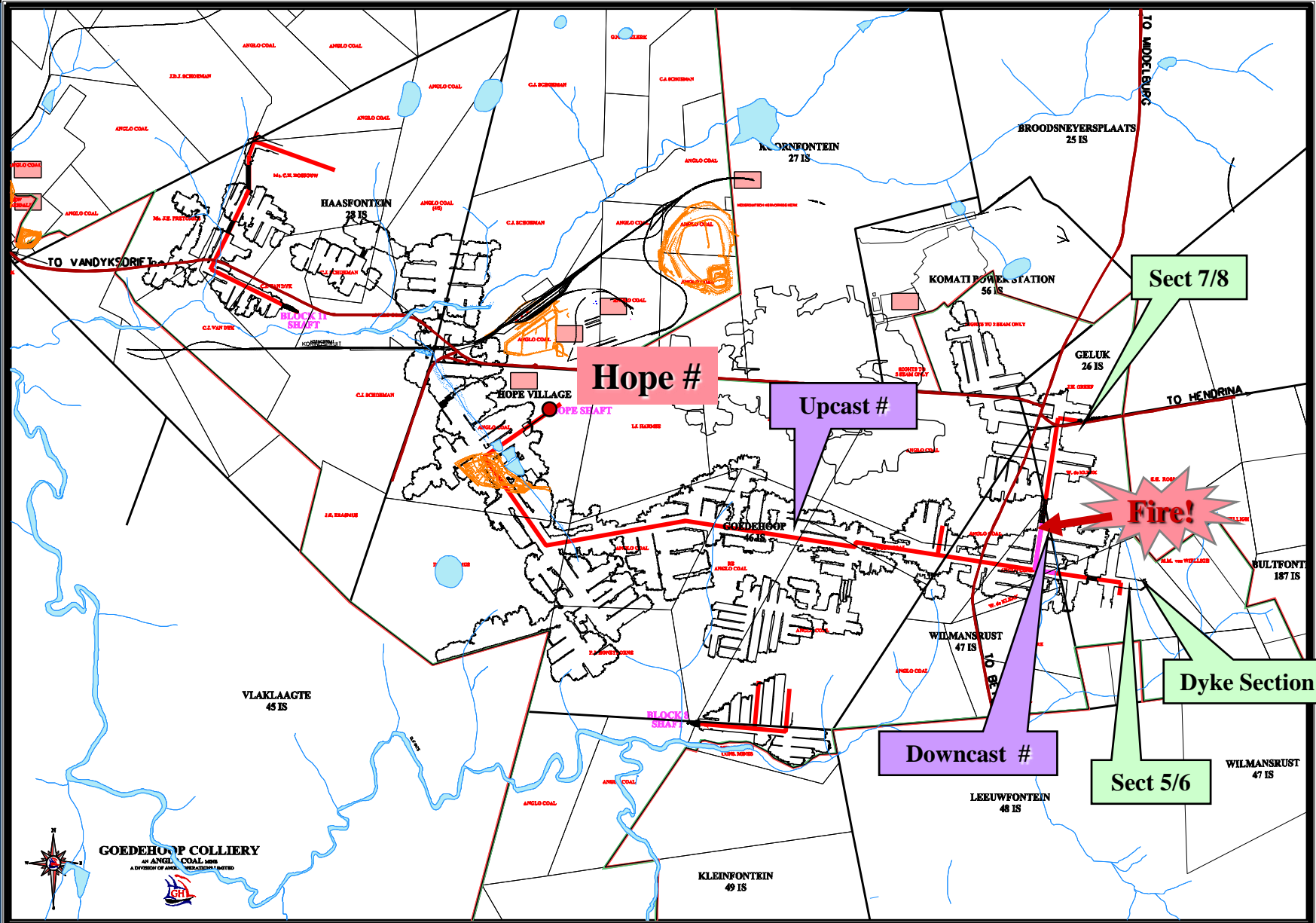
Contact Numbers

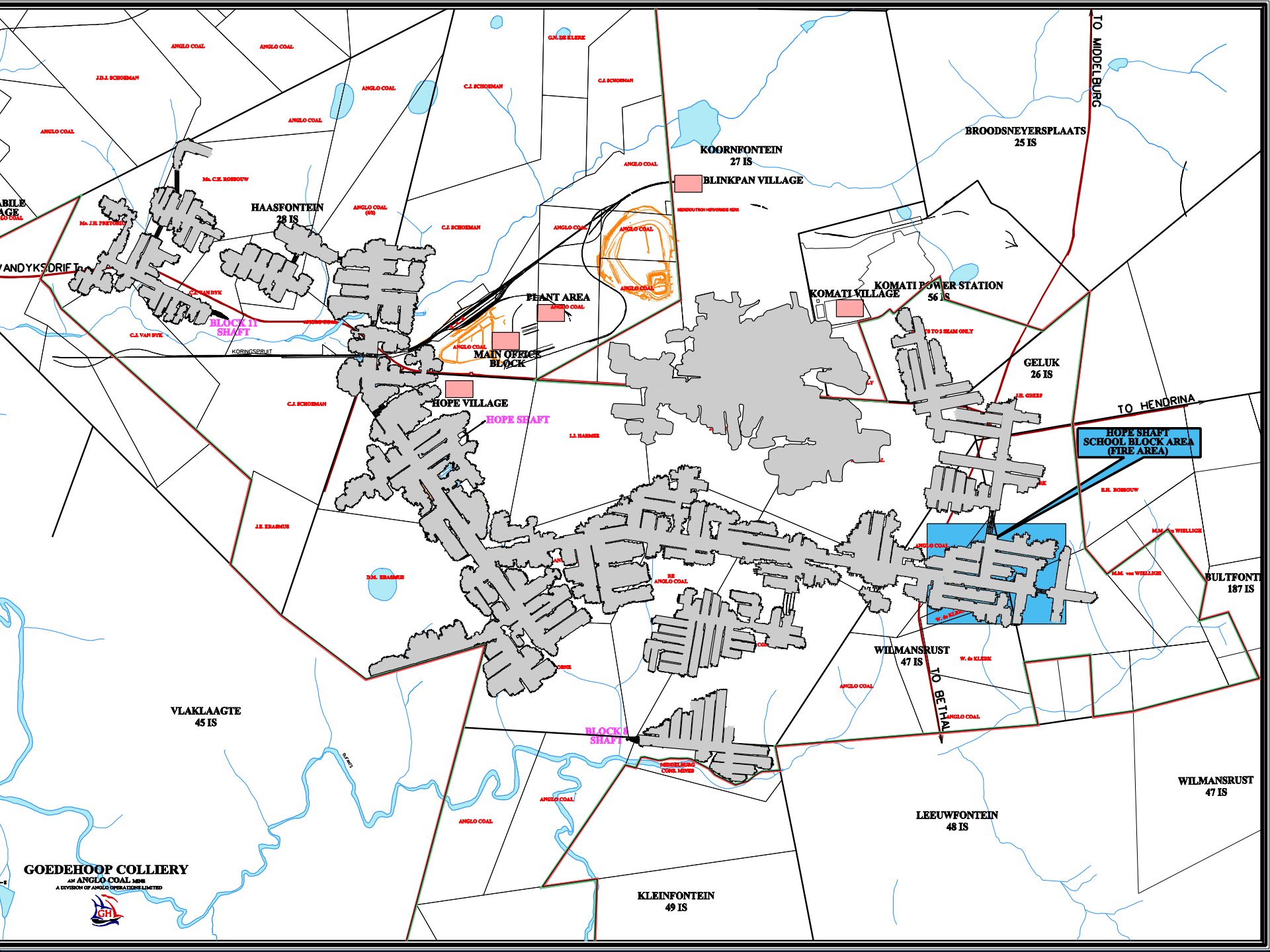
DESIGNATION	INCUMBENT	OFFIC	OTHER
REGIONAL GENERAL MANAGER	J. STANDISH-WHITE	5322	082 451 0394
MINE MANAGER	M.H. DU PLOOY	533/606	082 504 5869
ASSISTANT MANAGER	E. BECHT	5348	082 460 2980
ENGINEERING MANAGER	T. LOWE	5324	082 994 9810
FINANCIAL MANAGER	C. SWANERPOEL	5324	082 336 1693
PLANT MANAGER	S. CHAMBERS	5323	082 336 1694
PERSONNEL MANAGER	P. KORFF	5330	082 323 0491
PRODUCTION MANAGER - VLA-KAAGTE	D. TALLAARD	5327	082 848 5251
ASST ENGINEERING MANAGER - VLA-K	F. LUIJZ	5312	082 342 9963
ASST ENGINEERING MANAGER - HOPE #	F. GLAESER	5308	082 423 4548
SECTION MANAGER - HOPE #	L. MARTIN	5301	082 461 5143
ASST ENGINEERING MANAGER - HOPE #	S. SCHOLTZ	5321	082 323 0479
SECURITY SUPERINTENDENT	J. NIEMAN	607 9206	082 515 9328
VOHE SUPERINTENDENT	M. JACOBS	5435	082 463 4048
MATERIALS CONTROLLER	P. MULLENBELD	5371	082 662 7719
ENVIRONMENTAL COORDINATOR	E. THWALA	6136	072 117 9017
MEDICAL STATION SUPT.	J. FORD	5355	082 627 8556
PLANT SUPERINTENDENT	R. FOURIE	5359	083 415 2074
PLANT ENGINEER	L. PHEJANA	5426	082 376 8122
PLANT G.E.S.	S. SOVIA	5457	073 205 9232
SURFACE SECTION ENGINEER	H. VOUGEL	5351	082 441 0836
COMMUNITY SERVICES SUPT.	J. SWANERPOEL	5313	082 336 1693
INDUSTRIAL RELATIONS OFFICER	B. DUDGEON	5325	082 453 4098
CHIEF SURVEYOR	D. RAUFENBACH	5439	082 924 5151



DATE DRAWN: AUGUST 2007
 AMENDED: MAY 2005
 DRAWN BY: L. CRONJE
 CHECKED BY: G. USHERS
 APPROVED BY: J. NIEMAN
 VOHE SUPT. TEL: 013 646 1205

Area plan Hope





GOEDEHOOP COLLIERY
 AN ANGLO COAL 2008
 A DIVISION OF ANGLO COAL LIMITED



**HOPE SHAFT
 SCHOOL BLOCK AREA
 (FIRE AREA)**

ABLE
 AGE

VANDYKSDRIFT

HAASFONTEIN
 28 IS

KOORNFONTEIN
 27 IS

BROODSNEYERSPLAATS
 25 IS

BLINKPAN VILLAGE

KOMATI VILLAGE
 KOMATI POWER STATION
 56 IS

GELUK
 26 IS

HOPE VILLAGE

BULTFONTEIN
 187 IS

VLAKLAAGTE
 45 IS

WILMANSRUST
 47 IS

WILMANSRUST
 47 IS

LEEUFONTEIN
 48 IS

KLEINFONTEIN
 49 IS

TO Middelburg

TO Hendrina

TO BETHAL

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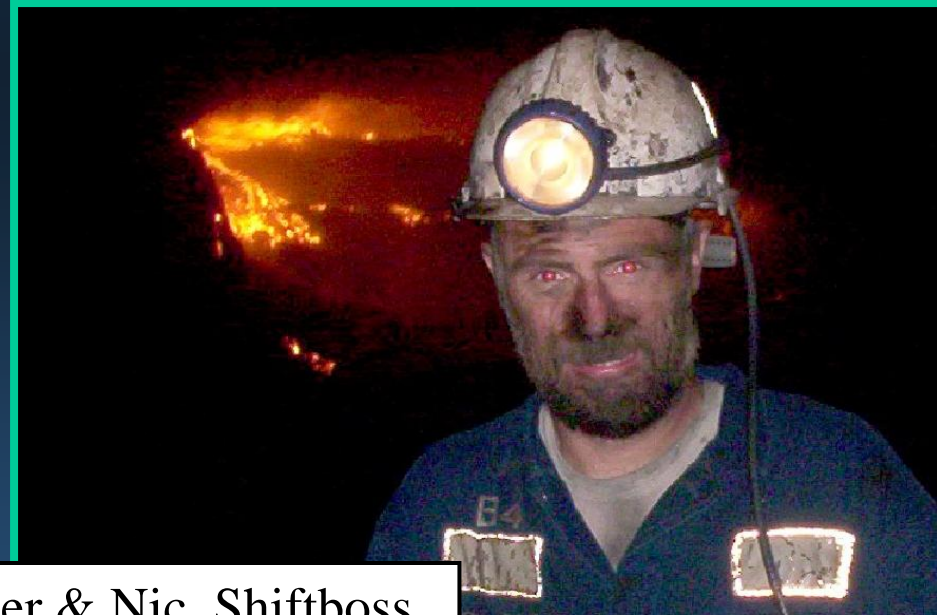
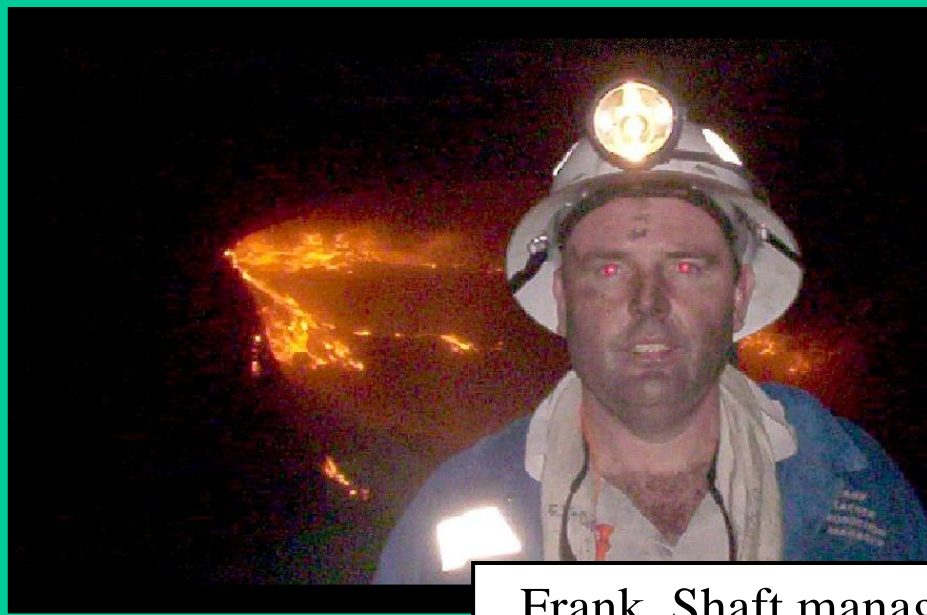
TO Middelburg

TO Hendrina

TO BETHAL

1. Detection
2. Emergency Planning
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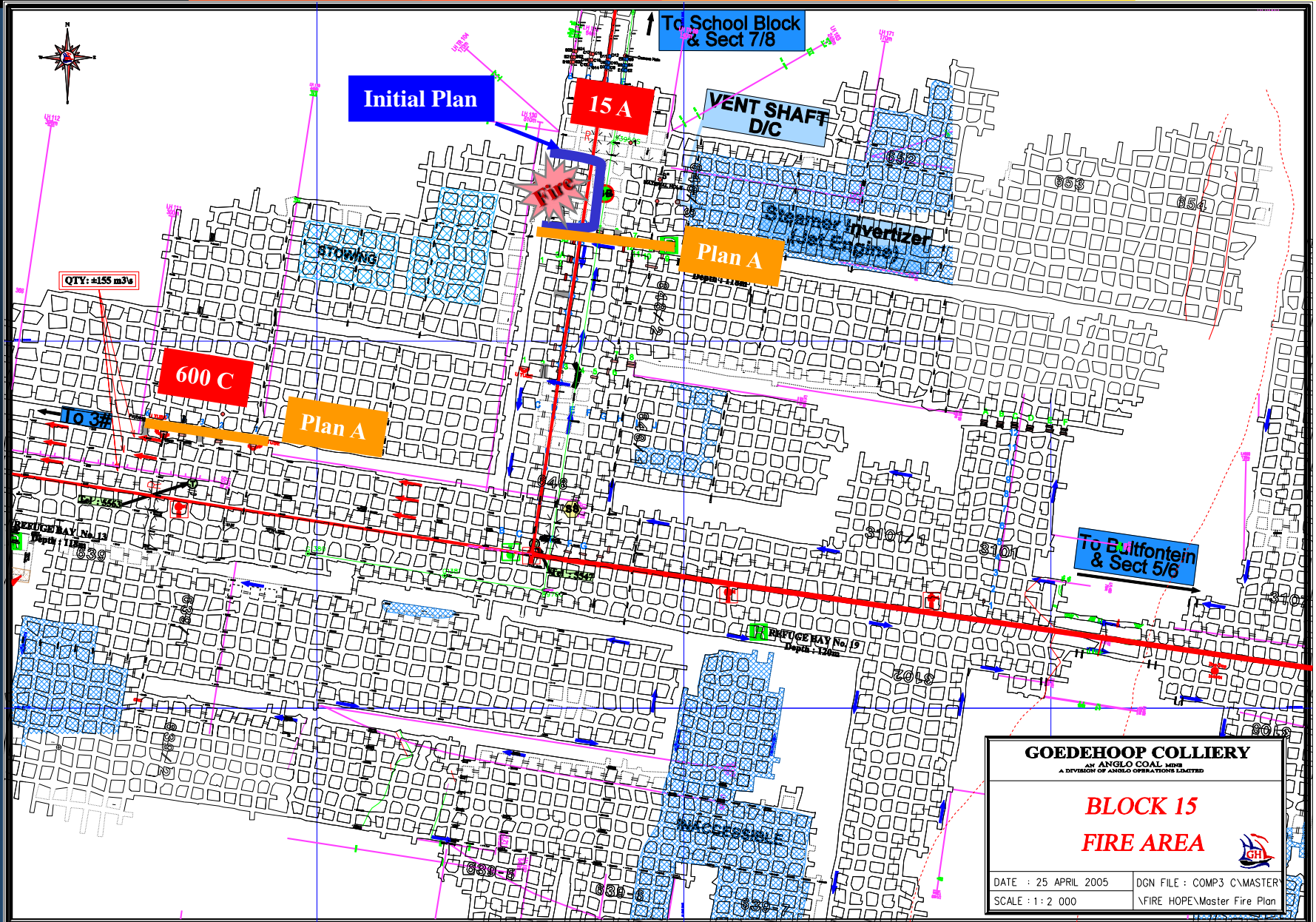
- Lamp room and Skycom report - stone dust operator underground 600C
- First recce consisted of shaft manager, VOHE officer and shift boss
- Proto team called out and ready to proceed underground at 04:50.



Frank, Shaft manager & Nic, Shiftboss

- One main fan was stopped and the other was reduced to 80%
- Downcast shaft partially closed
- RTS notified - proto teams on standby
- DME notified
- Shaft inspector appointed
- Fresh Air Base (FAB) established
- 06:30 first recce reports fire out of control
- FOG within fire area - roof conditions deteriorating
- 5 Proto teams used first day

Fire area Plan initial – 10 April

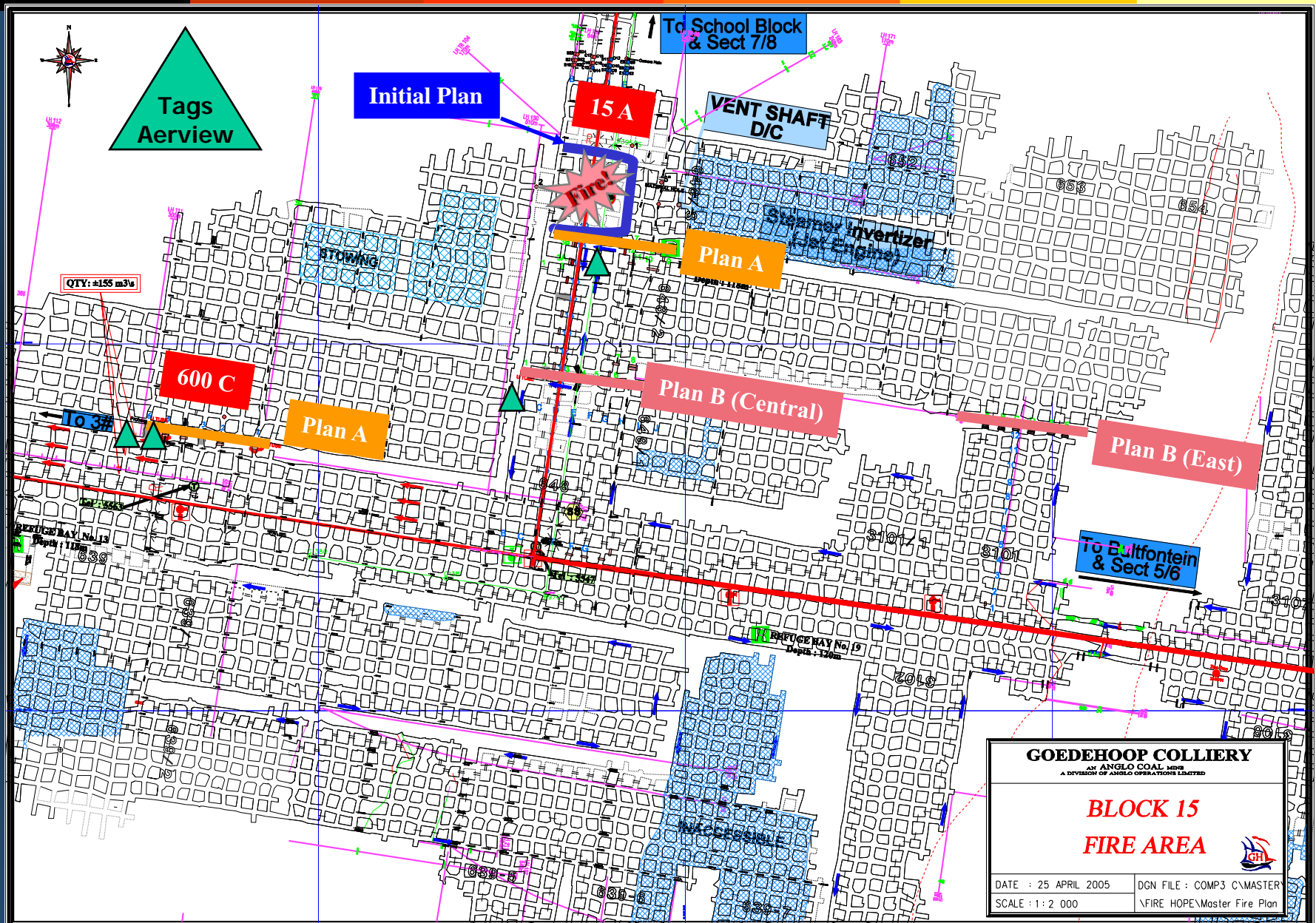


1. Detection
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- **Five building teams to assist proto with Plan A**
- **Hollow bricks and vermiculite bricks used to build walls at 15A**
- **760mm ducting installed – access**
- **Water u-tubes and sampling pipes installed**
- **Brick walls slow - “dura-seal” walls**
- **“ersi-foam”**
- **Fan turned to 50 amps.**
- **15A Plan A seals completed on 12 April**

"5m ϕ Vent Shaft turns U/C"






GOEDEHOOP COLLIERY
AN ANGLO COAL MINER
 A DIVISION OF ANGLO OPERATIONS LIMITED

**BLOCK 15
 FIRE AREA**

DATE : 25 APRIL 2005 DGN FILE : COMP3 C\MASTER
 SCALE : 1 : 2 000 \FIRE HOPE\Master Fire Plan



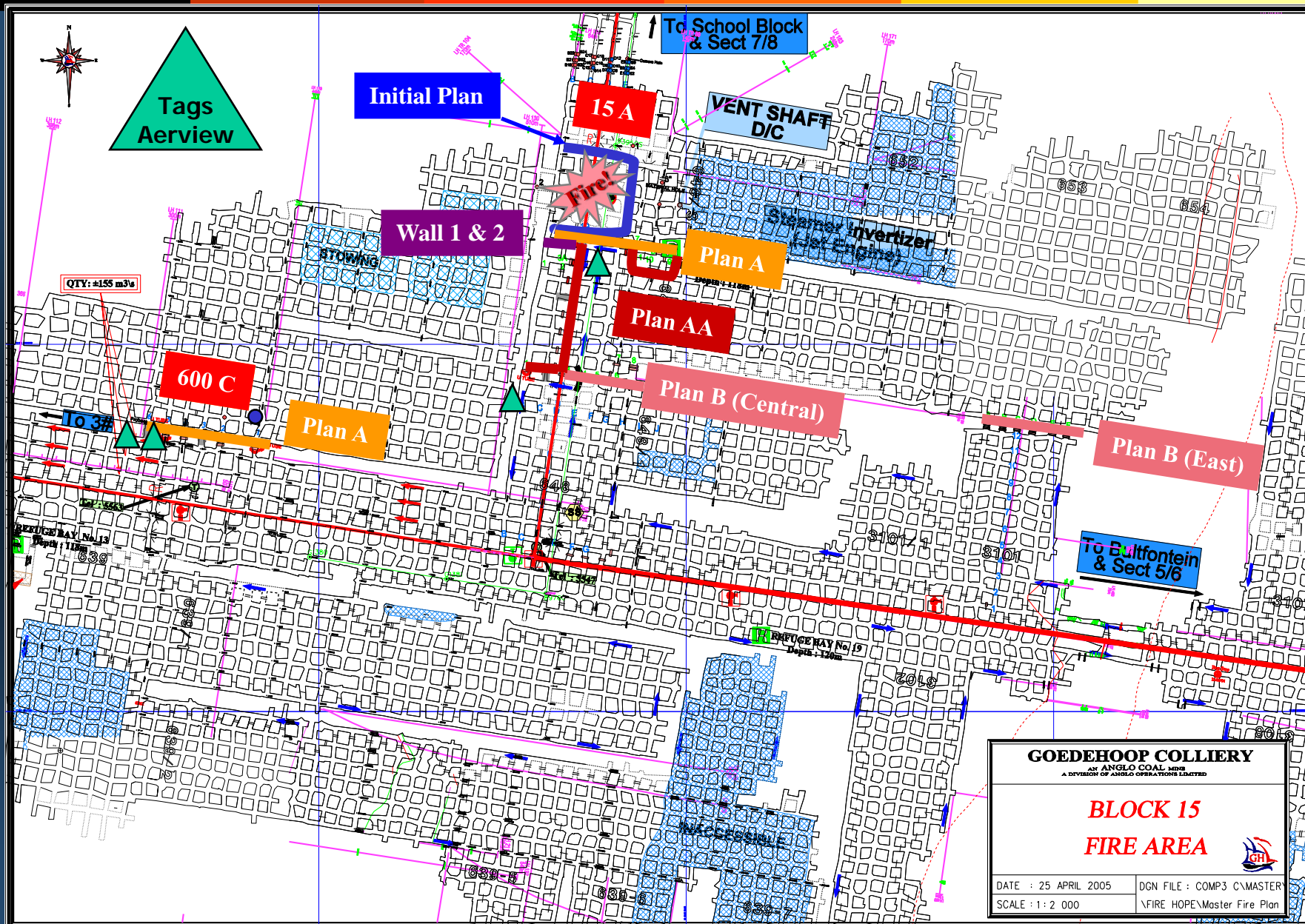
- Plan B east temporary seals complete 11 April.
- Wall 1 and 2 collapsed at 15A - 4 contractors exposed to smoke
- DME notified
- “Dura-seals” installed at wall 1 and 2
- Plan B central seals at 15A complete on Tuesday 12 April
- 600C temporary seals completed 12 April
- “Chimney” kept half open to build walls in fresh air



Management support



Kaptein Martiens & GH Span



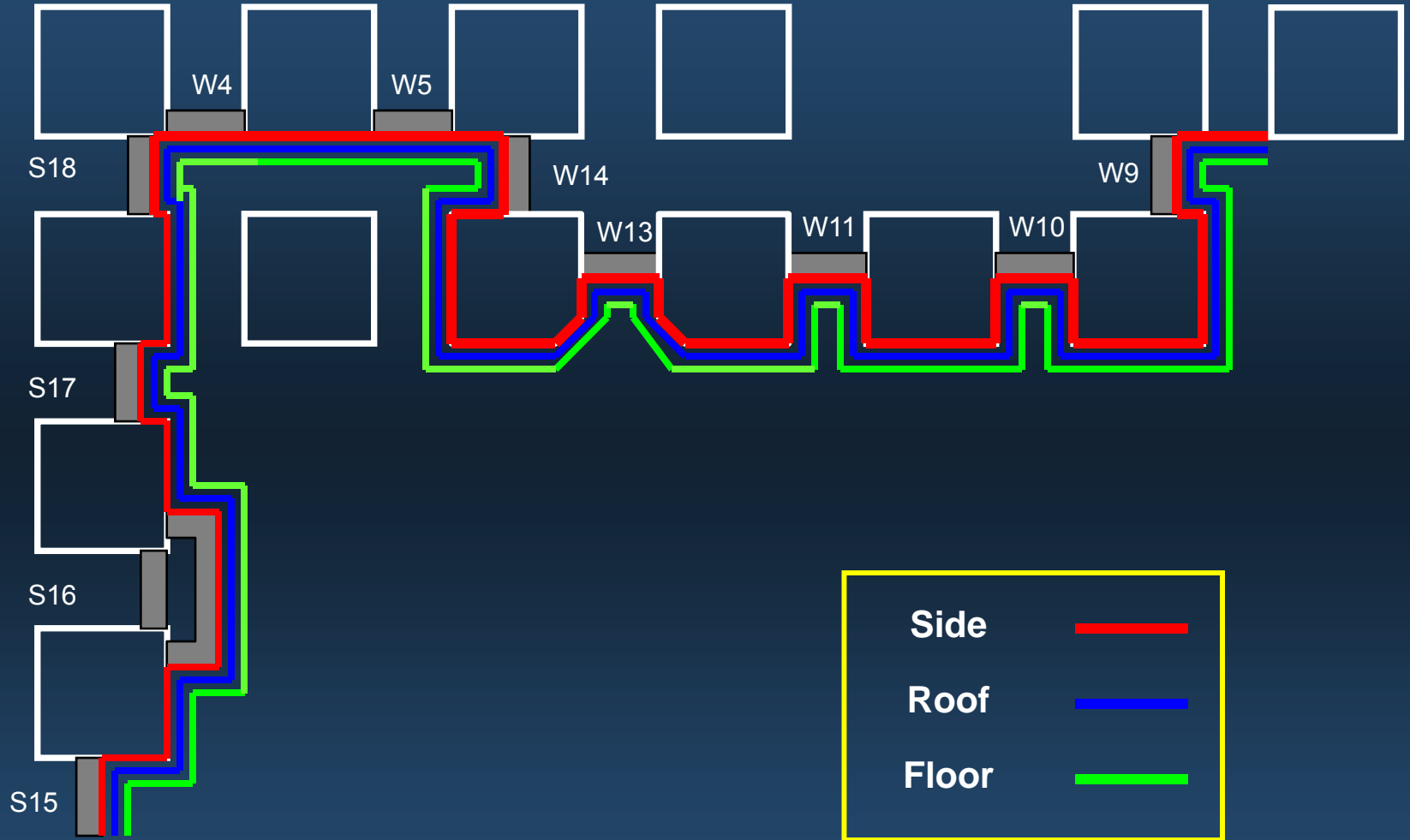
- Plan AA wall collapsed on two proto members
- Long holes sealed
- Thermocouple installed at 600B RAW – unsuccessful
- Refuge boreholes in Block 15 sealed
- Plan AA complete 13 April
- Mogal sampling at “chimney” and Main up cast fans
- Builders start building at 600C, with proto supervision
- Camera used but visibility zero due to smoke
- Plan B completed 14 April
- Section 7/8 started mining in Block 8 (6 days after fire began)
- 600C walls completed 15 April
- “Chimney” – fluctuate with BP and weather changes

- Continuously checking and re-sealing walls
- Wall 1 at 600C under water - Gipson bags used to seal
- Second walls built at various places – originals leaking or “shaky”
- Fan amps set up to 74 amps 17 April – smoke plugs RAW
- Chimney closed completely
- Commenced guniting 15A walls 21 April
- No gunite between 10h00 - 14h00 and 22h00 - 02:00 “breathing out”

All walls have been gunited – leakages being “versi- foamed”



15A - Area Gunned



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- **Christo de Klerk MRS 11 April – article jet engine**
- **Dr Rao Balusu arrived 17 April from CSIRO Queensland, Australia**
- **H/O, Sasol and BHP assisted**
- **Different options investigated against following parameters :**

Safety

Earliest start date

Completion date

Reliability

Practical

Quantity supply

Mobilization Cost

Running cost

Labour cost

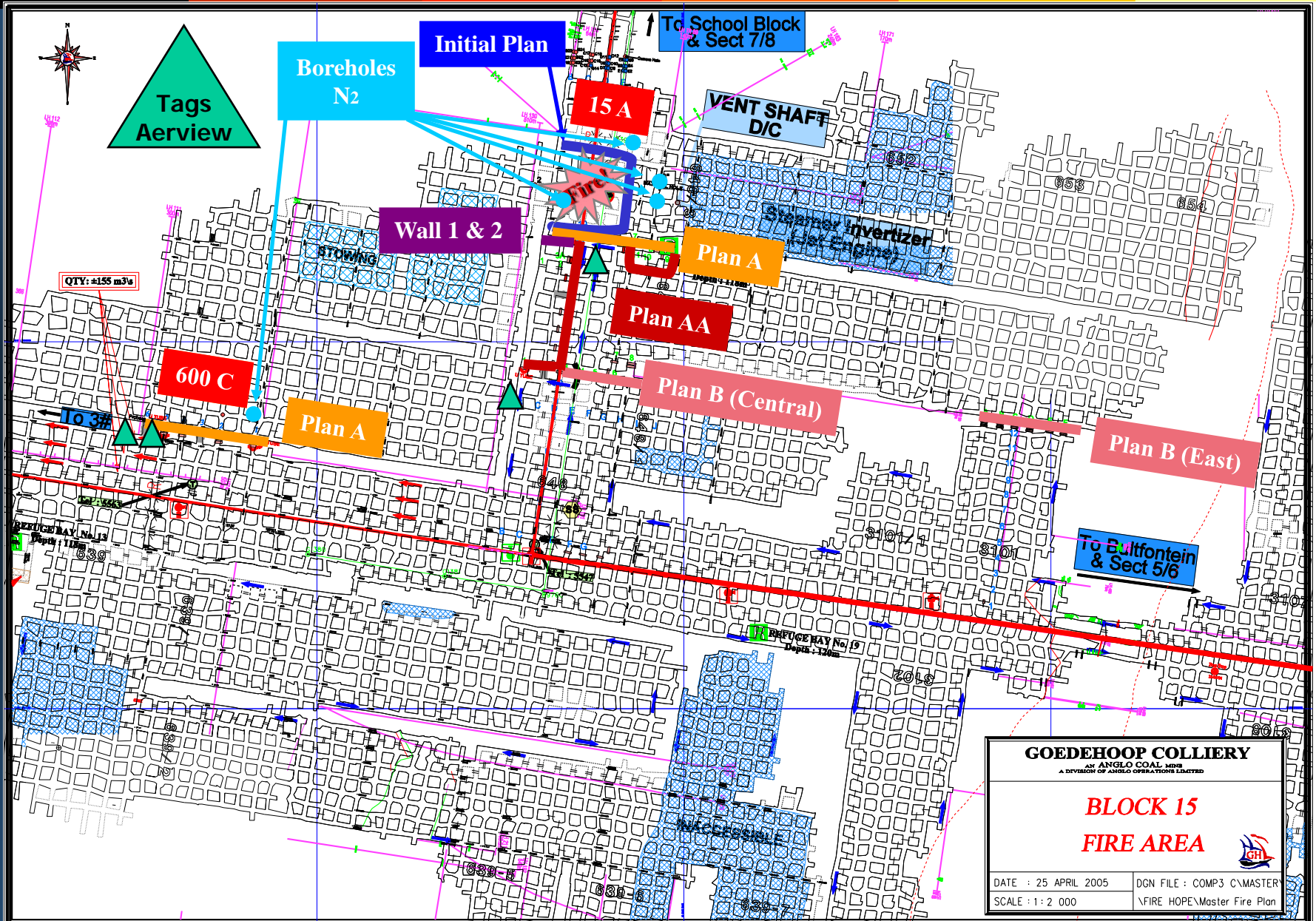
Weight

PARAMETERS	GAG HOLLAND	GAS AUSTRALIA	GAG GOLDFIELDS	TOMILSON BOILER	NITROGEN FLOXAL	NITROGEN TANKS	CO ₂ TANKS
SAFETY	SURFACE INSTALLATION RISK REDUCED	SURFACE INSTALLATION RISK REDUCED	SURFACE INSTALLATION RISK REDUCED	SURFACE INSTALLATION RISK REDUCED	SURFACE INSTALLATION RISK REDUCED	SURFACE INSTALLATION RISK REDUCED MANAGE FREEZING	SURFACE INSTALLATION RISK REDUCED MANAGE FREEZING
EARLIEST START DATE	5 DAYS TO BE CONFIRMED ON MINES DECISION	10 DAYS	REPAIR/RELIABILITY CONCERNS	NOT AVAILABLE IN SA – DIFFICULT TO TRANSPORT			LOW QUANTITIES AVAILABLE
COMPLETION DATE	10 DAYS	10 DAYS	N/A	2 TO 3 MONTHS	JUST TO PREVENT O ₂ LEAKAGE	N/A	N/A
RELIABILITY	SIMILAR TO OTHER GAG NEW BUSINESS VENTURE	PROVEN	REPORT REFERS TO USE THE STEEMEX SYSTEM – LAST USED IN 1993			SUPPLY NOT RELIABLE	LIMITED SUPPLY AVAILABLE
PRACTICAL	10 PEOPLE TO OPERATE	19 – 19 PEOPLE TO OPERATE	SYSTEM OUT OF USE FOR EXTENDED PERIOD	TOO BULKY TO TRANSPORT FOR EMERGENCY		TANKS NOT AVAILABLE FOR CONTINUOUS SUPPLY	LIMITED SUPPLY
QUANTITY SUPPLY	25 M3/S	22 M3/S	5 M3/S	0,5M3/S	0,25 M3/8	UNKNOWN	<0,1 M3/S
MOBILISATION COST	10 000 AUS \$	47 000 US \$ 2 YEARS AGO	N/A		R1 MILLION		
WEIGHT	400 KG	8 TONS	N/A				
RUNNING COST	1200/16/00 LITRES HOUR AVIATION FUEL R4-72 DEL R180 000/DAY	1200/16/00 LITRES HOUR AVIATION FUEL R4-72 DEL R180 000/DAY	N/A	200 LITRES DIESEL PER HOUR	ELECTRIC POWER SOURCE	R6 MILLION FOR 2 WEEKS	
LABOUR COST	10 PEOPLE (R50 000/DAY)	18 – 19 PEOPLE (R100 000/DAY)	AVAILABLE EXPERTISE SUSPECT	2 PER SHIFT			
TOTAL COST	R2 – R3 MILLION	R3 – R4 MILLION			QUOTE	R6 MILLION (QUOTE?)	
REMARKS	<ul style="list-style-type: none"> •LESS PEOPLE •AVAILABILITY •ROBUST •TECHNICALLY ADVANCED •WEIGHT •EASY TO TRANSPORT (CRATED) 	<ul style="list-style-type: none"> •PROVEN •AVAILABILITY •MORE PEOPLE •BULKY •WATER PROBLEM (OLD TECHNOLOGY) 	<ul style="list-style-type: none"> •LOW QUANTITY •UNABLE TO CONFIRM •RELIABILITY (Last used in 1993) 	<ul style="list-style-type: none"> •BULKY TO TRANSPORT •NOT AVAILABLE IN SA 	<ul style="list-style-type: none"> •COMPANY TO SUPPLY PROPOSAL WEDNESDAY 	<ul style="list-style-type: none"> •COMPANY TO SUPPLY PROPOSAL WEDNESDAY 	<ul style="list-style-type: none"> •LOW AVAILABLE QUANTITIES
	TO BE COMMISSIONED IMMEDIATELY – EITHER THIS HOLLAND GAG OR AUSTRALIAN GAG	TO BE COMMISSIONED IMMEDIATELY – EITHER THIS AUSTRALIAN GAG OR HOLLAND GAG	NO	MAY BE A LONG TERM OPTION – FOR FUTURE	TO BE CONSIDERED AS A LONG TERM OPTION	NO	NO

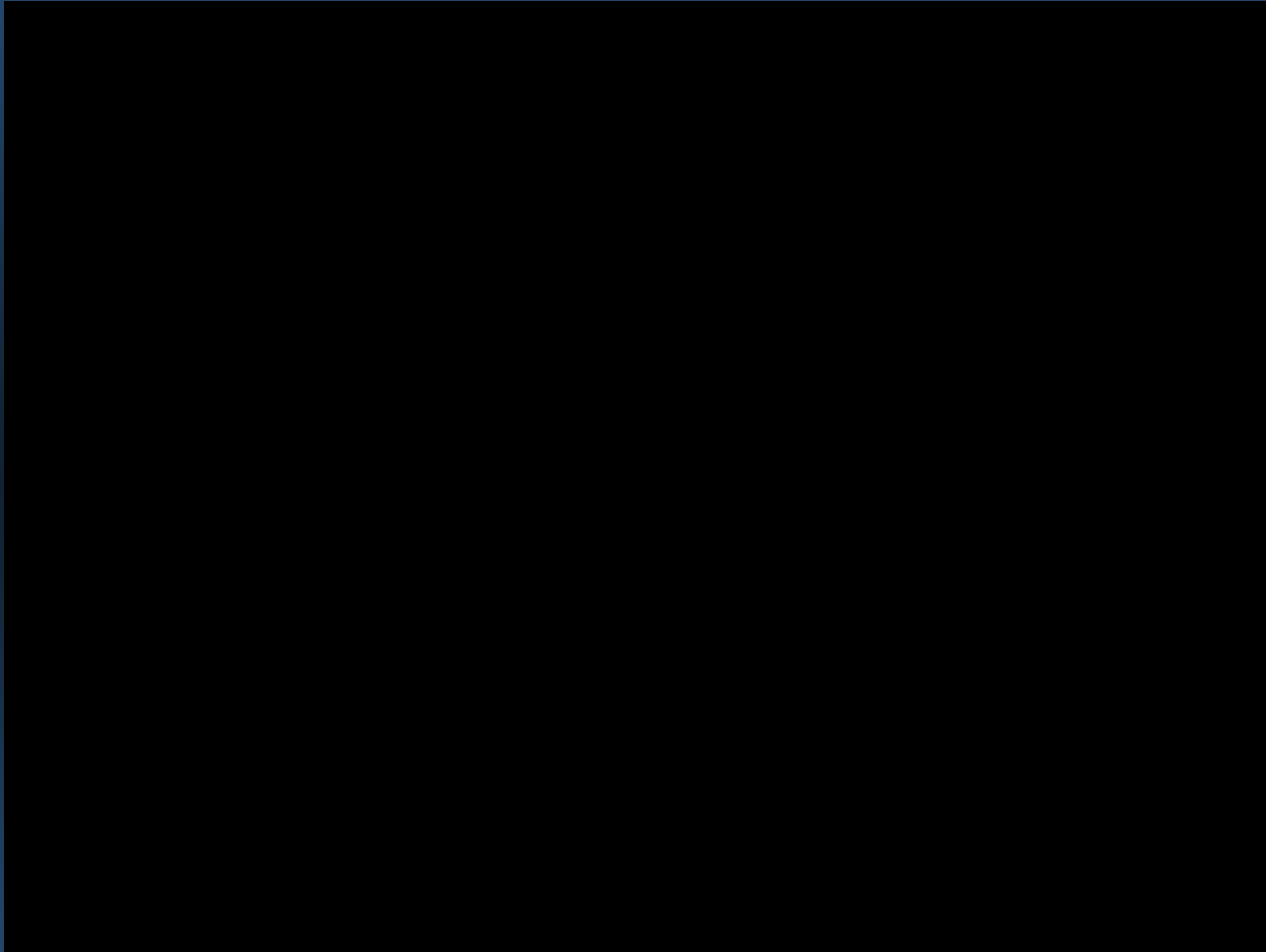
- 5 boreholes drilled 15A and 600C (11 April)
- 21 000 tons Nitrogen pumped into fire area
- Delivery pipes froze up - process stopped
- Nitrogen partially successful due to size of sealed area (6 million m³)
- It played a role in reducing temperatures



Fire area – Nitrogen



GOEDEHOOP COLLIERY <small>AN ANGLO COAL MINER A DIVISION OF ANGLO OPERATIONS LIMITED</small>	
BLOCK 15 FIRE AREA	
DATE : 25 APRIL 2005	DGN FILE : COMP3 C\MASTER
SCALE : 1 : 2 000	FIRE HOPE\Master Fire Plan



**12/24 Holes drilled
1 Roadway complete**



North hole sealing : Sand, foam & cement

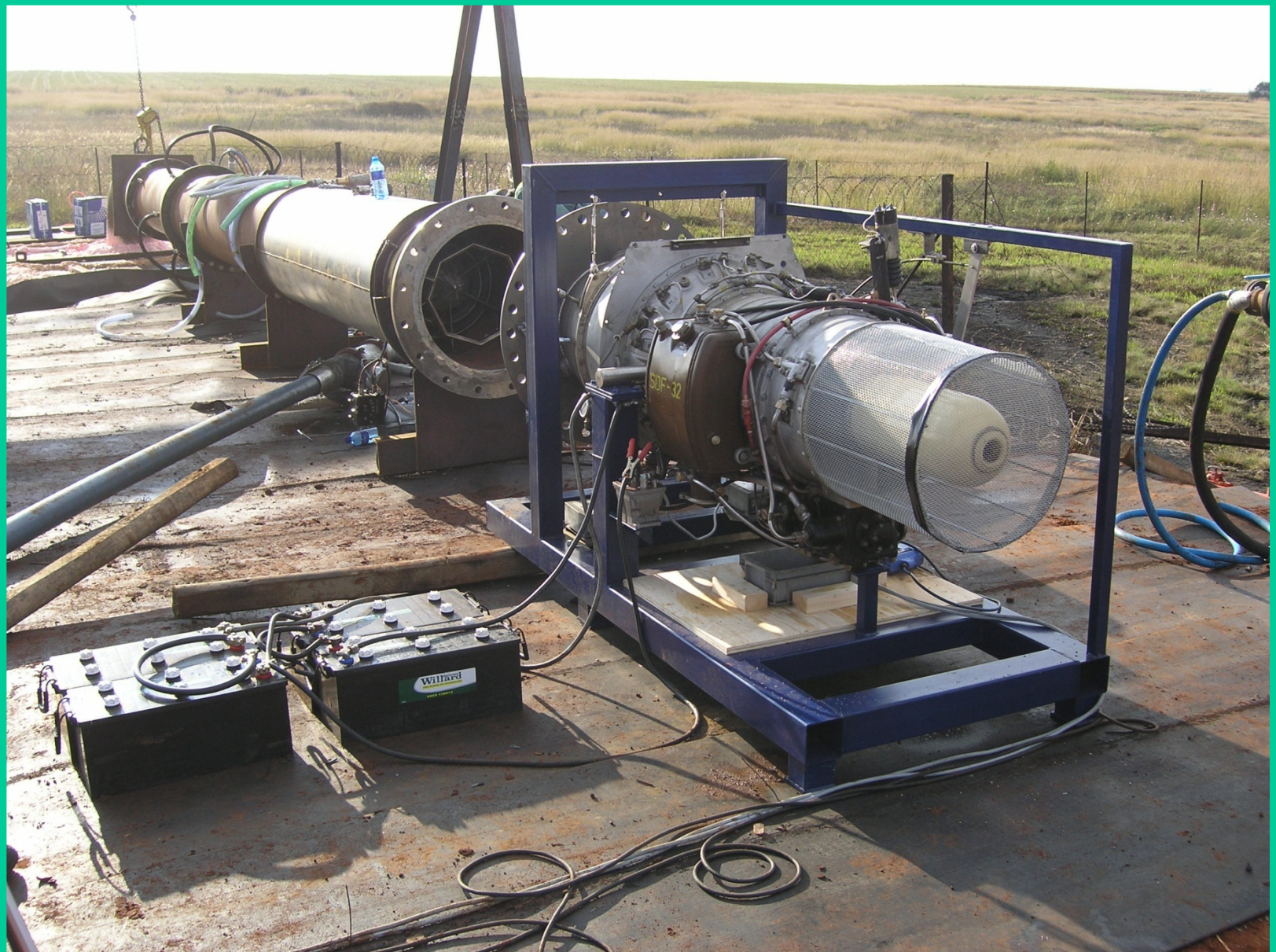


- 20 April preparation for jet engine
- Fuel tank and water dam installed
- 21st jet engine crew arrive
- 22nd jet engine on site and installation commenced
- Power 24/7 = Generators
- Spotlights, security, surface fire team, safety officer, food!
- Airport, transport, accommodation for 10 workers
- 24th 14H45 jet engine started
- Affected area pressurised to maximum 6.5 inches water gauge

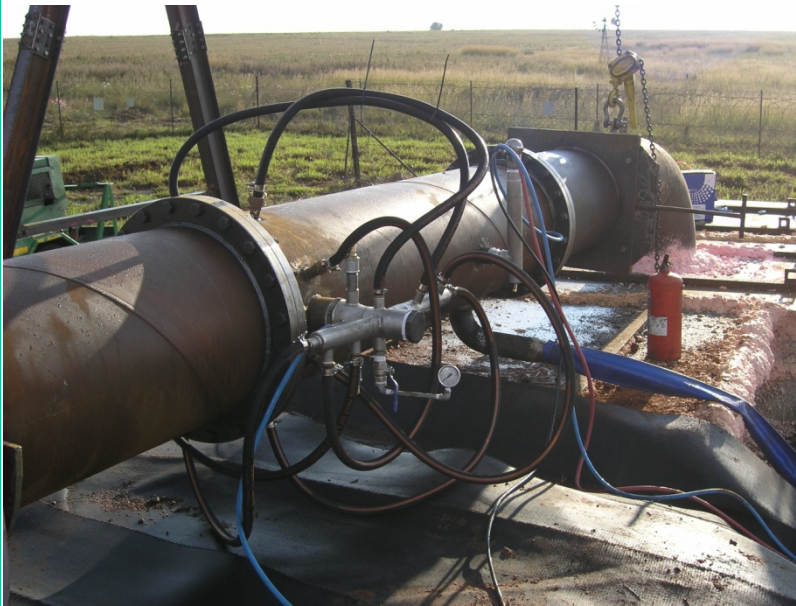
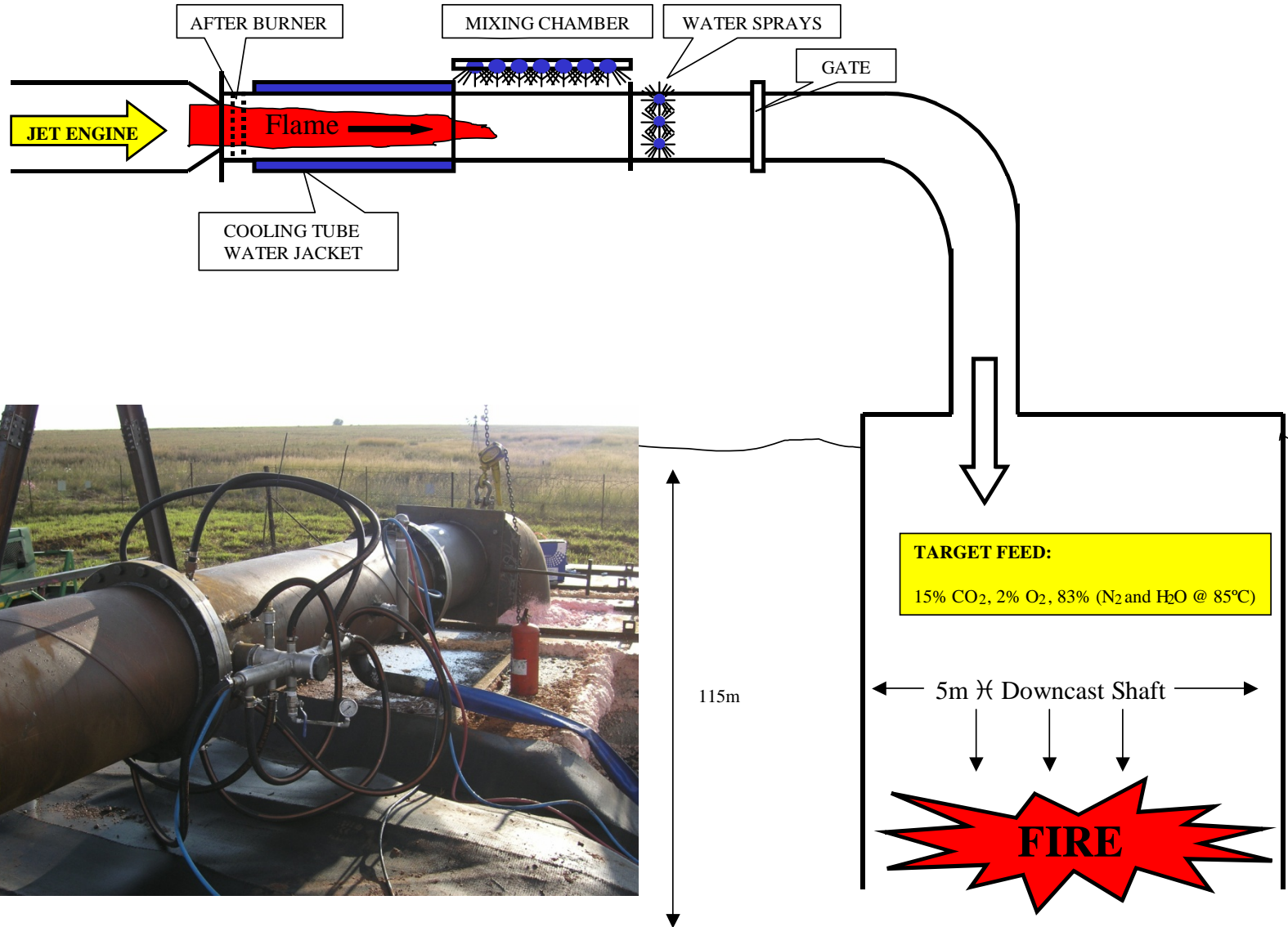




23 13:18

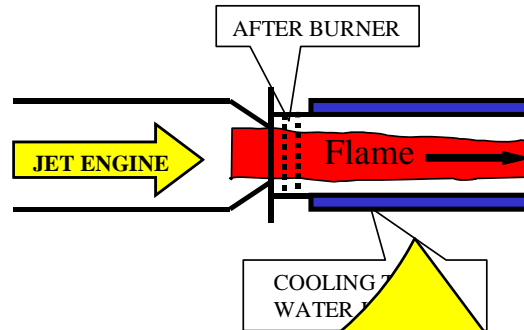






“FLIGHT KLM GH!”

JET ENGINE IS RUNNING ... what to expect?



Objectives known

TARGET FIRE FEED: Jet exhaust: 15% CO₂, 2% O₂, 83% N₂ & H₂O steam (85°)

O₂: 2% - 4%

CO: 500 – 1000 ppm

CO₂: @ ϕ 150 000 ppm (15%)

H₂: 300 – 1000 ppm

C₂H₄: 0-10 ppm

Wall temps below 40°C and “leaking” outwards (into fresh air)

Targets for fire area

Started Sunday 24 April @ 20:03

- Recipe:
- Run jet for 4 days Fire dies out
 - Caucus meeting
 - Run jet for further 4 days ... maak hom **dood!!!**
 - Big caucus meeting !!!
 - Pause 2 days (Jet in position) ... monitor very carefully

Questioning

Are our people safe?: U/G and Surface
 What do we feed the fire? (Jet engine)
 What do we read at the fire? (U/G info)

Monitoring

- Jet feed: Jet engine vs GH
- Surface holes: S”3” and S4
- U/G: 15A, 600C, Heads 71 + 75

Marek/Rao/Andrew/Johan/Dup/John as @ 25/04/05

- Initial pressure too low to access Block 15 area.
- Initially too much O² introduced into the fire area (14-18%)
- Impurities in fuel supply system blocked sprays causing incomplete combustion.
-
-
-
-
-
- Additional fine filters installed on after burner sprays

- **3 May 8:15 jet stopped**
- **O₂ levels dropped to 6-8%**
- **System operational 7.9 days**
- **Estimated volume inerted - 17 235 000m³**
- **Fuel used - 183 014 liters @ 40 000 l/day**
- **Water used - 6010m³ @ 36 000 l/hour**
- **System standby until 5th May – operation declared successful**

Jet fuel storage tank



Fuel used - 183 014 liters @ 40 000 l/day

Water dam for cooling

3200m x 150mm
pipeline

Water used - 6010m³ @ 36 000 l/hour



24 12:27

Water Cooling After Burner



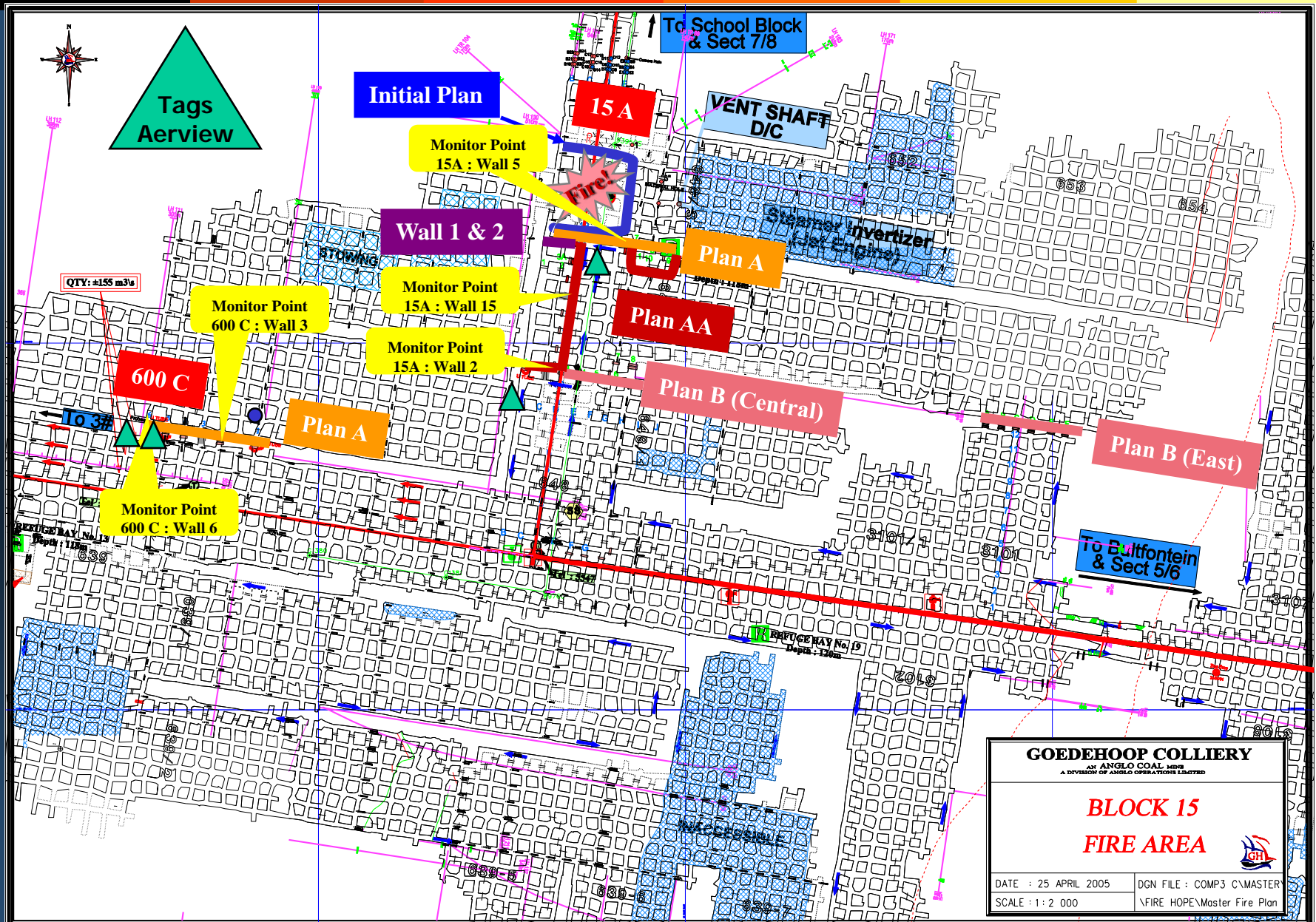


STEAMEXFIRE.CO



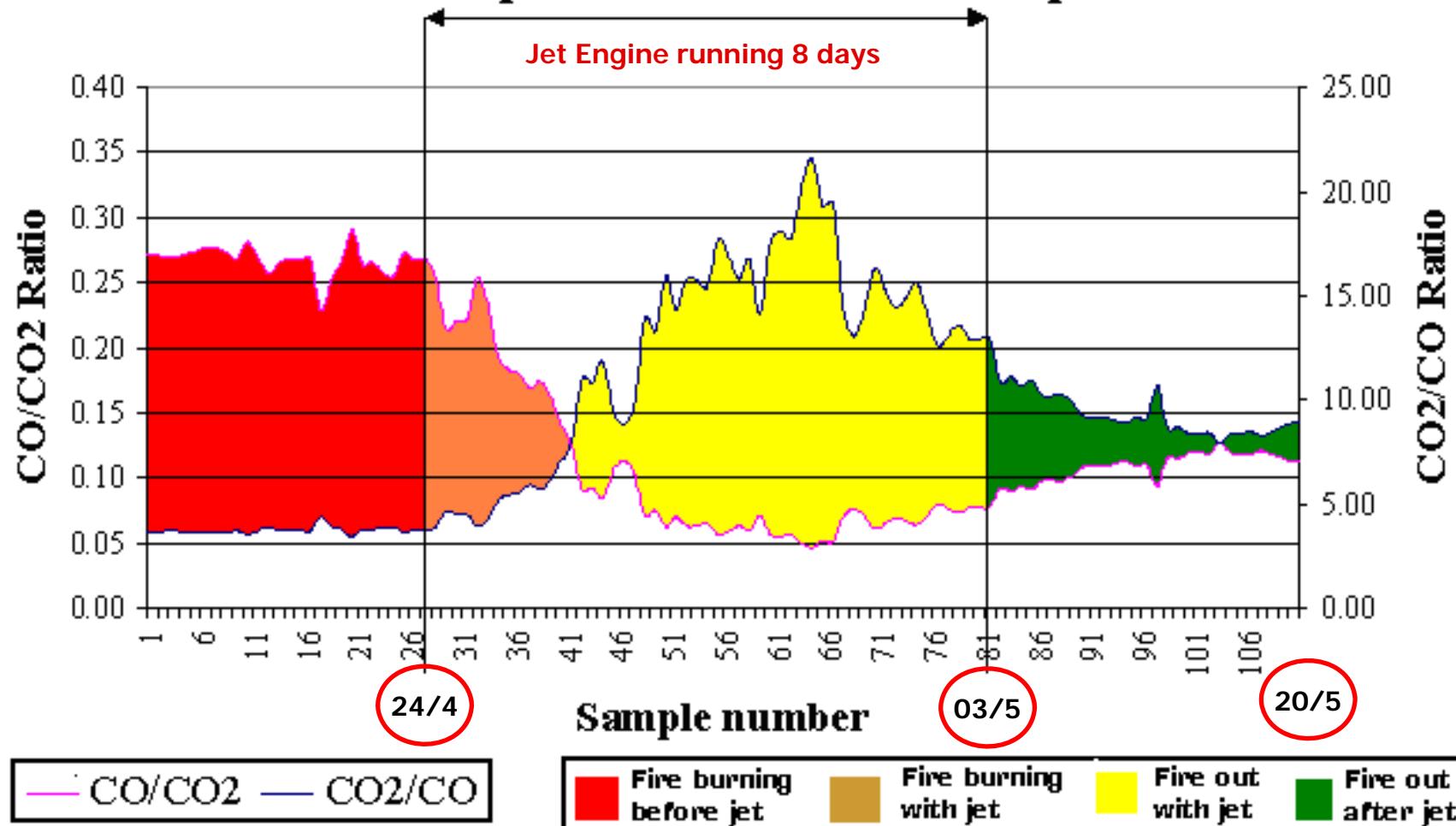
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- Proto monitor air, wall and water temp, CO, CH₄, CO₂ and visibility
- Pressure on walls
- Graphs displayed to establish trends
- Sampling with gas cylinders main fans and chimney up casting
- Proto taking gas samples with pump and cylinders for Mogal analysis
- Sample at 600C w3 (16th) and 15A w5 (17th) sampling on a 1- 2 hourly basis
- 21st sampling pipe was installed at 600C w6 and 15A w5 top and w6.

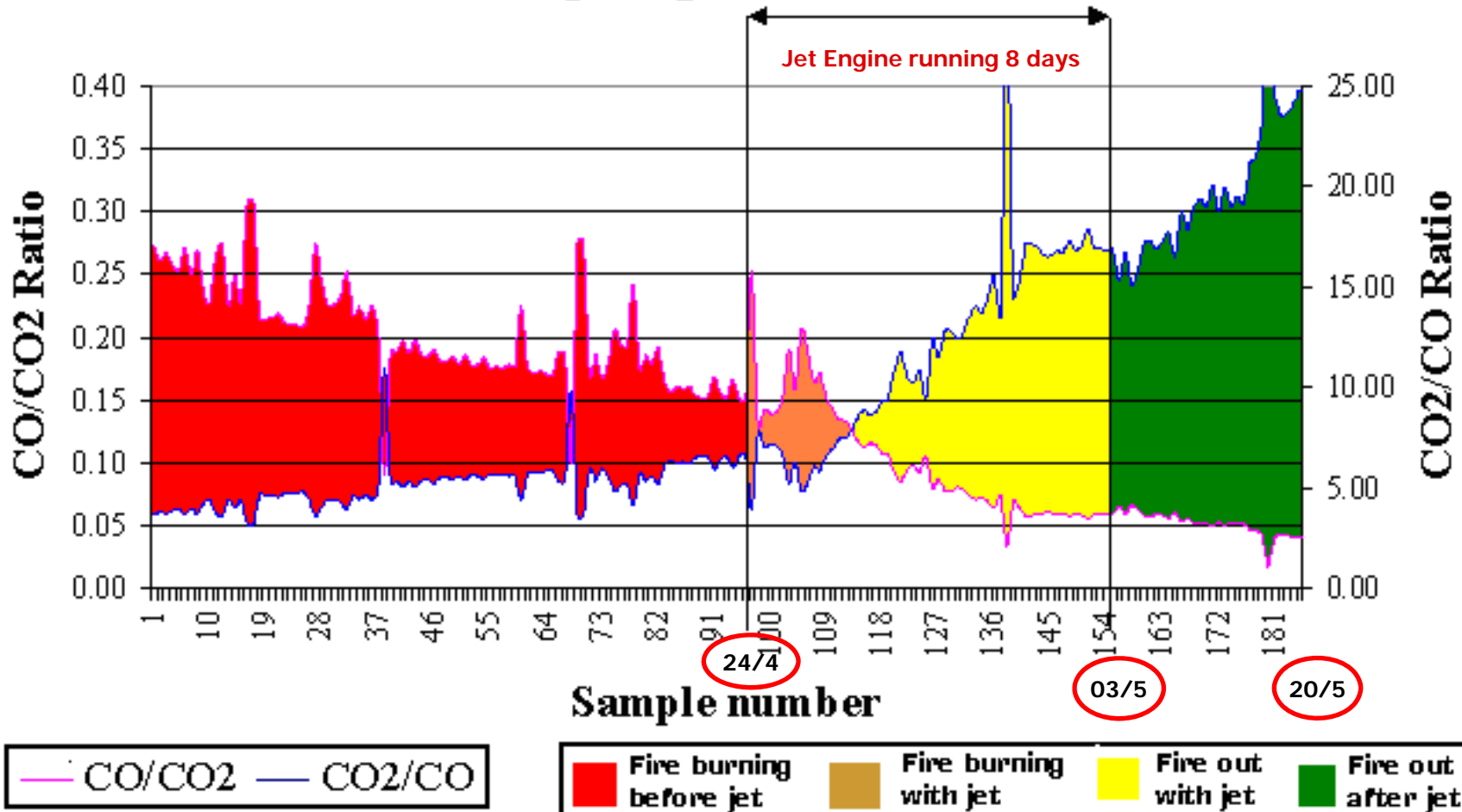


- Fire atmosphere results plotted on explosibility charts and compared to BP fluctuations.
- O_2 , CO, CO_2 , CH_4 and H_2 analyzed by the Mogal and trend graph
- Sampling reduced to 3 hourly on 22 April
- Mogal stationed on the mine with CECS staff
- Alan Cook attempted to take samples from surface boreholes - not successful on the 22nd
- GH and ITASCA jet exhaust readings are similar (results on 26th)
- Fire atmosphere moved into explosive range 19 April
- 25th moved into non-explosive mixtures after the jet engine started running on the 24th
- 25th jet engine exhaust were sampled hourly to ensure low O_2 levels
- 27th only sample at w5, 600C and jet engine

Goedehoop Fire 10 April 2005 Sample Point 5 at 15A Top



Goedehoop Fire 10 April 2005 Sampling Point 600C



15A WALL 5:

O ₂ ↓	3.3%	to	1.6% (Target below 2%)
CO ₂ ↓	9.0%	to	4.2%
CO ↓	0.9%	to	0.02%
CH ₄ ↑	2.7%	to	14.7% (Explosive 5-15%)
H ₂ ↓	1.3%	to	0.00%
Balusu ratio ↓	1.5	to	0.00 (Target below 1)
Water temp ↓ ↙	+40°C	to	~24°C (Target 25-35°C)



600C WALL 3:

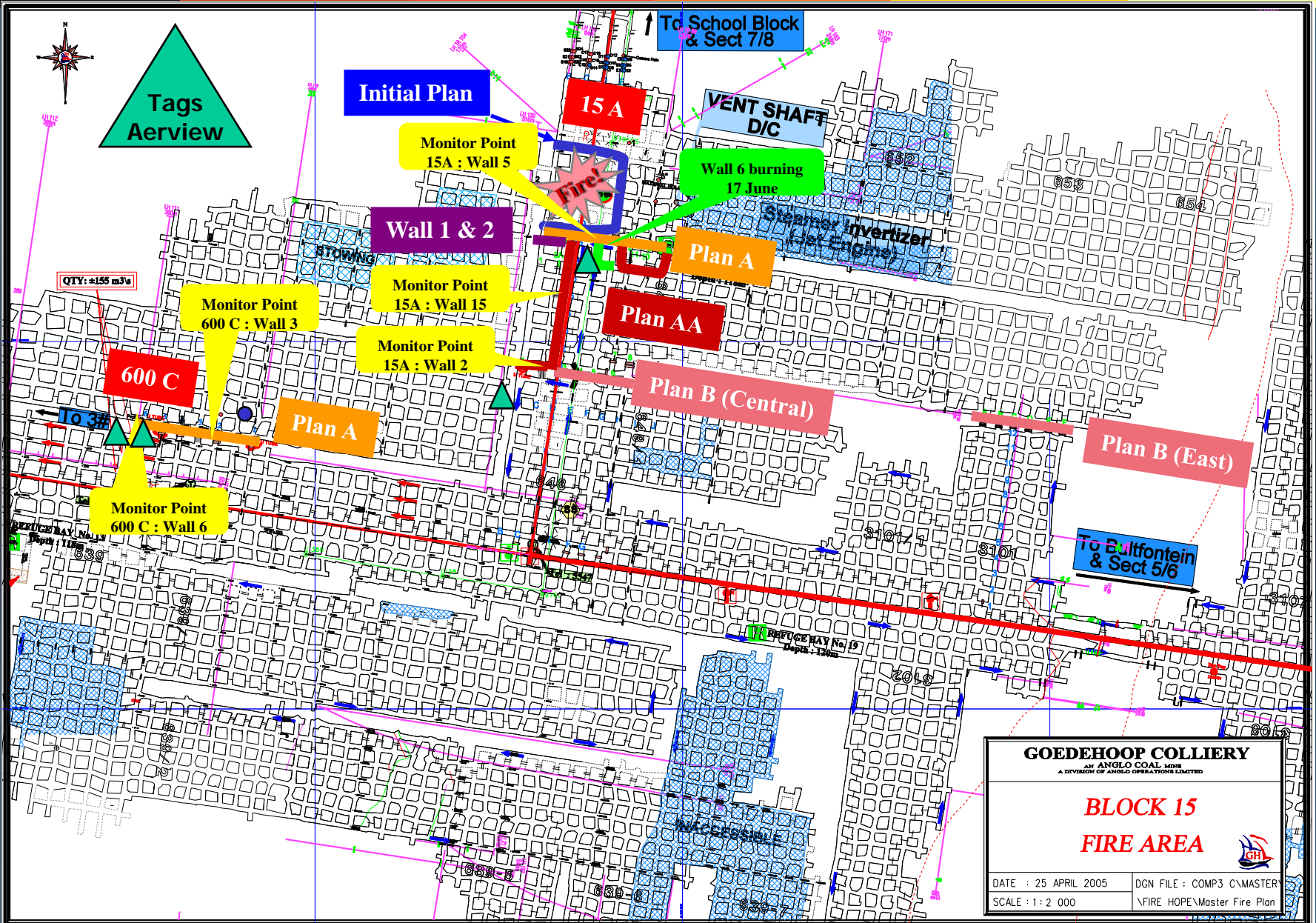
O ₂ ↓	3.9%	to	0.08% (Target below 2%)
CO ₂ ↓	6.3%	to	4.0%
CO ↓	0.4%	to	0.01%
CH ₄ ↑	1.8%	to	14.9% (Explosive 5-15%)
H ₂ ↓	0.7%	to	0.00%
Balusu ratio ↓	1.8	to	0.00 (Target below 1)
Leakages ↓	~10.5m ³ /s	to	~0.9m ³ /s (Target below 1m ³ /s)



There are many indicators and ratios to determine the status of the fire, the main ones used for the Hope fire were:

- “*Balusu ratio*” (H₂/CO)
- “*Grahams ratio*”
- “*CO/CO₂ and CO₂/CO ratios*”
- Advice from GSIS
- The O₂ target


- Post 26 day period of active fire fighting and construction no more proto teams
- 54 proto teams used
- Daily sample taken from day 26 – 100
- Sampling was reduced to 3 times a week – daily inspection conducted
- Post 26 days weekly fire review meeting
- 17 June wall 6 at 15A smouldering - roof, floor and ribside gunited



GOEDEHOOP COLLIERY
AN ANGLO COAL MINE
 A DIVISION OF ANGLO OPERATIONS LIMITED

**BLOCK 15
 FIRE AREA**

DATE : 25 APRIL 2005 DGN FILE : COMP3 C\MASTER
 SCALE : 1:2 000 \FIRE HOPE\Master Fire Plan



1. Detection
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3. Sealing and Containment
4. Extinguishing the fire
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8. 8. Lessons learnt

- Preparation to start up on 2 May night shift - 20 days on stop
- RA done before mining commenced:
 - CTC rescue hole drilled (17th April) in refuge bay 20
 - Long duration sets purchased for refuge bay
 - Additional stone dust barriers installed
 - Section LTR velocity kept at 1,5m/s
 - Air crossings constructed to ventilate fire walls
 - Aerview heads on Block 31 intakes and district return
 - Additional “GAZMO” flickering cap lamp issued to section crew
 - EWAC system in section working
 - Control room operators briefed on situation in Block 31
 - Daily fire wall inspections and sampling of sealed atmosphere
 - All communications 100% operational
 - All section employees briefed

Rescue borehole drilled and tested with MRS



1. Detection
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8. Lessons learnt

- Two sections on stop
- One section and equipment trapped in fire area
- Estimated property damage:
 - o Plant and machinery 9,500,000 US\$
 - o Isolate and extinguish fire 4,000,000 US\$
 - o Construct new downcast shaft 1,800,000 US\$
 - o Repair infrastructure to Block 15 & 31 3,800,000 US\$
 - o Total property / material damage 19,100,000 US\$
 - o Business interruption lost 34,500,000 US\$
- Current reserve: 53,600,000 US\$ - deductible of 7,500,000 US\$ + loss adjusters + consultant fees of approximately 350,000 US\$
- Overall recommended current reserve - 46,450,000 US\$
- GH fire resulted in fire insurance premiums increasing for all coal mines in the industry.

1. Detection
2. Emergency Planning
3. Sealing and Containment
4. Extinguishing the fire
5. Monitoring
6. Risk Assessment
7. Financials
8. Lessons learnt

- Naming detection tags
- Recognition of fire trend time view
- Importance of CRO knowledge
- Quick installation of temporary “dura-seals”
- Guniting walls, roof, ribside and floors
- Nitrogen as cooling agent
- SteamExfire jet engine works
- Working with the BP in the fire area
 - Longhole positions
 - Sealing incline roadways?
 - $O_2 < 2\%$
 - High velocities increase risk (288m³/s)
 - Old area and stowing management important

Decision to re-enter January 2006