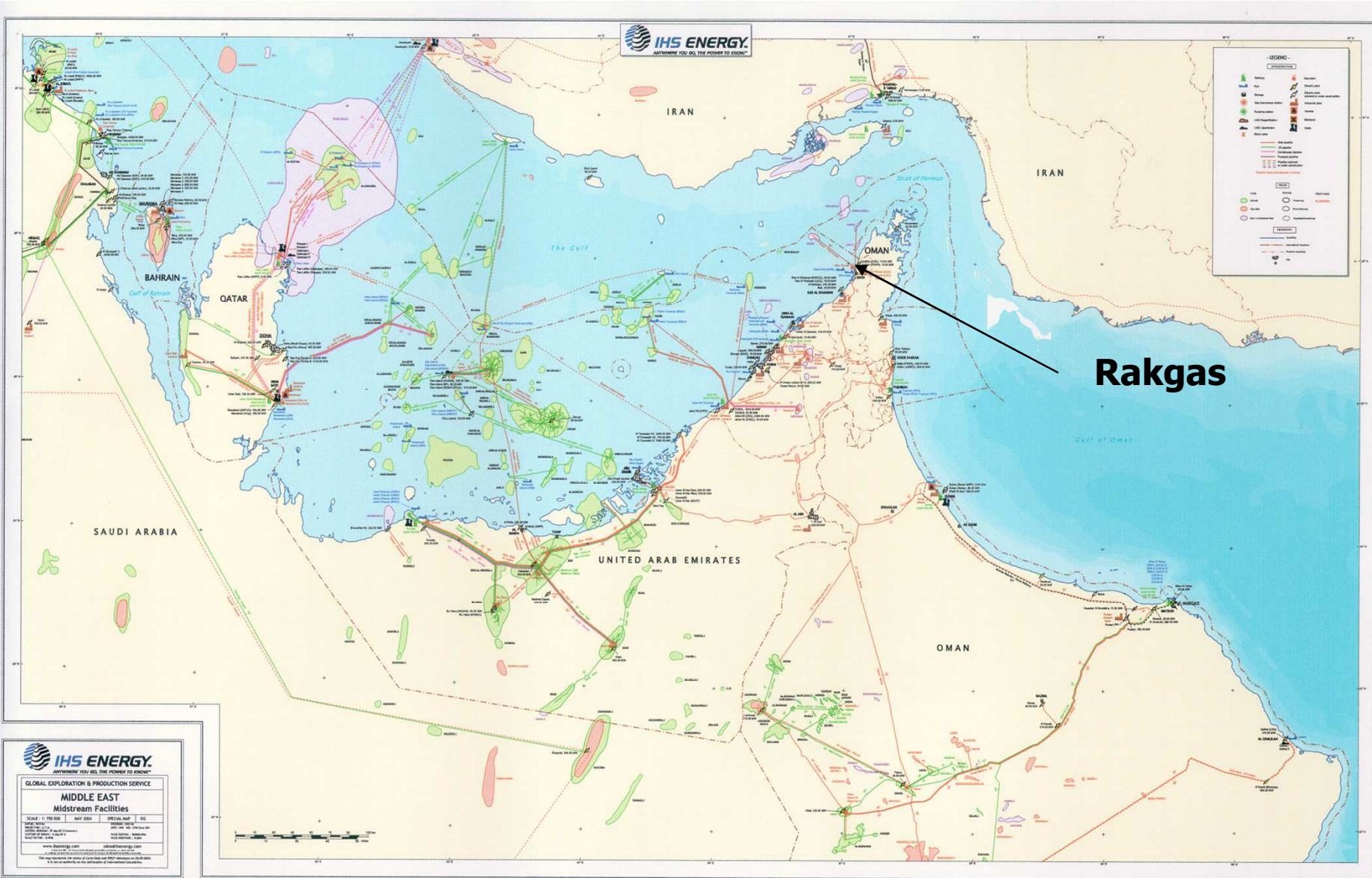


# Central Control Room Explosion in a Gas Treatment Plant

**“A freak Accident”**

**Ruurd Abma, Chief Operating Officer of Rakgas**

# Southern Gulf





**1984**



**1994**

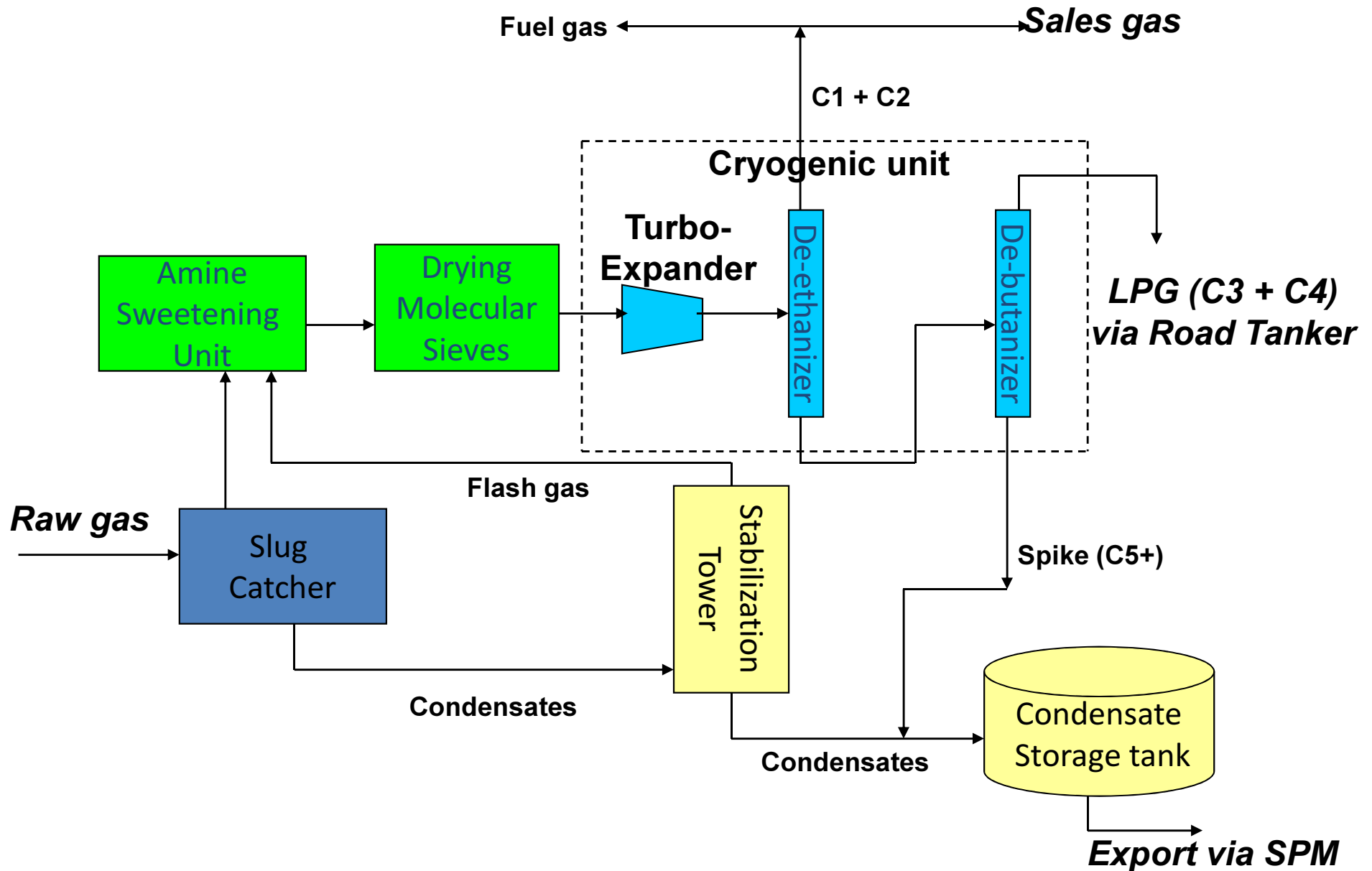
Present Rakgas plant is capable of handling:

- 60 MMscfd of gas. After expansion 150 MMscfd
- 20,000 barrels of condensates per day
- 120 tons of LPG per day



**2008**

# Schematic Flow Diagram of Gas Treatment Plant



# Situation in July 2008

- In July 2008 the new expansion of the plant, the so-called Atlantis train, was being commissioned
- Both construction workers and plant operators were on site
- The Central Control Room (CCR) was also a Motor Control Centre (MCC) with electrical panels and pneumatic regulator

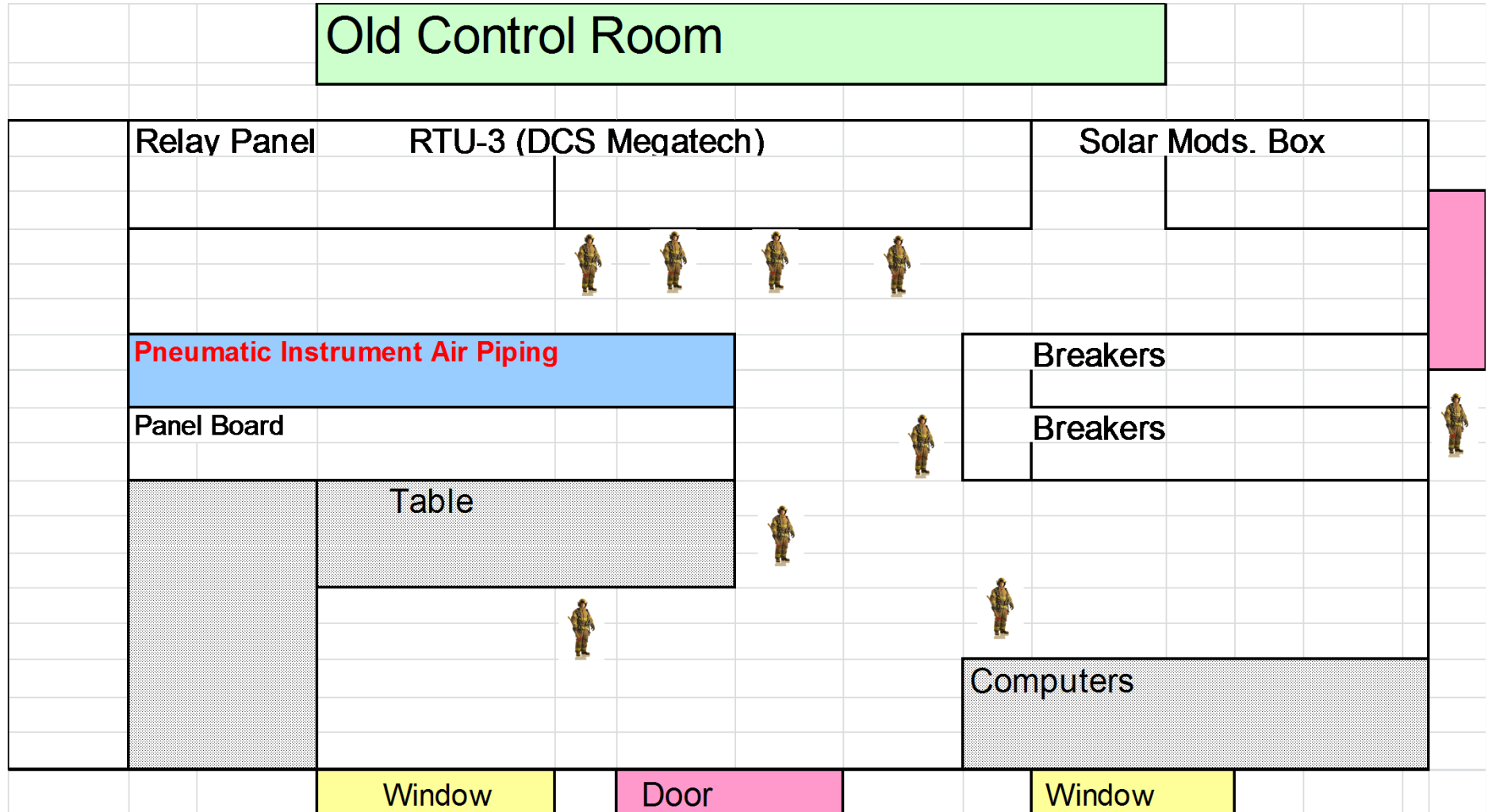
# Explosion on 16<sup>th</sup> of July 2008



# Explosion

- **On Wednesday July 16th 2008** around 18:00 hrs Rakgas' control room (**CCR** and **MCC**) exploded from within. The roof and side walls were blown off. The entire control room and control panels were destroyed thereby disabling the 2 main processing trains and various utility systems
- Ten people were injured in the blast suffering various degrees of burns. Nine were inside and one just outside the **CCR**. All survived.
- It was Wednesday evening, last working day of the week. Weekend being Thursday and Friday

# Lay-out CCR (MCC)



# Events just after the Explosion

- Injured people came running out of the CCR
- At the plant some individuals ran to the source of explosion and others organized taxi's, own cars and an ambulance
- Contractor staff went to assembly points
- Rakgas staff were **reluctant to press** the emergency stop button (ESD).



Eventually it was done 10 minutes later!

# Events just after the Explosion

- All gas flows both incoming and outgoing stopped, but not always according to plan.
- The fire was extinguished initially by own staff and later by Civil Defense, who arrived some 15 minutes later
- The plant could be compared with a body without brains
- Accident Investigation team was established that same evening
- Crisis Management team was formed as well

# Accident Investigation Team (AIT)

- Consists of :
  - an gas production expert from another company
  - our commercial manager and
  - myself as COO
- First meeting next morning
- All personnel had to come to the plant.
- First action of AIT:
  - Those, who witnessed the blast were asked to write down what they saw and were interviewed (“no blame”)



# Findings from Interviews:

## The ingredients for the explosion

- For an explosion to happen one needs:
  - A flammable mixture and
  - A source of ignition



Pneumatic Air regulator which fed the fire after the blast



# Findings from interviews

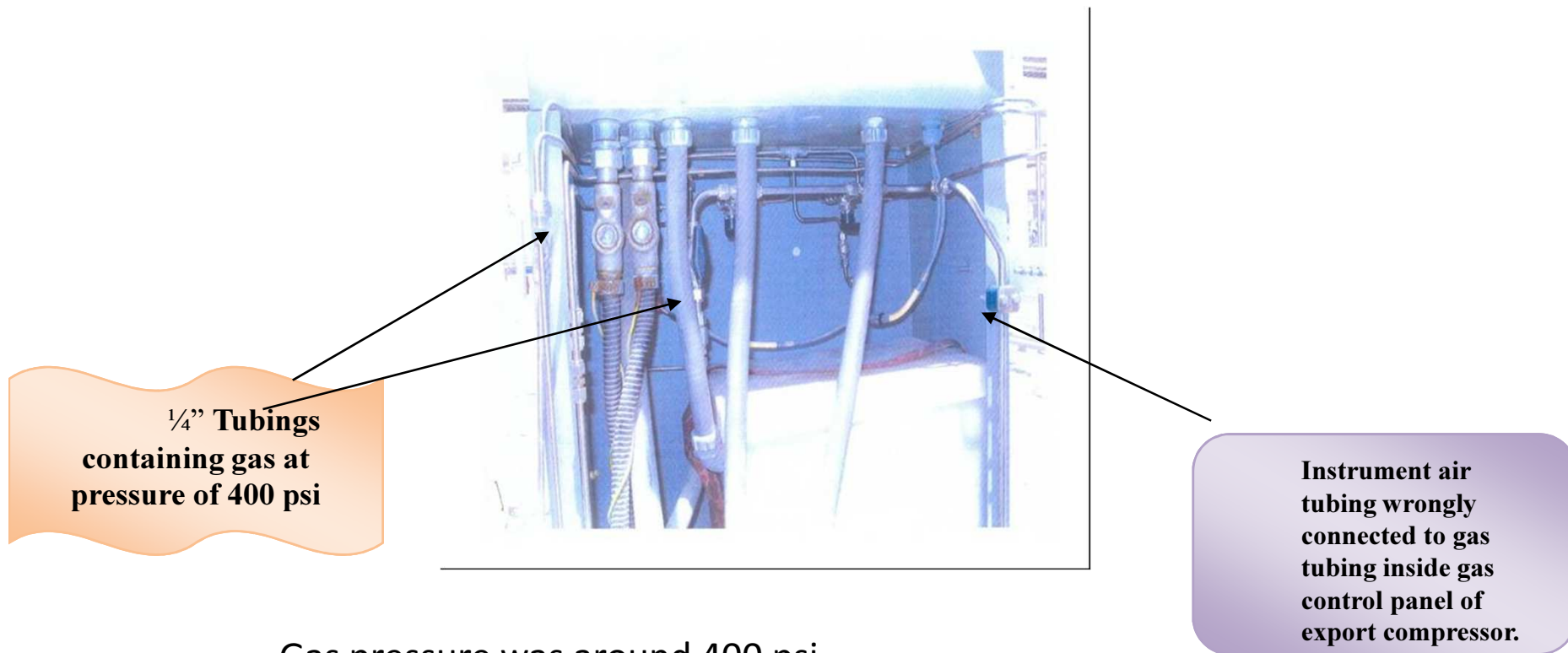
## The cigarette lighter

- The gas export compressors were commissioned and were running for the first time in anger.
- The standby ground flare needed to be lit with a stick with petrol filled cotton at the end, to be ignited with a cigarette lighter.
- This had become standard procedure since the ignition panel had failed years ago and replacement was refused due to costs.
- The lighter was tried out in the CCR, as it was considered a safe haven.

# Findings AIT

## Flammable Mixture

Wrong connection Instrument Air and Gas on control panel of the 3 export gas Compressors.



Gas pressure was around 400 psi  
Instrument air pressure was 120 psi  
As a result gas migrated into the control room

# Conclusion AIT

## Immediate Causes of Accident

**Table 2: Immediate Causes**

- |  |
|--|
| 1. Failure to follow rigorous new plant construction inspection and process commissioning procedures, resulting in an incorrect connection being made and not detected between plant air and process gas systems |
| 2. The control room contained electric panels and pneumatic piping.  |
| 3. Failure to maintain existing process equipment to normal industry standards   |

# Conclusion AIT

## Basic and Underlying Causes of Accident

1. RAKGAS Plant Operations Personnel and Consultant Startup Crew were under considerable pressure to achieve startup.
2. Insufficient focus by both RAKGAS and Consultant on safety engineering aspects of new process design (like HAZOP), startup procedures and operating procedures.
3. Insufficient management focus on control of POB within the plant compound

# Conclusion AIT

## Basic and Underlying Causes of Accident(2)

1. Lack of an HSE culture that assures the employees that they are empowered at all times to act when they feel a situation is unsafe, i.e. operating an ESD push button during a plant fire
2. Lack of an effective Management of Change system for process alterations.
3. Failure to replace equipment that had reached technical obsolescence and was no longer supported by its manufacturer. (Ignition panel of ground flare)
4. There was a culture of minimizing expenditure into extreme

# Crisis Management Team (CMT)

- Members:
  - acting plant manager,
  - head of maintenance and
  - myself as COO
- Objectives:
  - Re-establish full or part gas flow to customers a.s.a.p., hereby securing cash flow
  - Address the causes of the accident.
  - Review all safety and process systems and procedures
  - Re-build confidence among staff.
  - Build a new control room outside the plant



# Communication

- Tell “bad news” directly and factually.
- Use people of the same cultural background to tell “bad news”
- Call Civil defense
- Involve your Chairman and Board
- Inform your customers
- Inform your suppliers
- Be open and transparent to the authorities
- Try not to get involved with the media

# CMT Objectives & Results

- Re-establish full or part gas flow a.s.a.p. hereby securing cash flow
  - 30% of Gas flow was back on line within 3 days.
  - The full 100% took 8 months
- Address the causes of the accident.
  - Checking connections and redesign critical elements
  - Replacing instrumentation
- Implement the Control Recovery Project costing \$ 3 million (of which \$ 2 million was reimbursed by the insurance company).

# CMT Objectives & Results 2

- Review all safety and process systems and procedures
  - Took two years with use of consultant.
- Re-build confidence among staff.
  - Took most of my time
- Build a new control room outside the plant
  - Carried out within one year

Crisis Management Center



# Learning Points

- Beware of **how “history” shapes your company**: from MCC and modular based plant to more automation and CCR in MCC
- **Emergency response manual** was based on plant manager in control and the CCR as base.
  - As it happened the plant manager was injured and the CCR was blown away.
  - Have a flexible manual and ensure the CCR is truly a safe haven
- **A new “real” control room** and office block was built outside the premises of the plant with only fiber optic cables and computers, i.e. no pneumatic system nor any electric panels
- **An emergency room** was introduced with all drawings, procedures and communication tools put together



# Learning Points 2

- The injured had burns in the face and on the arms. From then on coveralls had to have long sleeves.
- Everybody had the authority to push the ESD button.
- POB system is essential: who, where and when on plant site
- Next expansion project had a company project management team with the various disciplines (mechanical, electrical, instrumentation, process and safety): no accidents occurred



# Observations

## Human Aspects of Explosion Incident

- Reactions of Individuals: organizing evacuation and fire fight
- **Togetherness:** all people, some accompanied by family, returned to the plant and afterwards everyone visited the victims at the hospital
- The CCR/MCC was within a container, being a rickety building, but it saved the lives of the victims.
- The gas explosion affected the victims from 1<sup>st</sup> to 3<sup>rd</sup> degree burns, the latter being holder of cigarette lighter



# Observations 2

## Human Aspects of Explosion Incident

- It took a long time to rebuild the confidence: give staff the chance to re-examine the construction process and the safety procedures for themselves.



- Interviews were essential. Use open questions. People who actively witnessed the incident wanted to tell their stories and their assumptions of possible causes.

