

# **COAL MINES TECHNICAL SERVICES, GAS DETECTION RELATED SERVICES FOR MINES RESCUE**

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## **ABSTRACT**

The NSW Mines Rescue Service technical division, Coal Mines Technical Services (CMTS), was established in 1982, initially providing technical services for the Southern Mines Rescue Station. Its role was essentially to provide a service facility for the gas monitoring equipment used by the mines rescue service and also provide gas analysis and interpretation of mine atmospheres during emergencies.

This paper details the development and role of CMTS in providing gas monitoring services for mines rescue and for the Australian coal mining industry in general. It also looks at relevant in-house technical services for mines rescue and appropriate gas monitoring equipment used in post incident gaseous events.

## **INTRODUCTION**

As the result of perceived limitations in the technical capabilities of the New South Wales (NSW) Mines Rescue Service, a decision was taken in 1982 to establish a laboratory/workshop at the Southern Mines Rescue Station. Although the NSW Department of Minerals and Energy during that period maintained mobile facilities for on site gas analysis services, immediate availability of personnel for call out to mine emergencies could not be guaranteed.

Following the initial establishment of a technical facility, a fully equipped mobile laboratory was also commissioned to provide on site gas analysis and gas monitor calibration services for the NSW mines rescue service. To offset the operating costs for the new division, commercial gas detector calibration services were offered to local collieries.

The long term goal for this new division was to provide a high level of gas analysis and gas detection related technical support for the mines rescue service and the coal mining industry in general.

## **HISTORICAL DEVELOPMENT**

Following the appointment of a technical manager in 1982, the initial structure for the Southern Mines Rescue Station technical division was put into place. It was essentially based on the methodology utilised by the then NSW Department of Minerals and Energy. This model was chosen as at the time it was considered to be at the forefront of technology in Australia for this work.

In order to offset the cost to the NSW Mines Rescue Service for maintaining a technical services division, formal laboratory and workshop accreditations were gained in 1983, thereby enabling it to offer a range of accredited commercial services to the mining industry. Initially, only coal mines in the southern NSW coal fields were offered these services. The first mobile laboratory was commissioned in the same year and was fully equipped with the necessary sampling and analytical equipment.

Although subsidised by the Southern Mines Rescue Station and the NSW Mines Rescue Service during the developing stages of the division, the ensuing commercial success resulted in a breakeven position by 1987. This also coincided with the introduction of a formal business plan and registration of the current trading name, Coal Mines Technical Services (CMTS).

CMTS gained quality accreditation in 1996 and in 1997 the division was re-located from the Southern Mines Rescue Station to its current premises as a stand-alone business unit. The ongoing development and broadening of commercial services has also been beneficial for the NSW Mines Rescue Service in providing supplementary funding, thereby assisting in offsetting the operational costs for the service to the mining industry.

CMTS currently operates under an ISO 9001:2000 quality system, is accredited by the internationally recognised National Association of Testing Authorities (NATA) in the fields of chemical testing (ISO/IEC 17025) and approved workshop (ISO/IEC 17020, ASNZS 3800). Although initially servicing the NSW coal industry, CMTS has expanded its operations and services to include interstate coal mines, international customers, rescue and emergency services, local government councils, water boards and general industry.

From its humble beginnings in 1982, CMTS is now the largest provider of statutory gas detector calibrations for underground coal mines in Australia, with bases in the states of NSW and Queensland (Qld).

## **TECHNICAL SERVICES PROVIDED BY CMTS**

While the key role for CMTS is to provide gas analysis and interpretation support services for mines rescue and the underground coal mining industry during gas related incidents such as heatings and fires, serious occurrences are relatively infrequent in NSW coal mines. While this is an ideal situation, ongoing commercial services must be maintained to ensure the viability and retention of the division. Briefly, these services include the following:

- Gas detector service/ calibration
- Gas analysis and interpretation services
- Supply of “**SMARTGAS**” remotely accessed micro gas chromatographic systems
- Three fully equipped mobile laboratories
- Training and consultancy services
- Diesel exhaust testing services
- Equipment hire services
- Gas detector equipment sales
- Supply of certified gas mixtures

## **IN-HOUSE TECHNICAL SERVICES FOR MINES RESCUE**

While the commercial aspects of servicing and calibrating gas detection devices/systems on site at underground coal mines is an important consideration, the expertise gained in carrying out this work provides important knowledge in relation to the strengths and weaknesses of the various systems that are currently utilised. Most gas monitoring systems have limiting factors. By gaining an understanding their capabilities, reliability and accuracy, effective utilisation of the data provided by the various systems can be made. This is particularly important when reviewing gas analysis data on site during post incident mines rescue operations. Knowledge of the limitations of a gas monitoring system can reduce the likelihood of incorrect assessments being made.

The benefits of in-house technical expertise for mines rescue services in gas detection related fields cannot be understated. As per the NSW Emergency Preparedness and Mines Rescue Guidelines 2005, rescuers will not be deployed underground unless the “*atmospheric conditions and trends are known*”. Gas analysis and subsequent interpretation of results is a specialised field, with a relatively limited number of industry experts readily available to carry out these services when required. When incidents such as spontaneous combustion and fires occur in underground coal mines, rapid provision of these services is essential. While there are eminently qualified personnel capable of assisting incident management teams in the post incident management of serious underground gas

related occurrences, they are not always readily available. While immediate on site response by CMTS mobile facilities may also be delayed by other commitments, verbal technical assessments and recommendations can be provided at all times.

Additional benefits for in-house technical services for mines rescue include a familiarity with the mines service structure and relevant mines rescue guidelines, knowledge of mines rescue team operations and in-house servicing of equipment and thereby confidence in the gas monitoring equipment that will be used.

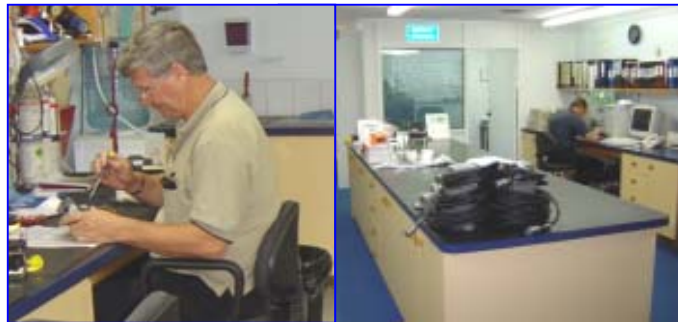


Fig1 - CMTS Laboratory/ workshop

## **APPROPRIATE ANALYTICAL TOOLS**

For a technical division in mines rescue to be effective in providing relevant data from post incident gas analyses, it must be equipped with the appropriate analytical tools. It must also have competent personnel to operate the equipment. In terms of decision making when advanced oxidation, spontaneous combustion, fires and explosions occur underground, normal colliery gas monitoring systems employing fixed sensors and infra red analysers may not provide adequate and reliable data to enable informed assessments. In these situations an analyser capable of the accurate determination of low concentrations of components such as hydrogen, ethylene and propylene is required. For this type of analysis, a gas chromatograph is the most appropriate option. Apart from providing accurate and unambiguous data for these gaseous components, it can also determine all other relevant gases that are required for trending and calculation of ratios. Modern ultra fast micro type gas chromatographic systems have proven to be a good analytical tool for this purpose (see Fig 2).

As indicated above, the use of some types of sensors commonly used during normal underground mining operations may not be suitable for use in a background of other gases that can be produced during a spontaneous combustion, fire, etc. Some electrochemical chemical sensors, for example, can give erroneous readings in a background of fire gases. "Catalytic" type sensors that are commonly used to detect methane will also be affected by the presence of high concentrations of other flammable gases. Some infra red analysers have limited ranges and may also be affected by background contaminants. There is a risk in these circumstances of incorrect assessments being made.



Fig 2 – Typical modern micro gas chromatograph

Where a suitable gas chromatograph is not available, there are alternative analysers that can provide reliable data. Good quality infra red analysers for the determination methane, carbon monoxide and carbon dioxide may be used. Paramagnetic oxygen analysers have also been commonly used for the determination of oxygen. However, allowances may have to be made for the possibility of the presence of other gases. For instance, none of the above analysers can determine components such as hydrogen, ethylene, ethane and propylene. Depending on the type of incident, approximation for the presence of some non-detectable gases may have to be made in some circumstances.

Ideally, the relevant gas monitoring equipment operated by a mines rescue technical division should be transportable. An appropriately equipped mobile facility is a good option for this purpose. The flexibility of manoeuvring and locating such a vehicle at a preferred monitoring site is also advantageous.



Fig 3 – Mobile laboratory

## **CONCLUDING COMMENTS**

In conclusion, the provision for in-house gas analysis and gas detection related services for mines rescue is of significant benefit. The ability to supply these services in a timely manner is an important consideration when assessing their value. In addition, the broad based knowledge that an in house technical division is able to acquire, is a valuable asset in assessing the data produced from gas monitoring systems.

While external individuals and organisations may have the necessary skills required, and able to assist in the management of post incident gaseous events, they may not always be available when required. In addition, they may not have the broad based knowledge for the range of coal mining systems that an in house technical division would be able to acquire, and is necessary for accurate decision making during such incidents.