HISTORY OF THE

M.V.S.

by
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The Mine Ventilation Society of South Africa, 1994

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The growth and formation of the Mine Ventilation Society follows the fascinating history of the mining industry in South Africa. A number of farsighted professionals recognised the need for a forum to discuss common ventilation problems, and in 1944 *The Mine Ventilation Society of South Africa* was formed. The growth and success of the Society has been due to the vision of these early members, many of whom were charismatic and colourful characters. It is often said that the strength of a society is its members and the MVS certainly has had many strong and dedicated members.

This publication outlines ventilation problems that mines have experienced over the years and the part that the Society and its members have played in their solutions. The Society has been the forum where many thought-provoking discussions have taken place between our members.

I wish to thank all those who dedicated so many hours providing countless interesting anecdotes and giving invaluable information. For many of us, who did not know the early members, it allows us to get to know them and appreciate their personalities.

I also wish to thank the Committee Members for their support with this project.

A special thank you is given to Melanie Low who has recorded our history with feeling and understanding. It is through her effort that our founders are recorded for future generations.

Russell Ramsden
Chairman, History of the Mine *Ventilation Society*

CHAPTER 1

The scene was set, and waiting in the wings was the discovery that was to move South Africa on to the world stage. It came in 1886, with the proving of the conglomerate beds of the Witwatersrand Geological Basin, halfway between Barberton and Kimberley. As the full potential of the Witwatersrand conglomerates became known, the finance houses built on Kimberley diamonds moved to the Rand, and with the backing of the banks of Britain, France and Germany, began the development that was to amaze the world. The importance of the rapid acceleration to available world stocks of gold, and of the revealed potential of southern Africa, aroused the attention of the great European nations. They tightened their hold on the possessions in Africa and scrambled for African territories still unclaimed.

John Lang, 1986

The beginnings

The discovery of gold bearing conglomerate on the Witwatersrand in February 1886 caused a sensation throughout the world. George Harrison, an insignificant gold digger from Australia whose illusions of wealth and fame had long been shattered by the ruthlessness and unscrupulousness of the so-called great men, had taken a temporary job building a house for a widow on the farm, Langlaagte. While passing the time away one Sunday afternoon, he accidentally fell over a boulder well hidden under the long summer grass. Swearing loudly he picked himself up and was about to kick the offending rock, when he became transfixed by a golden sparkle glinting in the sun. It was unmistakable. He, George Harrison, had found the gold.

Development then accelerated rapidly as the full potential was realized and within months the horizon was dotted with excavations along the outcrops of gold bearing reef. Foremost in the minds of the prospectors was the scramble for gold with the inherent dangers of inadequate ventilation conveniently forgotten or tacitly ignored. Dust conditions were as bad as could be expected considering that the silica content of the rock mined was about the highest in the world coupled with the dry mining conditions which resulted in miners commonly looking like flour millers after a shift at the face.

The first preventative measures

The period of awakening came in about 1901 just after the Boer War. Lessons were learnt slowly and painfully when the scourge of miners with silicosis took its toll. Employers, employees and the Government all realised the pressing need for adequate ventilation, and the subsequent close collaboration between the parties involved paved the way for a solid foundation from which modern ventilation practice has risen.

The historic action which marked the advent of this new era occurred in November 1901 when the Mine Managers' Association requested the Transvaal Medical Society to appoint a committee investigating the high mortality rate among rock drillers. A meeting was held in early 1902 and later that year the Miners' Society also approached the Transvaal Medical Society with a view to establishing preventative measures. The gravity of the problem is borne out in the Government

Mining Engineer's year end report of 1902 which showed that 85 out of every 1 000 rock drillers were known to have died of Miners' Phthisis between October 1899 and January 1902. The Transvaal Medical Society, with the diagnostic techniques available to them at that time, also conducted medical examinations and found that at least a quarter of the underground workforce had or were suspected of having the disease.

In December 1902, a Government Commission was appointed to enquire into and report on the disease commonly known as Miners' Phthisis. The Commission's report was issued in 1903 and contained many important and far reaching recommendations which included wet drilling as well as the need for planned and controlled ventilation. Warnings were also issued about the dangers of workers entering development ends until blasting fumes had been cleared.

The practice of wet drilling became well established fairly quickly. The water blast was introduced and water was made available to wet the rock when it was being moved or handled. Blasting was limited to the end of the shift and a 'blasting interval' was introduced. In addition the importance ventilation assumed in the minds of those responsible for the production targets of mines is shown by the topic chosen for the first paper to be presented to the newly titled Chemical, Metallurgical and Mining Society of South Africa in 1903, The paper, entitled 'The Ventilation of Deep Levels', stated that neither the cubic feet per minute per person nor the total quantity of air sent down a mine should be regarded as a reliable guide to the efficiency of the ventilation, and that the important criterion was the need for efficient air distribution.

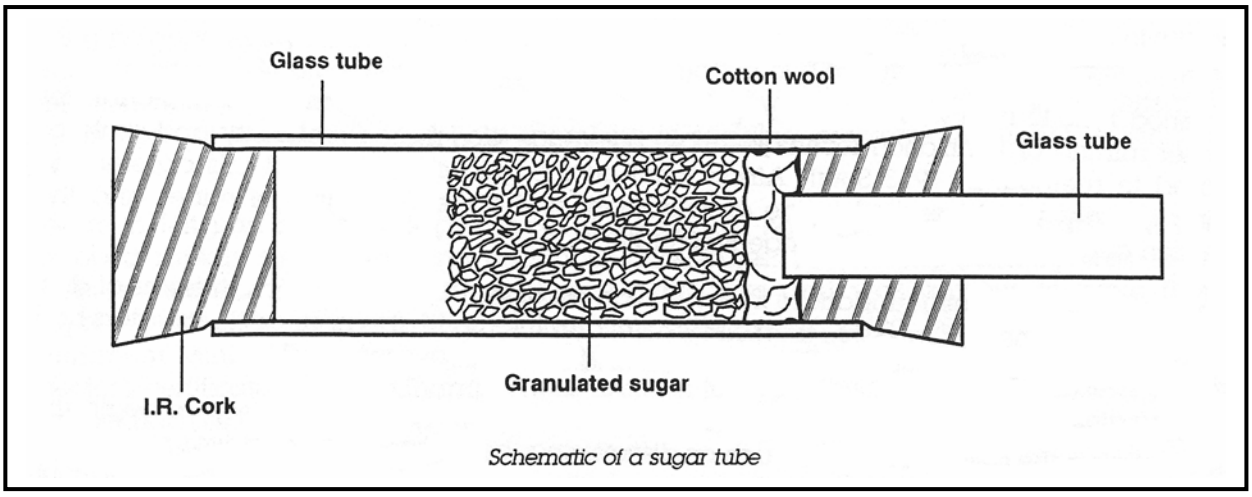
In 1906, East Rand Proprietary Mines pursued the first plans to mechanize ventilation. Consideration was given to the relative merits of large air quantities in addition to careful distribution. By 1910 the main source of ventilation of the mine was not only through the use of fans. Blowers or a type of air jet, which were the predecessors of venturis, were also being used to ventilate development ends. Other mines now began considering the merits of mechanizing ventilation and recognition began to be given to the need to carefully plan requirements for deep level ventilation.

The Government Mining Engineer was, at this time, also extremely active. A Commission investigating the prevalence of Miners' Phthisis was appointed in 1911 and resulted in the first Miners' Phthisis Act of 1912 where, for the first time worldwide, compensation was awarded for the disease.

The first measurements of dust concentrations in the air in the Witwatersrand were made in 1903 by weighing dust caught on cotton wool. Measurements indicated that workers were exposed to concentrations as high as 400 milligrams per cubic metre after blasting, and from 15 to over 100 milligrams per cubic metre in drives, workings and raises.

It took another eight years before systematic dust sampling was introduced to the South African gold mining industry by the Consolidated Goldfields Group. The sugar tube was used as the standard instrument. Surveys in 1913 showed that the compulsory use of water had reduced concentrations to 5,4 milligrams per cubic metre. In 1914 the Chamber of Mines of South Africa established a dust department headed by Mr J P Rees who was to be instrumental in later years in the formation of the Mine Ventilation Society. Visits were made to each mine with all sections now sampled systematically. The maximum standard of permissible dust concentration was fixed at five milligrams per cubic metre. By 1916, the Government had appointed a dust inspector to assist in the control of dust.

The initial enthusiasm voiced for the sugar tube began to wane as the concentration of dust in mine air began to be reduced. Other instruments were tried and in 1916, Sir Robert Kotzé invented the konimeter. The konimeter enabled dust sampling on a routine basis to finally become entrenched on mines in 1919. The other landmark in the history of dust suppression occurred in 1917 when regulations were formulated making it compulsory to appoint dust inspectors for



Schematic of a sugar tube

mines employing over 1 000 workers. Once again South Africa triumphed on the world stage for this was the first time that specialists were given the responsibility of protecting workers from the hazards of the mining environment. These inspectors were the forerunners of the modern ventilation officer and environmental engineer, and the creation of this post paved the way for the development of expertise and knowledge in an area which is now fully recognised as integral to the profession of mining.

Initial duties of the dust inspectors, as gazetted in the Mines and Works Regulations, were mainly concerned with water reticulation. This was understandable because it was an area lacking in skill and expertise before the mandatory introduction of wet drilling some years previously. As a result of the legislation, mines had been rapidly equipped with reticulation systems and it was the responsibility of the inspector to ensure that the water supply was adequate, although the installation and maintenance of the piping, valves and dams soon fell into the domain of the mining department.

Unfortunately many mine managers, more involved with meeting production targets than with understanding the medical implications of exposure to high dust concentrations, failed to understand the true mission of the dust inspectors. They were regarded as a nuisance and the job was fobbed off to unpromising youths or older men whose best years were long gone. This naturally prolonged the prejudicial attitude towards the role of the inspector but at the same time it marked the beginning of the struggle which was to last for decades to prove the worth and potential calibre of men involved in this discipline. Before long, men with both admirable ability and qualifications began to be drawn into the profession. Moreover, the interest aroused by the still pressing problem of Miners' Phthisis was attracting the increasing attention of men outside the sphere of ventilation.

Miners' Phthisis, or pneumoconiosis; provided a challenging field of research, and the professional and humanitarian benefits accruing from the discovery of its cause, and then the development and application of preventative measures, were enormous. There were differences of opinion as to its cause with strongly held views on the relative importance of serecite which is one of the constituents of airborne dust. Convictions of other protagonists included the size of the dust particles, blasting fumes, and the dangers of prolonged exposure to relatively low dust concentrations as opposed to short exposure to high concentrations.

At first these men took an interest in ventilation related problems from the distance of their professions. Medical men studied pneumoconiosis case histories and published valuable papers on the results of their research. Mine managers took up the challenge and devised new techniques to lessen dust production during mining. Findings were published in the technical journals of the Association of Mine Managers and the Chemical, Metallurgical and Mining Society.

The task of refining ventilation practice

The period 1920 to 1944 was marked by gradual advances without any monumental changes in either mining or ventilation techniques. The difference was more in intensity and scale as opposed to method. In 1933 South Africa went off the gold standard and this accelerated mining activity which resulted in the development of the West Wits line of mines and the extension of gold mining to the Orange Free State.

By the early twenties the foundations in ventilation had been laid. Legislation in terms of dust and disease was more progressive than elsewhere, and the medical experts and legislators had begun handing responsibility over to engineers and scientists.

With the broader aspects now clearly defined, the burden then fell on engineers to begin the task of refining the details. Problems such as discovering the reasons why dust was so harmful and then eliminating or reducing the concentration had to be tackled. The limitations associated with the use of water were also in need of urgent consideration. In addition, as mines gradually extended deeper into the earth, heat emerged as a serious problem with the first fatal heat stroke case being recorded in 1923.

Shaft sinking, development ends, ore passes and stopes all created specific difficulties. As a result of the joint committee set up by the Chamber of Mines and the Mines Department in 1923 to investigate development ends, South Africa again led the world in being the first to systematically ventilate these areas according to set standards.

While the experts continued to ponder over devising ways and means for improved dust determination, mines were becoming deeper and deeper and problems of heat were assuming greater importance. The words geothermal gradient became the catchphrase among those planning either new mines or extensions to existing ones. Air distribution was improved by installing regional booster fans underground to augment the one or two main ones on surface. Information on temperature increases in mine workings began to be collected and thought was given to directing air within the stopes to the working face. In this way ventilation became fully integrated into the ambit of mining.

The problem of heat fell squarely on the shoulders of the dust inspector who was now known as the ventilation officer. The original brief of the dust inspector had expanded into ensuring the working places were kept cool using the most cost effective methods as well as reporting on conditions in the stopes. Besides reporting on dust concentrations, the ventilation officer was responsible for the collection of data on air quantity, air temperature and cooling power, air velocity and gas concentrations.

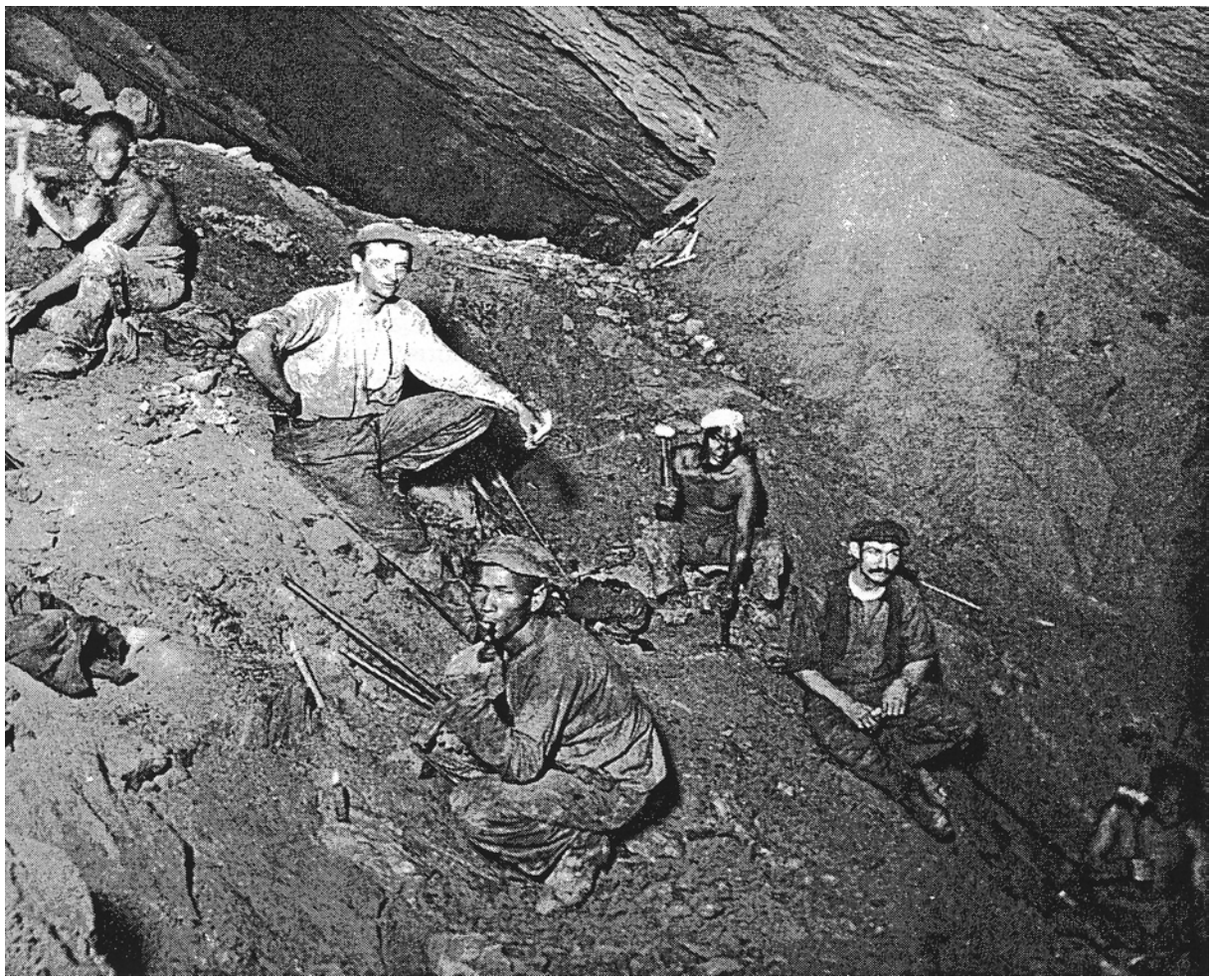
Ventilation problems were thus becoming increasingly complex and in the early forties it was painfully clear that a forum was needed where experts could meet regularly and discuss the urgent issues at hand. High calibre men had been attracted to the discipline and feelings were expressed that for real progress to be made, a platform would have to be provided where members of the ventilation fraternity could address co-workers and initiate high-level discussions relating to their experiences. Although there were outlets at this time both in South Africa and overseas, they were purely vehicles through which ventilation men could publish papers. The Association of Mine Managers and the Chemical, Metallurgical and Mining Society of South Africa welcomed papers, as did the Institute of Mining and Metallurgy in the United Kingdom.

Many of the senior men in the mining industry also recognised the need for professionals to discuss problems unique to their disciplines and the Chamber of Mines appointed specific bodies to deal with ventilation matters. This certainly eased some of the isolation experienced by ventilation men but attendance at these meetings was always in an official capacity as a representative of a mining group. Also, only senior men were invited to attend the meetings

leaving no opportunity for discussion and exchange of ideas with the new generation of junior ventilation officers. Another positive factor in the formation of a society specifically catering for ventilation men was the need for a technical journal which would also aid in the effective dissemination of knowledge and help members in tackling problems frequently arising on mines.

Three men felt particularly strongly about the issues at hand. A career in ventilation had developed rapidly into one posing enormous challenges. The mining industry was in the process of establishing a series of ventilation certificates and was anxious to have them accepted by the Government Mining Engineer. Help was needed because otherwise the Government Mining Engineer would probably require something similar to a statutory dust inspector's certificate and the Chamber was anxious to avoid this becoming a necessity. The Chamber had also commissioned Professor C W B Jeppe to write a new textbook on mining and it was to include a substantial section on ventilation.

And so Messrs R A H Flugge-de Smidt, J P Rees and A W T Barenbrug determinedly set about the task of establishing a society whose members could work together and strive to attain a fraternity of men which could collectively further the aims of the profession of mine ventilation.



Taking out the foot wall the old way, and probably contacting miners' phthisis at the same time.

CHAPTER 2

Councils and Committees alone cannot run a Society. They are mainly its organizers. A Society can only be run efficiently and effectively if all the members show their willingness to help

A W T Barenbrug, 1948

Forming the Society

Flugge-de Smidt, Rees and Barenbrug were convinced that the formation of a mine ventilation society would help solve the communication difficulties being experienced between both mining groups and the mines within each group. Problems were resolved or discussed in a fairly uncoordinated fashion with each group or mine providing their own solutions without being aware of whether others had previously found themselves in similar predicaments.

Doggedly the three continued their campaign. Flugge and Barenbrug were both forceful charismatic characters with Flugge being particularly loquacious. Rees, on the other hand, was no extrovert and achieved respect through erudition, thorough knowledge of his subject and dedication to his task. From his central position in mine ventilation as head of the Chamber's Dust Department his span of influence was wide and he set about his task of persuasion with sincerity and integrity.

Equally well known in the industry, Flugge was a prominent member of the Chemical, Metallurgical and Mining Society having been awarded their Gold Medal in 1926 and being elected President in 1935. In spite of his excellent standing in the most prestigious society in the country he realised that the ventilation officer needed his own forum, and relentlessly pursued his goal. Wearing his Bishops school tie and pith helmet, he persistently raised the topic and was instrumental in persuading many of his colleagues and superiors that a society should be formed. He believed fervently that the society could play an invaluable role in coordinating activities and disseminating information vital for the efficient running of ventilation departments.

The three persisted in their attempts until they finally managed to allay fears expressed by members of the upper echelons of the industry and the Chamber that the Mine Ventilation Society was likely to become an unofficial trade union or pressure group lobbying for higher wages and better working conditions. Whenever misgivings were expressed they pointed out that there had been enormous growth in the number of ventilation officers now employed on mines. Reasons for this increase were mainly the pressing need for improving dust concentrations which were now aggravated by the introduction of more intensive mining methods and the deployment of mechanization. Heat was also a problem which tended to become more and more serious as mines spread further into the depths of the earth. Also no-one could now deny that environmental conditions affected the accident rate as well as the daily output.

Eventually the powers that be were convinced of the integrity of the proposed society and there was no going back. Largely due to Rees, who persuaded the Chamber to give a society the chance to establish itself, every form of encouragement was lent to its formation. In 1941 a provisional committee was established to investigate whether a society was in fact feasible.

Besides the three pioneers, members of this committee included Messrs E C Polkinghorne, and J Buist of the Chamber as Honorary Secretary. The committee had no difficulty in deciding that such a society was feasible. They had been unanimous on that score for years. What was difficult was agreement on any one particular idea. This is not surprising considering the strong willed, resolute and outspoken characters involved. After three long years of deliberation, a draft constitution was finalised and a 'general meeting of prospective members of a mine ventilation society' was scheduled for 25 November 1944.

And so it finally happened. Flugge took the chair and declared the meeting open. The draft constitution after being amended was unanimously approved. Then within those first few hours the now constituted Society suffered its first shock. Everyone present for the election of office bearers presumed that the first President would be Flugge. After all he was the natural choice having worked so relentlessly in its formation. He was also an eloquent speaker, an excellent organiser and being the Chief Ventilation Officer at East Geduld, very much respected and on top of his profession. The room was subdued as Flugge explained, with earnest sincerity, that *'I prefer to take a back seat to show that my efforts towards forming the Society were entirely free of personal ambition'*. In the wake of being deprived of one man who would have guided the Society with energy and distinction, Rees also declined to stand as President. Members stared disbelievingly as he pleaded that in his position as head of the Chamber's Dust Department, it really was not tenable for him to head the Society.

After an eventful session, Mr Paul Mullineux was elected the first President. Rees compromised and agreed to be elected together with Mr Tom Drury as Vice-President. Buist who had been Honorary Secretary for the provisional committee consented to continue in this position. Other members of the first Council were

> *West Rand:* Mr T H Miller (Randfontein Estates), Mr D M Meyers (West Rand Consolidated), Mr M Barcza (Consolidated Main Reef), Mr J L Allen (Venterspost).
>
> *Central Rand:* Mr J L Atkinson (Crown Mines), Mr R Phillips (Nourse Mines), Mr R Campbell-Pitt (City Deep), Mr M Moser (East Rand Proprietary Mines).
>
> *North East Rand:* Mr E C Polkingthorne (Government Gold Mining Areas), Mr N R Bradshaw-Gilbert (Brakpan Mine), Mr S Roberts (Van Ryn Deep), Mr R A H Flugge-de Smidt (East Geduld Mines).
>
> *South East Rand:* Mr O B Swallow (Grootvlei Proprietary Mines), Mr A W T Barenbrug (Vlakfontein), Mr E Kadden (Springs Mine), Mr A A Foster (Sub Nigel).

This memorable meeting was followed by the first Annual General Meeting at Kelvin House on 21st April 1945. All appointments made during the previous meeting were confirmed with the exception of Drury, from Consolidated Main Reef, who stepped down at his own request. Swallow was elected Vice-President in his place.

The first General Meeting took place on Saturday, 7th July 1945. Those present were determined not to be daunted by the leadership setbacks, and debate and discussion was as lively as it had promised to be. Much was said about training and education of ventilation officers. And it was generally acknowledged that officials engaged in this career must have a working knowledge of an amazing variety of subjects. These included basic physics, the principles of airflow, chemistry, mathematics and statistics, mechanical, electrical and mining engineering, law, organization and administration. It certainly was an ambitious and daunting schedule for younger members. Lively discussion also ensued about the possibility of a Government Certificate of Competency with members arguing the advantages and disadvantages with conviction. The meeting ended after a lengthy discourse on the difficulties and problems experienced in the ventilation of mines.

During the first three years the Society kept a relatively low profile and there is little record of its activities. This can be partly attributed to the limit on funds which were solely dependent on

members' subscriptions. Each member at this time paid 10/- per annum which was particularly low even considering the value of 10/- in those days. Unfortunately Council's hands were tied. They could not even consider increasing this sum because members paid the subscriptions from their own pockets and salaries in the profession were unrealistically low at the time. Hence the initial worry of the upper echelons that the Society would become a pressure group lobbying for higher wages was incorrect.

The first roots

Then in 1947, Barenbrug was elected President. At 40 he was a formidable man who was intensely, almost obsessively involved in his career. And it was these obsessive characteristics which saved the Society from floundering on two later occasions. Barenbrug was elected President not only in 1947/1948 and 1948/1949 but in 1955/1956 and 1965/1966. Each of these periods was preceded by the Society's fortunes reaching a perilously low ebb, and members became to rely on Barenbrug to lead the revival. He faithfully rose to the challenge and proved their trust perfectly placed.

Under Barenbrug's regime, the Society was transformed. Regular ordinary meetings were now held at quarterly intervals, and papers of real merit began to emerge. The month January 1948 marked a milestone in the history of the Society. Barenbrug finally achieved his dream. Under his leadership the first issue of the Mine Ventilation Society Bulletin was distributed to members. The appearance was humble; the cover was a simple, yellow roneoed sheet with the name of the Bulletin, the volume number and date inked on with stencils. Barenbrug's ideas and hopes for the Bulletin were summed up in the first editorial

> *'In order to offer to the members of the Society as much information as is possible within the present means of the Society, your Council has decided to issue 'a monthly bulletin. A special technical and editorial committee consisting of six members has been appointed whose principal duty is to scrutinise contributions and issue this bulletin. The first issue lies now before you. It is as yet small and simple, but it is eagerly hoped that it may be the forerunner of a larger and better journal. In order to achieve this object, I make an appeal to EVERY member to support this committee in every possible way. Do not leave the matter over to those who have offered their time freely to take care of this bulletin. Councils and Committees alone cannot run a society. They are mainly its organisers. A Society can only be run efficiently and effectively if all the members show their willingness to help. Therefore send to your Secretary anything that might be of interest to other members of the Society. Small or large papers, questions, problems, solutions, suggestions, and ideas, however small they might be. If everyone is impressed by the spirit of co- operation, then I have no doubt, a successful period lies before us. May this monthly bulletin grow to a journal of which every member can be proud? May it serve as a useful guidance to all those who seek the progress of mine ventilation'.*
>
> *A W T Barenbrug, President*

This first issue also contained the list of Council members elected at the Annual General Meeting on 13th December 1947, and a note on subscriptions. Members were informed that subscriptions paid for the year ending 31st March 1947 would be valid until 31st March 1948. This statement is telling in that it reflects the level of activity of the Society until Barenbrug took the helm.

The second Bulletin opens with a page on Society News. Amongst other snippets it is mentioned that

'Although we know that the Transvaal Chamber of Mines has the 'impurities of air' well under control, we heard that they were unexpectedly caught by the 'impurities in the milk'. The whole staff of the Chamber had to be inoculated against typhoid fever.'

Barenbrug, never losing sight of the original aims and goals of the Society, was determined that the Society would begin initiating projects which would provide members with practical guidance. In March 1948 he proposed the first task. This was to survey all types of ventilation piping and pipe joints used on the Reef. He was quite adamant that all mines should participate to ensure the survey's validity. Besides descriptions of the pipes, mines were asked to include the sizes, types and thicknesses used, the average length, the average volume circulated through them and the average pressure loss (water gauge). He ended his request with the note that a small description of the joint in use together with a rough sketch would complete the job.

And then, just to make sure members realised quite how serious he was about this particular goal, he proceeded to propose a similar survey of all types of ventilation doors. Wryly, he added that he also hoped that in the near future a standard method of testing small fans would be fixed. Members were left in no doubt that Barenbrug would not rest until the Society had made its mark. He expected other people to have the same commitment which drove himself.

Barenbrug's Presidential Address that year covered economy in mine ventilation where he stressed the necessity for the utmost care in selecting mine ventilation schemes. In a style reminiscent of a patient teacher, he explained that assuming all technical and engineering costs can be met; the ultimate mining depth depends mainly on two factors - grade of ore and working costs. He showed that the economic ultimate mining depth is not necessarily constant across the whole Reef, and that reduction in grade and increase in cost both reduce the economic mining depth. Cost-factors he reiterated time and again were particularly important on the Rand which was vulnerable to fluctuations in working costs and therefore all measures taken to reduce costs would be rewarded by a considerable extension of the life of a mine. He painstakingly explained in the most simple terms the relationships between output and environmental conditions, and wet-kata and air circulation. Finally he covered economic air velocities, fans, the distribution and control of air, ventilation of development ends, ventilation of stopes, and conditioning of air. His purpose in the address was clear by his last sentence

'If the outlines given in this paper can serve as a guide to you in your mine ventilation planning, then the object of presenting this paper has served its purpose.'

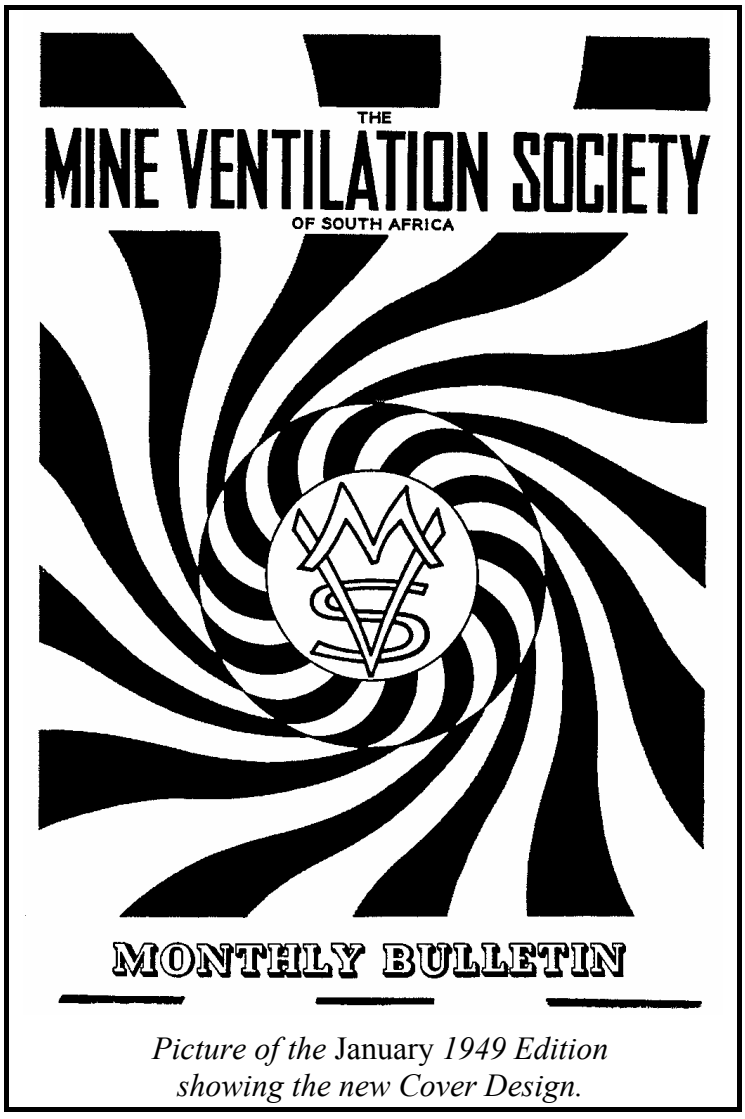
Response to the survey on pipe jointing was proving very disappointing a month later. Barie and the editorial committee were clearly angry about the lack of response and their frustration about the apathy of members was borne out by statements in the April editorial. However still refusing to be daunted, they tried to persuade members to co-operate by once again pointing out the advantages to be gained from such a survey. There was however an edge to the tone of the editorial which was written in an authoritarian style.

'An appeal was made in the March issue of this bulletin to supply the editorial committee with the type of joint in use on YOUR mine together with a small description. So far the response has been very disappointing. Everyone must agree that it is almost impossible for the editorial committee to gather all the necessary information unless each member co-operates. Therefore, in order to make this survey a success an appeal is made to YOU. Take up your pencil and draw a rough sketch of the joint in use on your mine and give us a small description of it. DO IT RIGHT NOW……..It is your duty to report this leakage.'

New front cover for the Bulletin

Council had been deliberating a front cover design for a few months. Eventually it was decided to feature a competition in the Bulletin with a prize of 3 guineas being offered to the winning entry. A consolation prize of 20/- was mentioned but there was a proviso - only if the entries were of sufficient merit. The winner of the competition was Mr Bradshaw-Gilbert from Brakpan Mines, and the design first appeared on the cover of the January 1949 issue. No consolation prize was awarded.

It was an inspired design with a clear message. Bradshaw-Gilbert explained that he chose a fan as the overall concept as this symbolised ventilation. The letters MVS in the centre symbolised the Society which being the core of the profession, held it together. Finally the rays indicated the radiation of knowledge from the Society.



Picture of the January *1949 Edition showing the new Cover Design.*

In the Annual Report from Council in June 1948, satisfaction was voiced about the marked revival of Society activities. Barenbrug informed those present that membership was now 68 full members and 48 associates making a total of 116. He felt, however, that there was still room for expansion and that, in the near future, an extensive campaign would be launched to draw every eligible person into the Society. With some pride, he also announced that the Government Mining Engineer had no objections to his staff joining the Society. Clearly it would add to the prestige of the Society if Inspectors of Mines became members.

Conversation also centred on the problems of attracting promising young men into the profession. Barenbrug bemoaned the fact that the discipline had never attracted many intelligent young men but his situation was being aggravated by more experienced personnel being enticed away by lucrative positions elsewhere. He also regretfully acknowledged that although the importance of ventilation was recognised by some, it was regarded as a necessary evil by others, and it was therefore of utmost importance that ventilation officers be given every encouragement possible. In his forceful manner he concluded that ventilation officers should stand together.

> *'A lack of unanimity of expression is a sign of weakness, which your Society should try to eliminate as much as possible. Standardisation is possible in many subjects and it should be a major object of the Society to achieve this.'*

Nineteen forty-nine began on a positive note. The Bulletin's new cover appeared for the first time with the design spanning the whole page. Other improvements were the heavy paper on which the cover was printed, and the use of green as the dominant colour. Spirits were high and the editorial

was written in a positive tone. It ended with the motto chosen for the year -
ex unitate vires - in unity lies our strength.

The Bulletin was still being produced by the small but dedicated editorial committee. Resources and funds alike were limited. Luckily the Chamber supported the Society and respected the headway which had been made. A blind eye was turned to the hours spent during the day preparing the Journal, with typing and printing facilities generously being made available.

In March 1949, Mr Willie le Roux, who was known for his practicality, defied conventional mining practice by introducing to members the concept of an 'air-recirculator' when in a tight spot. He himself had used it when trying to ventilate a development end which was too small to accommodate a ventilation duct. Another controversial comment made by le Roux was that the re-introduction of return air did not necessarily increase the dust content.

Twin haulage development

Meantime activity in the mining industry was expanding, this time into the Orange Free State, Klerksdorp and the West Wits line. Concern was being expressed about the apparently steeper geothermal gradients being observed in the new mines opening up in the Free State, and ventilation specialists were engrossed in trying to devise new or improved methods of cooling mines and purifying air. Work was also being carried out in the design of shafts and underground airways to give the maximum air quantity with the minimum resistance.

Responding to these dilemmas, the Mine Ventilation Society invited Mr H M Forrest, the Mine Manager at Western Reefs Exploration and Development Co. Ltd, to address members on recent advances being made in twin haulage development. Forrest addressed the Society at the Annual General Meeting in April 1949. Members were honoured for it was the first time that a mine manager had addressed the Society and the paper given aroused considerable interest. To date the Rand had used ventilation piping or the brick wall partitioning system to form the intake or exhaust passage for the air to or from the working face. But problems were encountered when large quantities of air were needed over long distances in areas where the rock structure was weak. Forrest described an experiment at Western Reefs where the twin haulage method had been applied to overcome these difficulties.

Members were impressed. The new President, Mr R E Campbell-Pitt, who had been inaugurated only hours before, expressed his appreciation for the enlightening address. New ground had been covered at the meeting and this had always been an aim of the Society. Mr Mizi Barcza and Flugge proposed votes of thanks and indicated that members would be particularly interested in the air temperature history, the rock cooling and possible heat transfer between intake and return haulages.

The spirit at the meeting was positive. Campbell-Pitt, an able, energetic man with a great deal of initiative, inspired confidence when he said that he would follow in Barenbrug's footsteps conscientiously. The Society had just been addressed by a Mine Manager on a completely new development in mining, and they had recently been informed that the Chamber had introduced elementary and advanced certificates for ventilation officials. Although the Society and the goals of the profession had not yet been attained, steps were being taken in the right direction and confidence was high that the status of ventilation officials would soon be enhanced.

CHAPTER 3

I think it was Napoleon who said that everything is possible, and probably it is, if we don't count the cost. However, we as engineers are very much concerned with costs, for is it not the very essence of our profession to make for one pound what any fool can do for twenty?

H C Cawood, 1950

The positive spirit of 1949 continued into 1950. The hopes expressed by Barenbrug two years previously in the first editorial of the Bulletin were being fulfilled. The Bulletin was thicker and much improved but more importantly, a constant flow of both practical and theoretical information had been sustained. In only two years it had begun to achieve recognition as an authoritative medium for publication of new and useful information in the profession, and as the volumes and numbers grew it was slowly reaching it's sought after objective. It was becoming known as a compendium of practical ventilation information and consequently indispensable for teaching and reference purposes. Enthusiasm for the cover designed by Bradshaw-Gilbert persisted and in 1950 the cover was printed in purple instead of the green used in 1949.

Shaft resistance to airflow

An issue being deliberated at this time was the resistance of shafts to airflow. The cost of providing air to workings as mines went deeper was becoming an aspect of concern and more precise knowledge of the resistance was necessary. In February 1950, Mr L B van der Merwe from Van Dyk Consolidated Mines Ltd presented the first paper on this topic to members. It resulted from an experiment to determine the effects of streamlining shaft buntons.

The shaft which instigated the experiment was elliptical with a major axis of 35 ft and a minor axis of 15 ft. It was sunk from surface in two stages to a total depth of 8 000 ft and was to be the sole entry to a deep level mine where stoping would take place, on average, 7 500 ft below surface. This shaft was obviously to play an important role in the resistance of the whole mine as it would be required to handle large quantities of air. The shaft was lined in its entirety with concrete behind smooth faced precast bricks which Van der Merwe felt 'left nothing to be desired'. Experiments were then conducted at East Geduld Mine in one of the main upcast airways where conditions characterised those of a 'natural wind tunnel'. The buntons used were 8 inch x 10 inch I girders or RSJ's spaced 10 ft vertically and 6 ft 8 inches horizontally.

Members applauded Van der Merwe enthusiastically when he finished his presentation. His conclusions gave greater insight and support to what had been regarded as conjecture in the South African mining industry. The results demonstrated that timber spacing played an important role in determining the resistance of a shaft, and that the closer the spacing, the greater the overall resistance. He showed that shock losses due to timber were not merely proportional to the total frontal area of timber exposed to the air flow but were also a function of the timber spacing. Also he emphasized that the geometric shape of the buntons played a large part in the shock losses caused by the buntons. Finally he argued that the results had clearly indicated that streamlining loses its effectiveness with very close timber spacing. Greater benefit could be gained by placing continuous bratticing between the timbers.

Flugge was particularly impressed. He awarded Van der Merwe full marks. Since 1927, when he had visited the Aero-Dynamical Institute in Goettingen, he had been fascinated with the

possibilities of streamlining. It was here that he saw demonstrated a pear shaped streamlined body that offered the same resistance in an air stream as a disc of one-eighth the diameter or one-sixty fourth of the cross-sectional area. But although he had often advocated the principle of streamlining buntons, he had never had data at his fingertips to support these recommendations. He credited Mr Georges Braunger, an excitable enthusiastic Frenchman who had been living in South Africa and working as Ventilation Officer at East Geduld, as being the first to suggest using an air measuring station underground as a test tunnel. Pressure differences had been measured for both plain and streamlined girders but it had been Van der Merwe who had evolved a method of directly measuring the thrust produced by the airstream on a girder or a series of girders. Flugge felt that the most important conclusion of Van der Merwe's presentation was that the resistance of the first girder was considerable, that of the second considerably less, tapering off until at the fifth or sixth girder the resistance was constant for all successive girders. He was also impressed by the recommendation that the rounding of the nose should have a greater effect than the rounding of the tail and that closing in the sides of the girder would have the reverse effect to what was expected.

Mr J de V Lambrechts seconded Flugge's Vote of Thanks. Then the Group Ventilation Officer at Anglo American Corporation, he was well known for his keen and enquiring mind and tenacious personality. Lambrechts always had to be convinced.

True to form on this occasion, he stood up and congratulated Van der Merwe on an excellent paper. But he was sceptical about the accuracy of the results. He welcomed the development calling it 'a rational expression for the shock losses of buntons or other beams in shafts'. The problem was he could not help but believe that Van der Merwe had substantially overestimated the total resistance of airflow in the type of shaft being considered. Lambrechts believed it could have been as much as by 30%. The other criterion which he raised as being of utmost importance was whether or not the cost of streamlining would in due course be more than offset by the value of power savings. Finally he expressed interest in the finding that shock-loss is reduced when the front end of the beam is rounded, and wondered whether there would be any merit in deliberately rounding the upper face of shaft timbers. This could be done at the saw mills before installation in the new timbered shafts.

Members left the meeting at 11h00 on that Saturday morning. The last one and half hours had indeed been interesting. If Van der Merwe was correct, streamlining shaft buntons could go a long way in reducing the cost of supplying large quantities of air to deep level workings. The research certainly seemed to have merit. Flugge had been very enthusiastic and even Lambrechts, in his own way, had been impressed with the findings. The initial indications were that this experiment would make its mark.

The Society in 1950

The Bulletin continued to arouse interest with the coup of 1950 being the appreciation expressed by Prof. Guy van Eschbroek. He was at that time Professor of Mining at the University of Ghent in Belgium and ranked among the foremost experts in the world on the analysis of airflow in mines. And so when he contributed valuable comments on articles published in the still roneod Bulletin and promised to give his views on other fundamental problems, the Editorial Committee reacted with delight and pride. It was a sure indication that the Bulletin was beginning to receive worldwide recognition as an authoritative and reputable mouthpiece for the profession.

In the light of these successes, Campbell-Pitt still believed that the Society could rise to greater levels and at the Annual General Meeting held in May 1950 expressed his disappointment at the lack of response from members.

'The Executive Committee of the Council, whose function it has been to organize all

the activities of the Society have been hard pressed to keep the Bulletin up to the standard set last year. Many appeals have appeared under 'Editorial' but the response has been disappointing.

Frequent interchange of knowledge between ventilation officials is the underlying idea of your Society, and it is most important that all members bear this in mind and come forward with their contributions.'

Campbell-Pitt was echoing the sentiments expressed time and time again by Barenbrug. Although spoken less forcefully, the message was clear. There was a strong and dedicated inner circle that was carrying the brunt of the load and working ceaselessly to both maintain and improve the image of the Society. These men recognised their own fallibility and sincerely wanted the co-operation of all members as it was through new blood that the Society would be boosted to its next level.

In 1950 the Bulletin had reached a circulation of 203 copies. Unfortunately one third of these were distributed free of charge but it was felt that in time, this gesture of goodwill would pay its dividends.

Members: 70 copies (subscribed), Associate Members: 49 copies (subscribed),
Mines and other subscriptions: 14 copies (subscribed),
Mine Managers: 58 copies (gratis),
Group Libraries and Technical Societies 9 copies (gratis),
Overseas Universities 3 copies (gratis).

Membership figures in 1950 had shown an encouraging increase from 91 to 119 members. Campbell-Pitt was pleased but once again he felt that more effort could be made in recruiting and attracting new members.

'This increase reflects a satisfactory step forward, but your Council feels that as there are about 160 men employed in ventilation on the Witwatersrand and Orange Free State mines, plus others on other mining fields, there is still room for improvement. Once more an appeal is made to all to assist in bringing along new members so that ultimately we will have 100 per cent membership of all ventilation officials.'

Campbell-Pitt, being the President for the year 1949 – 1950, was particularly aware of the enormous work load the Bulletin posed for the Editor. And he had only praise for Solly Rabson, the man who had ably and enthusiastically not only produced the Bulletin on schedule every month but had personally sent it out. Rabson, or Solly to his friends, was however known to be solid and reliable, never being anything but friendly, kind and helpful and always willing to have his brains picked by those with technical problems. The Bulletin certainly owes a large part of its early success to both Rabson and Barenbrug whose combined energies and determination managed to secure its position in the ventilation fraternity worldwide.

Also during this year Mr J Buist, known as Sam, announced his resignation from the Society, and his retirement from the Industry. Buist had been one of the early pioneers belonging to the early Provisional Committee set up in 1941 to investigate the feasibility of a Society. From those early days he had assumed responsibility as Honorary Secretary and had continued in the position after the Society had been officially formed. A shy and reserved Scotsman with a bristling grey moustache, he accepted the thanks proffered by Campbell-Pitt for his services in his normal unassuming style. He did not fully realise the extent to which his energy and dedication would be missed and how difficult he would be to replace.

Duties of the ventilation officer

Inaugurated as President at the 6th Annual General Meeting of the Society held on 8th May 1950, Mr Jack Drummond began his term of office on a positive note. The topic he chose for his

presidential address was close to the hearts of every member. It detailed the duties and organization of a ventilation department and was a topic he was well qualified to address, being the Chief Ventilation Officer at Grootvlei. In introducing his topic he made the pertinent remark

'The development of ventilation departments has not been uniform throughout the Reef, and the status achieved has been more or less on a personal basis, depending on the ability, personality and qualifications of the ventilation officer or dust inspector, as well as the nature and magnitude of the problems on the particular mine.'

Spoken truthfully, Drummond knew from experience that he had achieved his position in the mining industry through persistence and dogged determination. He had joined the mining industry in 1936 at the age of 21 as an official learner at East Rand Consolidated Ltd. By 1945 he had obtained his Mine Manager's Certificate and had held positions in the Ventilation Departments of East Geduld Mines Ltd., Marievale Consolidated Mines Ltd. and Grootvlei Proprietary Mines Ltd. He was to be awarded his Advanced Certificate in Ventilation later in the year of his presidency of the Society.

In his speech he outlined the main categories of responsibility for ventilation officers in the Witwatersrand. These were * Dust Inspector * Dust Inspector plus Dust Suppression Adviser * Dust Inspector plus Dust Suppression Adviser plus Ventilation Adviser * Dust Inspector plus Dust Suppression Adviser plus Ventilation Adviser plus Ventilation Executive.

Of the four categories, he believed that the last was the 'best suited to meet the ventilation requirements of the Free State goldfields where it is thought ventilation problems will be more severe than those on the Witwatersrand.' He then proceeded to detail all the duties demanded by the functions outlined in his fourth category. They were impressive in terms of both length and degree of responsibility.

Mr Misi Barcza, a leading light in the profession, proposed the Vote of Thanks and reiterated that the subject was of vital importance to all ventilation officers. He agreed with Drummond's comments that the current status was being achieved through personal ability and, on a positive note, added

'Since Ventilation Engineering is a new branch of mining, such looseness in status is difficult to avoid, but it should make us feel that it has at least the advantage of making our status to a large extent dependent on our own individual and collective efforts.'

Regarding Drummond's assertion that the ventilation officer be given an executive authority, Barcza held a different viewpoint:

'...On some mines this system works satisfactorily, and the Ventilation Officer is in charge of the installation and maintenance of some of the equipment. I am of the opinion, however, that the Ventilation Officer should function in an advisory capacity only. If he has - and he should have - enough tact and personality he should get sufficient co-operation from the mining executives to ensure that all ventilation appliances are installed and maintained sufficiently. If the Ventilation Department has executive duties and responsibilities, it may be difficult to draw a sufficiently well defined dividing line between the Mining and Ventilation Departments sphere of activity, and some overlap or divided responsibility may cause friction. However one cannot be dogmatic, and the set-up of the Ventilation Department has, of course, to fit in with the general organization of the mine.'

Understanding the effect of heat on man

Since the first recorded case of fatal heat-stroke on the Witwatersrand gold mines in 1922, concern had been expressed about the effects on personnel working underground in hot, humid conditions. Five years later the registrar of deaths attracted the GME's attention to the not so infrequent number of seemingly avoidable deaths from heat-stroke occurring on the Rand. Investigations in 1931 showed that 92 mineworkers had died on 11 mines since 1924 with 67 succumbing to heatstroke while working in places with wet-bulb temperatures 30°C or over and 81 had died within their first four shifts underground. The problem was exacerbated as the mines grew deeper and the mining industry expanded into the Orange Free State where geothermal gradients were higher than those recorded on the Witwatersrand.

In the early 1950s the effects of the thermal environment on man were still not fully comprehended, and it was a topic which members were anxious to understand. In September 1950, 83 members and visitors gathered at Kelvin House to listen to a lecture presented by Dr C H Wyndham on the "Human aspects of the environment in SA mines".

Wyndham in his introduction summed up the problems posed at the time

'At first sight it may appear that the problem of the effects of heat and humidity on mine labourers should be capable of solution merely by carrying out a careful environmental survey to determine whether conditions are sufficiently severe to constitute a physiological problem, and then to apply the results of investigations made overseas. Unfortunately it is not as simple as that. Most of the overseas work was done on subjects of European origin. Manifestly these results cannot be applied to Africans without rigid scientific tests to compare their responses to those of Europeans. Furthermore, even if our experiments show that there is in fact little difference between the responses of those two racial groups, there is another limitation. No information is available on the amount of energy expended as metabolic heat, in various mining operations by Africans in South African mines.

For example, there is fair agreement that when men are acclimatised they are capable of relatively efficient work at an energy expenditure of 200 to 300 Kgcal/hr (i.e. 800 to 1200 BTUs/hr) up to a limiting environment of 91°F saturated air temperature, and a mild wind velocity of about one to two hundred feet per minute. If, in fact, our African mine labourers are shown to work at twice this rate of energy expenditure, then clearly the tolerance limit in the miner will be much lower. Also, mining introduces problems which were not investigated during the war years, such as the probable higher rate of metabolic heat production when men work in awkward positions such as in narrow stopes, and also exposure to heat for eight or more hours without established breaks for rest or food.'

This lecture was very comprehensive and covered the basic principles of heat exchange between man and the environment (radiation, convection and evaporation). Empirical methods for measuring the cooling power of the environment, biophysical methods for modelling heat exchange processes within the human body, working efficiency, and acclimatization and tolerance limits were also detailed. In conclusion Wyndham stated

'Some areas in our hotter mines have saturated temperatures above 91°F, and it would be interesting to see whether Africans have a higher limit of toleration to heat than Europeans. We also need to investigate the relative rates and ability of different tribal groups of Africans to achieve acclimatization; see whether the upper limits of tolerable heat can be raised in the African by applying more recent methods of acclimatization and, in view of the fact that the African mine labourer is largely migrant, investigate the rate at which he loses acclimatization.'

Members were fascinated by what Wyndham had told them. Debate was heated after the lecture

not only because of the interest aroused by the paper but because the issue of racial difference and superiority was in the 1950s both topical and controversial throughout the world. People tended to hold strong views both for and against emerging evidence that the difference between races was purely in physical appearance. Because of Caucasian dominance in world affairs and activities it was a difficult concept for many to accept that whites were not necessarily inherently superior to other races.

The first man to congratulate Wyndham on the lecture was Rees who proposed the Vote of Thanks. Speaking from a ventilation viewpoint he remarked

> *'It seems that we all possess in our bodies a conditioning system consisting of heat generators, a vast network of conductors or pipes for conveying the heat, regulators for controlling the distribution of the heat, means to control the heat supply, means to insulate the body from cold and, alternatively, means to transfer heat to the surface of the body to increase the coefficient of heat exchange between the body and air, means to provide evaporative cooling, means to regulate the evaporative cooling and means to step up the efficiency of the whole mechanism. What a dream mechanism for a refrigeration engineer. It only astonishes me that the human body does not produce ice in suitable quantities when the need arises!'*

After Campbell-Pitt had seconded the Vote of Thanks, Dr A O Dreosti the pioneer of acclimatization in South Africa, who had also been invited to the meeting, rose and commented on some of the points raised by Wyndham.

> *'He (Wyndham) mentions that I have stated that the native mine worker can work in a temperature of 95°F saturated. Of course, this only applied to the well acclimatised natives who worked in our heat chamber for a period of an hour with a short break halfway. I am not prepared to say what would happen if they were allowed to work in the same underground conditions for a full shift of eight hours.*
>
> *Dr Wyndham also mentions that mine natives do 28 days on the surface before going underground. I am afraid he has been misinformed in this matter. Only about 10% of our natives do any surface work before going underground; the remaining 90% go underground on the day after their arrival at the mine. The natives who do preliminary surface work are "tropical" natives and the period varies from 7 to 28 days depending on the tribe i.e. their source of origin. The surface work is given for medical reasons and for acclimatization to our surface conditions, not as a heat stroke preventative.'*

Importance of airconditioning

In 1935 Mr Krynauw in his presidential address to the Association of Mine Managers said

> *'From Randfontein in the West to Sub- Nigel in the East - the distance around the reef basin - assuming a modest percentage payability of the ore, for every 1°F increase in temperature that we work to, or put in another way, for every additional 200 feet in depth, it is estimated that there is a recoverable gold revenue to the value of no less than R20 000 000. This figure is therefore the value to this industry and to the country of a saving of 1°F in mine air temperature.'*

This extract was used by Barenbrug to introduce his paper called 'Air-conditioning in the mining industry' to the first meeting between the Society and the Institution of Heating and Ventilating Engineers in October 1950. The meeting was the fulfillment of one of Barenbrug's dreams. He believed that the necessity to provide cost-effective air conditioning to South African mines was such a pressing problem that all outside input could only be of value. His speech was as excellent as his reputation. It covered all aspects of the topic as simply as possible and was graphically

augmented by numerous drawings. Barie loved to present work graphically and was one of the first in the profession to understand the advantages of this method of presentation during public speaking.

Mr H C Cawood, Chairman of the Institution of Heating and Ventilating Engineers, was impressed with Barenbrug's speech which he described as objective and showing clarity of thought. He was particularly struck by the scale of air conditioning in the mining industry.

'We as heating and ventilating engineers concerned with buildings, think in terms of thousands of cubic feet of air per minute and hundreds of tons of refrigeration, Mr Barenbrug talks of millions of cubic feet of air per minute and thousands of tons of refrigeration.'

In an attempt to provide some practical solution to the problems mentioned by Barenbrug he suggested that 'heat pumps might be employed in winter to use the heat from mines for heating buildings in Johannesburg.' He wryly concluded however that 'the difficulty is what to do with the heat during the summer when no heating of buildings is required.' Barenbrug's answer to this statement was that, from an economic point of view, the heat pump could not be adopted because coal was relatively cheap on the Rand and water expensive.

Finally he asked Barenbrug

'whether advantage is to be gained by using dehumidified compressed air for ventilation at great depths?'

Barenbrug replied that

'the use of devaporised compressed air certainly has advantages in that the cold exhaust air cools the atmospheric air instead of heating it up as is the case when using electric machinery. However the use of devaporised compressed air as a means of cooling air is expensive.'

An unavoidable consequence of men united through similar professional goals is professional competitiveness. Normally well under control between members of the Society, it was very apparent on this occasion probably because the topic Barenbrug chose encompassed most aspects on which various members thought they themselves were the experts. Debate was fairly heated and because of the characters involved, amusing and entertaining for onlookers.

After Cawood's mild and complimentary Vote of Thanks, Lambrechts seconded the Vote of Thanks by complimenting Barenbrug but at the same time being fairly critical of what had been advocated.

'Mr Barenbrug has explained to us with the aid of impressive figures that mining is going to be an unbearably hot occupation at depths greater than 8 000 ft or thereabouts, if something drastic is not done about it. I feel sure, however, that Mr Barenbrug is not one of those engineers whom he refers to as looking into the future with dismay'

The reputations earned by the two men were at opposite ends of the spectrum with Barenbrug leading the theorists and Lambrechts being the champion of the empiricists.

On the issue of whether large cooling plants should be on surface or underground, Lambrechts begged to differ from Barenbrug although conceding that they both agreed that

'any mine cooling installation should be looked upon as something supplementary to good ventilation practice, dry intake airways, concentrated mining, and should not be regarded as a shortcut means of counteracting poor practices'. Lambrechts supported underground plants but Barenbrug was adamant. '……My own opinion is that on average our mines are too vast in area for a successful and economic application of cooling plants. Consequently cooling plants should be used as a last resort only.'

Regarding Lambrechts favouring underground cooling plants because of their higher positional efficiency, he retorted that it might not be realised that

'The co-efficient of performance of an underground plant is lower than the COP of a surface plant due to the higher condenser water temperature.

The positional efficiency of an underground plant is, at the point of underground cooling, obviously greater than the positional efficiency of a surface plant. However, the positional efficiency of an underground plant deteriorates far more rapidly than that of a surface plant. In my opinion, underground refrigeration and dry mining is just as wrong as surface refrigeration and wet mining.'

Conversation then centred on acclimatization. In the light of prevailing opinions worldwide on the differences between blacks and whites or the possible similarities, research and advances in this area was internationally hampered by protagonists who sincerely believed that blacks were physiologically and biologically different from whites.

'Most heat stroke cases occur within the first few days of a labourer's arrival in a new working place on a new job i.e. before he has reached the stage of being able to do his job without thinking. A European is most likely to succumb to heat when he starts worrying or loses his temper. I have long felt that we should have two separate scales, one for Europeans and one for Natives due to the different rate of heat absorption or emission between white and black surfaces. It is also possible that the difference in nervous make-up of the individual would influence the value of such readings.'

Barenbrug's retort to this last statement was that 'there is not much difference in normal blood pressure.'

And so 1950 drew to a close. The direction of the Society had changed course. Instead of focusing on the more mundane issues of getting the Society to stand on its feet, members were now freer to address the major issues facing ventilation engineers. The envisaged dream was becoming actuality. The Society had begun to earn itself the reputation of being a platform where men of calibre could argue collectively on the issues facing the profession.

Links had been firmly established with related disciplines albeit through admiration and respect for certain personalities but, as succinctly put by Cawood, the sphere of the Society's activities embraced *'a field of most fascinating study for our young engineers.'*

CHAPTER 4

Are we advancing at all in methods of improving our treatment of dust samples?

J Lawrie, 1951

Sampling - trying to get one step forward

In the 1950s the industry was still reeling under the long and drawn out controversy between the experts on the best known method of dust sampling. Argument was vehemently heated and two very definite camps had been formed. One group believed fervently in the use of the thermal precipitator and the other, as obsessively, in the konimeter and the acid-treatment of konimeter slides. The Society found itself in the middle as both sides formed part of the inner core of its membership.

The earliest method of dust sampling in the Witwatersrand was the sugar tube gravimetric method which measured the mass of the dust. It was however abandoned in 1938 because, among other reasons, it took no account of particle size. Current thought ran along the lines that information received from the mass of dust just did not match up to that of particle determination. The other reason was also quite simply that the levels had been reduced to such a degree that the mass of the dust in the sample was too low to measure accurately with the sugar tube.

In 1916, the konimeter which counted the number of particles, was developed to supplement the sugar tube. Over the years improved versions of the konimeter were developed in line with the initial principles. The problem as one writer once put it was 'little of the trouble in routine work arises in connection with the taking of the sample; nearly all arises in connection with the sample once taken.' This was very true and gave birth to the controversy which lasted some 20 years until 1959.

The final modification in the technique of using the konimeter was dark-field microscope counting after ignition and acid immersion. Then in 1936 the thermal precipitator (TP) was introduced as a sampling instrument, specifically for research purposes. Within months pandemonium broke out. Counts of several thousand ppcc were measured during wet drilling operations as opposed to a few hundred ppcc recorded by the konimeter. After much thought ventilation officials were ordered to stop acid-treating konimeter slides. Then, following another investigation, it was found that a larger proportion of the count on the slides was derived from mine water salts. More arguments followed and acid-treating was again adopted, this time for both methods.

By now the dust campaign was temporarily lost. Mining men lost patience and decided to get on with their priority which was mining not dust. The dust experts continued the debate although in principle accepting the advantages and disadvantages of each method. In 1951 Rabson was elected president of the Society. A renowned expert in the field of dust, ventilation and dust collecting equipment, his appointment was a meritorious reward for his dedication to the Society since its early years. The topic he chose for his Presidential Address was what he knew best; observations on dust.

A supporter of the use of the konimeter as a routine dust sampling instrument because of its rugged construction and simplicity of operation, he recognised the value of the TP in terms of its

sampling efficiency and accuracy. But *'the thermal precipitator is not very satisfactory for the sampling of coarse particles, particularly in rapid currents'* because of particle inertia caused by the fact that the direction and rate of sampling were not dynamically correct. The other problem with the TP was that acid treatment caused mechanical loss of rock particles, to varying degrees, because the particles were only lightly deposited on the slides.

Nevertheless, in his speech, he went to great lengths to avoid being contentious.

> *'A few (points) may be considered contentious - they are submitted not dogmatically but to indicate possible points of view, to arouse interest, to set off a train of thought in the reader's mind which may lead to the final correct solution, perhaps very far removed from the original opinion.'*

He explained that it is literally universally accepted that the constituent of dust that causes silicosis is free silica and that medical men believed

> *'The action of quartz particles in the lung is exerted by solution of silica from the particles, but this solubility theory shows many anomalies.'*

After detailing some of the anomalies he continued

> *'Some of the strongest evidence in favour of the solubility theory is the fact that experiments have shown that the finer the dusts, the greater the effect in experimental silicosis causation. Thus in experiments where equal weights of particles of decreasing mean size were injected in animals, the degree of injury was found to be approximately in inverse ratio to the particle size, or proportional to the surface exposed, which, as an approximation, can be taken to be a measure of the solubility.'*

When discussing solubility and the surface area of dusts he said

> *'The amount of silica that dissolves from an exposed surface of quartz will vary directly in proportion to the surface area. Suppose a large particle or quartz is immersed in a liquid - a certain amount of silica will dissolve from it in a fixed time. If, now, we break this quartz into several smaller particles, the surface area exposed will be increased, and the amount of silica that will dissolve from it in the same time will increase. Thus the smaller the particles, the greater the solubility <u>from the same mass</u> of particles. It is important to note that individually one small particle does not possess a larger surface than one large particle and, therefore, cannot produce more silica in solution.'*

Then when talking about toxicity, he introduced the crux of his speech

> *'It is, however, just possible that the threshold value is one of surface, and not size. .....The effect of the smallest sizes should, however, by no means be minimised. It has been found that the finest particles below 1 micron, although their fibrosis-producing ability does not appear to be strikingly accentuated over that expected from their surface, are extremely active as a tissue poison and cause acute degenerative changes which may have a strong bearing on the production of the disease.'*

Flugge who proposed the Vote of Thanks did not agree with everything Rabson put forward and tried to be as polite as possible.

> *'The scope of this paper is so great that I am only going to touch on a small part of it.....May I be permitted to re-iterate my theory about dust particles and the human lungs. Before air enters the lungs it passes through a filter represented by the nose and the cilia in the bronchial passages. This filter can cope with a moderate concentration of dust and little if any enters the lungs. The filtration process can get*

overloaded and break down in two ways: Firstly, when the person is panting i.e. breathing as much as 8 times as fast as the normal rate of breathing, by breathing through the mouth and bypassing the nose; Secondly, by entering a dust cloud. ..... Referring to ultra-fine particles 0.1 micron and less, I believe they are exhaled as easily as they are inhaled and I firmly believe they are harmless to the human body.'

He continued using the research of a Doctor Moir as back-up evidence for his own belief about the cause of silicosis. In essence this was that if you stopped mining before you had accumulated 1.5 grams of dust in your lungs you would escape silicosis. It really was quite simple and he had proof.

'My theories are based on many such observations over along period, and it would take a might lot of pathological evidence to dislodge them.'

When Flugge believed in something, that was exactly what it took; a lot of evidence. In his dealings with people he displayed similar traits. One behaved according to etiquette and if these customs were not observed he became extremely annoyed. An example was when the King and Queen of Great Britain visited South Africa he presented them with a book he had written called 'Flowers by the Roadside'. They behaved with perfect decorum and wrote a polite reply thanking him for the gift. He then presented D F Malan, Prime Minister of South Africa, with a copy. On receiving no reply, he was fuming and sat down and wrote a letter to Malan complaining about this discourteous oversight.

Lambrechts then joined in the discussion. He was one of the most authoritative and respected figures worldwide in the field of dust. The topic of his MSc thesis had been 'A critical review of dust sampling methods in the Witwatersrand Gold Mines' which also won him a gold medal from the Chemical, Metallurgical and Mining Society of SA in 1940.

He agreed with Rabson

'Taking everything into account, it would appear that already a fairly strong case can be made out for the choice of surface area as the best criterion for silicosis risk, rather than number or mass. If this should prove correct, then it means that we are erroneously placing far too much emphasis on the very finest particles which can be seen through our standard darkfield konimeter microscope or high power TP microscope; and the electron microscope will err further still if one should assess air dustiness by counting with this microscope.'

The problem was that although there was general agreement throughout the world that particles larger than 5 microns were not important, neither the lower limit nor the sampling instrument had been determined. But advances were being made slowly. A number of members of the Society were among the most authoritative in the world on the topic and they were beginning to discuss the issues more logically than before, and with less irritability. They accepted the limitations of both the konimeter and the TP, and agreed that a new dust sampling instrument would be desirable. They were nearing a turning point reaching beyond relying on number of particles. Not quite yet on the right track, the Society was giving them the platform needed for brainstorming.

Dust extraction

Besides the dilemma of dust sampling, dust also had to be filtered and extracted from the workings. In 1951 Braunger presented a paper to members alerting them to the dangers of atmospheric pollution and smog. Although the Witwatersrand gold mining industry had made considerable progress in protecting its own workers by using exhaust systems to remove dust at its source or diluting it to keep contamination to acceptable levels, *'there is still some degree of*

uncertainty as to when dust thus removed may be delivered to the atmosphere, or when and to what degree it should be done'.

He explained to members that surface plants had to collect greater quantities of dust, comparatively larger in size. Consequently the required equipment was of a fundamentally different nature. He outlined the advantages and disadvantages of the types of filters available and introduced the concept of multi-cyclone plants which he believed were able to attain efficiencies of 95% and more, according to the size of the dust collected, and retain this efficiency independently of dust load. He believed that more and more attention was going to be focussed on surface plants and ended his presentation with the challenge

'Here is an opportunity for the Ventilation Officer to put his specialised knowledge in the service of complex filtration problems.'

Members probably for the first time agreed with everything that was said. Barenbrug praised Braunger and was particularly interested in the design of multi-cyclones.

'An interesting new development in the design of multi-cyclones is mentioned by the author. As Mr Braunger explained in his paper, the filtration efficiency of the ordinary cyclone drops with decrease in particle size and increase in cyclone diameter. The evolution of a number of smaller cyclones of smaller diameters placed in parallel was thus a logical development.'

Rabson was equally complimentary.

'Mr Braunger has done a service in drawing attention to the methods of dust separation which have been successfully used for similar purposes in other industries and which, from an economic and operating point of view, are often more suitable for these purposes than our specialised underground filters.

And of the sampling technique used in these extraction plants he said

'A feature of Mr Braunger's work is the use of the gravimetric technique in sampling these extraction plants and the determination by weight of the size distribution of the dust. I am in full support of this method of sampling for the purposes mentioned by the author.' 'In conclusion, I would like to state my appreciation of Mr Braunger's paper which I think will stimulate many to think of other dust extraction methods besides flannel and sawdust.'

The flannel bag had in fact been popular for quite a number of years. One of the champions of their use was an ex-professional racing driver from the U.K. He had come to South Africa a few years previously and joined the Ventilation Department of a mine. Obsessed with achieving the highest degree of mechanical efficiency from his car, he removed the manufacturer's air filter and replaced it with a flannel bag claiming he could drive far further than with the standard filter. Members were impressed but sceptical, and waited patiently for it to jam in the fan belt. It never did.

In October 1951 Mr H E R Rayner presented the first paper on what was to become the Rayner filter. Instead of using flannel to construct the bag, Rayner used blanketing filter tubes which consisted of a mixture of horsehair and other materials giving them a rough long-haired furry appearance. The filters were self-cleaning and were to be vogue on mines for quite some time. Members of the Society were, besides the personnel at Vogelstruisbult G.M. Areas Ltd, the first to be informed about the development and in this way instrumental in it becoming accepted within the mining industry.

CHAPTER 5

If the tools *are blunt, let* us *sharpen them.*

R Gorges, 1952

Underground refrigeration

A technique that had been used earlier but was expanded on in the 1950s was underground refrigeration. Surface refrigeration plants, mostly ammonia units of some 1 700 tons of refrigeration, had been in use since the 1930s on several mines notably Crown Mines, City Deep, ERPM, and Robinson Deep. While these plants were very efficient, the obvious disadvantage was that all air was cooled on surface.

In order to avoid this disadvantage, environmental engineers were beginning to consider the siting of refrigeration plants underground. However there was much reluctance to using ammonia underground because of its toxic properties. And, unaware of possible dangers to the ozone layer, the chlorinated hydrocarbon refrigerants (the Freons) were becoming more accepted as a safer alternative and this added impetus to the decision to start using underground refrigeration.

In January 1952, Misi Barcza presented the first paper to members on the use of upcast air to cool the condenser water of an underground auxiliary cooling plant. The thrust of the paper was that Consolidated Main Reef Mines and Estates Ltd had resorted to using upcast air to cool recirculated condenser water. The experiment had taken place because the mine needed to sink a deep exploratory winze and a development drive. They installed a 30 refrigeration tons cooling plant where, instead of returning the condenser water to the main circuit and then pumping it to surface, they recirculated the condenser water after cooling it with upcast air. Barcza concluded his presentation saying that

> *'The results confirmed findings already obtained on Crown Mines and ERPM that auxiliary plants can effectively cool selected working places and make conditions suitable for performance of work where, without a cooling plant, efficient work would not have been possible, if indeed any work at all were possible'.*

He added that

> *'With a forcing system of ventilation the useful range of auxiliary cooling plants is great and only in special circumstances would it appear justified to move the plant ahead as development advances. Even in their present form, the commercially available small cooling plants are suitable for underground installation, although minor improvements will be incorporated in future plans. Water supply difficulties can be overcome by cooling and recirculating the condenser water. The disposal of waste heat is (however) the greatest practical difficulty with underground cooling plants and each case will have to be treated on merit. Layouts can however be made rather flexible; and by using balanced head condenser water circuits or balanced head cold water circuits, it should be possible to extend the scope of auxiliary cooling plants.'*

And so Misi Barcza, who was already very much one of the leading lights in the Society and field of ventilation, introduced to members the dual concept of spot cooling in development ends and the use of recirculated condenser water for rejecting heat from underground cooling plants.

The second landmark paper was presented by Ralph Gorges on 30th October 1952 at 8pm during the third Joint meeting of the Society and the Institute of Heating and Ventilating Engineers. The meeting was well attended by about 70 people and was indicative of the growing support and interest being expressed in the Society's sphere of activities. The slightly built, underground manager of ERPM who had also been the Chief Ventilation Officer, took the platform and in his genuinely cultured and charming manner delivered his paper called 'Air conditioning mine air, and some experiments in connection with deep level ventilation'. But it was not his charm that won him the admiration of the vast majority of those present but more the far-reaching wisdom of his paper. His keen mind, superior intellect and dedicated approach won the day.

Gorges began his speech with a brief historical review and said

'While it is impossible to name all who have contributed to our knowledge, one must single out such men as Augustadt, Barenbrug, Campbell-Pitt, Carleton-Jones, Carrier, Davies, Dobson, Dolan, Elsdon-Dew, Foraker, Jeppe, Jones, McIntyre, Malcolm, Ranson, Rees, Richardson, Spalding, Walker and Walton.'

He then explained in detail to those present why air in mines needs treatment and what was involved in cooling air.

'.....Ventilating engineers who practise on surface are asked to provide safe and comfortable conditions, to make working conditions healthy and attractive, and reduce fatigue, spoilt work and absenteeism. Gases and dust are the main hazards; heat is often not dangerous. In deep mines, however, we are up against all three.

.....Heat we combat by more air, higher velocities, colder air and by acclimatising the workers. Dry mining would make the fight easier, but at present is restricted to having dry, or, more usually, less wet intakes and less wet workings. What is good for dust is bad for heat; heat and humidity are our troubles.

.....The heat itself comes from four main sources, of which surface engineers will readily recognise three. The fourth is adiabatic compression from vertical downcast movement, causing an unavoidable rise in WB of some 2 degrees F per 1 000 ft. The other three sources are heat from rock, from machinery, and from short circuiting.

Rock Heat

.....If the air is saturated it will not pick up more moisture unless it is heated; if it is heated without adding moisture it acquires sensible heat which then provides the latent heat of evaporation when moisture is met: evaporation drops the dry bulb to the wet bulb and a temperature gradient is established for heat to flow from the rock, which raises the wet bulb and the heat content of the air.

Machinery heat

The downcast can absorb it, retaining its volume and velocity and raising its temperature, or some air can be detached to remove it, leaving the downcast air unaltered, but dropping the volume and velocity. Air is difficult to get into the mine and it is a pity to let it go after using 10 - 20" W. G. on it. Small local cooling plants may be the answer.

Shortcircuiting

Hot am from the returns to the downcast, or recirculation across a fan, may be considerable sources of heat. Loss of cold air by leakage or illegitimate opening of doors is analogous.'

He continued, elaborating on the cooling process. His explanation was simplistic as many of

those present were not at all well versed in refrigeration.

'A refrigeration machine has three parts, evaporator, compressor and condenser. In the evaporator, the refrigerant liquid drops in temperature below what is to be cooled, by evaporating at a low pressure. The gas is sucked away and, in turn, heat flows from the object being cooled to the refrigerant.

.....In the compressor, the gas is raised to a high pressure and discharged, hot, into the condenser where it gives up its heat to a medium supplied to cool it, and the higher the temperature, the harder the machine has to work. The gas is usually superheated and the condenser must remove the sensible heat and the latent heat of condensation, and it must remove not only the heat picked up by the refrigerant in the evaporator but also the heat equivalent of the work done in the compressor, say a third more.'

The bulk of his speech then concentrated on the air conditioning plants installed at ERPM. The first was on surface and was designed to provide a capacity of 2 400 ice tons per day. It used three reciprocating ammonia compressors and employed nine evaporators and six condensers. The second plant was 6 400 ft below surface at Hercules Shaft. The condensers used direct heat exchange to water which was then pumped out of the mine. He noted that this plant gave a great deal of mechanical trouble and earned a bad name for Freon losses. The third small cooling plant was relatively new and was installed 6 000 ft below surface at the Cinderella Shaft. It was the first plant with a two-tier heat rejection system and used Freon 11 instead of Freon 12 as the refrigerant. He mentioned the importance of water quality, instrumentation and the need for qualified attendants. Regarding instrumentation he said

'The maker's thermometers are unsuitable, of dial type with a range that far exceeds the fluctuation to be measured. Some are so placed that only an ostrich can read them accurately. Recording thermometers would help him.'

He concluded his speech on a positive note but refused to become drawn into the controversy about surface versus underground refrigeration plants.

'The moral is that the answer to deep level ventilation does not lie only in sending more air down the mine, or cooling it, but just as much in learning how to make the best use of it, in controlling it and in preventing wastage and abuse - the wind must not bloweth where it listeth. This is where the Ventilation and Mining Departments must work hand in hand. If we have been given the tools, let us push on with the work and if the tools are blunt, let us sharpen them.'

Mr le Roux proposed the Vote of Thanks endorsing everything Gorges had said. He was clearly proud of his colleague's speech and it was clear to everyone present that the use of underground cooling plants could achieve workable conditions underground and produce more coolth per year for the capital invested than the conventional surface plant.

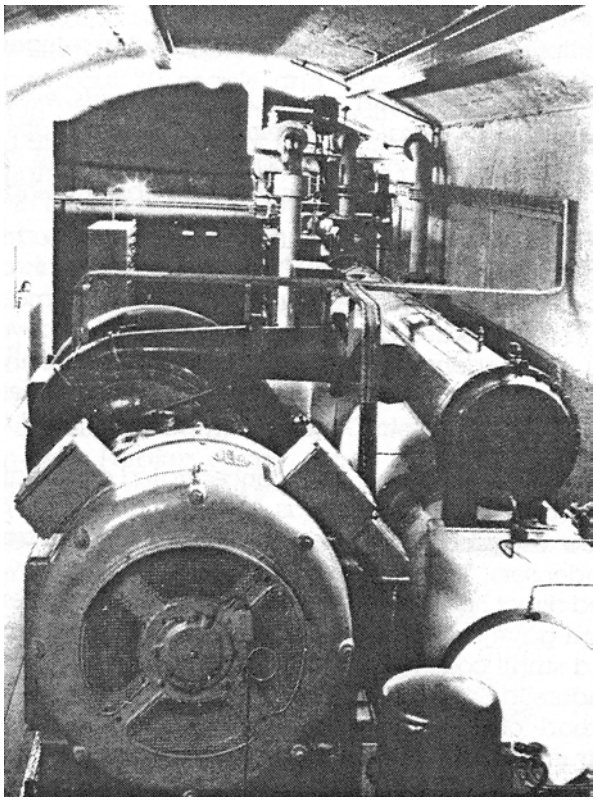
Cawood, Chairman of the Heating and Ventilating Engineers, who had at previous meetings only passed mild and complimentary remarks, was more forceful on this occasion and tried to bring home to those present exactly how much more effort would have to be expended in this area if suitable solutions to combating heat were to be found. Being aware that his remarks could be perceived as facetious, he approached the topic as delicately as possible. The remarks were contained in his contribution which was obviously read by the Vice-Chairman as Cawood had sent his apologies.

'The author says early in his paper "Our primary object is not to cool the air but the workman. 'He then describes various ways of achieving this object but in all of them it is apparent that the bulk of the energy is expended in cooling vast quantities of rock as well as the workman. This statement is made in no facetious vein, but it is intended to bring home to ventilating engineers the fact that the

present methods of providing suitable working conditions at deep levels, leave much to be desired. If deep level mining is to pay, then a more economical method of maintaining an environment conducive to human effort at great depths, will have to be found.
The solution, as the author correctly points out, lies in delivering a small volume of air at the right place, and in the right direction. Surely this is not beyond the powers of the ventilating engineer.'

He ended his contribution on a note with which everyone present had to concur.

'I hope I shall not be accused of sticking my neck out, but in engineering there is no room for dogmatism. What is regarded as impossible today often becomes the practice of tomorrow. It is the prerogative of the engineer to develop new techniques to meet changing conditions and in this, as in other problems, I feel confident that he will not fail to meet the challenge.'



An underground cooling plant.

The reference to dogmatism was particularly important. Cawood had picked up the professional competitiveness among members at the first meeting between the Societies two years previously and had taken note of the strong willed personalities who assumed prominence in the Mine Ventilation Society. The obvious intellect of those members was indeed an advantage for both the Society and the profession, but it was imperative that each person realised how important it was to move with the times and not become entrenched in old beliefs and practices.

The ventilation officer as the guardian of health

A topic which continued to be foremost in all members' minds was the scope of the present and future activities of the ventilation officer. Drummond, in his presidential address two years previously, had reviewed the duties and organization of a ventilation department and had made the remark that development had not been uniform on the Reef, with the status being achieved very much dependent on the personality of the ventilation officer concerned as well as the nature and extent of the problems on each particular mine.

Georges Braunger tackled the same issue when he delivered his presidential address on 16th August, 1952. The new president was 51 years old and had qualified as a mechanical engineer at the University of Karlsrhuke in France. After leaving France, he had joined Flugge at East-Geduld in 1938 and had been promoted to Chief Ventilation Officer in 1949. Being a founder member of the Society and a dedicated part of the inner core desperate to see the status of members of the profession enhanced, the topic he chose for his speech was an appropriate one. Braunger was honoured to be chosen as President and had been looking forward to giving his presidential address for weeks. He took the Chair and immediately launched into his paper called 'The Sphere

of Activity of the Ventilation Officer on the Mines of the Witwatersrand' with a gusto that was totally in keeping with his exuberant personality.

After giving an historical overview which placed his speech in perspective, he tackled issues such as the introduction of new protective devices in the field of ventilation and how the ventilation officer can play an important role in communicating the needs of the operator.

> *'Very often the adaptation of a general principle to a particular case has required a careful study of operating conditions over a considerable period of time. Such long term study is often essential if the new installation is to be a success. This is where the understanding and co-operation between the operator and designer are not only desirable but imperative. Even a brilliantly designed device has to meet with wholehearted acceptance if it is to prove a success. This only holds true if the device has been introduced mainly for the benefit of the operator, whose co-operation is required. A typical instance of this has been all attempts to introduce portable dust protecting devices underground, also of protective masks for welders. These have never met with real success and one is forced to the conclusion that the least possible burden must be placed on the operator.*
>
> *The responsibility and the onus of the efficient working of any air conditioning devices in the wider sense of the word rest in the end upon the person responsible for the general condition of the air.'*

He then covered training where he recapped on the new scheme for examinations which was introduced in 1949. Examinations now included a practical and written examination for an elementary certificate in dust prevention and mine ventilation, and once candidates had successfully completed these papers, they could progress to the advanced certificate. Ventilation officials could also attend classes at the Department of Mining at the Witwatersrand Technical College which had introduced a National Diploma in Mine Ventilation. These classes consisted of lectures in chemistry, physics, mechanical engineering, air conditioning and mine ventilation and were aimed at mine employees who had qualified in mining but wished to specialise in mine ventilation.

Braunger had captivated everyone's attention. He was warming more and more to his topic. Flailing his arms wildly he continued, now concentrating on the importance of ethics and the power of enthusiasm in strengthening human relations.

> *'That this type of work cannot be successfully accomplished without a great deal of enthusiasm will be readily appreciated, and true enthusiasm is, as we know, contagious. Much can be done by the Ventilation Officer in that direction, by awakening ventilation mindedness and interest for the ventilation problems at hand.'*

As he was nearing the end of the last statement, he rushed forward, gesticulating in his desire to get across to members the importance of enthusiasm. He was jumping up and down, balanced precariously at the end of the platform. Members watched fascinated, all eyes were glued on this charismatic figure. Was he going to fall off? No, he moved back. Audible sighs of relief were breathed as he reached the end of his speech. He the leapt forward and with a single jump fell over the edge of the platform. Unphased, he picked himself up and excitedly yelled *'Does anyone want a motion?'*

Silence fell over the room and then everyone began to laugh. No-one present would ever forget Braunger or his presidential address.

Barenbrug congratulated Braunger in his Vote of Thanks and from his comments it is clear that he too was proud of the inroads being made by ventilation officers practising on mines. Through concerted effort the profession was beginning to be regarded as integral to mining.

> *'As the President outlined in his paper, the position of the ventilation officer has*

remained an exceptional one when compared with other branches of mining activities. Although not directly connected with the production side of mining, the ventilation officer is the "guardian of health", a strong link in the chain of mining activities. The importance of good ventilation has long been recognised by the Industry, and its value is constantly increasing. Today, one cannot visualize an efficient mine without proper ventilation.

.....As the President remarked, great progress has been made but still greater tasks lie ahead. For this reason it is the duty of every ventilation officer to become - be it in a small way only - a research worker so that he can play his part in building up further ventilation knowledge; and in this respect it may well be stated that our Ventilation Society has played no small part in building up further ventilation knowledge.'

Barenbrug's views were supported by Drummond when he delivered his Supporting Vote of Thanks.

'.....the paper clearly indicates the scope available to trained ventilation men and removes the impression that ventilation is a "dead end" job.

As Mr Braunger indicates, the status and authority of ventilation officers varies from mine to mine. It is often difficult to gain appreciation for work or knowledge not directly connected with production, but the influence of a comparatively small group of individuals, whose names appear so frequently as authors of papers and articles on ventilation, coupled with the problems raised by increasing depth and temperature, has resulted in the ventilation officer being regarded not as a necessary evil required by law but rather as an asset to be used to obtain maximum efficiency.

.....It is our task, and that of our Society, to ensure that trained personnel will be available when required. In this connection I welcome Mr Braunger's suggestion that the training syllabus be extended to include such subjects as elementary mechanical and electrical engineering, mechanical drawing, physics etc.'

The last note of the morning was by Mr M G Devine who also wholeheartedly agreed with the contents of Braunger's speech. He himself still felt fairly indignant about the ventilation officer's status on mines.

'.....With such development in the ventilation officer's responsibility and scope of activity and influence, the time has arrived when the status of the ventilation officer should not have to depend entirely on personal initiative and personality, but should have a more definite level from which to begin,'

Murmurs of 'hear, hear' were heard around the room as Devine continued, this time outlining a system whereby technical journals should be circulated between mines and Groups.

'.....A list of subjects in which it would be advantageous for the ventilation officer to have a working knowledge would be fairly extensive. One would include certain aspects of engineering, as mentioned by our President, of physics and even physiology. For the present, however, I would place emphasis on general mining practice. The importance of ventilation is today being more and more appreciated by the mining people, and willingness to work in conjunction with ventilation officials is becoming increasingly obvious.'

The meeting closed after a stimulating one and a half hours of discussion, including Braunger's 'stage' performance. The topic discussed was however one which every member present was intimately connected to and the spirit of the meeting had been positive in every way. The Society had certainly achieved more than even Barenbrug had hoped for in just eight years.

CHAPTER 6

Ventilation, once the mild hobby of professors, is today the breath of life to mines.

J P Rees, 1953

Barometric pressure surveying

An aspect of integral importance when designing mine ventilation circuits is the accurate determination of pressure losses. Over the years many methods had been proposed. Mr J de V Lambrechts in 1953 outlined to members a technique for barometric pressure surveying. The paper was practically orientated and was in keeping with the image which Lambrechts had so painstakingly tried to build up for himself over the years. *'It is intended in this paper to set out the technique in such a way that it can be easily followed and applied by almost anybody with a reasonable knowledge of the fundamentals of ventilation, physics and mathematics.'*

The method which he detailed to members consisted of two sensitive aneroid barometers which were used side by side throughout the experiment. He believed this method was fundamentally more correct and less time-consuming than the density method of calculation. Observations recorded underground included barometer and dry and wet bulb temperature readings at each station; time; general direction of air travel; locality; and pressures across doors, stoppings or fans using a U-tube manometer. The calculations involved the actual barometric pressure at the downstream as well as what the pressure loss would have been had there been no airflow. The latter was calculated using a formula from International Meteorological Tables which correlated barometric pressure increase of the atmosphere with vertical depth, temperature, humidity, latitude and mean elevation above sea level. The formula was logarithmic and to simplify its application, Lambrechts appended suitable logarithmic tables to his paper.

As Lambrechts spoke it became clear that although he believed the method to be the most accurate and efficient available at the time, it certainly would take the average ventilation officer a lot longer than the time advocated by the organised and energetic Lambrechts who insisted to members that

'.....If necessary, it is possible to complete a whole mine circuit embracing downcast and upcast shafts and an internal route of perhaps a few miles, as well as all necessary calculations, all in one day.'

Barenbrug proposed the Vote of Thanks which was a typical Barenbrug 'tour de force' in the way he thoroughly analysed and examined the subject. In his straightforward, rather blunt manner, he opened his presentation by contesting whether the meteorological formula used by Lambrechts was as accurate as other methods.

'Mr Lambrechts concluded his paper by saying that the use of the meteorological formula for calculation of the hypothetical frictionless pressure at the bottom of a shaft is fundamentally more correct and less time-consuming than the density method of calculation. We might ask ourselves what causes atmospheric pressure to increase when descending a shaft. The answer to this is that the (frictionless) pressure is increased due to the increase in the superimposed weight of the air column.'

He then examined eleven alternative methods, drawing on Professor Hinsley's work amongst

others. Each method was presented in detail with worked examples. As could be seen the results showed little variation between the different methods although Barenbrug himself favoured the density method. The effort Barenbrug had expended into researching this contribution was appreciated by all present as the information he had prepared so meticulously was invaluable to any practising ventilation officer.

Barenbrug ended his presentation, knowing that members could draw their own conclusions, saying

'As can be seen from the summary, the variations in results are small. The meteorological formula can successfully be used provided the proper corrections are applied. It is therefore my pleasant honour to propose a vote of thanks to Mr Lambrechts for giving us another method to calculate the pressure losses in shafts and airways where differences in elevations are involved.'

The other contributor to Lambrechts' paper was Mr Derrick Beadle who at the time was employed in the Dust Department of the Chamber of Mines. He had joined the Chamber of Mines in 1935 under H S Patterson and had immediately become engrossed in dust physics which became his vocation. Apart from his scientific work, he was a born lecturer and members always looked forward to meetings where he would be speaking as few could equal his skill at imparting knowledge.

He had enjoyed listening to Lambrechts' speech and felt that it

'.....describes clearly and accurately a satisfactory technique for measuring pressure losses along the airways of a mine. I have no practical experience of pressure surveys myself, and so cannot comment on the advantages or disadvantages this method may have when compared with other methods which can be used for obtaining such information. I found it difficult to appreciate Mr Barenbrug's remarks in his verbal contribution at the meeting that the "density method" was fundamentally more correct. If one is concerned with estimating pressure differences it is probably more convenient, and certainly fundamentally more correct, to measure pressure directly and not to have to deduce the pressure differences from the results of other measurements from which in turn the density is calculated. This does not of course imply that the direct method is necessarily more accurate.'

He continued his contribution by questioning Lambrechts' assumption that it is accurate enough to assume that atmospheric pressure changes during a survey will follow the average diurnal variation. Finally he stressed the need for frequent calibration of barometers and referred to the Askania microbarometer, which *'may herald a new era of accuracy in pressure surveying by mechanical barometers'*.

J de V Lambrechts.

Debate on this topic continued for over a year. In the June 1954 issue of the Journal, Lambrechts finally replied to both Barenbrug's and Beadle's contributions.

'I have been convinced by Mr Barenbrug that in practice the density and meteorological formula, as well as the others to which he refers, will all give substantially the same answer if correctly applied. In this reply I wish to speculate a little, however, on Mr Barenbrug's statement that pressure increase is fundamentally a function of density and depth, whereas I feel the density factor is per se merely a useful artifice'.

The professional competitiveness between the two men was clearly evident in this reply by Lambrechts. He felt, although did not directly state, that Barenbrug had used his paper as an arena to try to prove to members his own superior intellect over Lambrechts' and had manipulated his results for his own ends. After detailing his comments about the relationship between atmospheric pressure and depth, the shape of the curve, and the effect of air temperature on calculated column weight, he got to the crux of his contention.

> *'In Mr Barenbrug's "Summary of Results", the value obtained from the meteorological formula is given an unfortunately poor showing. Items (3) and (8) are uncorrected and meaningless figures as they stand, and should not have been included. The figure 10.418 under item (4) was a misprint and should have read 10.481. Then it still has to be converted from mean density to surface density leading to a final value of 10.069. If Mr Barenbrug's "density" value of 10.098 under items (1) and (6) is corrected to the extent of -0.3%, as suggested by himself, his answer becomes 10.068, confirming that virtually identical answers are obtained from meteorological and density formulae, provided all necessary corrections are applied.'*

He was less critical of Beadle's remarks and agreed that an accurate barometer should be used to monitor surface barometric pressure during a survey, with the use of the standard diurnal curve as a less viable alternative.

Both men, namely Lambrechts and Barenbrug, were possessed of great minds but unfortunately they approached their topic from different perspectives. Once again it was clear to members closely involved with the two men and to those observing from a distance that Lambrechts would always favour a more empirical stance and Barenbrug would conversely always attack, however indirectly, using his vast theoretical reservoir of knowledge.

Society affairs - 1953

In May 1953, Misi Barcza was elected President and his two Vice-Presidents were Barenbrug and Lambrechts. This election was the first to occur after the new constitution had been formulated the previous year and the other innovation was the election of Honorary Life Members. This honour was bestowed on three distinguished members of the Society, namely Flugge-de Smidt, Professor Jeppe and John Rees. In terms of the new constitution only full members could now be elected office bearers and members of Council. All members of Council, including associate members were however entitled to vote. The Council members elected that year collectively made up a formidable committee and consisted of Rabson, Rayner, Le Roux, Antonie, Beadle, Grave, Botha and Meyers.

Braunger, the retiring President, reported on the activities of the Society during the previous year. Membership between 1948 and 1953 had increased as follows.

	1948	1949	1950	1951	1952	1953
Members	53	56	70	74	84	98
Associates	18	34	49	97	111	121
Total	71	90	119	171	195	219

The Society had £233 3s 7d in the bank after expenditure had been deducted from income. The number of Bulletins published each month had risen to 500 and of these 371 were sent to either members or subscribers, with only 29 copies being distributed free of charge. The remaining 100 copies were held in reserve should special orders be received. In 1953, 109 separate copies had been sold.

In September of the same year, Barcza announced that the first winner of the Mine Managers' Association Prize was Ralph Gorges for his paper entitled "Air conditioning mine air and some experiments in connection with deep level ventilation". Lambrechts then took the Chair while Barcza delivered his Presidential Address.

Barcza had initially come to South Africa from Hungary in the mid 1930s after qualifying as a mechanical engineer. He joined Consolidated Main Reef Mine in 1936, and after a disastrous first day, never looked back. On his first day he had been told to report at the mine at 7 a.m. sharp. Anxious to make a good first impression, he had donned his only suit and tie which had been neatly pressed for the occasion. He left his boarding house at the crack of dawn as he had no means of transport and began his long journey on foot to the mine. It took him appreciably longer than he had expected and when he arrived, exhausted from the long walk, he was given nothing but strange side-long glances. After a few moments of unease with everyone staring at him, someone offered him a hard hat and a pair of boots, and then led him to the cage which bore its first worker ever to wear a suit underground!

He was an exceptional man, commanding respect wherever he went. His energy was boundless and his mind equalled by few. The confidence he inspired in all he met, was never misplaced. The topic he chose for his presidential address was 'Some statistical information about the ventilation of South African gold mines' and was an authoritative review of all relevant aspects of current ventilation practice and trends.

The introduction to his speech was indicative of his ability to mobilise resources and support whenever he required and for whatever reason.

> *'It is customary to extend to Presidents of technical Societies special privileges in their choice of subject matter for a presidential address. 1 have taken full advantage of this tacitly conceded licence even beyond the choice of my subject, because, having decided on a title, I proceeded to leave the work for others to do. This was achieved by asking you to provide the information I intended to use. Indeed, there can hardly be a member of the Society resident in South Africa who has not assisted me in obtaining the data for this address.'*

He began his address with an overview of the number of mines which had reached a depth of over 8 000 ft below surface by 1953. These were Crown Mines, ERPM, Robinson Deep, City Deep, Consolidated Main Reef, Simmer and Jack, and Van Dyk. The total volume of air downcasting at that time was 30 million cubic feet per minute (cfm) or 930 tons of air per minute. An extension to this analysis was that he showed that 30 million cfm corresponded to 488 million tons of air per year; 7,2 tons of air per ton of ore mined; 5,35 cfm per ton mined per month; 130 cfm per person underground; 107 cubic miles of air per year and 550 000 cfm downcast per mine.

In 1953, there were 322 shafts serving mines from surface. The number of fans amounted to 5 998 with 2 234 being driven by compressed air. Two of the fans were still driven by steam. Nearly half a million konimeter dust samples were taken during 1952 but only very few thermal precipitator samples. There were 634 dust filter installations handling about 4 000 cfm. Four hundred and twenty eight of these were flannel bags. The total number of surface cooling plants was five with a total capacity of 122 000 000 BTU/h, and there were eight underground plants.

In the middle of 1953, the mining groups were employing 207 permanent ventilation officials, 37 official learners and 10 clerk-microscopists. He gave the educational qualifications of the 207 permanent employees as follows:

	No.	%
Not matriculated	92	44.5
Matriculated	83	40.0
Some post-matric education	12	5.8
Mining graduates	8	3.9
Engineering graduates	7	3.4
Science graduates	3	1.4
Higher degree	2	1.0

Rees proposed the Vote of Thanks.

> *'If it is not trespassing into the field of discussion, I am going to say that it is very right and proper that at this time we should look at the ventilation of the* mines *as a whole and gain some idea of* the *magnitude of the work in* which *each of* us *individually plays only a small part.'*

Known for his unusually perceptive appreciation of the future he continued, saying

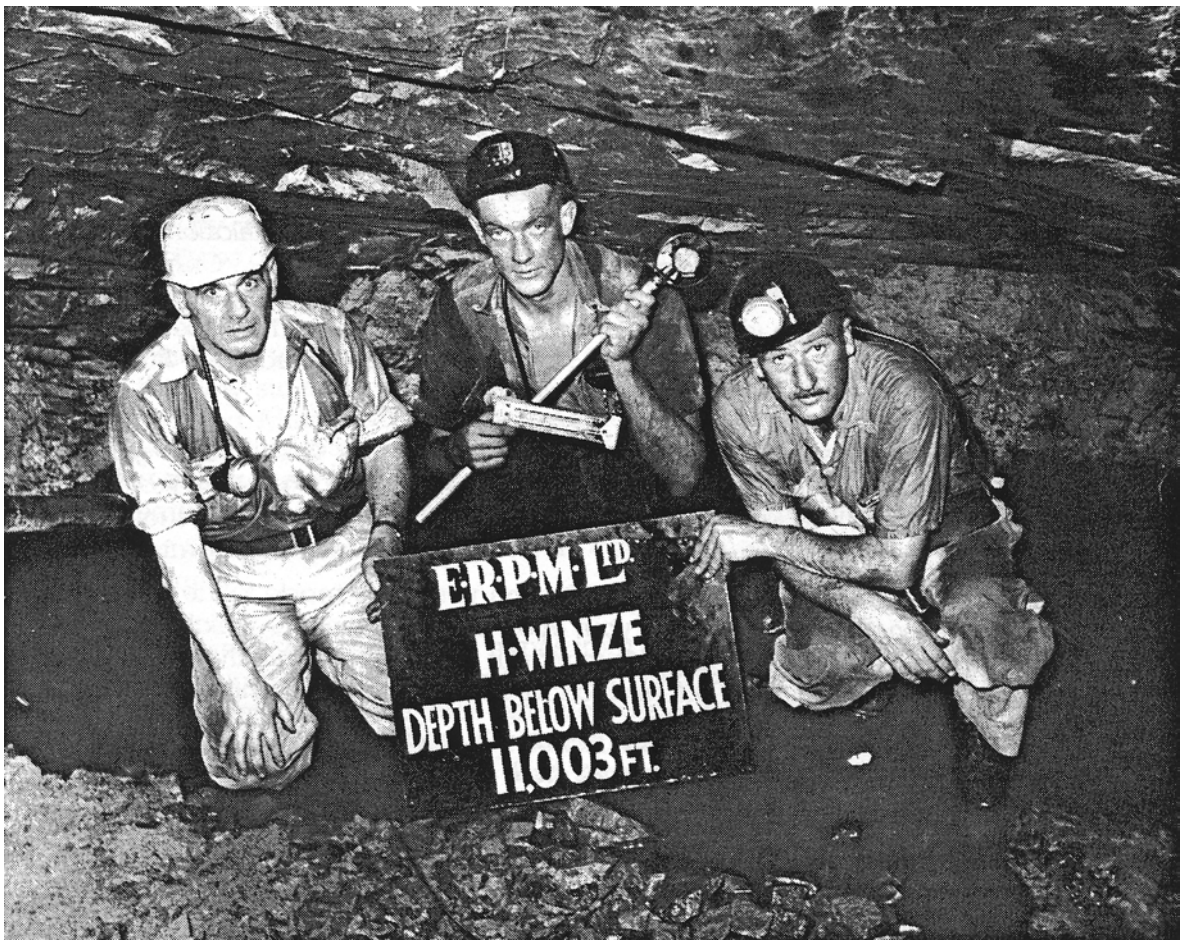
> *'I say this because we are on the threshold of a new industrial age. Engineers and scientists who know what they are talking about tell us that an enormous revolution is imminent in transport. And transportation is the life-blood of nations and international activity. Within 10 to 25 years the cost of transport and travel by sea will be halved, the cost of air travel will be halved and the cost of railway travel, if electrified, will be nearly halved. This will be done by the application of atomic power. And in our gold mines we have one of the largest sources of the raw material of atomic power in the world. The changed world outlook for our mines produced by this overwhelming fact is too big for us to appreciate. No longer do we mine a metal morally disreputable and destined only to be buried as soon as it is obtained. We are mining the raw material of unlimited power and usefulness.*
>
> *The new mines, however are deep and ventilation is important. Ventilation, once the mild hobby of professors, is today the breath of life to mines..... Only by application of more and more ventilation can the raw material be supplied for the industrial revolution which is waiting for us around the corner. This aspect is probably not fully appreciated by the atomic scientists in their laboratories. But our President appreciates this.'*

Blissfully unaware of the dangers of atomic pollution and the power of inflation to erode any cost benefits that might materialise in the near future, he concluded on a poetic note which may have sounded emotional to an outsider but to those present, it echoed sentiments felt by every member.

> *'Mr President, it is indeed a valuable contribution you have made to the great harvest of learning now ripening before your eyes, a contribution for which we are greatly indebted to you, We shall all wish to read it again and it will always, I feel sure, be a valuable source of information for future ventilation engineers.*
>
> *.....May I conclude, Sir, by offering you personally and collectively our sincere congratulations on your attainment of your high position and assure you of our loyal support during your term of office.'*

Barcza was truly touched by the sincerity of Rees' speech which must have been one of the most open hearted and genuine ever given at a meeting of the Society. The Supporting Vote of Thanks was given by Mr Tommy Gibbs who emphasised the value of statistics, particularly those

published by the Mines Department, and called for more statistics reflecting ventilation trends. Flugge, being his normal contentious self, then stood up and contradicted Barcza's statements that compressed air fans should be replaced by electric ones on economic grounds. He was supported by Mr Vic Steed. Flugge also pointed out how closely actual rock temperatures conformed to predicted ones. Beadle was the next contributor and said he felt that more details should be made available of salaries and qualifications of ventilation personnel. He also pointed out that dust statistics are based on dust samples taken largely between 9 a.m. and 12 midday and are therefore not truly representative of "round the clock" conditions. Another contention was that he queried the validity of dust statistics based on the konimeter as an indication of the health hazard. The meeting closed after the final contribution by Lambrechts who made a plea for better training in, and a better understanding of, statistics as far as ventilation personnel were concerned. He also quoted a few examples of statistical manipulation.



M. Barcza, O.C. Smith, M. Hill.

CHAPTER 7

It is only by free and frank exchange of ideas that we can go forward together.

T Gibbs, 1954

Integrating ventilation into mining problems

Eighty two people attended the meeting on the Saturday afternoon in August 1954 when Lambrechts was scheduled to deliver his presidential address. Members were looking forward to the address as it had the potential to be both stimulating and controversial.

Lambrechts had called his address 'The need for closer integration of ventilation into mining problems in deep level mining' and began by saying that he was only too aware of the types of criticism that would be levelled against him for many people believed ventilation had already been accepted as playing an important role and that it most certainly was not a subsidiary art.

> *'What is needed is neither a patronizing acceptance by the mining engineer of ventilation because it is important nor an ambitious direct claim by the ventilation officer or engineer for greater recognition because his job is important - rather it is a case of intimately blending the various skills needed in mining.'*

He also forcefully pointed out that

> *'Let us be quite clear, however, about this fact, namely ventilation, per se, is no primary objective at all but simply a means to an end. The all-important objective, obviously, is the extraction of the payable ore, be it gold, copper, coal or other minerals. But let us also be quite clear about two other important facts, firstly that bad ventilation conditions can very seriously hamper the efficient extraction of ore and, secondly, bad mining methods in a deep mine can do far more harm than it is possible for good positive ventilation and refrigeration techniques to rectify.'*

He then proceeded to detail how the two issues are 'both part and parcel' of the same objective for every aspect of mining. Areas covered were shafts, grade control, concentrated mining, drainage, stope support, silicosis, and the future scope of research. The section on silicosis covered blasting, orepasses, mechanical scrapers and dust allaying by water.

On finishing his speech, Mr Francis Hill, nicknamed Pinkie, stood up and proposed the Vote of Thanks. He had agreed with everything Lambrechts had said and called for a committee technique *'whereby specialists were brought together and problems discussed'*. In connection to Lambrechts' reference to the proposed silicosis investigation, he asked whether *'it might not be more effective to carry out an occupational dust survey of individuals over a complete shift rather than taking random spots?'*

Gibbs gave the supporting Vote of Thanks and it was clear that Lambrechts was a man he admired.

> *'I found Mr Lambrechts' address most stimulating and I think the main reason for this can be traced to its frankness. This frankness is apparent even in the title, where he refers to the need for closer integration not close integration, obviously inferring that your President is not entirely happy with the present position.'*

Gibbs felt very strongly about the dust problem and stated that it was obvious *that "no good purpose will be served by mining men sitting back complacently and waiting for research workers to bring forward new designs and methods"*. Beadle then stood up and agreed with Lambrechts on the need for research and gathering data, but thought that the data should be collected by research specialists to make it more reliable. He also disagreed very vehemently with Lambrechts' suggestion of using the konimeter for the proposed fact finding survey.

> *'I do not agree. It is time that it was generally recognized that the konimeter is an inaccurate instrument which often gives misleading information .....and these observations will not be the truth, the whole truth and nothing but the truth.'*

Behind the differing views however, there was the feeling of gratitude that they now had the forum they had always wanted where they could debate issues of concern publicly, as heatedly as they wanted. They always enjoyed these meetings.

> *'Mr Lambrechts finished his excellent speech with an apology for being controversial. May I say the same, but I firmly believe, as I am sure that Mr Lambrechts does, that it is only by free and frank exchange of views that we all - mining engineers, ventilation staff and the scientist - can go forward together in co-operation and solve the many problems ahead of us'.*

The meeting ended with Lambrechts calling on the President of the Mine Managers Association, Mr W Cousens, to present their annual prize to the winner for 1954. Before handing Rayner the prize for his paper called "Automatic self-cleaning filters", Cousens recapped on the background to Rayner's invention.

> *'I am afraid that the discovery of the self-cleaning filter was rather forced on Mr Rayner, Originally he had nine boys in his department but with the labour shortage this number was cut down to five. Having no boys to do the cleaning of sawdust filters and changing of flannel bags, he had to do some heavy thinking and it was thus that the labour saving "Rayner filter" came into being. Today he has four boys in his department and I am wondering what the result would be if this number were reduced to one boy. No doubt his inventive mind would also solve this difficulty.'*

The wet kata

Like dust, the issue about the effects of the thermal environment on man raged unabated. In recent years another variable had been introduced into the argument. This was whether or not the wet kata thermometer was to be regarded as a reliable instrument to measure environmental conditions underground. Once again the Society saw its members split into two camps and Phil Kitto found himself immersed in both the dust and wet kata battles.

A quiet, retiring man Kitto was essentially a physicist. He had obtained his MSc in Physics from Rhodes University and had joined the Chamber of Mines' Physico-Chemical Department in 1937 under H.S. Patterson, Although not particularly ventilation orientated, he became intimately involved with the Society after Patterson retired and the Department was merged with Rees' Dust Department. He and Beadle had joined the Chamber through the same route, Beadle having persuaded Kitto to join. Kitto, like Beadle, supported the use of the thermal precipitator and was responsible for the further development of the instrument which had been brought to South Africa by Patterson in the early 1930s.

He had become known to members as a researcher of integrity with a gently forceful will in the late 1940s when he had presented a paper on a technique which he had developed for the preparation of konimeter slides. In early 1954 he had given a paper on a new method he had devised for measuring the diffusivity of a rock specimen by comparing it with rock of known

diffusivity. The need to develop a quicker method of measuring than the old "divided-bar" had arisen from the expansion of the Orange Free State goldfields, as data was required urgently for the different types of rock being encountered.

Kitto's other expertise was the wet kata thermometer. In September 1954 he published a paper in the Journal called 'The practical value of the wet kata thermometer'. Unlike Wyndham, who was bitterly opposed to the instrument, Kitto said

> *'Purely as a physical instrument which combines into one index, within limits, the effects of air velocity, wet and dry bulb temperatures and radiation, I think the kata thermometer is sufficiently accurate to be of considerable value to the mining industry until such time as a better index becomes available, and the influence of such factors as clothing and work rate may be assessed from practical experience.'*

He then discussed the safe limits for different rates of work and the chief difficulties in the derivation of an index of physiological stress as distinct from a purely physical index such as the kata reading.

Wyndham hated this paper and hated Kitto's defence of the wet kata thermometer. He said little but he was known to have minimal patience for those he regarded as fools. Kitto however was no fool, only eminently sensible. In November 1954, Wyndham addressed the Joint Meeting between the Society and the Institution of Heating and Ventilating Engineers on the topic.

Wyndham had qualified as a medical practitioner and remained dedicated to his Hippocratic Oath throughout his career. Although he chose not to practise as a doctor, his physiological research in mining broke the barriers leading to modern day understanding of the topic. Also, to keep in touch with the practical skills he had learnt during his qualifying years, he voluntarily gave up every Thursday night to work at Baragwanath Hospital in Soweto, Johannesburg.

He began his paper, speaking softly.

> *'Is it possible today to make a reliable estimate of heat stress experienced by man when he is exposed to rest and to work in hot environments?'*

He said he felt the problem had not been resolved, resulting in a myriad of practical solutions such as the wet kata cooling power, the effective temperature scale and the predicted four-hourly sweat-rate index.

> *'The confusion arises largely because two different but complementary, experimental approaches were essayed to the problem. On the one hand, attempts have been made to establish the general laws of heat transfer between man and his environment. On the other, the empiricists have been concerned to measure the strain of certain isolated physiological and psychological effects in given heat stress situations'.*

Regarding the wet kata he said

> *'It does not seem to be appreciated generally that studies which elucidated heat transfer processes took little or no account of either the physiological or psychological effects of a given heat stress situation. Man was regarded as a passive physical entity; no account was taken of physiological mechanisms, notably sweating or blood-flow, which cause the temperature of the surface to vary in an active manner. Hence these solutions are applicable, if at all, only under extremely limited circumstances. Moreover, it is impossible to predict the state of the organism in a particular heat exchange situation. The wet-kata cooling power is perhaps the extreme example of confused thinking in this regard. It purports to be a*

measure of heat exchange by evaporation, convection and radiation, being related apparently to these processes in man. This relationship is open to serious doubt. The evaporation and convection profiles are quite different. The surface temperature is not capable of being varied in an active manner. Unlike man, a set quantity of heat is available for transfer - the heat content of the apparatus at 97.5°F. Little or no consideration is given to radiation. The wet- kata cooling power is therefore unlikely to be an accurate method of estimating heat transfer in man.'

It happened at every meeting between the two Societies. For some unknown reason, the topics chosen for each meeting were highly controversial and the speakers were always those well known for their lack of tact and desire for verbal combat. When Wyndham finished this first part of his speech, members tried discreetly to glance at Kitto to see his reaction. There was no outward sign of annoyance but the clenched fists in his lap betrayed the emotions he was obviously feeling.

Wyndham continued by outlining the various empirical indices in use to express heat stress. In conclusion he emphasised the need for psychological studies and a research programme which could yield heat transfer data on naked men at various rates of work and different combinations of environmental heat-stress parameters.

Cawood proposed the Vote of Thanks and, seemingly unaware of exactly how inflammatory the speech had been, made the comment

'Dr Wyndham makes much play of confused thinking in this matter, but I hope he will not take it amiss when I ask him whether the confused thinking cannot perhaps be said to apply more to the medical aspects than to the engineering aspects of the matter. In other words, I feel that we heating and ventilating engineers can provide the necessary conditions provided medical science will tell us precisely what the conditions in all types of environments must be.'

But Cawood had understood the controversial nature of the speech and ended his contribution with the words

'Dr Wyndham has given his own ideas as to how the problem of measuring heat stress may be approached constructively. He calls for heat transfer data on naked men at various rates of work and different combinations of environmental heat stress parameters. No doubt such data will throw much light on a rather obscure subject but will it be the complete answer? Human beings react differently to the same environment when clothed than when naked.'

Campbell-Pitt seconded the Vote of Thanks. He compared the existing controversy with the one on dust, and called for Wyndham and his staff at the Transvaal and Orange Free State Chamber of Mines Applied Physiology Laboratory *'to provide something better, and prove its practical usefulness, before we give up a well tried and familiar instrument'*.

The debate was then thrown open to the floor and the first contributor was Kitto. This was the moment members were all waiting for. What was he going to say and how was he going to say it. His tone was flat and his face expressionless. He was angry but would always behave like the perfect gentleman.

'.....In fact, from the data given in his (Wyndham's) paper the problem appears to be so complex that it seems doubtful whether even his proposed programme of work will provide us with an answer to the various factors involved in the foreseeable future, particularly the psychological factors.'

In the same bald, bland fashion he continued.

'In the meantime, Dr Wyndham's paper leaves the Ventilation Officer rather in the

air as regards what index he should be using, as all of them appear to be condemned for one reason or another. The reading of this paper might, in fact, result in more "confused thinking" about scales and indices than existed before. However, as he does not advocate any of these other scales, I presume he is in favour of continuing with the wet kata thermometer until a better method becomes available.'

Kitto was quite right. Barenbrug then rose and analysed Wyndham's speech as objectively as he possibly could. He made the pertinent remark

P.H. Kitto

'The ventilation engineer is not concerned about a reliable estimation of heat stress only; he is concerned with the relationship between all physiological reactions affected by environmental air conditions and work-output. Physiological reactions do not only include factors of heat stress which might limit the capacity to work, they include also physiological reactions which affect the inclination and declination to work.'

Barenbrug supported Kitto totally and felt that

'Dr Wyndham condemns the wet-kata completely; he also condemns the effective temperature. It appears that he is now not at all sure of the value of the predicted four hourly sweat-rate index, which he advocated so strongly. Dr Wyndham condemns them all, but does not give anything in their place. All that we are told is that a new approach to the subject should be made. Apart from the uncertainty as to whether such a new approach may or may not give us a better index, it will, no doubt, take a considerable time before such an index is evolved! In the meantime we must carry on.'

Barenbrug, like Kitto, understood the real issues. The wet-kata despite its shortcomings was the best instrument available and it served a purpose. Dogmatism that it should not be used solved none of the practical problems.

He concluded his contribution on a very forceful note.

'The experienced ventilation engineer knows fairly well what environmental air conditions must be provided for in deep mines. He appreciates the value of theoretical approach and research, which refines the imperfect and incomplete judgement of an imperfect human being; he looks forward to the results of Dr Wyndham's work. However, if theory conflicts with practical experience there is only one outcome - the theory will be rejected.'

Dr. Wyndham

This was the first time there had been a clash of wills between someone working for the Chamber in a research capacity and someone working for a mining group. Granted Kitto himself worked for another section of the Chamber, but the reputation he had earned for himself was far more practical than academic. Barenbrug might have been the champion of the theorists but he was also Assistant Group Ventilation Officer at New Consolidated Goldfields, and he was genuinely concerned about making the quality of the ventilation officer's position on mines easier, not more difficult. In addition, engineers working on the mines felt they were far more qualified to judge what was appropriate to use underground than "academics" working in laboratories, and felt very strongly about being prescribed to when no practical alternative was offered. They would always close ranks and support their own colleagues.

Heat acclimatization

In January 1953, the Chamber of Mines' two-stage acclimatization method had been introduced to the mining industry and by October the following year, the method was being used on 16 mines. At that time there were 60 officials who were qualified to administer the procedure which had been completed by some 2 000 blacks.

The method involved working, under strict supervision, moderately hard for one week in a "cool" stope with a maximum wet bulb temperature of 87°F. This was followed by another week at the same work rate in the hottest normal working stope on the mine (usually about 90 - 92°F). Dr Nic Strydom published a paper called "A detailed analysis of the Chamber of Mines two-stage acclimatization method" in the Journal in October, 1954. He gave details of the method together with training procedures for supervisors and boss-boys. Results since the introduction of the method were highly encouraging prompting Strydom to write

> *'Apart from one mishap, due only to negligence on the part of the supervisor in charge, the method itself has a clean record as far as heat stroke cases are concerned. In fact we firmly believe that, correctly applied, the original two-stage method is foolproof. Unfortunately, rectal temperature recordings were not popular with the Natives and we therefore had to switch over to oral temperatures. Anyhow, most of the mines that have adopted it are well satisfied with the method and it would, therefore, seem that the method has come to stay.'*

Strydom was an astute and determined man who had a passion for fishing and the topic of backache. He generally achieved his goal and in this instance he knew that research had yielded a solution which was immeasurable in terms of its value to the gold mining industry. It was his firm intention to ensure that the acclimatization method was refined even further, and he would work tirelessly until the day dawned when every worker in the industry was acclimatized to working in heat.

CHAPTER 8

Much of the subject of mine ventilation requires drastic revision.

Prof H Briggs

Consolidation of footwall dust

The quest to reduce heat flow from the rock into the air remained a priority of all ventilation engineers. Wet mining of course exacerbated the problem, and engineers had for years recognised the benefits that would accrue in terms of reducing the heat load if the intake airways were dry. The overriding obstacle was however that of dust if water was not used to suppress it.

Mr Basil Botha published a paper in early 1955 called "The consolidation of footwall dust at Vlakfontein Gold Mining Company Ltd". It was the first paper published in the Journal to contain professionally printed photographs. Botha reviewed the theories of deliquescence and hygroscopicity as well as their application to footwall consolidation. He explained that 'deliquescence is the process of dissolving and becoming liquid by attracting and absorbing moisture from the air whereas hygroscopicity is the process of readily absorbing and retaining moisture'. He then described the practical application of calcium chloride in great detail which included calculations of the results. He admitted that there were considerable snags in the use of calcium chloride but said that

> *'To date over 12 000 ft of footwall has been treated at Vlakfontein, and so far no, remedial treatment has been required. In the great majority of cases the treatment has proved successful.....The use of calcium chloride has certainly eliminated the dust hazard along the dry intake airways and will no doubt play a big part in the control of silicosis in the future.'*

The equivalent mine capacity

When calculating *the ventilation* requirements for either an existing or a new mine, an essential consideration is the accurate calculation of the volume flow rate of air. Until the 1950s most of the formulae assumed that air was an incompressible fluid and consequently the volume remained constant throughout the mine. Air is however not an incompressible fluid and its treatment as such was only acceptable when designing ventilation networks for shallow mines as the effect of the pressure changes on the volume flow rate on air was negligible. But as mines grew deeper, the use of these formulae yielded more and more misleading results.

It was an area that had been fascinating Barenbrug for some time. He had been avidly corresponding with Professors Hinsley and Van Esbroeck for some time and was in complete agreement with them that the *'simple hydraulic formulae no longer suffice to explain many ventilation phenomena'.*

In February 1955 he put pen to paper and clarified his thoughts on the topic. He was sure that the use of mass flow rate of air would be more accurate in analysing ventilation circuits. To emphasise the point he was making about the need to find alternative methods to aid the ventilation engineer in the efficient execution of his job, he wrote

'Professor Henry Briggs once said "The fact is that much *of the* subject *of mine ventilation requires drastic revision. It is packed with antiquated "Aunt Sallys" whose sole purpose in life is to provide material for questions in the examinations for the Colliery Manager's Certificate.'*

The paper was called 'Equivalent mine capacity' and was based on the premise *'that there are many problems today in deep mine ventilation which cannot be satisfactorily solved unless the thermal vehicle, air, is treated in its correct perspective, i.e. when compressibility is taken into account'*. He cited the Equivalent Orifice formula and agreed with Professor Briggs' statement that *'it is time these "orifices" passed into limbo'*. He then criticized the formula using the Atkinson unit of resistance saying that it *'brings about another derived unit, which is not accepted and understood by everyone, and in my opinion, went only half way as it relates the volume to a fixed density but not the pressure'*. The crux of his paper was the introduction of the concept which he called 'equivalent mine capacity' and defined 'as the mass of (dry) air in lbs/min. that can be circulated for an energy expenditure of one air horsepower, assuming that the horsepower varies as the cube of the quantity.'

Barenbrug was proud of this concept and believed he had offered the mining industry an alternative to the outdated hydraulic formulae used in calculating the volume flow rate of air in deep mines. He pressed his point home.

'The equivalent orifice formula and the equivalent mine resistance formula can only be used for comparing the resistance of one mine with that of another mine if volumes and pressures in both mines are related to one and the same density. As reference to density is often neglected, the equivalent mine capacity is a more satisfactory way of comparing the resistances of two mines as the formula deals with absolute values.'

Society affairs - 1955

The Society was growing from strength to strength and in 1955, the number of members had risen to 253. The Journal was receiving more good quality papers with less harassment of members than in previous years. Beadle had started abstracting technical literature on ventilation as well as related scientific and engineering topics, and the service was proving popular with members who did not normally have access to a wide range of journals. Discussions were also well under way about starting an Orange Free State Branch because of the distance members had to travel to attend meetings. In addition, Barenbrug was elected President for the year, and in the minds of most members Barenbrug was synonymous with good fortune for the Society.

An issue however that was concerning the more learned members of the Society was the papers for the Advanced Examination for Ventilation Officers. Members felt that every effort should be made by the Examination Board to ensure that the questions set were expressed clearly and indicated precisely the scope of the answer required. Barenbrug was therefore put out when he received calls from candidates criticizing the questions in the recent examinations. On looking at the questions, he agreed with the complaints about their ambiguity and consulted his colleagues. The decision was unanimous, and they decided to publish their protest in the May issue of the Journal. Four members of the Editorial Committee prepared answers to the questions and, as might be expected, different results were obtained.

Barenbrug indignantly wrote

'.....We have another criticism of this particular paper. A good examination paper should separate clearly the candidate who has prepared himself thoroughly and conscientiously from his colleague who has only a cursory knowledge of the subject. If the scope of the expected answer is not clearly stated, the better

candidate will see many factors which he feels he should bring into his answer, some of which he undoubtedly does, although the examiner might not intend this and thus during marking can allow little credit for these subsidiary calculations. In a paper with a definite time limit (and the particular paper under consideration was undoubtedly on the long side) this may result in the good candidate failing to finish the main calculation only, thus losing valuable marks, while his less far-sighted companion, blind to these inviting distractions, goes straight ahead with the obvious calculations only, and finishes up with higher marks. The marks then do not reflect the abilities of the candidate.

.....In view of our criticisms of the present paper - criticisms which we believe are widely held - we wonder if the present paper was in fact properly moderated and, if so, why its defects were not noticed and corrected, and what the examiner's and moderator's model answers were to the various questions.'

When the Society had been formed years previously, worries had been expressed that it would form a pressure group lobbying for higher wages. Higher wages had never been a direct concern of the Society, but when it came to attracting staff to the profession they regarded it as a priority. They would fight tooth and nail if they believed the examinations being set were unfair and therefore prevent prospective new ventilation officers from considering joining the profession.

Blasting fumes

Disposal of blasting fumes and dust had always been viewed with seriousness in the gold mining industry. The current practice was to restrict blasting activities to the end of the shift and so ensure that personnel were not exposed to the fumes. However certain situations such as rapid development required the use of multi-shift blasting and more often than not there was no method of disposing of the fumes before people re-entered the area.

The Chamber of Mines had recently established a special sub-committee to look into the current methods of treatment and removal of the products of blasting fumes. The investigations had involved laboratory work into the chemical and physical behaviour of nitrous fumes and the various possible methods of dealing with the fumes as well as sampling and experimental work underground, and the installation and testing of plants erected for treating the fumes. The concentration of effort in this area had yielded excellent results with a practical fume filter being developed.

A number of members of the Society had been involved in the research because practical collaboration had been needed on mines, and members had been responsible for organizing the necessary permission for underground tests. However the vast majority of members were unaware of the recent developments being made in this field, and so the Society decided to hold its first Symposium. Eight papers were submitted.

The first paper was read by Solly Rabson who was the leader in this field. It was called "Investigation into the elimination of nitrous fumes". Rabson first defined the need for fume filters and then described the process of investigation and development leading to a suitable design. He explained that the first attempts used water sprays only and alkaline solution sprays. After more detailed sampling, analysis and laboratory tests, it was discovered that potassium permanganate and sodium carbonate solution dispersed in exfoliated vermiculite could absorb nitrous fumes effectively. He concluded the paper by outlining the underground tests and the design details.

The second paper was by Doug Grave, the Chief Ventilation Officer at Durban Deep. Grave, like Beadle and Kitto, was recruited by Patterson in 1939 into the Physico-Chemical Department of the Chamber of Mines after completing an Honours degree in Chemistry. Grave's paper was

called 'Notes on a nitrous fume filter at Durban Roodepoort Deep Limited' and it described the application of the fume filter in the ventilation of a sinking shaft. Grave described the first fume filter which consisted of an electrostatic precipitator in series with a scrubbing chamber equipped with sodium carbonate solution sprays. In a later version the solution was sprayed on to a porous bed through which the fumes passed. He explained that the final version adopted was the design by the Chamber of Mines using potassium permanganate and soda ash.

Mr W Geldenhuys presented the third paper called 'Dust and fume extraction from blasting fumes' where he described an arrangement used in the ventilation of a sinking shaft at Rand Leases (V) G.M. Company Ltd. The installation consisted of a primary dust filter (blanket) followed by a Chamber of Mines type fume filter and then a double secondary dust filter.

The other papers presented covered the chemical composition of blasting fumes, the treatment of the fumes using a Collectron which replaced a bag filter, and a fume and dust extraction plant.

The symposium had been a great success and Barenbrug was pleased. It was the first time a number of papers had been presented on one particular issue and the topic had been covered in depth. The papers had been practically orientated and there had been consensus among the speakers that the fume filter developed by the Chamber of Mines Research Laboratories eased the problem of fumes during multi-shift blasting.

The fundamentals of thermodynamics

Everyone in the Society knew that thermodynamics was a topic that fascinated Barenbrug. He had published a paper on equivalent mine capacity earlier that year, and the grapevine said that he intended to deliver a really long paper on thermodynamics as his address. The grapevine was quite right but no-one ever suspected that the paper would take two hours to deliver and then take up 153 pages of the Journal with the first four being occupied by the Contents Page. It was beyond most members' comprehension.

Sixty eight members and visitors braved the meeting on 6th August 1955, when Barenbrug spoke about the fundamentals of thermodynamics as applied to mine ventilation. Never before had Barenbrug's dedication to his vocation been so obvious. He was high-spirited as he delivered his epic. The paper was way above the majority of those present but at least Barenbrug had an audience. Among the guests were two distinguished visitors, namely Professor R A L Black who was Head of the Mining Engineering Department at the University of the Witwatersrand and Professor F R N Nabarro of the Physics Department at the same University.

Barenbrug's paper consisted of 16 parts and covered in meticulous detail the concepts of adiabatic, isothermal, polytropic and variable compression and expansion. In his introduction he did however concede that the topic was certainly a difficult one to come to grips with.

> *'Thermodynamics is not an easy science. Yet it is so important for the proper understanding of mine ventilation problems that I cannot see myself doing a greater service to you or our Society than by trying to make clear as simply as possible, the fundamental behaviour of air when travelling through a mine system.'*
>
> *It is fully realised that it is difficult to express complicated matters in simple language. Many frills and phrases have to be left out in order not to fall into complicated traps. If, however, I succeed in explaining to you the fundamentals of the thermodynamics as required for the proper understanding of mine ventilation, then the attempt will be worthwhile. It has then opened the way to improve one's knowledge by further study and investigations.'*

When he reached Section 6.3.2. of his paper which covered the 'determination of the natural ventilation energy in an existing mine ventilation system, ventilated by natural means only', he was in his element and explained

'The thermodynamic-mean-specific-volume can be defined as the mean-specific volume weighted against pressure. It is not necessarily equal to the arithmetic mean- specific-volume of initial and final volume.....'

Nabarro was highly amused. He had been looking around the room and had seen the bewilderment on members faces. This had changed after about an hour to pure bedazzlement and he jokingly turned to Quilliam who was sitting next to him and said *'Do you know what on earth he is talking about?'* Quilliam, who could not believe his ears, replied dryly *'No, but I'm sure he doesn't either.'*

Barenbrug, now oblivious to the audience, continued postulating about the hypothetical.

'The pressure-loss of a downcast shaft can be obtained from the pressure produced by a hypothetical isothermal fan placed at the bottom of a hypothetical upcast shaft in which the true-density of the air is assumed to be the same as the true density of the air in the actual downcast shaft.'

A.W.T. Barenbrug

Barenbrug finally ended his presentation and was surprised to be greeted with a stunned, extended silence. Even the Professors appointed to deliver the Vote of Thanks looked somewhat overcome, as though not certain that their turn to speak had really arrived. Professor Black composed himself, stood up and admiringly congratulated Barenbrug on being elected President for a second term, and for his recent appointment as Group Ventilation Officer to the Anglo-Transvaal Group. He had thought Barenbrug's paper was very clear and the only regret that he had felt was that Barenbrug had not addressed the importance that moisture played in ventilation air.

Nabarro seconded the Vote of Thanks. Jokes aside, he had been exceedingly impressed by the extent of Barenbrug's understanding of thermodynamics. His only criticism was along the same train of thought as Black in terms of moisture not being covered and concluded

'I should like to congratulate your Society on having a President who is not content with a full understanding of the present practice in mine ventilation, but is determined to understand the principles in order that present practice may be improved, if improvements are possible.'

And so ended the meeting on 6th August 1955. No-one would ever again doubt Barenbrug's vast intellect.

CHAPTER 9

So long as man controls gold and not gold man, it will serve a useful purpose.

Barenbrug, 1956

Formation of the Orange Free State branch

Worry had been expressed by Council members for some time that the Society was not able to communicate effectively with members in remoter areas because its affairs were controlled solely in Johannesburg, and meetings and discussions were also limited to the city centre. Serious consideration had been given to opening a branch in the Free State during 1955, and an extraordinary meeting had been held on the 6th August 1955 to amend the Constitution and so pave the way for the formation of branches in the outlying districts. Members residing in the Orange Free State then approached Council and at a meeting on the 25th October it was unanimously decided to open the first branch of the Society.

The inaugural meeting of the branch was held on 19th January 1956. Barenbrug took the Chair and addressed the poorly attended meeting which consisted of 18 members and 6 visitors. The greatest disappointment was however, that none of the mine managers who had been invited bothered to put in an appearance. Nevertheless Barenbrug refused to be daunted and delivered the inaugural address with his usual vehemence. By way of introduction he explained to those present how the mining industry had expanded since 1935, and the importance of proper air conditioning.

'Can we really afford to sit back and await the evil days when excessive air temperatures make mining at depth impossible? Are we allowed to take an easy attitude and hope that time itself will solve the future problems confronting the mining industry? The issue is clear.'

He continued, dogmatically stating

'It is the moral duty of everyone connected with practical mining to do his utmost to explore the unknown, to study and develop his knowledge so that he may one day be in the position to control the causation of high temperatures and so play his part in increasing the possible mining depth.'

He then summarized the role and activities of the Society.

'In order to assist the mining industry to build up an efficient ventilation staff, the Mine Ventilation Society of South Africa was formed. As the first paragraph of its Constitution says its object is to disseminate knowledge amongst its members; knowledge which is so scarcely found in text books or technical journals. It is a friendly Society; it seeks no selfish interest; it is non-profit making but is only formed to help others in their ventilation problems. It is the only Society in the world whose activities are solely devoted to matters of ventilation and dust control.'

In conclusion, he mentioned the ventilation problems which were of particular concern to members of the new branch.

'There are many problems with which members in the Free State are confronted, problems which either do not occur on the Rand or which are there already

successfully overcome. To mention only a few - the control of methane, the application of fiery regulations, excessive faulting, corrosion and, in my opinion, a very important aspect, the absence of training facilities. I have not the slightest doubt that the Chamber of Mines will lend a willing ear to all sound requests. It has always assisted the parent body greatly. It is only through its assistance that the publication of the bulletin is made possible.

Barenbrug then called for nominations for Branch Chairman. After voting by raised hands, Mr O A (Arvie) Huss was elected Chairman with Messrs. G H Hurford, R T Yasbek, M P G Sandys and G P Badenhorst voted as Committee members.

Rabson then presented the first paper at a branch meeting. It was called *'A vertical multi-tube filter for underground use'* and it described the results of his painstaking and meticulous research which had yielded the *'Rabson filter'* which was to become the standard flannel bag used on most gold mines for many years to come. The characteristic of this filter was the use of a large number of small-diameter filter tubes or bags supported vertically. The bags were cleaned in situ by a shaking mechanism which could be manually operated and the shape and dimensions of the filter units enabled installation with minimal excavation.

Rabson proudly explained the advantages of the filter which were its compactness that combined high capacity with small space; easy transportability; high dust extracting effectiveness; simple cleaning; negligible wear and tear; and low cost.

The Orange Free State Branch had been formed and Barenbrug's closing remarks expressed the sentiments felt by the rest of the greater Society.

'On behalf of the Council of the Mine Ventilation Society and all members and associate members of the Transvaal, I wish to congratulate you on the formation of this Branch. May it grow in strength and may it fulfill successfully its purpose to assist its members for their personal benefit as well as for the benefit of the mining industry in the Free State as a whole.'

Overseas impressions of ventilation in the South African gold mining industry

Communication, other than through the written word, between men working in the field of ventilation throughout the world was fairly limited in the 1950s because of the time it took to travel from the southern to the northern hemisphere. The concept of the overseas trip was not boarding a jet plane but rather taking an extra month's leave and embarking on a time-consuming and expensive sea voyage, albeit relaxing. Alternatively, flying took three days from South Africa to the United Kingdom.

As a result whenever members travelled overseas, usually on holiday, every opportunity would be taken to visit mines or research institutions and exchange ideas as to the current thoughts regarding effective mine ventilation. Back in 1950, Mr C Czank had travelled to England and on his return had written an article called 'Notes on ventilation in Great Britain' which was published in the Bulletin in March 1951. Starved of free exchange of ideas on topics other than ventilation in South Africa, the interest this article aroused was considerable, Flugge de Smidt's comments included

'When it came to studying ventilation, Mr Czank no doubt found, as I did in 1927, that there is not much that is not already known to us. This is not surprising because in South Africa one keeps more or less up to date with developments in Great Britain and possibly because our own developments in that direction, with the rapid expansion of our mining industry, have been in advance of those in Great Britain.

In the matter of dust determination, gravimetric sampling instruments are in common use as they used to be in our mines when the dust concentration used to

be very great. Owing to the tremendous success of dust suppression methods in the mines of the Witwatersrand, ordinary routine gravimetric dust sampling could no longer give any indication of the amount of dust in the mine air and konimeter sampling took its place.

....It is interesting to note that the thermal precipitator is considered the standard instrument for purposes of comparison. It must be remembered that this refers to slides that are never washed.'

Beadle also contributed to the article and vouched for the accuracy of Czank's facts as he himself had been in Britain only a few months before Czank. He corrected Flugge-de Smidt's interpretation about the widespread use of gravimetric sampling saying *'Mr Flugge-de Smidt, in his contribution, appears to be under the impression that gravimetric sampling instruments are in common use. This is not so - all the instruments in common use give a particle number count, although their efficiency and consistency vary'*. Members were so interested in Beadle's contribution that he was persuaded to write an article for the Journal on his experiences and observations during his study tour in 1949.

Then in November 1953, Mr John Bromilow, the Chief Ventilation Engineer of the National Coal Board in Great Britain, visited South Africa and personally delivered a paper to the Society on the ventilation of coal mines in Great Britain. Members were particularly interested in his comments as the majority had little experience of colliery ventilation, and scant knowledge of the organization of the National Coal Board and other large mining combines in Europe. Bromilow was also impressed. It was the first time that he himself had come across such a tightly-knit group of men united through a desire to advance their own knowledge of ventilation and so improve working conditions in mines. On his return to the United Kingdom he went out of his way to encourage a number of fellow professionals to join the Society.

During the latter half of 1955, the Society received a visit from Professor Andre Houbrechts of the University of Louvain who was also the Director of the Institut d'Hygiene des Mines in Belgium. The Professor had been visiting the Belgian controlled copper mines in the Katanga Province of the Belgian Congo, and had at the invitation of Barcza, interrupted his busy schedule and detoured to South Africa. Members were honoured as it was not often that so distinguished a figure in the field addressed the eleven year old Society, let alone travelled thousands of miles to give the talk. The presentation was informal and covered cooling plants used in underground workings in Belgium.

Another visitor in 1955 had been Dr W Hoffman, the General Manager of Lohberg Colliery, who was also an overseas member of the Society. Lohberg was one of the deepest coal mines in the Ruhr area and produced about one and a half million tons of coal annually. It was also the first colliery in that area to install a large underground refrigeration plant for cooling the mine workings. On his return, he had written a paper which he had presented to a meeting of the 'Steinkohlenbergbau Verein' in Essen about his impressions of ventilation engineering in the South African gold mining industry. A translation of the paper was published in the March 1956 edition of the Journal. Members were ecstatic about what he said for it showed the standing of the South African ventilation officer as being a world leader in the field, and that was no mean feat for a profession regarded as being fairly insignificant locally. Dr Hoffman had echoed their own sentiments when he said *'What we saw in South Africa made a great impression on us'*.

They were amused, thinking back to the old days, when they read

'The offices and laboratories of the Ventilation Departments at the mines also bear witness to the importance of ventilation in South Africa. For example, in the new mine offices in the Orange Free State the Ventilation Department has approximately 600 sq. ft. of floor space, consisting of 3 offices, a laboratory, a darkroom and a storeroom. One should compare this with conditions on our own mines where, in many cases, the Ventilation Official does not possess his own office. The ventilation

officials are usually young, active and intelligent men. The Chamber of Mines organises special training courses for ventilation officials, leading up to an elementary and advanced examination. The ventilation officials carry a whirling hygrometer which readily enables the determination of dry and wet-bulb temperatures. This shows that the significance of wet bulb temperatures and relative humidity is well recognised. Here in the Ruhr mines, we are not only far behind with this recognition but, also, with the measurement of wet-bulb temperatures.

.....'These officials, engaged in mine ventilation and dust suppression, came together 7 years ago to found the Mine Ventilation Society of South Africa. They hold meetings periodically and publish a monthly bulletin. This Society is supported in their endeavours by the Chamber of Mines, but is otherwise independent. This Society is probably the only one of its kind in the world.

It must be stressed emphatically that the Ruhr mining industry is behind in this sphere and should take the organization in South Africa as an example. The British Coal Mining Industry is on the point of developing a similar organization arising from study visits.'

The Society in 1956

Barenbrug was succeeded by the tireless Harry Rayner on 28th April 1956. The new president had been closely involved with the Society since its early days and was one of the most highly thought of senior men in the Gold Fields management team. Members respected his innovative mind and were envious of his energy which had earned him several trophies over the years. The preceding year had yielded results still closer to the goals expressed by Rees, Barenbrug and Flugge-de Smidt when motivating the formation of the Society. Under the stern direction of Barenbrug, it had been decided to stop issuing Journals to subscribers who were more than six months in arrears, and to remove from the membership list those who were more than 18 months behind in paying subscriptions. This unfortunately meant that 53 members were summarily deleted from the list, and the result was that the nominal membership decreased by eight for the year. But it showed that the Society no longer had to carry half hearted members to boost membership figures. It marked the advent of a new confidence that more members would be found amongst those genuinely and sincerely interested in furthering the aims of the Society.

Barenbrug reported proudly that the bulletin was 25% thicker than the previous year. Members let him get away with the comment although they pointed out to one another that his presidential address had taken up 152 pages! However, twenty-seven papers had been submitted and the first paper in Afrikaans had been published. The Chamber of Mines was also reacting favourably to the request that assistance be given to the Society to help in the more professional reproduction of drawings and photographs. Regarding the first annual dinner, Barenbrug explained its purpose

'Our Society is a very active one and an occasional relaxation from strenuous discussions in order to strengthen the ties of friendship and comradeship is necessary. It was considered that a social gathering would serve a useful purpose, enabling the members of the Society to meet each other, and for this reason Council decided to organize an annual dinner. This function took place on 2nd March and was regarded as a great success….. The attendance at the dinner was 49.'

In addition the Head of the Department of Mining at the Witwatersrand Technical College, Mr A Willows-Munro, had requested help from the Society to assist in checking lecture notes intended for the advanced class in Dust Suppression and Mine Ventilation. The Society had responded to this request efficiently and had immediately organised a sub-committee to exclusively deal with the issue.

The Government Blue Book as a wealth of information

Beadle had always felt strongly about ventilation officers having access to official statistics which related directly to the profession. He cared strongly about health and safety, and had also always believed that average salaries should be known. The latter was of course a touchy topic as the pioneers still clearly remembered the initial worries expressed that the Society would form a pressure group lobbying for higher wages.

But in October 1956, he managed to get the Editorial Committee to agree to his writing an article based on the annual report of the Department of Mines, popularly known as the Government Blue Book. It was almost two years out of date but at least it gave members some idea of the extent of silicosis, average salaries as well other statistics such as dust counts, air quantities and temperatures. His instinct had been correct. As he had quite rightly presupposed, members in general did not have access to statistics of any nature and they read the abstracts with fascination. Many did not even know, over two years after the new law had been introduced, that the appearance of the very first nodules in lung tissue were now diagnosed as silicosis. As a result in 1954, the number of new certifications of the disease amongst white miners had risen from just over 200 per annum to 887. He also drew their attention to the positive side which was that the average duration of exposure to dust amongst the same group notified of silicosis was 23 years, 1 month. He compared this figure to 9 years 8 months in 1920 and 13 years 6 months in 1930 - 1931.

STATISTICS INCLUDED BY BEADLE IN HIS ARTICLE

Average Ventilation Officer salaries	
Witwatersrand	£54/month
OFS	£51/month
Total tonnage treated for recovery	65 349 907
Shaft-sinking	35 863 ft
Development	2 626 321 ft
Uranium oxide production	
No. of mines producing	11
No. of mines expected to commence production	7
No. of mines authorized to produce	26
Heatstroke	
No. of cases	27
Fatalities	13
Ventilation	
Average quantity of air (24 hours)	31 522 500 cfm
Average per ton mined per month	4,96 cfm
Average per person underground	143 cfm
Dust counts	
Average counts taken by konimeter	
Stopes	160 ppcc
Development ends	160 ppcc
Depth	
Maximum stoping	9 020 ft
Maximum development	9 714 ft
Temperatures	
Over 50% of observations, wet-bulb below	80°F
In less than 0,1%, wet-bulb exceeds	93°F
Gap between dry and wet-bulb on average less than	2°F
Dust extraction plants	
Total No. underground	727
Total capacity	5 000 000 cfm

CHAPTER 10

It is always necessary for the teacher to be teachable and receptive to new ideas.

Freedman, 1957

Compressed air control

Compressed air began to be used as a source of energy in the South African mining industry in the late nineteenth century, and by the 1950s it was used extensively in mining applications. Its advantage over steam was that it could be transported over long distances and it was preferable to electricity as it was not affected by the moisture in the mine workings. In addition, skilled labour was not required to connect air driven machines to the mains.

Mr Willie le Roux had been given the task of controlling compressed air on a large, deep mine some years previously and had found, to his dismay, that the basic factors and principles involved were not clearly understood by the consumers of air and that the co-ordination between the producers and consumers left much to be desired. It worried him particularly that *'to some extent compressed air is used legitimately for ventilation, and in hot mines it is used illegitimately for ventilation purposes to an undesirably large extent. The result is that, in costing, a large proportion of the cost of compressed air production and distribution is often charged to ventilation'*. Being eminently practical and with his feet firmly placed on the ground, he set about rectifying what he saw as an enormous problem. He studied textbooks on the topic, made countless practical observations and then attempted to apply what he had learnt. In December 1956, he published a paper on his findings in the Journal and as a result of the interest members displayed in its contents, presented the paper at a meeting of the Society in January 1957.

Besides his outrage at the abuse of compressed air in hot mines, his reasons for introducing the topic through the Mine Ventilation Society, and not a more production orientated medium, were

> *'The principles controlling the performance of compressors and the flow of compressed air through pipes and hoses are very similar to those applying to fans and the flow of ventilating air. Secondly, the Ventilation Officer, by virtue of his knowledge of Mining and Engineering practice and Ventilation conditions and principles and by virtue of his intimate knowledge of his mine, as well as his non-executive position which brings him into constant liaison with all the various departments on the mine, is often the most suitable person to undertake the task of controlling the production and consumption of compressed air.'*

He then expounded on the principles of compressed air reticulation together with the cost of the production of compressed air.

> *'Some mines buy compressed air from a central compressor station and pay for it at an agreed price for each unit passing through a meter on the mine property. Others have one or more compressor stations of their own and calculate the cost of an air unit by dividing the total cost of air production by the number of air units metered on the discharge side of the compressors.'*

He then discussed the sizing and siting of compressors relative to variations in demand, and the advantages of maintaining a high pressure for certain operations. He refuted rules of thumb for the estimation of pipe sizes and proposed more scientific methods of calculation, control measures and the philosophy of appointing an independent Compressed Air Controller. Regarding bad practices he said

'.....Any leaks found must be reported and repairs checked. Where a branch or service pipe leads to an area which no longer requires a supply of air, closing the valve is not sufficient. The pipe must be disconnected and blanked.

.....No buried pipes must be allowed anywhere unless a leak from the pipe would be detected immediately by a permanent meter.

...A very big source of wastage is the use of compressed air for the cooling of men or machinery. Both of these objects can be achieved much more effectively and cheaply by means of fans, but unfortunately it is so much easier to use compressed air. A very strict attitude has to be adopted by Management if this kind of abuse is to avoided and no exceptions must be allowed.

An audible leak from a joint or a valve spindle on a shaft bank may account for a wastage of as little as 10 cubic feet of air per minute costing only about a penny per hour, but think of its indirect cost in the form of negative propaganda value. The thousands of labourers who hear the leak twice every day must realise that all the senior officials are also hearing it daily and doing nothing about it!'

Barcza proposed the Vote of Thanks and commented that

'The great value of Mr le Roux's paper lies in the fact that he explains in some detail how compressed air can and should be controlled. He missed few, if any, of the points to be considered; and much of what he wrote should be heavily underlined'.

Grave warmly seconded the Vote of Thanks and quantified the rewards for adequate compressed air control.

'In the case of one large mine, over a period of two years after improved compressed air control was introduced, the cost of air power per ton milled fell by 12.6%. While this saving is large, the full value does not show up until it is noted that over the same period most other mining costs had risen appreciably. For example, white wages had risen by 32.3%, reduction costs by 19.5% and total mining costs by 5.5%. The overall cost per ton milled had risen by 9.1 %. Viewed in this light the decrease of 12.6% in compressed air costs becomes almost spectacular.'

Flugge-de Smidt was in complete agreement with Le Roux and amused members with some of the history behind the use of compressed air systems.

'Many years ago a compressor was installed on a certain mine, but was registering well below its peak efficiency. The volume meter was attached to a tube protruding into the inlet duct of the compressor. The engine-room fitter found that, by cutting the end of this tube off at an angle (it now took the impact of the air stream), the volume meter now showed peak efficiency and everyone was happy!'

Mr D W Meyers then made the comment that he felt the control of compressed air should be left to the Engineering Department who were responsible for the compressors. Mr J Kipling remarked that *'a copy of Mr le Roux's paper should be sent to all Section and Underground Managers on the mines as it is sure to make them more compressed air minded'.* Finally Mr P Rosenthal mentioned a situation he had experienced when employed as a Ventilation Officer.

'....but when I started plotting surface air lines, it turned out to be a problem of some magnitude.

The numerous pipe lines were in the form of a most intricate maze. I found pipes that crossed one another a dozen times and vanished below ground; other pipes were often duplicated and even triplicated.

I remember a one inch compressed air pipe that fed four air pumps, two winches, a furnace, several riveting machines and finally ended up in the extractor house.'

Members laughed and all recalled to themselves similar predicaments. The topic Le Roux had chosen was of immense interest to the Society and in Barcza's words *'far too little time or space is devoted to this important subject in our Technical Societies'.* The paper was a worthy winner of the Mine Managers Association Award for 1956.

The new Journal

Discussions had been on-going between the Society and the Chamber for some time about enhancing the appearance of the Bulletin. Council particularly wanted to use professionally reproduced photographs as well as drawings which were of a higher standard than the rough copies which were generally being submitted by the authors of papers. Unfortunately the Society was not in a financial position to afford either the cost of printing photographs or the services of a draughtsman.

Representation had been made to the Chamber in 1956 about the possibility of assistance and the Chamber's first response had been to send out a GPC circular recommending that annual membership fees be paid by the mines instead of individual members. Luckily mine management supported this recommendation and the Society was able to increase the annual subscription fees. Discussions then centred on other ways in which funds could be raised. Advertising was mooted as a possible suggestion and it was realised that it was indeed a feasible solution to the problem.

Kelvin House, 1937.

Further meetings were arranged with the Chamber and finally a decision was reached. The Chamber agreed to assist the Society with an annual grant of £1 000 as it approved of the Bulletin and was anxious to see the publication continue being issued each month. In addition, the Chamber was aware of the amount of time being devoted to the Journal during working hours by members of the Editorial Committee and therefore suggested that the Society apply to join the Associated Scientific and Technical Societies which were based in Kelvin House. Part of the grant could then be used to pay for secretarial services which would reduce the work load being carried by the Editorial Committee.

Council, and the Editorial Committee in particular, were delighted and set about the task of organising quotations for printing with determination. They set a deadline. The first issue would be published in 1957, and befitting the occasion and status which would be

accorded by the new image, they decided that the name would be changed to the 'Journal of the Mine Ventilation Society of South Africa'. Mr Joe Quilliam was elected advertising manager and set about his task energetically and enthusiastically. Then in October, Solly Rabson, the Editor, took extended leave and Quilliam became acting editor. He approached this task with the same attitude and members knew that the project had to succeed under his direction. But no-one, not even Quilliam, realised the extent of the work involved when dealing with typesetters and printers. The decision had been easy to make but to put into effect required attention to a hundred and one items which were all urgent and needed instantaneous resolution.

Quilliam learnt that he now needed to know his four times table off by heart due to printers dividing documents into four page segments. None of the Committee realised the difficulties this created. They gaily approved the contents of the first issue and sent the copy to the printers. The galley proofs were then returned and they checked the typesetting for errors. There were many. The galley proofs were then returned for correction, and then they had to be checked again. After this procedure had happened a few times and the copy seemed free of mistakes, the Committee felt drained but relieved that the work involved in this first printed issue was finally finished. Then Quilliam received something called the 'page proofs' from the printers with a curt note explaining that there were 26 pages of copy. This, the printer explained, meant that the Committee had to decide whether to cut two pages or find two more pages of copy. Quilliam telephoned the others, and explained the predicament in his unassuming, non-dramatic style. They reacted with disbelief. They could not just cut two pages of a paper which would make the Journal look silly and was sure to anger the authors. Also, how would they know if any additional copy they found would fit in two pages? The saga dragged on and on, and finally the January 1957 issue was sent out in May.

The Committee's embarrassment at the lateness of the first Journal was soon forgotten in the wake of the extremely positive response by members and subscribers alike. Mr F C Steinhobel, when presenting the Mine Managers Association Prize for 1956 to le Roux commented

> *'Your Society is going ahead by leaps and bounds and is attracting considerable attention overseas. I am particularly impressed with your Journal, in what I may call its NEW DRESS SUIT, and would like to congratulate the Society on the excellent presentation of the Journal in its printed form.'*

Quilliam was proud of his role in the realization of what had, until 1957, been nothing but a pipe dream. He was also touched by the goodwill members had generated towards the Committee and expressed his thanks in the February editorial.

> *'Since the distribution of the first issue of the printed Journal, the Society has received numerous messages from its Members, Associate Members and private subscribers who have paid many compliments and warmly praised the layout, contents and cover design and offered their good wishes for the future success of the new venture.*
>
> *On behalf of the Editorial Committee I wish to convey their sincere thanks and appreciation for these tributes and messages of goodwill which indicate that the reputation and prestige of the Journal has been considerably enhanced.'*

Quilliam was correct; members were proud of their Society. They were however also indebted to him for his dedication to the project, and agreed wholeheartedly with Rayner when he said

> *'Fortunately we have had as our organizer a man of such amazing and boundless enthusiasm and never-ending drive that the project was bound to succeed as soon as it came under his control. I refer of course, to the quiet gentleman whose name today is synonymous with the Mine Ventilation Society - Mr J.H. Quilliam.'*

Training of ventilation personnel

Mr Willie le Roux was elected President for the year 1957/58. He was at the time the Group Ventilation Engineer of General Mining and Finance Corporation Ltd and was as such a highly respected member of the Society whose wealth of practical experience enabled him to criticize constructively and realistically on many aspects of mining and ventilation. The topic he chose for his presidential address continued the theme chosen by Drummond in 1950 and Braunger in 1952. Le Roux was concerned that the men who staffed ventilation departments in the mid 1950s were *'in many cases selected by virtue of their availability rather than by virtue of their suitability'* and he consequently centred his address around the difficulties of training ventilation officers.

He first tackled the training of ventilation learners who he referred to as

> *'.....a liability to a ventilation department until such time as he is able to earn his salary by making reliable and useful reports on routine observations and until he is capable of doing this without endangering his own safety or the safety of others.'*

He described a training schedule for learners which should be covered at the learner's own pace and checked periodically by the instructor. After the learner had mastered the practical use of the anemometer, pressure gauge, konimeter and water tube gap meter, Le Roux advocated issuing him with a 'ventilation questionnaire for learners'. This consisted of 171 rudimentary questions, the purpose of which was because *'new recruits are normally encouraged to ask as many questions about their work as they may wish. I soon found that intelligent men were restrained by the fear of asking foolish questions, whereas those with little intelligence just could not think of any questions to ask'.*

He continued, explaining

> *'It all started when I found that only half the learner officials who came to me after having spent three months as samplers could define a pennyweight (dwt.) or knew the price of an ounce of gold. I dreaded the thought that they might pass on to the next department without knowing the difference between the Fahrenheit and Centigrade scales or whether methane gas was lighter or heavier than air!'*

The learner official was then given two months to prepare his answers after which he was given an impromptu test. Le Roux found the system to work very well, saying

> *'Conscientious and reasonably intelligent learners obtain 90% or more at the first attempt. Those who do not are told that they will be re-examined at an unspecified date in the near future and that they consequently have to start learning immediately.'*

The psychology of Le Roux's method was shrewd and played an important role in the success of the scheme.

> *'The system has been found to work very well. The learners find it interesting and competitive and their questions form the basis of lively discussion both in the office and on underground situations and in the change house. Senior ventilation officials also brush up on their knowledge for fear of being caught out by their new assistants.*
> *'The main secret of success of the system is that the learner must have no forewarning of the exact date of his examination. If he has, he will be inclined to learn the answers off by heart the previous night, to pass the exam and to forget everything the day after.'*

He then went on to describe training for ventilation assistants who had passed the Elementary Certificate, and who *'must be trained to look beyond the ventilation of individual working places,*

to view a ventilation district as a whole and perhaps to assume *a measure of responsibility for it'.* Besides attending lectures for the Chamber of Mines Advanced Certificate in Ventilation and Dust Prevention, he recommended that the assistants use technical libraries and the Mine Ventilation Society publications. Equally important was discussion with more senior people where he warned that *'tact, firmness and absolute honesty are the only foundations on which they can build satisfactory personal relations and they must shun the temptation of gaining cheap popularity by turning a blind eye to what it is their job to see'.*

Finally he tackled the training of senior ventilation officials. He felt that *'once a ventilation official has obtained the Advanced Certificate and has been appointed to a senior position, he finds himself in grave danger of stagnating'.* Le Roux expressed the need for such officials to be involved in high level planning in co-operation with top management as well as for a higher professional qualification. The Mine Managers Certificate was a suitable alternative but unfortunately could not be used because the law required that only persons with six months experience as a shift boss were eligible to write the examination. He called for this regulation to be viewed sympathetically with regard to ventilation officials, and if his suggestions were not acceptable, then the suggestion made to Council by Professor Black that the Society should institute a Fellowship or Diploma of a very high standard should be given consideration.

As always, this topic generated lively debate. Members admired the systematic and methodical way Le Roux had approached training junior staff, and from word of mouth, they were aware that his method was indeed successful. But the training scheme required dedication on the part of the senior staff and not all were as motivated as Le Roux.

Kitto did not agree that once an official had obtained the Advanced Certificate he was in danger of stagnating any more than in any other career. He felt that *'one cannot go on indefinitely taking examinations, and I think it is up to the individual himself to take sufficient interest in his work to keep up to date with the latest developments and to strive continually for improvements in whatever sphere of work he feels he is, or should be, responsible for'.* He did however feel Professor Black's suggestion was an excellent idea. Mr S. Willows-Munro, who had until recently been the Head of the Department of Mining at the Technical College, then made the comment that *'average men do not vary greatly in their abilities; but variation in perseverance and training makes all the difference between success and failure'.* Regarding Le Roux's suggestion for further study he drew members attention to the National Diploma in Mine Ventilation which had recently been approved by the Department of Education and Science.

Mr J de V Lambrechts, the Group Ventilation Engineer for the Anglo American Corporation, agreed with Le Roux that mine ventilation personnel needed a measure of scientific training, and made the comment that *'it is perhaps not sufficiently widely appreciated that mine ventilation involves something more than merely blowing car through holes in the ground'.* Quilliam, who besides being the Honorary Secretary and Honorary Editor of the Society, was employed by the Chamber and was a part time lecturer in mine ventilation at the Technical College, mentioned the recent intensification given to training junior personnel. He also suggested that students use the two textbooks available by two members of the Society, namely Rayner's 'A Guide to Mine Ventilation Calculations', and Rees' 'Ventilation Calculations'.

Mr Harris Freedman, Head of one of the Mining Colleges, made the comment that

> *'To carry out one's duties and teach at the same time may cause undue strain on certain officials. This reminds me of a little story I heard recently about two women who were overheard talking. One said to the other "My husband has got a job, it's terrible, it's killing him; fortunately its permanent." '*

Everyone present realised the value of training, and the address as well as the following debate gave members the motivation to begin putting ideas into practice.

CHAPTER 11

Stagnation can lead only to retrogression and to the eventual changing of a vigorous and flourishing industry to one hidebound and wedded to archaic methods and standards.

D Grave, 1959

Mine fires

The topic of mine fires was uppermost on members minds in the late 1950s. Large numbers of fires continued to break out underground despite the introduction of preventative measures such as fire-proofing the timber, control of cheesa sticks (fuse ignitors), the use of electric cap lamps and the electrical fuse lighter. In essence, every member knew that a mine containing large quantities of timber was very vulnerable to fire and that the fumes could spread rapidly through parts of the mine causing loss of life. Fire fighting was a formidable and hazardous procedure which was complicated by intense heat, caving of the rock, burning of the timber, the heavy smoke which made it often impossible to see ahead more than a few inches, and the practical difficulties of reaching a fire in a mine, particularly in an abandoned area.

Members decided that one way the Society could contribute towards solving the problem was to organise a symposium where members could discuss their own experiences and share knowledge on methods which had proved to be effective in preventing and detecting fires. The symposium was held in February 1958, and eleven papers were presented. Misi Barcza had been chosen to chair the meeting because of his experience of mine fires both as a Proto Team member and as an organiser of the fire fighting at a number of large fires. Unfortunately he was ill in hospital on the day and Doug Grave, who had convened the meeting, willingly stepped in and led the discussion.

Jack Drummond, the Chief Ventilation Officer at Grootvlei Proprietary Mines Ltd, presented the first paper where he reviewed the causes of fires during the past three years. He then dealt with fire prevention which he divided into control of combustible material, ignition and personnel.

CAUSES OR POSSIBLE CAUSES OF FIRES IN THE PERIOD 1955 - 1957

Cause or Possible Cause	No.	Mainly associated with
Unknown	21	Mat packs, old timber
Cheesa sticks	11	Mat packs, old timber
Electrical	10	Mat packs, shaft timber
Cigarettes/matches	8	Mat packs, old timber
Oxy-acetylene torches	6	Old timber
Blasting	4	Mat packs mostly during disposal of old fuse
Igniter cord	3	Mat packs
Carbide lamps	1	Old timber

He believed that the best solution was obviously to keep combustible material separate from possible ignition sources but, as was often impossible when large quantities of timber are stored underground, every effort should be made to fire-proof the timber and fabric found underground. After explaining the extensive measures taken by management on his mine to prevent fires he continued, saying

> *'The measures have been taken, but we still have many fires, and the link between the igniting device and the combustible material in approximately 70 per cent of the cases is the human element. Either through carelessness, ignorance or stupidity the ignition device is brought next to the combustible material .....If we can educate both the Natives and the Europeans; we will eliminate the majority of our fires.'*

The second presenter was Dr A L James, Director of the Timber Research Laboratory who spoke on fireproofing of timber. He, rather laboriously, explained that fire-retardant was a more appropriate term than fire-proofing for the treatment as *'the practical results are that fires are not started by some sources of heat which would be sufficient to set untreated timber alight, the spread of the fire is slowed down while the fire itself is less fierce and more easily brought under control'.* Mr J H Northcott presented the next paper which covered the detection of fires. He recommended that fire patrols use a watch clock system and routes be reviewed each month. Other fire detection systems which he described included stench capsules for use in detecting overheating motors, ionization chambers, photo conductive cells, temperature alarms and radiation detectors.

Mr H Currie, Superintendent at the Chamber of Mines Rescue Training Station, then addressed members on Proto teams describing the type of men chosen as brigadesmen as well as the strenuous training programme which they underwent. Georges Braunger analysed the causes of the propagation of mine fires which he believed were

> *'Radiating heat from the burning fire; heating up through convection currents set up by hot gases emerging from the fire; conduction of heat through the rock above the fire; and sparks or flames emitted by the fire'.*

His other main comment, which Grave agreed with, was that it was imperative

> *'.....To keep the main fans running so as to have a normal circulation of air in every part of the mine. It is then possible to determine which sections of the mine can continue to work normally and no dangerous, unexpected reversals of air are then likely to occur. From then on reduction in the quantity of fresh air entering the fire area can be contemplated and this is where the ventilation department of the mine can make its most important contribution to the fighting of a fire.'*

Other papers at the symposium were written by Botha, Campbell-Pitt, Grave, Kennedy and Polkinghorne. Discussion on the topic was lengthy with endless questions being posed to both the presenters and the Chairman, Doug Grave. Vic Steed asked whether anybody had any experience in fighting fires in very steeply dipping workings. Willie le Roux answered that he would have thought the obvious solution was to keep the shaft downcasting as strongly as possible. Doug Grave in answer to Le Roux's question on the use of air in fire fighting said *'It reminds me of what Shakespeare, I think, said: "Though little fire grows great with little wind, yet extreme gusts will blow out fire and all." I don't think it is practicable to blow out a fire underground, but I do very much agree that there are cases in which it pays to blow in plenty of air so that you can get access to the fire'.*

Mr Kennedy, Captain of a Prototeam, made the final contribution of the day when he described to members a bad but unexpected experience he had recently encountered.

> *'On a certain mine here we used carbon dioxide in the form of dry ice, building walls to head off the fire. Now, it all went very well but it was a wet shaft and while*

the skip was lowering the dry ice the hoist went out of action and this ice was stuck in the shaft. The dry ice started to melt, with the result that we got large quantities of CO_2 flowing in our fresh air.....We were stuck underground for some time with headaches and oxygen running low before the shaft was put in order again.'

It had been an extremely valuable symposium and members left knowing far more about the topic than when they had arrived. The Society had reached maturity and was discussing issues on a far more detailed scale than ever before. Also the ability to mobilise top experts on the topic within the Industry was another indication of the status now accorded to the Society.

High velocity water-cooling towers

In 1956 Lambrechts had shown that the resistance of upcast mine shafts was influenced by water falling against the air stream and when air velocities approached the terminal falling velocity of water droplets, the effect was quite dramatic. Lambrechts' explanation of this phenomenon was that *'water droplets are retarded in their fall by the ascending air current, thus resulting in an accumulation of water-droplets in the air'.* What occurred to him, however, was that a corollary to this observation could be useful in the design of water-cooling towers. His hypothesis was that because the water droplets were retarded in their fall, they would spend more time in contact with the air stream in the cooling tower and should consequently be cooled to a lower leaving temperature.

Lambrechts then conducted experiments with fifteen inch and twenty two and a half inch diameter model cooling towers and published his results in the Journal in March 1958. The main conclusion which he drew from the experiment was that air velocities of up to 1 500 ft per minute could be used instead of the usual 400 - 500 ft per minute thus reducing cooling tower excavations. Pressure losses through the cooling tower were however comparatively high but the increased fan power costs were offset by power savings due to an increased co-efficient of performance which would result from lower temperature condenser water becoming available. Members found the results to be particularly significant as the trend at the time was towards underground cooling towers using relatively hot air. The best possible use therefore had to be made of the limited air supply.

Dust and pneumoconiosis

In 1958, pneumoconiosis was still a serious problem in the South African mining industry. The last official report from the Pneumoconiosis Board gave the latest figures which showed a further 6 129 new cases were granted compensation in 1956/1957 at a cost of £3 810 000 to the Industry.

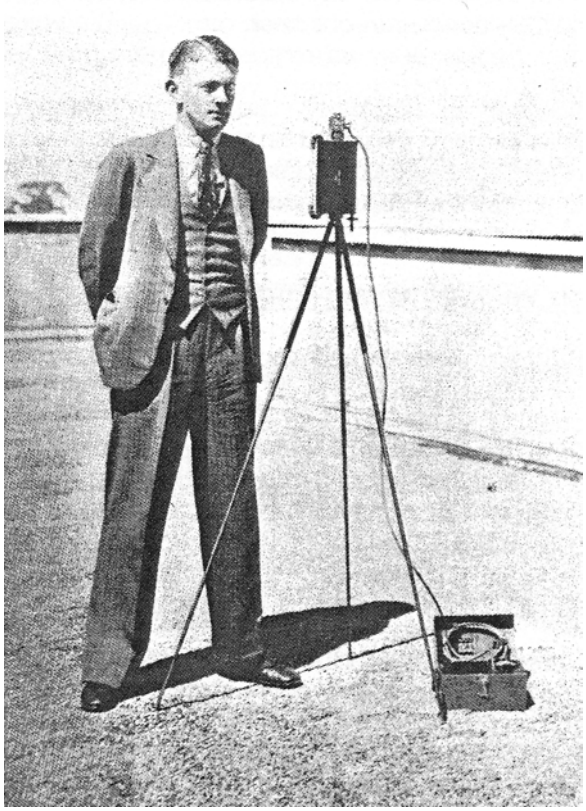
Beadle was elected president for the year 1958/59 and the topic he chose for his presidential address was, quite aptly, a topic close to his humanitarian heart. The address was structured around twenty commonly asked questions about dust and pneumoconiosis, and as Beadle put it

'If they could all be answered positively the reward would be measured in millions of pounds - the sum which is spent annually in this country compensating pneumoconiosis in our mines. There would be an even greater reward from the humanitarian aspect - the gain in the health of the workers, the prevention of premature retirement due to lung disease of many people when they are at the most useful stage of their careers, and the prevention of the disruption of family life and security which must come when the breadwinner has to leave his employment due to ill health and subsist on his pension.'

He explained that it was still not known whether one half-micron silica particle was more or less dangerous than one two-micron particle; or whether peak concentrations were more dangerous than a steady average level of dust; or, in fact, if freshly fractured dust was more dangerous than old dust. Regarding other factors which could influence the disease he said

'The man who rushes furiously around breathing heavily, must breathe in much more air than his companion who carries on more quietly. On the other hand, the rapid breather has the air in his lungs for a shorter time giving the particles less time to settle or diffuse to the walls of the alveoli! Which is more dangerous?

.....Surely the clean-living, athletic type is more resistant than your heavy drinker and smoker, who practically never breathes fresh air? Incidentally, I am told that when information was sought on this subject, the survey revealed that there were no miners who ever smoked more than three cigarettes a day or had more than a pint of beer a week!'



Derrick Beadle with TP – Circa 1936.

The debate was also still raging about whether the measure of dustiness should be number concentration, surface area or mass. Beadle strongly believed that the correct parameter was the surface area of the particles which could reach the alveoli of the lungs, and mentioned that *'some people argue that it does not matter what property of dust is measured.....but I entirely disagree'*. He also felt that the time was now ripe for a re-appraisal of the measurements taken and *'if the old methods are found wanting, for the development and introduction of new methods'*.

Members all knew his absolute aversion to the konimeter and were waiting eagerly to hear what he had to say about its continued use. But Beadle was all too aware of the antagonism outrageous comments would cause and restrained himself to two remarks; namely that the konimeter was *'of doubtful validity'* and *'I am convinced that the konimeter is misleading us grossly at present'*.

The remainder of his address concentrated on strategies for control, dilution and prevention of dust as well as a cure for pneumoconiosis. The conclusions he had drawn on each of the questions did not paint to members a positive picture about the status quo regarding the topic. But he had made them aware that complacency about technological advances in the field was not the answer. A united effort was urgently required by everyone concerned from Consulting Engineers at Group Head Offices, managements of the mines to officials, miners and labourers.

The address plus the International Conference on Pneumoconiosis held in Johannesburg in February 1959, renewed members interest in the topic. The conference was not organised by the Society but was a successor to several that had been held in the past starting with the historic Johannesburg Silicosis Conference in 1930. Unique to this conference however was that it was the first to embrace both the medical and engineering aspects of the problem and many of the resolutions passed were adopted by authorities from both disciplines worldwide. It pleased members that the Society was well represented among the South African delegation and included Beadle, Kitto, Lambrechts, Barcza, Du Toit and Le Roux.

Regarding pneumoconiosis, the most far-reaching recommendation agreed upon relating to dust and engineering was that

> *'measurements of dust should relate to the "respirable fraction" of a dust cloud, this fraction being defined by a sampling efficiency curve which depends on the falling velocity of the particles and which passes through the following points: effectively 100 per cent efficiency at 1 micron and below, 50 per cent efficiency at 5 microns, and zero efficiency for particles of 7 microns and upwards; all sizes refer to equivalent diameters'.*

This relationship was to be used in designing instruments to collect airborne dust samples simulating the dust which would be retained by humans in the work situation.

The surge of interest in dust related topics continued throughout the year and fourteen papers were written for the Journal. Beadle's influence was continued by Kitto who was elected President for 1959/1960. Kitto, had at this stage, risen to the post of Director of the Dust and Ventilation Laboratory at the Chamber, and chose to give his address on 'Research and the Ventilation Officer', with particular emphasis on dust.

Kitto began his speech by referring to the value of the International Conference but warned members that to now sit back and relax, expecting the experts to get on with the job, was the most counter-productive attitude to adopt.

> *'It has been said that all research consists of "90 per cent perspiration and 10 per cent inspiration" and here in the mines we have the men capable of providing both these ingredients. If we are not making full use of this potential force - and I claim that we are not - the time has come to reassess the whole situation and make use of the material at our disposal in such a way that their efforts and achievements are not wasted.'*

He spelt out to members that the objects of a mine research team were not to do research of a fundamental nature but to reduce health hazards and, at the same time, increase productivity. He pointedly showed how current findings on dust could be applied to the day-to-day hazards met by men on mines, and suggested ways in which the Industry could use the knowledge gained by research more effectively. Regarding training, he re-iterated Le Roux's call a few years earlier to allow ventilation officers the opportunity to write the Mine Manager's Examinations without making them leave ventilation and go into mining before being eligible to write the examination.

The tone of his speech was urgent yet positive. Research needed two ingredients to be productive, namely leadership and efficient liaison between the industry and the research worker. Kitto understood the dynamics involved and sincerely believed that the problems could be solved but as he said in his conclusion

'...if we are to eliminate pneumoconiosis there is one aspect more important than all the others put together, and that is the determination of all underground staff to reduce dust by their own efforts, led by those responsible for this reduction .....It only remains to be seen whether we can do it in time to help not only the future generations but ourselves as well.'

The dust campaign had been lost for the last twenty years because the experts had quibbled about logistics. The effort, dedication and professional integrity of men like Beadle and Kitto was at last beginning to pay dividends. The scale had begun to tip back in favour of the dust men. They had progressed further.

CHAPTER 12

The man underground today is the one to be protected. We must react.

Haven, 1960

Coming of age

The admission into the Associated Scientific and Technical Societies on the 1st June, 1958 signified the recognition of the Society's standing in the technical community. *'It marks our coming of age'* was the pertinent remark by Barcza who also solemnly explained that

> *'It will bring us certain privileges, but it also entails serious responsibilities. Not only must we maintain our already commendable standards but we must strive to raise the standards of our members and our Society'.*

By 1959, the finances of the Society were looking very healthy. Grave had worked tirelessly in 1958 persuading advertisers that the Journal was an effective medium through which they could publicize their products. His achievements in this field generated almost enough revenue to pay for the printing costs of the Journal paving the way for the indefatigable Steed to triumph in 1959. In just two and a half years the efforts of these two men had enabled the Journal to become self-supporting. The Society had also made a small profit by selling over 500 reprints from Barenbrug's article in October 1957 on 'A resistance chart for standard galvanized swaged ducts', and as the New Consolidated Goldfields had donated the stencils of Rayner' s book to the Society, further income had been generated by the sale of over 300 copies of the book. Entrepreneurship leading to revenue had also been shown by the Society when it obtained permission to print a booklet containing all the current Mining Regulations on Ventilation, Dust, Gases and related subjects. Advertising once again covered the printing costs and the booklet was sold at a nominal price of 2s 6d.

However not all activities were profit generating. Beadle wrote a correspondence course in ventilation for use by the Witwatersrand Technical College which was introduced in 1959. The writing of the book was sponsored by the Chamber of Mines but responsibility and credit were given to the Society. Steed, besides devoting time to advertising, prepared the first Consolidated Index to the Journal covering the years 1948 - 1957. It had been a difficult task requiring inordinate attention to detail, and was praised by Beadle in 1959 as being *'an invaluable reference source to anyone seeking information on what has been published on any given ventilation subject'.*

The only disappointing activity was the preparation of the Society's Ventilation Textbook. The idea had first been mooted in 1956 and a sub-committee had been formed under Professor Black. Progress had been sluggish, Black had taken leave of absence and Quilliam acting as Chairman had *'made valiant efforts to persuade the various authors to get busy on writing their chapters, or even synopsis of these, but progress has been slow'.*

Heat exchange between water and air in underground cooling plants

By 1959 a large number of refrigeration plants had been installed underground to cool mine air and there was every indication that this number would increase substantially over the next years. Normal practice was to use water as the medium to transfer the heat rejected by the condenser to

the return air. The important design consideration was that the condenser water should be kept as cool as possible.

After giving the issue serious consideration, Le Roux wrote a paper advocating that the most efficient and cost-effective method of transferring heat from condenser water to upcast mine air would be through the use of an extended spray system. He felt that his analysis proved that

> *'With 'perfect' heat exchange, a spray bank could theoretically achieve the same results as a perfect counterflow heat exchanger, but the system would be easier to install and maintain than a counterflow cooling tower. The benefits to the Industry could be enormous and so full-scale experimentation should be conducted at this stage when the practice of cooling mine air underground is finding increasing application in South African mines'.*

Lambrechts who had written a paper the previous year describing experimental studies with high-velocity vertical cooling towers, found Le Roux's paper stimulating but was not quite sure whether Le Roux was just indulging in *'arm-chair speculation'*. He mentioned current figures to give members an idea of the scope of air cooling at present, and to demonstrate that there was as yet no standard practice in condenser-water cooling.

> *'In the Anglo American Corporation Group we have installed fifteen 300 ice ton underground cooling plants in the last few years and another nine are awaiting installation, or are being installed, with another two on order. Of the 15 plants now operating, 14 have horizontal spray banks for condenser water cooling and one has a vertical cooling tower. The 16th plant, to be commissioned shortly, will also have a vertical cooling tower and the 17th, almost completed, will have an extended horizontal spray arrangement.'*

His opinion about current designs was quite derogatory although he qualified his reasoning.

> *'One suspects that spray chambers designed for, say, the skyscrapers of New York have been installed underground in our mines! This is no reflection on the manufacturers or suppliers - it is simply a case of a completely different field of application having developed fairly quickly and now we have to plan for changed conditions.'*

Lambrechts then gave preliminary performance figures of the vertical cooling towers designed on the basis of his previously published work, and said that although the theory of heat transfer was well understood, they were still a little in the dark about *'the mechanics of keeping water in contact with the air to best advantage'*.

> *'Things have a bad habit of simply dropping to the ground unless they are fixed. Now, if we could persuade hot water droplets to do, say, a zig-zag or circular journey in mid-air, and then fall into the sump after perhaps half a minute or so, we would have a case of perfect water cooling, and then Mr Le Roux's novel and logical requirement of "equivalent thermal capacity" could be satisfied at the same time.'*

This is where he had doubts about an extended spray system and believed a counterflow vertical cooling tower with a high air velocity would enable hot water droplets to lose their heat more easily.

Le Roux replied to Lambrechts comments, in September 1959, making the point that measures taken to improve efficiency of a condenser water cooling tower are only justified provided the total energy input to the refrigeration system as a whole is reduced in the process or if there is an increase in refrigeration output to balance any increase in energy input. He maintained that the advantage of the extended horizontal spray system is that pumping costs are generally not as high

as the pumping costs associated with vertical towers, and that the use of multi-stage horizontal spray chambers were not recommended because of possible high pumping costs. The topic had began to intrigue members who were all only too aware that the outcome would have important ramifications on the design of cooling systems in the future.

Methane and the Orange Free State branch

One of the motivating reasons when forming the Orange Free State Branch in 1956 had been the need for members living and working in that district to tackle the issue of methane. Methane was hardly experienced in the mines on the Witwatersrand but it was of such importance in the Orange Free State (OFS) that it was the topic chosen by the branch for its first symposium on 22nd November 1958.

Gorges opened the discussion and did not mince his words.

> *'Methane is of immense importance in the OFS. It is an insidious foe, giving no warning of its presence to man's senses. It can cause asphyxiation; it can burn; it can explode - violently. Its danger arises largely from its intermittent but widespread occurrence. One has to guard against it; one can neglect precautions ninety-nine times out of a hundred and get away with it. One is caught the hundredth time - and of course it is always the other man who is caught. If the gas was never absent, there would be no temptation to neglect the precautions and the mines would be ten times safer. The precautions are a nuisance, particularly when smoking is prohibited. This is unpopular and difficult to enforce, and the chances a man will take to enjoy a cigarette are unbelievable.'*

Subjects discussed that day ranged from the properties of methane to instruments for detecting the gas. Attendance was excellent with over 80 people participating including Mr E Quilliam, the Underground Manager of the newest mine, Free State Saaiplaas. Mr C Roos of President Brand GM, when discussing safety precautions that needed to be taken, mentioned that *'air velocities should not be less that 50 f.p.m. in all workings'*. Mr G P Badenhorst, from the Government Mining Engineer's Department replied that

> *'the Mines Department does not demand an air velocity of 50 f.p.m. It is a recommendation, but we are not sure that this velocity will always be sufficient to clear the gas'.*

Roos, known to be quick witted, replied *'under the circumstances, a recommendation is enough for us'.*

A lot of interest was shown in Mr G Honeybun's paper about the safety lamp. He advocated the use of a lamp without a probe for the detection of thin methane layers, a practice which had been discredited in Europe. Members were clearly uncertain about the exact method of using a safety lamp, and prolonged discussion ensued on this as well as on the merits of testing a development end with the fan switched off where methane emission was slight. The most practical and comprehensive paper that day was presented by Mr O A Huss who was the Ventilation Officer at St Helena Gold Mines Ltd. The paper, which won the Mine Managers Association Award for 1959, was highly practical and accurately reflected the state of the art as regards methane problems in mines. He told those present that adverse ventilation conditions are caused by low volume, low velocity and cessation of flow. Accidents could be prevented but only if all accumulations were detected. Danger spots included pockets in the hanging, development ends, stope faces worked above the strike in the form of back stopes and those worked up on a fault plane, and finally, raises connected above the through ventilation.

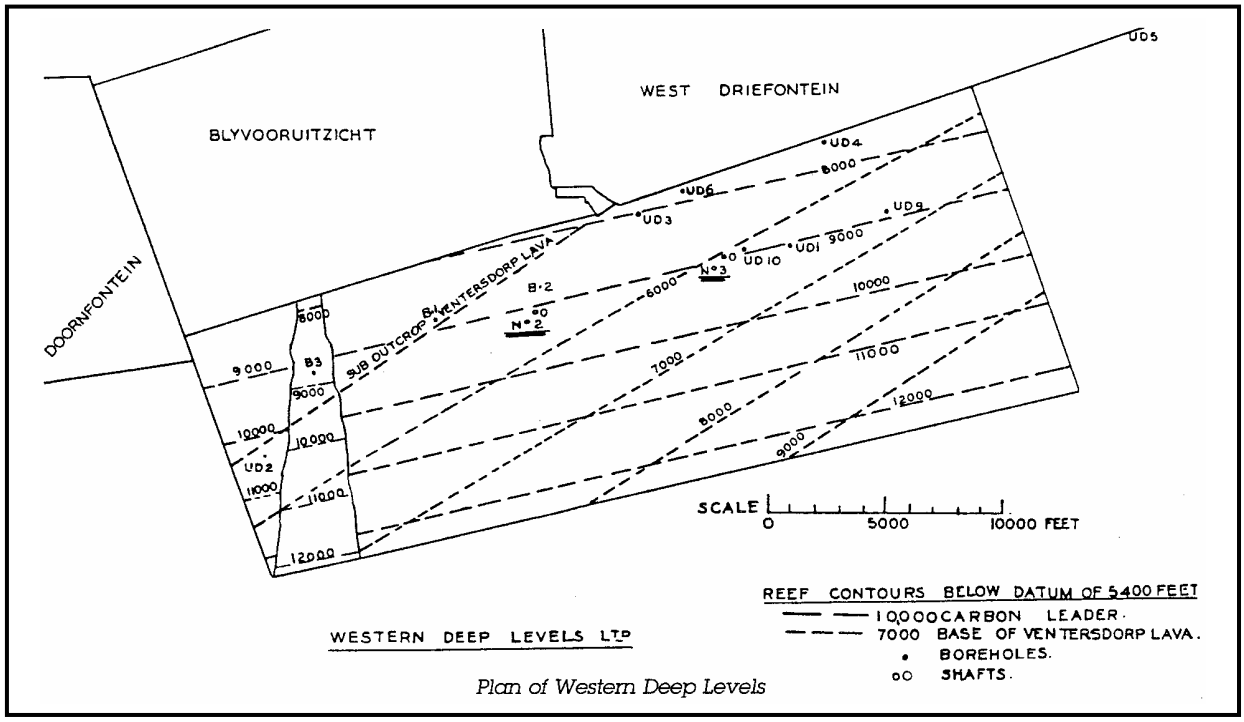
The response to the symposium had been so positive and encouraging that the proceedings were

published in the Journal in October 1959 and the result was that other members of the Society, although not dealing with the problem directly, were able to learn about problems being experienced and resolved just a few hundred miles from the Witwatersrand.

Ventilation planning

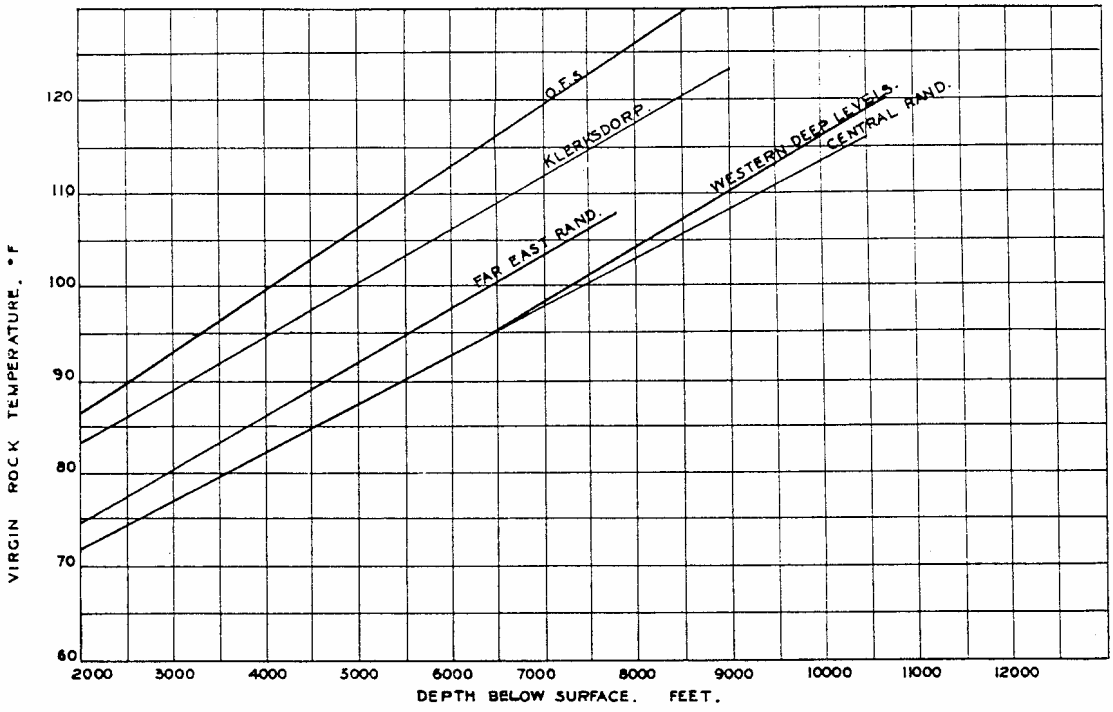
The ventilation planning for Western Deep Levels situated some 50 miles west of Johannesburg was a mammoth task. The mine, owned by Anglo American Corporation, was destined to become the world's deepest mine and the capital requirements for bringing the mine to full production was estimated at the time to be about 30 million pounds. Lambrechts had been the Group Ventilation Engineer of the Corporation for about 12 years when he assumed responsibility for the ventilation layout of the brand new mine. When the planning which for the first time integrated every sector of mining was complete, Anglo American circulated the details to the veterans in the other mining groups asking for comment. Lambrechts presented a paper to the Society on the ventilation aspects in July 1960.

When introducing the paper, he made it clear that the object of the exercise was to decide on the main features of the system and not to dwell on specific internal details. He described the area to be mined and mentioned the favourable rock temperature gradient.

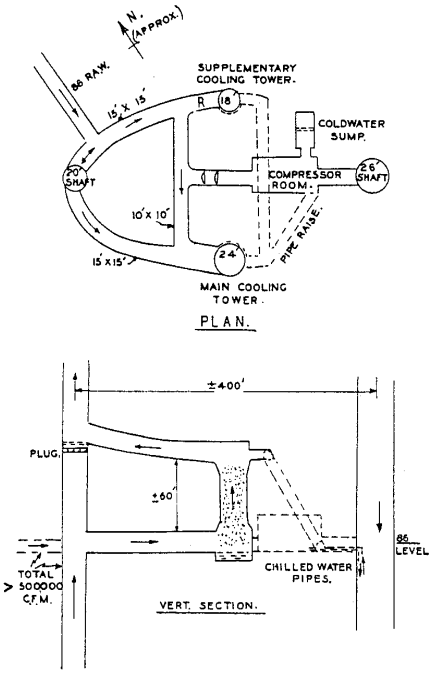


Plan of Western Deep Levels

He said that the air requirements that had been stipulated were 300 000 c.f.m. for the Ventersdorp Contact Reef horizon and 1 000 000 c.f.m. for the Carbon Leader which gave a total of 1 300 000 c.f.m. in each shaft measured at underground density. Refrigeration requirements were estimated to be a surface fan quantity of 1 000 000 c.f.m. per shaft in conjunction with an underground cooling capacity of 2 300 ice tons at each shaft. He continued by describing the main fan system, and made reference to the use of streamlined buntons in the downcasts and provision for plugs, to be by-passed by the air, in the upcast system around the 6 000 ft level to separate out the water. After elaborating in some detail about the refrigeration system, he concluded the presentation with a brief description of the proposed stope ventilation.



Rock temperature graphs
(Shows the difference between the various mining areas)



Diagrammatic arrangement of cooling plant

He paused as he ended the speech. He never really knew how members would react and remembered the days when discussions had turned into raging arguments. The planning of Western Deep Levels had been the highlight of his career and he was slightly nervous that his colleagues in the Society would try to influence his carefully thought out decisions. He added his rider

'Shaft sinking is well advanced at Western Deep Levels mine and since, in the matter of deep level mine ventilation, the primary shafts constitute a pre-requisite for adequate ventilation, this part of the planning programme can now be said to be fait accompli. Furthermore, the main fans have already been ordered and this completes a second major step. For the rest of the plans, although tentatively agreed upon, they are flexible enough to stand such modifications as may be reasonably expected by the exigencies of mining.'

He waited. Barcza made the comment that *'I will not cross swords with the author in what he has planned to do, but*

intend rather to examine whether my slightly different approach would have led to the same recommendations'. He then described his own attempt to optimise ventilation and refrigeration reaching a different conclusion to Lambrechts. He concluded, saying

> *'No doubt I have been walking "where angels fear to tread", and my comments should not be regarded as a criticism of Dr Lambrechts' reasoned approach and undoubtedly sound solution.*
>
> *.....At the same time, I am sure that he will agree with me that although we have acquired the skill that enables us to ventilate our mines to any depth likely to be reached, we have not yet enough knowledge to allow us to state with confidence that we are using the most economic methods that are possible.'*

Barenbrug then rose and said it was a pity that Lambrechts had submitted only superficial data to the Society and warned members that

> *'Every mine is different and for this reason it can be dangerous to transfer data from one mine to another without knowing the reasons for such decisions. A detailed analysis of the ventilation planning of a mine of this nature could well have formed a standard work for future guidance.'*

He then commented on the number of shafts proposed for Western Deep Levels and concluded from a ventilation point of view it might be possible to reduce the number of shafts. He reached this conclusion by relating shaft friction factors to economic velocity and judged that Lambrechts had been pessimistic in his assumptions regarding streamlining.

The ideas of the experts were fairly different on the topic but Lambrechts had been the one brave enough to take the plunge. Barcza was however right when he made the comment

> *'Our ignorance may well cost the Industry hundreds of thousands of pounds per year. What we need is more knowledge, and to achieve this, the Industry must attract more suitably qualified men to mine ventilation work, whereas we ourselves must strive to improve our knowledge. We have a long way to go.'*

CHAPTER 13

For young and ambitious men there are many opportunities for new thought and the application of fresh ideas in the science of ventilation.

J H Quilliam, 1960

The Society in retrospect and in outlook

The tireless, friendly and sociable Quilliam succeeded Kitto as the President of the Society in April 1960. He was liked by everyone but it was Rabson who expressed in words the sentiments felt by members who had grown to respect and admire the man who had carried the banner of the Society for many years.

'I find it particularly satisfying to know that his untiring efforts and enthusiasm in the cause of the Mine Ventilation Society have led to his achieving the highest award the Society can offer, namely the office of President. I can think of few members who so justly deserve this reward. Mr Quilliam's work for the Society started many years ago, in his capacity first as Honorary Secretary of the Society and later as Editor of the Journal together with the Secretaryship, and finally for a long time the mainstay on whom practically all the work and arrangement of the activities of the Society developed. I think I can truthfully say that no single member of the Society has put in so much actual practical work and devoted so much time to the affairs of the Society as Mr Quilliam.'

The theme chosen by Quilliam for his presidential address was a retrospection of the Society's activities and achievements since its inception, and an outlook for the future. It was an apt choice, being of general interest to all members. When explaining his reasons for choosing the topic, the quotation he used befitted the moment.

'A time comes in eight, ten or fifteen years when, having learned and practised their calling, men do well to cease for a while from action and to think about what they are doing and why and how they are doing it. This is apt to be the most fruitful educational phase of all and these men, who by thinking have more thoroughly possessed themselves of what they are doing, are ripe for greater responsibility.'

He then recapped on the reasons for the formation of the Society and the initiative shown by the founder members. Regarding the administration of the affairs of the Society, he explained that management and control were vested in the Council which had the power to appoint specialist committees. He told members that he considered the Executive Committee to be under utilized and made the comment that many matters *'are often first discussed by Council, in some cases unnecessarily so, and I feel that such matters should initially be put before the Executive'.*

Referring to the Journal, he suggested that a standard questionnaire should be introduced for completion by referees when assessing the suitability of papers for publication, and that the referees should consider every paper's potential for presentation at meetings. This he said would *'avoid what has so often happened in the past viz. that, when the Council is faced with arranging an Ordinary General Meeting, one of our senior members must be hastily blackmailed to prepare a paper at very short notice'.*

He bemoaned the need, on the part of the Editor, to resort to personally approaching authors to ensure a continuous supply of papers, and advocated the appointment of representatives in the

various mining fields to *'ferret out the existence of suitable material'*. The other problem, he said, was the need to maintain a proper balance between practical and highly technical papers because *'scientific knowledge and scientific facilities can be so easily wasted if the practical value of the end product is not kept in view'*. He then presented to members an analysis of the papers which had been published to date.

ANALYSIS OF PAPERS PUBLISHED UNTIL EARLY 1960

Subject	% of all papers published
Filtration of dust and extraction of gases	13.3
Ventilation	8.6
Air and airflow	7.6
Dust	7.2
Shafts	6.7
Heat and temperature	6.7
Instruments	6.2
Fans	6.2
Doors and airlocks	5.7
Fires and mine rescue	4.8
Gases	4.8
Air conditioning	4.8
Temperature	3.3
Water	2.8
Ventilation piping	1.9
Economics	1.9
Acclimatisation and heat stress	1.4
Graphs, charts and slide rule	1.4
Pressure	1.4
Meteorological data	1.4
Silicosis	0.9
Pressure surveys	0.5
Stoping	0.5

In connection with the various sub-committees which had been established over the years, he mentioned the Fan Standardization sub-committee whose terms of reference had been to define terminology and standardize methods of testing fans. He expressed regret that *'this committee's recommendations were never concluded and were thus never published or made available'*. Continuing he said *'might I venture to suggest that the work of the committee be revised and continued, and further, that they consider other aspects of the standardization of ventilation equipment, instruments and accessories'*.

Rabson proposed the Vote of Thanks. He re-iterated that the *'Journal remains the king-pin around which the activities and interest of the Society revolve'*. He suggested however that the contents could be made more stimulating through input by non-members who were specialists in particular subjects. By way of explanation for this suggestion, he recalled an incident which had occurred a few years previously.

> *'I remember for example being quite shocked a few years ago to hear a member, accepted as being eminent in mine ventilation, say that there was no useful data of a fundamental nature available on the design of cooling towers, and so he had to work out a design for an underground cooling tower experimentally and empirically himself. Surely people like him should be aware that any chemical engineer trained or experienced in heat and mass transfer could supply the*

necessary information. It is to fill gaps like this that I feel contributions outside of actual mine ventilation can be of value'.

Members nodded in agreement remembering the incident. Drummond then seconded the Vote of Thanks. He generally supported Quilliam's reservations about the lack of participation by members in the Society's activities but disagreed as far as the Orange Free State Branch was concerned.

'Mr Quilliam indicates his disappointment at the lack of discussion at the meetings which have tended to become lifeless and uninteresting. Meetings which must be exempted from this criticism are those held by the Free State Branch, where free and spontaneous discussion is the rule rather than the exception. Their secret may be in their less formal atmosphere and more intimate circle.'

The presidential address given by Quilliam had been a success. The war veteran who himself was descended from a mate on H.M.S Victory at the Battle of Trafalgar as well as a member of the crew who mutinied on the ship H.M.S. Bounty, had certainly made many of those present aware of the challenges still open to the Society. Rabson and Drummond had also, in their contributions, made pertinent remarks as to ways improvements could be made. Many members left the meeting absorbed in the questions and ideas which had been posed.

Shaft resistance and design of shaft equipment

Since Mr L B van der Merwe had presented his paper on the effects of streamlining shaft buntons to the Society in 1950, interest in resistance of shafts to airflow had become tantamount to an all-consuming passion for a number of members.

Until about 1950, nearly all shafts serving the Witwatersrand and the Orange Free State mines were timbered and rectangular. The prime considerations were ore and material handling ability with air carrying capacity being relegated to second place. However when the Virginia circular shaft was sunk in 1951, the modern advances in the design of circular shaft equipment and improved sinking rates brought to the fore the advantage these shafts had in ore, material and airway capacity. Slowly the industry began to change over.

But there were problems. The equipment installed in the shafts for supporting the guides for the conveyances resulted in a serious increase in the resistance to air flow. However because of the shape factor the rubbing surface per unit area was drastically reduced as was the total frontal area of the shaft supports. A circular shaft also did not need wall or end plates and required fewer dividers.

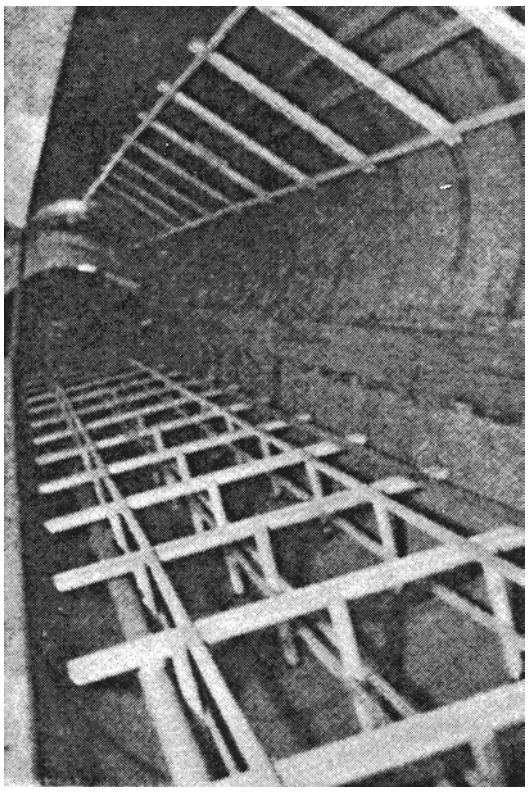
Fewer buntons, smaller and different in shape to those traditionally used, were installed. It became clear after a while however that the arrangement, shape and spacing of buntons played a far greater part in the resistance of the shaft to air flow than the mere shape of the cross-section.

In 1954 the Director of the National Physical Laboratory of the CSIR, Dr A J A Roux, proposed that research be undertaken in this area. As a result, a new investigation was launched into the problem on an industry-wide front and in association with the CSIR.

Members all readily appreciated the importance of finding the best way to design and arrange shaft equipment to ensure minimum resistance to airflow. The first tests were carried out by Rand Mines Limited. Barcza initiated the project and soon persuaded Mr Mike Martinson and Mr Stewart Pyne-Mercier, a vacation student at the time, to work with him. Together they conducted the pioneering scale model tests into ways of reducing the resistance of a rectangular timbered shaft at City Deep. The findings which described the correlation of the resistance of an existing shaft with that of a scale model built in a specially constructed wind tunnel and demonstrated the

advantages of altering the shape of the shaft support were published in 1955 by the Journal of the Chemical, Metallurgical and Mining Society of South Africa. This pioneering work made it possible to approach the issue from a scientific perspective and therefore begin practical planning of shaft streamlining.

Martinson, always known to become totally engrossed in whatever fascinated him, continued to improve on his pioneering work. In 1957 he published, in the MVS Journal, the results of tests he had carried out to predetermine the ventilation resistance of two dissimilar downcast circular shafts in the Orange Free State. Members recognised the far reaching value of the paper for it was practically orientated and provided useful data. In addition, Martinson gave a detailed account of how scale model tests should be designed, carried out and interpreted.



Test Section equipped to represent No. 3 Shaft.

Then in 1958, after feedback from members about his other papers had been so positive, he published his notes on a resistance survey of the South East Vertical Shaft at East Rand Proprietary Mines Limited. The survey had been carried out using the standard method where Askania microbarometers were used on surface and in the shaft. He calculated Atkinson friction factors for each 500 ft increment and arrived at a weighted mean factor for the whole shaft. Most of the results obtained fell within the expected limits except for the friction factor value based on single readings at the bottom and the top of the shaft. This, he explained, was

> *'almost certainly due to the fact that the mean of the two densities did not accurately represent the true mean density in the shaft, and should serve as a warning against the unguarded use of this short-cut method'.*

At the same time the National Mechanical Engineering Research Institute (CSIR) in Pretoria was working on scale model testing. In December 1958, Mr J F Kemp published a paper which covered the principles of low-speed aerodynamic model testing and then considered the potential and limitations of the technique when applied to airflow resistance of mine shafts. He mentioned that the specific problems associated with scale model testing were the effects of compressibility, wall interference, turbulence, flow profile and surface roughness. His conclusions were however positive and added weight to the experiments being conducted by members of the Society who were tackling the issue on a more practical level in the mines.

> *'Although scale model testing presents numerous pitfalls, the technique can in many cases be applied with confidence for studying the resistance of mineshafts.*
>
> *Where bluff buntons or semi-streamlined ones with abrupt changes in contour are used in the internal structure, all the major problems with model testing can be overcome.'*

The results of this early research then spurred Le Roux on to combine forces with Mr Vic Chasteau from the National Mechanical Engineering Research Institute and together they tackled the resistance to airflow of the Pioneer Shafts at Buffelsfontein Gold Mining Company Limited. They worked well as a team with Le Roux conducting in-stitu tests on the downcast and upcast

shafts and Chasteau working on a scale model of a typical length of the Main Shaft. Le Roux found, after commissioning the main fans, that the total resistance of the two shafts was much higher than originally calculated but did not know which shaft was the cause of the excessive resistance. He decided to measure the resistances of both shafts individually using the full volume-reduced volume method, and then re-assessed the future requirements of the mine using the measured shaft resistances and an estimate of the natural ventilation pressure. The results led him to conclude that the requirements could only be met by increasing the fan power or by reducing the downcast shaft resistance by streamlining the buntons.

Chasteau's work concurred with Le Roux's conclusions. Using a scale model, he aimed at trying to determine the airflow resistance of the shaft when it was equipped with an internal structure which incorporated various degrees of streamlining. The results showed that the use of semistreamlined fairings could reduce the resistance considerably and that the addition of tails to give fully streamlined sections did not yield any further appreciable reduction.

More papers on the topic were published in the Journal in 1960. In particular, the results of studies carried out at Durban Roodepoort Deep Limited and Vaal Reefs. By this time all members of the Society were aware of the advances being made in the field and a joint symposium was convened by the Society, in conjunction with the South African Institute of Mining and Metallurgy and the South African Institute of Mechanical Engineers. After the opening address by Mr C B Anderson, President of the Transvaal and Orange Free State Chamber of Mines, Grave as President of the Society reviewed the research to date into shaft resistance. When discussing the change over to circular shafts in the industry and the new requirements for spacing, he amused members by saying

> *'Spacing between setts, which in the early days was about 5 ft (possibly as far as Cousin Jack could reach comfortably) and had later increased to 7 ft 6 in (South Africans are tall men), was now doubled and 15 ft became the common interval with 20 ft in more recent cases.'*

The symposium which took more than a year to organise was a landmark in the history of mine ventilation and mechanical engineering. Papers were presented on every aspect of the issue and included measurement of shaft resistance with a number of types and arrangements of shaft equipment, scale model testing, design of shaft equipment, resistance of rope guided conveyances, exit and entrance losses at shaft heads, design of shaft banks, methods and instruments for measuring shaft resistance, the effect of removing water, and streamlining in upcast shafts.

The advances that had been made in the field over the last 10 years had indeed been astounding and during the symposium it had become very clear to all those present that the progress had only been made possible through the enthusiastic co-operation that had existed between all parties integrally involved with the problems. But, as Le Roux also put it *'It is certainly fitting that at this stage…… tribute should be paid to the pioneers in the field of shot scale model testing.'*

CHAPTER 14

What was considered impossible yesterday is being put into practice today, and becomes routine tomorrow.

Anderson, 1961

Equipment exhibition

Since mid-1960, Beadle had been ruminating about the idea of holding an exhibition where all the types of ventilation equipment, instruments and accessories available in South Africa would be on display. He discussed the idea with others in the Society who immediately responded with enthusiasm.

They unanimously felt that such an exhibition would not only be a coup for the Society as no similar display had ever been staged in South Africa but that the advantages in terms of exposure for ventilation officers, manufacturers and agents would be enormous. Ventilation officials from the mines would be able to see what new equipment was available, and they would be able to compare the products from different firms. Manufacturers and agents, on the other hand, could only welcome the opportunity of meeting a cross-section of ventilation officials. An exhibition of this nature would also give mine staff the chance to see equipment they had heard and read about but never seen.

The original enthusiasm for the project infectiously affected other members, and a committee was set up to arrange the logistics. It consisted of Beadle as the Chairman, and Messrs. CCF Bell, JA Drummond, RSJ du Toit, DFH Grave, J Lawrie and JH Quilliam. However, as with the Journal, no-one realised the amount of work involved. They all agreed that the initial priority was to arrange a venue. The first choice was the Chamber of Mines' pavilion at Milner Park. But conditions for rental were not quite as simple as members had originally anticipated, and after protracted discussion the negotiations fell through. They continued the search and eventually signed a contract with the M.O.T.H.'s for their club hall in Auckland Park.

The next step was a brainstorming session to identify every potential exhibitor. It was an easy step but once done, the real drudgery started. Each company had to be contacted by letter and then telephoned as Beadle insisted that personal contact was essential if the endeavour was to be a success. Members of the committee began to contact the 60 companies with Beadle pushing them all the way. His energy for the project was infinite and everyone knew that there would be no peace until every arrangement had been finalised to perfection. Twenty-four companies eventually agreed to participate or as Beadle felt *'accepted the invitation'*. But as the floor space available was only 4 000 sq. ft, any more exhibitors would have meant that the stalls would have become too small. Beadle said that it was a lucky coincidence.

The first day of the exhibition, which was to last 3 days, coincided with the opening of the symposium on shaft resistance and the design of shaft equipment. Visitors poured into the hall. Many of them were from the Free State and Western Transvaal and were delighted to be able to combine attendance at both functions. Over 500 people signed the visitors book in the foyer over the three days, and as Beadle said *'not all visitors bothered to sign it'*. The list of names included several consulting engineers, many mine managers and senior mining personnel, practically all the Group Ventilation Engineers, Inspectors of Mines, senior officials from the CSIR, the Professor of Mining of the University of the Witwatersrand and many of his students.

Beadle was thrilled and knew instinctively that the exhibition would be a triumphant success after he had been introduced to a ventilation engineer from one of the copper mines in Northern Rhodesia. The man told him that he had been sent down to Johannesburg by his company specifically to attend the exhibition.

After closing, compliments about the standard of the exhibition poured in. A consulting engineer wrote to the Society and said

'Thank you most sincerely for inviting me to your wonderful exhibition. I enjoyed seeing the very interesting collection of instruments and plant which were on view and wish to congratulate your Society on a worth-while exhibition.'

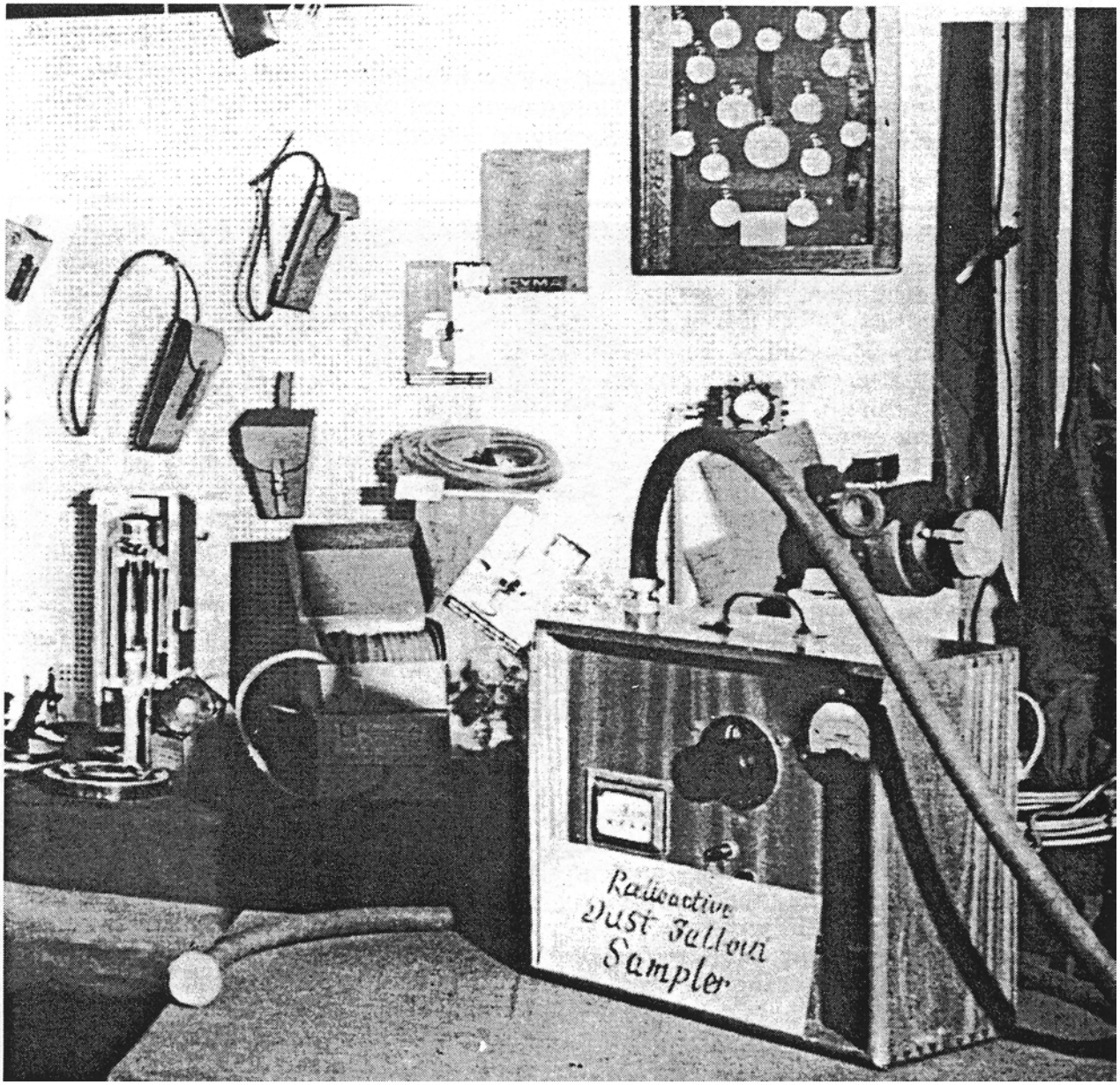
A general view of the Exhibition Hall. This picture shows approximately half of the stands.

A surprising letter was also received from a non-exhibiting firm where the managing director wrote

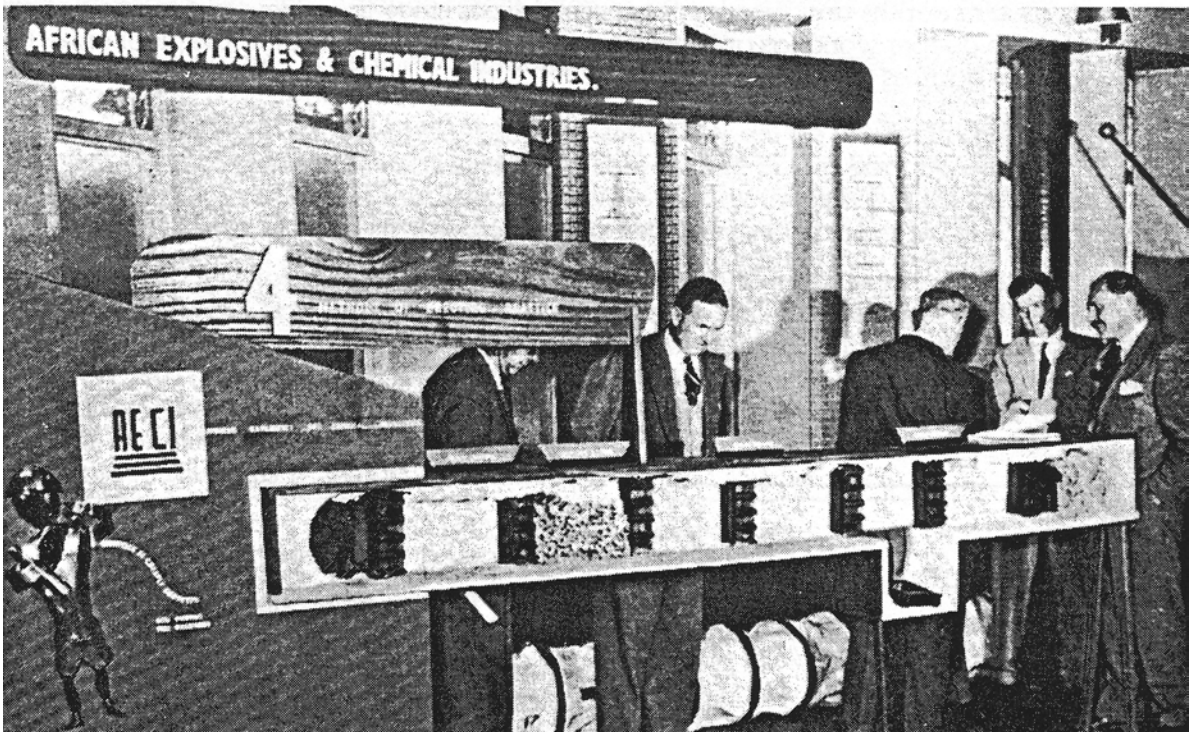
'....not able to take part in the exhibition. We do appreciate the efforts you are making to demonstrate ventilation equipment made in South Africa, and in recognition of this, we are enclosing our cheque for R40 towards some of the expenses incurred by the Society.'

Beadle and the other members of the committee had certainly scored a victory for the Society. The exhibition was not only the first in South Africa for ventilation equipment but also, they ascertained, for any mining equipment. Another measure of success was that the Society was

immediately inundated with requests to repeat the show in Welkom. This was done with the willing co-operation of the Orange Free State Branch and the enthusiastic support of the commercial firms. The second exhibition opened in October, just four months after the first.



Portion of the stand of Douglas Giles and Company. The instrument in the foreground was especially developed by this company for measuring radioactive dust fall-out.



The model of a stope exhibited by African Explosives and Chemical Industries, showing four different methods of erecting "Vynide" brattice cloth for controlling air-flow.

Trends in the ventilation of South African gold mines

Both the symposium on shaft resistance and the exhibition of ventilation equipment were held during the year of Grave's presidency, and much of what was accomplished during the year can be attributed to the President's strength in benevolent leadership which evoked from members a willingness to work for him.

He gave his presidential address at an Ordinary General Meeting of the Society on 2nd December, 1961. Thirty-one members and 23 visitors attended the meeting, and the esteem that Grave commanded in the industry was borne out by the presence of Mr TL Gibbs, the Government Mining Engineer, and Professor E Linsel from the Steinkohlenbergbauverein in Germany.

Grave chose as the topic for his address one which was both pertinent and stimulating for all present. In 1953 he had been very aware of how well Barcza's address on statistical information about the ventilation of South African gold mines had been received plus how interested members had been in Beadle's contributions regarding publishing statistics from the Government Blue Book. The title of the address was "Trends in the ventilation of South African gold mines", and by quoting Gibbs vote of thanks to Barcza in 1953, he explained his objectives.

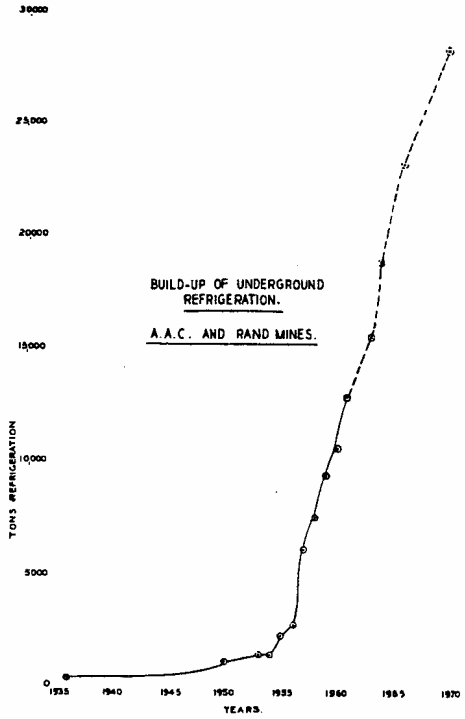
> *'. ". the golden opportunity for someone in five or ten years time to bring the information up to date and to use Mr Barcza's figures for purposes of comparison to indicate improvements and new developments". This golden opportunity I shall try and grasp and use to the best of my ability.'*

He said that between 1953 and 1961, three large-scale goldfields had been opened up, namely the Welkom area in the Orange Free State, the Klerksdorp-Stilfontein area in the Western Transvaal, and the Leslie-Kinross area to the east of the Witwatersrand. The overall trend had been towards

greater depths and higher rock temperatures since the newer mining fields had in many cases both deeper workings and steeper geothermal gradients than the older ones. He referred to Barcza's address and said

'he lists seven mines (all on the Witwatersrand) that had reached depths of over 8 000 ft below surface by the middle of 1953. The deepest point was on Crown Mines (9 876 ft below surface) with E.R.P.M. a close second at 9 561 ft. The virgin rock temperature recorded in both cases was 117°F.

In 1960 there were nine mines in the range of 8 000 to 12 000 ft below surface and the VRT at the deepest point, just over 11 000 ft below surface, was 125°F. In the Klerksdorp area, though the depth of workings was less - the four deepest mines were operating in the range of 6 000 - 8 000 ft below surface - the VRT was also high, up to 114°F. In the Orange Free State, where the deepest point reached is 7 435 ft below surface (VRT = 122°F) all eleven mines were in VRTs of over 100°F at their maximum depths.'



Graph showing build-up of underground cooling since 1935 together with an estimate of the requirements for the next 10 years.

Grave then posed the question.

'What, then, is being done to provide satisfactory working conditions in these increasingly deep and hot mines? What success is being achieved in this important task, which can be called the largest mine ventilation project in the world.'

He turned to air quantity and quantities supplied per ton, and showed that the quantity per ton had increased by about 85 % over the last 20 years. Regarding air conditioning, he traced the trend from bulk air cooling on surface to the installation of underground plants while also illustrating the steady rise in total installed refrigeration capacity.

In reviewing conditions in the workings, he drew attention to the general increase in working temperatures which had coincided with the opening up of hotter mining fields. He showed that there was a similar trend in heat stroke cases which pointed to the need for more effective acclimatization.

HEAT STROKE CASES

YEAR	Fatal	Non-Fatal	Total	Total per 1000 persons employed
1950	2	17	19	0.083
1951	7	12	19	0.089
1952	8	8	16	0.075
1953	8	10	18	0.087
1954	13	21	34	0.154
1955	10	25	35	0.148
1956	11	32	43	0.174
1957	12	31	43	0.171
1958	9	73	82	0.333
1959	9	65	74	0.255

When assessing filtration, he once again referred back to Barcza's earlier address.

> *'The total volume of air filtered underground has thus increased by half since 1952, and there is a strong movement towards the use of flannel bag filters, which now dominate the field even more than they did then.....It can be taken that the bulk of flannel bag filters in use now are of the Rabson vertical bag type. Electrostatic filters have doubled in number though the total number of installations is still small. Blanket and sawdust filters are obviously losing their appeal though a considerable number are still in use. The trend is also towards larger filters - from an average of 6 200 c.f.m. handled in the average installation in 1952 to 8 200 c.f.m. per filter in 1960.'*

He then covered fans, ventilation piping, shafts and ventilation costs before focusing his attention onto personnel.

Year	Cost of ventilation piping and fittings £
1957	488 309
1958	589 437
1959	642 076
1960	727 721

Personnel who were highly motivated and highly trained, he felt, were a priority on every mine and he found

> *'... it disturbing, therefore, to note an increasing tendency for ventilation officials to drift away from the ventilation department and to take jobs in other branches of mining - in the mining department where the financial rewards and prospects are very much greater and the physical work not all that much harder - in other ancillary departments where there is no need for an elementary ventilation certificate'.*

He ended his address with the question *'we can do it - but what will it cost?'* and quoted a prominent mining engineer who had recently said

> *'...with increasing depth, not only do the technical problems become more difficult, but the difference in cost between the optimum method and the less economic methods of ventilating that may well be adopted through inadequate knowledge, becomes increasingly great.'*

Members nodded in agreement. They remembered what Barcza had said the previous year when referring to Lambrechts' paper on the ventilation planning for Western Deep Levels. Grave's opinions were respected and every member was aware of his reputation for keenly balanced judgement without getting bogged down with petty details.

The Government Mining Engineer, Gibbs, proposed the Vote of Thanks. Referring to the question of knowledge and its application, he queried *'to what extent has there been an increase of knowledge of the various problems of ventilation and dust control in the period reviewed by Mr Grave and, equally important, to what extent has this knowledge been applied?'* He emphasised the important role research had to play in this regard and said

'I feel that a more intensive scientific approach to many of our fundamental problems is long overdue. We talk for instance about increasing air quantities, improving layouts, better application of water for dust allaying and many other aspects, but do we know exactly what we should aim at? I feel that our knowledge in relation to a clear definition of the various targets in the field of ventilation and dust control and how these targets can be reached efficiently and economically is very limited, and increased research is urgently called for.'

Discussion then followed with similar sentiments to those of Grave and Gibbs being expressed. Mr S C Newman, Manager of Durban Roodepoort Deep, mentioned that staff *'cannot plan in a vacuum*' and that *'the effect of factors quoted by your President such as depth, heat and gradient, emphasize the importance of planning, and this requires great ability and intimate knowledge; once again a blending of skills.'* The last contribution of the morning was from Mr J Nolan, a non-member, who ably summed up the prevailing opinion of the Society within the industry.

'(I would like).. to express the view that from this address, the papers of your Society and the enthusiasm of its members that the future and its problems can be safely left in your hands.'

Mine fans and air current

During Grave's presidency, another coup for the Society was a visit and lecture by Professor F B Hinsley who was at that time the Head of the Department of Mining and Fuels at Nottingham University. Hinsley was a world authority on ventilation, and his latest investigations had concerned the *'question of how rapidly the air current slows down and reaches a steady state in a mine ventilation system after the main fan has been stopped or slowed down.'*

The view held by several authorities at the time was that several hours were needed for a steady state to be reached. But Hinsley, in his infinite and patient wisdom, had been convinced for a number of years that this was not necessarily the case. After conducting a series of tests, he showed that after the fan was stopped it, in fact, took 33 minutes for the pitbottom water gauge to fall completely back to natural conditions. However, he informed members *'97% of the fall took place in the first five minutes.'*

Barenbrug had proudly accepted the invitation to propose the Vote of Thanks to Hinsley. Hinsley was a man he deeply admired and he was honoured to be regarded as a personal friend. He wanted to make sure everyone in the room was aware of the prestige to the Society of having a guest as highly renowned as Hinsley.

'I am of the opinion that the work done by Professor Hinsley is of fundamental importance for the understanding of the behaviour of air in deep mines. What Atkinson did for the behaviour of air in individual sections of a mine, Professor Hinsley has done for a mine as a whole; and for this he deserves our whole- hearted appreciation.'

Lambrechts seconded the Vote of Thanks and clearly felt the same as Barenbrug about the stature of the man standing before them.

'Prof. Hinsley has, entirely to my own satisfaction, given incontrovertible proof that when a main fan is stopped, conditions rapidly stabilize again, within a matter of a few minutes.'

It was not often that these two men were in total agreement. Members were surprised. They had grown to expect some form of dissention. Then Barcza stood up and also agreed with Hinsley and the proposers. He was followed by Botha, Drummond and Martinson. It was indeed a memorable day for all 85 people present.

CHAPTER 15

We have perhaps been sailing too close to the wind for too long.

J de V Lambrechts, 1961

Heat and performance

It had been recognised by the 1960s that there were four variables in the underground environment which contributed to heat stress. These were air temperature, the velocity of the air, the quantity of water vapour (which determined the humidity and therefore the wet-bulb) and the mean radiant temperature of the surrounding surfaces. Ventilation engineers could control wind velocity and air temperature but direct control of the other two variables presented problems.

During the years 1958 and 1960, the Applied Physiology Laboratory of the Transvaal and Orange Free State Chamber of Mines carried out studies to provide the gold mining industry with reliable data on the effects of changes in wet-bulb temperature and wind velocity on the productivity of "native" labourers. Mr HM Cooke presented the findings to the Society at the Annual General Meeting in 1961. The paper called "The effects of heat on the performance of work underground" had nine authors, with Cooke being the principal author.

It was indeed a milestone in the history of acclimatization, and true to Cooke's reputation, did not contain any irrelevant details. He stood on the podium and surveyed his audience. He needed to ensure the rapt attention of his listeners. He first reviewed previous research concluding that it was not entirely valid for two reasons, namely that the physical task performed was not a mining task and because the same subjects had been used throughout a fairly long trial without taking account of their cumulative state of acclimatization.

An improved regime was therefore used for this study. Pairs of labourers were set to work lashing rock into mine cars in a development end under the supervision of a "boss-boy". A range of air temperatures were used at fixed air velocities of 800, 400 and 100 ft per minute, and the productivity was simply the number of cars filled in a five hour shift. The results showed that the quality of supervision had a significant effect at wet-bulb temperatures below 93°F but little effect at higher temperatures. He continued saying

> *'Under really hot conditions, however, i.e. over 93°F wet bulb temperature, the effect of heat appears to be so profound that it swamps the effects which differences in the quality of supervision may be expected to have. The significance of this is that good production boss-boys will be wasted if they are put in charge of gangs working at wet-bulb temperatures of over 93°F; they will have their maximum effect at the lower wet bulb temperatures, about 87°F and below. On the other hand, because of the dangers of heat illness, the ideal type of boss-boy to employ in hot conditions is one who, while maintaining a steady rate of work, albeit low, is able to detect signs of distress among the natives working under him.'*

Regarding the effects of wind velocity, he said that the relationship between work performance and wet-bulb temperatures in the range 81 to 96°F, was influenced far more when the wind velocity was changed from 100 to 400 ft/min than when it was changed from 400 to 800 ft/min.

Barcza proposed the Vote of Thanks, referring to Cooke as the *'architect, the clerk of works and one of the brick-layer members of his efficient team'*. He also reiterated Cooke's premise that

> *'The performance of a huge manual labour force is of considerable economic importance under any circumstances, but when environmental conditions are severe, the performance of the labour becomes a sensitive barometer.'*

Lambrechts seconded the Vote of Thanks. He stressed the humanitarian aspects of improving the thermal underground environment and warned that

> *'Increased productivity is not the only benefit that will be derived from an improved environment. Let us say that it represents the attractive bait which will make the swallowing so much simpler or more spontaneous. I am referring now to the fact that a very hot mine is bad for business from the public relations point of view. People are not born to spend their working hours in Turkish baths underground, and this on top of the other hazards and discomforts of underground mining. They dislike it and, where opportunity offers, they find alternative employment in secondary industry, farming and many other walks of life. In other words, hot mines are not favourably suited for the recruitment of workers, and the indirect cost to the industry arising from these circumstances is probably far greater than is generally realised.'*

The practical Lambrechts had come a long way in his thinking since the early 1950s, and on this occasion had never spoken a truer word. He was absolutely right.

Barenbrug then stood up and contentiously used the figures presented by Cooke to establish a relationship between productivity and wet kata, and between productivity and effective temperature. He then tried to quantify the effects of these relationships and concluded that he preferred the wet kata. As usual, he had researched the topic meticulously and presented his own findings in detail. He referred to Cooke's work as a *'crash programme'* but conceded that *'they have given us sufficient data to make a preliminary study of the results worthwhile'*.

All eyes turned to Wyndham who was the second principal author of the paper. The historic difference of opinion between Kitto and Wyndham on the topic of the wet kata back in 1954 would never be forgotten by members. But Wyndham had learnt from that experience and his reply to Barenbrug was very controlled.

> *'We have done the same calculations (as Barenbrug) and, in addition, have examined the relationship between productivity and effective temperature, as calculated from the same data; our conclusion is that effective temperature is considerably better than wet-kata as an index of the effect of heat on productivity.'*

He continued in the same restrained tone.

> *'It needs to be emphasised that heat-stress affects not only productivity, but also causes discomfort and physiological strain; the latter, in its ultimate extreme, is manifested as acute heat collapse and/or heat stroke. The wet kata has been shown to be quite hopeless in earlier studies from the laboratory for predicting physiological strain and, in fact, it is wishful thinking to imagine that one index can be used to predict both physiological and psychological reactions.'*

Members this time agreed with Cooke and Wyndham. The paper had made sense and they felt honoured that the authors had regarded them as a body of sufficient importance with which to discuss the implications of the research findings.

Society affairs - 1962

The year of Grave's presidency had been one of the most active for the Society since its inception. Besides the exhibition, the "Symposium on shaft resistance and the design of shaft equipment" and Hinsley's visit, the Society had also held another symposium, on stope ventilation.

On 28th April 1962, Grave handed over the reigns to Mr Rudi du Toit, who was later to become Dr Rudi du Toit. Before doing this however, he summed up the year's progress to members. The first edition of "Answers to ventilation examination questions" had completely sold out and a second edition was expected in the near future. Progress, although fairly minimal, had been made with the writing and production of the textbook, and positive response had been received about the Afrikaans list of mining and ventilation terms which had been completed the previous year.

The Association of Mine Managers prize was won by Mr Middleton Hill for his paper called "Refrigeration applied to longwall stopes and longwall stope ventilation". Mr Holl, Vice-President of the Association, when presenting Hill with the prize remarked

> *'The reader of this paper is at once aware of the difficulties associated with the older deep-level mines such as E.R.P.M. Limited where the ventilation system of necessity grew as mining operations proceeded to even greater depths and downcast facilities became more and more limited.*
>
> *The practical manner in which these problems were eased under the prevailing conditions and the lucid manner in which the work was described is very creditable, and of value to mines in a similar position. It is also a guide to the trend of thought to be followed in newer mines with the object of avoiding these difficulties and the expense connected therewith.'*

Du Toit, who worked for the Department of Mines, was then inducted as President. Grave explained to members that *'his service in the field of dust research is of a high standard and he is well known for his energy and originality of thought'*. His election was unique to the Society for he was the first to be chosen from the ranks of a Government Department and not from the mining industry.

Du Toit felt very nervous about addressing members. There was little need however for he was respected by members for his practical approach to solving problems facing the industry, and his educational credentials certainly befitted a president of the Society. He had obtained his B.Sc.(Eng) in Mining at the University of the Witwatersrand in 1945, and had then achieved his Mine Manager's Certificate in 1952 and his M.Sc.(Eng) in 1959. His personality also inspired admiration for he was known as both a boffin and an eccentric. Members often laughed when he used to tell them about his daily ritual which involved getting up at the crack of dawn and milking his cow before setting off to work.

However, he was deeply honoured to be elected as President and told members with honesty his feelings about his new position.

> *'The thought of myself as President of the Mine Ventilation Society of South Africa stirred in me a variety of emotions, predominant of which was the emotion of pride. I must confess, however that I have also experienced the emotions caused by anxiety. I have experienced the emotion due to doubting whether I will be able to make the grade, having to follow in the footsteps of the calibre of Mr Grave and others elected President of your Society.'*

He continued saying that an additional worry was the Society's poor financial standing at present but added that members had *'acted wisely in the election of Members of Council, and it instills*

confidence to find tried and tested members back on Council together with new blood so essential to prevent stagnation in a society.'

Cost of adverse environmental conditions

Barenbrug presented a paper to members on the morning when Du Toit was inducted as President. The paper followed on from Cooke's "The effect of heat on work performance underground". When Cooke had presented the paper, Barenbrug had voiced a number of objections which had not been particularly well received by members. This time the topic he chose was pertinent for who could argue with his opening remark that *'the studies on the effects of heat would not be complete if the economic implications were to be ignored'.*

In achieving his goal which was to optimise the ventilation quantity and refrigeration capacity for a given mining situation, he explained that three factors had to be considered. These were the cost of labour related to productivity as it was affected by the thermal environment, the cost of air circulation and the cost of refrigeration. His calculations, he believed, showed the *'limit temperatures below which refrigeration becomes uneconomic'.*

These were
* 88°F - for a stope face velocity of 100 ft/min
* 90°F - for a stope face velocity of 200 ft/min
*91.5°F - for a stope face velocity of 300 ft/min
* 92.5°F - for a stope face velocity of 400 ft/min.

Lambrechts proposed the Vote of Thanks. He said that his comments would *'be of three kinds'.*

> *'(i) Nothing but praise for Mr Barenbrug's study in methodology.*
> *(ii) Little else but criticism on the purely quantitative side; in other words, the figures he used or arrived at.*
> *(iii) Some overall personal comments on the probable future techniques and economics of deep-level mine ventilation.'*

Quoting from personal work which he said was in the *'embryo stage'* and *'still not officially available for publication',* he advocated lower air quantities and more refrigeration together with the use of concentrated mining. He was emphatic about the last point and stressed that

> *'The future of deep level mine ventilation and the economics thereof lies not primarily in more ventilation and refrigeration, but in much more intensive or concentrated mining. Without wishing to work myself or any of you out of a job, I would say, facetiously, to the production mining men: "God helps those who help themselves!"*

Once again everyone present knew he was right about the future resting in more intensive or concentrated mining. No-one could argue. Le Roux then rose and, like Lambrechts, praised the soundness of Barenbrug's methodology and reiterated to members the difficulties of arriving at reliable figures. Barcza's contribution was similar to the one he had made when discussing Lambrechts' paper on the ventilation planning for Western Deep Levels.

> *'By applying our limited knowledge with care and discrimination to a particular problem, we can hope to evolve a plan which is reasonably sound from an economic point of view, but by basing our plans on unproved data and simplified assumptions, we could be party to misspending large sums of money.'*

Barcza's instincts were correct but someone had to begin the process of new discovery each time. This time it was Barenbrug, and Le Roux verbalised the sentiments of the other members that day.

'We are fortunate in having members of this Society such as Mr Barenbrug who make mathematics their hobby in preference to less productive pastimes. I, for one, am very grateful to Mr Barenbrug for the practical economic language into which he has translated the very interesting information obtained by Dr Wyndham and his co-workers.'

Ventilation ant-ics

For years the Editorial Committee had been pleading with members to supply fillers for the Journal. In mid 1963, they received a note about ant technology from Mr Hans Rossocha, a member who worked on the commercial side selling borehole equipment. Rees could not stop laughing for it was the best piece ever submitted. He showed the other members of the Committee and they agreed wholeheartedly. Rossocha wrote, quite truthfully

'To me ants know quite a bit about mine ventilation.

Travelling from Bothaville to Allanridge one can see plenty ant-heaps and ant-chimneys. They are always in pairs of two, sometimes more, but never single. This is because one needs at least one downcast and one upcast shaft to ventilate workings.

.....How do they obtain air circulation? By raising the shaft collar higher on the one side than on the other. You will find that the collar of the downcast shaft is raised on the lee- and the collar of the upcast shaft on the bluff-side of the prevailing wind direction. This must obviously lead to air circulation, and one can test the air movement by holding a cigarette in the chimney. It's a proper exhaust system.

As the season gets hotter they build the chimneys higher. They also make adjustments for the seasonal change of wind direction and wind velocity.

Different kinds of ants believe in different ventilation systems.

Between Potchefstroom and Klerksdorp one can see a type making round moulds. They ventilate their workings by exhaust only. They use the venturi principle, and since the mound is symmetrically round, they are quite independent of wind directions.

.....It seems that the ant-ventilation engineers must have a lot of executive power to get things done fast, so the weather does not catch up with them.

If the leading ants ever hold meetings, there certainly must be fairly quick decisions. But I rather think there are a few despotic specialists running the whole show of each ant- state.'

He ended this technological discourse on a broader note by referring to the capabilities of moles.

'Ants are interesting, but so are moles. I have to find out yet how they can develop tunnels their own size with such fantastic speed. I know how they break the ground, but I don't know how they move it along the haulage to the ore pass.'

CHAPTER 16

Without your help, and without your appreciation of the problems involved, little will be achieved.

P H Kitto, 1963

Dust is dangerous

With the exception of Grave, dust had been the speciality of all Presidents elected since 1958/1959. Du Toit was renowned for his ceaseless campaign against dust and his presidential address in October 1962, served to enlighten members further on the topic. The focus of his address was however slightly different to the addresses given by Beadle and Kitto which had concentrated on commonly asked questions about dust and pneumoconiosis, and research and the ventilation officer with special reference to dust.

Du Toit chose to relate the quality of mine air to the duties of ventilation officials and began by reviewing conditions in mines over the past 60 years and the concomitant regulations which had been enforced. When assessing present day dust conditions he pointedly informed members that *'the opinions expressed in this address are my own and do not necessarily coincide with the official views of the Department, to which I am attached'*. He said however that he believed there had been little improvement in dust conditions over the last 20 years. Reasons for this were mainly economic but the *'absence of official dust standards for the various classes of working places'* and the possibility that the routine dust results do not reflect the true position' were also factors which should be taken into account. He added that

> *'Routine results are mostly the only results available, and this situation will continue for along time to come in the case of many classes of mines. In view of this, I should like to plead with routine dust samplers to take and record routine dust results in such a manner as to be useful for purposes of computing dust exposures.'*

Before addressing the changes recently introduced in the Pneumoconiosis Act, he discussed the motives for taking dust samples as well as the better use of routine dust sampling results. The changes to the Pneumoconiosis Act which he drew attention to were

> *'(a) That the Minister of Mines may recover from the owner of a controlled mine such sums as he deems necessary for research in connection with any matter affecting the health of persons employed at that mine or for the medical treatment of persons.*
>
> *(b) That the Act calls for the establishment of a Pneumoconiosis Risk Committee whose duty it shall be to establish "by whatever means the committee deems fit" the pneumoconiosis risk to which persons employed in dusty atmospheres at that mine are exposed and the committee may estimate different risks in respect of individual mines or parts of mines or classes or groups of mines or occupations or localities at mines.'*

Mr AB Daneel, Technical Adviser of the Chamber of Mines, thanked du Toit and said

> *'It is the perrogative of the person who proposes the vote of thanks to disagree with the President of the Society on any point in his address, and I must say that I find little to differ with.'*

In May 1963 yet another dust man was elected as President of the Society. A humble man, Mr James Lawrie had been active in the field of mine ventilation since 1927 and was the inventor of the Lawrie Immersion Cell which was used in the acid treatment of konimeter slides.

Working in the Chamber's Dust Department for 36 years had exposed Lawrie to the fundamental problems facing the industry with regard to dust sampling. He felt fairly strongly that the industry in general was unaware of both the research and the efforts being made by the Chamber of Mines Dust and Ventilation Research Laboratory and The Corner House Laboratories of Rand Mines Limited. Beadle, he knew, felt the same way and after discussion, it was decided that the Society should hold a symposium on all the recent developments and advances.

The symposium was held in August, 1963 and the speakers were drawn from both the Chamber and Rand Mines. It was an outstanding success with 19 papers being presented on topics such as the thermal precipitator, the konimeter, photoelectric assessors, variations in dust levels, gravimetric dust sampling and x-ray diffraction.

Kitto was elected to give the closing address which he appropriately called "Where do we go from here?" He emphasised to those present that no-one should lose sight of the objectives of dust sampling which were simply *'to determine the dust concentrations to which men are being exposed at various places in the mines with the ultimate object of keeping these exposures to a reasonable level'*. He felt that the amount of sampling being carried out at the time was totally inadequate and that because *'present methods of assessment are slow and laborious'* it made it difficult to *'increase the amount of sampling without excessive increase in staff'*. Looking to the future, he predicted that *'we may reach the stage where every man wears his own personal dust sampler, so that a permanent record is obtained of his cumulative exposure'*.

He concluded his speech by pleading for co-operation.

> *'Without your help and without your appreciation of the problems involved, little will be achieved. Let us not go down in history as the generation that merely maintained the "status quo" - let us rather make a real effort to break through the present "dust barrier". Both morally and physically we shall reap the rewards in time to come.'*

Kitto was beginning to lose faith. He had ended his own presidential address in 1959 on a similar note. The problem was still the same. The impetus to break the existing barriers had to come from the staff on mines. Research could do so much and no more.

Then in November 1963, Lawrie delivered his presidential address. The topic was, not surprisingly, the history of dust sampling and associated instruments in South African gold mines. It was the perfect choice considering the success of the recent symposium. He was also the most

qualified person in the Society to give the talk having worked intimately with the issues for so many years. The speech reflected his character. It was meticulously prepared, informative and to the point, He covered the history from 1902 to 1963, and members all agreed that it was the first time that the issues through the decades had been portrayed so lucidly.

In his conclusion he echoed one of the conclusions that Kitto had drawn after the symposium. Not as aware as Kitto of the problems involved when motivating staff in the underground working places, he still felt that the solutions lay in the hands of research.

'As for the future advances in Dust Sampling and Suppression, much depends on the simplification of sampling methods and serious attempts to eliminate the residual dust which has foiled all efforts for some years.'

Energy and pressure losses in shafts

In 1965, the Society awarded its first gold medal. Ernst Kislig, a scholar of extraordinary ability, was the worthy winner. The paper which earned him this recognition was called "A theoretical and critical analysis of the various methods of determining energy and pressure losses in shafts", and it had occupied 60 pages in the Journal spread over four months.

After qualifying as an engineer in Switzerland, he had spent the war years as a Messerschmitt pilot in the Swiss Air Force. He explained to friends that although Switzerland remained neutral throughout the war, she had reached agreements where both sides supplied her with arms. The condition was, of course, that she would never use them against the nation concerned in the deal. Thus, as Kislig once explained to Grave, *'the Swiss Air Force had at its disposal both Spitfires and Messerschmitts'.* In 1965 he still spoke with a German accent and his colleagues had long since learnt that when he spoke of "arie", he was in fact referring to "area".

Kislig's paper, which won him both the gold medal and the Association of Mine Managers of South Africa Prize in the same year, tackled the analysis of every published method of determining energy and pressure losses in shafts. The methods he examined were the Hinsley P-v diagram, Hinsley's long tube, the modified P-v diagram, Taylor's method, the energy equation, the polytropic equation, entropy, enthalpy, density and the simplified international meteorological formula.

Being extremely scientific, the paper was understood by relatively few members. Lambrechts however fully understood the implications of the findings and was annoyed as he believed that *'practical expediency sometimes overrides the use of a rigid scientific approach to a problem'.* In *1953* he had advocated the use of the simplified meteorological formula and had been subtly criticized by Barenbrug who believed the density method to be more accurate. A year later Lambrechts had strongly defended the method and now, ten years on, Kislig's findings were far more critical and damning than Barenbrug's had ever been. Putting pen to paper in 1965, he wrote a contribution to the Journal to voice his protest.

> *'There is the danger that if the subject were made to appear too difficult, some ventilation officials might refrain from doing certain necessary surveys. The fact remains that it is possible to relax scientific rigidity and yet get results which are perfectly adequate for most practical purposes.*
>
> *The writer, having used the simplified international meteorological formula on hundreds of occasions and finding it even simpler than the density method, is a little disappointed at the over-critical comments which Mr Kislig made concerning the former method.'*

He continued saying

> *'Mr Kislig states (p. 162) that the "formula is unscientific because the equation does not reveal the thermo-dynamical process on a P-v or entropy diagram". Why should this requirement be regarded as so important?'*

He then dissected the rest of Kislig's comments on the method and concluded that

> *'Mr Kislig has perhaps done rather less than justice to the meteorological formula by his critical comments. It is a method which has been used on numerous occasions with adequate accuracy and simplicity, for those who have used it regularly.'*

Lambrechts could be very obstinate. Even though his contribution made some sense, members were aware that it was Lambrechts, not Kislig, who was splitting hairs. The method was just not as accurate as some of the others Kislig had examined. No-one was surprised when Kislig won the gold medal in June that year.

Responsibilities of maturity

On the 20th anniversary of the Society, Mr Frank Startup was elected President. A modest man, Startup was one of the few remaining members who had grown to seniority in the Industry practically hand-in-hand with the growth of the Society. He however only gave his presidential address in 1965, on the 21st anniversary, as he was handing over to Barenbrug who had agreed to his third term of office because *'I feel the time has arrived to inject some new vigour in the Society and I am determined to do that'.*

Startup who had been the driving force behind drafting the first constitution chose, as his address, to recall the history of the Society. Lawrie proposed the Vote of Thanks and recalled with amusement the

> *'Coterie of gentlemen both from the Chamber's Dust Department and mine officials who were very interested in a friendly game of golf on a Saturday afternoon - it was quite amusing how their "seats" became very uncomfortable when the quarterly meeting became a bit drawn out which, as you know, should not interfere with golf.*
>
> *I can assure you that the chatter during these games went a long way to the formation of the Society. Of these gentlemen, most have left the industry or passed over.'*

Rabson seconded Lawrie and mentioned that

> *'For many years now we have had to stop regarding the Society as young or as one of the younger bodies, and we have had to begin to realize that we are part of a comparatively long Institution. This year officially marks the end of the period of "youth" and the Society becomes of age with the full responsibilities of maturity.'*

Startup then presented the Annual Report of the Council for the year ending 31st March 1965 before inducting Barenbrug as President. This time Barenbrug did not make a long speech. He stood on the podium and glowered at those present. Recalling the past he said tersely

> *'When the Society got well on its way in 1948 the interest shown by members was very great. Meetings and visits were well attended and contributions of members in the form of technical papers was very gratifying indeed. Often remarks were made by mine managers about the virility of the Society. Today the position is quite different. Meetings and visits are often poorly attended; contributions by members in the form of papers for our Journal are few and dwindling fast.*
>
> *.... We must not look to the past. That is over and will never return. We must look to the future. But the position today is simply this that a greatly improved activity is required if we want to improve or even hold our position in the Industry,'*
>
> *....everyone must play his part. If we are all determined to give it a go - no matter how small each contribution is - we shall succeed in elevating again the Society to the position in the Industry which it deserves.'*

With these sentiments, he closed the meeting. Members were fairly dumbfounded. They knew that the Society's finances were not particularly healthy but they certainly, in general, did not regard the situation as seriously as Barenbrug. However they knew, either from personal dealings with Barenbrug or from his reputation, that he was tenacious and committed to his visions. He would succeed where others had failed or there would be no peace.

When Barenbrug gave his presidential address in 1966, it was very different to the one he had given in 1955 on the fundamentals of thermodynamics. This time he chose to discuss his thirty years experience in the ventilation department. Members expected another history of mine

ventilation together with personal anecdotes, and were surprised when he chose to concentrate more on legal issues.

He began the address by stating that

> *'In order not to create confusion, I would like to refrain from statistical data' because conditions in mines have changed to such a degree in the last 30 years' statistical figures might give an entirely wrong impression'.* He continued saying *'We all know the expression that there are three forms of lies, "lies, damned lies and statistics". Not that I am against statistical data. They can indeed serve a very useful function, but the danger of statistics is that, unless they are used in their full context, i.e. unless all factors involved in the comparison are considered, statistics can be very misleading.'*

When analysing the question of mine ventilation he felt that one must consider the problems from three angles namely economics, humanity and a combination of the two. This point led to him introducing the point of his speech which was

> *'One can through regulations only demand a minimum standard commensurate with the technical, economical and humanitarian standard of our mining field as a whole and to leave it to the individual companies to decide whether they can do better than the minimum requirements.'*

His main criticisms of the present regulations were that 'the minimum requirements laid down are vague and confusing, and the interpretation of the regulations varies from area to area'. Also the terms of *"competent person"* and *"adequate ventilation"* were so vague that they led to *'innumerable arguments'*. The other result was that the ventilation officer had no specific frame of reference within which he could carry out his duties. The consequences of this, he said, were *'that if we want to attract better men to the ventilation departments we must be sure that they know where they stand. Nobody with any strength of character likes to be pushed around.'* He then compared the conditions of 30 years ago to those of the present, and reiterated what he had been saying to members since the inception of the Society.

> *'Although I do not want to claim by any stretch of imagination that I am as proficient as I should be, I am convinced that the only way of making our ventilation officers more acquainted with their subject is to pull them out of the whirlpool of controversial arguments and to be taught to think for themselves. This can only be done by training.'*

Mr Mike Sandys, Chairman of the Orange Free State Branch, proposed the Vote of Thanks. He said that he had mused over why Barenbrug had chosen to concentrate on the legal aspects for his address and on thinking the matter over

> *'It had become clear to me why he has done this. To many of us, Mr Barenbrug and mine ventilation are synonymous. Consequently, a history of mine ventilation would largely be a matter of self-praise.'*

Members were in agreement. They admired the man who had been true to his word and had been able to *'inject some vigour into the Society'*.

CHAPTER 17

Apart from the general rule that people resist change, their reactions are notably less predictable than that of equipment.

J Curtis, 1966

Surface acclimatization

Since Strydom had first published his paper on the two-stage acclimatization method in the Journal in 1954, he and his colleagues at the Human Sciences Laboratory had been working tirelessly to refine the technique even further. During the intervening years they had now introduced surface acclimatization as opposed to underground acclimatization. They had also expended considerable energy in educating the mining industry as to the vital role acclimatization played in the safeguarding of workers against the threat of heat stroke. In 1966, Barenbrug arranged the first meeting between the Society and the Institute of Refrigeration and Air Conditioning. The meeting took the form of a symposium and the topic chosen was surface acclimatization of Bantu labourers as it was of equal interest to members of both societies.

Strydom presented the first paper which covered in detail the need for acclimatizing labourers for underground work. He explained that the cooling function of sweat depended on the relative humidity of the air as well as on air movement and that above 75°F Wet Bulb Temperature the heat dissipating mechanisms of the body are greatly taxed, South Africans were however partially acclimatized because of the prevailing climatic conditions but when an unacclimatized individual had to work in temperatures of 82°F or above, he could develop heat stroke or heat exhaustion. Exceptions to this rule had also been recorded but he felt, these were more than likely due to malnutrition, incipient disease, innoculation reaction, water and electrolyte imbalance, age, drug and alcohol abuse, or cardio-vascular conditions.

OCCURRENCES OF HEAT STROKE AT WB TEMPERATURES BELOW 84°F DURING THE PERIOD 1962 - 1965.

DATE	WB °F	DB °F	REMARKS
1962	82.0	83.0	moderate case
1962	82.5	83.9	moderate case
1962	82.6	83.0	moderate case
1962	81.0	83.0	moderate case
1962	82.0	83.0	severe case
1962	83.0	84.0	fatal case
1964	83.5	84.0	moderate case
1964	78.0	79.0	fatal case
1965	83.5	84.0	moderate case
1965	82.5	83.5	severe case

The data he presented showed undeniably that heat stroke can and does occur at temperatures below 84°F. He ended his presentation on a sombre note by saying that

'Not only are the risks of heat stroke significantly greater to Bantu not acclimatized by the Chamber of Mines methods, but the mortality rate for Bantu not acclimatized is five times that of Bantu properly acclimatized.'

Le Roux, when thanking Strydom for his presentation, accurately summed up the industry's attitude towards the contribution being made by Strydom and his colleagues at the Human Sciences Laboratory. He praised the results, saying

'Of the 300 000 underground labourers in our mines about 60% work in places where the wet-bulb exceeds 80°F. About 10% are exposed to wet-bulb temperatures exceeding 88°F. It is a great tribute to Dr Strydom and his colleagues....that the annual incidence of heat stroke in recent years has been of the order of only one in ten thousand of this total labour force, and that of these only about a quarter of the cases have proved fatal.

This remarkable result has been achieved mainly as a result of the acclimatization procedures introduced by the Human Sciences Laboratory. At the same time these methods have resulted in the increased working efficiency of the labour force.'

The second paper was given by Mr Jack Curtis who was the Assistant Manager of Services at Loraine Gold Mines Limited. The topic he addressed was 'The economic basis for the adoption of surface acclimatization at Loraine Gold Mines'. He explained that two-stage underground acclimatization at Loraine took 12 five hour sessions but because of the time taken travelling to and from working places, training could not be done concurrently with the result that the time taken was actually 12 shifts. However with the improved supervision possible in a surface acclimatization chamber, the period could be reduced to 9 sessions of four hours each. This meant that four hours could also be spent each day on training. His analysis showed that in terms of costs, the mine could expect to save R19 000 per annum in salaries for acclimatization staff by using surface acclimatization and that the total gain in terms of shifts worked would be 40 297 per annum. He continued, explaining that this was equivalent to 130 labourers and that the annual cost for 130 labourers was R34 255.00 as the marginal cost of each labourer per year was R263.00.

The vote of thanks was proposed by Grave who complimented Curtis on the admirable and logical way he had approached his topic. Grave then outlined to those present the inherent difficulties of underground acclimatization.

'The productivity of acclimatization gangs is generally very low - at most half of that of a normal gang. Transport of acclimatizees (to borrow Mr Curtis' word) is a problem; being for the most part new recruits, they have to be virtually herded to the working place. Supervision underground is not as good as on surface, largely because of the geography of the working places. Wet bulb temperatures in acclimatization stopes have to be within a certain range. Frequently the temperature in an otherwise suitable stope moves out of that range (usually downward!) and an alternative working place is not always available. This leads to the undesirable condition that the mine is forced to make the acclimatization stope hotter than it need be in order to maintain the correct acclimatization conditions.'

Regarding surface acclimatization, he confirmed the savings mentioned by Curtis and then told those present about recent developments at East Daggafontein.

'A four-hour training shift, consisting of lectures in Fanakalo, use of tools etc., is combined with a four-hour surface acclimatization shift. It was originally thought that the training shift should be held in the morning, while the men were fresh, and the very strenuous acclimatization shift should follow in the afternoon. However, it was found that, contrary to expectations, the trainees tended to hold back their reserves on the morning shift - in expectation of the hard work in the afternoon - and

not put their full effort into the training. Now the order has been reversed and it is found that the response to the afternoon training shift, after the acclimatization shift in the morning, is much better.'

Mr T Hodgson from the CSIR then presented a paper on the design, construction and calibration of a surface acclimatization chamber. The meeting was adjourned at 22:35, and members were left feeling that once again the Society had succeeded in organising a meeting which had effectively combined theory with practical knowledge. They certainly knew more about surface acclimatization than they had two and a half hours earlier when they had walked into Kelvin House.

Temperature increases and heat flow

The period 1960 to 1965 marked the beginning of a new era for environmental control in gold mines. Western Deep Levels had begun production and ERPM was rapidly expanding to greater depths. By the mid 1960s very real concern began to be expressed as to whether heat could be controlled in the coming years at the projected depths of 3 000 to 3 500 m. Tools which would allow the ventilation engineer to accurately predict the heat flowing from the rock to the air were therefore urgently needed before ventilation planning could ever be carried out with any scientific exactitude.

In 1964, Mr Tony Starfield submitted his thesis entitled 'A theoretical study of heat flow in rock surrounding underground excavations' to the University of the Witwatersrand. It was to be the beginning of a long and distinguished career in the development of mathematical models which could be used for the prediction of heat flow into mine workings. His work was first brought to the attention of members in February 1966 when he published a paper in the Journal about heat flow into an advancing stope. In the paper he explained the reasons behind his assumption that the stope moved intermittently rather than continuously, and then introduced to members the concept of a cyclic pattern of heat flow corresponding to the cyclic pattern of blasting. His results were then derived for the total heat flow into a stope over one complete cycle which was the period between two successive blasts.

The paper attracted a lot of interest with contributions being received from three world renowned experts in the field. Dr G G Wiles who worked in the Physics Department of Cape Town University questioned Starfield's assumption that there was a difference between a stope advancing continuously or one advancing in jumps. He ended his contribution however with a comment on Starfield's use of computers

'It is interesting to notice that this problem in mine ventilation provides yet another example of the changes that electronic computers have brought to problems of all kinds. Methods which hitherto were not even considered, because they would involve life-times of computing, have recently become quite practical. Calculations of temperature gradients in tunnels which a few years ago took about six to eight hours each, can now be calculated in one second on a computer. When Dr Starfield mentions that a certain problem took 7 hours to compute on an IBM computer, one indeed gets a view of the enormous change that has taken place in the scope of numerical analysis. It is a pleasure to see full use being made of the new tools.'

Starfield then published his second paper in the Journal in October 1966. In this paper he explained how he had developed a numerical model for the calculation of dry and wet bulb air temperature increases in dry, wet or partially wet airways. He demonstrated the effect of intermittent cooling of the air as it entered the airway, and then calculated, on an '*electronic computer',* the consequences of the wetness of the airway. In his conclusion he stated that

'The examples given are only illustrations of preliminary investigations into one or

two of the many important questions which a computer model of heat flow can attempt to answer. The model presented above may well prove to be incorrect in some of its assumptions. It is however suggested that the basic approach is correct, and that once the various constants have been measured and correlated underground, and that once details of the model have been filled in, it should in future be possible to investigate on a computer how mining practice affects heat flow, and it would be possible to predict not only when cooling will be essential, but also the most economic way of cooling the ventilating air.'

The tool, although not flawless, had been found. Starfield was a dedicated man and members of the profession were in no doubt as to his ability to perfect the technique upon which much of the future of ventilation planning for deep mines depended.

Ventilation of twin haulages at depth

Ventilating development ends at depth had always presented problems because of the high temperatures of the surrounding rock. When encountering this situation the first solution was always to circulate large volumes of air to keep the temperatures of the air at a level where reasonable working efficiencies were possible. Other possible alternatives were dry mining or refrigeration.

Mr Japie Jacobs succeeded Barenbrug as President in 1966. A successful and well respected man, Jacobs' presidential address was to become a classic in the annals of mine ventilation. The topic he chose differed from previous addresses in that it was specific as opposed to general. As Barenbrug said

'It has always been the policy of the Society that the presidential address should be of a general nature rather than of a specific topic. When I read through the presidential address, which has just been presented to you, I was, at first, of the opinion that his subject was of too specific a nature to be provided at this annual general meeting. However, after a more careful consideration, I came to the conclusion that the general content of his address is of such a fundamental nature that the industry as a whole could derive great benefit from it, if his methods are followed up in all its details.'

Jacobs was the Chief Ventilation Officer at Buffelsfontein Gold Mining Company and his address was titled 'Ventilation of twin haulages at depth'. In his introduction he explained to members that Buffelsfontein had to develop a twin haulage system for a distance of 12 500 ft horizontally where the VRT was 111.8°F. Large volumes of air to these ends were not available and refrigeration seemed to be the only alternative. However it was decided to try and see to what extent refrigeration could be delayed by keeping the intake haulage dry. The noteworthy result was a temperature (wet bulb) rise of about 3°F over the whole distance or 0.3°F per 1 000 ft and, what impressed members even further, was that these results were achieved in winter.

Jacobs and his staff managed to complete the development end with no refrigeration and only 50 000 c.f.m. of air for both ends and, as he said in his conclusion

'The method reduced the flow of heat from the rock to the air to such an extent that it might have been possible to have continued the development for a total distance of 30 000 ft. Alternatively it can be said that the development could have been completed without refrigeration with even less air than was actually used.'

Barenbrug, in proposing the Vote of Thanks, observed that the project owed its success to the extremely dry conditions in the haulage. He continued saying

'Over the whole distance only 9 grs/lb of water was taken up by the air, most of which was either at the beginning or at the end of the haulage, near the face. The main reason for this low moisture increase was the pumping of the waste water back to the shaft in pipes rather them in drains. Although many people accept drains as the solution for dry intake airways, the majority of drains are not watertight.'

Mr Basil Botha, a crusader of dry airways, seconded the Vote of Thanks. Although a number of members did not agree with him they took his point when he said

'I find it surprising that the mining industry has not made more use of the benefits to be derived from dry intake airways, and general water control as Mr Jacobs has so clearly set out in his paper. Surely then it is clearly a better proposition to "look after the air" than to spread water willy nilly, and then purchase expensive refrigeration equipment merely to "squeeze" the water out again.'

Jacobs' address had proved to members that the respect afforded to this remarkable man was indeed not unfounded. He had broken ground not only in his work but had shown initiative in choosing a topic for his address which, although unusual, had truly furthered the objectives of the Society. Knowledge had been both shared and effectively disseminated.

CHAPTER 18

The man who is best able to express himself clearly and exactly is the man who will rise in his profession.

J P Rees, 1968

Optimization of ventilation and refrigeration requirements

In 1965 Lambrechts presented a paper called 'Optimization of ventilation and refrigeration in deep mines' at the Eighth Commonwealth Mining and Metallurgical Congress in Australia. He was at the time Professor of the Department of Mining at the University of Pretoria having resigned from the mining industry in 1964.

The paper was published in the Journal in April 1967, and his conclusions seemed to evoke a wave of controversy and, at times, hostility from other members in the ventilation fraternity. However, those who managed to remain more objective about the issue said that the hostility could be blamed more on the way in which Lambrechts released his work rather than on the work itself. An article had appeared in the local press implying that Lambrechts' conclusions were absolutely correct and that the rest of the mining industry had been foolishly and extravagantly applying erroneous methods. It was suspected by a few of the more sensible members that this press release was really nothing but a PR exercise as Lambrechts had just taken up the post in the newly formed mining department at the University of Pretoria.

Lambrechts' basic contention was that there had been *'a quite unwarranted tendency to counter increasing depth and rock temperatures in mines with ever increasing ventilation rates'.* He continued saying that

> *'These increased ventilation quantities have meant more and bigger shafts with consequently very high capital expenditure. It would appear now that very much smaller air quantities, perhaps half or one third or even less, with provision for full and frequent re-cooling of the air, would be economical; that is a drastic shift in emphasis from ventilation to air-conditioning.'*

He said that his studies had shown that

> *'The air quantity requiring the smallest total number of heat extraction was found to be about 25 000 c.f.m. which is only about a quarter of that currently thought good practice.'*

In mines practising extensive underground air cooling with heat rejection to the return air circuit, the above low optimum ventilation rate may mean that there will be insufficient return air available for heat rejection, with currently available refrigeration plant and refrigerants. The economies which can be effected, particularly by way of fewer deep level ventilation shafts if drastic curtailment in ventilation rates can be accepted, should prove a strong incentive for exploring the possibility of developing a new type of compressor plant with, if necessary, a new refrigerant. These should operate at very high condensing temperatures, thus requiring smaller quantities for heat rejection and making the attainment of the desired optimum a practical possibility.

There was an outcry which rippled throughout the industry. It was difficult to be objective and

many members took personal affront to the paper believing it to indirectly imply that little thought was being given to optimization of ventilation and refrigeration in South Africa. Barenbrug was the first to respond. He politely agreed with Lambrechts that there was a danger of indulging in excessive air quantities in the future but found the statement that the industry had already been so indulging fairly presumptuous.

But his main point of contention concerned Lambrechts' economic boundaries of air circulation versus refrigeration. Barenbrug was convinced Lambrechts had once again got his final numbers wrong and bluntly stated that *'Professor Lambrechts does not give all the data on which he has based his analysis. No cost figures are mentioned; it becomes therefore difficult to pin point any discrepancies'*. He shrewdly however pointed out that the economic curve given by Lambrechts (tons refrigeration required against stope air volume) had a *'most unusual shape for mining economics'* and that generally the curve *'is far less pointy and usually presents a range over which costs do not alter much. In Professor Lambrechts' figure there is no range. The economic condition is very definitely defined'*.

Using his incisive mind he then proceeded to query the accuracy of Lambrechts' conclusion that 25 000 c.f.m. was the ideal volume for a 3 000 ft longwall stope. He said this figure broke down into 1,5 c.f.m. per ton broken per month which would lead to the mine experiencing severe dust problems. In addition, this allowed only 2,5 c.f.m. per labourer which was not an adequate oxygen supply. The face velocity of 140 f.p.m. implied a high utilization factor and allowed little air for areas such as the scraper path, centre galley or loading boxes. He ended on a fairly sarcastic note saying

> *'Professor Lambrechts speculates that the desired balance between ventilation and refrigeration is not at present attainable with existing compressor plants and refrigerants. However he need not worry about that. An air-conditioning plant in one of the super-stratosphere planes has a condensing temperature of 245°F. It can be done, but it costs money, both in capital costs for special plants, and very high power costs.'*

From the few points that could be analysed, it is felt that Professor Lambrechts' model-mine is too over-simplified, and it is doubtful whether one can obtain a realistic answer from his approach.' Barcza was, true to character, more controlled in his contribution. He congratulated the author on his analysis but felt fairly strongly that the general comments and application of results could *'lead to an incomplete assessment of the position in South Africa with regard to deep-level ventilation'*. In addition he felt that Lambrechts had unfairly and unjustifiably created the *'impression that hitherto insufficient thought has been given to optimizing ventilation systems and that our mines have been and are being established with too many shafts of too large a size; also that the mines circulate too much air instead of resorting to more air cooling'*. Using the same train of thought as Barenbrug, he then looked at the results and illustrated why he thought Lambrechts' deductions were over-simplified and misleading. He objected to the optimization being based only on tons of refrigeration which he said was merely one of the many factors involved in ventilation planning. Other aspects which should have been considered were the cost of power, plant, pipes, insulation, labour, maintenance, shaft sinking, interest rates, as well as the life of the mine, taxation, the amortization period, the whole layout of the mine, the hoisting arrangements and the availability of labour.

Lambrechts was angry. His only means of defence was a stinging reply to the discussion. He maintained that the study was not intended as a blueprint. It had been written for the Australian Congress which had called for papers in a category they had termed 'On the Horizon'. He was also adamant that *'none of my critics ... have really given any constructive criticism; they were more concerned with their own ideas than prepared to build on what usefulness there might have been in the paper'*. Concerning Barenbrug's criticism of his use of the figure 25 000 c.f.m., he said

'...since I never intended this figure to be a practical objective there is little point in replying in detail. Obviously 25 000 c.f.m. will be insufficient for various practical reasons and my main conclusion was that we may have to think in terms of considerably less air than hitherto, without my trying to prescribe what the amount should be.'

He then attacked Barcza's contribution and scathingly rejected the conclusions of the third contributor, Mr C C F Bell, saying he had fallen into the trap of comparing different cases. Lambrechts unfortunately did not handle criticism well. His reaction was out of all proportion and caused considerable bad feeling between himself and the industry. Technically he was fifty percent correct but he should have repeated the exercise using other variables and so reach the most economic balance between air and refrigeration.

Those members not directly embroiled were disappointed as the only real error in the paper was the use of the 25 000 c.f.m. Lambrechts, not Bell had fallen into the trap!

Spray-filled counterflow cooling towers

In the mid 1960s an increasing number of vertical cooling towers were being used for the rejection of heat from underground cooling plants to the upcast air. However rule of thumb had to be used when designing these towers as little work had ever been published about the heat transfer rates in spray-filled cooling towers.

Mr Bruce McKay Torrance published the first paper on the topic in 1965. Following on from this work, Barcza realised that the available literature on the topic was indeed far too scant and managed to raise funds to begin the necessary experiments. Torrance worked on the project and after leaving Rand Mines, Mr Roger Hemp was left to analyse the results. In 1967 he published a paper in the Journal which broke new ground in the understanding of cooling tower performance. After completing his Bachelor of Science in Electrical Engineering in 1958, Hemp joined Rand Mines as Barcza's technical assistant and rapidly became regarded as the only worthy successor to Barcza.

The paper which was to win him only the second gold medal ever awarded by the Society analysed the performance of a spray-filled counterflow cooling tower. As he said in his introduction

'Previous investigators have found that the coefficient of total heat transfer (per unit volume of the tower) is a function of the height of the tower, but have not, to the best of my knowledge, taken this into account in the theoretical analysis of the tower performance. This paper includes an analysis of cooling power performance which assumes that the coefficient of total heat transfer varies exponentially with distance below the sprays.'

He continued explaining that he had carried out tests with different air and water quantities, and had varied the height of the tower from 16 to 64 ft. Observed performances of other cooling towers and two horizontal spray chambers had then been compared with the performance of the experimental cooling tower, as had published performance figures for packed cooling towers. His results showed that

'Packed towers with a similar performance to a 50 ft high spray-filled tower had volumes varying from one-sixth to one-twentieth of the volume of the spray-filled tower.'

Barenbrug read the paper with great interest. He himself had given the issue some thought over the years but did not agree with Hemp's method. He concurred with Hemp that

'The accepted theory today is that the enthalpy difference is the driving force for performance of cooling towers' but felt that *'although this might well be the correct theoretical approach, I doubt whether this approach is of great practical value in the calculations of spray-filled cooling towers where the correct air and water distribution are of far greater importance than in packed cooling towers.'*

But Barenbrug had at last met his equals in Barcza and Hemp. Hemp knew his subject and could counter Barenbrug with confidence. He had made no mistakes and could argue from a position of strength. Standing his ground, he skillfully replied to Barenbrug's contribution.

'While I agree with Mr Barenbrug when he says air and water distributions are of great importance, I cannot see why this should be an excuse for avoiding the correct theoretical approach. In addition, I think I am correct in stating that air and water distributions are as important in packed cooling towers as in spray-filled towers, the difference being that correct distributions are generally much easier to obtain in packed towers.

I don't agree with Mr Barenbrug's contention that it is necessary to use both air and water efficiencies when dealing with underground cooling towers. The only factors which affect the cooling plant compressor horsepower consumption as far as the heat rejection circuit (apart from the condenser) is concerned are the temperature and flow rate of the condenser water arriving at the condenser. The condensing temperature of the cooling plant increases for increasing return water temperature and decreases for increasing water flow rate.'

He then systematically countered each of Barenbrug's objections from both a theoretical and practical point of view. Members were impressed and were acutely aware, from that time, that Hemp would soon make his mark in the field of mine ventilation.

The Society by 1969

Jacobs had ably followed in Barenbrug's footsteps. He had maintained the momentum achieved by Barenbrug and this was, in part, evidenced by the high standard of papers being published in the Journal. Before inducting Rabson as President on 28th April 1967, he presented the Annual Report of the Society's activities for the year. He began by saying

'I am pleased to say that the high standard of service of the Society was maintained. Good progress was also made with the Text Book. The translation of English ventilation terms into Afrikaans was completed. Revenue from advertising was increased to a satisfactory level and the method of payment of assessment and subscription fees by ventilation personnel employed on Mines which are members of the Transvaal and Orange Free State Chamber of Mines, was altered.'

After the Annual Report had been adopted, Jacobs inducted Rabson as President. This was his second term of office and in the sixteen years which had elapsed since he had last served as President, Rabson had risen to the position of Director of the Chamber of Mines Environmental Sciences Laboratory. He was, by this time, well known throughout the industry for his dedication to tackling the problems of ventilation, dust collecting and gases. In addition, he had also developed the multi-filter, vermiculite blasting fume extraction plants, and the multi-bag scrubber for dust filtration at surface crushing stations.

On taking the Chair, this man who had worked in the industry since 1934, was clearly moved by the decision to re-elect him to the office of President. His health was beginning to fail and it was almost as if he knew this would be his last chance to make a final contribution to the Society which he had served tirelessly since its inception. His pride in the status achieved by the Society was evident when he said

'I wonder whether particularly the younger members realize the important opportunity that the Society offers in establishing the status of its members. For example, I have myself on more than one occasion when speaking to young ventilation officials who claim to be ambitious to make their mark in the profession, asked what tangible evidence they can produce to prove their interest, and pointed out that if they had published a paper in the MVS Journal or otherwise actively participated in the Society's affairs, this would immediately establish in a definite manner that their interest or ability was indeed factual and not imaginary.'

Although unwell, Rabson rose to the challenge of his position with the zest of a man many years his junior. Sandys, on succeeding him the next year, commented

'As your new President my first duty, an easy and pleasant one, is to pay tribute to our retiring President ... The manner in which he has conducted affairs and proceeded to follow up his thoughts and ideas was highly rewarding to the Society and, in addition, highly educational to me. His successful term of office will be recorded in the history of the Society because it is the first year that our finances have shown a credit balance without the usual assistance of the Chamber of Mines annual grant, and secondly, for the conception and launching of the area representative scheme and thirdly, for the decentralizing of the General Meetings.'

Sandys was a popular man both within the Society and the industry. Born and bred in Ireland, he was renowned for his sense of humour and ability to inject life into otherwise routine activities. During the war he had joined the South African Irish Regiment and had fought in Abyssinia and North Africa. In 1941, he was taken prisoner at Sidi Rezegh and was forced at one stage to work in the coal mines in Upper Silesia as a lasher and trammer. But not being one to be daunted by the force of circumstance, he returned to South Africa after the war and resumed his duties at Brakpan Mines where he was appointed the first Assistant Ventilation Officer.

His connection with the Society had dated from 1947 when he had joined as an Associate Member. By the time he was elected President, members were well aware of his leadership abilities. He had served on the Committee of the Orange Free State Branch for many years and had been elected Branch Chairman on three occasions. His first year as Chairman had won the Branch financial independence as a result of his successful organization of the OFS Mine Ventilation Exhibition. This sociable man also loved to play golf particularly with Grave, his immediate superior at Anglo American Head Office. He loved these afternoons and used to exasperate Grave throughout the entire game, accusing him of either sinking shafts or digging new sand traps free of charge for the Club.

Sandys presidential year was marred by the death of Rabson in February 1969, just 10 months after he had handed over responsibility to Sandys. He also never knew that he had been awarded a gold medal for his paper called 'The development of a wet scrubber for use at crushing plants and the like' which had been published in the Journal in January 1968. Presenting the prize to his friend's widow was one of the saddest moments in Sandys life. In his tribute to the man whom he had so greatly admired he said

'One of his greatest attributes was the sound application of theoretical and practical aspects to the job or projects.

....On behalf of the Society, I would like to say how gratifying it is to have the opportunity of paying this tribute to a stalwart of the Mine Ventilation Society.'

The topic Sandys chose for his presidential address was particularly pertinent as it marked the twenty-fifth anniversary of the Society. It was called 'The Mine Ventilation Society - an appreciation 1944 - 1969' and paid tribute to the *'prominent part played, and hard work undertaken by our office bearers in the early years'*. After outlining the Society's achievements

over the years, he demonstrated to members how its growth had kept abreast of the tremendous changes which had occurred in the industry during that time. He said that the Society now had 307 members as opposed to 17 in 1944, and 650 Journals were printed each month compared to 150 in 1948. Expanding the comparison to the growth in the industry, he said

'In 1944, there were 47 gold mines down casting a total of 19.9 million c.f.m. and the c.f.m/ton/ month factor was 3.98. There were a total of 97 ventilation officials employed in the gold mining industry. The average monthly working costs were R2.29 per ton.

Geographically, too, there was a compactness of the gold producing mines then which is not the case today. There were no producing mines in the West Wits area beyond Venterspost. The Klerksdorp mines as we know them today did not exist with the exception of Western Reefs. The Orange Free State and Evander goldfields were unheard of.

In 1968 there were 49 gold mines downcasting 50.1 million c.f.m of which 13.1 million c.f.m. was filtered (there was no data recorded on air filtration in 1944). In addition underground refrigeration had developed from some 500 tons of refrigeration in 1944 to 24 000 tons of refrigeration.

The c.f.m./ton/month factor had risen to 5.51 in spite of substantial parallel rise in production over the same period. The tons mined per month was now 9.1 million compared to 5.0 million in 1944.

The number of ventilation officials employed in the gold mining industry is now estimated at 320.'

He then paid tribute to each of the past presidents, honorary secretaries, honorary editors and past chairmen of the Orange Free State Branch, and each member present fully appreciated what he meant when he said

'I feel no shame in trying to imitate that famous, person, Winston Spencer Churchill, when I say that we, the members, have been fortunate that in those first twenty years so often did so few of so purposeful a character serve so well the Society. And now, because the Society cannot expect this service from these members to continue at quite the same rate and quality, the next twenty-five years will prove to be ones requiring much time and hard work from other and newer members.'

CHAPTER 19

Lord Kelvin once stated that until you can measure in numbers what you are talking about, your knowledge is meagre and unsatisfactory.

A D Unsted, 1970

Mine ventilation notes for beginners

Le Roux was a born educator, believing fervently that knowledge should be shared. This particular character trait became particularly noticeable to other members after he was appointed Chief Ventilation Officer at E.R.P.M. in 1950 when he became obsessed with trying to improve the quality of training offered to his junior staff. He dedicated many long hours of his time to this pioneering task and was well known and respected in both the Society and industry for the strides he made in the development of a systematic approach to training. Older members still clearly remembered his presidential address in 1957 where he had outlined the difficulties of training ventilation officers and then tried to give practical suggestions as to ways which could successfully be used to overcome the problems.

Since the early 1960s he had been thinking very seriously about writing a series of articles for the Journal which would help juniors further their understanding of the basic principles of ventilation. The problem, he explained to other members, was that there was no such textbook available and the only short-term solution was to write a series of notes. The Editorial Committee was also always complaining about the shortage of practical papers submitted for publication, and articles of this nature would fill this gap. His idea was greeted with enthusiasm from every quarter. Those who did not know him very well privately thought it was a pipe dream but those who were personally acquainted with Le Roux's tenacity, knew that he would approach the project with a dedication that could only succeed.

In November 1964, the first note called 'Constituents of air and atmosphere pressure' was published in the Journal. The feedback was very positive and it soon became apparent that Le Roux was single-handedly tackling one of the most significant projects ever to be launched by the Society. His unbending determination surprised even Barenbrug after the notes were still appearing religiously every month after two years. Three years then passed and by this time they were synonymous with the Journal. Then after four and a half years, Le Roux announced he had completed his 'Mine ventilation notes for beginners'. He had written 65 notes in total, and the textbook which had been started many years before the idea of the notes had even began to germinate in Le Roux's mind, was still nowhere near completion. Everyone knew that Le Roux's contribution to the Society this time could never be quantified. It was immeasurable in its worth.

Rees did however try to express the gratitude of the Society in his editorial in March, 1969.

'The final number of Mine Ventilation Notes for Beginners is published in this issue of the Journal. The first note was published in November, 1964. For four and a half years Mr Le Roux has never failed to produce one or more notes for the Journal. As Editor throughout this period it has been a source of strength to me to have this steady support. All readers, and especially beginners, owe him a great debt for his skill and industry. He has provided them with information which will be of great value to them in raising their knowledge to examination level. The notes will form an ever-ready source and reference book in their work. Indeed, I have heard it said that the title is modest; not beginners only, but senior ventilation officials have

profited from reading these notes. The Society proposes to publish the notes in book form and the book should be ready this year. I am sure that for many years to come it will serve as a textbook for all engaged in the ventilation of these mines.

To Mr Le Roux a big thank you from THE EDITOR.'

Le Roux's labours were furthered rewarded at the Annual General Meeting of the Society in 1970 when he was awarded both the Association of Mine Managers' Prize as well as the Gold Medal Award. The president of the Society, Mr HMW Eschenburg, in presenting the gold medal to Le Roux summed up the unanimous attitude of the Prize Awards Committee. It was the first time there had been no dissention.

'The awards committee had no difficulty at all in its decision, their verdict was unanimous.

I believe that in this instance it reached one of its quickest and easiest decisions. Mr Le Roux's notes are an outstanding contribution to the training of future ventilation officials.'

Le Roux was honoured. The gold medal had been awarded only on three previous occasions. On accepting his medal, he thanked the Society for this recognition and then quite humbly stated that he had *'enjoyed the time spent on writing the "Notes" and that I did not regard it as an arduous task. This recognition of my labours is unexpected'.*

The first edition of the book was published in Afrikaans in July 1970. The Federale Mynbou/ General Mining Group financed the cost of publication and in 1971, the Chamber of Mines agreed to underwrite the cost of an English edition which was finally made available in 1972.

Refrigeration practice

As mines became deeper, more and more refrigeration began to be used to ensure that temperatures were maintained at acceptable levels in the underground workings. The capital and running costs of refrigeration plants were high and members were being put under considerable pressure to acquire more knowledge about the various refrigeration and heat transfer processes involved so that maximum benefit could be obtained from the installed plants.

In September 1967, the area representative for the Orange Free State, Mr Bill Reynolds organised a technical discussion in Welkom on current refrigeration practice in mines. The discussion formed part of a General Meeting of the Society and Rabson explained its significance to the 130 members and visitors present at the Welkom Miners Club.

'This is an historic occasion for a general meeting of the Society to be held, for the first time since the formation of the Society in 1944, at a place elsewhere than in Johannesburg. And it is indeed fitting that such a meeting should be held in the O.F.S., where the first branch of the Society was formed and where this branch has acted as an outstanding example of activity and energy.

...I feel specially privileged to be serving as President on this memorable occasion, an occasion which marks the beginning of a de-centralization movement of the Society from its original pivot in Johannesburg, for I regard this as a natural tendency to follow the centre of gravity of the mining activity and therefore also ventilation intensity, away from the Witwatersrand.'

In introducing the speakers to members, he said that the discussion would emphasise the practical side of refrigeration and would cover refrigeration requirements, plant specification, design and plant maintenance. The first speaker was Mr Glen Griesel, a mechanical engineer, who had joined

the ventilation fraternity after becoming responsible for the installation of the first major refrigeration complex at Western Deep Levels in the mid 1960s. He made such an outstanding success of his job that he had soon been transferred to Head Office where he was promoted to Assistant Group Ventilation Engineer before being made Group Refrigeration Engineer for Anglo American Corporation.

Griesel spoke to members on plant specification. He explained that

> *'Refrigeration plant specification for mines embraces all equipment from the point of heat extraction in the stopes back to the cooling tower and that it is really only when one precisely knows what is required that one knows exactly how and what to ask for. Consequently from the technical viewpoint, and without losing sight of the legal and financial conditions, the correct information and requirements must be clearly provided so that all tenders can be adjudicated on a competitive basis.'*

He then proceeded to outline the basic minimum technical design data that needed to be specified in each category, such as cooling tower conditions, design load, condensers and evaporators.

The second speaker was Mr J I Hancock of Mining and Industrial Air Conditioning (Pty) Ltd. His presentation covered the role of the refrigeration engineer in the mining industry. Members were amused when he elaborated on his initial impression of what he was supposed to talk about.

> *'When I was first informed of this meeting Bill Reynolds suggested that the talk should be confined to purely the selecting of centrifugal machines for mining application. This would have suited me down to the ground, as obviously I could crawl into my little theoretical shell and no-one could contradict me. Anyhow, following a discussion with Mr Barenbrug this is no more, and I offer myself as a sacrifice to the Air Conditioning Industry.'*

Hancock was an excellent speaker and possessed the rare gift of being able to simplify the most complicated of topics. He explained to members, who really knew very little about the subject, that refrigeration plants were different from air conditioning machines *'because the rigorous duties imposed on plant underground, together with the necessity for continuous trouble-free operation call for heavy duty industrial machinery as used for refrigeration machinery'*. He stressed the importance of the compressor saying that *'on an average mine installation the refrigeration compressor accounts for less than 20 per cent of the total capital cost. Nevertheless it is the heart of the installation and the wrong item on which to try and economize'*. The major operating characteristics of reciprocating and centrifugal compressors were outlined and he ended his speech by explaining the effects water temperatures have on the capital and operating cost of centrifugal compressors.

The final presentation, before the summing up by Dr Austin Whillier of the Heat Mechanics Division of the Chamber of Mines Research Laboratories, was given by Mr J Park and covered routine maintenance. He emphasized that *'maintenance starts at the planning stage'* and that for *'trouble free operation, trained artisans are a must'*. He continued saying

> *'No-one would hand his car over to a garage where he had any doubts regarding the qualifications of the mechanics. So why should machinery of this nature be handed over to untrained personnel? The plant performance is in direct proportion to the artisan experience. He must be equipped with the necessary test equipment and special tools for the job.'*

The symposium was highly successful, and Whillier acknowledged the role played by the organizing committee in his closing remarks. He added, using his unique ability to simplify anything fairly complicated, that

'It is apparent from the various papers that refrigeration is becoming of increasing importance in deep mines. To put the matter in perspective it is interesting to note that if the installed refrigeration capacity of a mine like Western Deep Levels is divided by the total length of stoping face, one arrives at a figure of about 1 ice ton per 4 ft of face. Now recalling that the conventional office- type window air conditioner has a nominal cooling capacity of one ice ton, it means that such a mine has, in effect, one window- type air-conditioner placed every 4 ft along the face! Under the circumstances, therefore, one might ask why is it still hot in mines?!'

In October 1969, Mr J R M Damhuis, presented a paper called 'The Refrigerant Pressure Enthalpy diagram' to members at a meeting at Blyvooruitzicht Mine. In his introduction he said that *'to obtain maximum benefit from the installed plants it is necessary to understand the principles of refrigeration, and to be able to check plant performance it is necessary to understand and be able to use the refrigerant pressure enthalpy diagram'.* The refrigerant he used for his examples was Freon 11 because it was the most common refrigerant in underground refrigeration plants at the time. He outlined to members the principles and properties of refrigeration, and showed how the pressure enthalpy diagram can be constructed. Grave proposed the Vote of Thanks saying

'The intricacies of the theoretical side of the refrigeration process are not always readily followed by mining men (and in this category I include the ventilation officer), and it is therefore doubly valuable to the Society to have the pressure enthalpy diagram so lucidly explained and demonstrated. While much of this material will be "old hat" to some, it is by no means so to the majority of ventilation officials, and the clear way in which the principles have been enunciated makes this contribution very worthwhile.'

Hemp then described two instances where he himself had found the pressure-enthalpy diagram to be very useful. He explained that

'The pressure-enthalpy diagram is just a graphical representation of refrigerant properties, much as psychrometric charts are graphical representations of the properties of a mixture of air and water vapour. Every ventilation official is familiar with a psychrometric chart, and I think all will agree that its use leads to a better understanding of the properties of air and water vapour. In a similar manner the use of a pressure enthalpy diagram will lead to a better understanding of the processes taking place in a cooling plant. Mr Damhuis is to be congratulated on so clearly explaining the construction of the diagram.'

The first example he gave was the use of the diagram to determine the effect of condensing and evaporating temperatures on the power required by a cooling plant, and the second described its use in analysing a set of measurements made on a cooling plant. He concluded saying

'It can be seen that by taking additional measurements in the refrigerant circuit of the cooling plant, and by using the pressure- enthalpy diagram to analyse these measurements it is possible to assess the compressor efficiency. In addition and probably equally importantly, the pressure-enthalpy diagram makes it possible to see whether the observations make sense. This is very important, for usually this is the only way of assessing the accuracy of any underground observation.'

The face of the Society was slowly changing. By the late 1960s it had further evolved and was providing both a forum for debate as well as one through which knowledge could be gained. Education of younger members was becoming a priority and the large attendance at meetings clearly indicated that members were highly appreciative of this new direction.

Metrication

During the year of Eschenburg's presidency it was announced that South Africa would be changing over to the metric system of measurement during the period 1970 to 1975. In early 1970, the Chamber of Mines informed members of the ventilation fraternity that all returns submitted after 30th September 1970 should be in metric units. The only leniency granted would be to candidates writing ventilation examinations in 1971 but thereafter, all examinations would be written using only the metric system.

The Society responded to the news with efficiency and alacrity. Council was aware that many members would be bitterly opposed to the change over and there was a danger that these stalwarts of the currently used imperial system could negatively influence the attitudes of younger members. After careful deliberation it was decided to begin publishing a series of articles which would help introduce and clarify the new system and its advantages to readers. The first article was published in the April 1970 issue of the Journal. It was written by Mr Dave Unsted and its objective was to lightheartedly illustrate the advantages of the new system over the old. He explained that *'basically measuring problems on a scientific and industrial level resolve themselves into the problems of measuring mass, length and time'*, and that *'the units in which mass, length and time are measured are purely arbitrary'.* Showing how measurement had often been based on 'fancy' in the past, he gave some examples.

'The cubit, used by carpenters in Noah's era, was the length of a man's forearm from the elbow to the tip of the middle finger.

It was reported that the rod was defined as a combined length of the left feet of 16 men lined up to go the church.

The amount of land that a man could plough in a day was defined as an acre.

Three barleycorns laid end to end comprised an inch.'

In the same tone, he then outlined the history of the metric system and ended his article with the witticism

'The simplicity of the metric system saves metric countries countless hours of calculations. This has prompted Nobel prize winner, Harold Urey, to say: 'America's use of the English system is Russia's secret weapon".

Educators in the USA estimate that the system would save a student six months of figure drudgery. Let us take the point to task.

Suppose an object moves at 50 m/s. How fast is this in km/hr? There are 60 s/min and 60 min/hr. Hence there are 60 x 60 = 3 600 s/ hr. Since the object moves at 50 m/s, it moves at 50 x 3 600 = 180 000 m/hr.

To convert metres to kilometres requires a simple division by 1 000 giving the answer 50 m/s = 180 km/hr. All mental arithmetic.!'

Mr John Burrows, the Ventilation Training Officer at the Chamber of Mines, published the next series of papers which were designed to explain clearly and coherently the main features of the metric system, the conversion factors, and the use of ventilation formulae. Burrows was an eminently practical man with a sensibility that was equalled by few in the Society. The papers were exactly what the Society and other members in the gold mining industry needed. They answered all the commonly asked questions about the new system and were to be used for years to come whenever members were grappling with problems about the new 'SI units' and their application to ventilation formulae.

Burrows' papers were interspersed in the Journal with snippets provided by various members of the Editorial Committee. The first of these was printed in the June 1970 edition under the title

'What's in a name'.

'Metrication committees have universally felt that the unit for mass, the kilogram, is an unsatisfactory name.

Some people feel that the kilogram should be called the Quillo, as it is in Portuguese.

In France the French are pressing for the kilogram to be called the Gaulle in honour of their former statesman. If the French are successful, amusing situations could arise.

If one found a stone weighing one kilogram, one wonders if the French would be happy with this stone being referred to as a Gaullestone.'

The combination of the more serious papers by Burrows and Mr Bill Holding who published a paper called 'Resistance, resistance units and metrication' in December 1970, and the silly snippets served to constantly remind readers of the reality of the change over as well as to reassure them that the new system was not going to be as traumatic as some members believed. The efforts made by Burrows, Holding and Unsted during 1970 and 1971 certainly helped make an event, which could have presented immeasurable problems, pass by almost unnoticed.

CHAPTER 20

It is time the ball was handed, with confidence, to the younger members, who should be encouraged to play an active part in our important contribution to the welfare of all who go underground to earn their living.

R D Wright, 1971

Waste in ventilation departments

Hemp succeeded Eschenburg as President on 23rd April 1970. Eschenburg's presidential year had run very smoothly marred only by the deaths of Flugge-de Smidt and Gorges. Before inducting Hemp as President, Eschenburg delivered his presidential address entitled 'A review of 12 years in mine ventilation'. A man of utmost integrity, he had been annoyed for years about certain blatant wasting of money on mines and decided that he would get his point across during his presidential address. Unbeknown to most present, it was to prove a contentious expose of ventilation practices on some mines. He began by saying

'Ventilating modern deep level mines is an expensive business no matter which way we look at it.

.....What I do want to do, is show how much more expensive we can make it, if we are not ever watchful.....1 have chosen this title as I am going to use developments over the last 12 years to illustrate what I mean when I say that we, as Ventilation Officials, must always be on the alert if we don't want to help to price the gold mines out of business, and thus deprive a large number of people of their livelihood.'

Regarding air control, he mentioned that in the last 12 years rigid polyurethane foam, plastic brattice materials and vermiculite had been introduced into South African mines. An incredible discrepancy had been noted when using rigid polyurethane foam between the theoretical cost per foot of R1.25 and the actual cost of more than R2.00 per ft.

'The reason for the gross discrepancy was traced to numerous points, the main ones being trouble with the equipment leading to wastage of chemicals and the impossibility to spray 1 inch thick. Two to 3 inches was the rule rather than the exception in underground conditions.'

He continued, adding

'The material is still being used in mines. Let me hasten to say that it is very effective, but wherever possible mines should have the job estimated, and the area to be covered measured up. A price from preferably an outside contractor should be obtained before the job is started. It seems common practice at the moment to pay for chemicals used, that is to weigh the drums before and after the job and pay for the difference. If a machine gulps chemicals at 3 lb per minute at 85 cents per lb i.e., at R2.55 per minute, it does not need many minutes to race up a tidy bill.'

Plastic brattice materials, he said, had been sold to mines for a number of years. He queried though *'how it is possible that some mines paid 70 cents and more per foot of material which is readily available at 60 cents per yard.'*

He said that it appeared that

'All someone had to do was to add a gimmick, such as some eyelets and wire, or a pre-glued edge, etc to get away with it.

The band wagon, there is no other way to describe it, was soon discovered by other opportunists, which luckily for the mines resulted in a price war which brought prices back to realistic levels. Needless to say, some "entrepreneurs" lost their shirts, some their jobs. All this need not have happened if ventilation officials had been on their toes.'

His next example about lack of foresight concerned the use of rayon ducts.

'Rayon ducts were installed in a certain area of a mine for test purposes with good results. As a result it was decided that a long development end would be developed using this material as the main force ventilation column. After the end had been advanced approximately 1 000 ft, some of the ducts started to split along their seams. Investigations showed that this type of material in an untreated form was subject to fungal attack in damp atmosphere at high temperatures.

If samples of the material had been submitted to the Chamber of Mines Laboratories for evaluation, a considerable amount of time would have been saved, some delays in the development schedule would not have occurred, a fair sum of money would have been saved and certain officials on the mine would have had fewer ulcers. In this particular instance the more expensive Nylon would have been a better choice.'

Concerning cooling and insulation, he stressed the importance of vapour barriers in certain instances and reminded members of examples where

'Insulation has been transported to great depths underground, installed under arduous conditions and rendered virtually useless for want of an effective vapour barrier which would not have added a great deal to the cost, Without it, for instance, the effectiveness of the insulation has been virtually nullified. In other words- this insulation was a waste of time and money'.

But it was on the topic of dust that he was his most critical, and as in the previous decade it was a highly contentious topic. Quoting from the "Critical review of the anti-dust campaign" he said that much research had been done over the years into dust produced by scrapers. But he asked *'have any concrete recommendations been made?'* or *'what has happened to the results of these investigations?'* and *'is it not possible that dust levels can be reduced if use is made of the findings of the investigations?'*

Regarding sampling, he dryly remarked that

'Numerous sampling instruments have been developed over the years, the standard Thermal Precipitator (TP) has been redesigned doing away with the water tank, the modified TP has been remodified, improved and made more automatic - and more expensive in the process. DISA has been developed and is a wonderful research tool.'

He said that at a recent symposium the konimeter had been called *'a complete and utter anachronism in this day and age',* but why, he asked *'was it still in regular use?'* One mine had recently investigated the reasons for wandering bias, oversampling of coarse dust and undersampling of fine dust, and the results had shown that wandering bias was caused by *'slackness and inattention of the microscopist'* and oversampling caused by *'aggregates shattering on the slide'*. His question here was *'why must an individual mine find these things?'* and *'why were these faults not rectified years, if not decades ago?'*

As to be expected, this address caused a fair amount of indignation amongst members. Debate was heated with many people feeling that Eschenburg had portrayed isolated incidents as common occurrences. But the President's prerogative in his address was that he could speak on whatever topic he wished and it was also accepted that it was a purely personal opinion. Nevertheless, the tone of the debate afterwards meant that members left with a sense of uneasiness instead of the enthusiasm normally felt after an interesting and thought provoking talk had been given. No-one could deny that Eschenburg had been brave enough to bring a contentious subject into the open and that the afternoon had been very stimulating. Nevertheless, it was decided after the response to this address, that no comment from the floor would be permitted in future years.

Underground fires

Since the introduction of timber as the main method of support in stopes, the gold mining industry had been faced with the problem of mine fires underground. Members had first discussed the issue in depth in 1958 during a symposium where they had shared experiences and knowledge about methods which had proved to be effective in preventing and detecting fires. It had been an extremely valuable symposium and in late 1969, Council decided that the time had come for a similar symposium to be held. Recent underground fires had cost the industry hundreds of thousands of rands and as Sandys said

> *'The drain on the time and energy of those whose job it is to fight the fire is heavy and, as in modern warfare, there are no victors and successes are only measured in negative terms, Prevention is the greatest remedy but the second line of defence, and equally important, is early detection.'*

The symposium was held in Welkom on 11th February 1970 and as far as members of the Orange Free State Branch were concerned, not a moment too late particularly since they had to cancel their meeting on 14th January because of a fire at President Brand gold mine. Six papers were presented that morning to the 61 members and 21 visitors who attended the meeting. The first two papers were given by Mr B J Bout of Anglo American Electronics Laboratory and Mr Roger Hemp of Rand Mines, and covered fire detection with particular emphasis on ionisation detectors. Sandys chose fire patrolling as his topic and justified this choice by saying

> *'Notwithstanding past criticisms levelled at the system, the fire patrol method of fire detection continues to be the most common and popular.*
>
> *The criticisms levelled at failures in the fire patrol system have not always been the fault of the system, but quite often it has been the weaknesses in the operational organization.*
>
> *The system is adopted to provide early detection and location of fires during the most vulnerable periods of the daily and weekly mining operations because the great majority of fires are caused directly and indirectly by blasting operations.'*

A paper by the Chief Ventilation Officer at President Brand, Mr W Viljoen, was then read by Mr Hartwig. It outlined the function of the newly appointed Fire Masters who he stressed should work in *'close co-operation with both the mining and ventilation officials'*. He ended the paper on a sombre note saying that although *'it is the Fire Master's duty to draw attention to possible fire hazards and recommend or assist in taking corrective action, the final responsibility of eliminating the fire hazard rests with the official or officials concerned'*. The final two papers of the morning were presented by Mr John Smit, the Technical Assistant Ventilation Officer at Harmony Gold Mining Company. In his first paper he discussed monitoring during and after an underground fire as well as the specific reasons for monitoring airflow, gas and temperatures. Smit's second paper centred on the use of foam in underground fire fighting. He began his presentation by saying *'some widely differing opinions exist'* about the current use of the method

ranging from *'whether foam should be used at all to combat fires'* to *'the mechanics whereby foam suppresses a fire'*. He continued explaining

> *'Because of recent fires which have occurred on Harmony, and the fact that foam was used during the last three fires with varying results, it was decided to embark on a limited research project on the mine to answer some of the commonly asked questions. The results of the field trial showed that foam can be used to combat fires which are inaccessible due to caving or the nature of the site. Foam is a means of conveying water to the above type of fire using air as a carrying media, but it must be remembered that air supports combustion. Foam can never be better than directly applied water.'*

The symposium certainly addressed some of the critical issues which had been worrying members for some time but the real solution to the problem still eluded the industry. More information was required if successful methods were to be found to control mine fires and reduce their incidence, hazard, extent and cost.

As one step towards solving the problem, the Research Organization of the Chamber of Mines, on the recommendation of the Association of Mine Managers, set up a subcommittee in the early 1970s to investigate causes, propogation, precautionary measures and fire fighting methods and hardware. The subcommittee was backed by the considerable resources of the Research Organization, and basic as well as practical factors were examined. In 1973, Council decided that the time had come to ask the key researchers at the Chamber (mainly members of the Society) and other authorities on the topic to share their findings with other members.

A full day symposium was arranged on 3rd May at the Goldfields West Recreation Club in Carletonville. Attendance reached record levels with 315 people crammed into the Recreation Club. The opening address was given by Mr A B Daneel, Chief Technical and Labour Adviser at the Chamber of Mines, whose presence alone signified the importance of the topic and the credibility now afforded to the Society within the industry. In his introduction he placed the extent of the problem into perspective saying

> *'In a special enquiry made last year in an attempt to establish the size of the problem, it was estimated that the cost of fires in gold and coal mines, for members of the Chamber of Mines, during 1971 amounted to some R4.5 million, with the cost to individual mines of individual fires varying from a low of R12 to a high of R3,4 million.'*

Regarding recent steps taken by the Chamber such as the compilation and distribution of 'A review of fire prevention and fire detection methods in use on gold mines' he forcefully stated that

> *'It will only be of use if it is read and acted upon, with the accent on the latter factor. Pilot error is responsible for some 98% of all aircraft accidents and, in the same way, human error is responsible for a great majority of mine fires. It is no use whatsoever for a mine to have the most carefully considered set of precautionary measures if they are not in fact carried out.'*

He continued explaining that

> *'Poor housekeeping in respect of hanging of electric cables and the misuse of igniter cord continue to be the major causes of fires. The failure of users of cutting torches to take the precautionary steps which are prescribed both in mine standard practice and in the PAC Code caused no fewer than nine fires last year and already six this year. The most up-to-date precautionary rules and sophisticated equipment are of no use unless the personnel on the job know their stuff and work in accordance with the rules, and it is unfortunately an added burden on mine management to ensure that this is done in addition to chasing tally, grade, safety and the thousand other things that clamour for attention.'*

The first paper was presented by Dr Austin Whillier, Assistant Director of Mining Research at the Chamber. He covered the dynamics of timber fires in mines and began with facts on the conditions necessary to start and propogate fires. Normally a complicated topic, Whillier was a born lecturer and as usual his gift of simplifying the most complex topic was apparent to each of the 315 people present. He introduced a new term to members, namely that of the ventilation factor which would be of assistance to fire fighters in determining to what extent the ventilation current must be reduced when sealing operations were necessary. In addition he referred to the growth and spread of timber fires and suggested that more concrete blocks should be used in the supports and that the top 20 cm of each timber pack be fire-proofed in some way because of the hot gases that travel along the hangingwall.

Dr Jack Greig then told members about the chemical processes involved in the ignition and combustion of timber. He also warned those present that plastics represented a greater fire hazard than timber because *'the structure is completely broken down leaving very little char so that the products of pyrolysis are available rapidly as a combustion fuel'*. In addition he said that foam plastics increased the risk even further.

> *'The very factors which make these such good insulating materials, i.e. low density and low thermal conductivity, cause the temperature on the surface to rise rapidly when the material is exposed to heat. It has been calculated that a given size flame would heat a surface of polyurethane foam to its ignition temperature in one hundredth of the time required for timber. Thus the flame would also be expected to travel 100 times as rapidly over the surface of polyurethane than over timber; this has been verified experimentally.*
>
> *All plastics produce large quantities of carbon dioxide and carbon monoxide when they burn. However, plastics which contain atoms other than C, H or O also produce, in addition to these gases, quantities of other toxic gases when they burn. For instance, polyvinylchloride (PVC) produces relatively large amounts of hydrogen chloride gas, polyurethane produces relatively large amounts of hydrogen cyanide gas, and so on.'*

Other papers that day covered automatic fire detection and means of fire fighting such as pre-planning and zoning, sealing, water barriers, foam and difficulties experienced by brigadesmen. Debate after each paper was lively and finally at 15:00 Mr E A Quilliam, the Assistant Consulting Engineer of Goldfields South Africa, stood up to deliver his closing address. He praised the Society for the excellent organization of the symposium.

> *'You and your Society are to be congratulated, Mr President, on arranging this stimulating symposium. It is an attempt to close a very important gap in our technological know how. There is no derogatory intent in the use of the word 'attempt' as no single symposium could possibly answer all the questions which emerge when dealing with a subject as complex as mine fires. However the most encouraging attendance here today is surely indicative of the interest in the subject and if the papers put forward and the comments thereon lead to yet further research and thought on how to deal with this problem, the efforts of the Mine Ventilation Society and authors will have been worthwhile.'*

The symposium had indeed been a milestone in the history of the Mine Ventilation Society of South Africa. Its record attendance of 315 people was to mark the beginning of a new era. The topics with which it was concerned were truly integral to mining in South Africa.

Stoffel and the dust chats

As in previous decades the anti-dust campaign continued in the early 1970s but without the help of Stoffel Waterman, the cartoon character, who had been used for about five years as the

identifying symbol of the campaign. The only mine not to join the campaign was Harmony, and the reason was that the General Manager was unfortunately also a Waterman. Alas the early 1970s witnessed the demise of Stoffel. Numerous reasons were behind this decision to phase out Stoffel, the main ones being ridicule by White workers and suspicion by Black workers who thought he could be a tokolosh.

In December 1971, Mr Ulrich Schwanecke of the Department of Mines who was also an artist, published a postscript on Stoffel in the Journal explaining his downfall as well as his uses during service.

'Superficially the article offers amusement. But, I hope, by taking the micky out of the caricature who has been the hero of our last anti-dust campaign, it also offers gentle criticism of the caricaturistic approach. The article should be seen as a plea to the Society's members, and other readers of the Journal, to consider new forms of anti-dust propoganda. Propaganda is hard to assess and its effect seldom spectacular, but its absence may well increase the health risk in our mines.

I pity all who are eccentric or physically deformed and most of all those who are both. They suffer rejection like transplanted hearts. This appears to be the case of Stoffel Waterman too.'

No doubt he was odd! His outward appearance reduced him to a ridiculous gnome. He was hopelessly underweight. His frame was too frail to support his misshapen head and one wonders how he managed to get a "Red Ticket". The low forehead and that overdeveloped jaw made him look very ugly indeed. Now add to such handicaps the fact that he was eccentric - even fanatic - in his attitude towards dust and you can gauge the odds he faced in the group. Whereas every normal underground worker mined to make money, Stoffel went underground to "mind" an invisible enemy. He used various methods of propaganda to bring his colleagues around to his way of thinking i.e. posters, films, word of mouth, slogans and example, and at times he even reverted to verse. One morning he pinned the following limerick in front of the change-house door:

'There was a young man from Fontein, Who announced:
"I'm mining for gain, And never mind dust." Says Stoffel: "You must! Without health your wealth is in vain." '

Using his own name as a symbol of the anti-dust spirit which, strictly speaking is paradoxical, led to much horseplay and ridicule. But Stoffel fought back valiantly. When his colleagues hid his watering can his temper remained unruffled. He might as well do without it, he said, since the watering can, just as the use of his first name, had a symbolic significance only. Next they challenged the posters on which he displayed himself with a pipe in his mouth. They claimed, that, on fiery mines, it was unlawful to take a pipe underground. Well Stoffel simply stopped smoking and felt better for it.

But when Oom Koos, a resident of Bank, died of silicosis, an incident which caused much unrest on the mine, Stoffel's anti-dust efforts took on a desperate tone. The very next morning the miners found this composition displayed on the change-house door:

'There was a miner from Bank, Who called good Stoffel a crank, But, "it seems you were right, Oh Stoffel! he cried - When he lay in his coffin and stank." '

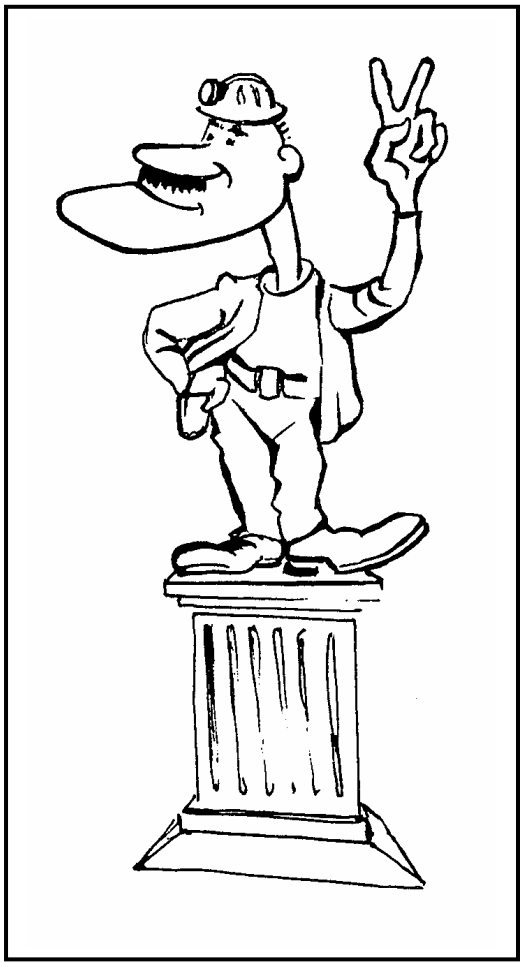
As the deceased had been very popular, the chaps took offence to this strong scented verse. They retaliated. Taking advantage of the country-wide drive for water conservation they branded Stoffel's slogan "dust is better wetter" as an affront to the authorities. Stoffel often portrayed himself on posters spurting water from hoe and watering can. This they denounced as indiscriminate waste. But worse was to follow. Shortly after the 26th October, 1968, whilst West Driefontein's shares were dropping as fast as her waters were rising, this incriminating

limmerick was published anonymously in the Carletonville News:

'There was a poor man on Westdrie, Who, in flood waters up to the knee,
Cried: "Stoffel! I'm sopping! It's time you were stopping.!
Drown dust if you must, but not me!"'

Of course it was soon established that Stoffel was not to blame for the flooding disaster, and to forecome any further misunderstandings he had pamphlets dropped all over town advocating the "judicious" use of water.

I am sure you all agree that Stoffel's zeal deserves admiration, but I don't think he was all that successful. He didn't command respect. True he received official recognition when the Chamber made him the focal point in an all-out campaign. For a while they had faith in his potentialities and put him high on a pedestal. But all too soon he was completely obscured by "FOG" and no-one seems to mourn his demise.'



But even if Stoffel did not command respect, Fred Rose, Dust Officer at Western Deep Levels, did. Highly intelligent and well-spoken, this man devoted a lot of his time to furthering the aims of the anti-dust campaign. For years every morning he used to issue a 'Dust chat' to staff at Western Deep Levels. The Chats all told a tale, fact or fiction, which had a punch line concerning the hazards of dust. Over the years, Rose issued about 400 anti-dust reminders and, as a result, his fame as a ceaseless campaigner spread throughout industry and in particular the ventilation fraternity.

Mr Dave Unsted was Honorary Editor of the Journal in 1971. His quick wit and sense of humour was by now also well known throughout the industry particularly since he had published his lighthearted article on the advantages of the SI system over other systems in the Journal in 1970. He approached Rose and arranged by some of the Chats to be submitted to the Journal for publication. Most members and subscribers agreed they were excellent and looked forward to seeing them printed in the Journal. The first appeared in February 1971.

The Noble Metals

'The ancient Romans called it hydragyrum, meaning "water of silver", but we know it as mercury or quicksilver, it is more than thirteen and a half times as heavy as water and one litre would weigh 13.6 kg (30 lb), and a gallon makes heavy carrying at 136 lb. It is the only metallic element which exists as a liquid.

Amalgams are alloys containing mercury. To fill back teeth, dentists use mixtures of metals with mercury as an amalgam. When the amalgam filling solidifies it expands and seals the tooth cavity.

Gold besides copper, is the only metal that has not got a grey colour, is one of the rarest elements, and was the earliest metal used by prehistoric man. In pure form it

is very soft and wears quickly but it defies destruction - even buried bars found in the holds of galleons sunken several centuries ago and steadily attacked by the spawns of the sea have not been corroded although perhaps bedecked with barnacles. Since it is soft its wearing qualities are frequently improved by the addition of copper, silver or nickel. The amount of gold present in an alloy is measured in carats: fourteen carat gold has fourteen parts of gold to twenty- four parts of alloy - about 36 per cent gold.

Had it not been for silver there would be no photographs today - fancy catching the big one that did NOT get away and having no permanent evidence!!

There is, however, very permanent evidence of the lung destruction due to mining dust.
Act NOW and live a healthy, happy life.'

CHAPTER 21

The Mine Ventilation Society welcomes any person connected with mine ventilation and assists the more junior members in advancing their knowledge and hence their qualifications.

A Whillier, 1971

Society affairs in 1971

In presenting the annual report of the Council for the year ending 31st March 1971 the outgoing president, Mr Roger Hemp announced that

'I am honoured that it has fallen on me to confer Honorary Life Membership on Mr A W T Barenbrug and Professor F B Hinsley in recognition of their exceptional contributions to mine ventilation.'

He briefly explained to members Barenbrug's background and quite truthfully added that

'His paper on Psychrometry and Psychrometric Charts has made the name Barenbrug a byword in mine ventilation'.

In accepting his first award of the afternoon, Barenbrug was clearly moved as he expressed his appreciation of the honour which had just been bestowed on him. His second honour that day was the award of the Association of Mine Managers of South Africa Prize for his paper entitled 'Natural ventilation - a review'. Members marvelled at this stalwart of the ventilation fraternity who although retired, seemed to be as active and as determined as he had ever been.

Hemp then announced that membership during the year had increased from 322 to 350 members and that with regret he had to record the deaths of both Beadle and Braunger.

In addition he informed members that some time had been spent during the year revising the Constitution. The most important change that had been approved was in the names of the different grades of membership with Honorary Life Members becoming Honorary Life Fellows, Full Members becoming Fellows, and Associate Members becoming Associates. After covering all the activities of the year, he then gave his presidential address which he called 'Fifty years of South African Mine Ventilation'.

In introducing his paper he said that

'The basis of man's knowledge and abilities lies in his learning from the experience of the past and building on this learning. The most accessible source of past experience is the written word, and this review has been based on a study of papers on ventilation presented to four South African technical societies in the last fifty years. The Societies are the Chemical, Metallurgical and Mining Society of South Africa, which in 1958 became the South African Institute of Mining and Metallurgy; the South African Institution of Engineers, which in 1951 became the South African Institution of Mechanical Engineers; the Association of Mine Managers of the Transvaal, which became the Association of Mine Managers of South Africa from 1954; and last, but I hope by no means least, the Mine Ventilation Society of South Africa.'

The address covered all aspects of ventilation except dust because he said *'during the period under review a large number of papers have been published dealing with the problems of dust and silicosis'.* In addition several previous presidents of the Society had devoted their addresses to this subject.

Barcza proposed the vote of thanks. He was clearly impressed by the address and said

> *'It is salutory at times to take stock, it helps to assess our resources and to plan ahead. Our President has done just this. His stocktaking has been thorough, the assembly of his material logical and his presentation easy to follow. It will be one of the most useful works of general reference published in our Journal. The topic of Mr Hemp's address may have been dealt with before, but never so thoroughly and so competently.'*

And members all agreed with him when he warmly ended his vote of thanks saying

> *'Our President has found time during his busy year of office to write an excellent address in addition to the many valuable contributions in our Journal. Now that his term of office has expired, I hope he will find time to write up some more of the excellent work he has been doing in the very fields, where he complains there is a dearth of published information; so that when a President ten years hence writes about 60 years of South African mine ventilation, Mr Hemp's name will figure as prominently as his past, present and future work will no doubt justify.'*

No-one present doubted these prophetic words uttered by a true leading light of the Society.

Isentropic compression of moist air in fans

In June 1971 Dr Malcolm McPherson who was on sabbatical leave from the University of Nottingham presented a paper to 106 members and visitors called 'The isentropic compression of moist air in fans'. The paper was the subject of his Ph.D thesis which he had completed under Professor Hinsley.

Until the publication of McPherson's paper, the thermometric method of fan testing had been confined to unsaturated air because of the complexity of isentropic pressure-temperature relationships in fogged air conditions. McPherson's paper was a breakthrough in this area of research as it was the first time that a thermodynamic analysis had been carried out to investigate such relationships and the results showed that the thermometric method could be extended to fans passing an 'air-water' 'vapour-liquid water' mixture.

The paper which was to win him the Society's Gold Medal in 1972 fascinated members. Debate was lively after the presentation and six of the contributions were published in the February 1972 edition of the Journal. Whillier congratulated McPherson saying

> *'The efficiency of mine fans is usually specified by the manufacturer at the time of delivery. After installation at the mine it has usually been impossible for the fan efficiency to be checked adequately, largely because of the impracticability of measuring with sufficient accuracy the quantity of air passing through the fan, and the fan shaft power.*
>
> *This is particularly so in the case of fans located on surface at the top of the upcast shafts where there is the additional problem that the air carries a heavy load of liquid water in the form of fog. Now, however, Dr McPherson has provided us with the means to determine fan efficiencies even under fogged conditions without the need to measure the airflow rate or the shaft power!'*

He continued however saying that

'The differential equation given by Dr McPherson for calculating the isentropic temperature rise of fogged air is so complicated as to deter even the most resolute engineer! However it is possible to write this equation in a form that is more suitable for slide-rule calculation and which provides some insight into the significance of the various terms.'

These *'composite nomograms derived by Dr Whillier'* even McPherson had to admit were *'a great improvement for the practical application of the technique and will give perfectly adequate accuracy for in situ fan testing'.*

Other contributions were made by three of the Group Ventilation Engineers namely Mr Bill Holding, Mr Roger Hemp and Mr Jack Drummond. Holding said he was puzzled by the use of the term "fog" to describe the free moisture in a fan drift. He had got the impression that

'The fog component of the air moisture mixture had been considered as a compressible gas obeying the universal gas laws and therefore capable of thermo-dynamic treatment, but from Dr McPherson's verbal presentation this would appear not to be so and I would like further clarification on this matter.'

Wryly he continued saying

'Finally, I was intrigued by Dr McPherson's use of the Classic Theory of Evaporation and Condensation because I believe some time ago South African meteorologists requested that an upcast ventilation shaft be made available to them to further their studies of the nature of rainfall. This being so their studies in some respects will be converse to Dr McPherson's.'

As usual Holding made everyone present laugh although some members were not quite sure whether he was joking or completely serious!

Heat - a challenge in deep-level mining

Dr Austin Whillier, Chief of the Applied Mechanics Division of the Mining Research Laboratory, succeeded Hemp as President on 27th May 1971. In addition to this position, he was also Vice-President of the South African Institution of Mechanical Engineers.

Whillier commanded respect wherever he went. He was not a cold, rude or arrogant academic. He experienced to the full the intense pleasure which is derived from wrestling with the complexities of nature and his enthusiasm positively affected most people who came into contact with him. The topic he chose for his presidential address was one which, out of all members of the Society, he was the most qualified to address. It was called 'Heat - a challenge in deep level mining'. His address was also unique in that it was not given at the Annual General Meeting of the Society but rather at an Ordinary General Meeting on 24th February 1972. The reasons, he explained to members were to *'enable, in future, the incoming President of the Society to deliver his Presidential Address at the beginning of his term of office rather than at the end'.*

None of the 52 people present for the address were disappointed. Whillier's exceptional skill lay in his ability to perceive the engineering world through an array of numbers. Members were all aware of his reputation for knowing the sizes, flow rates, physical properties, thermal constants, and costs of absolutely everything, and more than this - the relationships between these numbers. Armed characteristically in this way, his notes for the address were hastily sketched on to a piece of paper. He began by saying

'My association with the mining industry has been relatively short - since 1966 - but two of the things which have impressed me most are the tremendous competence of the men on the job for getting things done, and the enormous magnitude of the technological difficulties that are encountered in deep level mining. My own endeavours in the past few years have been concerned primarily with the thermal problems of deep level mining, and it seems appropriate that in my Presidential Address I should review some of the broader aspects of these problems, mention some important benefits of recent research, and indicate how research might benefit the men on the job in future years.'

He then explained the role of gold in the South African and international scene, and the alternatives that must be faced if the mining of gold had to be abandoned. Concerning mining at depth he said that the most severe problems of mining at depth were those associated with strata control and rockbursts. However *'of similar severity are the problems of heat, so much so in fact that the refrigeration cost in stopes requiring cooling now often exceeds the cost of explosives per centare mined'*. He then reviewed the factors contributing to underground heat problems which included the effects of rock temperature, depth and heat exchange with the rock in shafts.

Dr. Austin Whillier

His next sections covered recent research investigations and methods for reducing heat pick-up. Never before had the effect of wetness or off-shift wetting-down in scopes appeared so logical and simple.

In conclusion he said that major advances should soon become apparent in micro-climate acclimatization, the use of ice jackets by proto teams, and in the direct cooling of stopes and development ends by pre-cooling the water used for drilling and wetting-down. His final comment was

'Let it not be forgotten, however, that the ultimate success in overcoming the thermal problems of deep- level mining will rest largely with the enthusiasm and competence of the ventilation staff on mines. These attributes have been amply demonstrated in the past, and I have complete faith in these persons being able to rise to the challenge of the future.'

The address was extremely well-received. Whillier had made it all sound so simple. He did not try to confuse anyone with theory but rather enlightened members with his utterly practical genius. It was an address that would be remembered for many years to come.

Here and there

The two editors appointed from 1971 and 1972 were Mr Dave Unsted and Mr Bill Holding. A distinguishing characteristic of both these men was the pleasure and delight each got out of lighthearted jocularity. Council was well aware that their flashes of wit had to be carried into the

Journal - which it was in no uncertain terms.

'Here and There' was a column which had been started by Unsted the previous year. It contained true or false witticisms with a ventilation slant, and Holding and Unsted together continued the tradition with glee. A true one published in January 1972 had readers highly amused particularly as many knew who the story was about.

'This story comes from the Western Transvaal.

Deep in the bowels of the earth a conscientious refrigeration plant attendant was fussing about his plant making sure that everything was "just so". Everything had to be spick and span and in order. Having found a loose connection on a panel board he had repaired it and then he decided to check on other wiring. He reached out to try some wiring.....

Unbeknown to the underground population, a fierce storm was raging with nerve shattering cracks of thunder and blinding flashes of lightning.

A terrific flash of lightning struck the surface sub-station and power for the entire mine was off....
Within seconds the telephone in the engineer's office jingled - it was the refrigeration plant attendant. "Sir, all the power to the fridge plant is off! Not to worry though, I know exactly what I touched and I'll have it fixed in no time!'"

Selection and training of ventilation officials

Whillier when inducting the incoming President for 1972/73 noted that

'Mr John Burrows is known to most of you as he probably comes into contact with more ventilation officers than anyone else in the country. They pass through his hands in acquiring their necessary theoretical training leading towards their professional appointments.'

Burrows was also known as a determined man and on taking the Chair stressed that

'I shall make every effort to ensure prompt publication of the Textbook on Mine Ventilation. I most earnestly request all those authors who have not yet completed their chapters to do so as soon as possible,'

Members exchanged glances and agreed that if anyone could possibly get the textbook out after all these years, it would be Burrows. He was almost their last hope!

The topic Burrows chose as his address was as pertinent to his own reservoir of knowledge as Whillier's had been. Being the Ventilation Training Officer at the Chamber of Mines, and good at his job, the title he chose for his address was aptly titled 'Selection and training of ventilation officials'. He began his speech by detailing the important events which occurred in the training of ventilation personnel between 1916 and 1966. Referring to the method Mr Willie le Roux had outlined in his Presidential Address in 1957, he paid tribute to the man who he said made the *'first true attempt* to *train, rather than to lecture, ventilation personnel'.* He continued saying

'Mr le Roux is well known today as the author of the book "Mine Ventilation Notes for Beginners", but I personally believe that his greatest contribution to the training of ventilation personnel was in the work he performed in compiling his various training schemes for junior ventilation personnel.

The contributions to Mr le Roux's address indicated that despite the great deal of thought and effort being given to the training of ventilation staff, there was still

room for improvement and that this could perhaps be best achieved by inaugurating a system of training, under the guidance of a competent person, on an industry or group basis. However little or no changes were made until 1964 when a Chamber of Mines committee consisting of ventilation engineers and training officers reviewed the system of training ventilation officials.

As a result of the recommendations of this committee a system of centralised courses under the direction of a Ventilation Training Consultant and a Ventilation Training Officer commenced in 1966.

The training of ventilation officials has altered considerably since the formation of the Chamber's Ventilation Training Section and I shall now outline the methods which are currently being used.'

Mr W S Nel, Group Training Officer at Anglo American, in proposing the Vote of Thanks, echoed others' sentiments when he said the rest of Burrows' speech

'. .. gave us some tantalising glimpses of the instructional strategy and tactics underlying the ventilation training programme, which if judged by its sophistication and success must surely be regarded as one of the most effective training programmes in the country, and one of which he and his staff, this Society and the Chamber of Mines may be rightly proud.'

Burrows' address marked the beginning of a year where the Society's activities expanded into the realm of training and education. The new president was dedicated to his vocation and he was determined that by the end of the year every member of the Society would fully appreciate exactly how important training was in the field of mine ventilation.

As a follow-on to his address, Burrows arranged a symposium on 7th November 1972 to discuss the duties and activities of the ventilation departments. Ninety six people attended the meeting at Carletonville where seven papers were presented on topics ranging from routine observations to special investigations and communications. It was a highly stimulating symposium and members were aware when they left that their Society was now fully entrenched in the mining community. Gone were the days when one had to beg to be allowed to attend a Mine Ventilation Society symposium. It was now recognised that the topics chosen by Council were always of direct relevance to every ventilation department and that time spent at these meetings led to knowledge gained.

CHAPTER 22

To be productive, a man must have his basic needs satisfied. In this respect the environment in which he lives and works is of prime importance and, unless cognisance is taken of this need, any productivity campaign will have limited success.

R M Stroh, 1974

Ventilation officials are overpaid

In January 1973 the inauguration of the J P Rees Memorial Prize was announced to members. The only conditions that Rees cited was that the R100 be awarded every two years for the best paper submitted for publication in the Journal describing the existing layout of a gold mine or other large mine. Papers submitted during 1973 and 1974 would be eligible for the first award. However by the end of January 1974, not a single paper had been submitted. Holding came to the conclusion that *'ventilation officers consider R100 to be such a trifling sum as to be not worth the effort',* and said as much in his editorial of January 1974.

'In these days when discussions on closing the wage gap, galloping inflation, wage differentials etc., seem to occupy such a prominent place in everyone's minds, one would imagine that people were struggling to make ends meet. This is no doubt true in the vast majority of cases but there are exceptions.

Among these exceptions are mine ventilation officials who certainly seem to have more money than they need. This might appear to be a startling statement but the following facts support it.

.....1973 has now passed and so far no-one has shown the remotest interest in trying to win the prize. This is very surprising when one considers that the hard core of our members work on mines and that these mines, presumably, do not defy description.

One can only assume, therefore, that ventilation officials consider R100 to be such a trifling sum as to be not worth the effort. Hence the original statement, VENTILATION OFFICIALS ARE OVERPAID.

The prize is still available however with another year to run before entries close, so why not make the effort for the honour of winning even if you are affluent enough to turn your nose up at a mere R100.'

Most readers found the editorial entertaining. The ventilation staff working on Anglovaal's mines were however not amused. Asking for increases on the basis of the wage gap, galloping inflation and wage differentials was clearly irrelevant - the number of papers submitted to the Journal was what really counted!

Another step forward

Burrows' presidential year was marked by a frenzy of activity in every sector of the Society and it was clear to older members how the Society had progressed from the early days and also, how the focus and orientation was beginning to change.

In 1944 when the Society had been formed, the science of ventilation was still evolving. The foundations in ventilation had been laid by the early 1920s with legislation in terms of dust and disease being more progressive than elsewhere in the world. Between 1920 and 1944 the medical experts and legislators began handing responsibility over to the scientists and engineers who had to begin refining the details. By 1944 ventilation complexities began to be severely compounded by the increasing depth to which minds were reaching. Members of the ventilation fraternity realised that there was an urgent need for a Society which could meet and discuss the issues at hand. High calibre men had been attracted to the discipline but it was felt that, for real progress to be made, a platform would have to be provided where ventilation men could address co-workers and initiate high-level discussions relating to their experiences.

The Society had certainly achieved its aim in this respect. Every topic relevant to the discipline had been addressed through the years and discussions and debate had proved highly educational and stimulating for all participants. In addition the Bulletin, and then the Journal, had received acclaim worldwide, and had enhanced the professional standing of the Society in mining and engineering circles.

Twenty years after the formation of the Society, the Chamber of Mines formed its Research Organization after it became obvious that systematic research was needed on both a short and long term basis. The total staff complement was over 200 and it consisted of the Human Sciences Laboratory, the Environmental Sciences Laboratory, the Physical Sciences Laboratory and the Mathematical Statistics Division. The value to the Mine Ventilation Society and other allied societies was that brain-storming sessions about future directions, and existing and new technologies could now be carried out within a more formal structure. This left the societies, who had to a lesser degree been fulfilling this role, free to expand in other directions and address issues which directly concerned their own welfare. Clearly, more time and effort could now be devoted to tackling topics which would have perhaps appeared too trivial in the past. The other consequence of the formation of the Research Organization was that the Mine Ventilation Society began to be identified as a unified body rather than just a group of prominent experts. The contributions of individuals began to be seen as a broad-based collective effort.

In Burrows' presidential year, this new freedom became very apparent. Two symposia were held. The first covered mine fires which was an industry-wide problem, but the second centred on the duties and activities of the ventilation department which was of direct concern to members of the Society. The other development was the decision to host the 1st International Mine Ventilation Congress in Johannesburg in either 1974 or 1975. Council was aware that the organization of such a venture would be a mammoth task but felt strongly that international congresses of this nature were vital for the transfer of technology worldwide, and the Mine Ventilation Society was as qualified as any other organization to initiate the first congress. But just the acknowledgement that the Society was able to organize such an event was confirmation of its professional standing internationally.

Another area the Society had been expanding into was the publication of textbooks. Prestige was not the only gain of these time consuming projects. Each of the books published effectively disseminated knowledge throughout the world about the topic, and once again helped achieve one of the Society's original goals. The Society in its fledgling days had pledged to educate members and this is what they had succeeded in doing by the year 1973 with the final coup being the completion of the textbook 'Ventilation of South African Gold Mines'. Burrows' promise when inducted had proved to be very sincere.

Members knew that at this stage the task that now lay ahead was preserving the reputation deservedly gained in the past. They would continue to keep members informed of all the latest developments and they would continue to play a vital role in the education of both ventilation officers and the mining industry at large.

Cooling power of the underground environment

The Society's gold medal in 1973 was won by Dr A Whillier and Mr D Mitchell for their paper 'Cooling power of underground environments'. The paper which was published in the Journal in August 1972 advocated the use of specific cooling power as the method which should be used when estimating heat transfer to man as opposed to the use of the wet kata reading. Older members when reading the paper were reminded of the heated debate in 1954 when Wyndham had attacked the use of the wet kata but had lost credibility through being unable to propose an alternative method.

Whillier and Mitchell's paper was the next stage of the wet kata saga. They explained in the introduction that

> *'The problem of heat stress underground in the gold mines is approached on the basis of heat transfer between the human body and the underground environment. Experimental measurements of radiant and convective heat transfer and a theoretical calculation of maximum evaporative heat transfer enable the maximum cooling power of an environment to be calculated in terms of dry-bulb and wet-bulb temperature, the mean radiant temperature, the wind speed and the barometric pressure. For most underground applications the cooling power can be expressed as a function of wet-bulb temperature and wind speed only. The relative importance of wind speed and wet-bulb temperature can be assessed. In working places where wind speed is low additional cooling of workmen can be achieved better by increased wind speed than by decreased wet-bulb temperature. The wet kata reading proves to be of limited value as an index of heat stress because environments with equal wet kata do not necessarily have the same cooling power. Finally, thermal equilibrium with the environment is possible when cooling power equals or exceeds the rate of metabolic heat generation.'*

This time the Human Sciences Laboratory made no mistakes. Their proposals were all validated scientifically and experimentally, and they stated unequivocably that

> *'The result provides a theoretical basis for the experimental findings of Wyndham et al who twenty years ago established wet-bulb temperature and wind speed as the most important environmental determinants of physiological reactions to heat.'*

Lambrechts, and Kitto were amongst the members who believed that Whillier was leading the mining industry along the wrong route. This time discussions took place behind closed doors unlike the drama in 1954 which had almost turned into a free for all. It was not that they did not agree with the concept of specific cooling power but more that they felt it was being given too much positive publicity.

More experience was needed they said in the use of specific cooling power before it could be billed as the answer to all cooling power problems. However, this time no-one could point the same finger at the Laboratory as Barenbrug had done that fateful day in 1954 when he had rightfully stated, very forcefully, that

> *'The experienced ventilation engineer knows fairly well what environmental air conditions must be provided for in deep mines. He appreciates the value of theoretical approach and research, which refines the imperfect and incomplete judgement of an imperfect human being; he looks forward to the results of Dr Wyndham's work. However, if theory conflicts with practical experience there is only one outcome - the theory will be rejected!'*

Planning of ventilation and refrigeration requirements

Since Lambrechts had presented his paper to the Society on the ventilation planning for Western Deep Levels in 1960, members had watched the progress being made with the introduction of new systems and methods at the world's deepest mine with interest.

In June 1972, Mr Doug Grave co-authored a paper with Mr Dick Stroh who was the Ventilation Superintendent at Western Deep Levels on the planning of ventilation and refrigeration requirements in deep mines. In the paper they discussed planning methods with particular reference to the application of computer techniques. They also demonstrated the use of the Starfield-Dickson programs for calculating heat flow into airways and advancing stopes as applied to Western Deep Levels which had now extended to a depth of over 3 km below surface. The paper was extremely well received and as Stroh explained *'it marked the beginning of a phase of trying to get confident with the use of computers'.*

Stroh's Presidential Address on 7th June 1973, the day before he assumed the position of Assistant Group Ventilation Engineer at Anglo American, filled members in on the major changes that had been implemented at Western Deep Level since Lambrechts had delivered his pioneering paper some 13 years previously. He praised Lambrechts saying

'This paper dealt with the broader aspects of providing sufficient air of good quality for the mine as a whole. It is to his credit that much of the planning has come to fruition. In fact, it is quite remarkable how accurate many of his long range predictions have been.

Since 1960, however, major changes in mining policy have been implemented. Notable amongst these changes was the elimination of two of the four shaft systems originally planned and a consequent increase in production from 222 000 to 370 000 tons per month from the remaining two shafts. These changes have naturally occasioned dramatic increases in refrigeration requirements.

It is interesting to note that current refrigeration requirements for the mining area envisaged by Lambrechts are consistent with his original planning viz:

	1960	*1973*
	PLANNED	*ACTUAL*
Tons mined per month	*145 000*	*184 000*
Refrigeration - kW	*16 200*	*18 700*
kW/ton mined	*0,112*	*0,102*
Mean virgin rock temperature	*45°C*	*45°C*

The following statement by Professor Lambrechts in the original paper is also worthy of note

'The plans are flexible enough to stand such modification as may reasonably be expected by the exigencies of mining'. These plans have withstood the test of time and have proved flexible enough to satisfy almost unreasonable changes in mining policy.

It has been my good fortune to witness the growth of the mine for the past 10 years. During this time a great deal of planning has been necessary to accommodate the many changes that have been implemented. It was predictable therefore, that I would describe the refrigeration systems on Western Deep Levels in this address.'

The paper was very practically orientated and everyone present knew that it would be used for years to come by any ventilation engineer involved with refrigeration.

CHAPTER 23

The mine ventilation officer has become a specialist, and is in charge of a specialist department.

P F Cilliers, 1974

The Ventilation of South African Gold Mines

On 7th June 1974, Stroh announced that Quilliam wanted to make a special announcement. All eyes turned to Quilliam and the pessimists present half expected him to rise and dolefully tell them that something else had now gone wrong with publishing the textbook. It had after all been a year since Burrows had announced that the textbook was complete and would be published in a few months.

But Quilliam as he stood before them had a twinkle in his eye. He still wore the same suit which he had worn at the inaugural meeting in 1945, but today he seemed to wear it with more panache. He breathed deeply and began by saying

'I have been given the privilege and pleasure of announcing, with humble pride coupled with intense relief, on behalf of my colleagues on the Textbook Committee, Messrs. Hemp, Burrows and Lancaster, the receipt of an advance copy of 'The Ventilation of South African Gold Mines' published by our Society with the support of the Chamber of Mines.

.....The first meeting of the Textbook Committee (a standing Committee) was held in February, 1956, and I received this advance copy on 30th May 1971 - a time period of 18 years, 3 months and 12 days. (I suggest that no further reference be made to this unenviable record).'

Unenviable indeed. Someone was heard to whisper to a colleague that perhaps the time delay even qualified for the Guinness Book of Records! Quilliam ignored the jibe, and continued, recounting the history of the book.

'The late Professor Black was appointed first chairman in 1956 and after a short period in office, made the understatement of the year by saying that "It will not be possible to finalize the book within the next twelve months", and this was followed by his resignation.'

Although the saga of the textbook was funny in retrospect, members began to understand the anguish which Quilliam had gone through over the years. They were also finding his narration of events quite interesting.

'Thereafter, the textbook committee faced a decade and a half of frustration and despair with hardly any progress being made, despite constant efforts.

During this period I found my major function was to attempt to persuade certain authors to submit their chapters; a duty to which I was probably unsuited.

However 35 meetings of the Textbook Committee were held, together with seven joint meetings of the committee and authors, at which the latter were expected to provide individual progress reports. These joint meetings were a failure as the defaulting authors did not attend.'

He continued detailing the multitude of methods that had been tried to attempt to force people to write chapters.

> *'Every conceivable effort was made to get these authors to co-operate. Verbal approaches were made whenever possible, promissory notes submitted, signed and returned, utilizing the art of persuasion.'*

What he failed to add here is that persuasion cannot work if attempted through gritted teeth! Threats, he said, also made no difference. *'In some cases veiled threats were made such as "If you don't comply, you must withdraw," or 'If you don't comply you will be replaced'. All these efforts were to no avail.'*

Members laughed because, although not obvious to Quilliam, it was patently clear that many of the authors would have loved to be replaced, and Quilliam thought he was threatening them with something terrible! *'Unfair tactics were also used, the following of which is an example. I once approached Mr Le Roux and asked him when I could expect his two chapters. His reply was brief and to the point when he said*

> *'When half the chapters for the book are in your possession I will submit mine within a fortnight.' After a suitable period of time and due consideration I told Mr Le Roux untruthfully that I had ten draft chapters in my possession. He was true to his word, and in due course, his two chapters were received. Unfortunately, at the next Council Meeting I had to make a progress report on the book. When I proudly announced that a total of two chapters were available, both by Mr Le Roux, it proved a very embarrassing situation. I don't think I have ever been forgiven for this, but in submitting an apology once again, it certainly was a starting point which was used to advantage in a desperate situation.*

Even Quilliam was laughing by this stage as he recounted yet another ruse used, and how the authors began to behave like naughty schoolboys dreaming up the most implausible excuses to avoid having to start writing.

> *'After being submitted to pressure, some authors complained that they could not work at home because of family commitments, nor snatch some time during working hours because of constant interruptions, so we conceived the idea of arranging writing sessions in private rooms at Kelvin House. I can still see in my mind's eye two authors, each in separate rooms, pencils poised over a sheet of foolscap, deep in thought. The idea was eventually scrapped because no reference books were readily available.'*

Quilliam continued saying how the Committee then invited the authors of 'Rand Metallurgical Practice' to address them on how to complete a book. They were considered experts in the field having taken only 10 years to complete their book. But at the meeting it was stated that the chairman of the Textbook Committee had to be *'an individual with the perspicacity, personality and ability to constantly urge authors to undertake their commitments up to the point of being dictatorial'.* This description apparently made up Quilliam's mind. His personality could not have been more different. With relief, he handed in his resignation. It was refused point blank, the reason Quilliam said was that no-one else would do the job.

The book was however eventually finished with the help of Hemp, Burrows and Mr Felix Lancaster.

> *'The quiet, unassuming, efficient approach by Roger Hemp was balanced by the ebullient forceful attitude of John Burrows. Combined with the experience and ability of Felix Lancaster in the work of editing, this provided a highly efficient and successful combination. John is an author and no doubt the extensive behind-the scene contribution of Roger Hemp prompted Council to invite the latter to write the introduction to the book.*

Having been prodder-in-chief for many years I found myself in the unenviable position of being prodded by one, Burrows, (deservedly or not), who, as Ventilation Training Officer, probably needed the book more urgently than others.'

International Mine Ventilation Congress

The idea of holding the 1st International Mine Ventilation Congress had been mooted during Burrows' presidential year with the final decision that it should be held in 1975 being made while Stroh was president. Unanimously members voted Barcza as the Chairman of the Organizing Committee. He was the natural choice, not only because he had conceived the idea but because his skill at mobilizing resources was second to none.

He set about his task with enthusiasm and vigour although members were aware that his health was beginning to fail. The organisation that was required was a mammoth task, and in recognition of this formidable undertaking both an Organizing and Executive Committee were established. The Organizing Committee consisted of Messrs. M Barcza, J H J Burrows, P F Cilliers, C J Csatary, Dr R S J du Toit, Messrs. D F H Grave, R Hemp, Mrs D Hemp, Messrs. W Holding, M J Howes, M J Martinson, W L le Roux, J H Quilliam, R M Stroh, S G Taussig and Dr A Whillier. By 31st March 1974, Barcza was already able to report some progress to Council.

Proudly he said

'First I am very pleased to report that Mr Dolf Schumann, Technical Director of General Mining, and Vice-President of the Chamber of Mines has agreed to be President of the Congress. Mr Schumann's interest in mine ventilation and his standing in the South African scene generally, and in the mining industry particularly, will enhance the image and success of the Congress.'

Regarding possible participants he mentioned that

'The response to our first circular has to date been gratifying, particularly from outside our Borders.

Nearly forty people from Australia, Austria, Belgium, Botswana, Burma, Canada, Germany, Japan, the Netherlands, Poland, Rhodesia, Spain, the United Kingdom, the United States and Zambia have indicated their interest, and twelve of these persons have offered papers.'

He however expected far more papers to eventually be forthcoming.

'The indications are that some fifty papers will be offered for presentation. The response from South Africa is coming in slowly: less than ninety at the moment. September 1975 seems to some of you to be a long way away. It would, however, help the Organizing Committee to have an early indication as to the likely number of delegates.'

Cillier's presidential year in 1974/1975 was frenetic. All anyone ever heard about was the Congress. Barcza was on the telephone every day, and it was the first time members of the Committee wished they had secretaries to firstly, do the work and secondly, stall Barcza. But all the work was getting done and then the blow hit the Society. Members knew that Barcza had cancer and that he had been ill. But his death was totally unexpected. It was an enormous shock, both professionally and personally, when the Society learnt of his sudden death in May 1975.

Pandemonium literally set in. The Organizing Committee felt lost. They had never really had to acknowledge how dependent they all were on Barcza before. Grave however remained calm.

He knew who could do the job. It was quite simple. If Burrows could get the textbook finished then finalizing the negotiations and arrangements for the Congress was, in comparison, a simple task. Burrows was elected Chairman; there was no second choice.

At the Annual General Meeting held on 26th May 1975, he reported the progress to Council. He paid tribute to Barcza saying

'I don't have to tell you how much we will miss Misi Barcza in the organizing of it, but I can assure you that the hard work he has done and the manner in which he planned will make the duties that we have to do in his absence much easier.'

He continued saying that 61 papers had been accepted of which 37 were from overseas authors. Fourteen technical sessions were planned and members could expect pre-prints of all the papers in August. In this respect, he said

'The Society as a whole is indebted to Mr Hemp and the Papers Committee and all those who have assisted the papers committee because they have done an enormous amount of work and a good job to get the papers ready by the end of July.'

He concluded his report saying

'Finally I would just like to mention that the tempo of our work will have to increase as we draw closer and closer to the date and in doing this we will draw more and more on you as members of the Society for assistance in doing all sorts of things. I am certain that you will help us when asked. Indeed, I hope that you will volunteer when not asked. I think we are doing this to improve our knowledge of ventilation, to enhance the image of the MVS and indeed of South Africa.'

Said so sweetly, no-one would have guessed how dogged Burrows knew he was going to have to become if the Congress was to be a success. But he was determined. It would be a milestone in the history of the Society.

Another problem which had been debated at length when the idea of the Congress was first put forward, was the question of who should be elected as President during 1975/1976. The person chosen would have to be a leader, highly presentable, knowledgeable, polished and eloquent, Mr Mike Martinson was the clear favourite. Eccentric in nature, he had joined Rand Mines under Barcza in 1953 after completing his degree in mining engineering. His career had been distinguished particularly in his contribution to shaft resistance measurement by means of scale model testing in wind tunnels. He was however unsure of his career choice and in 1960 he left Rand Mines and took up a position in the legal department of Anglovaal. It was not an entirely surprising move since he had been studying part-time for his LL.B, which he received in 1961, for a number of years. But in 1965, he gravitated back towards mining and assumed the position of Senior Lecturer in Mining Engineering at the University of Witwatersrand where he seemed to find his niche.

By the end of July, Burrows was winning. Nothing could defeat him. He made sure that nothing was left untouched. He organized contingency plans for every possible scenario, he double checked or triple checked every arrangement and he nagged, nagged, nagged. But he was pushing willing horses. And he triumphed. Not a single member begrudged him that. He was totally indispensable.

On 15th September 1975, the Society finally staged the most ambitious project in its history. The 1st International Congress began its first day at the University of the Witwatersrand with 661 local and overseas delegates in attendance. Dr Piet Koornhof, Minister of Mines, gave the opening address. He extended a warm welcome to both overseas and local delegates. Regarding local delegates he said

'South Africa is aware of the great contribution that you have made to the

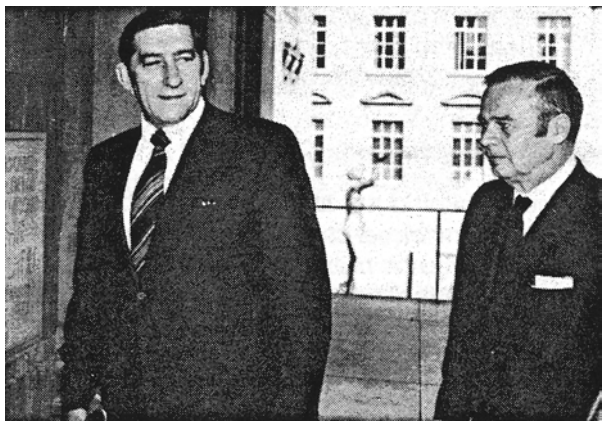
development of the mining industry of this country. I am glad that you will now have the opportunity to share your expertise with other experts in this country, which you have served so admirably for so many years.'

He continued saying

'I understand that the Mine Ventilation Society of South Africa is the only one of its kind in the world and this is perhaps a good example of the very real interest that we in South Africa take in all facets of our mining industry, and of the abilities with which we strive to serve this industry in all its ramifications. For this there is one most important reason, and this is the economic growth and strength of South Africa, and the development and the extent of its mining industry.'

Mr A W S Schumann, President of the Congress, thanked Dr Koornhof and added that

'I would like to give my own, and I think I should add, the thanks of the whole of the mining industry, to the Mine Ventilation Society of South Africa, for the imagination and initiative which they displayed in planning this congress, and for the enormous amount of old-fashioned hard work which they have done in preparing for it.'



Dr. the Hon. P.G.J. Koornhof, Minster of Mines, and Mr. A.W. S. Schumann, President of Congress.

The next speaker was Martinson, who with his usual eloquence, recapped to delegates the history of mine ventilation and the Society. He was followed by Mr Henry Doyle, who was internationally regarded as the doyen of Industrial Hygienists in the United States of America. After commenting on the excellent social programme which had been arranged for delegates, he wittily mentioned that *'one fascinating object which I have found in my attaché case, was the book of South African recipes. I hope this will rekindle my affiliate's (his wife's) interests in the culinary process'.*

Every aspect of mine ventilation was covered during the week. Sixty- two papers were presented in fourteen sessions.

Each session was followed by in-depth discussion and the knowledge shared during that week was incomparable. The image of the Society was now firmly entrenched throughout the world. The congress was to be the forerunner of other international congresses and the US Mine Ventilation Symposia. No-one would ever again refer to it as that 'relatively new little Society'. Little it may be but it certainly commanded respect within the ventilation profession.

But the organizing had not only been restricted to technical discussions. There had been a social committee chaired by Mrs Doreen Hemp who, with wives of other members of the Organizing Committee, had been extremely active in arranging a myriad of activities for the wives of delegates. In addition Stroh had organized hotel bookings and devised scenic tours, Mr Mike Howes had designed a stimulating programme of technical visits, and Mr Russell Ramsden performed his first task for the Society by personally meeting every overseas delegate at the airport.

The Congress had been an overwhelming success. Despite the hard work, everyone had a lot of fun. Friendships were formed between the South Africans and overseas delegates that were to

span across decades. Professor Hinsley who had come as a guest had, in fact, been so impressed by the Society and its activities both past and present that he pressed Holding to motivate that the Society begin recording its own history. It was after all unique.

But it did not end on 19th September. Roger Hemp with the help of Felix Lancaster, still had to complete the second part of his enormous task which was to prepare the proceedings for publication. This involved not only thorough editing of the papers but also writing and compiling the notes on the discussions held after every session. Eventually he managed to get the bound volume on the shelves by August 1976 and so ended the largest venture ever attempted by the Society.

CHAPTER 24

Mining is generally acknowledged to be an inherently hazardous occupation, and under the circumstances it is surprising that risk in the context of personal injury has received so little attention in mining literature.

M J Martinson, 1975

Occupational health and safety

A humanitarian at heart, Mr Mike Martinson had always been concerned about the health and safety of workers underground. He also believed that far too little attention was given to mine safety by universities and researchers throughout the world, and decided that in his presidential address he would review occupational health and safety on mines. The paper he delivered to members on 28 May 1975 was indeed most thought provoking. It was researched meticulously with 128 references being cited but as he said

'In view of the considerable mass of material reviewed it is surprising that no previous attempt to review the field of occupational health and safety in mines has been encountered. Studies in the field seem to be highly compartmentalized.'

The paper covered occupational health and safety through the ages with specific reference to dust, rockbursts and heat in the Witwatersrand gold mines. It was particularly interesting as it was the first time that any paper had been delivered to the Society which emphasized legislation in each of these areas. He then detailed design criteria for mine ventilation and stated that

'The question of risk as a design criterion has to all intents and purposes been ignored. This is anomalous, because without correlating risk and air flow rate the selection of flow rates for design purposes must be based on intuitive or arbitrary criteria. Intuition plays an important role in engineering design, but if it is merely used as a soft option for rational analysis it degenerates into arbitrariness.'

The acceptability of risk was then discussed as was the employer's duty of care, and the US Federal Coal Mine Health and Safety Act of 1969. Wyndham proposed the Vote of Thanks and said he was

'...delighted that Mike Martinson has come down on the side of assessment of risk as the criterion for judging of environmental control. I say this because since I started the Applied Physiology Laboratory in the mining industry, our endeavour has been to give factual data in terms of risk of heat stroke by which ventilation control should be judged. The extraordinary thing we found in 1950 was that we had the wet kata thermometer - but no-one could really tell us the wet kata reading at which there was a risk of heat stroke, nor could they tell us the level at which efficiency would be markedly affected and, least of all, could they tell us which individuals would be uncomfortable. This situation fortunately is changing very markedly as Mr Martinson has very rightly said.'

He then explained to members the history over the last 20 years of the efforts made in gaining factual information on the levels of thermal stress at which researchers could quantitatively indicate the heat stroke risks. He continued saying

'A point I want to make here is that this was not a simple task. As Mr Martinson has again indicated it is a very difficult task indeed and we had to give these risks of heat stress in terms of acclimatised and unacclimatised people. Very roughly there is a 3 degree wet bulb temperature difference between acclimatised and unacclimatised people, with acclimatised people being safe at 3 degrees wet bulb temperature higher than unacclimatised.'

Whether members agreed with the stance that Martinson took or held differing opinions, they all had to agree that it was an excellently researched address, and that his stress towards the need to base environmental control of mine atmospheres on accurate estimates of the dose responses of any of the hazards which occurred in mines was extremely timely.

Chilled service water

In June 1976, Dr Austin Whillier published a paper in the Journal which he had presented at a Chamber of Mines Productivity Campaign Seminar in February 1975. The paper was called 'Machine water - the forgotten factor in mine cooling' and was to mark the beginning of one of the most heated controversies within the Society, and between the Chamber of Mines Research Organization and members of the ventilation profession in the industry.

Until the mid 1970s underground cooling had been restricted to the cooling of air. However Whillier had for a number of years been working on introducing another form of cooling, namely that of chilling the service water used for drilling. The concept was really quite simple since all that was needed was to cool the service water before it was used at the face. He introduced the concept to the industry in 1975.

Whillier began his presentation by explaining that

'The thermal environment in hot mines has a major influence on productivity and safety and on the attractiveness or otherwise of mining as a career. It is recognised that wet-bulb temperatures below 28°C are cool, so that acclimatised workmen are reasonably alert mentally, and are able to work at almost peak productivity and in complete safety from a physiological point of view. On the other hand at wet-bulb temperatures above 33°C there is a tendency for a don't-care attitude to develop, productivity falls off drastically, accidents tend to become more frequent, and the danger of heat stroke increases rapidly.

There is hence a difference of only 5°C between what might be called "heaven" (28°C wet bulb temperature) and "hell" (33°C wet-bulb temperature). The challenge facing ventilation men today is to bring conditions in deep mines much closer to heaven!'

Regarding the possibility of heat removal by the service water, he said

'A second fluid that is circulated through mines is the service water (or machine or industrial water as it is variously known), the quantity varying from one to four tons of water per ton of rock broken. It is apparent therefore that if this water were cooled from the present typical temperature of 30°C to say 15°C before entering working places it would contribute very substantially to the removal of heat. (Such cold water flowing at a rate of 1 ℓ/s would remove between 50 and 60 kW of heat.) Investigations by the Chamber and independently by various mines have confirmed that cooling the service water is indeed effective in bringing an immediate and significant benefit to the labour force due to lowering of wet-bulb temperatures.'

He continued outlining the advantages of the use of chilled service water. The main benefit was

that the cooling is always available at the remotest extremities of the mine thus eliminating hot spots. The water would also tend to cause condensation helping to reduce the moisture content of the air and assist in allaying dust.

The advantages claimed by Whillier were supported by a paper published the next month in the Journal by Messrs J C Jacobs and J E Olivier of Buffelsfontein Gold Mine. They said that they had started

> *'...experiments at the beginning of 1973 in an area with virgin rock temperatures of 43°C. A section breaking 12 000 centares per month was supplied with service water chilled to 10°C as the only cooling medium. Ventilation conditions of this area compared very favourably with conditions in adjacent stopes equipped with conventional water- to-air cooling coils.'*

They continued saying that

> *'The results obtained from these experiments prompted the mine to investigate methods of using service water cooled in bulk as a means of refrigeration. One such method comprises the use of a cooling installation situated on surface to cool all the service water supplied to the Southern Shaft.'*

Initial experimentation was carried out in April 1975 with the help of Whillier and his staff, and the results showed that it appeared *'to be a feasible method of cooling'*.

Any outsider would have to agree that these two papers appeared completely innocuous. All they seemed to purport was a fairly cost effective way of introducing further cooling into the mines. However behind the scenes the issue was rapidly developing into the most touchy topic in the history of mine ventilation in South Africa (besides the wet kata debacle in the 1950s). No-one ever really knew how it started, how it was fuelled and why it caused the animosity that eventually surfaced. What was however clear to every member, no matter what side they took, was that there was considerable political manoeuvering going on in the background. The Group Environmental Engineers accepted that *'it was the forgotten factor in mine cooling'* and that more use should be made of the concept in the future. What they did not accept was that it was the answer to all cooling problems in mines. Unfortunately, through either misunderstanding or deliberate intent it seemed to the Group Environmental Engineers that the Chamber was determined to gain as much mileage from the issue as possible.

The Chamber embarked on a publicity campaign where the slant was definitely skewed towards claiming that the Research Organisation had finally discovered the answer to cooling problems in deep level mines. The first mistake was that little credit was given to the mines which had also conducted pioneering work in the field. Years before, Mr Bill Reynolds had reported results of his experiments at Loraine Gold Mine where he had coupled the drilling water to chilled water. The senior Chamber Committees then also tried to force the ventilation fraternity to wholeheartedly accept the concept and if anyone dared ask questions, they were regarded as belonging to the 'anti' side of the campaign. Other members also felt that if they voiced differing opinions, namely that the concept was not in fact the saviour of mine cooling, they would be accused of professional jealousy. One problem mooted was that the sudden cooling of the hot rock would make it 'spit' at workers!

Whillier was caught right in the heart of the problem. He certainly believed that the use of chilled service water in mines was eminently sensible but had never really meant it to be perceived as the ultimate answer. In essence he had merely formalised a concept into an engineering system which could potentially ease the problem of localised cooling. However he found himself in an unfortunate predicament. As the debate for and against the concept became more and more convoluted, he also understandably became angry. He knew he was being wrongly accused but to have backed down completely would have meant that chilled service water would have taken another ten years to be introduced. So he continued to defend its merits and the industry continued

to believe that the essence of what he was saying was that the system was the ultimate answer. It was a no win situation, complicated by the myriad of misunderstandings that had developed and persisted throughout the drama.

Then in 1977 Whillier was jointly awarded the AS & TS National Award with SASOL. The Journal recorded that the SASOL team were recipients of the award for 'successfully developing a unique process for the manufacture of commercially valuable gaseous liquid and solid chemicals and fuels from coal' and Dr Whither was a recipient for 'his outstanding contribution to science and the application of science in the control of the thermal environment in deep-level mining'.

Dr. A. Whillier (R) receives the AS & TS National Award from the President, Mr. E. J. Hall.

This award to Whillier did nothing to mend the barrier which had been formed between the industry and the Research Organization. Once again speculation as to why Whillier had actually won the award was rife. Many said it was just the continuation of the Chamber's drive for publicity and that if the award was to be given for the concept of chilled water, then others should have shared in its honour. However there were many, mainly outside the profession, who sincerely believed that Whillier wholeheartedly deserved the award and that the time had come to forget the animosity and begin with the introduction of chilled service water on mines.

The Society and the collieries

Bill Holding was inducted as President of the Society on Friday 11th June 1976. He had come to South Africa in 1966 and had joined the Union Corporation Ventilation Department. In the same year he joined the Mine Ventilation Society and in his several years of membership had been Assistant Editor and Editor of the Journal. He moved to Anglovaal to become the Group Environmental Engineer in 1970 and was a long standing member of the MVS Council having served since 1971.

However before coming to South Africa, Holding had worked for the National Coal Board in the United Kingdom for 15 years. Amongst his achievements was joint recipient of the C G Greenwell Medal of the North England Institute of Mining and Mechanical Engineers in 1965 for a paper called 'The re-opening of the 2nd South District of Easington Colliery' as well as a bronze medal of the National Association of Colliery Managers for a paper on 'Retreat mining at Easington Colliery'. Holding was a well respected member of the South African ventilation fraternity and as Martinson said when inducting him as President

'There is no doubt that the National Coal Board's loss was South Africa's gain when Bill came to this country and entered the mining industry here, He has played a very active part in the Society's affairs, and, if I may say so, I think you have an excellent President for the new year.'

The theme Holding chose for his presidential address was 'Mine Ventilation - two decades, two continents' and he introduced the paper explaining that

> *'It is coincidental that the start of my Presidential year in office in 1976 occurs twenty years after my first appointment as a ventilation engineer. It is further coincidental that it also occurs ten years after my entry into the South African mining industry. I have therefore completed this year twenty years in mine ventilation of which half were spent in the coal mining industry of the United Kingdom and the other half in the South African mining industry.'*

Of interest to members were his remarks about the difference between South Africa and the United Kingdom in the appointment of ventilation officers.

> *'It is of rather curious significance that the cross-over point in my career when I left the United Kingdom in 1966 to come to South Africa was the exact opposite of what one might have expected. It would be reasonable to assume that such a move would be a transition from an old established order to anew and immature society. In terms of mine ventilation the converse was the case. Whereas the mine ventilation fraternity in South Africa had its origins as far back as 1913 with the appointment of the first dust inspectors, it was only in the late 1950s that mine ventilation specialists were appointed on a nationwide and uniform basis in the United Kingdom. Previous to the nationalisation of the mines, most colliery companies had relied on private consultants, often university professors, for advice on ventilation matters outside the scope of colliery managers, although some of the bigger groups of companies had ventilation specialists.'*

The address was a fascinating account of Holding's past twenty years in the two industries, and it was made more interesting because he had purposefully dwelt on aspects which were rather unfamiliar to the majority of members, namely those working in gold mines. In conclusion he dwelt on the coal industry in South Africa, and its projected expansion, since the Wankie Colliery explosion in 1972 and stated his objective for the year.

> *'It is true to say that the Wankie Colliery explosion in 1972, in which over 400 lives were lost, led to a reappraisal of attitudes to coal mine ventilation in Southern Africa. The future expansion of the industry will, in its own right, lead to greater ventilation problems. Greater concentration of mining may well lead to higher methane emission and dust deposition, while the inevitable trend toward higher ventilation pressure could increase the incidence of spontaneous combustion. Apart from this the sheer logistics of supplying ventilation and other services to meet the increased production is a problem in itself.*
>
> *The need for increased emphasis to be placed on colliery ventilation has already been recognised. Some mining groups have transferred experienced gold mining personnel to coal mining where their professional expertise will be of great value.*
>
> *The Chamber of Mines has instituted a certificate for colliery ventilation personnel and the first examination was held in April this year. Thirteen candidates wrote the examination.*
>
> *The Mine Ventilation Society also has a role to play. A collieries representative has been appointed and he has organised what promises to be an extremely virile section of the Society's activities.*
>
> *It will be one of my objectives during my Presidential year of office, and indeed my personal pleasure, to try and extend the Society's influence more into the field of colliery ventilation and to induce more of the expanding ranks of colliery ventilation personnel to become involved in the Society's affairs.'*

Like so many of the Presidents of the Society before him, Holding was true to his word.

Formation of the Collieries Branch

As Holding had mentioned in his address, ventilation officials began to play a far greater role in colliery ventilation after the Wankie Colliery disaster in 1972. Previously the managers, with perhaps the assistance of a few junior ventilation personnel or the surveyor, had overseen the ventilation aspects on each colliery. Mr Neale Thorp when proposing the Vote of Thanks for Holding's presidential address had commented that

> *'The appointment of personnel on British collieries, with a mining background, as colliery ventilation officers and assistants seems to be a more satisfactory arrangement than our system of using colliery surveyors to make routine observations. This statement is not intended as a criticism of the capabilities of surveyors. In fact, those with whom I have been associated are all capable men and the majority of the successful candidates in the recent Collieries Ventilation examination were surveyors, but their main occupation is surveying and one finds that not enough time is spent on ventilation matters as is necessary. The increasing emphasis on colliery ventilation will in time necessitate an increase in ventilation staff. With the guidance and encouragement being received from this Society, colliery ventilation personnel will, I am sure, contribute as much to this Society as their gold mining counterparts have done.'*

Thorp was one of the colliery representatives of the Groups and, together with Messrs Yvan Haven, Sebastian Crous, Mannie Swanepoel and J H van Dyk, had been trying to constitute a Collieries Branch. Council agreed in principle but decided that the first step should be the formation of an Area Representative. The meetings were always very well attended, and during Holding's year of presidency bye-laws were finally introduced which enabled a fully fledged Collieries Branch to be instituted. The Branch, in terms of the constitution, was empowered to elect a committee and chairman, with the Chairman being an ex-officio member of Council with full voting rights.

CHAPTER 25

The human body is not a machine which can be taken to pieces to find the fault and put together again.

From the Report of the Medical Bureau for Occupational Diseases for the period 1 April 1975 to 31 March 1976.

Colliery fires and explosion hazards

The highlight of 1977 for the Collieries Branch was the hosting of a symposium on colliery fires and explosion hazards on 10th March 1977. Over 170 people attended the Branch meeting including Mr N Orsmond, the Government Mining Engineer and Mr A B Daneel, Chief Technical and Labour Adviser to the Chamber of Mines.

Holding welcomed delegates saying

'It is my privilege to welcome you to this Symposium, which is the first function of this size organised by the Mine Ventilation Society in connection with coal mines. It is my particular pleasure to welcome you because one of my Presidential objectives has been to bring the Society to the coal mines.

There is no doubt that the Mine Ventilation Society is a product of the gold mining ventilation fraternity. While it is also true to say that capital investment and the resources in ventilation in the gold mines probably outstrip those of the coal mines, it is equally true to say that it is in coal mining where the greatest potential disaster could arise from faulty planning or faulty ventilation implementation. I think it is time that the Mine Ventilation Society and its expertise came closer to the coal mining industry so that we can have an interchange of ideas which will benefit both the Society and the mining industry in general.'

The symposium was then officially opened by Mr Orsmond who placed into perspective the current position of coal mining in South Africa.

'All those participating in the symposium will gain considerably by the pooling of knowledge on incipient heating and colliery fires. But more important than this is the fact that the proceedings of the symposium will form an easy, informative and authoritative reference for colliery officials, especially new entrants to the industry.

As you are aware the present energy climate has placed an unprecedented priority on coal throughout the world especially in South Africa where we are more dependent on this mineral than almost any other country. However, having no oil, few friends and a vast development programme ahead of us, it stands to reason that besides building up our production of coal, we must also ensure its continuity and make certain that none of our reserves are lost.'

The symposium was divided into two sessions. The first was chaired by John Burrows, Ventilation Training Officer of the Chamber of Mines, and the second by Mike Sandys, Assistant Group Ventilation Engineer of Anglo American Corporation. Seven papers were presented that day with the speakers being drawn from the Government Mining Engineers Office, Welgedacht Exploration Company, Northfield Colliery, Wankie Colliery and Anglo American Corporation.

Of particular interest was the paper by Mr S A Z Liedberg who was the Chief Ventilation Officer at Wankie Colliery. He explained to those present that the colliery was now using incombustible dust. However he said that *'prior to the Disaster, it was believed that Wankie coal was "non explosive" and, as a matter of fact, the Colliery was a "naked flame" mine for over 55 years without any serious incidents recorded'.* He continued saying that

> *'The first coal delivery from Wankie took place in 1903 when the railway line from the South was completed. Since then, coal has been continually mined and to date some 20 million tons have been extracted from the coal field, mainly from underground workings. A few minor incidents of explosions, or rather ignitions, are on record. However, in spite of being a naked flame mine for more than 55 years, no serious accidents had occurred, On the contrary, it was believed that Wankie coal, although rather liable to spontaneous combustion, would not explode. A number of tests have been carried out in the past and the conclusions were that, under normal circumstances, this type of bituminous coal was non-explosive. Unfortunately this was proved very wrong by the Wankie disaster in June 1972.*
>
> *Incombustible dust was used during the 40s but for some unknown reason this was stopped in the early 50s. At the present time dust is used extensively in all underground workings and apart from normal precautions such as testing for inflammable gases and routine sampling of return air, the use of incombustible dust is the only means of preventing a re-occurrence of a widespread underground coal dust explosion.'*

During the discussion session, Doug Grave congratulated Mr Liedberg on evolving and maintaining a highly satisfactory stone dusting system. He added that other Anglo American collieries were implementing a stone dust system which was based almost entirely on the system used at Wankie, which in turn was modelled on the National Coal Board system.

The symposium was highly successful and had certainly achieved its objective of establishing closer contact with the coal mining industry. In addition, Holding was pleased to report to Council that

> *'Many people have spoken to me during the day and commented on the value of the discussions taking place and of the necessity to place on record the details of occurrences such as colliery fires and explosions.'*

Letters from Inspectors of Mines to the Government Mining Engineer

Towards the end of 1976, Joe Quilliam chanced upon the 'Final Report of the Miners' Phthisis Committee' dated 1919. Contained in the report were letters from various Inspectors of Mines to the Government Mining Engineer referring to dust and ventilation conditions underground in 1919.

Quilliam was acutely aware of the need for fillers for the Journal and also knew that letters to the editor were an added plus to any edition. So he put pen to paper and submitted extracts from some of the letters. They were published in January 1977, and Quilliam was certainly right in his supposition that it would highly amuse members.

> ***'Water supply*** *- Water was laid on to all machines in development ends, but was used irregularly; sprays and jets were out of order more often than not, and an old tin can was frequently used to keep out the dust.*
>
> ***Attitude of miners*** *- The majority of miners were against the use of water saying they preferred to die of miners' phthisis than of pneumonia or rheumatism, and many of the mine officials regarded the introduction of water as unnecessary and a Nuisance.*

Water-blasts *- A few water blasts were in existence, but were looked upon as curiosities, and were very rarely in working order.*

Dust sampling *- No dust sampling was done, except occasionally by an Inspector of Mines, and the apparatus used was so cumbersome as to excite derision on the part of mine officials and anathemas from the Inspector.*

Ventilation of dead ends *- Dead ends were ventilated by the exhaust from the machines and, as a rule, mine officials made trouble if any air was allowed to escape merely to assist ventilation.*

Occurrence in 1911 and the years immediately preceding it *- A miner was running two Waugh drills in a raise; water pipes were laid on, but no water was coming through; the boys and man were white with dust. Upon my stopping the machines until the water came on, a mine official who was present told the men they had better apply to the Mines Department for their wages, as the mine would not pay them. I would say that the mine did pay the men eventually, but this shows that the danger of dust was not realised.*

A miner, running two machines in a drive, had water laid on, but was not using it. When asked for his explanation, he stated that if he used water he got rheumatism, and so would not use it, stating further that he had worked twenty years on the Rand and had never had phthisis and was not likely to get it. The same man died two months later from the effects of acute silicosis.

Water supply: Phthisis prevention *- Water was laid on to all the machines and was regularly used. I made a point of examining the nostrils of every machine and spanner boy I met, and in no case could I detect dust in the nostrils. This, I think, is the best proof that water is regularly used.*

Latrines *- The latrines were excellent and a great improvement was noticeable in the way they were kept; the underground latrines on the Rand compare favourably with those of many country hotels.'*

Readers were delighted by these extracts and wondered how the miners in the early days would have taken to chilled water. Also, clearly the only conditions which seemed to have deteriorated by the 1970s were the latrines. Or had country hotels merely improved theirs?

Society affairs by 1978

Dr Jack Greig succeeded Bill Holding as president on 8th June 1977. Greig was Chief of the Chemistry Division in the Metallurgy Laboratory at the Chamber of Mines, and although principally a chemist, had become involved in the ventilation of mines many years previously. He had studied for a Bachelor of Science degree at the University of the Witwatersrand and had majored in chemistry and physics. After spending five years at the Modderfontein factory of AECI, he moved to the Chamber of Mines under Mr Solly Rabson and became intimately involved with the elimination of blasting fumes. He had joined the Society in 1952 and had been a member for 25 years before being elected president.

Members were apprehensive about the quality of his presidential address as he had categorically stated that it was to be based on his in-depth knowledge of fans and fan performance!

However when the day arrived, Greig did his own profession justice by giving an authoritative paper called 'A fresh look at noxious atmospheric contaminants on gold mines and collieries'. He explained the purpose of his address in his introduction.

'Much has been said and written during the existence of our Society on the role of ventilation in countering heat and flammable gas in underground environs. In

addition, a considerable amount of work has been done in the past on the elimination of dust from air in underground workings. The work, however, has been concentrated on reducing the concentration of quartz dust particles of respirable size in the air. Relatively little has been done on examining workers' exposure to other noxious gaseous, liquid and solid atmospheric contaminants sometimes present in mine air.'

The address formed an excellent overview for members of the present position with regard to noxious gases, vapours and dusts on mines. Each of these three factors was reviewed in terms of operations underground and on surface and in conclusion, he introduced the effect mechanisation of mines could have on the underground environment. In particular he mentioned the possibility of higher noise levels and recommended that the National Research Institute for Occupational Diseases and the Medical Bureau for Occupational Diseases be asked to help in providing evidence for or against any work that needed to be done by the industry.

The highlight of Greig's presidential year was the holding of a winter school in conjunction with the South African Institute of Mining and Metallurgy (SAIMM) on mine ventilation at the University of the Witwatersrand. This school lasted two days and all participants agreed that it was time well-spent, and it certainly served its purpose in indicating the complexity of the ventilation of mines and collieries to engineering and production personnel.

The other highlight of the year was the publication of Mr Roger Hemp's paper entitled 'Airflow in deep mines'. The paper had taken 18 months to write and was a continuation of the work which he had presented at the 1st International Conference in 1975. He explained his motivation for the paper in his introduction.

'Most of the published work on this subject has concentrated upon the energy approach to the problem, and has tended to discredit the pressure approach. In practice however, one always deals with pressure losses and fan pressures, and all methods of assessing losses depend upon pressure measurements. The writer has for a long time felt that both the energy and pressure methods are of equal validity, and in fact are based on the same equations, and this paper is an attempt to develop fully both methods.'

The results he said indicated

'Pressure surveys can be analysed using the energy method, pseudo pressure method or the pressure method. All three methods are equally valid, as they are based on the same basic equation.

It is felt, however, that the pseudo pressure method should be avoided, for this method is in fact a very thinly disguised energy method, and the results obtained from the pseudo pressure method could be confused with the results obtained from the pressure method, as both are in units of pressure. This confusion cannot arise if the energy and pressure methods are used.'

For those members who understood the paper, it was clear that it was a milestone in the history of mine ventilation. The Prize Awards Committee were unanimous in their decision to award Hemp his second gold medal at the Annual General Meeting held on 21st June, 1978. And that was not the only honour the Society bestowed on him that day. In recognition of his conspicuous and outstanding contribution to the science and practice of mine ventilation and his services to the Society, Greig had the honour of conferring on Hemp the Society's greatest honour, namely Honorary Life Fellowship.

Performance of forced-draught cooling towers

An essential initial step in the specification of large refrigeration plants is to predict the temperature at which cooling water will be available for removal of heat from the condenser. By 1976, various designs of cooling tower were in use in mines ranging from vertical counterflow systems to horizontal tunnels in which water was sprayed. Methods outlined in overseas literature for predicting the performance of cooling towers were of little help, cumbersome, uncertain and did not allow for variations in barometric pressure. Furthermore they were not easily applicable to spray-filled towers having no packing.

Members of the Society had been trying to overcome these defects since 1958 when Dr J de V Lambrechts had published his paper called 'Experimental studies in high velocity water-cooling towers'. The second paper published in the Journal was Mr Willie le Roux's 'Heat exchange between water and air at underground cooling plants', and this was followed by Mr Roger Hemp's gold medal award paper in 1967 called 'The performance of a spray-filled counterflow cooling tower'. Since 1967 two other papers had been published namely 'Some aspects of the design of cooling plant installations' by Hemp, and 'The design of underground cooling towers' by Dr Austin Whillier.

In January 1977, Whillier published another paper called 'Predicting the performance of forced-draught cooling towers'. He explained in the introduction that each of the earlier papers in the Journal of the Mine Ventilation Society of South Africa reflected attempts to overcome the problems in predicting performance and that *'each has met with some success but none is perfect'*. He continued saying

> *'Subsequent investigation has revealed that there is indeed a simple, direct method based on rigorous thermodynamic concepts, for predicting the performance of cooling towers. Although still requiring test data to fix an important factor in the theory, the method needs no "empirical adjustments", as do methods referred to in the standard reference on the subject. (ASHRAE, Equipment Volume, Chapter 21, 1975.)'*

The paper laid down the basic do's and don'ts of cooling tower design. It was a revolutionary way of calculating cooling tower performance and was the first time that the factor of merit had been used. By way of conclusion, Whillier wrote

> *'In this paper, the importance has been stressed of the relative thermal capacities of the water and air streams in cooling towers, and a new concept, the tower capacity factor R, has been described. The tower capacity factor R is equal to the ratio of the thermal capacity of the water stream to the thermal capacity of the air stream. In no other published work has this factor been taken into account properly or rigorously.*
>
> *The apparent unique dependence of the performance of a given design of cooling tower on the capacity factor R has suggested that cooling towers can be rated in terms of a factor of merit, F, which indicates how closely the actual performance matches the maximum possible performance.*
>
> *.....Further work is needed to establish methods for predicting the value of F for a specified design of cooling tower. The limited amount of work already done by the author indicates the effectiveness or efficiency depends primarily on the retention time of the water in the cooling tower. It appears that a retention time of 2 seconds is too short, while a retention time greater than 10 seconds is already in the region of diminishing returns. The retention time is obviously related to the surface area of water that is exposed to the air in the tower, and hence, in spray-filled towers, to the size of water droplets.'*

Whillier's work was expanded by Mr Neale Thorp, Chief Ventilation Officer at Durban Roodepoort Deep Ltd, in 1979. Born in Naini Tal, India, Thorp was educated at Sherwood College and had joined Rand Mines as an official learner on Consolidated Main Reef Mine in 1950. He had been an active member of the Editorial Committee for a number of years and had been one of the driving forces behind the formation of the Collieries Branch.

Thorp in his paper on 'Cooling tower performances' used the same techniques as Whillier had proposed in 1977 but improved the performance of the cooling tower by introducing the concept of swirling air. Regarding his observations he said

> *'They re-confirm the significant effect that air-water distribution, air-water contact time and exposed water surface area have on cooling tower performance. An encouraging factor is that a comparatively unsophisticated cooling tower can be made to perform at a level above the average performance level of the majority of towers in the industry.*
>
> *...The most significant improvement occurred when air was swirled into the tower. The degree of improvement appears to be dependent on the amount of water removed from the sidewall. To have uniform water distribution in a tower must result in some water being deposited on the sides and removing the water off the sidewall and introducing it back into the tower appears to have potential for improving the performance of towers to a varying degree.'*

Whillier read the paper with great interest and in his contribution agreed that *'significant benefits can be achieved by introducing swirl'.* In his conclusion, he also paid tribute to Hemp saying

> *'As a result of the improved performance which was obtained on this tower, and recalling the (forgotten) comments of Mr R Hemp on this topic some years earlier (Journal Mine Ventilation Society of South Africa. Vol 25, June, 1972 pp 85 - 93) it is now my strong recommendation that some degree of swirl must be introduced into all vertical spray-filled cooling towers. It is a simple practical way to overcome the adverse effects of imperfect water distribution in towers. It is apparent, too, that screens need not be installed in cooling towers since they have a negligible effect in correcting uneven water distribution.'*

CHAPTER 26

To any young man seeking a truly satisfying career, we can say with confidence: join us in this young and growth prone profession.

A D Unsted, 1978

Impact of technology on mining and mine environmental engineering

The new president inducted for 1978/1979 was Mr Dave Unsted, Technical Assistant at Anglo American Corporation. Dependable, enthusiastic and tireless in his contribution to the Society, Unsted had served on Council since 1969 and had assumed the position of Editor for three years from 1970 to 1972. His background was steeped in mining tradition having grown up on Consolidated Main Reef Mine. But his introduction to mine ventilation engineering was at Durban Deep where he rapidly became qualified before joining Anglo American on a dust research project, sponsored by the Chamber of Mines, and directed by Dr J de V Lambrechts. Unsted delivered his unforgettable presidential address to members on 21st June 1978. When thinking about what topic to choose, he had been quite adamant that it was not going to be a technical dissertation and that he would not bore members but rather provide them with an entertaining morning. This he certainly did. He spoke on 'Technology: its development and its impact upon mining and mine environmental engineering' and the four months that he had spent on his research for the paper was certainly appreciated by all those present. What no-one expected however was the musical accompaniment to the address. Unsted had personally prepared 100 slides and had carefully chosen background music to *'complement the ambience created by the topic'*. Although this final touch was regarded by some members as amusing, Unsted regarded his address with the utmost earnestness. In fact he had been so worried he would lose his voice on the day that he had recorded the entire address on tape as a contingency measure. Reactions from members to the speech varied. Some agreed with Mr John Burrows when he said that when the music first filtered into the room, he had thought that it was coming from a march outside in the street because he could not believe such ghastly music could be the deliberate accompaniment to a presidential address. Mr Bill Holding, on the other hand, loved the music and thought it was one of the greatest innovations ever to be introduced.

Unsted began his speech by summarising the progress that civilisation had made by virtue of inventions and technological advances through the ages. Computers he noted

'...had enjoyed a phenomenal rate of propagation. In 1954 the number of working computers in the USA was about 15; in 1965 it was about 35 000 and in 1975 it was over 100 000. At this point one might dabble in statistics and come up with the prediction that if the computer continues to proliferate at this pace then by the year 2500 AD the entire surface of the earth will be covered to a depth close to two metres by computer coded documents!'

He then outlined the impact of technology on coal mining and detailed its impact on gold mining. Regarding dust he said

'Primarily because of the problems of dust and water, dust inspectors were appointed on the Witwatersrand in 1917. The legal duties of a dust inspector remain virtually unchanged up to present times although both designation and specified

duties are vastly outmoded. A ventilation, refrigeration or environmental engineer does not exist in the legal framework of mining *engineering in South Africa.'*

Concluding his address with predictions about the future, he made the observation that

'Forecasting from trend curves is a fascinating pastime. If, for example, one plots the number of gold mines operating over the years and extrapolates into the future then there should be only one mine working in the year 2016. At the same time, if the total air volume flow rate in all mines is plotted annually and extrapolated to the same year, 2016, then there should be a total of 45 000 m^3/s circulating through this single mine! This should create an interesting environmental engineering post.'

Whatever individual members might have thought about the speech and its presentation, no one was bored for one minute and Unsted certainly achieved his aim of providing a memorable morning of entertainment. Some said they had even been enlightened for they had never before realised that *'if you extrapolate the life-expectancy-at-birth curves, it appears that everyone is going to be immortal after the year 2000'.*

Mechanisation, health hazards and mine gases

Following on from the success of the 1st International Mine Ventilation Congress in 1975, members had become acutely aware of the immense contribution that symposia and seminars made in disseminating knowledge to members as well as their use in providing a platform for discussion. It was decided that more effort would be devoted to organising functions locally in the future, and between 1978 and 1980 three symposia were held by the Society.

In May 1978 a symposium was held in Carletonville on the ventilation of mechanised mines. In the opening address Mr E Schmid, Consulting Engineer at Anglo American Corporation, posed the question 'What has ventilation in common with mechanisation of mines?' He said that, in his opinion,

'Ventilation is rapidly outgrowing what it used to be, namely the control of airflow and the quality of air on the mines. This change will be even more evident in the time ahead of us. It probably will end up in a continuous monitoring of the underground environment by telemetry and the continuous control of this environment from surface. And mechanisation requires an acceptable and controllable environment.'

He continued explaining that mechanisation was becoming more and more necessary because of the aspirations and rising costs of labour, the high cost of establishing new properties and the ever increasing depth of the mines. In addition, he said

'There may be a shortage of Black labour. According to one estimate by 1980 we may reach full employment in the Black labour situation and there may be a shortfall of a half a million in 1985. This assumes an economic growth rate as experienced in the period 1965 to 1975 and the employment of a half a million of foreign labour.'

Six papers were delivered that day. Topics included raise boring, telecommunication, noise control and environmental problems associated with mechanisation. As usual the discussion sessions were stimulating and all those present left the meeting with the feeling that it had indeed been opportune to focus attention on this issue which was bound to play a far greater role in the future of environmental engineering in mines.

Unsted organised the next symposium on 'Health hazards: measurement and control of the mine environment'. This seminar was held in Kimberley and was the first to be held outside the

principal gold mining areas. It was a two day function and was also the first to include a formal ladies' programme of events. Deliberations about the venue in Council had been intense for many members believed that attendance would reach an all time low because of the distance delegates and their wives would have to travel. Unsted was however determined to prove that distance was irrelevant and that the deciding factor would be the importance of the topic to the ventilation fraternity.

Arranged single-handedly with just the help of the Society Secretary, Unsted managed to show that his predictions were in fact correct. The symposium was oversubscribed, and Unsted's efforts in personally booking hotel accommodation for delegates and typing welcome notes and name tags were appreciated by every delegate in attendance. Topics covered during the proceedings included dust filtration, wet scrubbing, stack emission, asbestos dust as well as factors of safety in mine design and the legal aspects of risk work in mines and works. The ladies' programme was as stimulating with visits arranged to Magersfontein battlefield, De Beers dog kennels, Bultfontein mine, the Duggan Cronin Gallery and the new McGregor Museum.

It was a first for the Society and hopefully was to mark a new tradition in symposia. Not only was the Society now able to draw members to outlying areas but the value of including a wives programme certainly added to the social joviality of the occasion.

In September 1979, the Society hosted yet another landmark symposium. The theme chosen for this event was 'Mine gases, air sampling and gas detection' and was particularly pertinent as the mining industry was presently reviewing its existing publication 'Routine mine ventilation measurements'. The symposium was indirectly initiated by Mr Lionel Isserow from the Department of Mines through his proposal the previous year to amend Mines and Works regulation 10.6.6. which dealt with measuring concentrations of carbon dioxide, carbon monoxide, the oxides of nitrogen and hydrogen sulphide. The issue had been discussed in depth by various Chamber committees and it was decided, *'because the matters needing to be debated were of sufficient substance, to request the Mine Ventilation Society to arrange this symposium'.*

The opening address was given by Mr Dennis Etheredge, President of the Chamber of Mines. In his introduction he said

> *'May I begin by saying, in my capacity as President of the Chamber of Mines, that the Chamber is indebted to the Mine Ventilation Society of South Africa for arranging this important symposium and for gathering experts from all over the country to discuss subjects of such vital importance to the well-being and safety of the men who work underground and, consequently, to the industry as a whole.'*

He then proceeded to introduce delegates who were not members of the Society.

> *'Other "outsiders", if I may call them that, who are most welcome and from whom we can learn much to our benefit are Dr J K Basson, Director, Isotopes and Radiation Division of the Atomic Energy Board, Pelindaba; Dr M Barry, of the Department of Community Medicine, Colin Gordon Hospital, Johannesburg; and Professor A M Coetzee, of the Division of Occupational Medicine in the Department of Preventative and Promotive Medicine at the University of Pretoria.'*

He continued acknowledging the scope of ventilation officials

> *'The presence of medical men is an important aspect of this conference, because ventilation engineers consider themselves, with justification, to be industrial hygienists as well. Therefore close co-operation with medical men is welcomed by them.*

.....It is hoped that the symposium will arrive at some firm recommendations to be made to the Department of Mines on how the proposed changes to the Mines and Works regulations can be practically implemented, and come to conclusions about so fundamental a change as the legal replacement of flame safety lamps with methanometers.'

Twelve papers were presented over the next two days, and in his closing address, Mr W S Rapson, acknowledged the benefit of symposia of this nature.

'I am sure that the comparatively happy state of affairs which we enjoy is in part a result of the constructive approach of our controlling agencies, especially the Departments of Mines, Water Affairs, and Health to their responsibilities. In my experience they have always been ready to talk in terms of 'our' problems rather than 'your' problems. In the mining industry it is also a consequence of the generally responsible attitude of both organised industry, as represented by the Chamber of Mines, and of individual mines and their managements to environmental and safety matters. To no small degree, however, it derives from the activities of our technical societies who, on occasions such as the present one, are able to provide forums for objective discussion of matters which in other contexts could well develop controversial overtones.

I mention this because I feel that it is most important that the members of your Society should be very alive to this aspect of their activities and that they should do all in their power to ensure a continuation of the Society's present relationship with both the Chamber of Mines and the Department of Mines.

.....This symposium has been timely and useful, in that it will assist both the Chamber of Mines and the Department of Mines in the taking of important decisions. It has also, I feel sure, been highly rewarding to you all in your professional capacities.'

Never had a truer word been spoken. It was the most prestigious local symposium ever to be held by the Society and there is no doubt that after holding the First International Mine Ventilation Congress, the credibility of the Society was never again to be in question.

The Society by 1980

On Wednesday, 27th June 1979, Mr Mike Howes was not only inducted as President but also received the Society Prize for his paper on 'The development of a functional relationship between productivity and the thermal environment'. It was a strange day for after Howes delivered his address, members knew that they would probably never see him again at a meeting of the Society.

When he had been elected Senior Vice President, Howes had not realised that he would be leaving for Cornwall soon after the beginning of his term of presidency. On hearing the news, he had informed Council that he would not be able to assume the position but it was unanimously decided that he had most definitely earned the honour and should still be president even if it was in absentia.

The contribution this warm hearted, engine room man had made to both the Society and the profession since he had arrived in South Africa had been inestimable. He was the undoubted leader in noise and illumination and had also published excellent papers on economics and costing, productivity, and refrigeration. During the 1975 Congress he had handled the difficult 'Visits' portfolio with panache and had performed his task with distinction and always maintained a sense of humour, sometimes under very trying conditions.

The last paper he presented to the Society was his presidential address called 'Mine Ventilation and Planning'. It was a remarkable paper, following on from the approaches originally adopted by Lambrechts and Barenbrug. In proposing the Vote of Thanks, Burrows noted that

'It is in his detailed method of evaluating the various parameters and then relating them to productivity that Mr Howes will enhance our knowledge. Frankly, I found some of the mathematical expressions frightening and I offered a thankful prayer for the graphs which made them so meaningful, and for modern computing aids.'

Burrows then paid a farewell tribute to Howes. It was an emotional occasion with Howes standing behind Burrows with tears in his eyes. Truthfully spoken, Burrows said

'His professionalism, enthusiasm and dedication have resulted in his serving on many committees within the Industry. He has at all times been a strong and realistic supporter of the ventilation fraternity - he was never averse to criticising us if he thought we were wrong or misdirected. I have never known Mike to refuse to serve on any working party or committee.

.....Mr Chairman, gentlemen, you will have no doubt gathered that I have a high regard and admiration for Mike Howes. This is shared by so many members of this Society who consider it a privilege to call him their friend and associate.'

When Howes left in August 1979, Werner Gebler as the Senior Vice President deputised as President of the Society. 18th June 1980, Gebler was inducted as President. It was therefore a long presidency for which he deserved nothing but accolades. Had he not agreed to deputise for Howes, the Society would have been placed in a fairly difficult situation. Gebler had however acquiesced most graciously. A popular choice, he was known throughout the industry for his incredible sense of humour as well as his strong sense of duty. His knowledge of ventilation was also impressive being the Ventilation Engineer at Vaal Reefs which was the largest gold mine complex in the world.

His presidential address reviewed mine cooling practices through the ages and traced cooling and refrigeration from its primitive beginnings to its present highly sophisticated level. In proposing the Vote of Thanks, Mr Roger Hemp, noted that

'I think that an historical review paper such as this one is particularly valuable, for it serves to place on record interesting information, and to remind us of the stages in the development of a technology. This is extremely important, for when we think of it, all our work is built upon the work of others, and a better understanding of early work must lead to a better appreciation of what we are doing now.'

He was quite right but as members left the meeting that day they remembered Gebler's closing remark

'Considering the enormous amount of installed refrigeration and looking ahead at the planned capacities, one realises the magnitude of the challenge confronting mine ventilation personnel to manage and utilise the vast quantities of refrigeration to the maximum benefit of the mining industry.

The degree of success with which this can be achieved will have a direct bearing on prolonging the life of our mines which make a vital contribution to the economy of this country. It is the duty of ventilation officials to equip themselves with the knowledge and skills necessary to meet the challenge and of the mining industry to give due recognition in order to encourage persons with suitable qualifications to embark upon mine ventilation as a career.'

CHAPTER 27

The craftsman bases his design on intuition derived from experience, a trained eye, and manual dexterity, whereas engineering design is primarily based on numerical analysis.

M J Martinson, 1980

Second International Mine Ventilation Congress

The Second International Mine Ventilation Congress, following on from the success of the Society's initiative in organising the First Congress, was held in Reno, Nevada in November 1979. This time it was hosted by the Mackay School of Mines of the University of Nevada under the sponsorship of the Mine Safety and Health Administration of the US Department of Labor. As Chairman of the International Committee, John Burrows had once again been involved in the preparations leading up to the second Congress.

Thirty-eight delegates from South Africa formed part of the 500 strong audience attending the opening address by the Assistant Secretary, Mine Safety and Health Administration of the US Department of Labor. Among those present was the Society's President, Mike Howes, whom members had not seen since his departure to Cornwall earlier that year. Mike Martinson had been chosen to give the keynote address on 'A Design Philosophy for Ventilating Mines' which had been painstakingly researched in the tradition members had come to expect from this humanitarian man.

The camaraderie which had been so evident at the First Congress was soon regained as delegates renewed friendships formed four years previously, The South Africans were particularly excited as it was the first time the majority had been to a 'gambling city'. They were dazzled by brightly flashing neon lights and the overt decadence of the casinos. Money poured in and out of slot machines and, as one member told colleagues on returning, 'the toilets were even fitted with telephones'.

Pre-congress tours were informative and well-organised but there were two incidents which the South Africans would never forget. The first occurred during a visit to a Canadian mine where instead of being given routine kit made from cloth, members were issued overalls constructed out of reinforced paper. Showing respect to their hosts who seemed to think paper clothing was normal practice, they put on their disposable overalls but all felt a sense of unease as they walked gingerly to the shaft expecting their clothes to collapse or worse, slowly tear off in bits and pieces. The next memorable experience was being shown a remote controlled continuous miner which no-one had seen before. Advanced electronic technology was in its infancy in South Africa and continuous miners were still being adapted to suit the unique geological conditions which characterised South African collieries.

Refrigeration and air-conditioning

As mines became deeper, the increase in virgin rock temperatures was placing additional demands on refrigeration requirements. The installed cooling capacity in South African mines had doubled every five years since 1965 and there was no reason to suspect that this trend would not continue. Howes and Gebler had both covered the topic in their Presidential Addresses with Gebler paying attention to the move from underground cooling plants to the use of surface plants because 'air reject temperatures of 31°C or higher were just not acceptable anymore. This dictated a vast increase in refrigeration requirements and the established concept of positioning the plants underground was challenged and re-examined'.

The concept of using chilled service water provided the breakthrough. A number of mines were using the system by the mid to late 1970s, and were supplying service water from surface. The next logical step was to install the refrigeration plant on surface and cool all the service water. The economic advantages of surface plants over those situated underground included a smaller and less expensive main plant because of the possibility of using a pre-cooling tower to reduce summer load as well as eliminating all the costs associated with excavating large refrigeration plant rooms underground. Time taken to construct a plant was also halved.

By 1980 the wheel had turned back to where it started in 1935, and it was becoming common practice to install refrigeration plants on surface again. However the ventilation fraternity were acutely aware that the long term solution to the heat problem was inseparable from mining economics, and forward sighted members were aware that the present concept of mine cooling could easily become inadequate in meeting future demands, either economic or environmental.

With the focus firmly on refining and improving the present systems, the Society decided that 'Refrigeration and Air-Conditioning' would be topical for the 1980 Annual Symposium. The Riverside Convention Centre was booked for two days in October 1980, and the SA Institute of Refrigeration and Air-Conditioning were invited to participate in an effort to foster a closer relationship between the two organisations.

Eleven papers were presented with four of them being awarded Society prizes after publication in the Journal the next year. Roger Hemp spoke on the assessment and prediction of cooling plant performance. Although detailed and complicated, it was essentially a practical paper resulting from work conducted within the Rand Mines Group over the past 12 years. Hemp stressed that proper utilisation of cooling plants depends on a detailed understanding of operating principles. This, he said 'will lead to a better initial selection of the plant, to a better appreciation of the results of changes in the operating conditions, and to better operation of the plant'.

He continued saying

'Cooling plants are generally very complex. As many as five different fluid flow circuits can be involved (the air to be cooled, the chilled water, the refrigerant, the condenser cooling water and the air for heat rejection). The performance of the cooling plant is determined by the characteristics of these circuits, the characteristics of the heat exchangers used to transfer heat between the circuits, and the characteristics of the cooling plant compressor.

This complexity means that, when assessing cooling plant performance, it is seldom adequate to compare measured with related performance of the plant, unless the plant happens to be operating under the conditions for which the rated performance applies.

It also means that performance prediction is not something that can be done by merely examining the operating conditions and the performance characteristics of the components of the system.'

The first part of the paper covered the operation and performance of the core components of the cooling plant, namely the evaporator, compressor and condenser. Results were based on a total of 779 tests from 32 cooling plants and were analysed using a digital computer. In the second part of the paper, Hemp looked at assessing cooling plant performance and finally at cooling plant performance prediction. He concluded saying 'It is felt that the techniques described for assessment of cooling plant performance from routine measurements provide a simple method for obtaining meaningful results. There is no doubt at all that regular measurements, and an intelligent assessment of these readings, are important if mines are to make the best use of their installed cooling capacity. In most mines where cooling is installed the effective operation of the cooling plants is essential to the operation of the mine.

Cooling plant performance prediction, while treated separately in the paper, is in fact a necessary part of performance assessment, for it provides a means for predicting the results of any action taken to improve performance. The manual method of performance prediction, once mastered, is easy to apply, particularly if some standard calculation sheet is used.

Performance prediction has an additional application however, as a tool in the design of cooling systems. The computer method has been found to be best suited for this work'.

Delegates were aware of the substantial merits of the paper both practically and theoretically. It would be of use to mine ventilation personnel for years to come.

Another paper of note covering the performance of cooling coils was presented by Russell Ramsden of the Chamber of Mines Research Organization. Born and educated in England, Ramsden had graduated with a degree in physics. He had worked in the nuclear industry on developing thermal insulation for gas cooled nuclear power stations before emigrating to South Africa in 1972.

The background to Ramsden's paper was that although ventilation engineers were not often required to design cooling coils, they needed to select the operating conditions to give the various duties. Ramsden's paper described an approach which simplified most cooling coil selection problems. His paper introduced the concept that the duty of a cooling coil can be expressed in terms of a factor 'K' and the difference between the inlet wet-bulb temperature of the air and the inlet water temperature.

He began his speech saying

'There are two established methods for predicting the performance of cooling coils, namely the log-mean temperature difference (LMTD) method and the number of transfer units (NTU) method. When these established methods are used, the solution to many mine cooling problems is iterative. This paper describes a technique that expresses the duty of a cooling coil in terms of factor K and the difference between the inlet air and the inlet water temperatures, which results in direct solutions to most problems involving the selection of heat exchangers'.

This award winning paper covered every aspect necessary for the selection of a cooling coil. This included energy balance, the effects of condensation on performance measurement, the K factor, the NTU method, UA, selection of operating conditions and optimisation of a cooling coil circuit. Practical examples were given to illustrate each point made, and members were impressed by Ramsden's eloquent and succinct personal style which made the presentation easy to follow. He did not get caught up in theoretical jargon which often reduced the value of papers which were inherently practically orientated.

Another two papers presented that day by researchers at the Chamber of Mines Research Organization were also awarded prizes at the 1982 Annual General Meeting. These were 'The performance of direct-contact heat exchangers' by Steven Bluhm and 'An investigation into the use of water-vapour refrigeration for cooling mine service water' by Dick Shone.

Bluhm's paper, which won him the Association of Mine Managers Prize, reviewed methods of rating and analysing performance of direct-contact heat exchangers. He compared the factor-of-merit to techniques usually used when analysing cooling tower performance, explaining that it is 'a simple, direct approach which allows thermal performance to be calculated with a knowledge of the inlet conditions and some basic design information'. The various configurations of direct-contact water-air heat exchangers found in mine ventilation cooling systems were also covered as were a number of theoretical and practical aspects of the performance and design of counterflow, crossflow and multi-stage systems.

It was an excellent review of the current position and usage of direct-contact heat exchangers. His conclusion was short and to the point.

'The simplicity of the factor-of-merit technique is evident when it is compared to more commonly used methods of analysis.

The performance of crossflow, counterflow and multi-stage systems are best described by three separate families of curves.

When cooling towers are being evaluated for surface applications, they should not be judged solely on a factor-of-merit basis.

A wide variety of designs and sizes of spray chambers exist and each performs adequately for a wide range of nozzle selection provided that the water drops and air flow are evenly distributed across the cross-section of the chamber and that the water spray per m^3 of volume of chamber does not exceed 0,6 litres/sm^3.

The performance of multi-stage systems is significantly better than single-stage units and the use of up to three stages is usually justifiable'.

Shone's paper which won the Associates Prize in 1982 was more complicated. He looked at the use of a water vapour refrigeration plant for cooling mine service water using either a steam-ejector or an electrically driven mechanical centrifugal compressor, and outlined design features of a suitable plant. The research was the first of its kind and, as he explained to delegates who were listening with interest.

'In principle water vapour refrigeration (WVR), has the merit of a higher COP than a conventional plant because the water itself is the refrigerant and the heat transfer is by direct contact without the tubular or plate interfaces and their thermal resistances which are necessary with a chemical refrigerant. Apart from the relative cheapness of water as a refrigerant, the plant is simpler and potentially much cheaper as it does not have to be built to the stringent standards of a conventional plant'.

The paper examined the principles, advantages and disadvantages in detail. It was a new concept and, whether delegates believed it was feasible or not, it certainly was an interesting alternative. Shone concluded saying that the project was being pursued further to establish optimum design conditions of the WVR plant and two cooling towers. Indications so far were that running costs of a WVR plant using a steam-ejector were higher than those of a conventional Freon plant. Other benefits such as simplicity and low maintenance were possible but had not yet been evaluated. Regarding a WVR plant using an electrically driven mechanical centrifugal compressor, he said that 'it is not able to produce water much cooler than about 12°C and therefore can only be considered for partial cooling of the service water. However, it has a higher co-efficient of performance than a conventional plant and, used as an intermediate cooling stage between a pre-cooling tower and a conventional plant, there is a running cost advantage of about 16 percent compared to a 2-stage system using a pre-cooling tower and conventional plant only'.

'First estimates of capital and installation costs indicate that the WVR plant could be much cheaper than a comparable conventional plant and therefore there is a good case for a pilot plant to provide practical operating experience and test data'.

The symposium, organised during Gebler's year of presidency, was one of the most successful ever held. The balance of the papers delivered had been finely tuned to cover all aspects of refrigeration currently under the spotlight, and the four papers presented by members of the SA Institute of Refrigeration and Air-Conditioning had broadened the scope of the discussion to include the status quo in commercial air-conditioning.

CHAPTER 28

There is an excellent vehicle at our disposal for the dissemination of information, namely the Journal of the Mine Ventilation Society of South Africa, and it should be the dedicated aim of each and everyone in a position to contribute to use its pages to give others the benefit of their experience and knowledge for the betterment of mine ventilation.

N Thorp, 1981

Regulation 2.16.2

The Wankie Colliery disaster in 1972 had a profound effect on the South African gold mining industry, and was probably one of the motivating forces behind the appointment of ventilation personnel to local collieries. The Commission of Inquiry had found that 'sufficient attention has not, in the past, been given to the appointment by the mine of competent Ventilation Officers whose duties should be limited to the problems relating to ventilation, underground environment and explosion hazards'.

In general, South African mining houses took heed of the Commissioner's comments and immediately appointed area Ventilation Officers in collieries. However it was not until 21st March 1980 that the appointment of Ventilation Officers to collieries became a statutory requirement. It was a significant milestone in the history of the Society for it marked official recognition of the need for a more specialised approach to mine ventilation. Ventilation officers would in future report to the Manager on

- the mine's water supply, its quality, distribution and use;
- the ventilation in the mine, its quantity and distribution;
- the presence of noxious and inflammable gases;
- the presence of airborne dust concentrations except where measurements, as required by regulation 10.9.4 are made by a body approved for the purpose by the Government Mining Engineer; and the effectiveness of the measures taken to prevent explosions of coal dust or inflammable gas.

Neale Thorp, the incoming President for 1981/82, had been one of the initial Ventilation Officers in the mid-1970s who were appointed to a colliery. It was a challenging position as his previous experience had been restricted to ventilation in gold mines. Like the others appointed at that time, he had been required to rapidly adapt to methods and techniques vastly different from what he was accustomed to in gold mines. The consequences of a mistake were too severe especially one made through ignorance.

The topic chosen for his Presidential Address was eminently appropriate in the light of his experience and the gazetting of Regulation 2.16.2 just fifteen months previously. Before he began his speech, the outgoing president, Gebler, introduced the new President with a brief resumé of his career. As Gebler walked up to the podium, members noticed a perculiar look on Thorp's face. It looked as if he was waiting for something to happen. Some members present understood the look, others were curious. Those who knew remembered only too clearly the incident a year previously when Gebler had been presiding at the Society's Annual Symposium. He had turned to Thorp saying 'the next speaker, is so well known that he needs no introduction'. Silence followed. Gebler stared at Thorp; Thorp stared at Gebler. It gradually dawned on delegates that Gebler had forgotten Thorp's name, and it was left up to Thorp to introduce himself.

It had also happened on another occasion in Council when Gebler had made the remark 'that the human brain was the most remarkable organ. It started functioning at the moment of birth and continued all through life until one gets up to make a speech'. Once again he had forgotten what he was about to say.

Gebler's relief at remembering Thorp's name during the introduction was perhaps even greater than Thorp's, With this initial obstacle out of the way, Thorp began his address which reviewed ventilation practice on South African collieries. Besides being well presented, the speech was somewhat of an education for a number of members present. There were only 44 ventilation officers on collieries at the time and the compounding problems of increased mechanisation and concentrated mining placed additional demands on ventilation officers.

Thorp explained that, depending on economic, geological and rock mechanic considerations, collieries could use one or a combination of mining methods.

'Approximately 2% of the bord and pillar sections still practice hand loading, 53% mechanised loading, 15% pillar extraction and 6% employ continuous miners. Only about 2% of the production sections in South African collieries are longwalls'.

Regarding main fans, he said

'The Regulations specify that, except with the written permission of the Inspector of Mines, all main fans in fiery mines and non fiery coal mines shall be situated on surface, be equipped with an automatic alarm to alert responsible persons in the event of a stoppage and be provided with two independent sources of power supply. The circumstances would have to be exceptional indeed to provide a good reason to the Inspector of Mines for installing a main fan underground in preference to a surface installation.

'.....The trend in ventilation planning today is to provide for multi-fan installations in preference to the single fan installations that predominated on the older mines. There are several advantages in favour of multi-fan installation but one of the more important benefits is the ability to maintain an adequate flow of air in the event of a unit breakdown. The regulations stipulate that if a main fan stops for any reason, thereby endangering the safety of persons in the workings one of the steps required to be taken by the Manager must be to withdraw all persons from the workings to a place of safety'.

Thorp then detailed explosion hazards emphasising that 'coal mines and methane are synonymous, and the detection of methane is directly related to the prevention of explosions. There is no room for complacency or any substitute for diligence when it comes to dealing with inflammable gases, for the price for any such lapse is too high'.

He ended his address stressing that the fundamental changes in mining methods with improved productivity being linked to increased mechanisation and concentrated mining would place additional demands on the skills and expertise of colliery ventilation personnel.

'The need now exists for the introduction of a higher ventilation qualification on a par with the Advanced Ventilation Certificate that is issued for metalliferous mines, but related to coal mining'.

Mr C J Fauconnier gave the Vote of Thanks. He reminded members that '1980 will be probably be regarded as the watershed year due to the statutory recognition of the need for ventilation officials on our collieries. As a production man myself I can only agree with Mr Thorp that considerable progress has been made in improving the environmental conditions in our collieries since the appointment of ventilation officials. Indeed a sterling tribute to the abilities of the members of our society'.

He continued

'In conclusion I think Mr Thorp will agree with me that we still have a long way to go as far as the general acceptance of ventilation officials on the collieries is concerned. It is up to the

members of this Society to ensure that practical benefits stemming from their appointments on the collieries promotes this acceptance. If this is done, I am sure that the near future will see a general acceptance by line management of the good sense of such appointments'.

It had only been five years since Bill Holding's Presidential address when Thorp had proposed the Vote of Thanks and said, 'the increasing emphasis on colliery ventilation will in time necessitate an increase in ventilation staff. With the guidance and encouragement being received from this Society, colliery ventilation personnel will, I am sure, contribute as much to this Society as their gold mining counterparts have done'. The Society had later that year passed by-laws for the institution of a fully fledged Collieries Branch, and activities by the Branch since 1976 had added momentum to the recognition of the importance of ventilation officials on collieries.

Fans and systems

The symposium chosen for 1981 was 'Fans and Systems'. Papers were invited from members as well as engineers working in fan companies as the intention of the conference was to cover design of fans, the application of fans in systems, and the evaluation of fan tenders.

Manufacturers who submitted and presented papers included Gap Engineering Projects (Pty) Limited, James Howden Holdings Limited, and Donkin Manufacturing Company (Pty) Limited. The participation of fan manufacturers was a departure from established protocol but Thorp believed that 'the other side of the story' would be invaluable to members. It was an astute decision as the papers given by these delegates were purely practical and thus highly informative. In addition, fan manufacturers had been complaining bitterly that they had become so tied down by mine specifications that it had become impossible to use any initiative when designing fans for a particular application.

Ian Coates from Gap Engineering spoke on 'A logical procedure for the evaluation of dust control system requirements'. He divided his paper into 12 stages from identification of the problem through the logical progression to complete system design. Firstly the problem must be identified and the fan engineer informed of any legal requirements such as threshold limit values, hygienic standards and the nuisance value of various dusts. The second stage was simply 'avoid dust'. To this end he believed, a non or less-toxic material should be substituted; the product could be modified to avoid having 'fines'; fines generation should be avoided; and fine particles should be discouraged from becoming airborne.

The third stage was 'total enclosure' if airborne dust is unavoidable. 'Where flammable vapours exist, there may be a risk of explosion. This will require that the design incorporates explosion-proof features'. If an enclosure was practical to design and use, no further equipment is necessary. The fourth step, 'ventilation enclosure', should be used if total enclosure is not practical. This would involve an enclosure designed for minimum leakage and maintained under a slightly negative pressure. Leakage will then be controlled. When effective enclosure is not possible, Stage 5 suggests the capture technique where the extraction system must capture all the air into which the dust is escaping. Two systems were recommended namely the high or low velocity systems.

The remainder of the paper covered calculation of the air extraction rate as well as equipment necessary for dust capture such as filters, ductwork, exhaust fans and stacks, and finally disposal of the collected waste.

He concluded that he hoped delegates 'might benefit from having explored the most economical and practical solutions before launching on a high capital and equipment orientated approach that may not necessarily result in an effective control system'.

The Technical Director of James Howden Holdings, Mr J de la Harpe, presented a paper on fans and fan system vibrations. Vibrations were a problem as they usually led to failures of some kind.

It was common knowledge in the industry that the incidence of vibration increased as fans grew in size and power. The problem with small to medium size fans was usually mechanical but larger and more powerful fans were often beset by vibrations associated with the aerodynamics of a fan and/or fan system. De la Harpe's paper dealt with various mechanical and aerodynamic vibration problems.

He first covered vibrations of a mechanical nature. Each problem was succinctly outlined and solutions detailed. He covered a wide spectrum of problems ranging from out of balance impellers supplied with new fans, imbalance after repair to fatigue cracking, distortion and resonant vibration. Regarding aerodynamically induced vibrations, he covered problems associated with the inlet box vortex, rotating stall and surging. He explained that 'rotating stall is a very severe form of aerodynamic vibration and can cause damage to the fan and its associated system'.

He outlined the causes of the problem and continued saying

'rotating stall reaches a peak when the intersection of the system resistance curve and the fan curve lies in the region of the peak of the fan curve and a little to the left of the design flow. The reason for this can be underestimation of the system resistance or a partly closed damper'.

If the operation at the peak of the curve could not be avoided, he believed the solution would be installing inlet vane control.

'Partial closing of the vanes will cause the peak of the curve to move towards lower flow rates and the intersection of the fan curve and the system resistance curve will be in a region where rotating stall does not occur. The installation of dorsal fins in combination with vane control will avoid problems with inlet core vortex'.

Mechanical and electrical criteria for axial flow auxiliary mine fans was the topic chosen by Mr Caldwell, Technical Director of Donkin Manufacturing. In general the life of underground auxiliary mine fans before failure was shorter than that of similar fans used in industrial applications. It had been a source of concern by members for some time as it caused costly delays, and there was general agreement that manufacturers were not doing enough to alleviate the problem. Caldwell's paper addressed the issue but stressed that some of the responsibility for the problem lay with the mining groups themselves.

He began his paper saying

'It is felt that significant improvements in regard to reliability can be achieved. By means of the design approach used in the design and development of components for the aerospace industry, fans could be developed to meet significantly improved reliability levels. Basically this approach would entail designing fans to meet both performance and reliability specifications. A product development programme involving regular design reviews and evaluation tests would ensure achievement of design specifications, Historically specifications for auxiliary mine fans have not included requirements relating to reliability'.

He continued saying that the majority of failures are due to breakdowns within the electric motors because the motors are not matched to the fan and its application. Failures associated with the fans were generally minor such as loose mounting bolts or impellers, excessive corrosion, impeller blade failure and impellers interfering with casings. Electric motor failures could, however, be categorised by either bearing or winding failure.

Regarding motor winding and temperature rise, he acknowledged that 'the responsibility for ensuring satisfactory motor temperature rise lies with the fan manufacturer, who must undertake the necessary tests to ensure that the motor windings operate at a satisfactory temperature in the operating environment'.

Bearings, he said, must be selected on the basis of the in-situ dynamic forces and speeds that will be encountered. Adequate sealing must prevent contamination by dirt and moisture. The installation must ensure good alignment, and 'there must be no rotational movement between

bearing inner races and the shaft, and between bearing outer races and their housings'. A current problem was that most auxiliary fan motors in recent years had been fitted with a cylindrical roller bearing at one end. This caused a problem with relubrication as the maximum relubrication was achieved by using radial ball bearings of a smaller diameter. A further advantage was that ball bearings were less prone to damage during fitting and transport than cylindrical roller bearings.

He concluded

'I believe that there is scope for significant advances in terms of the reliability of auxiliary mine fans, and am confident that such advances can be attained with readily available technology. To achieve this objective small penalties in performance and efficiency may have to be made. Features necessary for improved reliability will inevitably have some bearing on the cost of the fans; however, it is necessary that the parameters of performance, efficiency, reliability and initial cost be placed in their true perspective in regard to total owning costs of the fans. The responsibility for putting into perspective the evaluation of these parameters lies with the mining groups themselves'.

'..... Lastly the success of a project aimed at the development of an improved range of fans would rely on competent project management through all phases and on close co-operation and communication between the mining groups and the fan manufacturers, and, in turn, between fan manufacturers and the motor manufacturers'.

A particularly pertinent paper for fan manufacturers was given by Dick Stroh on fan tender evaluation. This issue was a bone of contention between manufacturers and the mining industry, and delegates present from the manufacturing companies were interested to see just how the representative from Anglo American expected them to show initiative and at the same time win tenders which seemed to expect a standard formula.

Stroh's paper was short and to the point. He stated that 'a meaningful tender evaluation can only be performed when comparing equipment which meets the required duty and mechanical specification'. This led to the mines having to issue comprehensive specifications covering performance, mechanical components and ancillary equipment. He continued saying

'fan specifications must be sufficiently concise so that when adjudicating tenders 'apples' can be compared to 'apples'. Cognisance should however be taken of the need to leave manufacturers sufficient scope to be innovative. They are after all the specialists and we must avoid being restrictive with too rigid a specification'.

This last statement was like waving a magic wand. The manufacturers felt that their expertise was at least recognised, and Stroh had gone a long way in easing the tension by publicly acknowledging that they did in fact play an important role.

He concluded saying that 'in some cases where an adjudication reveals almost identical quotes then such aspects as standardisation with existing units, spares availability and past performance of the manufacturer should be taken into account. It should be borne in mind that improvements to the successful tenderer's offer can be made when discussing the details of the contract with the manufacturer. In many instances these improvements can be made without increasing the cost above that of the next lowest tenderer'. It was fair comment and practical business sense.

It had been a highly successful seminar albeit a departure from usual practice. Both manufacturers and members of the mining houses had been given a chance to air their stances on the current position, and the forum provided by the Society for this communication had certainly cleared up some of the simmering misunderstandings.

CHAPTER 29

Nowadays, it seems that many inventors' names are swallowed up in giant corporations and devices are recognised by brand or company names.

A D Unsted, 1982

Tributes

During Thorp's presidential year, two of the Society's past presidents passed away as did Basil Botha who would always be remembered for his crusadership of dry airways in the 1950s.

It was with deep sadness that members observed the deaths of Austin Whillier, Jack Drummond and Basil Botha in 1981. Whillier whose name would never be forgotten for his work on the cooling of deep mines was one of those rare men whose genius was utterly practical. Never seduced by the uselessness of pure theory, his work was grounded in reality. He somehow seemed to understand the phenomena of engineering in a way others only aspired to in dreams. His death when he still had so much of a contribution to make, was a severe blow to the ventilation fraternity.

Jack Drummond, President in 1950 – 1951, was a founding member of the Society. He had retired some eight years previously and was well known for his antics in his own workshop at home where he spent many hours either inventing new ventilation equipment or improving on existing designs. One of his hobby horses was the development of automatic ventilation doors.

New look Journal

The format of the Journal had essentially remained the same since its 'new dress suit' had been introduced by Quilliam and his editorial committee in 1957. In those days, a printed Journal was the realisation of what had once been a pipe dream. Periodically minor changes had been made to the layout but the format had remained the same for the past 25 years.

For some time members had been discussing changing the format. Then in September, Council agreed to the Editorial Committee's recommendation to change the Journal into an A4 publication. Basically the introduction of metrication had hastened the need for standardisation which, in turn, gave the Society an ideal opportunity to update both the format and presentation of the Journal. The cover design was to retain old features such as listing the contents but would aim to include a ventilation motif to emphasise the MVS identity and give an added aesthetic appeal. The Editor, Harry Rose, promised members the first issue of the new year would herald the Society's 'new look' publication. Older members bit their tongues remembering how in 1957, the January edition had finally only been distributed in May due to hiccups during production.

However, true to his word, the Journal in its new A4 glory appeared at the end of January 1982. Not only was the size different but Rose had worked hard on the layout. Text was printed in two columns putting the Journal on a par with more commercially orientated publications. It also had the effect of making the contents appear less technical and academic. Neale Thorpe was proud of the efforts of the Editorial Committee which comprised Harry Rose, John Burrows, Roger Hemp, Bill Holding and Bodo Schmitz.

'I should like to pay tribute to the Editor and his Committee whose time consuming labours of love make the monthly publication of our journal possible. They have been directly responsible for the design of this cover and it is largely through their efforts, and those of their predecessors, that the Journal has become an outstanding and unique publication which has expanded its circulation to many parts of the world. It is my hope that the 'new look' journal will contribute to its presentation and further enhance the reputation and prestige of our society'.

In the same issue of the Journal, Rose introduced a regular feature called the 'Ten Commandments of Ventilation'. It was an instant success. Designed and initially published by the Zinc Corporation Limited of N.S.W. Australia, Rose had been acutely aware that they would be appreciated by the South African ventilation fraternity. The first commandment was quite clear - thou shalt not tamper with any ventilation equipment without the consent of thy ventilation department!

Preparing and giving a presidential address is probably one of the most daunting tasks facing each and every one of the Society's incoming presidents. Dave Unsted, on proposing the Vote of Thanks after Graeme Ubsdell's speech in 1982, spoke from experience when he said 'each President finds himself racking his brains and querying his sanity in accepting his appointment when he tries to find a suitable subject for his Presidential Address'.

Graeme Ubsdell was a protegee of the late Jack Drummond having worked under him in 1953 at Grootvlei GM Ventilation Department. With 25 years of solid ventilation experience behind him, Ubsdell was fully equipped to deal with the responsibilities that accompanied the appointment of a President of the Mine Ventilation Society. He was a well known figure within the mine ventilation fraternity and currently held the position of Environmental Superintendent of Western Holdings Gold Mine. The topic he chose for his address was a tribute to a man whose achievements he deeply admired. It was also a brave choice for not since Harry Rayner in 1956 had a President focussed on one person for his address.

In his address, Ubsdell traced the events and occurrences leading up to the development of the safety lamp in 1815 and made the point that 'in this modern day and age, and with the advancement of mining technology and electronic development the mining world in South Africa still uses and is required to use by law a Flame Safety Lamp for the detection of the presence of explosive gases'.

Davy's greatness lay in his determination to benefit mankind. His quest was not for personal glory and when asked why he had not patented the lamp, he replied, 'I never thought of such a thing; my sole objective was to serve humanity, and if I have succeeded, I am amply rewarded in the gratifying reflection of having done so'.

It was a speech that deserved reflection as it told a story of human perseverance, dedication and courage. Ubsdell's address would be remembered for it struck a chord reminding members of the struggle fought by their forefathers which had ultimately secured the future of their discipline.

Environmental Engineering in South African mines

For many years the Society's standing in the ventilation fraternity world-wide had been regarded as authoritative. This reputation was further enhanced by the publication of 'Environmental Engineering in South African Gold Mines' which was launched at a cocktail party attended by the Hon. P.T.C du Plessis, Minister of Energy and Mineral Affairs, on 23 March 1983.

Although the project had been less traumatic than 'Ventilation of South African Gold Mines', co-ordinating the authors and trying to meet deadlines had been a difficult task for John Burrows. In June 1979, he had announced at a Council meeting that he hoped to have the galleys ready for printing by the end of the year. By February 1981, some members were laughingly beginning to

hope that the book was not going to take the 18 years, 3 months and 12 days it had taken to get 'Ventilation of South African Gold Mines' written and printed.

In March 1982 there was just one chapter outstanding. The other completed 37 chapters had reached page proofs, and quotes had been received for 2 000 and 3 000 copies. The budget was in-hand and arrangements had been made to transfer funds from the Society's investment account. By July the marketing campaign under the direction of Dick Sizer had been started in earnest. It was the most concerted promotional drive embarked on to date by the Society and was to pay dividends.

Members were excited. Harry Rose joined in the enthusiasm and suggested a special launching with the Minister of Mineral and Energy Affairs in attendance. Mike Martinson moved that advantage be taken of the arrangement between the SAIMM, the British Institution of Mining and Metallurgy, and the Society of Mining Engineers in America regarding the reciprocal sale of each other's publications. He also felt retail outlets such as campus bookshops could be approached.

The book was published at the end of 1982, three months prior to its launch. The hold-up was unavoidable as 23 March 1983 was the first free date on the Minister's calendar. By January 1983, almost 500 books had been ordered and dispatched. All managers of gold, coal and base metal mines had been sent information brochures on the book, and local reviews had been organised with the Institutes of Mining and Metallurgy and Electrical Engineers as well as the Journal of Science. Overseas reviews were arranged with over 10 publications including one as far afield as that published by the Chinese Institute of Mining and Metallurgical Engineers. In South Africa, the Institutes of Mechanical Engineers and Certified Engineers had agreed to distribute order forms to their members as had the Geological Society and the Institute of Mining and Metallurgy. The Geological Society had also requested copies of the book for display at its international conference in Zambia later in 1983.

The difference between the Black Book as 'Environmental Engineering in South African Mines' soon became to be known and the previous 'Ventilation of South African Gold mines' was in its scope, and the fact that it was the first book published by the Society with no financial assistance from the Chamber of Mines. The ambition of the project lay in its broad sphere of interest as opposed to being restricted to the ventilation of gold mines. The Black Book encompassed all types of underground and surface mining activities in gold, coal and base metal mines. Professor Brown, Head of Mining Engineering at the University of Cardiff, wrote a review which was published in the Journal. He commented on the international trend which focused more attention on environmental conditions than ever before and the vast amount of research and development that had led to understanding every facet of the mining environment.

'Based on this wealth of experience, the South African environmental engineers are well qualified to write authoritatively on the subject of environmental engineering. This particular volume is a comprehensive update of a great deal of technical literature on the subject which was previously available.

'The book is the combined effort of no less than 29 authors who are all specialists and authorities in their particular fields. The majority of them are drawn from the South African mining industry, while there are 3 contributors from overseas. The list of authors is indeed impressive and the many publications which stand to their credit is indicative of their vast experience. It is noteworthy that the top men in environmental engineering of six major mining groups as well as specialists from particular mines, are among the authors. In addition, authorities drawn from the two South African universities dealing with mining are included. Since the Chamber of Mines Research Organization was established in 1964, a great deal of attention has been directed towards research and development concerning environmental conditions and human heat stress. The fact that eight of the authors are drawn from that body emphasises the important role that the Organization presently fulfils.'

1982/83 year end

Ubsdell handed over the Presidency to Dick Sizer in June 1983. It was the 39th Annual General Meeting of the Society and was attended by 78 members and guests including Mr J W Erasmus, Manager of the Associated Scientific and Technical Societies.

The meeting observed a few minutes silence in memory of the eight members who had passed away during the year including Joe Quilliam. Quilliam, an Honorary Life Fellow of the Society, was a Council member for over 25 years and during that time had served as Honorary Treasurer, Honorary Secretary, Honorary Editor and was President in 1960/61. In its formative years, Quilliam was as much the Society as Barenbrug, Lambrechts, Rees and Barcza. Without his loyalty and devotion it would never have been in the position it had reached by 1983. He was Chairman of the first textbook committee and had been overjoyed by the initial success of the Black Book which had been published just one month before his death. A regret felt by all members was that he had not lived long enough to attend the launch of the Black Book.

There were two important announcements that day. First, Ubsdell proudly informed members that the Society had been singularly honoured by the posthumous election of the late Austin Whillier to the Solar Hall of Fame in Washington DC. It was a tribute bestowed on very few international scientists.

The second concerned introducing the new Secretary, Mrs Doreen Knott, who had succeeded Mrs Eileen Trouw, to members. A dignified and highly efficient lady, Mrs Trouw, would be remembered by many a past president for her invaluable help over the years. Many in fact could not envisage going into the office without being greeted by Mrs Trouw, seated in her high chair, leaning down to address anyone seated on the other side of the desk. It was a pose which signified 'no nonsense please', and which many came to admire and respect.

While delivering the Annual Report, Ubsdell paid tribute to those working on the Black Book saying that 'without the efforts of the textbook committee under the chairmanship of Mr John Burrows, the publication of this book would not have been possible'. He also gave mention to the successful Symposium About Face Environment which was held during the year by the Collieries Branch and had attracted almost 200 delegates.

Mr Mike Dumka presented the financial statements in the absence of Mr Chris Nissen who was unable to attend the meeting. He drew attention to the deficit showing on the balance sheet of R22 319,00 but said this should not be viewed too despondently as Council had decided to pay the publishing costs of the textbook in full and sales would soon recoup the financial outlay. The journal showed a loss of R3 313 but this was primarily due to three advertising firms having gone into liquidation during the year. Income from membership subscriptions had not been sufficient to cover administrative costs of the Society. He felt that 'with a continued policy of using only subscription income to meet the running costs of the Society, an increase in membership fees had become imperative and the incoming Council will approach the Chamber of Mines on this matter'.

Ubsdell then inducted the new President, Mr Dick Sizer. A highly experienced mining man, Sizer had begun his career at Union Corporation in 1961 as a learner official. After completing his official learners' course, he was transferred to St Helena Gold Mine as a shift boss in 1965. But by 1967, he was adamant that he was not destined to be a production man and transferred to the Ventilation Department at Kinross Mines. By 1981 he had been promoted to his current position of Assistant Group Environmental Engineer.

Sizer's presidential address covered raise boring and its potential in the environmental field. As he stood up, he was nervous and understandably so. Past presidents had advised him to begin preparation for the address at least two years in advance. He heeded this advice and had finished the draft months before. But he needed Rose and Dumka to check and edit the speech. Nagging and cajoling just did not seem to work until a few hours before he was scheduled to deliver the speech. The three of them had finally sat down together and worked at maniacal speed. There was

no time to retype so they decided to just cut and paste. The speech was therefore unrehearsed in its final form and Sizer was jittery that the glue would not hold, and bits and pieces of his address would end up fluttering gently to the floor before he had turned the relevant page.

No-one would ever had guessed as Sizer's presentation was flawless. It was the first time mechanical excavation had been covered during a presidential address and members were impressed at the environmental advantages offered over the commonly used drill and blast method. Hemp gave the Vote of Thanks where he stressed

'As far as safety is concerned I believe that adequate ventilation during drill and blast operations in raises or boxholes is difficult to accomplish and in fact rarely happens. Many of those present today will agree that we are particularly vulnerable in this area and as you have pointed out, raise and blind hole borers solve this problem for us.

'..... What is of some significance is the effect that bore holes have on power consumption. The recent drought has raised the spectre of power cuts in the short term and probably increased tariffs in the longer term. I think that energy conservation as alluded to in the paper must be one of our prime considerations for the future. This address has in essence set the scene for us.

'We live in an age of technological revolution and the giant new machines referred to by our President are surely going to play their part in future mines. Perhaps their use will lead to further improvements in ventilation conditions as well as introducing new scales of economy and safety.'

CHAPTER 30

It is a well known fact by now that the mass of air moved at any one time in our mines is equal to or greater than 10 times the mass of rock mined underground.

B Schmitz, 1984

Temperature rise of chilled water flowing through pipes

In September 1983, Russell Ramsden published a paper in the Journal where he contended that auto-compression of water in a shaft pipe is a myth and is not responsible, as commonly believed, for water temperature increases in insulated pipes. The temperature rise observed is, in fact, dependent on frictional losses.

In terms of established practices and beliefs, the paper caused quite a stir. Every year, kilometre after kilometre of water piping is installed in the gold mines to convey cold water from refrigeration plants to the working areas. These pipes are generally insulated to minimise the temperature rise of the water due to heat gain through the insulation. Ramsden contended that the frictional pressure drop also causes the temperature of water to rise as it flows through the pipe, and 'the change in temperature due to change in pressure at constant enthalpy is known as the Joule-Thomson effect.

This effect is usually ignored when calculating the temperature rise of water in insulated pipes. However, in mines, where the thickness of insulation is typically 25 mm and the temperature difference between the air and water is approximately 25 deg C, the temperature rise due to friction in the pipe can in some circumstances be significant.'

He explained that the temperature of cold water flowing in a pipe increases along the length of the pipe because of heat transfer from the ambient hot air through the insulation to the cold water as well as the frictional pressure drop in the pipe.

After separately considering the effects of temperature rise due to heat transfer through the insulation and those resulting from friction, he mathematically compared the relative magnitudes and economies of the two points in question. On vertical pipes in shafts he said

'the temperature change in water transported down an insulated vertical pipe column is often mistakenly called an "autocompression" effect. This so-called "autocompression" temperature can be regarded at a point just before the water leaves the pipe, as the sum of temperature changes due to an increase in enthalpy resulting from a loss of potential energy, and the Joule-Thomson effect associated with the change of water pressure.'

In conclusion he stated that

'this paper shows that the temperature rise due to the pressure drop (Joule-Thomson effect) in a pipeline cannot be ignored. In fact for pipelines where the pressure drop is high the temperature rise due to friction is far more significant than that due to heat transferred through the insulation. It is necessary for mines to include this effect in determining the optimum pipe diameter for a given flow rate and insulation system.

'It is also shown that the temperature rise of water flowing down a vertical pipe is due to the Joule-Thomson effect and not to "autocompression".'

The more theoretically oriented members read the paper with great interest. They did their own sums. Malcolm McPherson, Professor of Mining Engineering at the University of California in Berkeley, responded. He had examined Ramsden's contention from a different perspective and had come to the same conclusion.

He wrote

'I have examined the question in a somewhat different way to Mr Ramsden and have arrived at the same conclusion. If we write down the general steady flow energy equation for the flow of any fluid between end stations 1 and 2, then apply it (i) for air, and (ii) for water, we arrive at quite different results regarding temperature effects due to friction and autocompression.'

After mathematically illustrating his point, he said

'Mr Ramsden is quite right - the temperature rise of the water depends only on the frictional losses; there is negligible depth dependent "autocompression" effect on temperature in a closed water pipe.

Does this mean that we have been wrong in our previous calculations of 2,34 deg C temperature rise per km depth for water pipes? I think not. The error has been in referring to it as "autocompression". Mr Ramsden recognises this by his statement "when the water is discharged from the pipe and the pressure is finally reduced to atmospheric pressure ..... then there is a temperature increase due to the Joule-Thomson effect of 2,33 K/km." In other words, the temperature rise that we have previously called an "autocompression" effect will still appear as the water flows along underground pipe ranges and through any valves that involve a pressure drop ultimately down to atmospheric pressure. The temperature rise may be calculated ..... and is better described as a "frictional temperature rise".

'.....Mr Ramsden has not changed the laws of thermodynamics that govern water flow in pipes but he has improved our understanding of them. Well done.'

This was the exchange of information that Barenbrug had envisaged for the Journal when he said in 1947 'may it serve as a useful guidance to all those who seek the progress of mine ventilation'.

Registration of professional engineers

For some years, Bill Holding had been the Society's representative on a general industry committee investigating the possibility of registration of professional engineers. It was a long and arduous process. In 1981, the Interim Committee for Registration of Technologists and Engineers as it was then known, had specified qualifications which would enable prospective members to qualify. Council, after deliberation, had agreed to send a circular to members detailing minimum qualifications for membership and requesting an indication of the degree of individual interest regarding application. One hundred and nineteen responses were elicited which reflected an even distribution of those qualifying by experience or training, and those who did not qualify at all.

Holding diligently reported the finding to the Interim Committee. In September 1981, he explained to Council that a new umbrella body would be formed to represent engineers and technologists. In November of the same year, he informed members that the Interim Committee had now been replaced by the SA Association of Registrable Engineers and Technologists (SAARET) who wanted extracts from the Society's Constitution and By Laws for evaluation of the suitability of members.

A year and a half later, Holding advised that a Board of Control would be established by the Minister and the decision about qualifications acceptable for registration will be made by that Board. Until the Board was formed, it would not be possible to establish whether the Advanced

Certificate in Mine Ventilation would be acceptable. He added however that 'it would appear as if some members of the MVS will be able to register under the 'grandfather clause' as the HSRC evaluation of the 10 + 2 is likely to be used'.

In February 1984, Holding wrote a short announcement in the Journal saying that it was likely that, before the end of the year, the Government will establish a Board of Control for Professional Technologists (Engineers) and that registration of eligible persons will begin shortly afterwards. He said

'At the present moment registration is of little practical significance in the mining industry but, in future, registration may hold positive advantages. Members who are not employed directly in the mining industry may also find it advantageous to register.

The Society has been keeping a watching brief on the question of registration for several years and it is the opinion of Council that members must decide on an individual basis whether or not to apply'.

Qualifications for registration had not yet been decided upon but it 'is unlikely that the Chamber of Mines Certificate in Mine Environmental Control will be recognised. ... It is suggested that only persons who hold at least a Chamber of Mines Certificate in Mine Environmental Control and who have had at least 6 to 9 years experience in senior positions including 4 to 7 years as Departmental Head or higher, should consider applying for registration.'

It was not a cheering notice to the majority of members. It was almost as if they were in a time warp and had gone back to the days where they had to fight for recognition of the value of their profession. It was academically based. Degrees were what counted.

Third International Mine Ventilation Congress

More than 40 members, many accompanied by their wives, made their way to Harrogate which borders on the Yorkshire dales in June 1984 to attend the Third International Mine Ventilation Congress. Registration and interest expressed internationally reached into further corners of the globe this conference, with delegates attending from the USSR, other Eastern Bloc countries and the Republic of China.

John Burrows expressed disappointment however that 'considering the geographic convenience of the venue, the numbers attending from Europe, particularly Western Europe, were a little disappointing and this could possibly be attributed to the state of the European economy'.

Sixty-one papers were presented and a bound volume was given to delegates on registration. Burrows in his review, felt this 'made it difficult for delegates to apply themselves for discussion sessions and one suspects that the best discussions took place when various delegates had been working in the same field and had prior knowledge of each other's work'.

In addition, he added

'it was a fairly wide held view that some of the purely theoretical papers would be difficult to apply in practice and that the gulf between the theorists and the practitioners seems to be widening.'

A number of members not attending the conference agreed with this remark as this too was becoming an issue about the contents of the Journal. There had been murmurs for some time that it was too theoretically or academically biased and not enough space was being allotted to practical papers. But it was a never ending debate which the 'practicalists' never seemed to address. Hands-on papers needed to be written, and this was something that critics of more theoretical papers never seemed to bother to write. It took less time to censure than to write a paper.

Two of the most interesting tours for delegates were those organised to the Health and Safety Laboratories and the Boulby Mine. At the Laboratories, members were given details of a rapid response catalytic gas sensor used in detecting flammable gases and then introduced to the OSIRIS dust monitor based on the earlier SIMSLIN monitor currently used in collieries.

Boulby Mine which produces potash in the form of K_20 and salt has the highest virgin rock temperature in the UK (42 deg C). Members were fascinated by the major airways carved in salt instead of potash because of its higher stability, and were interested to learn that the preferred mining method was mechanised room and pillar with controlled pillar collapse. Burrows wrote 'conditions are hot and dry and the workings are subject to gas outbursts, the gas being 80% nitrogen and 20% hydrocarbons. The outbursts are associated with the mining of secondary ore which contains a black shale. Meticulous geological logging is used to try and predict occurrence of outbursts. Force fans are used in the main ventilation system, partly to overcome the serious corrosion problems which occur when exhaust fans are used. The mine is situated in a National Park, and fairly elaborate steps have been taken to reduce noise pollution from the fans'.

Members left feeling fairly ecstatic. At least they did not have to deal with the corrosive properties of concentrated salt plus a mine sitting in the middle of a popular national recreation spot which was visited by hordes of day trippers every weekend.

Water in the mining industry

The 40th anniversary of the Society was marked by the recovery of the deficit of R22 319,00 shown the previous year, and members were delighted to hear that the accumulated funds of the Society now totalled R27 846,00. This healthy financial position was largely due to excellent sales of the textbook.

Running costs however showed an operating loss of some R4 830,00 over revenue received. Dumka was not in the least perturbed and assured members that this shortfall should transform into an excess during the coming year because of an increase in subscriptions granted by the Chamber of Mines together with the R5 which Council had agreed to donate from the sale of each textbook from the beginning of November.

Mr Bodo Schmitz was inducted as President on this 40th anniversary. A mechanical engineer, Schmitz had begun his mining career as a learner official in 1962 at Venterspost before being awarded a bursary by Goldfields to study at the University of Witwatersrand. He currently held the position of Consulting Mechanical and Electrical Engineer with Goldfields.

His address, called 'Water in the Mining Industry', focused on water as one of the most basic needs of the mining industry. It was a topic which he felt was neglected in the mining industry and he, himself, was particularly proactive in this sphere of industry. He sat on the advisory committee of the National Institute for Water Research of the CSIR and had been personally involved in countless projects such as a water reclamation plant at Kloof and a defluoridation plant at Rooiberg which was due to be commissioned shortly.

He began his address stressing that water's role in mining is multi-faceted although it can at times be construed as a major obstacle and an expensive, scarce resource to manage. He covered water quality and usage in South African mines, and emphasised the primary role water plays in dust suppression, mine cooling, fire fighting, mud transportation, hydropower and mineral processing. Safe drinking water as stipulated in Regulation 4.2 by the words 'there shall be provided a supply of wholesome drinking water at points accessible to working places' posed a potential problem. He said

'water for dust suppression may have a number of suspended particles but is essentially to the human eye, crystal clear and clean looking. The quality requirements for cooling and dust suppression are not conflicting and therefore the same water can be used for both purposes. Exactly herein lies the danger - that is, this chilled and clear-looking water which is accessible at the working places will be used for drinking.'

He impressed on members that

'to supply separate drinking water is also no solution, as all too frequently one water supply is interconnected with the others. Educational programmes and warning posters are ignored by even the most educated amongst us.

He explained that bacteriological examination for coliform bacteria was the only way to ensure safe drinking water, and detailed current methods of disinfection including chlorination and the use of chlorine dioxide which does not react with ammonia. In conclusion, he stressed that water management must aim to reduce pollution by oil, explosives, chemical leaching and poor sanitation. In addition water disinfection and chemical control should become the responsibility of knowledgeable professional water technologists. He reminded members that the installed refrigeration capacity was expected to double within the next 10 years which meant that the volume of service water used in mines would also double. He proposed that the mining industry seriously consider implementing better water management schemes and recommended areas where this could be achieved. He said that sewage effluent should be reclaimed for re-use underground and that underground fissure water could also be reclaimed. Rain water collection should be contemplated and that by implementing these methods, the mining industry would be assisting in national water conservation and should qualify for tax concessions. Proper monitoring and control of the full water circuits should become a priority as should disinfection of service water which can be achieved by removing pollutants at source, educating the workforce, and monitoring from a central remote position.

CHAPTER 31

Have you got something to contribute or suggest or are you only a sleeping partner?

Bodo Schmitz, 1984

1984/85 President's policy

Five days after his inauguration, Bodo Schmitz chaired his first Council meeting at Kelvin House. His presidential policy for the year was clearly formulated and he began by explaining to those present that his priority was to motivate younger members to participate in the affairs of the Society. He stressed that this could only be done if all members of Council took an active role in the Society and motivated their junior staff by example. Members agreed as the younger generation would be the future leaders of the Society but it was noted that implementation of the policy could at times be problematic as juniors are often sent on courses and also have military call-up obligations. Mines were usually willing to release more senior personnel on a rotation basis to attend to Society affairs.

Schmitz continued saying that real communication between members should be encouraged with a view to dissemination of knowledge and, in this instance, Council representatives in contact with members on mines were in the position to actively establish meaningful communication. Another way in which this could be achieved was through the Journal. Shorter articles should be published with the aim of greater interaction between authors and subscribers.

The last point of his policy was establishing a Strategy Committee which would be responsible not only for long term planning and direction but would also look at education, recruiting and ways of enhancing the image of the Society. A particular issue which needed immediate addressing was upgrading the qualifications of members such as through obtaining a Government Certificate of Competency. Members thought a Strategy Committee was an excellent idea and after some discussion agreed that representation could change every year. The Junior Vice President would act as Chairman and other members of the Committee would be the President, Senior Vice President, Branch chairmen as well as those closely connected to policy decisions in the mining industry. As a first step, Schmitz suggested that the Committee draw up a questionnaire designed to elicit responses from members such as beliefs about the future direction of the Society, and how funds should be utilised for maximum benefit. The questionnaire would be augmented by an editorial in the Journal.

The other issue under discussion that day was the viability of establishing further branches. It had been a quest begun by Sizer but, unfortunately, marketing the textbook had been all-consuming. This mammoth effort had however paid dividends with almost 1 500 copies sold in just one and a half years. The newly formed Strategy Committee was therefore given another task that day. Patterson and Sizer were to look at the possibility of a Northern Branch, Rose and Cilliers at an Eastern Branch, Pretorius and Gebler at a Western Branch and van Vuuren and Moorcroft were to investigate a Southern Branch. Deadlines were set with initial reports to be given to the Strategy Committee which would report back to Council on 24 September 1984.

Society Coat of Arms

Most Societies affiliated to A S & T S boasted a coat of arms and in mid-1983, Council agreed to the suggestion that the State Bureau of Heraldry be contacted and the logistics involved in designing a coat of arms be ascertained. Dick Sizer and Dr Andrew Patterson set up the project and met to discuss designs. In record time they arranged for preliminary sketches to be drawn and presented the pilot concept to Council in January 1984. Members were overjoyed. The Society

would soon have its own coat of arms. Sizer however cautioned that there was a possibility that the Bureau would insist on changes but this would be ascertained shortly when he and Patterson met with Mr Brownell who would be able to obtain what was called a 'heraldic description'.

In March, Sizer reported that the meeting with Brownell had taken place, and the bad news was that the 'supporters' would have to be changed as the ones used in the preliminary sketch were sacrosanct to State. The other irritation was that the time required for preparation of the Coat of Arms by the Bureau of Heraldry could be as long as 12 months. Members groaned. They now knew from experience that it could be much longer.

The first draft was received from the Bureau in July. By September, Council members had all scrutinised the 'proposed' emblem but were no longer as happy about the concept as they had been with the preliminary sketch a few months before, After a long discussion, they agreed that Schmitz, Sizer and Patterson go back to the Bureau for further consultations. Patterson, erudite and well read in the classics, explained to members that there was method behind the seeming madness of the Bureau. The reason why the whole procedure seemed so anachronistic was that the rules were laid down in medieval times when it was necessary to identify a heavily armoured horseman both on the field and at a tournament. What also developed was a unique language and style of expression which could describe precisely the armorial bearings without the use of drawings. Wryly he added, 'even today, perhaps, six-hundred years after the age of heraldry, the arms of the Society are still blazoned in the traditional style'.

He went on to propose that he believed the elements which should be represented by the MVS coat of arms were the fan and shaft, the mining industry, the learned status attained by the Society, a measuring device, the metals and minerals mined in South Africa and some form of symbolism signifying 'works' In addition colours expressing a clean, healthy environment should be chosen. Members were impressed by his knowledge and agreed wholeheartedly with his suggestions. The next stage would be to submit three designs to Council for final selection.

By December 1984, Council had made its selection and all the symbols suggested by Patterson with the exception of 'works' had been incorporated into the design. A suitable motto, Custodite Aerem et Aquam, had been chosen with the help of the Department of Classics at the University of Witwatersrand. The motto in simple English meant 'take care of air and water'. Patterson then elucidated on the symbolism represented in the coat of arms saying

'the pick and shovel refer obviously to mining, and because it is so well known, the existing MVS device of a fan was included. The fan stands at the top of a upcast shaft and is coloured the conventional red of return air, A scroll, or open book, always suggest learning, and here proclaims that the MVS is a learned society. The dividers symbolise measurement, which is an important component of the professional activities of members, and the fountain is a symbol of pure fresh water. All the devices coloured gold represent the gold mining industry; those black are coal and base metals; those in silver remind us of diamonds, silver and platinum.'

Members laughed when he said 'a suggestion that the helm be replaced by a hard hat carrying a lamp (to represent illumination) and ear muffs (to represent noise) was received by the State with less than enthusiasm.'

Application for registration was finally handed to the Office of State Heraldry on 17 December 1984. It was like a Christmas present for Schmitz, Sizer and Patterson, No more running backwards and forwards. There were a few formalities which needed to be complied with which would take about four months before registration could be effected. But no-one was more relieved than Dave Unsted who had handled most of the personal dealings with the Bureau. It had been fairly agonising and had taken hours and hours of his time. The Bureau's opening times seemed to be based on those in vogue during the last century and conversations about the arms being described in gobbledygook such as 'Argent, a pile Gules surmounted by a pick and shovel in saltire Azure' were driving him nuts. Council was eternally grateful to him for without his devoted uncomplaining service, the coat of arms would certainly have taken much longer.

Shaft talk

When Schmitz had formulated his presidential policy, he had been adamant that communication between members must be improved. One of his suggestions about the way this could be achieved was that shorter, more practically oriented articles be published in the Journal. Following in the footsteps of Barenbrug, he had written an editorial which posed the question, 'I wonder how many of you reading this really know who constitutes this Society and what its objectives are?'

He continued saying that 'it is not a vague body somewhere in Kelvin House - Johannesburg. It is you the member of this society. Remember you only get out of it what you put into it'. After listing the objectives of the Society's constitution, he said that 'to achieve these objectives the society relies on only a small group of dedicated members, indeed, a tall order don't you agree? No, it is certainly not a case of this dedicated group wishing to monopolise the profession, but rather that of lethargy by others to share this considerable work load and the reluctance of younger members to come forward'.

It was a valiant attempt. Papers remained in short supply. But in October 1984, the concept 'Shaft Talk' was born. Initiated and written by Russell Ramsden, for months members were kept guessing as to who was writing the concise, practical articles. His first piece took up half a page and covered measuring instruments. This was followed by errors in measurement and an article called Some Remarkable Changes which, using the annual ventilation statistics as a reference source, commented on the growth of the field of mine environmental control.

He said

'In 1962 the total downcast air volume flow rate was 21 000 m^3/s and by 1983 this quantity had increased by nearly 70% to 35 000 m^3/s. On the basis of rock production these figures correspond to 2,3 and 3,5 m^3/s per kiloton broken per month. In this time period the quantity of air that was filtered, both on surface and underground, increased by a factor of more than 2,5.

During these years, by far the greatest change has come in what is now the widespread use of refrigeration and air cooling equipment in the gold mines. The installed refrigeration capacity on South African gold mines grew from 98 MW in 1968 to 931 MW in 1983.'

These articles were exactly what the Journal had been looking for over the years. Easy to read and interesting, they filled the gap which had always been gaping.

Introducing self-rescuers to the South African mining industry

Schmitz's presidential year had certainly been eventfull. It was a year of hustle and bustle. Members had been motivated into activity. There had been progress on all fronts. The coat of arms was almost finalised and the inaugural meeting of the Western branch had been held less than a year after the Strategy Committee was assigned the task of investigating its feasibility. Formalising the Eastern branch was nearing completion and the best news was that there was a 70% increase in accumulated funds. Debtors had decreased some 29% and income showed a 20% increase over the previous year. The Journal had shown a loss of R3 800 compared to a profit of R1 200 the previous year but, as Schmitz rightly pointed out, this could easily be rectified provided members made a concerted drive to obtain more advertising.

The annual symposium held at Sun City was an outstanding success with 292 delegates attending. The papers were of a very high standard and were professionally presented.

Schmitz handed over to Harry Rose, Group Environmental Engineer of Gencor, in June 1985. Rose's presidential address followed in the tradition of previous addresses. It was topical and relevant covering the introduction of self rescuers into the South African mining industry. Events preceding the address were that the Government Mining Engineer had announced his intention to promulgate legislation making it compulsory for all people going underground to wear self rescuers. The need for this action had arisen out of the number of fatalities in recent years due

to the ignition and propagation of flammable gases which were also toxic when inhaled. By the time Rose gave his address it was expected that employees in underground coal mines would all be fully equipped with self contained self rescuers (SCSRs) by the end of 1985. This would be followed by gold mines by the end of 1986 and all personnel in other mines would need to be equipped by the end of 1987.

Basically, he explained, that the 'underground environment may become irrespirable because of a deficiency in oxygen or the presence of toxic gases in sufficiently high quantities, or both. The ignition and propagation of flammable gases, with the highly likely occurrence of a coal dust explosion accompanying the initial ignition, will result in both an oxygen deficient atmosphere as well as a toxic one. Mine fires consume large quantities of oxygen resulting in high levels of carbon monoxide and carbon dioxide prevailing. It is obvious, therefore that as the industry expands, especially the coal mining sector, the need for protecting the work force in the event of a catastrophe becomes more compelling'.

He said that there were two types of auxiliary breathing equipment used by the international mining community namely the filter self rescuer (FSR) and the self contained self rescuer (SCSR). He covered the principles of the FSR but said that 'incidents had been reported where miners, using the FSR for escape purposes, have suffered severe burns to the mouth and throat due to the exceptionally high inhalation temperatures. An exemplary form of the very best in rescue discipline, but obviously not desirable; hence the sighting towards the self contained unit'.

He mentioned that the Government Mining Engineer had been 'autocratic when he announced his intention to introduce the self contained type of self rescuer into the South African mining industry. The directive was clearly labeled "non-negotiable" and, irrespective of the number of representations made to the Government Mining Engineer, on behalf of the industry, for leniency, no leeway whatsoever could be obtained'.

He continued saying that there were two salient points arising out of the GME's proposals. The first was that the SCSR had to be kept on one's person at all times which 'in the arduous conditions of low seam coal mines and narrow orebodies, is a major diversion from that practised elsewhere'. The second was that the self rescuer must be self contained with an oxygen supply which could last thirty minutes in the event of an emergency.

Self contained self rescuers were available internationally but none were suitable for South African mining conditions. The industry had no choice but to draw up their own specifications. He paid tribute to employees of industry and COMRO about whom he said 'it is no exaggeration to report that many thousands of hours and kilometres have been covered in finalising the specifications'. Some of these specifications included the need for the unit to be compact, rugged and light, and designed to be worn on a belt for a full shift. The rate of oxygen availability had to be demand based although the oxygen could be generated chemically or from a compressed oxygen cylinder, The carbon dioxide content of the air to be breathed should not exceed 2,5% and the unit must have a life expectancy of at least five years underground. Regarding service life, recommendations proposed that it last a minimum of 30 minutes at a work rate equal to walking at 4 km/hr at an inclination of 5,7 degrees, and have a life of 100 minutes at rest.

Proper management and administration of the system on issue, return, maintenance and control of the self rescuer would have to be instituted if chaos was not to ensue on mines where purchasing orders could easily exceed 20 000 units. He ended his address, on a cautionary note, with quotes from North American newspapers after SCSRs were introduced at the beginning of the 1980s.

They were well chosen and illuminated very clearly problems which could be expected if management, education and control were not approached with the dedication that any project of this significance deserved. The result of the exchanges he illustrated was the usual - a multi-million dollar lawsuit. For obvious reasons he left out the names of manufactures and company officials involved.

'A ... coal mining company has found that 70% to 80% of its emergency breathing sets are unusable. The equipment has only been in service for eight months'.

'The manufacturer suggested that the devices had been mishandled by the company'.

'The manufacturer said he thought the units had had very severe handling, adding "if you smashed your automobile, would you claim a manufacturing defect?"'

He concluded warning members that 'the road ahead does not afford an easy passage - indeed there are many hurdles. However the tenacity of the South African manager is highly respected and there is little doubt that this mammoth task will be tackled as all others have - with conviction and pride'.

It was an enlightening address given by a man whose experience in ventilation enveloped coal, gold and uranium and had spanned three continents. Don Morris in his Vote of Thanks reiterated the thoughts of all members present.

'It is no good giving a man half an hour to get out of a place and then to put the nearest safe place an hour and a half away - in other words the unit is only part of the concept.

Today we have had a talk which is like a breath of fresh air in the Johannesburg smog. It shows us where we are; it shows us where we should be going and it gives us a reference point.

For this clear and masterly summing up of the position with regard to self rescuers, we should all be very grateful to Mr Rose, and it therefore gives me great pleasure to propose a Vote of Thanks to him.'

Western and Eastern branches

After investigation, Sizer reported in November 1984 that the Society was indeed strong enough to create three more branches over and above the Colliery and Orange Free State branches. The Western branch could encompass Durban Deep to Carletonville, and the area in the opposite direction between Durban Deep and Vereeniging could be covered by an Eastern Branch. Cullinan to Messina could be incorporated into a Northern Branch.

Council was unanimous in their decision to create additional branches. They also agreed with Sizer's suggestion that the Orange Free State branch amend its constitution to include the Cape Province and nominated Moorcroft to discuss the possibility of changing the branch's name to 'Southern branch' with members of the OFS branch.

Patterson pointed out that there was a problem with creating a Northern branch as there had always been objections by platinum mines about cross-dissemination of information. He and Sizer would discuss this particular issue with the consulting engineers working with JCI and Gencor.

By March 1985, approval had been given by the OFS branch for incorporation of the Western Cape although the name would not change. Plans were well underway to co-opt a member from the Western Cape to serve on the branch committee. The inaugural meeting of the Western branch was held on 27 March and Mr S McIntosh was elected as the first Chairman. Establishing a Northern branch remained a problem. Discussions with JCI and Gencor had clearly shown that neither group was in favour of its formation. But Patterson and Sizer were not to be deterred. They proposed that members in the area be contacted and their opinions on the issue be elicited even though their employers were against the idea. The discussion ended with Council agreeing that the purpose of the branches is to encourage ongoing education and if a Northern branch was established, it may initially have to operate within the constraints enforced by management of JCI and Gencor. The Society's aim was not to be at odds with the mining groups.

The Eastern branch was officially established on Wednesday, 3rd July 1985 at E R P M's south east vertical shaft. The elected chairman was Mr C J Hattingh and in his opening address he set the branch's first objective. The Committee would be occupied during its early days drafting its constitution.

CHAPTER 32

No matter how high you climb on the corporate ladder, never forget
the smell of a freshly blasted pile of muck or the
sound of rock rattling down an ore pass.

J R Marks, 1985

The questionnaire

Besides investigating the viability of additional branches, one of the first tasks of the Strategy Committee was to draw up a questionnaire eliciting members' opinions about the activities of the Society and how the Society should allocate its funds. Under the direction of Patterson, the questionnaire was sent out in February 1985. By September, the Strategy Committee had analysed the results and were in a position to make recommendations to Council. The response rate was high by commercial standards but Council was still disappointed that only 35% of members had replied. Schmitz's words 'have you got something to contribute or suggest or are you only a sleeping partner' were remembered.

Sifting through some of the responses had been very funny. One member, in answer to how the Society should spend its money, had replied 'by sending me on an overseas trip!' But, on the whole, there were no surprises. The majority of members seemed very satisfied with responses being received along the lines of 'having worked in three continents and four countries I can say that there is no similar society anywhere that advances the cause of mine ventilation better than the Mine Ventilation Society of South Africa' and 'Ek is trots om 'n lid van die MVS to wees.....'

An interesting point that came out of the questionnaire however, was that a bewildering number of members seemed unclear as to the Society's function. Some thought it was part of the Chamber of Mines Training Department while others complained about late publishing of examination results. As Patterson later said in an editorial about the questionnaire 'we do not publish results'. Other members made demands to improve working conditions, negotiate hours of work, raise salaries and improve benefits. Patterson answered these demands with a curt 'the Society is not a trade union'.

There was strong pressure from overseas members for the Society to go international. One member said 'I think the MVS SA is the only hope for some time to come, for a world forum on matters pertaining to the underground mining environment. It can play a significant role throughout the world by encouraging sub-branches in other countries'. Several people proposed a quarterly international journal, or inclusion of much more material in the present journal on developments outside South Africa. Others put forward the idea of a full MVS branch in the United Kingdom. One respondent bewailed the fact that the Copperbelt branch never materialised, and another stated that as imitation is the sincerest form of flattery, he was modelling the United States society after the MVS.

Language came in for some criticism. A few members complained, as Patterson thought quite rightly, that they did not see enough Afrikaans in the journal or symposia. Written in English, someone said 'the majority of members are Afrikaans speaking, yet all the meetings, visits, etc. are normally done in English. That is one of the reasons I am not particularly interested in the activities of the Society. It is time to realise that there are two official languages in this country'.

The Editorial Committee agreed with these comments but it was the age old problem. It had struggled for years to elicit articles in Afrikaans but had failed in its quest even from Afrikaans speaking contributors who obviously had difficulty writing in English. In particular, the symposia were entirely in English so it was a little startling to read that one gentleman felt that there was too much Afrikaans at the conferences particularly in the light of overseas delegates.

Travelling time to and from work were given as the overwhelming reason for not attending Society functions. Here too the question of the exclusion of juniors arose where there were complaints that seniors were given more licence to attend. The standard of papers and public speaking came in for some criticism as did the symposia organisation.

Regarding articles in the journal, members were vociferous about wanting more practical and useful articles which were less theoretical and more closely related to work issues. The Editorial Committee expected this response but, once again, who was going to write the articles? One curiosity was the answer 'my colleague the ventilation engineer likes it' to the question 'do you find the journal worthwhile?'

Despite the fact that the Society is not a training organisation, many perceived that it ought to be more involved in this area of expertise. Comments made included 'get more involved in job training', publish full question papers plus answers in the Journal', 'establish a diploma/degree course', and 'publish study material'. In addition there were many requests for talks aimed specifically at training.

There was a small but insistent number of members who seemed to resent the carry over of rank hierarchy, so entrenched on the mines, into meetings of the Society.

Ideas which were generated from the responses elicited by the questionnaire on ways to spend the Society funds constructively were summarised and presented to Council by the Strategy Committee on 27 September 1985.

The first proposal was to produce a more "international" journal. The Committee thought that instead of producing a separate international journal, as suggested by respondents, papers should be canvassed from overseas authors for publication in the present journal which will be expanded from the current 12 pages to 16 pages of text. This procedure should be followed for three years followed by a re-assessment. Council agreed in principle but felt that a 16 page journal could only be implemented once the papers are received. The Strategy Committee was requested to submit a list of overseas members who could be contacted for papers.

It was also suggested that a book be compiled by the Society containing design data on all aspects of Environmental Control. The data could be obtained from various publications and in consultation with experts in each field. This would be a useful publication since available data are, at present, widely spread in various books and are, in some cases, vague. Council was very enthusiastic about this proposal and Dr Patterson was elected Chairman of the project.

The Strategy Committee felt that concerted efforts to advertise and encourage careers in Mine Environmental Control had failed. It was felt that this function should be taken over by the Society in an attempt to alleviate the continuous shortage of suitable personnel. A glossy brochure on a career in Mine Environmental Control was envisaged which could be distributed to schools, universities and military camps and will also be made available to mining groups at a cost. Professionals would be approached to compile the brochure.

Council liked this proposal in principle. Burrows undertook responsibility for production and would approach the Chamber of Mines for financial assistance.

On international expertise, the Committee suggested that an invitation be extended to an overseas expert to lecture on a specific aspect of environmental control. The course would be arranged on a concert tour basis at a minimum of four different venues at an estimated cost of R20 000,00. It was agreed that the expert should be someone knowledgeable about coal as there were sufficient people with expertise in gold mining locally. The person could address members at a luncheon or dinner, and when a definite decision had been made on whom to invite Rose would approach the Chamber of Mines for financial assistance.

Finally, they felt that capital must be kept in reserve for presentation of the 1992 International Congress. The Society intended extending an invitation at the 1988 Congress in Australia to host the 1992 Congress and upfront capital will be required before any income is realised. Hosting the

International Congress would eventually generate a profit for the Society.

Real communication had been integral to Schmitz's vision. The questionnaire had certainly provided answers. But the unspoken contract entered into when questionnaires of this nature are sent out, is that those eliciting the responses are genuinely interested in improving current gripes. This was the expectation that members now had of Council. The time had now come to show that there was value in real communication.

FRIGAIR 86

The past two FRIGAIR symposia of the South African Institute of Refrigeration and Air-conditioning (SAIRAC) had been national events in 1980 and 1983 covering a variety of topics in refrigeration and air-conditioning. FRIGAIR 86 was held under the auspices of the Department of Agriculture and was organised by the Fruit and Fruit Technology Research Institute, SAIRAC, the Chamber of Mines and the National Mechanical Engineering Research Institute of the CSIR. Well organised with its objective to provide a world forum for scientists, researchers, engineers and industrialists involved with refrigeration, arrangements had been made for speakers from Australia, Germany, France, Italy, Spain, Switzerland, the UK and the USA to address parallel sessions, The theme was 'Cooling - its vital role in agriculture, mines, factories and buildings' and technical tours had been arranged to include a gold mine, the Roodeplaat Horticultural Research Institute, a large fruit co-operative in Elgin, the container terminal and precooling facilities of Cape Town harbour as well as visits to wineries.

Although members were not interested in container terminals and the like, one of the parallel sessions at this conference was of great interest to them. The session on mine cooling was divided into four categories namely design environmental conditions, heat load prediction, refrigeration machines and refrigeration distribution systems. Members, both locally and overseas, comprised almost the entire delegation to this session.

The papers reflected the strong ongoing attempts to develop improved methods of cooling the working environments in very deep mines. As the depth of South African gold mines approach 4 000 m below surface, the heat loads particularly from rock surfaces constitute a major technical and economic challenge to mine designers. The first issue covered was the question of the thermal environment requirements for underground working areas. Johan Kielblock reviewed human heat stress in mining and was followed by Schu Schutte who looked at wet-bulb temperature and metabolic rate limits for acclimatised men. While the mines of the West German hardcoal industry are not as deep going down to a maximum of 1 400 m, higher geothermal gradients in Germany result in a similar general need for refrigeration. Mr G Mucke summarised recently introduced climactic regulations and gave examples of air-conditioning measures taken to maintain acceptable temperatures.

The second category, heat load prediction, was reviewed by Steven Bluhm and this was followed by a paper by Pierre Mousset-Jones and Malcolm McPherson which described tests carried out in North American mines. They also covered thermal problems in designing underground nuclear waste depositories where much of the methodology is also applicable to mining.

A number of papers were then given on different water chiller designs. A strong motivation behind these designs is the importance of achieving a low water temperature as it leaves the evaporator to minimise the quantity of cooling water to be circulated between the refrigeration installation on surface and the underground workings. Various types of evaporators were covered. Two particularly interesting papers were presented on the prediction of centrifugal chiller performance. Mr H Grollius described a computer program for predicting the off specification behaviour of single or two-stage chillers as normally encountered during mine operation where both load and lift vary. Roger Hemp, a past president of the Society and three times gold medal winner, evaluated the use of a chiller performance prediction program as a basis for comparison with plant measurements to diagnose the reasons for any under performance. He showed the versatility of a personal computer in performing all tasks from checking input data to producing

diagnostic reports on performance.

Discussion then centred on the various new systems for distributing refrigeration in deep mines, some of which were already being implemented. Chris Baker-Duly described a screw-compressor refrigeration plant located on surface which employs a direct ammonia-air, finned tube evaporator for cooling of downcast mine ventilation air. John Sheer, who had represented the mining industry on the Main FRIGAIR 86 Committee, outlined the need for new types of mine cooling systems for deep mines which were more cost-effective than those developed during the past decade. He described the three possible systems currently under investigation which were ice, air-cycle refrigeration and closed-circuit distribution.

As a follow-up H M W Eschenburg detailed the first large-scale realisation using ice at Harmony Gold Mine and K Anderson looked at a process which could meet the challenge of producing ice at lower costs.

Members' involvement in FRIGAIR 86 had been to the benefit of both themselves, the South African mining industry as well as the international community. Cross pollination bringing local developments to the attention of the international ventilation fraternity as well as acquainting local industry with developments overseas had been achieved with relative ease.

Mine Vent 86

It was a productive year for symposia. Frigair 86 was followed by Mine Vent 86.

Held at the Johannesburg Sun Convention Centre, the theme of the 1986 annual symposium was Practical Ventilation. Twenty papers were presented to the 280 delegates and 37 companies exhibited products relating to mine ventilation.

Council had hoped that the Minister of Mineral and Energy Affairs would be able to attend and deliver the opening address but due to prior commitments, the address was given on his behalf by Mr L N J Engelbrecht, the Deputy Director of the Department. Mr Engelbrecht spoke of how the perceptions of the ventilation officer had changed from someone who merely provided enough air for survival to the much broader spectrum now encompassed by the environmental engineer or environmental control officer. Illustrating this point, he mentioned the proposed amendments to the legislation regarding replacing safety lamps for testing for flammable gases with methanometers. He explained that the methanometer is a delicate electronic instrument and its use, calibration and repair must be controlled by trained technicians. The selection and use of the methanometers must be handled with responsibility and the onus was on the ventilation fraternity to provide positive guidance.

Papers were divided into four groupings namely power savings, mine practices, cooling and heat pickup. Although the cost of electrical power in South Africa had always been low, the steady increase over recent years has led to more attention being given to energy savings. The reduction of the pressure loss through the ventilation network and heat exchange equipment is the obvious way. A paper by Des Wrigley called 'Scale Model Testing of Erfdeel Division Upcast Shaft Bend and Fan Drift' described how by using models, the pressure drop and hence the main ventilation fan power was reduced. A complementary paper by Bill Reaney on cooling tower design with particular attention to saving power illustrated model testing for reducing fan power in surface bulk air coolers.

As mines become deeper, the need to examine cooling practices remains constant. 'Mine Cooling and Hydropower' by Macnamara and Ramsden described the effects of eliminating the use of compressed air and using high pressure water for all the stope machinery. The advantages of backfill for controlling face ventilation were outlined in a paper by P L J Viljoen called 'The Application and Benefits of Underground Slime Fill'. A paper by overseas specialists, R D Lee and I Longson, introduced members to the concept of controlled recirculation in the United Kingdom.

The third group of papers covered the operation and performance of cooling systems and air coolers. Mr G J van Rensburg described the cooling system at Western Deep Levels and D Coetzee looked at air coolers at President Steyn Gold Mine in a paper called 'Performance Evaluation of Direct Contact Heat Exchangers used for Secondary Air Cooling'. An interesting paper which depicted a cooling policy for operating pre-cooling towers only during the coldest part of the day was given by Steven Bluhm. Gebler and Ramsden reported problems associated with measuring the thermal performances of large bulk cur coolers.

Two papers were given on the measurement of heat pick-up in mines. Nick Alexander described the measurement of an energy audit for an individual stope and Paul Bottomley described the effect of insulation on the heat flow in an intake haulage.

The closing address to this successful symposium was given by Dr L Alberts, Director General of the Department of Mineral and Energy Affairs. He said that South Africa was a leader in deep level mining and that it had always been prepared to share this expertise with other people. It had been fortunate that people such as Austin Whillier had been prepared to dedicate their considerable energies into solving the environmental problem and called for an Austin Whillier commemorative lecture every year at the annual symposium.

CHAPTER 33

The everyday use of readily accessible microcomputers is coming in very slowly, partly, it seems, because not enough people who should be producing software are doing so, and partly because the majority of environmental officials seem to be afraid of them.

A Patterson, 1986

Mine ventilation - first impressions

The 42nd President of the Society was Andrew Patterson who by now was a well known figure amongst members. Well qualified with a BSc and MSc in Mechanical Engineering and a PhD awarded for work on heat transfer between man and his environment, he had been extensively involved with the education of aspirant engineers for years at the University of Witwatersrand. In 1979 he had left academia and joined the ventilation department of JCI where he was appointed Group Environmental Engineer in 1983.

In his presidential address called 'Mine Ventilation - First Impressions', he contrasted lecturing at Wits to mine ventilation. He was fairly scathing about universities saying

'after four years as an undergraduate registered for mechanical engineering, I was just beginning to develop an appetite for learning all that goes to make up engineering science and was very eager indeed to pass on what I was learning to other students coming up behind me. But what followed was years of gradual disillusionment. Part of this was the realisation that unlike their lecturers, probably 90 per cent of students have no real interest in the subjects they are studying and devote themselves whole-heartedly to discovering the bare minimum of effort which is required to obtain their degrees; it is not that they are merely disinterested; they are actually anti-intellectual. Another realisation was that despite protestations to the contrary, the South African public places very little value on education: there are many reasons for this, and much evidence to support it but teachers themselves have to take a good deal of the blame. A third realisation was that academics are at least as human as any other section of society: where I looked for nobility I found prima donnas and childish spitefulness; where I sought competence I found impracticality and feeble indecisiveness; where I expected wisdom and maturity, I found people huddling in a sort of academic uterus, disguising their fear to face the real world by pretending it was beneath them.'

He continued saying that lecturing did however give him the opportunity to flirt with the mining industry. One thing led to another and when looking for a problem suitable for a doctoral thesis, he ended up banging on Prof. Wyndham and Prof, Mitchell's doors at COMRO. They suggested that he try and learn more about the relationship between the flow of blood in the superficial tissues of the human body and rate of heat loss from the skin surface. The connection with mining was, of course, saving life by acclimatisation.

After attending the MVS symposium in 1986 on cooling in deep mines, he said 'that decided me. I was so impressed by the relevance, reality and practicality of what was being done and being said that I determined somehow to associate with these people'.

The next section of his address amused members. Tongue in cheek, he described his first impressions. Compared to the world he was used to, practices indeed seemed odd. He spelt these out in terms of laws with Law 1 being 'a ventilation officer gets nothing done' to Law 2 which was simply 'a ventilation officer has nothing to do' and Law 3 which had to be 'ventilation officers do not obey the law'. His descriptions were eloquent and very funny. His fourth impression written using the same tone as the three laws 'crystallised on the day I was pounding along a lengthy station cross-cut on the way to a certain stope; I was in a pretty big party of people all moving in the same direction. In front of me was a surveyor and with him, a sampler. On my left was an electrician and on my right, a fitter. The section geologist was behind and accompanying him

were a Grade Control Officer and a Rock Mechanics Officer. And of course following behind this party of pilgrims was an even larger and noisier rabble of masizans. But where were they all going? Why, to the self-same stope as I was!

Now what is the sense of this? Surely it must be possible at least at the level of simple observation to combine some of these function into a common services department? This would cut down significantly on the numbers of people who are all simultaneously wasting time in travelling. Furthermore consider that what very many of these officials are doing is playing policeman, snitching to the Manager. Have you ever thought that if we had a sort of highly trained super shift boss, doing all his own work and reporting accurately on it, many of us would be out of a job?'

He then spoke on impressions of ventilation planning and of the Society which he said 'unlike so many other clubs and associations, there is no animosity, there is great camaraderie, and a genuine spirit of agreement and co-operation which spills over into the work of other institutions, such as endlessly proliferating working parties of the Chamber of Mines'.

It was a refreshing address and as Grave said in the Vote of Thanks, 'I believe Andrew Patterson is a worthy President and through his efforts this year there will be significant advances in mine ventilation'.

Environmental software

At the first Council meeting with Patterson in the Chair, he announced that membership certificates would now have to be redesigned bearing the Society's new coat of arms which had been recognised and registered by the Bureau of Heraldry in October 1985.

However, another issue needed to be urgently tackled. This was the shortage of environmental software for microcomputers. He had raised this issue in his presidential address where he had said that mainframes are 'remote, awe-inspiring beasts that are unapproachable and unfriendly. Secondly, data preparation for most of the ventilation packages available on mainframes is mind-bendingly tedious. Thirdly almost all computer bureaux demand that the users submit and run jobs themselves from a terminal, which in principle is absolutely wrong. Needless to say, what we all want is a microcomputer on our desks, or at least within our departments. But having invested millions in mainframes, the mining houses, understandably, want them to be used, and are also afraid that the company would be vulnerable if vital data were Balkanised into many dozens of microcomputers and discs. On the other hand, we in the profession are caught in an awful Catch 22. There is a good deal of commercial software for which we have no machines: for the machines we do have, there is almost no software'.

Not surprisingly, he suggested that a new sub-committee be formed to tackle the shortage of environmental software. The proposal was well received and Mike Dumka accepted the post of Convenor with enthusiasm.

Patterson believed that a great deal of the routine work of the profession could be taken over by microcomputers and programmable calculators, if only the software were available. This was particularly relevant to regular surveys, handling of statistics, reports, graphs and repetitive technical calculations.

The new committee would start by surveying the machines accessible to members, and by compiling a directory of programs currently available for those machines. This would include commercial software, if applicable, as well as programs written by or for environmental control personnel in the mining groups or commercial organisations.

The vision was to set up a central library of software and suitable manuals where members could obtain copies of floppy disks, magnetic cards and manuals where copying is permitted. Later a service would be offered where members could get hands-on instruction in the use of any software package on the computer or calculator recommended.

Perhaps the most ambitious facet of the new committee's task would be hiring freelance programmers to write new software for applications where none exists at present. To do this, the financial resources of the Society could be drawn on, but subsequent users of software created in this way would have to reimburse the Society. The present vision did not include mainframes which, if Patterson had his way, would be dumped.

Society affairs by mid 1987

By June 1987, Patterson's term as president had come to an end. He paid tribute to the Secretary, Mrs Doreen Knott, whom he said 'uncomplainingly carried a heavy load'. She assumed responsibility for the day-to-day running of the Society which included clerical and administrative tasks plus took minutes at Council and Committee meetings. In addition to these duties, she also handled registrations and reservations of the annual conferences as well as the printing and distribution of the proceedings.

Plans for an international journal had not been realised mainly because no suitable articles had been submitted. The Journal itself was looking good however, and thanks had to be given to Cheryl Fritz who had been helping the Editor, Russell Ramsden, with layout and editorial in her spare time. Advertising revenue was still a problem which meant that it had not been possible to expand the contents to more than 12 pages of text per issue. Financially the Journal continued to slide deeper into the red with the annual loss increasing proportionately from 25% the previous year to 45% this year. But the economy was showing signs of an upturn so it was hoped that revenue from this source would improve over the next year.

The annual conference had not been as spectacular as those in the past due to adverse criticism. The decision had been taken to maintain a lower profile and the Riviera Hotel in Vereeniging had been booked for two days instead of the three which had been the trend over the last few years. The theme was 'Airborne Pollutants' and it was opened by Mr G P Badenhorst, Government Mining Engineer. An interesting innovation to the event was four technical visits, mainly related to air and water pollution which is rife in the Vereeniging/Vanderbijl Park/Sasolburg area, that were included in the programme.

Besides the Computer Committee which was busy addressing the problem of suitable software for members, the Data Book Committee had began its task of compiling equations, formulae, tables of data, graphs, nomograms and diagrams which will prove useful to members in their daily work. Progress was good and the committee had been fortunate in receiving the enthusiastic assistance of several experts in industry who were presently busy compiling chapters on specialised topics. Another project, a written record of the history of the Society, had been initiated and Doug Grave was asked to accept this assignment because of his personal memories of the early days and the then leading figures.

Environmental control staff - the future challenge

Lou Pretorius, the incoming president, was a hands-on man with years of experience in ventilation. Having started his ventilation career at Buffelsfontein Gold Mine in 1961, he had been appointed Group Environmental Engineer of General Mining in 1980. He then left to start his own business but returned in 1982, taking up the position of Area Environmental Superintendent.

Pretorius was worried about the staff position in operating departments hence his address on the future challenge of environmental control staff. Not sure whether members would agree with his stance, he nevertheless took the plunge. He began by saying that 'the subject is, due to its nature, controversial. The standard of Environmental Control Departments as well as the need for enhanced technological and managerial skills however, creates a measure of anxiety'.

The present situation on mines was not heartening. He bemoaned that 'it is commonly accepted that the number of employees must increase in accordance with increased workloads and

responsibility. The number of managerial staff on mines has increased in direct proportion to the people supervised and ore produced. These parameters have remained virtually unchanged over the past 15 years.

'In comparison, the Environmental profession has not kept pace with increased workload and technology. Considering only the number of environmental officers in Environmental Control Departments, the following emerges -

installed refrigeration capacity per environmental officer has increased from less than 0,5 MW to more than 3 MW (an increase of 500%); downcast air per environmental officer has increased from 78 m3/s to approximately 100 m3/s (an increase of 28%).'

He continued, expressing the concern that 'these figures clearly reflect that the industry's capital investment to improve environmental conditions has not been matched by a comparable increase in environmental staff to manage these systems effectively. The above proves that the number of staff members is inadequate and the standard reaction, whenever increases in staff complement are suggested, of "wanting to build an empire", is therefore unfounded. A more worrying factor is the capability and potential of environmental officials presently at the industry's disposal.'

He informed members that it would appear that, based on statistics from one mining group, only about 73% of environmental employees are matriculated but 'considering that the matriculation standard of some employees is suspect due to the differentiated education system, the picture looks even bleaker. If these matriculants are excluded from the above figure, the percentage is reduced to less than 50% of the total. This state of affairs is unacceptable and, although statistics for the past are not available, it can be stated that the educational standard of our employees was considerably higher some five years ago'.

Even worse, only 26% of staff in this mining group were qualified with a Certificate in Ventilation compared to the required 41 %. He then posed the question 'how did this situation arise and how can it be rectified?' Although believing that the removal of job reservation in 1983 was the correct action to take and was long overdue, he felt that subsequently the bottom ranks had been filled with people not tested for their suitability. Regarding training, he said that the Chamber of Mines Training Division quotes a growth figure of 90% in Environmental Control departments over the past decade but this doubling up is certainly not matched by the numbers attaining Certificates. He remarked 'it is therefore concluded that, despite the 90% increase in staff, the newly recruited personnel did not achieve the desired level of proficiency. It is questionable whether the presently obtained 20 Certificates per annum is sufficient to adequately staff future Environmental Control Departments'.

Apart from the difficulties of recruiting and training suitable staff, continual resignations of qualified or partly qualified staff are another cause for concern. To date, 1 838 persons had obtained the Elementary Certificate of which only 377 were still in service. Six hundred had been awarded the Certificate and only 295 of those remained. This meant a loss of 80% with Elementary Certificates and 51% with Certificates.

He concluded that his intention had been to highlight existing problems both from a quantitative and qualitative perspective and 'that it is imperative that a concerted effort be made to create an employment atmosphere where highly qualified, capable individuals are attracted to the environmental engineering profession. The time is now ripe to commence establishing departments which will be capable of adequately manning future environmental control systems'.

The address worried members. Pretorius had recounted a fairly disturbing situation. They had certainly been aware that the problem existed and for this reason had begun the careers brochure. But quantification in the way presented to them by Pretorius brought home the reality. As Steven Bluhm said in his Vote of Thanks 'our President has given us much food for thought in areas of environmental control, monitoring, productivity, safety and many other aspects but, I think one of the most important areas which he has touched on and this is my perception, is that unless we select, educate, train and re-train our most important asset and that is our people, we have failed in our duty'.

CHAPTER 34

After listening to all the papers which I have mentioned so far
I sincerely hope that every professional safety manager will
unhesitatingly state that operations should at all times be conducted
so the risk of death or injury is as low as possible.

J B Raath, 1988

Fire tunnel

Environmental control officers would always remember 1986. South Africans were stunned throughout the country when on 16 September the news came filtering through about the fire at Kinross Gold Mine. 177 miners lost their lives. A judicial enquiry later revealed that the fire had spread rapidly poisoning miners with the toxic by-products of polyurethane.

None were more shocked than members of the Society. Proactive measures were needed urgently to minimise the risk of a similar incident. Fire protection systems were immediately reviewed industry wide, and COMRO appointed a multi-disciplinary task force to investigate ways of ensuring the safety of gold mine workers in the event of a fire or explosion underground. Within 11 months, guidelines on protective measures had been published and research, accorded the highest priority, was still continuing. Work on self-contained self-rescuers intensified and three manufacturers' units had been approved for use in collieries. Evaluation of the units for gold mines had reached an advanced stage. The fourth prong of the strategy by COMRO was establishing a Hazardous Materials Unit which was given the task of investigating the properties of any potentially hazardous materials used underground. One of the recommendations made by this unit was to construct a large-scale fire test tunnel to simulate more closely the type of underground environment in which these materials are primarily used.

In the past, test facilities had been used at COMRO and on surface at various mines to work out every possible way to stop accidental fires involving timber from spreading. Timber, by far the most combustible material underground, had always been the greatest fear as it is used extensively to support excavations. However what had become patently clear was that these existing facilities are not suitable for representative investigations involving the behaviour of plastic, rubber or other similar materials underground during a fire. Experience gained overseas had also stressed that small scale laboratory tests were limited in their ability to accurately determine the rate a flame spreads or the amount of oxygen needed to sustain combustion when hazardous materials are involved in a fire underground.

Prior to the completion of this Industry test tunnel, Gencor had intended to start its own underground test facility. Harry Rose had been on an extended overseas trip visiting mining companies, government institutions, and various fire research and testing facilities to get a comprehensive update on fire and materials testing. The conclusion he had reached during this visit was that potentially hazardous materials need not necessarily be banned minewide because if used correctly, and with caution, they were safe for specific applications. He felt that the South African mining industry should follow the example of British Coal and evaluate each particular material in its own precise context and, if deemed safe for that application, permission may be granted for its use under strictly controlled and prescribed conditions.

A number of members including Rose attended the opening of the Fire Tunnel on 20 August 1987. Situated in a return airway at West Rand Consolidated gold mine, its primary purpose was to gather information on the safe use of combustibles underground and provide a centralised data

bank on the flammability and toxic properties of materials used on mines. Materials were going to be tested for combustion characteristics such as the emission of toxic fumes and the rate at which they are generated. The effect of varying air velocities on the concentration of gases in the air and the rate of ignition of the material would also come under the spotlight as well as its propensity to flashfire. They intended to monitor a fire's sustainability and its inclination to spread while simultaneously looking at the efficiency of fire retardants. Materials commonly used underground that would be tested in the fire tunnel included pipe insulation and the plastics used in stopes for equipment such as blast barricades, hoses, and ventilation curtains and brattices. Preliminary tests had shown that polyurethane foam is still very dangerous even when coated with a layer of non-flammable paint. Coatings on hazardous materials should be used with extreme caution and only after extensive testing.

Dr Horst Wagner gave the opening speech saying

'the main aim of the work at present is to formulate improved guidelines for the safe use of materials underground in mines. In addition new alternative materials will be assessed as they become commercially available, and indeed the development of safer alternatives will be strongly encouraged. The ultimate aim in the long term is to restrict to the absolute minimum the use of combustible material underground. This will require an ongoing effort by all parties concerned, particularly the suppliers of equipment.'

This last point was of particular interest to members. To date, little responsibility had ever been placed on the companies selling equipment or materials to mines. Seldom was proof demanded as to one hundred percentage legitimacy of the sales pitch. It was a thought that needed to be further pursued.

SHAPE 88

SHAPE 88 was organised by the Mine Ventilation Society in conjunction with the Association of Mine Managers of South Africa, the South African Colliery Manager's Association and the South African Institute of Mining and Metallurgy. Its theme was to discuss issues relating to safety, health and protection through environmental control.

The opening address was given by the Government Mining Engineer, Mr Jan Raath. Besides emphasising the importance of the role of the ventilation officer, his speech concentrated on total escape strategies, and the responsibilities of the environmental engineer in identifying and eliminating hazardous materials and conditions in mines.

He commented that he was pleased to see SCSR's, refuge bays and environmental monitoring were among the subjects to be discussed at the symposium, and said 'providing workmen with SCSR's is already catered for in existing legislation. The provision of self rescuers only forms part of an escape strategy and they do not by themselves represent the complete solution for the hazardous condition they are supposed to cater for. The complete strategy involves the early detection of possible emergency conditions by means of continuous monitoring of the environment, designating a person or persons to take charge in every workplace and to institute emergency procedures when necessary, correct donning of SCSR's which will only result from regular training, and then moving, within the permitted time, to correctly designed, constructed and equipped refuge bays or refuge chambers to await arrival of rescue teams or to where long duration breathing apparatus may be obtained to facilitate a safe exit from the mine.'

He paused for a breath. It was a fairly long sentence but in a way, symbolically represented the multitude of variables which were involved in perfecting an escape strategy. He continued by addressing potential problem parameters, and then reminded members of Regulation 2.10.2 which decrees that the manager 'shall not permit any incompetent or inexperienced workmen to be employed on dangerous work or work upon the proper performance of which the safety of persons depends'.

During his next point, a number of members remembered Pretorius's presidential address about the shortage of qualified ventilation personnel in mines. Raath somberly said 'while talking about Regulation 2.10.2, I may as well remind those of you appointed in terms of Regulation 2.16.1 that should you have incompetent assistants, who obviously perform work upon which the safety of others depends, to immediately bring this to the attention of the manager and not to wait for this to be revealed at an enquiry. The manager must rely on you to evaluate the competency of the worker'.

Eleven papers were presented at the conference and several equipment suppliers displayed a range of products in exhibition halls at the hotel. Overseas participation by visiting delegates from the UK and USA gave the symposium less of a parochial, and more of an international, flair. Most delegates were more practically than technically oriented but the presence of several Group Environmental Engineers combined with the input of the practically biased members gave rise to lively debate and discussion.

The closing address was delivered by Mr I Watson, President of the Association of Mine Managers, who expressed the sentiment that SHAPE should become an annual event. Making the point that new ventilation techniques may be necessary to cope with changes in mining methods, he said that far more research needed to be done in this area. He also mentioned that, in his opinion, COMRO was not being used enough by the mines and that the onus was on mine management to use the expertise being offered, especially in the implementation of new technology.

Restructuring mining diploma courses

For years both the mining industry and the Chamber of Mines had been discussing the possible restructuring of the Mining Diploma Course. The MVS representative on a special committee formed to investigate this issue was Dion Marais.

In March 1988, he reported to Council that he had attended a meeting during which it had become clear that there had been no significant change in the Mining Diploma course for the past 20 years and that there was a lot of duplication in the current course material. On behalf of the Society, Marais had mooted that it was essential that the Diploma remain mining oriented but that the Society would welcome the chance to contribute towards the syllabi for the section on environmental control.

Looking back on 1987/88

It was the year in which the Society learnt that three of their early champions had passed away. Barenbrug, Lambrechts and Prof. Frederick Hinsley who was a world authority on mine ventilation all died within the first four months of the year, All three were part of a fast disappearing generation of pioneers who strode the ventilation stage with distinction during the formative years of the profession.

Fiery, confident, controversial and eminently practical, older members would never forget the legacy left by Lambrechts. President of the Society in 1954, his address had looked at "the need for closer integration of ventilation into mining problems in deep level mining" where he had not minced his words when he said

'what is needed is neither a patronising acceptance by the mining engineer of ventilation because it is important nor an ambitious direct claim by the ventilation officer or engineer for greater recognition because his job is important - rather it is a case of intimately blending the various skills needed in mining.'

'Let us be quite clear, however, about this fact, namely ventilation per se, is no primary objective

at all but simply a means to an end. The all-important objective, obviously, is the extraction of the payable ore, be it gold, copper, coal or other minerals. But let us also be quite clear about two other important facts, firstly that bad ventilation conditions can seriously hamper the efficient extraction of ore and, secondly, bad mining methods in deep mines can do far more harm than it is possible for good positive ventilation and refrigeration techniques to rectify.'

These words would always remain true. Part and parcel of the same issue, they could never be separated.

Barenbrug, one of the three fathers, of the Society was a legend in himself. Elected president of the Society for the first time in 1947, he was already formidable at the age of 40. This term plus his other elections as president in 1948/49, 1955/56 and 1965/66 were all preceded by the Society's fortunes reaching a perilously low ebb, and each time his obsessive, intense desire to succeed pulled the Society back to the road to revival.

The professional competitiveness between Barenbrug and Lambrechts had stimulated members for years. Hardly did they ever agree but the value for members in their exchanges which were often public, was that they were both brilliant and quite willing to share their knowledge with all their colleagues. They approached ventilation from different perspectives with Lambrechts favouring a more empirical stance which Barenbrug would conversely always attack, however indirectly using his vast reservoir of theoretical knowledge. There was no doubt however in members minds that neither the profession nor the Society would have reached its current stage of development or eminence world-wide without these two very great men.

Besides the deaths of these three Honorary Life Members, the 1987/88 financial year was marked by one very radical change in the running of the Society. In April 1988, the Journal was produced for the first time since its inception by someone other than a member of the Society. It was a financial risk as the Journal was still running at a loss because advertising revenue had been insufficient to cover costs. But Council had acknowledged that the time taken to produce a professional looking Journal that could compete with the recent proliferation of other scientific and trade journals was becoming too much for any one member to tackle in his spare time. The bottom line was that advertisers needed to be assured that the Journal was being read by the ventilation fraternity otherwise budgets, always under pressure to deliver, would be wasted. A 43% increase in the projected cost of the Journal was budgeted for, and Council took the leap of employing a professional to help the Honorary Editor from March 1988. The economy was picking up so besides Council being prepared to bear some of the costs of professional help, the revenue from advertising was hoped to cover the costs of printing.

Ramsden had relinquished his duties at the end of December 1987 after effectively handling the portfolio since May 1986. During these two years, many beneficial changes were evident and the Society was grateful to him for the enthusiastic and professional manner in which he had coped with the publication. He was succeeded by Dr Rodney Burton who announced Council's decision in the April 1988 edition of the Journal.

'I am pleased to announce that professional assistance has now been engaged for producing the Journal of the Mine Ventilation Society.

Until now the Journal has always been produced entirely by the Hon. Editor with whatever voluntary assistance he could muster. However, after careful consideration of the matter, the Editorial Committee decided to recommend to Council in March that professional assistance was essential if standards were to be improved. Council fully supported this recommendation.

The new editor will be responsible for all the non-technical matters required in the production of the Journal. This leaves me in the position to tackle what I am qualified to do - concentrate on improving the technical content. During 1987, the editorial section of the Journal averaged 14 pages and my objective from this month is to increase the number of pages to at least 16, hopefully 20.'

He then resorted to the age old plea given by legions of Honorary Editors of the Society in years gone by.

'However, to achieve this I require your assistance. It cannot be stressed enough that the success of the Journal depends on its technical papers, both theoretical and practical. Branch news as well as short articles on new developments in ventilation practice on mines are also critically important if the Journal is to really fulfil its functions which are to interest, inform and educate readers on the current state of art in this field. Letters to the Hon. Editor commenting on the papers published would also be appreciated as this often leads to lively debate and food for thought.'

The Careers brochure was also published during this time. Called 'Environmental Engineering: A Challenging and Rewarding Career', it was a fold-out six page colour guide aimed at school leavers and matriculants. Qualifications, skills and talents needed such as being physically fit enough to obtain a red ticket were explained as were promotion routes and remuneration. The mining industry had a well established reputation for highly competitive starting salaries and above average fringe benefits, and these were emphasised in this recruitment drive. Holiday allowances were generous with 37 days leave plus a holiday allowance of an extra month's salary. Accommodation facilities were excellent with single men being housed in hostels where food is provided and married men given unfurnished houses at vastly subsidised rentals.

Produced under the direction of Steven Bluhm, the brochure had been printed in February 1988. Pretorius told members in his annual report for the year that 'it had been widely acclaimed, both for its content and attractive appearance'. Letters of congratulation had been received from Mr C D Noel, Principal Technical Division at Rand Mines, the General Manager of the Chamber of Mines as well as Prof. Brown of Pretoria University. He thanked Bluhm and his Committee for their excellent and speedy work. Copies had been sent to the careers department of the Chamber of Mines, all the mining houses and the Department of Education, and were available in both English and Afrikaans.

Besides the Journal and the careers brochure, Grave had finished the first draft of the History of the Society; the new membership certificates had been printed in English and Afrikaans; the computer committee had published a list of available software in the November 1987 issue of the Journal; the data book was proceeding well; and plans were in place for the reprinting of 'Mine Ventilation Notes for Beginners'.

CHAPTER 35

The computer and, in particular, the personal computer is the most powerful technological force at work in society today, and these developments have acquired such a force and significance that modem day philosophers are commonly referring to this being an era known as the Information Revolution.

S J Bluhm, 1988

Information revolution

By 1988, it had finally dawned on industry and society at large that personal computers were here to stay. They were not only going to be used by people who had degrees in computer programming as had been the case in the 1970's where access to the 'computer brain' was input into the mainframe by specialised personnel. The mainframe was enveloped by a kind of mystique which put it in a category outside the comprehension of ordinary mortals.

Initially integration of personal computers into business was slow but the aura began to be demystified. Engineers and accountants used PC's as did secretaries. Data bases began to be established. Large quantities of information could be now be stored and accessed almost instantaneously. Andrew Patterson had been the first member of Council to recognise how PC's would enhance the lives of members and this foresight had led to the formation of the Computer Committee.

Steven Bluhm's presidential address in June 1988 introduced to members, in detail, the use of computers for the dissemination of environmental control technology. He referred to the objectives of the Society where the essence of its existence was communicating technical information and said 'I will highlight some relatively new computer concepts, and I hope to present some idea of the way in which different computer systems can be used. I hope you will see that these new systems must inevitably have an important impact on ourselves and the functioning of the Society'.

He continued saying he was going to focus his attention that day on simulation and consulting programs. 'Simulation programs are those that simulate and so predict various processes. They are based on an input, a mathematical calculation, which then results in an output. These are, in general, the only types of programs that are presently available. On the other hand, consulting tools are programs that lead the user to a decision by an interaction of questions and answers. Such programs are sometimes known as Expert Systems'.

Simulation programs which environmental engineers would currently use for network analysis included VENT-PC developed by Professor Malcolm McPherson, PC-VENT by CERCHAR and VENTFLOW by COMRO. All these programs had reached a high level of sophistication in that they relied on the powers of PC's to make tasks easier for the user. The same applied to NETSIM developed by Ken Walt and RETIC by Richard Gundersen for water reticulation systems, and CHILLER by COMRO which simulated the performance of complex refrigeration plants. Simulation programs to estimate heat loads when planning and designing cooling systems included FRIG5, CLIMSIM, KLIMA, TUNNEL and HEATFLOW. TUNNEL which had been developed by Roger Hemp was used by COMRO's program, HEATFLOW, to calculate the heat flow from the rock in airways.

He then explained HEATFLOW in detail since he had been closely involved in its development but emphasised that his comments would apply to many of the other programs. HEATFLOW used

the concept of 'building blocks' which were either heat sources or sinks to build up a section of a mine or an entire mine. Since its release in 1986, there were over 300 registered users in South Africa and it had attracted attention throughout the world. He said

'I have been told that HEATFLOW has revolutionised the planning procedures for mine cooling systems in many mines and I would like to try and examine the reasons why.

Firstly the answers produced are accurate and some trust in the results has therefore developed. But there is much more to it than having merely produced an accurate simulation model. I believe the real essence has been in making the technology easily usable and available.

The program is a much more effective way of conveying information than that which is usually found, and often with difficulty, in text books and papers. It is in fact perceived to be a bridge between text books and practice - which indeed it is. Another reason for its success is what I would call the "space invader syndrome". The job has become more enjoyable (I am not suggesting users play games - but the job is actually more fun).'

This was a very pertinent point. The use of these PC programs made the job easier, quicker, more accurate and far less tedious. Default values for parameters such as airflow rates were incorporated into the program so textbooks were not required for constant reference.

Consulting programs could be compared to a panel of experts and the user asking and answering questions. The only difference was that the panel of experts is replaced by a computer program which contained all the required calculation methods or algorithms, and would be able to explain the reasoning behind both its questions and answers. So the essential difference between the two types of programs was that consulting programs offer considerable assistance and expertise compared to simulation programs which merely predict what may occur in a user-specified design. He then gave a live demonstration of a simple consulting program developed by McPherson. Members were fascinated by the ingenuity of the equipment he used. A large screen was hooked up to a PC terminal. While Bluhm operated the terminal and asked the questions, the program was displayed on the screen showing the answers, the internal logic and the decisions. A child would have thought it was magic.

The topic for his address was well chosen. Many present were aware of simulation programs but few understood the intricacies of consulting programs. John Burrows made the comment in his Vote of Thanks, 'if I may speak for a moment in less serious vein, since I do believe occasions such as these are often far too serious. I spent some amusing moments imagining a user's reaction when confronted with a panel of experts consisting of some of the more august members of this Society. It could indeed be a august experience. A modern inquisition! Reading the complete Black Book may be a much gentler alternative!'

Educating mining engineers

The Careers Brochure had been published because the industry was experiencing a shortage of skilled engineers and technicians. At the time, the mining industry in South Africa employed roughly 15% of the total workforce and accounted for 16% of the gross national product. Over 60% of South Africa's export earnings come from mineral sales which in 1986 were worth about R30 billion. What was less known, was that the mining industry was expecting to face a critical manpower shortage in several key disciplines. Current estimates were that at least 100 newly qualified graduates are needed every year and, at present, the rate was down to 25. Statistics for the 650 professionally qualified mining engineers in South Africa, showed that only one in three qualified locally.

This shortage had been compounded over the last few years as recruiting engineers from overseas was becoming virtually impossible. South Africa, with its volatile political climate, no longer held the same attraction and the few engineers who were recruited from overseas tended to regard the employment as a valuable training experience instead of a lifelong career.

To give members a greater insight into the problem, Melanie Low interviewed Prof Huw Phillips, Professor of Mining Engineering and Head of the Department of Mining Engineering at the University of the Witwatersrand, for an article in the Journal in August 1988. The first question addressed whether mining industries overseas are experiencing the same skills shortage. Philips explained that mining world-wide had lost much of its previous allure due to the cyclic nature of the industry as well as the industry's poor image. In the UK about 150 engineers graduate every year and there are only vacancies for about 45 graduates. In the USA and Australia, student enrollments in the past tended to increase during boom periods but as none of these periods have lasted very long, disillusionment had set in about stable lifelong career opportunities in the industry. This meant dropping enrollments, and the subsequent danger for South Africa is that American companies could soon start offering South African graduates tempting packages to overcome their own skills shortages.

Regarding reasons why mining was less attractive to school leavers than other industries locally, Phillips said this was because of its negative image. Frequent reasons given included the poor safety record of the industry, a perception that it is highly labour intensive working in an unpleasant, dark, dusty environment with little chance to utilise advanced technological skills, and a feeling that mining houses are large, impersonal, bureaucratic institutions. This was why it was so important that the mining industry and professional bodies such as the MVS embark on major campaigns. Also the mining industry because it never had to sell or advertise its products to the general public failed to project its corporate image. It was now paying the penalty through its inability to recruit the best students, and it had become strategically important to replace the old perception of a low-tech job with the image of an exciting, fulfilling career, solving some of the most difficult technological and managerial problems in South Africa today.

The biggest problem facing engineering faculties in South Africa was funding. Universities and Technikons had suffered severe cutbacks in Government funding over recent years and since the subsidy formula was heavily dependent on student enrollments, smaller Departments such as Mining Engineering, faced the greatest difficulties. The Mining Engineering Department was luckily subsidised by the Chamber of Mines.

On a more positive note, he said in answer to the question on an increase in black student enrollment over the past years, there had been a dramatic increase and these students now accounted for some 30 - 40% of the annual intake.

The extent of the shortage of skilled expertise was clearly outlined in the interview. The problems discussed by Pretorius in his presidential address were reinforced, and for those unaware of the reasons for the careers brochure, it was now quite clear why it had been such an important project for the Society.

The Government Mining Engineer and environmental legislation

Jan Raath had given the opening address at SHAPE 88, and had indicated very clearly his stance on total escape strategies. Since the conference, a number of papers on refuge bays had appeared in the Journal as the subject was now extremely topical. Rodney Burton, as Honorary Editor, thought it would be of benefit to members to hear about Raath's feelings concerning other issues relating to environmental control in mines. Raath was interviewed by Melanie Low and the topics covered, besides refuge bays, included the role of the GME's office and how South African legislation compared to similar legislation overseas. When asked whether he saw any gaps in current South African legislation, he replied

'Yes there are gaps but more importantly, there is a fair amount of outdated legislation in the Regulations. Right now we are investigating the possibility of consolidating all the Minerals Acts into one Act. When this has been completed, the next step will be to examine issues pertaining to safety in more detail as this will probably only take up one section in the new Act.

The major gap at present concerns off-shore oil recovery which, although a mining operation, is not covered in the Regulations. These are currently being formulated.

Concerning heat, dust, noise and illumination standards in South Africa there are only minor gaps regarding heat and dust. In terms of heat, legislation covers acceptable working temperatures and the need for men to be acclimatized before working in heat. Similarly with dust, legislation prescribes the maximum allowable dust concentration. Legislation on this issue also appears in the Occupational Safety in Mines and Works Act whereby mines are given a risk rating which is determined by the average dust conditions found in each mine. A levy is then paid by each mine according to the dust risk, and this money is used for compensation purposes should a compensatable disease result from exposure to dust during mining operations.'

On his position regarding the introduction of gravimetric sampling he said that a concerted effort was going to be made to introduce the procedure on all mines within the next years. To date it was operating satisfactorily in the steel and alloys industry. The Chamber of Mines and his department had formulated a strategy and letters had been sent to all collieries. The protocol involved management dividing the colliery into various population groups according to levels of exposure. Feedback from collieries was being awaited.

The new era of trackless mining was then covered. He felt that it was an excellent development which would contribute towards safer working conditions.

However, as with all new technologies, different hazards would be introduced and potential problems associated with trackless mining were being investigated. He said

'the existing legislation does not adequately cover aspects such as fuel supplies. At present the legislation permits mines to store up to three days fuel underground. Although mines never actually store this quantity of fuel, such large quantities could present a considerable fire hazard. Other issues are the workshops, where repair of trackless mining equipment is undertaken, and the areas where the vehicles are stored during the off-shift. Presently we say that adequate fire protection equipment must be supplied but a more specific definition is required. For example, mines in the USA are compelled to provide a fire detection and foam injection system over the area where the units are stored.'

Controlled recirculation of air in gold mines was the last topic covered. Raath believed that the technique should be the exception rather than the rule but that it could be used provided it was well planned and carefully monitored. At present, all proposed recirculation systems had to be submitted to his office for scrutiny, and legislation would be introduced if the practice became widely used on South African gold mines.

The interview left members in no doubt that Raath was serious about actively contributing to improved and safer working conditions on mines. As he said, 'although the Inspectorates have always concentrated on improving safety, tangible evidence is scant. Before being promoted to GME, I developed a computerised accident statistic data bank which has generated substantial information. The division is in a position to now apply this information and consequently improve safety conditions'.

Honorary life fellowships awarded

The award of Honorary Life Fellow by the Society was symbolically one of the greatest honours the Society could bestow on any of its members. It is made to current and past fellows who have made significant contributions to the science of environmental engineering and have excelled in services rendered to the society and the profession.

The decision was not one taken lightly by the Society and so it was a major milestone when in 1988, Council decided to award both Bill Holding and John Burrows the distinction of 'Honorary Life Fellow'.

Bill Holding was born in the heart of the British coal mining industry in Wigan, Lancashire. After obtaining a BSc. degree in mining at London University in 1951, he enrolled as a Directed Practical Trainee with the National Coal Board. He was awarded his Colliery Manager's Certificate in 1955 and appointed an Area Ventilation Engineer in 1956. Holding was instrumental in considering the use of district controlled recirculation for mines under the North Sea which resulted in the first system to be installed in a British coal mine. This is particularly significant since he was also involved in the successful controlled recirculation system installed at Loraine Gold Mine.

Holding began his career in South Africa in 1966 when he was appointed Assistant Group Ventilation Engineer for Union Corporation. Presently he was the Group Environmental Engineer for Anglovaal, a position he had held since 1970. His experience in mine ventilation was vast covering three decades, two continents, and both coal and metalliferous mines.

After joining the Society in 1967, he willingly shared his expertise with other members. In 1971, he was elected to Council and served as President in 1976/1977. He was the first president to have begun his mining career outside South Africa. Over the years, his dedication to the MVS was shown through his continuing involvement on a wide range of activities where he had served on numerous committees and also represented the Society on various scientific and government committees. Currently he supported the Society as a member of Council, the Editorial Committee, the Strategy Committee, the Computer Committee, the History of the Society Committee, the Prize Awards Committee and the Science and Technology Committee of AS & TS. He was Honorary Editor of the Journal in 1972 and 1973, and contributed three chapters to the Black Book plus co-authoring a fourth. His presidential address called "Mine Ventilation - two decades, two continents" helped motivate the formation of the Collieries Branch.

Accolades and thanks could go on forever but no-one would forget his talent and expertise which was always accompanied by his sharp wit and renowned sense of humour.

John Burrows was born in Plymouth, Devon and after completing his education at the Plymouth Navigation School of the British Navy, set out on a career at sea. In 1957 however these plans went badly awry when he met his future wife aboard the M V Kampala and was persuaded to visit South Africa for a holiday. He never left.

It was in 1969 that Burrows began to play an active and influential role in the business of the MVS, being then invited to become a member of the Editorial Committee in an ex-officio capacity. He was elected to Council in the same year and started the progression through the Executive which culminated in him serving as President in 1972/73. During his term of office, the Society held its celebrated Symposium on Fires at West Driefontein which, reckoned by the attendance of over 300, was the most successful held to date. His role as chairman of the Organising Committee for the First International Congress on ventilation certainly added to its success.

Burrows had been active not only in the organisational affairs of the Society but also in its efforts to publish and distribute technical information. He presented papers at both the First and Second International Congresses, and made many contributions to the Journal having been Honorary Editor from 1979 – 1981. He was a member of the committee which produced the first textbook ("The Ventilation of South African Gold Mines"), and also wrote the chapter on refrigeration. Also involved in the 2nd edition of Willie le Roux's "Ventilation Notes for Beginners" as well as the 1972 and 1982 revisions of "Measurement in Mine Environmental Control", his crowning glory was certainly the editing of the second textbook, "Environmental Engineering in South African Mines".

Burrows was known for his passionate belief in professionalism and the old fashioned virtues of doing the job well. Without these virtues, there was a slight possibility that the Black Book would not have been the commercial success it later proved to be.

CHAPTER 36

Compressed air consumption in the South African mining industry has virtually doubled over the past 25 years although the tons broken per rockdrill have decreased from over 600 per month to less than 350.

P Deglon, 1989

The effects of mechanised mining on the underground environment

The annual symposium in 1989 covered almost every aspect of the effects of mechanised mining on the underground environment. Held at the Carlton Hotel in Johannesburg, the conference ran from 21st May to 24th May, and over 200 delegates attended. Twenty-two papers were presented and 16 exhibitors displayed the latest products available in the environmental control sector. The Society was also fortunate enough to receive generous sponsorship from a number of companies which helped to enhance the professional image pursued by the Chairman of the Visits and Meetings Committee, Mr Jimmy Guthrie.

Tim Wadeson, Technical Director of Mining at Anglo American delivered the opening address. He stressed the relevance of environmental issues to the introduction of trackless mining in South African mines as well as other problems inherent in mechanised mines saying

'there is absolutely no doubt that the trend to mechanisation will continue and will accelerate. This will be driven by the need to increase safety and productivity and so reduce costs. It is certain therefore that environmental engineers will be required to solve the problems associated with the increasing number of diesel units in hot deep mines. Furthermore it will be necessary for the environmental engineers to predict future trends to ensure the availability of adequate airways to dilute fumes and remove heat.'

Wadeson expressed the regret that although South Africa is a world leader in underground mining, virtually none of the equipment introduced in recent mechanisation programmes is specifically designed for South African conditions. As for the future, he predicted that the development of underground equipment will follow closely on open pit practice and there would be a move towards electrically driven or diesel electric equipment possibly with some sort of trolley line or trailing cable assistance.

A cocktail party was held at the top of the Carlton after the proceedings of the first day. Besides delegates, it was attended by prominent figures in the field from the mining, education and commercial sectors as well as a number of wives of members. It gave delegates the chance to relax, mingle with colleagues, meet new associates, and renew old acquaintances both socially and professionally.

Mr H Scott-Russell, the Technical Director of JCI, delivered the closing address. He congratulated the Society on the organisation of the symposium and commented that he had found the papers to be of high quality with respect to presentation and content. Alluding to Wadeson's opening address, he said that in April 1986 when the decision was made to introduce trackless mining, only 15% of the units were locally manufactured. However, in a few months, 80 - 85% of trackless equipment and components used by JCI would be locally manufactured. He then went on to emphasise the need to review current attitudes saying

'if we are to design and control mines at great depth, then there must be a total change of attitudes, Attitudes are like techniques - they change and mature with experience and time. Organisation, technology, safety and training costs are all considered important aspects of mining but attitudes have always had a major influence on progress and decision making.'

'.....My message is that we should all recognise our own attitudes and those of others and challenge them as we would other forms of argument, to make sure that the best decision or solution can be put forward to the overall benefit of the organisation.'

In conclusion he said

'You, gentlemen, carry a great responsibility and without you the mines could grind to a halt very quickly. Enthusiasm for your profession, your patience in bringing about changes in attitude towards the correct application of environmental standards and your friendly co-operation with those responsible for production, make the members of your Society an integral and important part of mine management.'

Polyurethane foam

One of the consequences of the Kinross disaster in 1986 was the Government Mining Engineer imposing restrictions on the underground use of polyurethane foam (PU) on 1st January 1989. As the most common use of the foam was insulating chilled service water pipes, this development was of the greatest interest to members. The restrictions on the use of PU were that no more of the material could be introduced underground, and that all existing material must be removed at the earliest opportunity or rendered inert. The only situation where PU was still permitted was in sealing off ventilation districts in the event of a fire. In March 1988, Melanie Low interviewed Harry Rose to glean his views on the use of insulation in mines. The interview covered all aspects of the topic including the problems associated with the removal of the foam from the pipes as well as the extensive investigations being carried out by GENMIN to decide on alternative types of insulation which could assist in providing a safe alternative in the drive to attain satisfactory underground environmental conditions.

On exactly what the ban prescribed, Harry Rose said that it specifically related to polyurethane and that 'I do however find it strange that the Government Mining Engineer has differentiated between polyurethane and polyisocyanurate foams'. He continued saying 'I would also like to emphasise that I regard materials such as polyisocyanurate (PIC) as being as dangerous as PU. The two materials, although similar in physical appearance, have a different chemical structure. This results in PIC having a higher ignition temperature which produces less smoke on burning. However when ignited, its toxicity is no less hazardous than PU. The rest of my comments in this interview will therefore refer to urethane which embraces both PU and PIC'.

In reply to whether urethane could be rendered inert, he replied that there was no known chemical method and that the only solution lies in cladding the urethane using metal sheaths or by shotcreting. Problems were inherent with both methods in that metal expands in a fire, and shotcreting can be damaged by rockfalls, ground movements or passing locomotives.

He explained that urethane was extremely difficult to remove because of its excellent adhesives properties. At GENMIN they had tried a number of mechanical methods including attaching mechanical jaws to a locomotive which 'chewed' at the insulation. However quite a lot of insulation was left on the pipes which then had to be removed manually. The only method which seemed to work was stripping the insulation off with shovels but it is extremely labour intensive and takes about 15 minutes to remove 1 m. Removing the urethane was just the first phase which was then followed by immediate transport of the scrap to surface, and the complete disposal of the material incinerated under strictly controlled conditions.

A lengthy process especially considering that the total length of insulated pipes in South African gold mines was estimated to be about 1 200 km. The other issue, of course, was the cost. Rose said the three cost components involved were the cost of removal, and then those of purchasing and installing a new material. The estimated cost to GENMIN alone was R45 000 000. Other insulation materials now being considered after extensive testing were phenolic foam and mineral wool. Phenolic foam has superior thermal characteristics but is very difficult to apply in even thicknesses. But as he said 'although phenolic foam is far more expensive than urethane it has better thermal characteristics and with the advances we have made in applying the foam and using

Glass Reinforced Phenolic as the encapsulator, we believe we now have a safe, effective and durable product with which to insulate chilled water pipes'.

Raath, the Government Mining Engineer, read the interview and responded immediately with a letter to the Editor.

'I refer to your Personality Profile titled "Harry Rose in person" published in the June issue of your journal where the GME is criticised for not including polyisocyanurate foam in his directive prohibiting the future use of polyurethane foam in the underground workings of mines.

The reason for this decision was based on the fact that at the time of the directive, all foam fires experienced in this country had been attributed to polyurethane foam. Also, urethane foams had been favoured by the industry in the past and were the most extensively used of all polymer foams.

In this directive however, sight was not lost of other expanded foams and these were provided for in the last paragraph of the directive which reads as follows:

"further, any other expanded foam products for use underground in your mine (the manager) shall, as far as practical, be non-flammable, or if they burn, do not give off dangerous quantities of noxious gases while burning."

'Furthermore, on 8 March 1989, after additional information had been obtained, a second directive was issued to all Inspectorates requiring them to inform all mine managers that polyisocyanurate foam should not be considered a safe substitute for polyurethane.'

The interview had been held on 16 March and Harry Rose had not meant to criticise the GME. He was just worried that without specifying polyisocyanurate, there was a possibility that some mines would replace urethane with polyisocyanurate. Also, the other age old problem had shown its head. Although Raath had advised all Inspectorates, this had not yet been communicated to Rose, Group Environmental Engineer of GENMIN.

Compressed air

Months of meticulous research into both the history and present practice of compressed air usage in mines, culminated in Paul Deglon's brilliant presidential address on 21st June 1989. The importance of compressed air to underground ventilation had long been recognised by management who had in many instances made compressed air a function of the environmental control departments or at least insisted on a close liaison between the environmental control and compressed air departments. But there was more to the topic than most members realised.

Deglon in an address which was to later take up almost twenty pages in the Journal, began by outlining a general history followed by its use in South African mines. Rockdrills, the effect of air pressure on consumption and penetration as well as compressors and air receivers were covered. Recent studies had shown that compressed air consumption varies almost directly with pressure and that high drilling pressures without correct thrusting will increase noise levels, increase compressed air consumption and increase wear and tear on the machine without increasing the penetration rates. Compressor stations used to be steam driven until the 1930's when two new centrifugal units were installed. They were driven by electricity.

He then looked at metering and the use of compressed air fans in the 1930's. Now superseded by electrically driven fans, 4% of the air used underground was still supplied by compressed air fans. Cooling was then discussed in detail. Elaborating, he said

'compressed air although saturated has a low moisture content, usually far below that of the mine air. When compressed air is piped to the various areas of the mine it soon takes on the dry bulb temperature of the surrounding air. Then when compressed air is released, because of its low

moisture content, it has a low wet bulb temperature and low heat content and as a result can have a substantial cooling effect on the surroundings. When air operates a machine such as a rockdrill, a large amount of energy is removed from the compressed air and as a result its temperature is lowered. Tests have shown that compressed air temperatures leaving the exhaust of a rockdrill are below 0 deg C and thus have a substantial cooling effect on workers in the immediate area.'

At present calculations showed that over ten percent of the cooling supplied to underground workings is due to compressed air and very often this cooling is achieved where most needed, as a result of the high positional efficiency of compressed air as a means of cooling.

Regarding what can be achieved with compressed air consumption, he said **'the industry average consumption is 4,3 times the calculated ideal consumption. This is a cause for concern especially when the compressed air consumption used per metre drilled could easily be substantially reduced given higher drilling pressures and correct thrusting.'**

On costs, he pointed out that 'the capital tied up in compressors and their ancillary equipment in today's terms exceeds R600 million' and that the 'present overall cost of supplying compressed air underground and operating rockdrills exceeds R8/ton mined which amounts to about 8% of total mining costs'.

He then illustrated costs as they could be with savings of between R500 and R700 million per year. Members found it disturbing how little was being done to reduce wastage, rockdrills and the application of optimum thrust if, as Deglon put it, the cost savings that could be gained were hundreds of millions of rands.

Werner Gebler, with his renowned sense of humour began his Vote of Thanks saying he thought he had been chosen because like compressed air, he would disappear from the scene very soon. After laughter died down he continued, 'obviously they were referring to my pending retirement as well as the advent of electro-hydraulic drilling and hydro-power. That they were totally wrong, at least in the case of compressed air, became quite clear from the presidential address we have just heard; an address which embraces all facets of compressed air'.

He expressed surprise about how the numbers of rockdrills used in the industry had increased out of all proportion to the tonnage produced. 'Just think that the attainment of rockdrill productivity, similar to that which was achieved in the 1950's, would result in a saving to the industry of R500 million per annum'.

It really was unbelievable, and as Gebler said 'I hope that the work which our President has done will not remain as information only to members of the environmental control discipline but that it will also be disseminated to the mining and engineering disciplines who are in a position to implement the recommendations in practice'.

Everyone present nodded. Retrenchments were becoming more and more common in the industry and everyone was being hounded to save costs. Five hundred million rand lost through inefficiency and wastage made savings on stationery a joke. When members left the meeting, there was a feeling that this address would have wider implications. They were right. A summarised version was later printed in SA Mining World, Journal of the SAIMM, Engineering Week and Mining Mirror. A one-day seminar was also held on the topic which was very well attended by mining and engineering representatives.

Focus on computers

In line with other professionally produced Journals, Burton planned that four editions of the Journal in 1989 would be dedicated to specific topics. Response by authors was excellent and there was no shortage of papers. Monitoring was featured in January, coal mining in February, and computers were the focus in August.

Dion Marais, Environmental Control Training Superintendent at the Chamber of Mines and Frank von Glehn, Manager of Software Development at COMRO collaborated on writing an article trying to dispel some of the mystique surrounding the new age electronic wizards. They acknowledged that 'although computers have been in general use for over twenty years, they are often not understood, or alternatively, held in awe by the general public. This is also sometimes the case with technical experts on our mines'.

The article began by explaining the six basic functions of computers namely input, comparison, copy, relocation, arithmetic and output. 'Computers', said Marais and von Glehn 'cannot think or reason. They simply follow a pre-determined set of instructions specified in a program which determines the sequence of tasks'.

They also tried to dispel rumours that the computer revolution would lead to people losing jobs to an electronic brain, and said

'the main advantage of a computer is that it will carry out functions at great speed, thus saving time, money and in the case of intricate calculations or repetitive tasks, lots of hard work. However, regardless of how the answers to problems are derived or data manipulations carried out, the final decisions taken after the results become known still rest with humans'.

Components making up a computing system such as CPU's were outlined followed by a basic computer configuration and essential elements such as RAM and ROM. Personal computers (PC's) were then discussed. By far the most common PC's in use in the South African mining industry 'are IBM or IBM-compatible PC's. The basic system consists of one or two 5.25 inch flexible or floppy disk drives, 256 kilobytes of RAM (the memory available for the storage of programs and data while the machine is switched on) and a mono screen. XT personal computers contain a fixed (or hard) disk which can usually store 20 megabytes (MB) of data and programs - this is the contents of up to 55 floppy disks'.

Marais and von Glehn also went to great lengths explaining to members that it is not necessary to understand the language in which the program was written to run a program. Knowledge of the rules and syntax of the programming language were only needed if the user wants to modify an existing program or write a new one to perform a particular function.

The paper ended on a note voyaging into the future.

'As with almost all other useful innovations and technical advances, electronic computers appear to be here to stay whether as hand-held calculators, PC's or mainframes. The ease of operation of these machines will continually improve, and by the next generation (of humans) will be so much part of life that living without them would be unthinkable. Just imagine, your personal robot (PR) might very well have been serving you tea while you are doing your job on your PC from H.O.M.E.'

Also published in the focus on computers was a tongue-in-cheek article by Mike Dumka on 'the lighter side of GIGO's in environmental engineering'. GIGO was an abbreviation for garbage in, garbage out. As Dumka wrote 'the scourge of the GIGO has touched us all. It begins in the home, overcooking the Sunday roast; on the road, fictitiously reporting distance left to travel on the remaining petrol and of course at work, confusing the issue of the square root of 9 as being 2,99999. ....Computers are the (almost) infallible devices which do exactly what you tell them to do, not what you want them to do'.

Jokes aside, it was an excellent article. Dumka emphasised that computers cannot perform miracles. Meaningful input, accuracy and the need for disciplined cross checking by the user were essential for exact number-crunching. Fastidious formatting is the name of the game.

He then outlined the history of manipulating numbers beginning with the Chinese initially perfecting the abacus. Leading on to computation methods currently available, he said this revolution had been heralded in the 1920's with a bulky computer which had filled a room in Manchester University with its massive vacuum tubes, resistors and capacitors. Hand-held calculators were the

first computers accessible to the environmental engineer with a new era of 'techchange' emerging with programmable calculators and card readers.

Personal computers however have given the environmental 'fraternity a virtually limitless access into the upper echelons of the computational experience. PC's in stand-alone or modem-linked to mainframes offer the driver an environmental suite of software so comprehensive that most, if not all, calculation needs are addressed'.

He continued explaining

'Specialised software for the industry as a result of the work by COMRO has given the fraternity a host of user friendly packages - HEATFLOW, VENTFLOW, ENVIRON to name a few. Used correctly these systems have the ability to emulate the desired ventilation configuration and solve what-if scenarios with incredible speed. Invaluable indeed are these inextricably linked, do-what-you-tell-them-to-do, devices for planning, solving, storing, comparing and predicting'.

He ended on both a jubilant and cautionary note.

'The environmentalist has at his disposal a truly fantastic, sophisticated and powerful tool which he must learn to use to his advantage. The importance of realising the limitations of the device cannot be over-emphasised and the need to do so is imperative. There is no substitute for understanding the fundamental principles, practical experience and common sense. Without a mature blend of these ingredients you may be faced with an ultra-sophisticated, lightning quick GIGO and a potential mistake'.

One of the highlights of the computer feature was the results of the competition which had been announced in the January 1989 journal. Six entries were received and judged according to criteria such as relevance to the discipline, degree of usefulness to members, user friendliness, ease of operations, flexibility to adjust to differing needs and factors relating to the actual programming as well as degree of difficulty of the subject.

Richard Gundersen, Assistant Consulting Engineer of Goldfields, submitted a program called RETIC which calculated flow rates, pressures and temperatures for water flowing in a tree network of pipes as typically found in mining installations. C. PLANT, written by Wessel Nel in HP BASIC for use on a HP programmable calculator, solved refrigeration plant performance taking into account the condenser and evaporator water circuits in the process. The performance criteria calculated include the evaporator duty, temperature, Log Mean Temperature Difference, heat transfer rate and the same factors for the condenser, compressor power input and a heat balance.

A program called AIRRES, entered by Don Pienaar, Section Environmental Officer at Rustenburg Platinum Mines, calculated airway resistance from barometer readings and was written for the HP Model 41 type calculator. VENTDATA by Ian Brown, a Sectional Environmental Officer at St Helena Gold Mines, was more complicated and consisted of five different database programs. FANDATA was used to control the fan movements on a mine and METHDATA controlled methanometers. PERSON, STOPE and DEVELOPMENT were databases for storing information on employees, stopes and development ends.

Tony Murray-Smith put forward COOL which calculated cooling powers for acclimatized and non-acclimatized workers taking into account radiant or black globe temperatures, wetbulb temperatures and air velocities. The final entry was a joint effort by a father and son team. Danie Coetzee from President Steyn and his son Neil wrote REFRMAIN which solved a set of readings for a single stage cooling plant and required input for the evaporator, condenser and compressor. It then compared these results to a set of design figures previously entered by the user.

Judging the entrants was a difficult task for members of the Computer Committee. It required a fair degree of flexibility as the programs were very different in many respects and written for dis-similar machines. After much deliberation, Ian Brown was declared the winner, with Wessel Nel being the runner-up.

Two other papers on a computerised environmental information and control system, and the use of computers in an environmental control department rounded off the feature on computers. It had been well supported by members and had began the ball rolling in the need for all members to begin making the journey towards breaking barriers of habit and moving towards the advantages change could offer.

CHAPTER 37

I hope this encourages other members, and readers, to dig out their rusty files and share some of their experiences - and maybe save a life.

R E Gundersen, 1990

Changes in the Journal

Richard Gundersen, Assistant Consulting Engineer of Goldfields, succeeded Rod Burton as editor of the Journal in June 1989. Burton however continued to be co-opted on to the Committee but this time, in the role of advertising co-ordinator. This was the first time advertising was to become a function of the Editorial Committee in an effort to synchronise expenses and revenue of the Journal.

In May 1989 part of the tabled financial report reflected an increase in revenue from R41 000 in 1988 to just over R80 000 in 1989. This had largely been due to efforts by Paul Deglon in recruiting advertising and a survey had shown that advertisers were considerably more satisfied with the Journal than in previous years. Deglon had managed to *sell* space to six new advertisers since March 1989 and was fairly confident that another four would sign up.

At the Council meeting on 28 July 1989, Burton said he saw the role of the newly formed Advertising Committee as threefold. Firstly it was essential that present advertisers were kept satisfied which included ensuring that they received recognition through product purchase or, at very least, the opportunity to tender on projects from members of the Society. He raised an example of an advertiser who had supported the Journal for four years but had recently cancelled his contract because of no patronage of his business from mining companies.

The second goal was to continue Deglon's drive in attracting new advertisers. Means to achieve this included the introduction of a product news page where commercial concerns could alert members, free-of-charge, about any new developments or products in the field of mine ventilation. It was, of course, necessary for members to read this page and show interest in the products for it to be a success and achieve its ultimate objective, namely securing an advertising contract. The other method targeted to increase advertising was the introduction of specific feature issues which focused on one topic such as the computer issue in August. For this to work however it was imperative that someone on the Committee began trying to sell space a few months before the scheduled publication date.

In January 1990, Gundersen introduced major changes to both the front and back covers of the Journal. Since the Coat of Arms had been registered in 1985, it had been used as the front cover illustration, The back cover had been reserved specifically for advertising space. Gundersen's investigations into the image of the Journal presented every month by the same cover had shown that it was time for a change. He proposed an ambitious scheme. A different photograph would be used every month depicting some aspect of mine ventilation. It was ambitious because he was only too well aware that the success of the cover would depend on members submitting photographs. Like practical papers, this was a problem spanning decades.

In January 1990, he wrote

'Welcome to the 1990's and the new look Journal. As you will have noticed, the front cover is decidedly different to what we have become used to over the last few years. It is intended that the photograph will change every issue but will always relate to some aspect of the Journal's contents

or to some newsworthy item within our discipline. Authors of papers, technical notes and letters to the Editor are therefore encouraged to submit photographs for possible use as are members involved with interesting projects.

This month's front cover is a reminder for the annual symposium in Kimberley for which numbers are unfortunately limited and rapidly being filled.

You will also notice that the contents, besides being published on this page, are repeated on the back cover. This is the result of repeated requests from members who say they are tired of rummaging through numerous issues trying to locate specific articles'.

Other changes to make the Journal more accessible to readers plus broaden its focus were also introduced. He continued, writing enthusiastically

'an abstract section has also been re-instated and will attempt to summarise articles and papers appearing in other publications. Book reviews will also be considered in this section and you are all encouraged to submit contributions. Remember - this is your Journal!

The Computer Committee has opened a 'computer corner' and will keep you informed of new programs. What will really be of interest is tips from users on techniques and short-cuts to make optimum use of existing software including commercial packages such as Lotus and dBase'.

Dust and radon

Dust, the age old scourge of mining, was chosen as the topic for the annual symposium in 1990. Always topical, members could never be over-exposed to information exchange on the subject but, this time, it was decided to include radon gas in the conference as it was an issue about which few members were aware.

Members were looking forward to the symposium which was the 13th held by the Society. The venue was the Kimberley Sun and over 150 delegates from the mines, manufacturing companies and the GME's office attended the stimulating three days. Wives were also invited formally for the first time so socialising reached its peak during the evenings, and added a lighter dimension to the visits scheduled on the second day to the underground diamond workings and recovery plants in the Kimberley and Finsch Diamond Mines.

A special guest was Willie le Roux whose 'Notes for Beginners' had been completely revised and updated during the past months by a committee chaired by Dave Unsted. The textbook had been renamed 'Le Roux's Notes for Beginners' in recognition of le Roux's pioneering initiative. Deglon planned to salute le Roux's legacy among the ventilation fraternity by presenting him with a leather-bound copy of the new book during the banqueting ceremony.

Radon gas was not generally considered a major problem when measured in the workplace because it posed no radiological hazard even if inhaled. However in its process of decay, a series of four short-lived daughter products are formed. In a dust laden atmosphere, these daughter products which are ionised readily attach to the particulate material, and when inhaled are deposited on the alveoli of the lungs. This was the problem about which members needed to be aware. It also placed further responsibility on dust suppression in mines as the effects of radon daughters were totally dependent on control of respirable dust.

Paul Deglon opened the proceedings with a comment, 'not having had the good fortune to have studied this afternoon's papers, I am hardly in a position to comment on radon gas'. It was apt and symbolised the extent of knowledge held by most members on radon gas.

He wittily continued

'last week I did approach an expert on the subject who explained it to me in a way which he considered I might understand. Apparently there once was and still is a good lady called Mother Radon who was of noble birth. However she was unfortunate in having four daughters who were all wicked in varying degrees. These daughters all lived short but merry lives during which their main aim was to get as close to men, particularly those in dark places, as possible. Excessive exposure to the dubious charms of these daughters were however injurious to man's health.

It is rumoured that in future mines who house these daughters may have to pay licensing fees for harbouring members of this dubious family.

The mining industry is rightly concerned about the effect which these ladies is having on the health of its workers and intends taking steps to monitor and curtail their activities'.

Over fifteen papers were presented during the symposium. The balance between technical, academic and practical papers was evenly spread. Mr van Sittert from the GME's office covered the legal angle. He amused delegates with a double-edged comment when he said,

"Now what is dust? The environmentalist will probably define dust as potentially harmful airborne matter with an aerodynamic diameter of 7μm or less. Webster's dictionary defines dust as matter so finely powdered and so dry that it is easily suspended in air. Afrikaans dictionaries define "stof" in a similar way. However should you ask a mine production team leader what "stof" is, he will tell you that it is something that you must get into the main tip, by hook or by crook, with the emphasis on crook! In many instances, the "crook" referred to means ignoring all the basic rules of safety and health including the legal requirements'.

After explaining the requirements in legalise which made for dry listening, he ended his presentation on a sombre note saying

'after discussing the relevant Acts and Regulations which are in force, with the sole objective to ensure safe and healthy conditions, it is my considered opinion that the effectiveness of these statutory requirements is totally dependent on the attitudes of the people who have got to comply, meaning the very people who must be safeguarded by these statutes. In order to ensure the correct attitude and approach by these people, continuous training, education and propaganda is necessary. It is also essential that a state of constant awareness be "created" within all persons concerned. The Air Quality Section will continue with its efforts to do just that and in doing so requires the co-operation of the whole mining industry'.

It was a successful seminar generating almost R20 000 in profit for the Society. From the Icebreaker Braai on the first evening after a tiring, dehydrating drive through the midday heat, to the presentations and social events, delegates had both learnt about the potential problem of radon daughters and attained current knowledge on dust control.

Move from Kelvin House

Ever since the mid-80's, the threat of AS & TS having to vacate Kelvin House and find new premises had been an issue debated by the Society. In September 1988, Mrs Jenny Nel, Manager of AS & TS, reported to Council that a decision had been made to purchase the old CSIR site in Observatory but formal approval for the acquisition still had to be obtained from the Minister. Questionnaires to try and assess the requirements of the Societies at the new site had been circulated but member societies should note that replying in no way constituted any binding commitment.

The ball was now rolling and marked the starting point of a two year period which would be fraught with unforeseen complications and would call on all critical decision making skills of the Society's Presidents and Council.

Patterson was worried how AS & TS proposed to raise funds for the acquisition of the site and whether the Society would be financially implicated. Mrs Nel replied saying, 'we plan not to ask the Societies for any money whatsoever in their learned fee. A fund raising campaign will be organised by AS & TS and each Society will be asked to nominate ten companies which could be approached for donations'. In answer to his next question, she said that the 'possibility of another organisation taking over the office space of the present Kelvin House and running it on behalf of AS & TS is being considered. This would mean that the Societies could retain the use of committee rooms for meetings and they could also retain an office in Kelvin House. The bar and restaurant would still function'.

Council deliberated and agreed that the Society accepted the broad principle and would be interested in purchasing shares if a holding company were formed as part of the fund raising campaign. Kelvin House was, in the meantime, being renovated and the immediate priority was timeous completion for the AS & TS AGM on 18th November 1988. After the AGM, Mrs Nel reported that the minister had agreed to the purchase of the Observatory site but R 10 million needed to be raised. Besides each Society being asked for the names of 10 firms, companies would also be invited to become corporate members and these subscription fees would be used to maintain the new site. It was thought that the move would take place in about two years.

By January 1989, problems had arisen. Mrs Nel reported that although AS & TS still intended to buy the site, there were complications as re-zoning appeared to be needed and there was some contention as to whether the whole or only part of the site be declared an historical monument. The services of a professional fund raiser were also being considered as the possibility of corporate membership had been rejected by several other Societies. AS & TS would not however sign the agreement to purchase until the issues had all been resolved by which time, Mrs Nel was certain the R4,5 million purchase price would have been raised.

The purchase agreement was still not signed in September 1989. The CSIR had agreed to give consideration to reducing the price of the site but fund raising was not going well. In reply to a question by Neale Thorp, Mrs Nel advised that two floors at the Observatory site would need to be developed to meet the requirements of the Societies, and this would cost R2,5 million over and above the initial purchasing price.

In the meantime, an offer of R2,5 million had been made for Kelvin House by GENCOR. It was a good price as the market value had been set at R1,8 million. The Executive Committee and the Presidents of the Societies had given the office bearers authority to proceed but to try and obtain better terms, if possible. An additional soft loan of R3,5 million was considered necessary as R5 million was needed for the move to Observatory, and R 1,4 million would have to be re-invested as soft loan. Eventually negotiations proved fruitful with R3,5 million being agreed upon as the purchase price. Terms negotiated were an initial payment of R2,5 million and two subsequent payments of R500 000 each over the next year and a half.

The proposed move was not without consequence and was not as simple as the earlier picture had displayed. It had become an issue over which all Council members had an opinion, mostly quite vociferous. 'To move or not to move' was the question most bandied around and the least answered with certainty during this period. Council members felt torn betwixt and between the advantages and disadvantages which were more-or-less evenly balanced. The final answer which no-one could foretell with great accuracy was the future implications of any final decision on the financial standing of the society?

Good news in November 1989 greeted Council members. Mrs Nel once again attended the meeting and explained Kelvin House had been sold for R3,5 million and the CSIR had reduced the price of the Observatory site from R4,5 million to R2,5 million. The move was scheduled for the beginning of May 1990. In addition, she said that if GENCOR was not ready to proceed with building alterations of Kelvin House by May, AS & TS was negotiating a rate of R9,00 per sq. metre for remaining in the building.

Another worry now reared its head. Members wanted to know what facilities for meetings and, more importantly, the AGM would be available in the new site. Mrs Nel replied that there would be adequate facilities for meetings but initially resources did not stretch to being able to hold AGM's. Members sighed. Where were they going to hold the AGM? Luckily, Richard Gundersen solved the dilemma by arranging for the Society to use Goldfields for the AGM.

The move was proving a taxing problem for members of the Society. Not only was AS & TS running up against unforeseen complications but the Society was worrying about its own financial position. A working group was formed under Roger Hemp to consider the consequences of moving to Observatory.

In his written report to Council, Hemp wrote 'a firm recommendation is made that the Society remains a member of AS & TS'. One of the greatest obstacles to breaking away from AS & TS was the Society's obligation to give AS & TS one financial year's notice of any intention to terminate the use of any services currently provided. The catch was the timing of the financial year which ran from 1 October to 30 September and it was only May. On discussions, he said 'AS & TS have informed us that if we leave without giving the required notice, we would be liable for an annual payment of around R24 000. The basis on which this figure is calculated is extremely vague, and it could also be argued that it is AS & TS that is removing its services from us because of the move to Observatory, and not vice versa'.

Strong words from a man with a mild countenance. Hemp recommended that 'the working group continue to operate with a view to moving back to the central city area by the end of September 1991. He also felt quite strongly that services provided by AS & TS be investigated in terms of value-for-money and, in view of the financial position Council was finding itself, 'we take positive and immediate steps to place our membership and records on our own computer. It is envisaged that this will involve the purchase of a better printer, and the acquisition of suitable software'.

Paul Deglon ended his tenure as President just a month before the move finally took place in July 1990. It had been a stressful year with the uncertainty of the move exacerbating tensions already beginning to emerge over the Society's cash flow. In addition, Ilona Tredger had resigned as Secretary in November 1989 for 'personal reasons'. Some members were convinced that having witnessed all the headaches already associated with the move, the thought of actually having to physically move all the Society's belongings presented nothing but migraine potential for Mrs Tredger. No-one blamed her. In the end, Sue Moseley and her assistant, Carol Forrest together with members led by the new President, Russell Ramsden knuckled down and managed to relocate with fewer headaches than expected.

CHAPTER 38

I believe that cooling systems in the 21st century will use fluids which will have a much higher cooling capacity so that the size and cost of distributing cooling can be significantly reduced.

R Ramsden, 1990

Mine cooling towards the 21st century

Deglon's presidential term came to an end just two weeks before the Society moved from Kelvin House leaving the incoming President, Russell Ramsden, with the first major task of his year in office, However before Ramsden packed boxes, he delivered his Presidential Address to members on 22 June 1990.

An active member of the Society, Ramsden had written the chapter on water flow measurements for Environmental Engineering in South Africa plus published many articles in the Journal. He had been elected to Council in 1984 and for the next two years had served as Honorary Editor of the Journal. More recently he was Chairman of the Committee overseeing the writing of the history.

Born and educated in England, Ramsden studied physics and after graduating worked in the nuclear industry on the development of thermal insulation for gas cooled power stations. In 1972 he emigrated to South Africa to work at the Licensing Branch of the Atomic Energy Authority which he left in 1974 to join COMRO where he was Manager of the Mine Cooling Programme.

Ramsden had faced the perennial problem of choosing a topic for his presidential address and spoke of how past presidents had pointed out the difficulties of selecting a suitable subject for a presidential address. Opening his address, he said that 'in many there were no substantial developments taking place in their fields of interest or the timing was just not right. In my case, however, there are substantial developments taking place in mine cooling and, with the current interest, the timing is also right'. With the additional bonus of being at the start of the 1990's and all eyes on the 21st century I did not even have to struggle to find a suitable title. One of the privileges of giving a presidential address is that one is given some license to gaze into the crystal ball and predict future trends. I intend taking advantage of this privilege'.

He recapped saying that 'in the early 1970's many mines were forced to resort to the use of refrigeration for cooling and hence I shall limit myself to the period from the 1970's onward'. However 'since the early 1970's there has been a sustained and marked increase in the use of refrigeration which has led to larger and larger cooling systems being installed. These systems require additional skilled manpower to maintain, and are expensive in both capital and running costs. It is for this reason that there is a basic need to review the cooling systems of the 1970's and early 1980's so as to develop more cost effective and appropriate cooling systems which will meet the social norms and legislation of the 21st century'.

He called his address 'mine cooling towards the 21st century'. Covering all the pressing issues which the ventilation fraternity had to address to ensure the continued viability of the gold mining industry, he made the pertinent comment 'what are acceptable conditions are continually changing; what was perfectly acceptable to our parents is no longer acceptable and it is likely our children will demand even higher standards'.

When talking about how cooling from refrigeration plants is used he said that 'in the 1970's mines developed a three phase cooling policy. In the first phase, all the service water used in mining operations is cooled. In the second phase, the ventilation air is cooled in large bulk air coolers. In the third phase, the ventilation air is cooled in smaller quantities closer to the workings'.'

There had been a large increase in the cooling distributed through small air coolers positioned close to the working face but 'in recent times these air coolers have fallen from favour because of high maintenance requirements, flow control problems resulting in poor performance and generally high operating costs. I believe that many of these shortcomings can be overcome for future installations, in which, due to mechanisation and advances in mining methods, size and weight restraints might not be such limiting factors'.

He then covered the present trend where the majority of new refrigeration plants are installed on surface rather than underground. The reasons 'as you are all aware, are better heat rejection facilities, easier maintenance, and in general they are regarded as being more economical and practical to operate'. He explained that recovery turbines were also being introduced underground and that present developments were taking place to produce more efficient cooling using recovery devices such as three chamber pipe feeders which would further reduce pumping costs.

Problems with large cooling installations of 100 MW or more were then described before moving on to legislation where, he explained, changes can make equipment which had cost the mining industry millions of rands, both redundant and illegal to use. Using recent legislation concerning polyurethane as an example, he said that the outlook was not always gloomy and concentrated on the positive aspects of the change saying 'through good co-operation between all interested parties, suitable substitutes for polyurethane insulation have been found'.

The Montreal Protocol would however impact quite severely on mine cooling in the 21st century. He said that 'unless the limitations in the use of CFC'S are eased then many mines may well be faced with major expenditures. I am not qualified to talk about the effects of CFC'S on the ozone layer and hence shall only touch on them in general. However, I believe that this issue demonstrates why we, as mine environmental engineers, should be aware of developments taking place which at first sight are not related to our discipline'.

The properties which had made CFC'S so attractive to industrial chemists were their stability, inertness and low temperatures at which they turned from liquid to gas. This meant that they were the ideal refrigerant for both household and industrial refrigeration plants, and made them ideal as blowing agents when producing expanded foam plastics such as polyurethane. What was unknown was the effect CFC'S would have on ozone which prevents ultra violet radiation from reaching the earth's surface. It was now common knowledge that CFC'S decompose under the strong ultra violet radiation in the stratosphere and that one of the products of the decomposition is chlorine which acts as a catalyst in the destruction of the ozone layer. After explaining the basics of the CFC'S issue he left members with the thought 'I would like you to think for a moment; the mine environmental engineer is planning cooling systems to ensure a healthier working environment four kilometres below the earth's surface; to produce these conditions he uses refrigeration plants which make use of refrigerants that are having a detrimental effect on our environment due to chemical reactions taking place 25 km above the earth's surface. This is the extent of our interest: four km below surface to 25 km above surface'.

On prediction of minimum cooling requirements, Ramsden stressed the importance of computer modeling software for predicting heat loads but made the pertinent remark that it is almost impossible to obtain reliable data even for fundamental parameters such as mine production. This leads to environmental engineers designing cooling systems with extreme caution. The negative aspect of this approach is that it can lead to 'additional costs, and in the extreme cases make certain mining ventures uneconomical'. He continued saying 'I wonder whether our colleagues in the mine planning teams realise the additional costs which are incurred due to their so-called flexible approach. In fact I believe that we have an obligation to demand accurate data so that economical cooling systems can be designed and installed. Doug Grave in his presidential address in 1962 recognised the need for the ventilation engineer to be included in the initial mine planning team and not to take a backseat.

Although I acknowledge that mines grow and must change throughout their lives, it must be recognised that the less precise the planning data, the greater uncertainty and hence the greater the ultimate costs'.

Members present nodded as accurate data had always been a problem faced by the fraternity when planning ventilation and cooling requirements of a mine.

They also concurred with Ramsden's opinion regarding conservative approaches and knew he was thinking of the future when he said 'Over the last ten years there have been substantial developments in reducing mine heat loads for deep mines. These include backfilling of worked out areas, recirculation of the ventilation air, and insulation of intake haulages. The benefits to be achieved and limitations have been well publicised by our Society, both in the annual symposiums and the Journal. In spite of the careful and thorough analysis, environmental engineers are reluctant to introduce these practices on a minewide scale. For example, recirculation is only considered as a last resort, yet everyone acknowledges its benefits. I believe the time has come for environmental engineers to make a stand, to plan and introduce these technologies in new mining ventures'.

Ending his address with predictions for the 21st century, Ramsden said he believed that increased refrigeration would be needed in deep mines despite developments in reducing heat loads. Most of the plants would have to be installed on surface and would probably use fluids which have a higher cooling capacity than water so that the size and cost of distributing the cooling can be significantly reduced. In closing, he felt that many systems will use ice but to ensure that this technology is available for the needs of the 21st century, development is required now.

It was a stimulating and thought provoking address. Dick Stroh gave the Vote of Thanks where he said 'there is no question that environmental issues that were once relegated to the "greens" are now increasingly becoming the concern of mine environmental engineers and rightly so. Social norms as noted by Russell dictate that the quality of life for all mine employees, surface and underground, must be assured by providing a safe and healthy environment'.

With a twinkle in his eye, he concluded saying 'Mr President you have been intimately involved with the compilation of a history of the society. The first edition will conclude with the events of 1980. Perhaps you had the next edition in mind when preparing your address. When those responsible for updating our history look back, they will find your address of value. You have covered the current practices and have looked ahead and predicted the requirements towards the 21st century. I am sure the historians will find that your "crystal ball" was remarkably accurate'.

Expenditure crisis

At the end of Paul Deglon's presidential year there was a growing awareness that the society would have to cut its expenses and maintain its revenue if it was going to survive the current recession, Council did not hold much hope that income would increase.

Retrenchments in the gold mining industry were becoming a way life and there were very few vacancies to be filled. In Gundersen's words in the August 1990 editorial, 'the writing is on the wall - and all over the press. Daily the newspapers carry headlines about jobs on the line. The next phase will be the closure of mines'.

He continued asking 'are we the victims of natural cycles in commodity prices reflecting altering perceptions of supply and demand? Is this compounded by world peace and even the changing events here at home? Maybe so. But what are you doing - toddy? Everybody on the mine can make a contribution. How many unnecessary jobs are you doing? Are all the reports necessary? Are they too elaborate? Rationalise paperwork - and the time spent on it, both in preparing and reading it. Report by exception - focus attention on the real problem areas.

What can we do underground? What inefficiencies have we grown accustomed to that can be improved? Why do we ventilate and cool when there is no-one there? How long do you spend underground?'

Changing to exasperation, his tone was reminiscent of Barenbrug in the early days when he wrote 'What is so difficult about the compressed air problem? Our past president, Mr Paul Deglon, gave us the facts a year ago. What progress has been made?

Have the leaks been fixed? Five hundred million Rand a year may save your job - even mine. Are they being reported? Can you help fix them?"

"Change is essential. And that includes your lifestyle. Pull in your belt now to safeguard your future. Do it today because tomorrow may be too late.'

This editorial accurately summed up the current situation in which the gold mining industry found itself. The spin off was that the Society was inevitably going to find its own finances under strain.

Ramsden worried he would be the last president after Christo Oberholzer's financial statements were tabled for July. It was clear that the Society was spending more money than that being generated, and Oberholzer estimated that expenditure would continue to exceed income by R10 000 per month for the remainder of the financial year. The income from membership had been overestimated in the original budget and this needed to be revised. The stern warning was that a very concerted effort was required to generate income to maintain the Society's finances.

Members were unanimous that the costs incurred in payment to AS & TS were excessive. Ramsden reported that at a recent meeting with AS & TS, it had become clear that the Society would face bankruptcy if they had to meet the anticipated fees of R99 000 for the year. The problem had been partly resolved by AS & TS agreeing to the MVS taking over the responsibility for membership and accounting as these were high cost centres. This would save the Society about R4000 per month.

Another burden was the Environmental Engineering book. The market was saturated and its present price tag made it difficult to sell. The R300 000 worth of books being held by the Society was a liability because sales were almost non-existent. It was proposed that Council consider packaging the book with le Roux's Notes for Beginners to try and at least recoup the printing costs. The book had only cost R45 000 to be printed and as long as the cost did not fall below R23, the Society would break even.

In August, Hemp swung into action. He described the picture as frightening and felt that little constructive action was being taken by Council other than deciding to ask the Chamber of Mines for an increase in membership fees. He stressed that without a strategic long term plan, Council was only delaying the demise of the Society and all possible ways of increasing revenue and decreasing costs must be examined immediately. He was also concerned that before granting an increase in membership fees the Chamber of Mines would want to see a copy of the MVS balance sheet which unfortunately, showed a lack of discipline.

Gundersen, on the other hand, made the comment that if the Society was indeed losing R10 000 per month, he would also panic but felt that an accurate financial picture was not being portrayed as running and capital costs were not being differentiated. Bluhm agreed and concurred that not all members were convinced the problem was as severe as that being outlined.

The next issue which was raised was the cost of professional help for the Journal. The money being paid was considered by some to be a luxury the Society could not afford and, it was felt that in the past, many of the editors had handled the production themselves free-of-charge. Gundersen was asked to investigate and justify the costs of using professional help as well as looking into the possibility of Holding, on his impending retirement, doing the work or training the secretary to write articles, do the layout and illustrations, edit the Journal and proof-read.

Gundersen agreed but stated quite clearly that he would find it extremely difficult to continue as editor without professional help, because of his own work load at Goldfields.

By the end of Ramsden's tenure as President, the Society had succeeded in reducing costs and only showed a deficit of R20 000 compared to the R120 000 forecast by Oberholzer at the beginning of the financial year. The secretariat was reduced to Mrs Sue Moseley, advertising revenue was up and the decision had been taken to cease using professional help for the Journal. Publication of the History of the Society which had been written to the cut-off date of 1980 was to be deferred. The Data Book under the chairmanship of Patterson was the only project which was to be continued as it was believed that it could be a major source of revenue.

Environmental Protection

In the early 1990's the Society started to take a greater interest in general surface environmental issues such as land rehabilitation and water pollution. After much discussion, Council decided that it would provide an ideal subject for the 1991 Symposium.

The seminar was held in Witbank at the Cultural Centre on 12 March and called Environmental Protection. Considering the current economic climate, the turnout was very good with over 200 delegates and twenty companies who exhibited in the foyer. The proceedings were opened by Jan Raath, the Government Mining Engineer who acknowledged that 'having a quality environment and developing mineral resources are not mutually exclusive goals' but that 'we can and must have both'.

He also made the point that 'environmental issues are beginning to enter the political debate in Southern Africa, although they are not yet as significant as in Europe or the USA. This trend will grow and eventually "green issues" will govern politics to a similar degree here as they do elsewhere'.

He continued

'I am of the opinion, and this symposium demonstrates that you agree, that there is a need for the mining industry to participate in telling the public what is good about mining and to recognise that complacency can bring an end to many a mining venture much faster than all other factors affecting the survival of our mining industry'.

'The mining industry has the knowledge and expertise to lead the fight against environmental deterioration. For too long it has been regarded as the enemy of the environment, the killer of nature. We must correct this misconception and it must be seen as the natural starting point to create harmony between conservation and mining'.

Raath was a man of calibre and had an uncanny ability to foresee the future. So he was taken seriously when he said

'It is not the people sitting in some government building who will determine whether an effective environmental policy will succeed but it depends on those implementing it in the specific area concerned. It depends on you present today'.

He ended his opening address in a positive context showing his faith in members when he said

'Gentlemen, this symposium has been organised to help you formulate policy within the broader mining environmental context and I wish you well and trust that deliberations here today will assist you in perpetuating our most precious environmental assets. And that it will also help you perpetuate an even more precious asset namely a healthy mining workforce'.

It was an interesting symposium covering issues which were not thrust upon environmental engineers during the course of their daily duties but which impacted on the future of the discipline. Council also heaved a sigh of relief when Oberholzer announced that it had made almost R 18 000 in profit. It was money that the Society truly needed.

CHAPTER 39

Try with the best of your ability, courage, enthusiasm and dedication to obtain a superior technical achievement which will contribute to and promote a healthy and agreeable surrounding for all men, in open spaces and indoors.

Code of Environmental Ethics

1992 financial year

The President for the 1992 financial year was Jimmy Guthrie who had been a member of the Society for over 20 years. Beginning his ventilation career in 1965 at Nchanga Consolidated Copper Mines, he moved to South Africa three years later where he obtained his Elementary Certificate in Mine Ventilation and joined the MVS. In 1970 he passed his Advanced Certificate and was admitted as a fellow of the MVS.

Known as a dedicated and enthusiastic member of the Society, Guthrie's choice for his Presidential Address on the history of diamond mines showed the versatility of his wide experience in the mining industry. Members acknowledged that there were few among them who could claim to have worked fairly extensively in gold and diamond mining as well as in base metals. Guthrie characteristically shrugged this off but it was known that during his career he had spent 8 years in gold mining, 5 years in base metals and 5 years in diamond mining. Since 1986, he had worked at Anglo American Head Office where he was currently responsible for the environmental needs of the Diamond Division.

Elected to Council in 1985, he assumed control of the difficult Visits and Meetings portfolio. His level-headedness and organisational abilities were amply demonstrated in 1989 by the successful symposium held on the effects of mechanised mining on the underground environment at the Carlton Hotel in Johannesburg.

Guthrie's Presidential Address comprehensively covered the history of ventilation in South African diamond mines. It was a topic he was well qualified to discuss. Taking cognisance of most members' ignorance about diamond mining, he began simply by explaining why diamonds are coveted. Basically they are more than five times harder than the next known substance which is made possible by strong covalent bonding of carbon atoms which are tetrahedrally bonded to four equidistant neighbouring atoms. A diamond is regarded as the prototype of crystals and the whole crystal can be regarded as one giant molecule.

Diamonds are found in intrusive pipe and dyke-like bodies of igneous rock as well as alluvial deposits. Natural diamonds occur on all continents and in 1960, Africa made-up 95% of the world's known diamond resources of 636 million carats with 79% being located in Zaire. Demonstrating changing patterns, he said

'today, total known diamond resources are 2,5 billion carats of which South Africa has 40%, Zaire 12%, Australia 37% and Botswana 1% with Russia and China as yet unknown factors. Diamonds are mined in some twenty countries on four continents, and give employment to over 200 000 people in the formal mining sector and countless independent diggers, legal and illicit'.

Guthrie then covered old mining methods including chambering, block caving and bench mining. New methods had evolved into using mechanisation with sophisticated ventilation planning and design.

A unique aspect of diamond mines is the need to handle the ore as dry as possible especially when decomposed varieties of kimberlite are mined. He explained to members

'for these reasons, dust control for all ground handling operations except at the face is accomplished by suitably designed dust filtration plants that filter out the very fine dust and reintroduce the cleansed air into the mine ventilation system for re-use. The dust produced has a very low silica content and thus a low toxicity level but this benefit is partially offset by the large amounts of dust produced. Dust loads at some dust plants can be as high as 50g/m3. Poorly designed or maintained dust control systems can result in voluminous dust clouds, not unlike blasting fumes, entering the workings, limiting the visibility and causing stoppage of work'.

He continued saying

'the most convenient and economical method of dry dust disposal after capture is to return the untreated collected dust into the product stream from where it came. Obviously, the position of the re-introduction is critical to prevent the dust from being re-entrained into the dust extraction system. The position of dust re-introduction must be downstream of, and outside, the dust collection zone. The argument that this method produces dust problems further along the system is invalid. Tests have shown that only approximately 0,05 per cent of all available dust is collected at a specific extraction point and returning the untreated dust into the product stream has an insignificant effect on other downstream collection points especially with decomposing kimberlite. However, what is problematic is trying to re-introduce fine dry dust onto a conveyor belt system that moves at speed and is prone to stop-starting for whatever reason'.

In conclusion he said that the 'transition from open pit to underground mining and from old underground mining techniques to modern mechanisation methods has been a testing time for ventilation practitioners. In addition keeping abreast of the rapid technological changes in diamond mining methods has been, for the environmental engineer, a major challenge. The lack of similar technical expertise in the outside mining world to draw from has meant that a number of in-house innovations had to be tried and tested with varying degrees of success and failure'.

Change in Journal editorship

With Council's decision to end professional help for the Journal, the responsibility now fell on Sandy Nicoll of Rand Mines who had volunteered to both take over the editorship from Gundersen and the production from Melanie Low. He was about to be introduced to the publishing world and all its associated jargon. As Gundersen wrote in September 1991, 'it is hard to believe that this, my last editorial, is already my 24th. It does not seem that long ago when I stepped with fear and trepidation into Rod Burton's shoes and ventured into the publication world - a foreign land with a language of its own. Familiar or recognisable words took on new meanings - "point", "tone", "origination" - although there are some more obvious expressions such as pasting-up'.

Gundersen however still remained involved with the Journal. In October 1991, Nicoll wrote 'this issue of the Journal coincides with the departure of our previous Honorary Editor, Richard Gundersen who, as Junior Vice President of the Society, has now taken over the very important portfolio of Chairman of the Finance Committee so his involvement with the Journal continues as controller of the purse-strings'.

His wry sense of humour was apparent to members when he continued saying 'that leaves yours truly as the new Editor. Perhaps it is significant that Council has seen fit to appoint a Scotsman in this position in the light of the current situation. My brief, however, is simple; to maintain the high standards set by Richard and Melanie whilst keeping within the agreed (reduced) budget. In practice that may not be so easy'.

Easy or not, keeping within the budget was what Sandy Nicoll did. At the end of Guthrie's presidential year, he announced to members that 'under the enthusiastic leadership of Mr A W Nicoll, the Journal has maintained its high standard and once again promoted the image of the

Society. The professional help used over the previous five years to produce the Journal has ceased for sound financial reasons. The Journal is now totally compiled by the Editorial Committee members and is a fine example of voluntary effort given to our Society. This is the first time, for many years, that the Journal has paid for itself'.

Regarding the Journal Advertising Committee, he said 'once again, the difficult financial climate in which the mining industry finds itself has had repercussions in the advertising world. The Journal Advertising Committee under the chairmanship of Mr G Janse van Rensburg has had to work hard to promote advertising to potential clients as well as maintaining the needs of our long serving advertisers. To all our old and new advertisers, we extend our warm thanks, without their support, the Journal would not survive'.

It's been a tough ten years

Shaft Talk, introduced by Russell Ramsden in 1984, as a means of getting around the problem of long winded technical papers was still the only platform available for short to-the-point articles. Generally however the content was non-contentious. This cycle changed in December 1991 when Nicoll printed the frustrations of an anonymous ventilation practitioner. Called 'its been a tough ten years', the article bemoaned the extent to which the ventilation officer's responsibilities had increased over the past ten years. Starting off fairly innocuously, the anonymous writer moved onto more damning issues when he said 'ten years ago radio-activity was something we associated with uranium mines and nuclear power stations; now we are told that our underground workers must be examined, monitored, protected and cossetted, and if we cannot detect any levels of radiation sufficiently high to justify this, then by golly the allowed standards will be lowered until they do'.

Continuing this theme, he wrote

'there is now much more for a ventilation man to do and much more for him to know, and it is doubtful whether many of our recruits are equal to the job. Mine ventilation, in all of its ramifications, takes up now a much larger fraction of the working costs. When we protest, our legislators point out how little the current exercise is going to cost, actually, but no-one has sat down and totted up just how much the whole ten years has added to the bill.'

Although acknowledging the need for health and safety standards, Anonymous however felt that the balance between safeguarding employees and the realities of mining and its job opportunities for a mass of unemployed people was becoming precariously problematic. He continued saying

'how much of what has been introduced during the past ten years is really justified? Are we in danger of introducing standards appropriate to a high-tech installations in Switzerland rather than to a developing third-world country with a jostling mass of hungry mouths all clamouring to be fed. And just why are legislators pressing ahead with such determination anyway? What is their real motive? To be sure, the stance of an institution such as the Mine Ventilation Society of South Africa must be to uphold standards of health and safety, and there is no question that it does. But what are the world's best standards of health and safety worth if there is no longer a mine? Mercifully, the day will never come when the average mineworker will have the choice between the risk of an industrial disease contracted on a mine, and the death of himself and his family from starvation. But let us not forget that the Northern Hemisphere is littered with mines and factories that have shut down precisely because the demands of health and environmental protection could no longer be met'.

This was a debate which had raged for years. Nicoll by publishing this Shaft Talk had however surely put the cat among the pigeons. There had to be a response. Dr Johan Kielblock, Industrial Hygiene Consultant at Comro, who had spent his professional life dedicated to improving health and safety on mines, responded immediately.

He began by saying that the arguments put forward in the article did offer validity and pragmatism but another important perspective was that health and safety standards only become crippling and the demands excessive when potential hazards are persistently ignored until inevitably disaster strikes.

Concerning the Northern Hemisphere being littered with mines and factories that have shut down because health and safety standards could not be met, he remarked that if the demands had been reasonable and realistic and compliance still impossible, such operations deserved to be still-born or closed down. He continued saying 'the crux of the matter, therefore is exactly what constitutes a "reasonable" or "realistic" standard. Fundamentally, a reasonable/ realistic standard can only be derived through genuine commitment to proactive health and safety strategies. Such strategies, if permitted to evolve and grow in parallel with the operation in question and if based on sound expertise, provide the potential for being immensely cost-effective and, indeed, profitable in the long-term. In other words, the operation itself sets standards, subjects them to regular review and comes to be regarded and acknowledged as the expertise base.'

A practical man, he put the issues raised by Shaft Talk into perspective. He continued with

'in the present context there are three main sets of players: the industry or operation, the employee representative organizations and the legislators. Any industry which takes the lead, especially with regard to health and safety issues, leaves stragglers and incompetents behind and pre-empts the imposition of unrealistic standards. Conversely, an industry which does not lead surrenders the initiative to the remaining players who, in view of their own precarious juxtaposition, act in pendulum fashion. The result, in numerous instances, is an "unrealistic" standard, not only because of "political" motives, but also because, in the absence of a sound expertise base, a common enough phenomenon, there is a need to be over conservative. Very often also, off-the-shelf standards applicable to unique circumstances in other countries and industries, and largely irrelevant to local requirements, are used thereby introducing a further complication.

'Commitments to health and safety cannot be excluded from production costs, productivity and overall profitability. However, such commitments are long-term investments. On the other hand, to surrender the initiative in the interests of possible short term gains simply paves the way for the imposition of standards which, at best, can only be challenged from a position of relative weakness. The alternative is a costly capitulation exercise. This is when a standard becomes crippling and branded "unreasonable".'

He ended on the prophetic note, 'in agreement with the Guest Editor ..... Yes, it's been a tough ten years ... but then, don't we often make it tough on ourselves?'

At the same time that 'It’s been a tough ten years' was published, another article also appeared reminiscing about past years. This time the memories were penned in a lighter spirit. Past president, Bill Holding, wrote an article in December 1991 celebrating two of his personal anniversaries. In 1991 he had been a member of the MVS for 25 years and 40 years had passed since graduating from the University of London. Following in his own tradition, the article was witty and entertaining. He told the story how after graduating he found himself on the coalface carrying out a time and motion study. He said 'obviously this was not popular with the "troops" and soon I was confronted by a burly miner. Expecting a torrent of expletives and threats of violence, I was amazed to hear him say, very correctly, "Young man, it is my unpleasant duty to inform you that if you don't leave this coalface, we will." I left.'

Recalling some of the old days in the MVS, he said, 'these were the days of metrication and the process was being pursued with great zeal, which was rather irritating to some of the old guard. We were at a meeting at which was tabled a letter from the Metrication Board complaining that one of the fan companies was still issuing characteristic curves in the old units. Nobody knew what we were expected to do about this traitorous act, then Doug Grave said, very aptly, "Mr Chairman, I think this calls for a public flogging!" This struck exactly the right note, a tongue-in-cheek response to a ridiculously serious request.'

Rescue strategies in South African coal mines

One hundred and ninety eight delegates attended a one-day workshop at Secunda Collieries held by the Collieries Branch on 14 May 1992. Since promulgation of legislation on the deployment of self-rescuers in South African mines the previous October, this workshop was the first review dedicated to a comprehensive assessment of collieries' experiences so far. The programme was structured to cover all self rescuer operations on a wide range of subjects with particular attention given to incident analysis, hazard detection and communication, emergency response, back-up facilities, infrastructural requirements and optimised cost-effectiveness.

The workshop was opened by Mr Jan Raath, Deputy Director-General, Department of Mineral and Energy Affairs. He stressed that an integrated approach to safety was essential and highlighted regular training to generate worker trust and a feeling of safety knowing that management is sincere in executing its statutory duty of care. A further valid comment was that the enhancement of safety was closely related to a growing sense of ownership and self-pride thereby fostering a more pro-active climate.

Key issues identified in the papers presented on training were that it remains a management commitment and should not be seen as some kind of punishment. It should also not be associated with rewards. Regarding safety, the recent incident at Hlobane Colliery showed the need for escapees to operate within the capacity of the self rescuer and not to attempt to run to safety. Poor visibility was also identified as a crucial factor. Protective goggles should be supplied as a standard component of all approved self-rescuers as poor visibility resulting from eye irritation was becoming an issue which could no longer be ignored. Signs also needed to be more visible to assist escapees in retaining their sense of direction.

The financial impact of recent developments to improve escape and rescue strategies were covered by Roger Hemp. It was evident that the mining industry's commitment was substantial in this respect. The concept of refuge bays as integral to the escape strategy was well established on most mines. Costs per bay varied considerably from about R10 000 to R48 000 which showed the extent to which requirements are mine-specific. Nearly 40 000 self-rescuer units had been purchased so far at a total cost of about R27 million. Moreover many mines had installed monitoring systems for methane, carbon monoxide, combustion particles, smoke and air velocity at costs varying from about R30 000 to R3 million. Hemp said that with a financial commitment of this magnitude, the means should be established to ensure that collieries realise a maximum return on investment. In this regard, Trompie van Rensburg's presentation which identified the benefits of an ongoing self rescuer monitoring system was most appropriate. Such benefits include optimised safety, compliance with legislation, negotiating agreements with suppliers from a position of strength and planning self-rescuer replacement programmes when applicable.

The workshop ended on a highly positive note with delegates agreeing that dedicated seminars of this nature become a regular feature of the MVS's programme of events. As usual the day ended in style. With a well prepared braai and refreshments, further informal discussion of the day's proceedings continued until late into the evening. Luckily as some observed, these stayers were past masters of the art of self-rescue.

CHAPTER 40

We are going to need dedicated personnel who are master of their subject to cope with the increasing challenges facing us in the underground environmental field where ever increasing costs and the necessity for providing better working conditions remain major obstacles to viable mining operations.

Pierre Cilliers, 1992

Recirculation of air in practice

Although the controlled recirculation of air in underground mines was not a new concept in 1992, it had not met with enthusiasm within the South Africa mining industry. This surprised Harry Rose particularly in light of the mining sector circulating some 48 000 m3/s of air which in turn cost gold mines some R200 million each year. Following the successful field trials at Loraine Gold Mine in the early 1980's, GENMIN felt that the controlled recirculation of air had a strategic benefit both for their active mines as well as for the ventilation of new mines.

During the mid 1980's, GENMIN made the decision to increase the tonnage being mined from the No.2 Shaft at Winkelhaak Gold Mine. After discussion it was agreed that more air than catered for in the existing infrastructure was required if the increased tonnage was to be realised. Some 120 kg/s would need to be conditioned and recirculated to the lower portions of the area.

An important consideration throughout the project was the risks and hazards which could result from a component failure. Fire and gas detection monitoring systems were installed at each recirculation fan site, and to reduce the risk of component failure, the detection systems were duplicated. In addition, electrical interlocks were installed between the booster and recirculation fans to prevent the main surface fans from operating in the stall should a booster fan fail.

The system first came into use in late 1987 and by 1992, no problems had been experienced. Harry Rose, Group Consultant, Ventilation Services at GENMIN and a past president of the Society, decided in the spirit of dissemination of information to members, it was time to write a short, concise paper covering the basic issues. Part of his motivation behind writing the paper was to try and break down the industry's apparent reticence to adopt this practice.

It was an excellent paper. Completely to the point and written in accessible English, he outlined the basic considerations, air and cooling circuits as well as safety systems. His conclusion left no-one in doubt about the benefits of well planned controlled recirculation. He said

'the recirculation project at No.2 Shaft, Winkelhaak Mine has certainly met its prime objective, that is to adequately ventilate the new production area.

'For a capital cost of R7 million the gold production from this area has already increased by approximately 120 kg/month - certainly a worthwhile return. Indeed the economics of recirculating air is very attractive when one considers the cost of circulating 1 m3/s is R4 000 per annum. If South African gold mines were to adopt a recirculation programme of say, 30% per mine, the cost of processing air could fall by some R50 million per annum.'

The paper was exactly in line with Barenbrug's original intent. It served as a vehicle for spreading good practical information which could benefit the mining industry as a whole particularly in light of the depressing economic climate currently prevailing.

Future implications of environmental ergonomics

The Society's new president for 1992/3 was Dr Johan Kielblock who currently held the position of Industrial Hygiene Consultant at COMRO. Holding an MSc from Stellenbosch and a Doctorate from Potchefstroom University, Kielblock was world renowned for his work on heat stress and acclimatisation.

His Presidential Address tackled the future implications for the South African mining industry of environmental ergonomics. Basically environmental ergonomics embraces both preventative engineering and personal protection. If based on a total approach, Kielblock felt that it had the potential to make a significant contribution to occupational health and safety. He suggested that this potential had not yet been exploited to the full and that major challenges lay in establishing an integrated and co-ordinated occupational health and safety programme locally, and defining the precise role, function and legal responsibility of the environmental practitioner.

Regarding an integrated programme, Kielblock believed the South African mining industry was well placed to achieve this objective but, on an industry-wide basis had failed to do so. He mentioned that

'the Chamber of Mines is a logical facilitator .....yet even at the highest level of representation of the environmental control discipline and of the medical profession, no formal communication links exist, let alone any mechanism to co-ordinate and rationalise the respective health and safety functions.

'One of the most important consequences of a fragmented approach is the extent to which health and safety research and technology could be diluted, biased and, even, in instances made irrelevant. The essential interaction between prevention and cure, the major strategies in an overall programme of occupational health and safety, is lacking. According to the National Union of Mineworkers, "...a large number of committees in the mining industry are responsible for mine safety and health. Each committee has its own brief .... There is no overall co-ordination. Resources are locked into separate committees.'

It was one of the first presidential addresses for years which directly criticised the mining industry. Some members were quite taken aback and did not necessarily agree that structures were as dismally disintegrated as Kielblock was portraying. But it was food for thought. The new South Africa was waiting in the wings and input from the different political parties was surely going to have an impact on the mining industry's attention to health and safety.

Kielblock continued stressing that the mine environmental practitioner is in the front line when it comes to health and safety matters on the individual mines but still, in many cases, does not receive the recognition he deserves. To achieve credibility, environmental control practitioners need their qualifications recognised by organised labour and government as well as the mining houses. If there are short comings with their present qualifications, these must be rectified.

In conclusion he felt that an enhanced occupational health and safety programme could provide the mining industry with a meaningful instrument to achieve and retain long-term viability. In a general sense the major impact will be derived from preventative strategies but more particularly, from environmental ergonomics. The major challenges facing the industry in this sphere could be summarised in terms of co-ordination and a commitment to pro-active preventative strategies. Potential benefits likely to emanate from this approach included improved worker morale, reduced operational costs as a result of decreased accidents and of loss of property such as during fires, self regulation from a position of trust and creditability, and an improved industrial relations climate conducive to constructive negotiation.

It was almost as if Kielblock had access to a crystal ball foretelling the route that would be taken in the new South Africa when formulating the new Labour relations Act. His advice was not only sound but progressive and in line with first world thinking on the subject.

Fifth International Mine Ventilation Congress

1992 marked the year in which the International Mine Ventilation Congress returned to South Africa. The first Congress had been held in Johannesburg in 1975 followed by Reno in 1979, Harrogate in 1984 and Brisbane in 1988. The spotlight this time however fell on a South African mining industry operating in a fundamentally different political climate to that in 1975. The United Nations General Assembly had recently voted to lift all cultural and scientific sanctions against the country which members believed would help boost attendance at the Congress. It would also be easier for overseas delegates to visit South Africa and, similarly, it would be easier for South Africans to travel overseas and not endure the drama endured when trying to get visas for the Brisbane Congress.

Organised by the indomitable John Burrows, the Congress lived up to its reputation so solidly established in 1975. Some 200 full-time delegates attended the proceedings at the Sandton Sun Hotel from 26 - 30 October which was followed by post congress tours to the Eastern Transvaal and the Cape. More than 50 technical papers were presented which afforded delegates ample opportunity to exchange ideas.

The Society was honoured to have as its guests of honour, Minister George Bartlett, Minister of Mineral and Energy Affairs and Mr Edward Hugler, assistant Secretary for Mine Safety and Health, US Mine Safety and Health Administration who, respectively, delivered the opening and keynote addresses.

George Bartlett welcomed guests and stressed that the importance of health, safety and hygiene can never be over-emphasised. He gave an overview of the government's new tripartite policy whereby government, industry as employer and the employee are all involved in matters of common interest. Putting South Africa's mining potential into perspective he said that the RSA possesses the largest known ore reserves of chromium, gold, manganese and vanadium in the world. During 1991, the country exported more than 60 different minerals from 1 050 underground and opencast mines to 85 countries. Most of these exports were to Europe and the Far East. Mineral exports in 1991 amounted to almost R40 billion of which gold contributed 63% followed by coal at 14% and the platinum-group metals at 9%. The mining industry also employed some 640 000 workers annually.

Hugler, in his Keynote Address, began by congratulating the South African mining industry on its fine safety achievements over the past few years and mentioned, 'I'm told that in 1991, one of your collieries worked more than six years without a fatal injury and a platinum mine broke a 27-year-old mine record by working more than 3 million shifts without a fatal accident'.

He continued talking about the changes seen in the world's political, social and financial systems that have been ongoing for some time, and how the future effect is difficult to predict of all these variables and other shifts in the dynamics of the global marketplace. His basic conclusion was 'we are living during one of the great watershed periods of human history, and that the pace of change is just as likely to accelerate as it is to slow down. None of us knows what the next change is going to be - what unexpected opportunity is right around the corner, waiting to transform our lives'.

Posing the question, 'are we doing enough to meet future safety, health and task training needs and changing requirements of new technology/ In Short, is the global mining industry up to the job of seizing the opportunities and managing the risks? Hugler was confident that the mining community with its history of proven ingenuity and determination was equipped to face the challenge. 'It takes a special breed of people to look at a landscape - whether it be a mountain or open plain - and imagine, for example, a mine such as Western Deep Levels Mine, extending so far below the surface.....And then to engineer that vision into reality and make it a profitable enterprise'.

It was a motivating speech and set the tone for the next 5 days. The months of intense preparation by the MVS had paid off and once again, showed how important a medium such as the International Congress was for interchange of knowledge and ideas between mine ventilation practitioners and academics throughout the new global community.

CHAPTER 41

Ideally, I would like to see a situation where the mining industry is sufficiently pro-active so it can be self-regulating and simultaneously avoid unnecessary pressure in occupational health and safety matters.

Johan Kielblock, 1992

Data Book

Monday, 26th October 1992 was one of the Society's landmark dates for it not only heralded the first day of the 5th International Mine Ventilation Congress but also saw the launch of the Data Book. Initially conceived during the Society's first Strategy Committee meeting in 1985, it had taken 7 years to complete.

Dr Andrew Patterson had spearheaded the project from suggestion to completion and at the launch said 'it was a hell of a lot of work but the end result is very satisfying'. One of the tasks given to the Strategy Committee in 1985 was finding ways to spend the Society's money for the benefit of the members. As Patterson remarked later 'in the light of the financial difficulties the Society ran into in later years this looks quite amusing but it was a fact that at that time we had accumulated a lot of funds in call accounts and the like, amounting to over R500 000 as I recall'.

After the initial meeting, the Strategy Committee had recommended to Council in September 1985 that a data book be published. They suggested 'a book be compiled by the Society containing design data on all aspects of Environmental Control. The data will be obtained from various publications and in consultation with experts in each field. This would be a most useful publication since available data are, at present, widely spread in various books and are, in some cases, vague. Its size will be approximately that of Mine Ventilation Notes for Beginners, at an estimated cost of R20 000, spread over three years. This outlay will be recouped from the sale of the publication.

The possibility of including an "equipment" supplement in the book showing photographs of various types of equipment presently in use, should be discussed as this may enhance the appearance of the publication'.

Work had progressed steadily albeit slowly over the years. The amount of detail involved in each section was voluminous and, as members were all writing their designated contributions in their spare time, Patterson found it difficult to be too heavy-handed in meting out deadlines. By 1989, it was decided that the Data Book would be a handbook of technical information on mine ventilation and related topics. The information would be presented using definitions, equations, tables, charts, graphs and diagrams with little or no written text. It was envisaged that it would cover fluid flow, thermodynamics, standards and hazards, ventilation practice and heat as well as other practices such as compressed air, noise control, water quality, and fires and explosions.

By the AGM in June 1992, the outgoing president was able to report to members that the Data Book would meet the set deadline to coincide with the forthcoming Fifth Mine Ventilation Congress. Advertising space was being sold to interested manufacturers to help meet the costs of publishing the book, and a successful cocktail party to promote the book had been attended by some fifty manufacturers representatives and authors. The twenty manufacturers showing interest in purchasing space had the potential of generating approximately R40 000 towards the publishing costs.

Following a chaotic last few months of production where an additional typesetter had to be employed to cope with the volumes of material now descending on Patterson, the Data Book was launched on the evening of Monday 26th October, the first day of the International Congress. As planned it took the form of loose, three-ring bound A5 sheets similar to that used by computer manufacturers for manuals. The cover of the file was black and gold in line with the MVS publishing corporate identity. The Data Book eventually contained over 600 pages of information which were arranged into 22 main sections. The final production cost for 550 copies was R 104 000 which in light of the Society's financial worries was no small sum. The initial selling price was pegged at R200 but sales were slow and the Data Book Committee needed to expend considerable effort marketing the publication to recoup the costs.

Formation of the Northern Branch

Since 1984, the Society had wanted to form a Northern Branch. There had been logistical problems initially when first mooted along with the Western and Eastern Branches when early discussions with Gencor and JCI had clearly indicated that neither group was in favour of its formation. As the Society's aim was not to be at odds with the mining groups, the decision was taken to leave the matter in the hands of potential members and when there was enough support, retackle the issue.

By 1992, there was strong support by members resident in the Rustenburg area for a Northern Branch to be formed. The first meeting was held on 13 November 1992 at which Chris Nissen was elected Chairman, Gerald Enright as Vice-Chairman, C Roux as Treasurer and B Baker as Secretary for the current session. This was followed by the inaugural meeting in January 1993 at which Johan Kielblock gave a short presentation on heat stress. Ironically it was one of the hottest days of the year and Kielblock wryly noted that while he was sweating on the podium, Chris Nissen was relaxing in the South Coast. It was a well-timed holiday.

Environmental Management and Mine Rehabilitation

Choosing a topic for the annual symposium was always a nightmare for the Chairman of the MVS Visits and Meetings Committee. Derek Walters was no exception to the rule. His mind revolved around the questions 'have we done it before', 'is there an industry need', 'what do our members need to be updated on and 'will this interest them'.

Luckily in 1993, the Department of Mineral and Energy Affairs came to the rescue. In a burst of francophilia, they produced a document called 'Aide Memoir' and sent it to all Mine Managers. Walters discovered to his horror that it concerned the preparation of Environmental Management Programme Reports, and after a couple of phone calls to colleagues, found they had also all received the 'AIDE'. The other realisation which struck Walters was that they were all sailing in the same uncharted waters, and although not directly responsible for producing the Environmental Management Programme Report (EMPR) or rehabilitating a mine, a significant number of members would be involved in the project to some degree or another. It was the perfect topic for the annual symposium.

In January 1993, Walters informed Council that the symposium would take place on Friday 30 April in the Goldfields Training Services Centre at Kloof Mine which could accommodate 120 participants. The day would begin with a long morning session followed by a luncheon and the organising committee was looking into keeping the costs per delegate down to R 100. Members were currently busy contacting manufacturers who could help finance the symposium by exhibiting their products in the foyer. He then dropped his bombshell by telling Council that the Committee was considering approaching 'a radical greenie' to address delegates, and calmly asked whether anyone in Council had any objections. There was a dead silence. Forget the greenie, it was one of the most radical suggestions ever mooted at Council. Discussion was heated with Harry Rose saying that even if Council went ahead, he totally dissociated himself from the idea. It was eventually decided to approach a 'responsible' public figure to give an alternative perspective.

The debate about EMPR's was indeed an interesting one. As Sandy Nicoll said in his editorial in June 1993 'the whole matter again raises the question of whether or not mine environmental control departments should consider reverting to the old title of ventilation departments to avoid confusion with the broader field of responsibility of environmentalists particularly as "green" issues become even more prevalent'.

He continued saying

'whilst it is easy to argue in favour of reverting to the old name, as many mining houses and individual mines have already done, it perhaps does seem to be a pity in this era where "multi-tasking' appears to be the "in" word, some of our members prefer to take a more isolationist approach. Indeed the move towards integrated SHEM departments on many mines is evidence of the fact that it is becoming increasingly difficult to separate the responsibilities of safety, health and environmental practitioners. Their fields overlap extensively in many areas.'

'However it is probable that the mine environmental control or ventilation field is sufficiently specialised to warrant individual recognition. The question is what do we call ourselves? Whilst environmental control is probably now regarded as too broad a term of reference, surely ventilation is too narrow and doesn't properly reflect all our responsibilities?'

'Any supporters for the term Industrial Hygiene Engineering or something similar?'

The responsible public figure chosen to give the keynote address at the symposium was James Clarke of The Star. He gave a contentious speech which he opened by stating that he is not anti-mining or against capitalism but he felt that in the past mining giants have not put funds aside for environmental damage despite their massive contribution to the country's wealth. They pre-empt land, distort the local economy and show little concern about the negative impact.

He shocked delegates by saying the waste dumps are equivalent to the disaster of Chernobyl, and in Johannesburg 10% of the land is owned by mining companies who pay no rates and do not make land available to developers. In December 1992, World Watch issued a report which pointed out that 10% of the world's energy is used by mines which dump huge quantities of waste with South Africa having become "a desert of dumps". Society in South Africa showed no sign of the wealth generated by mines as it does not trickle down to the people. The Environmental Impact Assessment done by Richards Bay Minerals is the first of its kind and until now, the main concern of the government has been protection of the soil. The Minister however has the power to exempt mines from aspects of the Water Act. The Atmospheric Pollution Prevention Act is not being applied forcefully enough particularly in regard to grassing of dumps.

Clarke felt that those sections of the EMPR's which require auditing are to be welcomed and should be available to members of the public. He believed that the government favours mining houses rather than public interest and cited the example of prospecting being allowed in the Kruger National Park although it was illegal. In conclusion, he told delegates that South African mining houses are lucky that the public is not as 'neurotic about the environment' as are the North Americans and Europeans. However, 'some of these people are puritanical and can be expected to dictate very forcibly what we do with our environment if we wish to trade with them'.

Other topics covered that day at the symposium were legal requirements, post mining utilisation of resources, compiling EMPR's, safety standards for disposal of radioactive waste from mining and techniques of rehabilitation. On legal requirements, Jan Louw of the Department of Mineral and Energy Affairs stressed that 'an EMPR should be updated periodically so as to make the granting of a closure certificate easier, at least in theory. What is required is a so-called 'walk-away" solution meaning that the mine will need no maintenance after closure. During the life of a mine, monitoring is very important to ensure the EMPR is adhered to. At closure, unwanted buildings should be demolished, dust and smoke should be prevented, the land should be left safe and there should be no water pollution'.

The presentations made members realise the depth of expertise that is actually required to compile EMPR's and, it was worrying to note that with some notable exceptions, such expertise did not exist even within the larger mining houses. More than 70 delegates from as far afield as

Barberton and the Northern Cape attended the day's proceedings and Walters was pleased to see a significant number of mining and engineering personnel present at the symposium. Commercial support was given by Broseal, Haden Instrument Services, GFG, Boart MSA and Gasmo who all erected exhibition stands in the dining hall where luncheon was served. Further sponsorship was also received from Axial Flow Fan Repairs, Cemtec Fenzy and Krew Ventilation.

Lasting Impressions

Richard Gundersen was inducted as President for 1993/4 on 11 June 1993. A popular personality, Gundersen had previously served as both editor of the Journal and Chairman of the Finance Committee. After qualifying as an electrical engineer in England in 1977, he had moved to South Africa and joined West Driefontein Gold Mine as a junior engineer. His second career move was a three year stint at Kloof Gold Mine as sectional engineer which was followed by a transfer to Goldfields Head Office in 1982 with refrigeration as his portfolio. In 1986 he was promoted to Assistant Consulting Engineer - Ventilation where he remained until the beginning of 1993 when his career took a ninety degree about-turn after being offered the position of Assistant Consulting Electrical Engineer. His experience was broad-based and he had gained a reputation throughout the industry of being a sound strategic planner.

He began his presidential address by saying 'I am in the strange position of having the honour of being elected President of the Society just at a time where my professional responsibilities move me away from direct service within the discipline'.

'I find myself in a similar position to that experienced by Andrew Patterson when preparing for his Presidential Address in 1986, after only seven years in the discipline. Indeed it was interesting to compare notes and identify those areas where changes had in fact been made and achieved. What worried me though, were those areas where there had been little or no change. So, by way of contrast, and in view of my recent move, I have chosen to call my address, Lasting Impressions'.

After considering some of his first impressions, he commented on possible future directions for the discipline and more, specifically, the Society. One observation however clearly irritated him and he said,

'I fail to understand why a relatively clean colliery should be subject to the same rigorous sampling frequency as one experiencing the heavy dust loads generated by a large fleet of continuous miners, for example. In many cases the cost of determining the levy exceeds the levy itself.'

'In my opinion , the sampling rate should be proportional to the conditions, whatever the parameter being measured. In other words, the higher the values measured the more important it is to make sure they are correct especially as they approach or exceed recognised action levels or limits. The finer details of such a proposal are material for a lengthy debate but I would suggest that the scope for implementation is enormous'.

He continued in the same vein.

'Whilst on the subject of gravimetric sampling, I must make a plea to the Government Mining Engineer regarding the proposed uniform levy structure. Is it really appropriate for a long-term disease which is exacerbated by mine-specific working conditions? Would this be like putting a levy on petrol in place of speeding fines? If the authorities are really convinced that there is little difference between the conditions on the various mines, then why the gravimetric sampling programme at all?'

A forceful speech, it was the type of Presidential Address members were expecting from Gundersen whose opinions were well-known through his editorials in the Journal. He then covered scope for change within the mining industry and pointed out that there is no harm in reminding other departments particularly production, the difficulty and expense of ventilation

services. Using the analogy that full mining costs such as electric power and labour are not always visible to the average production man, he said it becomes rather like 'having someone paying your rates, water and lights while all you have to do is buy the groceries. This is fine until there is no money to pay the accounts and somebody has to disconnect the power. Then it is too late. We don't want that happening to our industry. We need to be aware of the full picture'.

He then moved on to the subject of compressed air. Ever since Paul Deglon's brilliant address in 1989 about wastage and potential cost savings, members were feeling increasingly annoyed about the general apathy in dealing with the problem. They wholeheartedly agreed with Gundersen when he said, 'there are times when I wonder whether the gold price has been low enough, for long enough. One of the best examples, which is still with us, is compressed air wastage and yet the potential savings are enormous. A typical large gold mine can probably save hundreds of thousands of Rands per month and yet there still appears to be an obsession with tons per man and a reluctance to employ additional people to sort out the problem explained to us in great detail by Paul Deglon in his presidential address in 1989 and, one that still needs attending to'.

'This creates a feeling of frustration. We are very conscious of a problem, which we regularly encounter, which we can understand, and yet are not in a position to do anything constructive about it except to report the location and the date. The same is of course true of many of the ventilation malpractices we encounter on our rounds, but in those situations we are at least expected to pass judgement and make constructive proposals. I know of a few mines that have embarked on compressed air campaigns and have achieved significant results. To you I say well done.'

His next issue of contention was the persistent use of, and plans to use diesel powered vehicles at depth. Members once again knew he was spot on in his judgement when he said, 'I once calculated that a diesel engine required so much ELECTRIC power to provide ventilation and cooling at depth that it was sufficient to both power and cool two similarly rated electric machines. And there is still the fuel bill to pay! Surely the inconvenience of the trailing cable is a small price to pay for such large savings? What about the other benefits such as not having the problems of exhaust emissions? This is another topic our industry is going to be hearing more about in the form of legislation in the future'.

He congratulated diamond mines for their increasing use of electric powered machines and said he was pleased to hear that planners at a deep mining complex in Klerksdorp have moderated, if not abandoned their much publicised plans for a large-scale mechanised mining project using diesel-engined machines at depth.

Old mine layouts being used as an excuse for inhibiting new mining methods were his next point of concern. He stated 'various technologies have been developed to improve support, cooling and communications. The tardy introduction of full-scale backfilling is disappointing. Surely by now there is enough evidence to appreciate the enormous benefits available which include drastic reductions in stope heatloads and improved ventilation in the reef plane?'

On face advance rates and the numerous benefits to be derived from concentrated mining which will improve in-stope conditions, he said 'I am convinced that the face advance rate of the majority of stopers is determined by the length of face he is asked to mine which is a management function! Very simply, I believe that each stoper can comfortably and reliably produce a certain number of centares. The less face, the greater the face advance rate'. Members laughed when he added 'but here I am treading on dangerous ground'

As all members knew, tens of thousands of pieces of information are recorded daily on mines. Using this topic to introduce his ideas on scope for change within the Society's discipline, Gundersen raised the issue of focusing on problem areas and abstraction of meaningful information from this sea of data. Although the law says all mine managers must see every ventilation report, more time and effort should be given to enhancing output. Exceptions needed to be highlighted such as conditions which had "gone off the boil", limits exceeded or any developing problem areas. He reminded members that the late Louw Pretorius had pointed out that 'status has to be earned through the proficiency of our personnel' and said 'we need to earn our

stripes, stop complaining and get out and do something. Maybe we should stop short of just lodging complaints and look at ways of putting action teams together within the structure of the mine and presenting managers with positive proposals. Let's promote positive action'.

After discussing the Society's role in the changes in the mining industry, he concluded forcefully by saying 'there is a mountain out there waiting to be climbed. Old habits die hard; but die they must if we are to survive. We are talking about the survival of the industry, not just our much eroded ventilation departments'.

'We must encourage responsible attitudes within the entire mining industry'.

'We must have better integrated planning of mines'.

'In this way we can emerge even stronger and not just because of a chance rise in the price of the mineral that we are mining. Within our own discipline we should work smarter. Remote selective monitoring on a continuous basis is becoming a reality. The industry must strive for sampling frequencies that are proportional to the level of the pollutant. There is a real need to interact with other disciplines within the mining industry and with other professional organisations. The Society's role in this can be achieved by having topical seminars and workshops with multidisciplinary, correctly targeted audiences. By these means we can play a more meaningful role within the entire mining industry.'

The address was stimulating and thought-provoking. Members agreed with Dr Steven Bluhm who in his Vote of Thanks said 'we must thank him for his very personal and sensitive observations about our discipline, our profession and the Society. His presentation cleverly oscillated between technical issues as well as the more personal side of working in our discipline and of membership of the Society'.

CHAPTER 42

If we are to survive, we need to be brave. The current jargon is that we need a culture change or maybe even a culture shock.

Richard Gundersen, 1993

New Editorial Structure

The July 1993 edition marked the end of Sandy Nicoll's term as editor of the Journal although he would still be responsible for layout and liaison with the printers. Having taken over from Richard Gundersen in October 1991, his contribution to the Society had been enormous. The period had been characterised by the challenge of producing the Journal under ever-increasing financial pressure for not only was the cost of publishing and printing the Journal rising but the prevailing economic conditions meant a substantial reduction in revenue obtained through advertising.

Nicoll's job had become more and more difficult as he found himself playing a balancing act to both meets the demands of editing and producing the Journal as well as coping with the pressures of his own position in Rand Mines. The quality of papers received for publication during 1993 was disappointing with the result that it was becoming harder to maintain the professional standard attained by the Journal during the past years.

When Derek Walters took over as Honorary Editor in August 1993, the structure of the Journal was simultaneously overhauled. The Honorary Editor became responsible for the contents only, and two additional editors were formally appointed for the Production, and Advertising and Finance portfolios. Walters' first editorial followed in the footsteps of other editors in the past. Long-standing members were only too familiar with the theme of trying to correct a perception that the Journal's principal audience was technical boffins. It was a cry from the past when he wrote, 'we cater to ALL our readers - from juniors observers to engineers. If you do have an erudite and profound paper on mine ventilation, great - send it in. However we really do like straightforward and practical papers. If you are unsure about the wording and the format, don't worry; there is a whole editorial committee to help you out. This also extends to having the paper translated if necessary'.

He appealed to readers to send in 'technical notes' which are short, informal contributions relating useful tips and experiences. He said 'things that go wrong are often worth telling, if only in an attempt to avoid the same thing happening again, We will also publish incidents/accidents involving mine ventilation (no names will be used) that highlight what can go wrong and what steps can be taken to prevent its repetition'. It was an excellent idea and members reading the editorial wished Walters the best of South African luck in his new position.

50th Anniversary

Gundersen's presidential year was primarily concerned with organising events to commemorate the Society's 50th anniversary. By November 1993, a programme of events had been formulated. Each branch was to prepare and host a two-day seminar or workshop. The first day would be the same for all branches and would consist of a road show incorporating the basics of ventilation. The second day at each Branch would be a region specific affair where the Branch Committee would organise a topical event of special interest to its members.

By January 1994, the Journal had a new look cover using the coat of arms bounded by '50'. In February, dates for the branch events had been set. The inauguration of Dion Marais as President for 1994/95 would mark the beginning of celebrations. The Western Branch would then run its seminar in July, followed by the Eastern/Northern Branches in August, the OFS Branch in September and the Collieries Branch in October. These events would be the preliminaries to the main gala occasion on 25 November 1994.

Ties also needed to be designed. On track in terms of deadlines, Gundersen presented two alternatives to Council in March 1994. Members were so impressed that they decided to accept both the designs. The 'fashion' tie was chosen to commemorate the anniversary and the 'conservative' sample was preferred as the future corporate tie.

As planned the Western Branch hosted the first branch event in July. Attended by 47 members, four presentations were given followed by a social event at Vaal Reefs Recreation Club. The second day was dedicated to a visit at R.E.G.M. where 42 members were split into two groups. The first group ventured underground to Cooke 2 Section where they were shown the 127" diameter Walker fan which was constructed in the early 1900's in the UK and shipped to South Africa. On arrival at Algoa Bay, the motor and impeller were transported to the Transvaal by ox wagons. The fan was commissioned in 1920 and was in use until 1976. Members were also shown the old hoist room which served the adjacent shaft. The hoist was originally driven by a steam engine which has now been replaced by a more conventional electric motor. While the first group was admiring the workmanship of days gone by underground, the second group were being shown around the open-cast mining operations at West-Wits. Members were quite astounded by what they saw. Operations are designed to mine ore from two pits around and under roads, railway lines and electric power pylons.

The Eastern and Northern Branches followed in close pursuit, a month later as arranged. Divided between the branches over the two days, the Eastern Branch hosted the road-show followed by a spit braai on 18 August, and the Northern Branch arranged for members and their wives to visit the RPM Union Section on 19 August followed by a luncheon.

Over 150 members, most of whom were junior members, attended the OFS Branch's celebrations on 23rd September. The presentations were followed by a unique dinner in an underground wine cellar. The final branch event hosted by the Collieries Branch was also successful with almost 50 members attending the celebrations.

The grand finale was the banquet which was a Black Tie occasion held at Gold Reef City in the Oppenheimer Hall. The Guest of Honour was Mr Dick Bakker, the Government Mining Engineer and other guests included Presidents of fraternal Societies. It was a wonderful evening with the tone being set at the beginning of festivities by a piper from the Transvaal Scottish Regiment. The Government Mining Engineer proposed a toast to the Society and Dr Andrew Patterson, renowned for his incisive mind, gave the after-dinner speech.

An allegorical perspective of the Society, the speech snugly fit the occasion. Witty and cleverly put together he began by saying 'fifty years ago, a small group of our professional forebears started out on a journey, and tonight, we, their successors, have reached a point in the road where we have stopped to take a breath. It happens that the visibility is good, at least to the rear, so that we have a clear view of the way we have come, and where we now stand'.

Tracing achievements using typically South African imagery of wagons journeying through the annals of time, he commented 'right in front is a particularly large wagon carrying a banner with the words 'The Mine Ventilation Society of South Africa'. Thanks to the efforts of our antecedents, it is sturdily built. On the back is a display window with a sign saying 'The Journal'; this is important, as it is the only part of the Society that can be seen by most of the members, and it is what the rest of the world uses to judge us. Yet it is almost empty; there are very few goods on display, and some of them are borrowed. Alongside the wagon walks the window-dresser, constantly wringing his hands. We who accompany the wagons are a goodly crowd, many more than decades ago when the Society was at its vigorous best. But none of us is producing the goods the window-dresser needs, possibly because we are all waiting for someone else to do it. There are

individuals circulating through the throng, pleading, cajoling and bullying. They feel strongly that the shop window is vitally important, not only for the profession, but also the Society, and especially the individual members who produce material for the window. The Society wagon is showing signs of decay. A few enthusiastic souls crowd around it and support it every inch of the way; but far too many hang back. Every year the cost of maintenance increases, and we wonder whether the Society has simply become too big. From the mouths of some issue forth groans: they are chained to iron balls which they drag along painfully and complainingly. Some of the balls are labelled Chamber of Mines Committees; others are marked Head Office. But none of these touch our hearts as much as the heart-rending lamentations of our Secretary, a martyr to the President and Council'.

Tongue-in-cheek for it was a celebratory occasion, Patterson had nevertheless hit at the core of what was proving to be the Society's biggest problem. Apathy and shifting responsibility seemed to be the insidious killer. But to be fair, leisure time in the 1990's seemed to have become far more precious than ever before. Increased job demands and greater responsibilities now being heaped on members as a result of retrenchments in the mining industry were putting pressures, previously unknown, on energy and stress levels, and it was almost unreasonable to expect members to devote their spare time to Society activities. Modern medical beliefs bandied about on every radio station, newspaper and magazine reinforced the idea that relaxing was essential if one was to maintain coping mechanisms in the face of modern day pressures.

Challenging Changes

The ancient Chinese saying 'may you live in interesting times' could aptly describe Dion Marais' presidential year. Inaugurated in June 1994, only two months after South Africa's first democratic elections, the moment was also to signify the beginning of the MVS celebrations for its 50th anniversary.

Marais was well-known throughout the fraternity having played a leading role in ventilation training since joining the Chamber of Mines as a Ventilation Training Officer in 1979. While at the Chamber he obtained his Colliery Ventilation Certificate having already been awarded his Advanced Certificate in April 1979. He quickly progressed to the position of Ventilation Training Superintendent and in 1988, enrolled at the University of the Witwatersrand for the Graduate Diploma in Engineering (GDE). After 10 years at the Chamber he joined ISCOR as Group Ventilation Officer, finished his GDE and obtained an MSc - Mechanical Engineering in 1992 after completing a heat flow project at ISCOR's Tshikondeni Mine. In May 1992, he joined JCI as Mine Ventilation Engineer and currently held the position of Group Ventilation Consultant.

Marais called his presidential address 'Challenging Changes'. Beginning with the assumption that mining will still be a viable industry in 2044, he said that the extent however will be dependent on, among other factors, global and local economies, demographics, and recycling efficiencies. He speculated that in the light of rapid scientific advances, science fiction today could easily be reality in 2044.

'Allowing one's imagination to step outside the existing limitations leads us into an area where underground mining is mainly done with automated, artificially intelligent mining machinery (AUTOMIN'S). These machines should be able to operate in environments which are more hostile than those we know today. Problems faced would most likely centre around the elasticity of rock masses (rapid closures) and high ambient temperatures'.

'To enable these machines to operate effectively would require a number of specific orientation and communication facilities. These would most likely be in the form of comprehensive data logging and monitoring networks covering aspects such as environmental conditions, rock mass stresses and a whole range of production related parameters. Also required would be a highly efficient multiple direction communication network to allow for relaying of instructions and information on changes as dictated by physical and economic factors'.

On changes and shrinking profit margins, he said unless the current trend is reversed, the major producers will be facing a crisis within the next decade. This would impact on the Society where 'the first and foremost threat is the potential reduction in membership numbers due to further shrinkage in the mining industry. We already experienced this to some extent some four to five years ago when, as a consequence, Council members had to critically re-evaluate expenditure on a number of planned projects'.

Over-generalisation of tasks was another problem area where loss of specialisation without human resource development is a longer-term threat to the discipline. Considering the very wide ambit members needed to cover, it is a possibility that some of the current functions such as environmental management would be transferred to subject specialists. This would impact on mine environmental control departments by way of further cutbacks or transfers which, in turn, implies a potential reduction in membership. He said 'any changes that might occur would be gradual and, initially imperceptible. Not being aware of this happening, or alternatively, not putting in place strong counter measures to prevent this tendency, would mainly be due to a lack of foresight by members of this Society'.

He then touched on training and education which was what members had thought, with his background, would form the backbone of his address. One of the very first issues, he said, addressed in the first AGM of the Society in 1944 was that of training. 'This is no co-incidence, as this factor has the greatest single impact on the performance of our members and hence, the well-being of the Society. Nothing has changed as far as this fundamental principle is concerned. I believe, however, that the time is right for the Society to re-address the issue of training and education in conjunction with other interested parties'.

He was not concerned about the future of existing technical training being offered by the Chamber of Mines but more for higher education and training. He stated

'through the not inconsiderable efforts of the Sub-Committee of Group Environmental Engineers and the aforementioned Technical Training Department approximately nine years ago, a post-graduate course was made available to a small number of practitioners at the University of the Witwatersrand. This course has, for a number of reasons, effectively disappeared from the scene as far as our members are concerned and no alternative is currently available. At the same time, a graduate course was offered, without much success, at the same university'.

'On several other occasions, the option of establishing a National Diploma in Mine Environmental Control (or something similar) at a suitable Technikon has been investigated. This has never come to pass, mainly on the grounds that there are insufficient potential students to warrant the effort and cost involved to develop and establish such a course and, secondly, that not enough candidates with the required entry level qualifications are available'.

Based on personal experience and observations, Marais felt that areas of weakness amongst environmental practitioners included basic knowledge specifically relating to physics and engineering and, to a lesser extent, basic mathematics. He said that there was also a lack of management skills required to manage departments the size of those found on mines. The problem was that environmental control specialists were often given these positions instead of human resources managers. Knowledge of occupational hygiene and an understanding of basic ergonomics were other areas he identified as weaknesses.

He suggested that the obstacles to higher education could be overcome by the development of a suitable correspondence course by, or for, a tertiary education institution. 'In the latter case it would simply mean that some of us would have to be willing to donate some time and effort in assisting such an institution in developing the material - free of charge, if need be'.

Continuing he said, 'once available, I have little doubt that a significant number of our members would enrol for such a course, on the understanding that it would probably address present and anticipated mining industry needs and enjoy national recognition. The long-term benefit would be to our members, their employers and the continued well-being of this Society for a long time into the future. If this is not done, I believe that we will slowly and inexorably lose ground to other dis-

ciplines who, almost without exception, have long established access to higher level, nationally accredited diploma and/or graduate courses'.

It was an interesting speech and his challenge, 'do the members of today and in the future have the will and ability to see the Society through the next 50 years?' was real in terms of the threats facing the entire mining industry.

International Radiation Conference

Multi-tasking together with the ongoing broadening of members professional knowledge led to the Society being involved in a joint 5 day conference with the SAIMM and Radiation Protection Society in February 1995. Final announcements were sent out in November 1994 but disappointingly it had been realised that not many local papers would be presented as there had been a very poor response from the call for papers. In terms of the joint commitment to organising the conference, the MVS had been assigned responsibility for pre and post conference tours, and Mr H Fourie told Council that the Society could expect to make about R20 000 out of the conference. Unfortunately attendance at the event was lower than expected, and the profits divided among the three societies was less than forecast.

As a precursor for members who were attending the conference, Harry Rose wrote an article for the Journal in January 1995. Called 'Notes on the Regulation of Radiation Hazards in the Mining Industry', the paper put the current status-quo in perspective regarding the Nuclear Energy Act 131 of 1993 which took effect on 1 March 1994. Basically the Act provided for the Minister to determine the levels of specific activity and total activity of radioactive material, and the radiation dose, below which the CNS may in its discretion exempt from licensing requirements any operation or process involving such material.

Rose explained that 'the Minister may also determine the levels of specific activity and total activity of radioactive material below which the provisions of the Act do not apply. Such a notice was published on 23 April 1994 and will almost certainly result in all gold mines having to acquire nuclear licences. Some other mines may also need to be licensed, and restrictions might be placed on the use of mining residues for building purposes (cement, aggregate, bricks and under floor fill) and old mining land for building developments. In addition, since most slimes dams probably are sufficiently radioactive to bring them within the scope of the Act, there could be great difficulties in obtaining licensing requirements once a mine has been closed'.

Society Affairs by 1995

By 1995 declining membership, a scanty Journal, dwindling attendance at Council meetings and a shaky financial position were cause for serious concern by stalwart members of the Society. An urgent Strategy Committee was called in January.

The first issue addressed was declining membership which had halved over the past few years from 1 200 to 622. Reasons given were the poor economic situation and increased labour costs as well as the Chamber of Mines withdrawal of fee subsidisation. More disturbing and directly related to the Society was that a recent survey showed junior members to be dissatisfied with the services offered by the MVS. They also felt that articles appearing in the Journal were targeted at the more senior levels, and were incomprehensible to junior levels.

Older members sighed in exasperation when hearing this comment. It remained a vicious circle. Marais noted that although the Journal should be maintained at a high standard, it should also hone in on specific aspects identified as important by juniors. Walters painstakingly pointed out that the response from juniors was non-existent from both perspectives. They neither requested

nor sent in articles. They only moaned. It was eventually agreed that the onus should be on senior staff to promote the Society to junior members and insist that a short technical note was written after the completion of projects.

It was suggested that subject specific debates should also be held to revive interest and that the Society should complement the Chamber of Mines Technical Services by setting up workshops and discussions relevant to the Certificate in Mine Environmental Control. Marco Biffi noted that the Western Branch had tried to encourage associate involvement by co-opting an associate member on the Branch Committee but staff cuts and pressure of work had led to his superior preventing him from attending meetings.

On involvement in current technical issues, those present felt that the Society was re-active rather than pro-active in its activities. This obviously detracted from the image and professional standing of the Society. Marais said that in this regard it was important that members be made aware of upcoming issues such as the results of the Commission of Inquiry into Health and Safety in the Mining Industry as there were possibly profound implications for the discipline. The Society had a Journal for this purpose and better use should be made of it as a mouthpiece of the MVS.

Walters then raised concern about the poor quality of papers appearing in the Journal. Obviously the Journal could only print the best of the papers submitted but the standard of those being received was too low for a professional image to be maintained. Morale was low and more support needed to be given to the Editor and Editorial Committee. Members of the Strategy Committee acknowledged that positive reinforcement for those battling with the production of the Journal was indeed vital if standards were to be improved and members' needs met.

Another issue raised about the Journal was that the previous recommendation by the Strategy Committee to produce the publication on a quarterly rather than monthly basis had been rejected by Council and, as such, Council was now obliged to assist the Editorial Committee. No-one could argue with Walters' logic.

The Society's financial dilemmas were well-known by 1995. Members present at the meeting agreed that the future policy of the Society should be to ensure the availability of sufficient monetary resources. It was suggested that the financial position be re-examined to affirm that the Society's objectives could continue to be met. Another option was that manufacturer's be encouraged to join the Society.

A further avenue that needing exploration was the role played by the Society on industry and national bodies setting standards of competence in ventilation and environmental engineering. Engaging in this activity would be an opportunity to enhance the Society's prestige and by inference, its members. The Strategy Committee were unanimous in their decision that the Society needed to make a concerted effort to ensure representation on these committees. Marais also noted that this was particularly pertinent with regard to the Mining Qualifications Forum, the National Qualifications Board and the National Qualifications Forum.

On the surface the orientation of the meeting could easily have been perceived as negative. However the Society's problems were in essence only a reflection of the difficulties being experienced by the entire mining industry. The difference, of course, was the funds and the resources at the disposal of the mining industry compared to those available to the Society. But in the spirit of the tradition fathered by the founders of the Society, members were determined that they could also turn threat into opportunity and face the challenges of the future. Obstacles had always been overcome in the past through dedication to the profession and a will to succeed.

The future was aptly described by Patterson in his after-dinner speech at the 50th Anniversary celebrations when he said

'we now look ahead along the road, and are confronted by nothing but a swirling mist through which we can make out some looming shapes, but the picture is obscured by a curtain made-up of boards shaped like question marks. Let us approach some of these boards and peer at the questions

written on them. Here is one: will the mining industry survive, caught between the jaws of rising costs and uncertain commodity prices? Another: if the costs of safety, health and environment truly threaten the industry, will the government consider these more important than employment and taxation? Will the country degenerate to a point where no industry of any kind is possible? Will affirmative action have the effect of raising a useful middle class, or will it bring about ruin? Will the great mining houses disappear, and be replaced by a multiplicity of small mining companies and artisan operations? And what of ourselves: will we end up as consultants to small operations, effectively working for the same concerns who retrenched us?

And there are other questions. Off to one side we perceive separate parties of pilgrims on more or less parallel roads; they are carrying banners inscribed Safety and Occupational Health and Industrial Ventilation, and there is one noisy rabble called Environmental Management. We wonder whether their road, and ours will converge some time in the future, and debate the desirability of this happening: would it result in a loss of identity for ourselves, or offer us the opportunity for richer and more fulfilling careers?

Regarding the future, there is only one thing we can be sure of, and that is that we cannot be sure of the future. Every time will be the best of times and the worst of times; there will be good times and bad times, fat times and lean times, times of despair and times of triumph, times of joy and times of sorrow, in short, the future will be much like the present. There will always be difficult times: the right thing to do is to pray not for the difficulties to be taken away, but that we have the wit and the wisdom, the will and the foresight, the flexibility and the firmness, to deal with anything that life can throw at us.'