SAIW looks forward to challenging year ahead

The 61st annual general meeting of the SAIW held on 8 May opened up with a moment of silence for immediate past president John Begg, who passed away recently after a long and bravely fought illness. Begg will be remembered for the generous, willing and kind person that he was, and for his invaluable contribution to the Institute and the industry as a whole. *African Fusion's* Dale Kelly reports:

Looking back at 2008, the Institute celebrated its 60th anniversary year with the highlight being the successful conference held at Gold Reef City in May that year. Titled 'Integrity of Welded Structures in the Energy, Processing and Transport Industries in Southern Africa', the programme had a good mix of local and international speakers presenting top quality papers.

"It was also an excellent networking opportunity for people from the various industries and research establishments to meet and share experiences and ideas," says SAIW president Andy Koursaris. "Our thanks go to Richard Fowles and John du Plessis and other members of the organising team for all the work they put into the event. Having been to many conferences, I can say that this one lacked nothing in terms of organisation, events and facilities."

The Institute's biennial Young Welder of the Year competition was held in February this year. Fifteen young welders under the age of 22 took part, welding carbon steel, stainless steel and aluminium projects, using four processes.

"The competition is well supported by the local welding community and our thanks go to the sponsors. The winner was Louis Steynberg from East Cape Midlands College in Uitenhage, who will participate in the WorldSkills competition in Calgary, Canada this September. He will be pitting his skills against young welders from about 30 other countries," Koursaris says.

The race for top honours was extremely close and congratulations go to runner-up Damian Pedro, whose work was also outstanding. The emergence of highly skilled young women was prevalent with Nonhlanhla Zulu becoming the first female ever to win a prize. She was awarded South Africa's Best Young Welder in the carbon steel category.

Another pleasing factor about this year's event is that many of the competitors will still be eligible for the next Young Welder competition in 2011, returning with more experience and raising the quality bar even further.

It was not only at the Young Welder competition where women welders shone. At the recent successful Awards Dinner held at Southern Sun OR Tambo International, a plethora of young females received their Inspector Level 1 certificates, reflecting the widening appeal of welding as a career for young people of both genders.

Looking at the Annual Dinner, Koursaris says this is intended to be a good balance of fun and entertainment combined with the Institute's recognition awards. The fully subscribed 2008 dinner was well enjoyed. "Feedback on the dinner is welcome as Council is always trying to improve member events."

The following awards were made at the 2008 dinner:

- The Phil Santilhano award for the best student on Institute courses went to James Cochrane from Sasol for his outstanding performance on the welding inspector courses. He is one of the first of a group of students graduating from the Sasol Plant Inspector training scheme, which is a partnership between the Institute and Sasol.
- The Harvey Shacklock gold medal for the best paper presented at an Institute event was awarded to Professor Madeleine du Toit from Pretoria University for the paper titled 'Failure of type 1.4003 welds due to intergranular stress corrosion cracking and pitting corrosion in the HAZ'. The paper was presented at a Johannesburg branch meeting.
- The Institute's Gold Medal was awarded to GRW Engineering in recognition of the company's outstanding example of building a world-class tanker business using the application of modern cutting and welding technology.

"This year, the Annual Dinner is being held at Gold Reef City on 26 June and we look forward to an enjoyable evening. The programme promises to be particularly interesting and you are all invited to join us for a small consideration," Kouraris told members of the SAIW.

"From a financial perspective, I'm pleased to report that the Institute remains in a healthy situation despite some challenges regarding continued sponsorship. More than 80% of our net income is self generated and steady progress has been made in building the reserve funds of the Institute to the level set as a safety margin by Council. The high proportion of internally generated income is clear testament to the efforts and success of the management and staff of the Institute, particularly in view of the generally adverse financial climate. Thus, for the immediate future, our financial worries are few."

Institute training courses in 2008 were high, and in some cases at record levels.

Pass rates on examinations run

	2007	2008
Welders	564	646
Inspectors	382	534
NDT technicians	397	514
Competent persons	130	114
Other categories	80	92

Training statistics representing students attending SAIW courses.

at about 80%. It is evident that more students are self-funding with the split between private and corporate students being about 50/50. Bookings for the first half of 2009 are encouraging.

"The Institute continues to work with Wits University to train welding engineers and technologists but the national shortage far exceeds the numbers coming through the current course," Koursaris confirms. "This year the Wits course has been modified so that it is completed in one year rather than two as was the case previously. The Wits examinations and IIW examinations have also been rationalised so graduates of the course will receive a Wits MEng and the IWE qualification. Our two organisations are working together to find ways to significantly increase the number of students qualifying through these courses."

As most organisations are finding, there is undoubtedly a serious shortage of skilled people and the Institute is faced with similar difficulties in recruiting suitable personnel. The SAIW is expanding its capability to meet the growing need of the rail, power generation, structural steel and petrochemical and refinery industries by strengthening the skills of its staff.

"In view of government's plans to spend hundreds of billions on infrastructure in the next few years, and in view of shortages in the market, the Institute is well positioned to make a significant contribution to capacity building through its education and training programmes," he says.

The Institute's Technology function under John du Plessis continues to make a far reaching impact in an increasing range of industries. Work is being undertaken in most regions of South Africa and in surrounding countries in fields as diverse as mining, ship repair and automotive componentry. Consultancy services are progressing well, with enquiries and opportunities extending well beyond the country's borders, and an additional consultant has been employed to help grow this important side of the business.

Looking at the IAEA (International Atomic Energy Agency), Koursaris says the good relationship continues and the Institute has gained further work from its position as a NDT Regional Designated Centre for AFRA (African Regional Cooperative Agreement for Research Development and Training). "Our staff also conducted expert mission visits to Vienna and Ethiopia on behalf of the agency and further visits are scheduled for Sudan and Kenya. We expect to conclude formal agreements with organisations in two AFRA countries for training and examining NDT technicians."

SAIW Certification has been operating since mid-2005, and has taken over all of the Institute's examination and certification activities. The independent board of directors is ably led by Professor Madeleine du Toit from Pretoria University as chair, and Eskom's Morris Maroga as deputy.

Koursaris says this year SAIW Certification beat all financial expectations, making a small net surplus on operations. "We had expected that the company would need ongoing funding from the Institute for a few more years, but this now appears not to be the case.

"During the year good progress has been achieved with the SAIW/IIW ISO 3834 quality certification programme for welding fabricator companies. We believe the certification scheme will become an integral component of quality requirements for local supply of fabricated equipment, and will support the efforts of companies in the export market."

Koursaris thanked all Council members for their time and expertise put into the governance of the Institute. "It is increasingly difficult for people to make time for involvement in organisations like ours, and we are very appreciative that they have been able to do so."

Personal membership of the Institute remains at 200, which is unchanged from the previous year, but up about 10% since bottoming out in 2005. Corporate membership has increased by 33% in the same period.

In conclusion, Koursaris thanked all Council members, and executive director Jim Guild and SAIW staff for the support received and for their contributions to the Institute. "The management and staff of the Institute are its cornerstones, and I would like to commend them for their loyalty and efforts this past year. There are always challenges and new developments, and I am pleased to be involved with the Institute at this exciting time."

60th Anniversary celebrations. From left: SAIW President Andy and Fedra Koursaris; and the late John Begg with his wife Nerina.

Welding metallurgy of stainless

an SAIW seminar by Damian J Kotecki

During the second week of May 2009, the South African welding fraternity was privileged to have Damian Kotecki, the international stainless welding specialist, present one day seminars in Johannesburg, Cape Town and Durban. *African Fusion* presents a short summary.

Copper first appears as a metal in 6 500 BC, Kotecki begins. "Copper appears as an element in some parts of the world but it didn't really become a useful tool until it became alloyed with tin 3 500 years later."

The first recorded use of iron was in 5 000 BC, which came from meteorites, as iron does not appear naturally on Earth as an element. "And because meteorites came from the sky, the ancients considered this to be a sign of divine intervention, so only the priests could play with them – which probably impeded development," Kotecki suggests. "Again we see a 3 500-year gap between discovering the element and making it into useful tools." Iron was a precious commodity though, all the way up to 1856, when the Bessemer converter was invented. "The Bessemer converter enabled iron to be produced in tons rather than in pounds, he explains, "and that changed everything."

It wasn't until 1899 when Henri Heroult of France invented the Electric Furnace – which could produce high enough temperatures in a liquid environment to retain chromium in the liquid metal – that it became possible to make stainless steel. It wasn't done though until 1912, when Brearly noticed that some of his artillery steel experiments didn't rust. "This rustless behaviour in the atmosphere marked the birth of stainless steel," confirms Kotecki.

Within a matter of months, Maurer and Strauss of Germany produced the first chromium-nickel alloy, which was the first austenitic stainless steel, a much more friendly alloy system to work with. "Since then, world stainless consumption has been growing."

Kotecki shows a graph of chromium content versus weight loss on an iron chromium alloy taken from data collected over 52 months. "This graph starts to get at what stainless steel is all about," he says. With no chromium, you have weight loss, but as soon as you go over 5% chromium, there is a significant drop in weight loss – and 5% chromium steels were at one time considered to be stainless – but it is not until you get up above 12% chromium where you get near zero loss, very close to Brearly's alloy.

But, it turns out that if you remove the carbon from the alloy, you can get rustless behaviour at around 10,5% chromium, "you don't need 12%," confirms Kotecki. He defines a stainless steel:

- A stainless steel contains at least 10,5% chromium.
- It contains more iron than any other element.
- Its carbon content must be less than 1,5% – the maximum amount of carbon that can be dissolved in the austenitic phase.

"So if you quench an alloy with less than 1,5% carbon, you can retain all the carbon in solid solution, but if you have more then you will definitely get carbide precipitation, which compromise the corrosion resistance," Kotecki explains.

Iron is one of the more interesting elements in the periodic table. "If you look at metals in the periodic table, most of them solidify as single phase elements, from the solidification temperature all the way to room temperature – metals like aluminium, gold, silver, nickel, but iron and titanium go through phase changes in the solid state, which allows you to manipulate the alloy properties by heat-treatment, Kotecki says. "This is what makes iron so useful.

"Pure iron solidifies at 1 538˚C as a body-centred cubic phase (BCC), a crystal structure with atoms arranged at the eight corners of a cube with one at the dead centre of a cube. This phase is called delta-ferrite (δ-ferrite). This phase exists for 144˚C of cooling, but below 1 394˚C, it transforms to a face-centred

South African delegates arrive at the Gold Reef City conference centre in Johannesburg for the stainless seminar.

cubic (FCC) structure called austenite, a structure with one atom at each of the eight corners of the cube and one in the centre of each of the six faces of the cube. This structure turns out to be a more densely packed form of iron, So there is actually a volume change, a contraction, when the ferrite turns to austenite." Austenite exists until 912˚C, at which point it turns back into a BCC-structure again.

"But as soon as you add alloying elements, you change the rules," Kotecki informs us. "If you add any alloying element, the solidification temperature goes down. With stainless steel, this will be a significant reduction, in the order of 150˚C. This means that it is easier to melt than carbon steel. The second thing is that the transformation temperature from ferrite to austenite changes. "If you add an alloying element that makes the transformation temperature up, nickel for example, then we call that element an austenite promoter. If the element that you add makes the transformation temperature go down, then you have a ferrite promoter, and chromium is the most important element for doing that.

"Then there is the second transformation from austenite back to ferrite. For the stainless steels, this transformation vanishes. It is replaced by another transformation that takes place at about 425˚C or lower, the martensite transformation. If you add enough nickel, then you can stabilise the alloy so that the martensitic transformation never happens and you end up with an austenitic alloy at room temperature. If you add only a little nickel or keep the chromium low and add a little carbon, then you can get a martensitic stainless steel at room temperature. If you add a lot of chromium and not much else, then you can stabilise the ferrite phase all the way down to room temperature to give a ferritic stainless steel.

"You therefore have all sorts of different possibilities to manipulate the microstructure and hence the properties of the steel by alloying."

This gives rise to the various families of stainless steel:

- Martensitic stainless, which is magnetic and highly hardenable.
- Ferritic stainless – magnetic and completely non-hardenable.
- Austenitic – non-magnetic and non-hardenable.
- Duplex – a 50% ferrite and 50% austenite mix, which are magnetic and non-hardenable.
- Precipitation hardened stainless steels – a special case of either ferrite or martensitic grades, where you add something else to harden the alloy.

"A good part of the rest of this lecture will be devoted to describing the welding characteristics of these various families of stainless steels," Kotecki tells us.

He begins with the martensitic grades – for which the most important consideration is how much carbon, says Kotecki.

The high hardness of martensitic stainless makes it very susceptible to cracking during or after cooling. Rules for welding include:

- Welding hot – 205°C to 425°C.
- Controlling the preheat and interpass temperature and slow cooling.
- Postweld heat treat.
- Use lower carbon filler metal if possible: eg, 410NiMo to weld 410.
- Use austenitic filler metal if possible.

For ferritic stainless, which is non-hardenable, but embrittled by grain growth and second phases, the most important welding consideration is how much chromium and molybdenum the alloy contains. Higher chromium in ferritic stainless steels makes avoiding embrittlement more difficult – and molybdenum makes matters worse. Welding rules include:

- Weld cold – with low preheat, low heat input, low interpass temperature or single pass welding.
- If possible, use austenitic filler metals.

In introducing the austenitic family, Kotecki says that the key characteristics of austenitic stainless are that they are non-hardenable but often sensitive to hot cracking. The most important welding consideration is the presence of ferrite. Welding rules include:

- Matching the corrosion resistance.
- If possible, choosing a filler metal to get a little ferrite in the weld.
- If ferrite is not possible, weld ugly – cold, crowned beads, with overfilled craters.

The seminar also dealt with: the complexities of ferrite number estimations and measurement; the sensitisation of stainless steels, pitting corrosion and stress corrosion cracking (SCC); the super austenitic stainless steels; the metallurgy, microstructure and welding of the duplex and precipitation hardened stainless steels; and much, much, more.

African Fusion wishes to thank both Damian Kotecki and the SAIW for the very high standards and usefulness of this event.

Element	Promotes	Effect on Properties
Chromium	Ferrite	Improves general corrosion resistance, especially in oxidising environments.
Nickel	Austenite	Improves general corrosion resistance, especially in reducing environments.
Carbon	Austenite	Increases strength at high temperatures, reduces corrosion resistance.
Nitrogen	Austenite	Increases strength at low temperatures, improves pitting resistance.
Manganese	Neutral	Improves hot cracking resistance, increases solubility of nitrogen.
Molybdenum	Ferrite	Improves resistance to pitting and crevice corrosion.
Niobium	Ferrite	Forms stable carbonitrides to resist sensitisation.
Silicon	Ferrite or Neutral	Improves wetting, high temperature and carburisation oxidation resistance.
Titanium	Ferrite	Forms stable carbonitrides to resist sensitisation.
Aluminum	Ferrite	Improves high temperature oxidation and carburisation resistance.
Copper	Austenite (weak)	Improves resistance to reducing environments. Can be used for precipitation hardening.
Sulfur	Neutral	Improves machinability, promotes hot cracking.
Phosphorus	Ferrite	Promotes hot cracking.

A summary of stainless steel alloy effects.

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ISO 3834 – world class standard "the way to go"

At a recent seminar held mainly for end users, engineering consultants and allied companies like insurance consultants, the ISO 3834 standard – the basis for the SAIW Welding Fabricators Certification Scheme – got a resounding thumbs-up from presenters and attendees alike.

Conference organiser Richard Fowles says he has no doubt that end users will be pushing harder in future to ensure that their welding suppliers are ISO 3834 certified.

One of the presenters, Southern African Institute of Steel Construction education director Spencer Erling, says ISO 3834 is the ultimate in 'horses for courses' standards. "Fitness for purpose describes it use. So, if we are building nuclear power stations, we will set up and manage the process accordingly, or at the other end of the scale, if we are making wheel barrows, we will set up our welding according to this activity."

Erling adds that one of the main problems of ISO 9000 series standards is that it is more a quality management system and not a process management system. "This, of course, is most pertinent to welding as it is a process – only a part of the whole production system.

"We have to face the fact that welding, which is used for creating the joints for steel structures, needs to be of a high standard to ensure structural competence. It is high time we had a process management system like ISO 3834, which allows us to hone in on the requirements of the welding specification of choice of the design engineer, which for steel structures in South Africa is the AWS D1.1.08 specification.

"While there are top-end fabricators in South Africa who are ISO 9000/1 registered and who do have excellent welding quality controls in place, the majority of fabricators need to be guided and certification by the SAIW according to ISO 3834 is the 'world-class' way to go," he says.

Because ISO 3834 is welding focused, those companies at the top end of the fabrication scale who are ISO 9000 registered and have good welding procedures in place, will also want ISO 3834 certification.

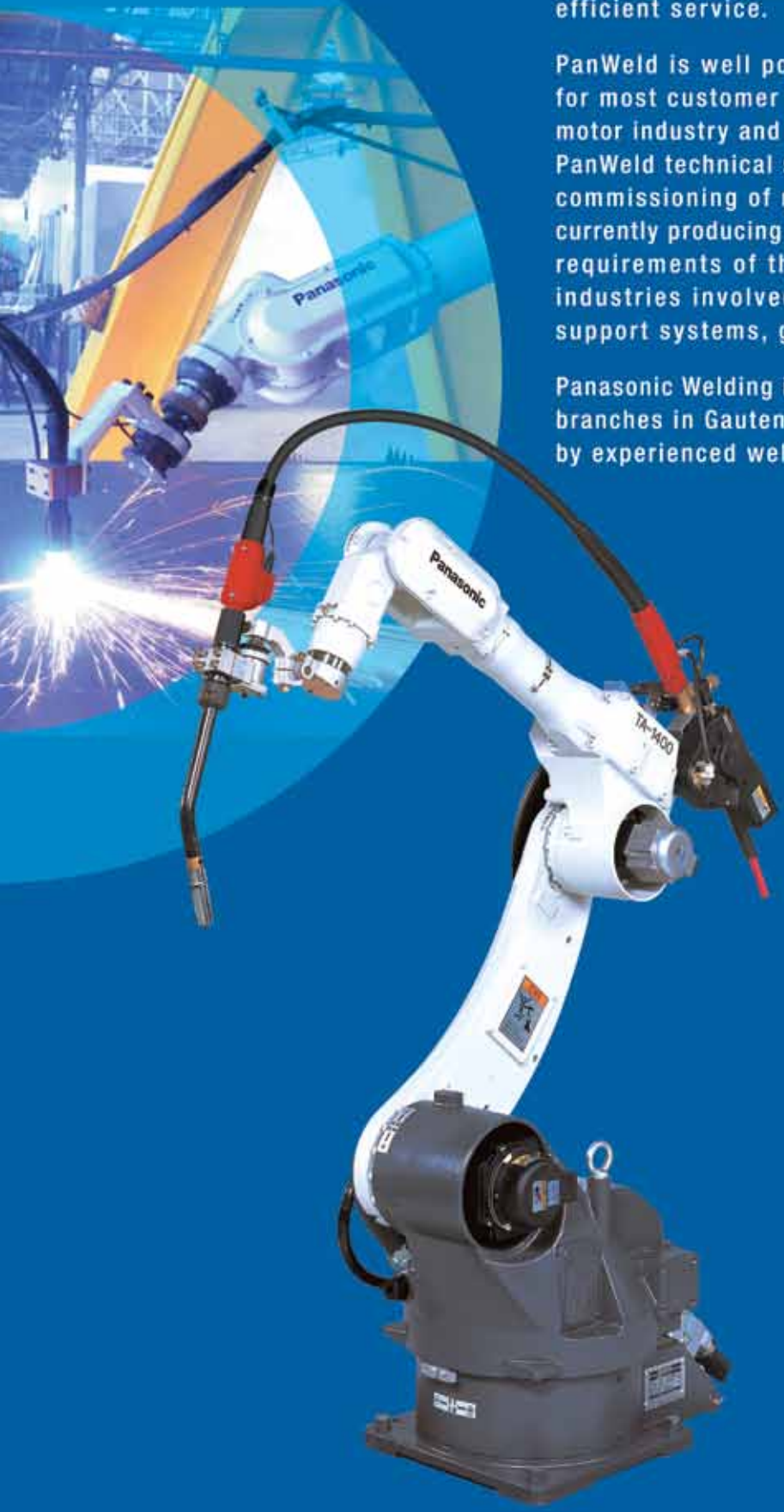
"This makes absolute sense, especially from a global perspective," Erling says. "Any professional fabricator will want to show their worth and, perhaps more importantly, increasingly both here and abroad, professional end users are insisting on ISO 3834 certification proof from their suppliers."

According to Fowles, ISO 3834 is ultimately about demonstrating welding fabrication competence against international standards and is for companies where fusion welding is the key feature of fabrication. "I think the bottom line is that fabricators must realise that quality cannot be inspected into a product, but has to be built in through controlling the welding process from design to completion of the project," he adds.

More than 50 people attended the seminar which included delegates from companies like Fluor, PWP Consulting, Kents Engineering and contractors BEMA Group and Praestar Administration Services.

"Certification by the SAIW according to ISO 3834 is the world-class way to go," says Spencer Erling, Southern African Institute of Steel Construction education director.

Panasonic Welding Solutions



Panasonic Welding (PanWeld) focuses on Panasonic branded equipment with the emphasis on solutions to welding problems, competitive pricing, quality and efficient service.

PanWeld is well positioned to offer welding solutions for most customer needs and is actively involved with motor industry and Tier I manufacturers of components. PanWeld technical staff was instrumental in design and commissioning of robotic welding applications that is currently producing product that exceeds the high quality requirements of the Japanese motor industry. Other industries involved in include furniture, mining and-support systems, general-and structural fabrication.

Panasonic Welding is represented in the main areas with branches in Gauteng, Durban and Port Elizabeth staffed by experienced welding and robotic specialists.

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SAIW's new branding

The SAIW has a new set of logos and branding.

"The Council debated this and ultimately agreed that we needed a logo that represented what the Institute had become in current times – a modern, dynamic, globally connected organisation representing an industry in which people from the full spectrum of South Africa, and increasingly African, life participate," says Jim Guild, executive director of the SAIW.

In presenting the new logo, the designers, from Krew Digital Solutions, identify the SAIW brand as:

- Upholding traditional values.
- Ethical in conduct and approach.
- Professional in all relations and dealings.
- In a class of its own.
- Maintaining a high level of precision.
- Modern and evolving.

'The success of the logo lies not only in its immediate visual appeal, its relevance resides primarily in how accurate it is in visually defining the Institute', we read in the logo's style guide. The logo as a complete element is designed to convey the following message:

- The insignia symbolises the Institute as a whole – a metaphorical creative spark broken by primary colours, which represent its versatility.
- The font used complements the flow and sharp shard-type feel of the insignia.
- The red and blue coloured elements represent the heat and energy of cutting and fusion processes.

"The logo is modern and dynamic representing the spark created by the welding operation, the brightness of our industry and our country. It also emphasises the 'SAIW' as the contraction that is now synonymous with this Institute and its work," says Guild.

SAIW
Southern African Institute of Welding

Site-based ISO 3834 certification for Group Five Oil and Gas

Group Five Oil and Gas has become the first site-based company to be certified to ISO 3834 in accordance with the SAIW Certification Welding Fabricator Certification Scheme.

"Group Five Oil and Gas operates under very different conditions when compared with factory-based fabricators," says John McLeish of SAIW Certification. "Site-based companies like Group Five often don't have direct control of the welding procedures, equipment, consumables and associated services such as NDT and post-weld heat treatment used for site construction, as these are supplied by the client," he explains.

The certification was awarded to Group Five Oil and Gas based on the site work it is contracted to carry out at the Chevron Refinery in Cape Town, McLeish tells us.

"Unlike a workshop-based fabricator, welding procedures, welding equipment, welding consumables and associated services used on the Chevron site are supplied to Group Five Oil and Gas by Chevron, so there is a tendency to assume that these factors are outside of the site contractor's control and responsibility.

This is a risky assumption because if a failure occurs on the refinery, even if as the result of an error on a welding procedure supplied by the client, it is still likely that the contractor will carry the responsibility."

As a result, the SAIW Certification auditors adapted the audit focus to concentrate on how Group Five managed the supply of goods and services from its client who was, in effect its main supplier. Group Five Oil and Gas developed their site-based quality system to address this situation and has referred some deviations back to its client. "By taking proactive action, the company not only minimises the risk of costly damages if a failure occurs, but it is also able to offer a higher quality service, which adds value to its client," says McLeish.

Thinus Botha, site manager at Chevron, John McLeish, SAIW Certification and Pravin Laljit, quality manager Group Five Oil and Gas.

Sad farewell to John Begg

John Begg, president of the SAIW from 2002 to 2006, a long-serving councillor who also served as chairman of the Technology Board, which became the Training and Technology Board, has passed away after a long and bravely borne illness.

"All at the SAIW are deeply saddened by his passing and will miss John, who has been such an important contributor over the years," says executive director Jim Guild. "He was the consummate engineer. Intelligent, practical and precise, and through the years his council and advice has been of great benefit to the Institute.

"All of us who worked with John will remember him for his quiet and professional disposition and for the enormous contribution he made to the SAIW and to the welding industry as a whole in South Africa. On behalf of all at the SAIW, our sincerest condolences and warmest wishes go to his wife Nerina, and his children Mechelle and Robert," Guild says.