

LOCAL COURT OF NEW SOUTH WALES CORONIAL JURISDICTION

No. 2424/08

INQUEST INTO THE DEATH OF SHAYNE HAMILTON McMAHON.

This is an inquest into the death of Shayne McMahon who died on 7 April, 2007, just a few days short of his twenty first birthday, at *Tweed Heads District Hospital*, Tweed Heads, NSW. Shayne was born on 17 April, 1986, the son of Paul and Chelmae McMahon who live on their farm near Murwillumbah in far north New South Wales . By all accounts Shayne was an active, athletic, healthy and fit young man, bright and intelligent, a quick learner with *a fantastic work ethic*. He was something of a golfer and even more of a fisherman. To his sister, he was a gentle giant and to many of his mates at the Pottsville Brigade of the *Rural Fire Service* which he joined when he was 15, he was *Panda*. Shayne had lived with his family on their farm near Murwillumbah for all his life since he was a few months old. He was in the final year of his apprenticeship with *Smart Gas* and it was while completing a job for them on 4 April, 2007 outside site # 205 at *North Star Holiday Resort* at 1 Coast Road, Hastings Point that he lost consciousness and suffered the injury that led to his death.

In this inquest, Mr. Cahill of Counsel assisted the Coroner, instructed by Ms. R. Graham, solicitor, of the NSW Crown Solicitor's Office. Mr. Magee of Counsel appeared for *Workcover* and its two inspectors, Maurice

William Vierow and William Keenan, Mr. Brazel of Counsel appeared for *Ladehai Pty Limited* and its director, Ian Beadel, the owner/operator of *North Star Holiday Resort* and Ms. Thompson of Counsel appeared for *Smart Gas Services Pty. Limited* and its Director, Glen Hanna. Mr. and Mrs McMahon were not legally represented at the inquest but I understand that they met and conferred with Mr. Cahill and Ms. Graham and were aware that they would be happy to guide and assist them where necessary.

The Coronial Brief was **EXHIBIT 1** and included the formal documents being the *P79A* Police Report to Coroner, the identification statement, the report, dated 1 May, 2007, of the *post mortem* examination undertaken by Dr. Brian Beer at *Tweed Heads District Hospital* on 11 April, 2007 and the Certificates of Analysis of the Division of Analytical Laboratories.

Those who appeared at the inquest to give evidence included the following:-

- The officer in charge of the police investigation, Senior Constable Michael Warren of Kingscliff Police;
- Inspector Michael William Vierow of *Workcover*;
- Peter John Latimer, the occupier of # 205 at *North Star Holiday Resort*, and
- Kenneth Knott, his neighbours who came to Shayne's aid;
- Paul Jones, David Mark Welsh and Mark James Woods, groundsmen at *North Star Holiday Resort*;
- Lucas Herrington, a Retained Fire Fighter;
- Andrew Bradley, a receptionist at *North Star*;

- Adam Wesley “Ben” Beadel, the Grounds Manager at North Star Holiday Resort;
- Colin McKay and Claire Richardson, jointly;
- Professor Michael Whyte and Professor Michael Moore, expert toxicologists, jointly.

In addition, Shayne’s sister, Renee, on behalf of the family, told the inquest about her brother and provided details about this fine young man which we could not have known without her.

The identity of Shayne McMahan and the time, date and place of his death are not matters of controversy and the *cause* of his death is the subject of ample evidence to be found not only in the *post mortem* report but in the reports of Dr. Hellestrand, a practicing consultant in cardiology and electrophysiology and Professor A.J.Ansford, a forensic pathologist, and the evidence of two expert toxicologists, Professors Whyte and Moore. The nub of this inquest is the *manner* of Shayne’s death.

On or about 22 January, 2007, Peter John Latimer who lived at site 205 at *North Star Holiday Resort* sought from *Smart Gas* which had been recommended by somebody at *North Star*, a quote for the installation of a gas water heater and the necessary meter and supply line. On 3 April, 2007, Shayne McMahan arrived to commence the works which, among other things, involved digging a hole in the nature strip outside the premises where it fronts Begonia Boulevard, tapping into the resort’s yellow, flexible *LPG* reticulation system, creating a T-junction and running a line into # 205 and

connecting it, via a gas meter, to the heater. According to Mr. Latimer, Shayne arrived at about 10am and worked for most of the day, digging the hole, fitting the heater and the meter to the outside of the house and installing the copper line from the house. Then, because he was missing a *T-piece* and unable to complete the job, he promised to return next day, 4 April, 2007 which is what he did. On 3 April, 2007 and, indeed, next day, he seems to have been unaccompanied and without either assistance or supervision.

In April, 2007, Shayne was in the final year of his apprenticeship, working for *Smart Gas Services Pty. Limited*. He had commenced employment as an apprentice plumber and gasfitter in December, 2004 and he was enrolled in the certificate III course in plumbing at the *Gold Coast Institute of TAFE*. By all accounts he was keen and clever and Mr. Hanna described him as a quick learner and a competent worker with a “*fantastic work ethic*” and a good attitude to safety. But he was only just twenty years of age, still unlicensed and, except under the supervision and direction of a licensed gasfitter, not yet qualified to perform the job he had been sent to do – to break into a *live* line so as to install a gas heater in Mr. Latimer’s home.

North Star Holiday Resort is a caravan park and mobile home complex containing over 300 sites, some of them occupied on a semi-permanent basis, at 1 Coast Road, Hastings Point. The semi-permanent residents occupy their sites pursuant to *residential tenancy agreements*, a specimen of which is contained in the Coronial Brief.

There is a special provision relating to the provision of gas to residents who are required, one way or another, to pay a security deposit to the park owner, *Ladehai Pty. Limited*, and it is provided that “*any plumbing or wiring that connects the resident’s dwelling or any of the resident’s structures to the utility services provided by the residential park are the property of the resident.*”

Evidently, there is no provision requiring a resident to seek and obtain *Ladehai’s* permission to install a gas service and, in contrast to the position regarding gardens, landscaping, maintenance and the erection or alteration of structures, there is no requirement that a resident hire a particular plumber to undertake the work or make the required connection. On the other hand, I was told that *Ladehai Pty. Limited* recommends and prefers particular plumbers and, in April, 2007, Glen Hanna, the principal of *Smart Gas Services Pty Limited* was one such tradesman.

The evidence is that, in April, 2007, entry to the park was gained through boom gates at the front of the premises. Evidently park residents were given a swipe card and, although Andrew Bradley, *North Star’s* receptionist and marketing consultant denied any knowledge of it, it seems that some favoured tradesmen including Glen Hanna of *Smart Gas* and Peter Thompson, another plumber, were also given a swipe card. But even tradesmen with a swipe card were expected to report to the front office so that their presence in the park could be noted. Others, without a swipe card, gained entry to the park through the front office. Given that on 3 and 4 April, 2007 he did not gain

entry to the park through reception, it appears likely that, somehow, Shayne McMahon may have acquired a swipe card (although I am not aware how he came by it) or else managed on both mornings to *tailgate* another vehicle and so gain entry. At any event, having gained entry to the park, he seems not to have reported his presence to the front office. Perhaps he was not aware that he was supposed to do so and he made no secret of his presence at *North Star*, entering in his purple service vehicle and parking it across Begonia Boulevard, outside # 237 and close to his work site. Or perhaps Mr. Woods' was right when he told Ms. Thompson of Counsel that "*tradesmen would report to us if they were doing work for us (North Star) but not if they were doing work for residents. So if they were installing a gas heater, they wouldn't come and tell us.*" He qualified that by saying "*if they (tradesmen) needed to break into a line and informed North Star, an employee would accompany them*" but the events of 3 and 4 April, 2007 suggest that such was not necessarily the case.

The inquest heard evidence about the evacuation policy prevailing at *North Star Holiday Resort* according to which residents, many of the elderly, would, in the event of an emergency, gather in the centre of the park, either near the gazebo or near the games room – about as far from an *exit* as it would be possible to be. No thought seems to have been given to how the residents would be shepherded out of harms way or how they would be protected once they had arrived at the assembly points.

The impression one gains is that *North Star Holiday Resort* has grown enormously over the years and that its management and governance have failed to keep pace.

As to the gas system at *North Star*, it appears that, originally, *Elgas* installed the bulk tank and the early stages of the pipe network. Later, *Ladehai* contracted with *Smart Gas* and sometimes Mr. Thompson to extend the network and to connect various park facilities. Residents then made their own arrangements for connection. *Ladehai* never contracted with anyone – *Elgas*, *Smart Gas*, Mr. Thompson or any one else, to manage and oversee the system and never itself effectively managed or operated the system and no body exercised the role or functions of *network operator* or *network technical regulator* in the manner contemplated by *Australian Standard AS4645-2005, "Gas Distribution Network Management."* *Ladehai* maintained very little documentation regarding the system so there was no map showing how the gas system fitted in alongside the other four or five underground systems (water, sewage, TV, phone, electricity) in the park. It is not clear that the maps of the gas system which it did keep were up to date. It may have assumed but did not ensure that tradesmen (or apprentices in Shayne's case) who worked on the gas system were licensed and qualified and that practices and equipment employed were in accordance with appropriate Australian Standards. *Ladehai* neglected to supervise work carried out on the gas system, failed to ensure the installation of sufficient isolation valves and failed to keep them in working order. When Shayne checked the isolation valve nearest to his work site on 3

and 4 April, 2007, the isolation valve outside site # 207, he found it was not in proper working order. Needless to say, despite the terms of *Australian Standard 3723 – 1989* that “*mechanical devices, either manual or hydraulic, that achieve the stopping of gas flow through an operating pipe by squeezing the pipe walls together shall be approved by the relevant operating authority,*” neither the clamp used by Shayne on 4 April, 2007 nor the clamps available at *North Star* had been approved and neither complied with relevant standards.

Since the sad events of April, 2007, *Ladehai Pty Limited* has taken some steps to *lift its game* and is taking its *OH and S* obligations seriously. Mr. Brazel of Counsel directed my attention to the series of *audits* of the *LPG* reticulation system at *North Star Holiday Resort* culminating in the report of Gordon M. Irwin of 3 March, 2011.

Mr. Latimer was in the kitchen of his house when Shayne returned at about 10 am next morning, 4 April, 2007. His kitchen is in the front of his house, overlooking Begonia Boulevard, and he saw Shayne arrive and offered him a cup of coffee. Apparently Shayne arrived without full length overalls. He was wearing neither safety glasses nor gloves. His gas detection equipment remained stowed in his truck along with his fire extinguisher. Evidently he was carrying only one clamp and that one not the appropriate one for the job he was undertaking. He did not have a map of the gas network and he was unaccompanied let alone supervised. There is no evidence that he had completed the *Job Safety Analysis* provided by *Smart Gas* and his

employer/supervisor was not there to ensure that he undertook the tasks specified in that document before starting the work.

The *JSA* is an important document.. Its purpose is to help the worker identify risks he is likely to meet on the job *before* he meets them and to identify the controls that are to be put in place before they arise. It is a form of hazard identification and risk analysis. One would have thought that, for a young and inexperienced apprentice like Shayne, the *JSA* is essential.

Not surprisingly given his youth and inexperience, Shayne seems to have made a number of mistakes before leaning into the hole and attempting to make the connection. He had failed to do all the *aboveground* work which should have been completed before attempting a connection with the main. He had hung the heater but had not yet installed and connected the meter. And he had not yet connected the copper pipe from the meter to the section of the polyamide pipe which would ultimately be connected to the main. I do not accept that Mr. Hanna had intended to be present, personally to supervise the ultimate connection to the main line. Indeed, on 4 April, 2007 when contacted by Andrew Bradley, he expressed some surprise to learn that the job had not already been completed on the previous day.

Mr. Latimer saw Shayne start work on 4 April, 2007 but had no reason to watch closely and so, made himself a cup of coffee. Meanwhile, Shane uncovered the hole he had dug the day before, tossed some necessary tools

into the hole, lay on his stomach on the ground with his head, arms and the top part of his body into the hole and began work. I think he attached one clamp to the gas line. There is no sign that he had a second clamp easily available to him which, because the gas was flowing in both directions, he would have needed to sever the line with safety. There are photographs of the cutter which Shayne utilized contained in the Coronial Brief. Evidently it employs a *ratchet* style mechanism and the evidence is one needs to take four actions before the blades will move from the fully open to the fully closed position. I am unable to say at what point in the operation Shayne pierced the pipe, producing a high pressure stream of gas but it seems clear that, accidentally or through inadvertence or inexperience or some combination of these, he cut into and severed the line.

One possibility is that Shayne had garnered relatively little experience in similar operations. The evidence is that on nine occasions he had assisted or, with supervision, performed operations which Mr. Hanna described to police as *similar* but the sad fact is that, at least in one essential and important respect, they had often been quite dissimilar. In at least some those earlier jobs and, certainly, in the most recent one of them, Shayne had seen a *dead end line* being pierced – that is, a line where the gas was flowing in only one direction, where one might staunch the flow of gas by applying one *upstream* clamp. But here, he was dealing with a *ring main* with gas flowing in both directions where there was no such thing as upstream or

downstream and, as events tragically demonstrated, a single clamp was quite inadequate.

Shayne had been working for four or five minutes when Mr. Latimer heard *“a very loud explosion”* which sounded *“like air escaping under pressure,”* followed by *“a strong smell of gas.”* To him it smelt like *LPG* gas and he and his wife joked about him lighting up a cigarette. But he had no reason to be alarmed and thought little of it and went out to the entertainment area at the rear of his house. He may even have taken a phone call and then, 7 or 8 minutes after the *explosion*, he heard an elderly neighbour, the late Lionel Gooda, call out *“...I don't think the young fellow's moving...”* Mr. Gooda's impression was that the explosion had seemed to stop Shayne in his tracks and that, afterwards, he could see that his shoulders were not moving. Mr. Gooda's further impression is that he raised the alarm, calling for help, almost immediately after the explosion but that impression is not shared by Kenneth Knott or Peter Latimer. Mr. Gooda was an old man and perhaps he made a mistake about the timing or perhaps he called a number of times and wasn't heard immediately. At any event, I acknowledge that there is a discrepancy in this area of the evidence and am unable to explain it.

At 11.10am, Kenneth Knott who lived across Begonia Boulevard at # 237 also heard *“a loud noise like somebody letting air out”* followed by a strong smell of *LPG*. Then sometime later, he thought perhaps 4 or 5 minutes after the *explosion*, he heard somebody, probably Mr. Gooda, cry *“Is this young man alright?”* and

he ran from the back of his house and towards # 205 and saw that Shayne was not alright.

Mr. Latimer, too, hurried between his house and # 204 to the front of the house, to find Shayne lying on the ground, on his stomach, the top part of his body in the hole and his legs pointed parallel to the street. By then, Kenneth Knott was trying to haul Shayne from the hole. Mr. Latimer slapped Shayne on the back but there was no response so he jumped into the hole and he and Mr. Knott were able to lift him out of the hole and roll him over on to his back. According to Mr. Latimer, Shayne *“didn’t look too good”* and his recollection is that Shayne’s eyes were open and black and his skin colour grey and Mr. Knott recalls that Shayne *“was very blue around the mouth and his eyes were bloodshot.”*

According to Latimer, he looked for a pulse to an arm and the carotid artery without success and he repeated this search several times and found no response at all. Both Mr. Latimer and Mr. Knott had some lifesaving/first aid skills and experience and they commenced *CPR* until Mr. Gooda’s community nurse, Ruth Warren, who happened to be visiting, and a *North Star* staff member took over. Mrs. Latimer phoned the ambulance and Mrs. Knott phoned the *North Star* office to have them turn off the gas.

Both Mr. Latimer and Mr. Knott looked into the hole. Both were aware of escaping gas and Mr, Knott told the inquest he could smell gas and could see a haze emerging from the hole. Mr. Latimer remembers that, when he first looked into the hole, he saw the severed gas line and one clamp attached to the severed end of

the line nearest site # 205. The clamp was a silver clamp which apparently Shayne had brought with him from *Smart Gas* and not one of the clamps which he might ordinarily have been expected to use, usually kept in the maintenance shed at *North Star*. The other end of the severed line was unclamped and gas was flowing freely from it.

Within minutes of Ms. Knott's call, *North Star* groundsmen, Paul Jones and David Welsh were on the scene. They were responding to a 2 way radio message and they arrived on a golf buggy. They brought no tools with them and neither did they carry any protective breathing devices. When Jones and Welsh arrived, Mr. Latimer and Ruth Warren were still undertaking *CPR* and, at some point, Mrs. Ashcroft, a neighbour, was sitting on the ground beside Shayne, holding his hand as if to comfort him.

Mr. Jones, who held a current first aid certificate and was the younger of the two took over from Mr. Latimer. He tried for a pulse at the carotid artery but failed to find one and Shayne gave no sign of life whatsoever. Although he now has no recollection of it, it is likely that Mr. Welsh, with only his T-shirt wrapped around his head for protection from the gas, bravely jumped into the hole and tried to stop the gas flow by bending the line backwards but it was obviously dangerous and both Mr. Jones and Mr. Knott told him to come out.

Mr. Jones could see that only one end of the severed line was clamped and he could see vapour escaping from the line and he could smell a strong smell of gas.

He radioed *reception* calling for clamps which were stored in the maintenance shed and were brought promptly by Mark James Woods, another *North Star* groundsman. According to Mr. Woods, it took him 5 or 6 minutes to respond to the radio message, collect the clamps from the maintenance shed and deliver them to the site. He gave the clamps to Mr. Welsh who again tried to stem the flow of gas but, evidently, the flow was still too strong and he was unable to install the clamp. Paul Jones told Mr. Woods to turn off the gas at the bulk tank which was situated near the rear gate of the park. Although Mr. Woods had received no training in the operation of the bulk tank, he “*just used his common sense*” and managed to stop the flow. Woods then returned to # 205 to find Mr. Welsh in the hole, able to install a clamp now that the gas flow was diminishing.

From time to time, in the course of their duties as groundsmen, Messrs. Jones, Welsh and Woods had all assisted plumbers in the installation of gas services to various sites in the park but they agreed that their assistance had been limited to digging holes and trenches, laying pipes, filling in holes and trenches and laying the metal ribbon which is used to aid in the detection of buried pipes. They are unanimous that they were never asked to tap into a gas line or make any connections. Each was aware of the existence in the *North Star* front office and in the maintenance shed of a map depicting the park’s gas reticulation system and, indeed, of separate maps showing the underground water, sewerage, electricity and television lines and occasionally, the gas map was shown on request to Glen Hanna of *Smart Gas* and to Peter Thompson,

another plumbing contractor, when they were doing work at the park. But it is not clear that these maps were entirely up to date and there appears to have been no co-ordinated map depicting the connections of all the various services and Mr. Welsh admitted that, when digging a hole or a trench at *North Star*, it was wise to dig slowly and carefully in order to avoid severing one line or another.

Evidently, *North Star* groundsmen were also sometimes required to assist when residents suspected a leaky gas meter but their evidence is that, in those circumstances, their assistance was limited to testing for a leak by applying a solution of soap and water to the meter and contacting a plumber if they found that solution bubbling.

Mr. Woods says that, as he was delivering the clamps to Mr. Jones, he was followed by an ambulance. Ambulance records indicate arrival at the scene at 11.22am. Once ambulance officers arrived, they noted that Shayne was receiving “*effective CPR*” but they took over the *CPR* and moved Shayne further away from the hole where there was still a strong smell of gas. Ambulance records note that, at 11.24, 11.30 and 11.34am, there were *no vital signs*. One milligram doses of *adrenaline*, were given at 11.27, 11.30 and 11.33am and 200 mls of *Hartmann’s Solution* were administered intravenously. At 11.39am, Shayne’s vital signs were recorded as “*pulse 146 bpm, blood pressure 125 systolic (no diastolic measurement recorded)*” and, at 11.51am as “*pulse 158 bpm, blood pressure 95 systolic (no diastolic measurement)*.” Shayne was then conveyed by ambulance to *Tweed Heads District*

Hospital where he was placed on a respirator and transferred to *ICU*.

According to the medical records, Shayne was diagnosed as suffering from a “*non-recoverable hypoxic brain injury*.” He was removed from the respirator at 1.00pm on 7 April, 2007 and died at 2.30pm that day.

In his *post mortem* report of 1 May, 2007, Dr. Brian Beer indicates that Shayne died of *asphyxiation* causing severe *hypoxia* and consequential brain damage. Dr. Beer found no external injuries nor any other abnormalities relevant to the determination of cause of death but he did find that Shayne’s heart weighed 530 grams which suggested to him *mild left ventricular hypertrophy*. Dr. Beer found that condition was consistent with Shayne being a fit young man which is a finding supported by Dr. Hellestrand.

Professor Ansford, a forensic pathologist, who was retained on behalf of *Smart Gas* to prepare a report, opined that perhaps the ventricular hypertrophy was attributable to pre-existing cardiac pathology, specifically a cardiomyopathy. Such would certainly surprise those like his mother who knew Shayne and his busy, athletic lifestyle and regarded him as a very fit young man.

In his report, Professor Ansford noted that, absent cardiovascular disease or other pathology, any such pathology would very likely be accompanied by familial history of early death, excessive alcohol consumption or hypertension, all of which were absent in Shayne’s case. Nor was there any sign of disease and, in those

circumstances, I think it is safe to say that the condition was benign and attributable to Shayne being a fit, healthy and active young man. It is necessary to view the findings at *autopsy* and Dr. Beer's opinion as to *cause of death* through the prism of the scientific evidence presented to the inquest, particularly by Professor Whyte and Professor Moore.

Each of the three *North Star* groundsman who attended # 205 on 4 April, 2007 gave evidence of the strong smell of gas they noticed on their arrival. Two of them, Mr. Jones and Mr. Woods, mentioned another smell sometimes experienced at *North Star Holiday Resort* which they described as the smell of *groundwater*, particularly evident after heavy rains and, according to Mr. Jones, strongest near the creek which runs at the rear of the park. But Mr. Jones was clear that the smell he experienced outside # 205 was not the *groundwater* smell but was the smell of *LPG* with which he was familiar from the ordinary, day to day experience of lighting a gas stove. Mr. Jones was able to draw a clear distinction between the two smells and noted that, the *groundwater* smell could be "*pretty strong*" but doesn't cause headaches, sickness or fainting and, at any event, was not present outside #205 on 4 April, 2007.

Mr. Woods was also familiar with the *groundwater* smell and he told the inquest that the gas smell he noticed outside # 205 when he arrived to find Jones and Welsh there was similar to "*the smell coming from drains after heavy rains.*" I did not find Mr. Woods a very reliable witness. His first description of the way he shut off the bulk tank – merely reversing the procedure he had seen

adopted by *Elgas* operatives, turned out to be quite wrong and he was wrong, too, in telling the inquest that he had travelled from the maintenance shed to # 205 by golf buggy. The evidence is clear that, at that time, there was only one golf buggy and that had been utilised by Jones and Welsh and, so, had not been available to Woods. At any event, Mr. Woods later told Mr. Cahill of Counsel that the *groundwater* smell occasionally noticed around the park was never overpowering and never caused headaches, sickness or fainting and was nothing like the strength of the smell of gas which met him outside # 205 when he delivered the clamps there. On the question of the smell emitting from the hole outside # 205, I would prefer Mr. Jones' evidence that the smell was a characteristic *LPG smell*, quite different from the *rotten egg gas* odour associated with *Hydrogen Sulphide* rather than the evidence of Mr. Woods.

Mr. "Ben" Beadel, now the *grounds manager* at *North Star Holiday Park* told the inquest that he has occasionally noticed around the park a smell which he associates with storm water. He cannot remember what he smelt on 4 April, 2007 but he said that what he would describe as *storm water smells*, when they are noticeable, seem to emerge from the approximately half dozen drainage openings placed in gutters in the park and opening into the underground drainage system. Mr. Beadel was able to show on a map the position of these openings, none particularly close to # 205. According to Mr. Beadel, the *storm water smells* differ markedly from *rotten egg gas* and he has never been aware of odours "*coming from the ground*" at *North Star Holiday Park*.

Neither Mr. Latimer nor Mr. Knott who certainly noticed the smell of *LPG* reported the presence of *rotten egg gas*. Mr. Gooda who could see Shayne in the hole at the time of the rush of gas could smell the gas but he, too, does not suggest rotten egg gas.

Retained Fire Fighter Lucas Herrington of Kingscliff Brigade gave evidence to the inquest. It was he who answered a callout requesting assistance to an ambulance received at 11.13am on 4 April, 2007. He followed the ambulance to # 205 and, among the functions he performed, was a test of gasses in the vicinity of the hole from which Shayne had been recovered. To undertake this task, Mr. Herrington used an *Orion Gas Detector* which had only recently been made available to the Fire Brigade at Kingscliff and which he calibrated in the fire engine *en route* to the park.

The *Orion* contains four sensors attuned to four different classes of gas, namely *oxygen*, *explosive or volatile gasses*, *carbon monoxide (CO)* and *hydrogen sulphide (H₂S)*. The machine sounds an alarm and displays a reading indicative of levels detected. Regarding *oxygen*, the machine will signal a departure from the normal level of 20.8%. As to *explosive/volatile gasses*, the signal is given where the level detected exceeds the *LEL* (lower explosive level) and, relevantly, in the case of *H₂S*, the alarm will be given when levels exceed 10 parts per million. According to the memorandum of Superintendent Chris Fabri of the NSW Fire Brigades of 27 November, 2008, a copy of which is found in the

Coronial Brief, *RFF* Herrington had reported “when sampling the atmosphere in the hole where the fatality occurred the gas detector went into alarm mode showing the following approximate readings from my recollection:-

-LEL less than 10%

-CO approx. 50 parts per million

-O₂ approx. 18%

H₂S (unsure of reading).”

In his statement of 15 February, 2011, *RFF* Herrington says that the *Orion* went into alarm mode when he placed the probe into the hole indicating that gasses were present. Evidently, the machine was responding to the possible presence of one or a combination of two or three classes of gas – a volatile gas or perhaps a combination of volatile gasses amounting to less than 10%, carbon monoxide at about 50 parts per million and oxygen at 18%. But Mr. Herrington reports that, while *Hydrogen Sulphide* was also present, he “was unsure what level was indicated” and “cannot recall from memory what the actual *Hydrogen Sulphide* reading was.” At the inquest, Mr. Herrington conceded that he cannot now be sure if he ever had an H₂S reading and he went further and said that he “would have remembered an H₂S reading exceeding 10 ppm had there been one.”

A complication for Mr. Herrington was the phenomenon of *cross-sensitivity* which is dealt with in the *Orion* operating manual. The manual warns that “some sensors react against gasses other than those for which they have been designed. For instance, the carbon

monoxide sensor will show a reading when hydrogen is present” and the operator is advised “do not be alarmed if the CO and H2S sensors show small readings while detecting combustible gasses with the %LEL sensor. This is neither a positive nor a negative reading...”

About 15 minutes after first testing the atmosphere in the hole, Mr. Herrington again applied the *Orion* and, this time, there was no alarm, all readings were normal and, the bulk tank having been turned off, the second clamp having been installed and some sand having been placed into the hole, all was safe. I think this argues powerfully against the suggestion of H2S having played a significant part in the incident.

The *Orion* has a capacity to electronically record and retain its findings but, sadly, they are not available in this instance. According to Mr. Herrington, the memory is to be accessed and downloaded by Fire Brigades technicians when the machine is sent down to Sydney for that purpose and, for reasons about which I am not entirely clear, that did not occur in this instance and the readings can no longer be recovered.

Further, *RFF* Herrington’s statement of 15 February, 2011, prepared almost 4 years after the event, was prepared by reference to Mr. Fabri’s memorandum of 27 November, 2008. Mr. Herrington had prepared an earlier statement at a time when his recollection of events was probably clearer and more complete but that statement was unavailable to him in February, 2011 and is unavailable now. In answer to a question by Mr. Cahill of Counsel, Mr. Herrington admitted that he had not kept

any data relating to his tests at #205 on 4 April, 2007 and that, when he first recorded the events, several months had expired since Shayne's death. For those reasons, it seems to me that the evidence of *RFF* Herrington adds very little to the question of the presence of *swamp gasses* and *hydrogen sulfide* in particular as a factor in Shayne's death.

Further on the question of *swamp gasses*, particularly *Hydrogen Sulphide*, it is noteworthy that a fracture in the sewer line at the rear of # 205 was uncovered in November, 2007, some seven months after Shayne's death. Although there was some *potholing* caused by soil and sand falling into the pipe in the area of the fracture, it is impossible now to say when that fracture occurred and whether it existed as early as April, 2007.

Now it is clear that raw sewage can generate *hydrogen sulfide* so, notwithstanding the lack of evidence that anybody noticed the smell of *rotten egg gas* at or near # 205 on 4 April, 2007, the possibility of that H₂S having been present as early as April, 2007 and having played a part in Shayne's death must be investigated.

A lengthy and detailed expert report was prepared for the Coroner by Colin McKay of *Environmental Earth Services Pty. Limited* of Artarmon. *Ladehai Pty. Limited*, the proprietor of *North Star Holiday Resort* commissioned and filed a similar expert report by Claire Richardson of *Air Noise Environment Pty. Limited* of Capalaba, Queensland. Those two experts were joined by David Arbuckle who was retained on behalf of *Smart Gas Pty. Limited*. Mr. McKay and Ms. Richardson

appeared at the inquest but, at the time, Mr. Arbuckle was in New Zealand and unable to be reached and Ms. Thompson of Counsel agreed that the inquest should continue in his absence.

After a conference on 4 March, 2011, Messrs McKay and Arbuckle and Ms. Richardson prepared a *Joint Experts' Report EXHIBIT 2* reviewing Mr. McKay's statement of evidence in which they announced that "*there are no material areas of disagreement.*" Their overall conclusion is that "*environmental formation of 'swamp gasses' including methane (CH₄), carbon monoxide (CO), carbon dioxide (CO₂) and hydrogen sulphide (H₂S) beneath the site is unlikely to be significant and unlikely to have played a role in the demise of Shayne McMahon.*" This conclusion is supported by particularly exhaustive soil, groundwater and gas generation tests at *North Star Holiday Resort* in general and in the area of # 205 in particular.

It is well known that *rotten egg gas* possesses a distinct and readily identifiable odour and Ms. Richardson told the inquest that even as tiny a concentration as 5 micrograms per cubic meter or .0005 parts per million would probably prompt vociferous complaint. As far as I know, no such complaints were ever voiced at around the time of Shayne's death.

But the evidence of the experts goes much further. According to Ms. Richardson and Professor Moore, the threshold level at which exposure to *H₂S* can generate significant health effects is something in the order of 320 parts per million which is an order of magnitude which

could hardly have been missed. Instead, the experts McKay, Richardson and Arbuckle concluded that *“having reviewed the available background information, monitoring data and results relevant to this investigation,.... ...it is highly unlikely that swamp gas (be it carbon monoxide, hydrogen sulphide or methane) played a significant part in the demise of Mr. McMahon.”*

There were very low levels of H_2S detected by Mr. McKay in the bore samples taken in and around the park in the course of his examination and he reported that *“hydrogen sulphide odour was smelt on some of the sediments below the water table (BH4, BH7, BH9, BH10). This was reported to me by Yolande Dowling, the scientist logging the holes, and I have followed up with her that the level observed was feint (she had to hold the sample close to her face before smelling anything.)”* A peculiarity of H_2S is that it causes paralysis of the olfactory nerve and can no longer be smelt at about 150ppm, well below the level at which it can cause physical harm.

In contrast, Mr. McKay’s evidence is that the bore holes and test pits installed in the vicinity of # 205 disclosed no evidence of *hydrogen sulphide*.

Further, while the evidence of *“Ben”* Beadel, the grounds manager at the park, is that the *groundwater smells* seem to emanate from entrances to the underground drains, Ms. Richardson told the inquest that the presence of leaf litter and other vegetable matter washed into drainage systems, together with standing water, can create an environment within the confines of

the drainage system that is capable of generating hydrogen sulphide. There is, however, no suggestion that it was present in the drainage system at *North Star Holiday Resort* in April, 2007 and no explanation of it having found its way to the hole which Shayne had dug without impacting on anybody else within the park.

As to the broken sewer pipe, if indeed it was broken as early as April, 2007, the theory that it may have played a part in Shayne's death was specifically rejected by Mr. McKay who told the inquest that monitoring, particularly of the groundwater, does not suggest that the allegedly leaking sewage main/pipe generated a plume of any significance – let alone a plume of sufficient magnitude that it was capable of generating *hydrogen sulphide* at significant, let alone lethal levels.

One should not be surprised or dismayed when scientists cannot give a categorical guarantee just as McKay, Richardson and Arbuckle cannot. When they speak of *categorical guarantees*, they are dealing in scientific certainty. At best, this inquest like almost all legal proceedings, must be content with *probabilities* but on the basis of the evidence and, in particular, the careful and thorough scientific evidence gathered by Mr. McKay, Ms. Richardson and Mr. Arbuckle, I am very comfortably satisfied that *hydrogen sulphide* played no part in the death of Shayne McMahan.

Professor Ian MacGregor Whyte of *Calvary Mater Hospital* at Newcastle was asked on behalf of the inquest to prepare an expert report regarding Shayne's death. Professor Michael Moore was retained for much

the same purpose by Messrs. Sparke Helmore, solicitors, on behalf of *Smart Gas Pty. Limited*. Both gentlemen are extremely well qualified in the field of toxicology and are leaders in their field in Australia and each prepared a report forming parts of the Coronial Brief. They appeared jointly to give evidence at the inquest. Where initially there were some apparent differences of view, Professors Whyte and Moore met in conference at Mount Gravatt on 8 March, 2011 and produced a two page *Joint Expert Report* **EXHIBIT 7** in which they concluded that *“the cause of death of Shayne Hamilton McMahon (was) most likely a butane – induced cardiac arrhythmia (contingent on no other evidence being provided of hydrogen sulphide generation).”* As Professor Whyte explained *“We both agreed that arrhythmia is the most likely cause of the brain damage causing Shayne’s death. Pure asphyxiation was insufficient to explain his inability to extricate himself from the hole. Professor Moore had been told that there was a possibility of hydrogen sulphide which can produce a rapid ‘knock down’ and we were aware of the toxicity of butane which causes the heart to be sensitized to catecholamines such as adrenaline. We were both sure that some event had happened very early on, leaving not enough time for hydrogen sulphide to have an effect and therefore we believe that butane caused a rhythm problem **within one or two breaths** sensitizing his heart to adrenaline ...”*

Professor Whyte explained that the two experts had agreed that, given the physical exertion involved in cutting the line and the sudden appreciation of the gas

leak – *the flight or fight syndrome*, Shayne probably experienced a rush of adrenaline with which his sensitized heart could not cope and that *arrhythmia* then stopped his heart. He went on to opine that “*there was no blood going to the brain for 4 to 6 minutes. 4 to 6 minutes is enough to kill the brain after which nothing can change the outcome*“.

Professors Whyte and Moore agree that *butane* has a propensity to produce *arrhythmia* and they mentioned that this is particularly problematic in warm climates such as the Australian where, as Professor Moore explained, the *butane* component of the *complex mixture* which goes to make up *LPG* warrants special caution.

Both experts agree that Shayne’s sudden exposure on 4 April, 2007 to a gas containing a high concentration of *butane* was sufficient to disable him and render him unconscious extremely quickly, leaving him no time to extricate himself, and to kill him. Professor Whyte explained that Shayne would have met a cloud of gas containing both *propane* and *butane* and that the *propane* would be expected to have emerged from the severed pipe more quickly so that, a short time after, in a matter of seconds, the relative concentration of *butane* emerging from the severed pipe would have been much more dense and would have been deadly. Both agree that “*the inhalation of very high concentrations of butane have in the past been associated with cardiac arrhythmias and sudden death.*”

Referring to a study of the *Health Council of the Netherlands: Committee on Updating of Occupational Exposure Limits. Liquefied Petroleum Gas, Propane, Butane, Health based Reassessment of Administrative Occupational Exposure Limits. The Hague: 2004,2000/150SH/134*, a copy of which is contained in the Coronial Brief, and its finding that “*butane abuse was frequently fatal, mostly due to heart failure (arrythmias, ventricular fibrillation, asystole)*” Professor Moore reminded the inquest that not everybody will react to *butane* in the same way. Nevertheless, both experts thought that Shayne might have been unconscious “*in one breath.*”

Pointing out that several other comparable jurisdictions require that the potential effects of *butane* be better described on the equivalent of *MSDS (Material Safety Date Sheets)* than *NSW* regulations presently require, Professor Moore called for an amendment to *the MSDS* to note “*the separate and deliberate risk represented by butane.*” Both experts suggest a recommendation to manufacturers and suppliers of *LPG* that “*attention be drawn to the danger represented by the presence of butane in LPG and that adequate toxicological information and warnings should be provided.*”

Regarding the suggestion that the fatal agent in Shayne’s death may have been *hydrogen sulphide* rather than *butane*, Professor Whyte certainly does not disagree with Professor Moore’s report insofar as it explains the potentially lethal effects of *H₂S* poisoning. “*Hydrogen Sulfide is a mitochondrial poison which acts like cyanide through inhibition of cytochrome oxidase.*

This results in uncoupling of oxidative phosphorylation and consequent blocking of utilisation of oxygen by tissues. In addition, it will bind reversibly to haemoglobin in the blood through generation of sulfmethhaemoglobin, a sulphur complex of methaemoglobin in which the haemoglobin iron is present in oxidized ferric state rather than the physiological reduced ferrous state.”

According to Professor Moore’s report “the most dangerous aspect of hydrogen sulphide is its capacity to cause olfactory paralysis. This means that individuals exposed to the gas can initially detect its presence by smell. After a relatively short period of time the paralysis of the sense of smell means that H₂S can no longer be detected. Unconsciousness and death have been recorded following prolonged exposure to 50pprn H₂S. At concentrations between 700 and 1000 pprn there is rapid onset of unconsciousness, respiratory paralysis and death....”

At the inquest, Professor Moore went on to explain that, at lower levels, the paralysing effect and loss of smell is progressive but, at levels of about 150 ppm, it is very sudden although well below the lethal level which would represent an increase by a factor of five. He explained, too, that exposure to lower levels of H₂S can cause brainstem toxicity leading to confusion and loss of consciousness and, “at high enough levels, very early paralysis with no time for nausea” leading to death.

In his written report, Professor Moore writes of the potential of H₂S exposure to cause rapid knock-down,

perhaps associated with *asphyxiation*, and, elsewhere, sudden death which can follow exposure to high levels of H_2S at 700 to 800 ppm causing *myocardial infarction* coupled with *cardiopulmonary arrest*.

I do not understand Professor Whyte to doubt the potentially lethal effects of *hydrogen sulphide* poisoning or the possibility it offers of rapid *knock-down*. Rather, both experts have arrived at a view, where the evidence of the presence of effective levels of H_2S seems scant, that a more likely explanation of the catastrophe which befell Shayne is *butane* poisoning. Professors Whyte and Moore opine that “*if hydrogen sulphide had been a significant contributor to Shayne’s collapse, there should have been a concentration gradient of hydrogen sulphide spreading out from the hole and we would have expected that someone would have mentioned the characteristic smell of hydrogen sulphide (rotten egg smell) at the time whereas evidence of only smelling LPG was given.*” Their view is that “*butane-induced cardiac arrhythmia*” is a medically appropriate explanation of Shayne’s death.

Professor Ansford came to the same conclusion that Shayne’s death was not caused by *asphyxiation* but, rather, by the inhalation of *LPG*. As he noted “*asphyxia is not a sudden process it occurs over a period of minutes to hours. However a sudden burst of gas directly into the face could potentially cause reflex cardiac stoppage and/or a cardiac rhythm disturbance (notably ventricular fibrillation).*” Professor Ansford concluded “*in my opinion, the most likely cause of the deceased’s cardiac arrest and death is a sudden burst*

of LPG gas into the face causing a fatal cardiac arrhythmia, most likely ventricular fibrillation.”

The sad consequence of these circumstances is that his family and our community were robbed of a wonderful young man who is so greatly missed by his family and his friends. On behalf of all those involved in this inquest, I wish to express our sympathy and sadness at what happened. At the same time I would like to express thanks and appreciation to the people who did what they could for Shayne on 4 April, 2007 – particularly to Mr. Latimer, Mr. Knott and Ms. Warren, to the lady who sat beside him and tried to comfort him, Mrs Ashcroft, and to the three *North Star* workers, Messrs. Jones, Welsh and Woods.

I find that Shayne Hamilton McMahon, who was born on 17 April, 1986, died at about 2.30pm on 7 April, 2007 at *Tweed Heads District Hospital*, Tweed Heads, NSW as a result of widespread *hypoxic brain injury* secondary to *cardiac arrhythmia, ventricular fibrillation* or *asystole* induced by an exposure to a high concentration of *butane*, when shortly after 11.00am on 4 April, 2007, he was working in the course of his employment with *Smart Gas Services Pty. Limited* on the connection of a new gas installation at site # 205 Begonia Boulevard within *North Star Holiday Resort* at 1 Coast Road, Hastings Point NSW.

As foreshadowed in my remarks, I make the following recommendations:-

1.To the Minister responsible for the *WorkCover* Authority of New South Wales and to the Chief Executive Officer of the *WorkCover* Authority of New South Wales:-

(a)That the *WorkCover* Authority of New South Wales issue a Safety Alert advising industry that the presence of *butane* in liquid petroleum gas (“*LPG*”) products has the capacity to induce a fatal *cardiac arrhythmia, ventricular fibrillation or asystole* upon exposure to high concentrations of *LPG*, for example upon the failure, or intentional severing, of an *LPG* gas supply line.

(b) That the Coroner recommend that the *WorkCover* Authority of New South Wales issue a Safety Alert advising industry that *Material Safety Data Sheets* authored and/ or issued with respect to *LPG* should include toxicological data and warnings relating to the risk of fatal cardiac arrhythmia associated with the presence of *butane* in *LPG*.

2.To the Minister for Commerce and the Minister for Fair Trading:-

I recommend to the Minister for Commerce and the Minister for Fair Trading, in their ministerial capacities relating to the administration of the *Home Building Act 1989 (NSW)*, that as a matter of urgency they notify all holders of contractor licences authorising the holder to contract to perform and/ or perform specialist gas fitting work as defined in the Act that the presence of *butane* in *LPG* products has

the capacity to induce a fatal *cardiac arrhythmia*, *ventricular fibrillation* or *asystole* upon exposure to high concentrations of *LPG*, for example upon the failure, or intentional severing, of an *LPG* gas supply line.

3.To the Minister for Education and Training:-

I recommend to the Minister for Education and Training that as a matter of urgency the Minister direct *TAFE NSW* to incorporate in its learning programme(s) including, but not limited to, the Certificate III Course in Plumbing a warning or Safety Alert that the presence of *butane* in *LPG* products has the capacity to induce a fatal cardiac arrhythmia upon exposure to high concentrations of *LPG*, for example upon the failure or severing of an *LPG* gas supply line.

4.To the Proper Office, *Australian Liquefied Petroleum Gas Association Limited*, trading as *LPG Australia*:-

(a) I recommend that the Proper Officer of *Australian Liquefied Petroleum Gas Association Limited*, trading as *LPG Australia*, notify its members, and in particular members who manufacture and/ or supply liquid petroleum gas ("*LPG*") that the presence of *butane* in *LPG* products has the capacity to induce a *fatal cardiac arrhythmia*, *ventricular fibrillation* or *asystole* upon exposure to high concentrations of *LPG*, for example upon the failure or severing of an *LPG* gas supply line.

(b) I recommend that the Proper Officer of *LPG Australia* notify its members, and in particular, members who manufacture and/ or supply *LPG*, of the view expressed in the course of the inquest touching upon the death of Shayne McMahon by Professors Whyte and Moore that *Material Safety Data Sheets* authored and/ or issued with respect to *LPG* should include toxicological data and warnings relating to the risk of fatal *cardiac arrhythmia*, *ventricular fibrillation* or *asystole* associated with the presence of butane in *LPG*.

5.To the Minister responsible for the *WorkCover* Authority of New South Wales, the Minister for Energy, Minister for Commerce and the Minister for Fair Trading and to the Chief Executive Officer of the *WorkCover* Authority of New South Wales:-

I recommend that the Ministers and the Chief Executive Officer give urgent consideration to referring the regulation of private gas distribution networks, where those distribution networks are contained entirely, and operate solely, within the confines of private property, to the relevant officer and/ or standards committee of *Standards Australia* with a view to the development of a standard designed to regulate the design, construction, extension and operation of such networks.

6.To the Commissioner of *NSW Fire and Rescue*:-

I recommend that the Commissioner of the *Fire and Rescue NSW* conduct a review of recording procedures relating to the keeping of records disclosing gas readings, including, but not limited to, gases detected and such other data as may be logged by gas detection units in use from time to time by the *Fire and Rescue NSW*, with a view to ensuring that all such data obtained with respect to attendances at incidents involving serious personal injury and/ or death are maintained.

Magistrate Scott Mitchell,
NSW Deputy State Coroner.
Ballina.
11 March, 2011.