OFFICE OF THE STATE CORONER

FINDINGS OF INQUEST

CITATION:	**Inquest into the death of Gregory Clifford Paterson**
TITLE OF COURT:	Coroner's Court
JURISDICTION:	Cairns
FILE NO(s):	COR 2747/07(3)
DELIVERED ON:	18 October 2010
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HEARING DATE(s):	22-24 June 2010
FINDINGS OF:	Kevin Priestly, Northern Coroner
CATCHWORDS:	CORONERS: Inquest – Concrete pumping, hose whip, supervision of construction site, Workplace Health & Safety

REPRESENTATION:

To assist the Coroner	Ms Judy Collins
For Family	Mrs Joanne Paterson
For Paynter Dixon Queensland	Mr Grady I/by Norton Rose Australia
For Mr Polley	Mr Ratanatray I/by Worcester & Co
For Workplace Health & Safety Qld	Mr Matthews I/by Legal & Prosecution Services Unit

FINDINGS

Mr Paterson was 56 years of age and resided at 35 Loffs Road, Loganholme. He was married and had six children. Mr Paterson carried on business as a concreter through the registered business name Paterson Concrete Services.

In 2006 the Queensland Government contracted Paynter Dixon Queensland Pty Ltd to construct covered walkways for 29 primary schools located throughout the Mackay/Whitsunday school region. Paynter Dixon engaged subcontractors to perform the trade work. In February 2007 Paterson Concrete Services was contracted to undertake the formwork and concreting of the pathways. Watkins Steel Pty Ltd was engaged to fabricate and install the structural steelwork. Paynter Dixon coordinated the sequencing of the work. Polleys Blocklaying Pty Ltd was engaged by Mr Paterson to provide a concrete pump to transfer concrete overhead from the delivery truck to the walkways. Mr Paterson also engaged Austral Masonry (Qld) Pty Ltd to deliver concrete to the site.

On the morning of 4 June 2007, Mr Paterson was working on the site of the Proserpine State Primary School. Also present were Anthony Polley (principal of Polleys Blocklaying Pty Ltd and operator of the concrete pump); Jeffrey Johnstone (line hand employed by Polleys Blocklaying Pty Ltd) Anthony Peoples (employee of Mr Paterson); Mr Justin Leeming (employee of Mr Paterson); Mr Kenneth Muller (employee of Mr Paterson); Mr Leo Schroeder (employee of Mr Paterson); and Mr David Dunk (concrete truck driver and employee of Austral Masonry).

Mr Polley had arrived on site with Mr Johnstone in the concrete pump and set up in preparation of the first supply of concrete arriving on site at 6.00am. It didn't arrive until 6.15 am. Upon completion of the first pour, the concrete pump relocated to enable it to reach the formwork and avoid trees. The concrete pump was set up in its new position. When the truck returned, the boom was moved out into position between the purlins ready to restart pumping.

Mr Johnstone was handling the discharge end of the line. Mr Patterson's workers were in the general vicinity and forward of the discharge point. Mr Patterson was standing behind Mr Johnstone at a point where the pump line descended down from the boom (above the purlins) and turned to run horizontally towards Johnstone. Mr Patterson was leaning with his shoulder against the pump line, pushing it forward in the direction of Mr Johnstone to extend the length of hose available him.

Shortly after resuming concrete pumping, the concrete pump experienced a blockage (it could be heard labouring without any output). Then suddenly it released itself under considerable pressure, sufficient to whip the hose from the hands of Mr Johnstone. There was a recoil in the hose and it struck Mr Paterson to the left side of the face, knocking him backwards to the ground. His head struck the region of a base plate at the foot of a steel post.

Immediate arrangements were made for an Ambulance to attend while first aid was administered. Mr Paterson was transported by Ambulance to Proserpine Hospital unconscious and suffering a serious head injury. He was then transported by Careflight to Townsville Hospital for neurosurgical review; arriving about 3.35 pm. Examination revealed a large laceration to the right parieto-occipital region (7 cm) and a palpable skull fracture in the same region. A CT Scan revealed a depressed skull fracture in the right parieto-occipital region but no raised intracranial pressure. Mr Paterson was admitted to intensive care and administered intravenous antibiotics and fluids. The head wound was later cleaned and sutured. Mr Paterson was managed conservatively until 13 June 2007 when he suddenly deteriorated. Investigations revealed a massive pulmonary embolism that requiring dissolution notwithstanding the risk of intracerebral haemorrhage.

Thrombolysis was attempted twice without success. On 15 June 2007, Mr Paterson went into asystole arrest and died.

Medical Cause of Death

On 19 June 2007 Professor Williams conducted an autopsy and concluded that death was due to head injury sustained in an industrial accident. His autopsy report is dated 5 September 2007.

On examination of the central nervous system, Prof Williams found a stable depressed skull fracture and small amounts of haemorrhage associated in the adjacent dura. There was no significant quantity of subdural haemorrhage and minimal subarachnoid haemorrhage. Extradural haemorrhage was not seen.

Examination of the cardiovascular system revealed what appeared to be the presence of a clot rather than thrombus in the vena caeva. Similar material was seen in the pulmonary arteries. However, Prof Williams reported it was difficult to identify this material as either thrombus or clot and queried the effects of thrombolytic agents.

Examination of the respiratory system revealed bilateral severe congestion of the lungs as well as an appearance suggestive of a degree of pulmonary infarction. Prof Williams reported bronchopneumonia was not an obvious feature.

Histological examination of the lungs showed frequent areas of large numbers of red blood cells within the alveoli spaces and in many areas, the appearances of those of infarcted lungs. However Prof Williams noted that Mr Paterson was given Thrombolysin which may have dissolved some of the pulmonary thromboembolism causing impaired blood supply to the lungs.

The toxicology results for the presence of alcohol and cannabinoids were negative.

In his conclusion, Prof Williams reported that examination of Mr Patterson demonstrated he had a head injury apparently sustained as a result of an industrial accident as well as complications from prolonged immobility in a hospital bed including pulmonary thrombi.

In a preliminary report dated 11 November 2009 Dr John Olsen, consultant physician in occupational and environmental medicine, expressed the opinion that Mr Patterson died due to a massive pulmonary embolism resulting in respiratory arrest and then cardiorespiratory arrest two days after the massive pulmonary embolus. Dr Olsen was provided with the medical records from Townsville Hospital for the purpose of preparing a final report. In interim, a further report was obtained from Prof Williams dated 13 April 2010 in which he reported: --

> *"This man had a clinically sustained pulmonary emboli while in hospital and had been treated for these pulmonary emboli by an agent that rendered the thromboemboli dissolvable. These dissolvable thromboemboli are similar in appearance to the post-mortem clot that is a major occurrence in every autopsy. These dissolvable thromboemboli do not have the same histological appearance as genuine pulmonary thromboemboli.*
>
> *In my opinion, these dissolvable pulmonary thromboemboli are not necessarily a real finding.*
>
> *In my opinion, I can only diagnose what I recognise as pulmonary thromboemboli not artefacts that may resemble pulmonary embolus.*
>
> *Despite that, even if this man did have the pulmonary thromboemboli, the cause of death could be given as:*

(1a) Pulmonary thromboemboli, due to
(1b) Deep vein thrombosis, due to
(1c) Immobility, due to
(1d) Head injury, due to
(1e) Industrial accident.

And by this I am implying that complications such as pulmonary emboli are recognised complications of people who have a major head injury.

In my opinion, this man had a significant head injury and he died of that head injury, his brain demonstrating swelling and also hypoxic Purkinje cells in the cerebellum. It is perhaps splitting hairs to suggest that there are alternative courses of the death of this man."

Dr Olsen provided a comprehensive report dated 10 June 2010 following his review of the medical records from Proserpine and Townsville Hospitals. Dr Olsen concluded his review as follows: --

"In my opinion the findings of cause of death found by Dr Williams are not consistent with the contemporaneous medical history as set out in the Townsville Hospital medical records. The clinical diagnosis made together with the CT scan investigation clearly show that this patient died from the effects of a pulmonary embolus resulting in right ventricular failure. Associated with that was renal failure and possibly infection associated with the recording of high fever. The absence of diagnosis of a DVT in my opinion does not affect the diagnosis of pulmonary embolism. Death by pulmonary embolus is not commonly a consequence of hospitalisation for a skull fracture, nor should it be expected."

During the course of the evidence, Dr Olsen was asked whether he agreed with the alternative cause of death as proposed by Prof Williams in the event that Mr Patterson did have pulmonary thromboemboli. Dr Olsen did not disagree with that manner of certification or sequencing of the mechanism of death.

The underlying issue is a causal connection between the industrial accident and death. Did the involvement of pulmonary thromboemboli constitute an intervening cause, severing any causal connection between the industrial accident and death? To my mind, this substantially depends on whether pulmonary thromboemboli is a recognised complication for a person suffering immobility due to head injury. Although Dr Olsen opines in his most recent report that death by pulmonary embolus is not commonly a consequence of hospitalisation for a skull fracture, the issue properly framed is whether pulmonary embolus is a recognised complication of immobility, not a skull fracture. On the direct evidence of Prof Williams, and indirectly by Dr Olsen's adoption of the alternative manner of certification of death proposed by Prof Williams, the answer must be in the affirmative.

Therefore, I find that the chain of causation of death should read:
(1 a) Pulmonary thromboemboli, due to
(1 b) Deep vein thrombosis, due to
(1c) Immobility, due to
(1d) Head injury, due to
(1e) Industrial accident.

Hose Whip – The Hazard

Before a closer examination of the concrete pumping operation, the reader will need a basic understanding of the hazard of hose whip.

Hose whip is well recognised as a hazard in concreting operations. This fact is the best demonstrated by the actions of the workers in the vicinity of the discharge end of the line where the concrete was being placed. Each of the workers who gave evidence reported hearing the concrete pump labouring and immediately turned to face away from the discharge end of the hose. It was their experience to expect a high pressure spray of concrete. The spray is accompanied by a recoil in the delivery line known as hose whip. Hose whip as a hazard is documented in most of the literature relating to concrete pump operations published by manufacturers of concrete pumps and associations of concrete pump operators. Some of that material was admitted into evidence.

However, there does not appear to be a reasonable level of understanding of the magnitude of the risk of harm posed by hose whip among workers, operators and Workplace Health and Safety Qld (WHSQ) inspectors.

The American and Concrete Pumping Association published a safety bulletin in January 2005 related to hose whip that lists three factors that must come together for a hose whipping hazard to exist;

1. There must be air in the delivery system,
2. There must be something pushing on the air, and
3. There must be restriction near the hose causing air to compress.

The bulletin also provides a good description of the dynamics involved in hose whip. The following description should be read in conjunction with a diagrammatic representation of the process taken from the same publication and included in Appendix A to these findings:

> *Once inside the pipeline, the air is pushed by the concrete coming behind it, and, in turn, pushes the concrete in front of it. Within moments, the air pressurizes to the same pressure required to push the concrete in front of it. When the air pressurizes, it takes less space, in much the same way a spring takes less space when a force is applied.*
>
> *As the air travels through the pipeline, it takes less and less pressure to push the concrete in front of it, (because there's less and less concrete in front of it). As the pressure drops, the air expands, taking more space than it had a moment before. As it expands, the concrete in front of it must move faster to accommodate the ever-expanding air pushing it.*
>
> *The vast majority of the time, concrete accelerating in front of the air pocket results in a harmless escape; the concrete squirts out rapidly, there's a small "puff" as the air escapes, and the concrete behind the air resumes flowing normally. Perhaps the hose gives a small jerk and there's some splattering by the air/concrete mixture. No one is at risk in this case.*
>
> *A small percentage of the time, the material accelerating in the delivery system gathers in the hose or reducer and forms a blockage. The fact that air is forcing the material to accelerate rapidly may cause some segregation of the material components, thereby increasing the chances of blockage formation. Whatever the cause, once a blockage has formed in front of air, the hazard is in place.*
>
> *In the best-case scenario, the blockage releases with minimal pressure increase, or the blockage is so complete that even when the pump reaches maximum pressure, it does NOT release. In the latter case, there is no expulsion, the pump stops moving material as the hydraulic relief systems are activated, and the operator can relieve the pressure before looking for the plug.*

In the worst-case scenario, high pressure is exerted on the air pocket before the blockage releases, and the reaction of the air escaping at high velocity causes the hose to whip violently.

What factors contribute to the ingression of air and the blockage of concrete thereby pressurising the air? On reviewing a number of publications tendered into evidence and on hearing the expert witnesses, the following contributors can be identified as possibly applicable to the present circumstances:

1. Faulty concrete mix design: The concrete supplied may have too much sand or not enough cement leading to bleeding or segregation.
2. Excessively wet mix: If the water content is too high, this may lead to bleeding or segregation. For example, rainwater entering the hopper.
3. During repositioning of the concrete pump, concrete in the lines may bleed or segregate creating air voids;
4. Air introduced through the tip: If the latter half of the boom and hose tip is positioned downward during a pause in pumping operations, air may enter and form voids in the line.
5. Concrete may start setting in the pipeline during a pause in operations, increasing friction on resumption.

Clearly, a number of these factors may operate cumulatively in the same instance.

What are the control measures used to mitigate this hazard and associated risk? Again, the publications admitted into evidence suggest the operator must minimise the opportunity for ingression of air. This presupposes that the operator has sufficient knowledge about the potential opportunities for air ingression. Clearly, one of these occasions is during relocation of the concrete pump. The operator must also recognise clues that air may be in system and take steps to minimise the effects such as carefully listening for tell tale signs and immediately reversing the pump to relieve line pressure. The operator must also ensure that the line hand is warned and all other workers are clear of the hose and the whip area during occasions when the risk of hose whip is significant e.g. when restarting the pump after repositioning of the pump.

The Concrete Pumping Operation - A Closer Examination

Mr Polley arrived at the Proserpine State School between 5 and 6 am, Mr Patterson's employees were already on site. Mr Polley discussed with Mr Patterson the best position for the concrete pump. It was initially set up at the western end of the site where a couple of a temporary fence panels were removed to gain access.

Outriggers were lowered and put in place on timber pads lying on the ground and the pump was levelled using hydraulic controls. The boom was 22 m long and folded out in three sections. The pump end had a 5 inch diameter pipe that reduced to a 3 inch diameter before attaching to a 3 inch diameter rubber hose about 5 m long. A slurry mix of concrete powder and water was prepared for pumping in the delivery line ahead of the concrete to provide lubrication. When the first load of concrete arrived, Mr Polley considered the batch was very wet and discussed with Mr Patterson whether he wanted to continue. Mr Patterson decided to continue with the pour. There was no discussion about the risks posed by pumping excessively wet concrete.

Mr Polley poured the slurry mixture into the hopper, and when the concreters were ready, started pumping concrete. Mr Polley used a remote control to operate the pump. Mr Johnstone was holding the discharge end of the rubber hose directing the concrete where it was needed.

After about three minutes, the concrete blocked in the reducer and Mr Polley said that he immediately put the pump into reverse to take the pressure out of the line. He removed

the clamp and tapped the reducer pipe. The blockage cleared with concrete falling onto the ground. Mr Polley reassembled the hose and clamp, and then continued pumping.

Mr Polley said in his statement that it was not unusual to have a blockage like that experienced on this occasion and the blockage is readily addressed by tapping the line adjacent to the blockage.

There were no further problems in pumping the remainder of the first truck load of concrete. The concrete truck went to the batching plant and returned with another load. The pour continued. The truck emptied its second load which was pumped without incident. While the concrete truck returned to the batching plant for another load, Mr Polley relocated his concrete pump truck to the eastern end of the site.

In his statement, Mr Polley gave this account about relocation of the pump:

> "… we had to bend the end of the rubber hose back on to itself in order to kink the hose to retain the moisture in the line and therefore the concrete, but also to stop the concrete pouring on to the ground.
> 62. In order to move the pump we had to fold the boom, then retract the outrigger legs, pack up the timber these were resting on and then drive the truck to the position indicated on the sketch as position 2.
> 63. We then drove out of the entrance from where we had come and drove across the grass to the next area.
> 64. We then set up in the position marked number 2 so that we could complete the pour.
> 65. The time for us to move the pump and then set up again was about 20 minutes.
> 66. We were still waiting for the next load of concrete to arrive and we had the pump set up with the boom folded up and the end of the rubber hose directly over the hopper so that we could circulate the concrete from the hopper all the way through the system to the end of the hose that was positioned directly over the hopper.
> 67. The truck then arrived back from the batch plant and we extended the boom out ready to recommence the pour."

A question arises as to whether the manner of restarting may have contributed to the blockage, in particular, the level of engine revolutions and associated line pressure.

In his statement Mr Polley stated:

> … Once the concrete truck arrived it backed up into position ready to fill the hopper again.
> 69. I had the remote control in my hand and I commenced walking from the pump towards the job and automatically started up the pump after receiving a 'thumbs up' from Jeff Johnstone to commence the pour.
> 70. When I started the pump, I kept it on low revs which was so the air pockets in the line could be cleared.
> 71. I heard the pump start and as I was walking forward I saw that Jeff Johnstone was holding the hose.
> 72. I cannot recall seeing the deceased pushing on the hose himself, however I remember seeing stones come out of the rubber hose which indicated to me there had been a blockage and I immediately switched off the pump.
> 73. I recall that it was only a matter of seconds from when I had switched on the pump to when this occurred.
> 74. My next recollection is seeing Mr Paterson lying on the ground near the post."

There are a couple of points to note from this account.

Mr Polley acknowledges the possibility of air pockets in the delivery line at start up and the need to clear them at low engine revolutions.

Mr Polley says that he remembers seeing stones come out of the rubber hose, indicating there was a blockage and he immediately switched off the pump. This account suggests that Mr Polley did not hear the concrete pump engine labour under the load of a blockage prior to a spray of concrete.

Mr Polley reported completing the job with no further blockage or incidents. He says that when he washed out the pump at Austral Concrete Plant he noticed there was not a lot of intermediate aggregate or fine sand. He says, in the language of the trade this would ordinarily be referred to as very "bony" concrete meaning, among other things, more susceptible to blockage. Finally, Mr Polley stated that over the 20 years of operating concrete pumps he had never had a blockage release so quickly.

Mr Polley gave evidence at the inquest.

He told the inquest that he was facing and walking forward towards Mr Johnson on restarting the concrete pump. Therefore, the position and actions of Mr Patterson, then positioned between Mr Polley and Mr Johnson, must have been within his line of sight and in full view. It is also relevant to note that Mr Polley was nearer the concrete pump than the other workers who reported hearing the pump labouring under load.

Mr Polley confirmed that the concrete mix was very bony and excessively wet. Mr Polley acknowledged that there is segregation of stones if the mix is excessively wet, increasing the risk of blockage, especially in 20mm stones. Mr Polley also said it was his practice to recirculate concrete at intervals of about 15-20 minutes if there was a stop in pumping operations. He would raise the booms to form a Z shape with the delivery end of the line raised above and feeding into the hopper. The concrete is pumped back into the hopper for a period. Further, he said it was his practice to recirculate the concrete immediately prior to extending the boom to the pour position to ensure free flow of concrete in the delivery line. Finally, Mr Polley confirmed that he did not hear the pump labour under load on this occasion.

Others present at the time of the resumption of pumping have a different recollection about this last point.

Mr Peoples was standing near Mr Patterson and says he heard the pump operator start the pump. He heard a straining noise and the boom ‘leaned’ or surged forward. As Mr Peoples turned his head, he expected the pump to stop but the blockage ‘relieved itself’. Mr Peoples said, in his statement to WHSQ, he believed the ‘revs’ were ‘up too high’. Later in his statement, he said that normally after the pump has been left sitting for 40 minutes, the pump is started under low pressure to make sure all the line is clear and the concrete is coming through. On this occasion, Mr Peoples said Mr Polley ‘just flicked the switch’ and said lets go. Mr Peoples also gave evidence the concrete was not recirculated during the pause in operations pending return of the concrete truck.

Mr Leeming, a concreter with 13 years experience, gave evidence at the hearing. He recalls hearing the pump block and release suddenly, showering him with pebbles. In his statement to WHSQ, Mr Leeming reported hearing the pump make a sound ‘as if it was about to block’. He said that he thought the revs on the pump were ‘up a bit’.

Mr Muller was another concreter on site. He reported to WHSQ hearing the pump rev up on starting and then heard a bang, turned and saw others ducking and Mr Patterson laying on the ground. Interestingly, Mr Muller reported that on hearing the pump restart, he moved out of the ‘line of fire’. Over years of working in the building industry, he reported that it’s known that concrete pumps can ‘cough and splutter’ when pumping

recommences. In evidence, Mr Muller recalled hearing the pump 'start up pretty quickly' and then the noise just sort of dropped. He 'dropped to protect himself'. He describes a loud whoosh, looked around and Mr Patterson was on the ground.

Mr Johnston was working with Mr Polley as the line hand. He provided a statement to WHSQ. However, he passed away prior to the hearing. His statement was admitted into evidence. Mr Johnston recalls that he 'heard' the blockage 'through the hose'. The hose then blew from his hands. Mr Johnston also recalls the concrete being recirculated after relocation of the concrete pump truck and while waiting for more concrete to be delivered to the site.

In addition to the witness accounts, I also had the benefit of expert evidence to assist in understanding what happened.

Paynter Dixon commissioned an expert report from Mr David Beale, a Consulting Engineer with considerable expertise in the field of concrete technology. His expertise was not in issue.

Mr Beale reviewed witness statements and other relevant documentation in the course of considering the causal factors that contributed to this incident. He concluded that the blockage was the cumulative result of the following:

- The failure to specify and use a grade of concrete better suited for concrete pumping, namely '25MPa *pumped* concrete with 20mm aggregate' which, in comparison with '25MPa normal concrete with 20mm aggregate' has a higher content of fine aggregate and reduced content course aggregate. Segregation and bleeding in the concrete is reduced. Mr Beale made reference to the Australian design code for concrete to establish the most suitable design mix.
- Poor use of the delivery hose. The delivery hose should be permitted to hang vertically above the area where concrete is to be placed. Alternatively, the delivery hose should be allowed to rest at ground level and the opening moved about with a control line or hook. The hose should not be placed onto the horizontal plane and directed so as to project the concrete forward. Any blockage is liable to result in forward movement of the booms. Any sudden discharge will result in backward movement. Mr Beale referred to the Jacon Boom Pump Operations Instructions that prohibits the drop hose being manoeuvred by hand.
- The relocation of the truck in a manner that did not address the risk of a degree of setting of the concrete in the pipeline, that is, by recirculating the concrete or using an additive.

Mr Beale reported:

> "The pebbles shooting out the end of the line indicates that after moving the pump, the concrete in the end of the pipe had segregated prior to the pumping restarting."

Mr Beale identified the type of concrete used by reference to testing of hardened concrete samples taken from site and documents reflecting the concrete ordered by Mr Patterson.

During evidence, Mr Beale provided clarification about the opinions expressed in his report. As to the manner in which relocation of the truck may have contributed to a blockage, Mr Beale said that during the process of folding the booms and putting away the outriggers as well as moving the truck, the concrete pump is not operating so there can be no recirculation of concrete[1]. Recirculation can only happen after relocation and extension of the booms. He acknowledged that recirculation of the concrete would reduce the risk of blockage. He also acknowledged that the first blockage experienced that day could be attributed to the properties of the concrete delivered. Mr Beale accepted

[1] L30 on 2-43

that if the concrete was too wet, that would contribute to an increased risk of blockage. Mr Beale also accepted the proposition put to him that if the concrete was recirculated after relocation of the truck and before pouring, the risk of blockage attributable to relocation was reduced, if not obviated. I note that the extent to which there was any delay in recommencing pumping operations after the booms were extended into place in preparation for the pour would increase the risk of blockage and hose whip.

There are some key issues about which there is either a conflict on the evidence or a dearth of evidence, namely:

- Whether, and if so to what extent was, concrete was recirculated after relocation;
- Whether, and if so to what extent, there was any delay after recirculation before restarting the pump;
- What level of power (as indicated by engine revolutions) was applied immediately on restarting the pump?

The coronial investigation conducted by police was substantially reliant on the technical expertise of inspectors or investigators from WHSQ. The statements obtained by WHSQ provide little or no assistance in resolving these issues. The initial statements taken by WHSQ lacked detail about the aspects of the operation relevant to hose whip.

I also acknowledge that it cannot be inferred solely from the fact of a sudden blockage on restarting; that air entered the lines during relocation and that the concrete must not have been recirculated. It might plausibly be suggested by reference to the earlier blockage partly attributable to the concrete mix, that the later blockage was similarly caused.

In the end, I don't need to resolve these issues. It is clear that there existed a risk of a blockage on restarting the concrete pump. That was acknowledged by Mr Polley. It is also clear that Mr Polley knew from the earlier experience of a blockage and the bony nature of the concrete that the chance of another blockage was higher. But he took no steps to warn or direct those in the immediate vicinity of the discharge line, including Mr Patterson, to stand clear. This failure reflected a lack of awareness about the risk of death from hose whip that appears to extend throughout the concreting industry.

Supervision of Construction Work – Paynter Dixon

Mr Chapple was employed by Paynter Dixon as the Project Manager for the works that involved Mr Patterson. Mr Chapel is an experienced contract administrator with a trade background in metal fabrication. He is also qualified as a Workplace Health and Safety Officer. Mr Chapple says that he was conscious of safety at the planning stage and decided to coordinate on site work so that only one trade was on site at the one time. In consultation with Mr Daniel Dunne, the Workplace Health and Safety Officer at Paynter Dixon, Mr Chapple decided to use subcontractors who had worked with Paynter Dixon and were familiar with its safety and quality requirements. Patterson Concreting Services was a well-known to Mr Chapple through work on other projects with Paynter Dixon. Mr Patterson was regarded as an experienced and competent concreter and the best person for this project.

On 23 January 2007, Mr Chapple met with Mr Patterson at the Paynter Dixon's offices in Brisbane to discuss the covered walkways project. Mr Chapple says that Mr Patterson accepted that all workers and sub contractors engaged in concreting works would be inducted into the Paynter Dixon construction safety plan and that Mr Patterson would be responsible for generally supervising the concreting work. A similar approach was taken with the other subcontractors engaged on this project. The contract between Paynter Dixon and Patterson Concrete Services was concluded on 19 February 2007.

On 15 March 2007 Mr Dunn and Mr Chapple met with Mr Patterson and his son Glenn Patterson at the Brisbane office of Paynter Dixon where they were inducted into Paynter Dixon's construction safety plan for the project. During that meeting, Mr Chapple says that

it was emphasised to Mr Patterson that he was responsible for conducting the site inductions for any additional labour or contractors that Mr Patterson brought onto site. There was also discussion about special arrangements for the safety of children at the schools. This aspect of Mr Chapple's statement was the subject of examination by Mr Ratanatray of Counsel appearing for Mr Polley. Mr Chapple agreed with the suggestion of Mr Ratanatray that the reference to additional labour or contractors included Mr Polley and that Mr Patterson was responsible for explaining to Mr Polley when and where he would need to use personal protective equipment including hardhats. This evidence may be probative of the understanding of Mr Chapple as to the responsibility of Mr Patterson but it does not go to the question of who in fact had responsibility for what aspects of safety. Mr Polley was the operator of the concrete pump and was responsible for management of hazards associated with its operation. The mere fact that he is operating the concrete pump under contract to Mr Patterson does not shift responsibility to Mr Patterson.

During the course of construction at other sites, issues arose relating to safety and Mr Chapple gave evidence as to how the issues were addressed. For example, on 29 March 2007 Mr Patterson telephoned Mr Chapple reporting that another subcontractor engaged in other works at the Camilla State School had removed fencing from around the site to enclose his work area. Mr Chapple made arrangements to ensure that additional fencing was delivered to the site on the following morning prior to school hours to ensure that adequate fencing was in place. Examples like this suggested that Paynter Dixon was responsive to issues raised by subcontractors.

On 1 April 2007 Mr Patterson provided Mr Chapple with a programme of works at various sites during April and early May 2007. That faxed document noted those schools where there was no truck access and where Mr Patterson recommended the use of a concrete pump. Proserpine State School was not included on that list. On 30 April 2007 Mr Chapple sent a variation to Mr Patterson agreeing to pay for concrete pumping in response to his fax. During his evidence, Mr Chapple was asked what would have been his response if Mr Patterson had reported needing a concrete pump for Proserpine State School and he responded, "I would need a cost of it". Mr Chapple remained of the view that a concrete pump was unnecessary at Proserpine State School. Having reviewed the photographs of that locality including those photographs showing the concrete pump in situ, I can understand how Mr Patterson formed the view that the job might be completed more efficiently with the assistance of a concrete pump.

On 4 June 2007 Mr Chapple boarded an aircraft to fly to Mackay to meet with Mr Brendan Beazley, a site foreman engaged to roam between the sites in the covered schools project. Unfortunately, adverse weather precluded the aircraft from landing at Mackay Airport and it diverted to Rockhampton. On disembarking and checking his mobile phone for messages, Mr Chapple received notification of the incident. Mr Chapple was unable to get to Mackay and his aircraft returned to Brisbane arriving at approximately 11:30 am. He was able to obtain a flight to Proserpine, arriving at about 4 pm that afternoon. He attended the scene, saw two men were finishing off the slab and was surprised to see that police or Workplace Health and Safety had permitted work to continue.

The next day Mr Chapple and Mr Dunne attended the Cannonvale site and met with Mr Patterson's workers including his son, Glenn Patterson. Mr Chapple obtained from Glenn Patterson a copy of Mr Patterson's safety folder which included all of the completed inductions together with a copy of Paynter Dixon's construction safety plan. All workers on site were re-inducted and participated in a toolbox safety talk.

During examination of Mr Chapple it became evident that there was substantial reliance by way of supervision on daily telephone contact between Mr Chapple and Mr Patterson as well as inspections of sites by supervisors from Paynter Dixon before and after concreting was completed. Mr Chapple could not recall any inspections while concrete

work was being performed. Further, Mr Chapple conceded that the first time he was ever requested to review Mr Patterson's safety folder was after the fatal incident.

During examination, Mr Chapple said that he was aware of a hazard called hose whip but he was not aware of anyone being injured in those incidents. He also said that if a worker was working under the concrete pump boom, he would require the worker to wear a helmet. No worker on this site was wearing a safety helmet. Safety helmets were required. However, the absence of a safety helmet would not have affected the outcome for Mr Patterson. The area of injury would not have been protected by a helmet given how he fell.

Paynter Dixon as the principal contractor had an obligation to supervise the construction being undertaken by subcontractors. The obligation to supervise related not only to quality of the work but also the safety of workers on the site. Mr Patterson also had an obligation to manage safety. This did not generally relieve Paynter Dixon of its obligation. Similarly, Mr Polley had an obligation to manage safety in respect of the hazards associated with his activities. Although hose whip was a hazard which was known to Paynter Dixon through the knowledge of Mr Chapple, the primary responsibility for its management rested with Mr Polley and to a lesser degree, Mr Patterson. Given the nature and extent of construction being performed on each site within the walkways project, the obligation on Paynter Dixon to supervise safety did not descend to the level of ensuring hazards like hose whip were appropriately controlled.

The Workplace Health and Safety Investigation

The Division of Workplace Health and Safety plays a critical role in investigating workplace fatalities for the purpose of assessing compliance with safety standards and if appropriate to commence and pursue a prosecution. It also plays an important role in investigating incidents to extract lessons that might be learnt and shared within industry groups to reduce the risk of a recurrence. It is in this context that I have considered the quality of its investigation and analysis for industry education.

Mr Gavin Wesche was the WHS Inspector based in Mackay who was responsible for this investigation. He was in his office when notified of this incident at 9.15 am. The information was scant and 5 minutes later, he contacted S/Constable Topp of Proserpine Police who briefed him on the basic circumstances. At that time, S/Constable Topp did not know the severity of the injury to Mr Patterson. He did not give a direction to stop work or cause photographs to be taken to protect the integrity of what relevant evidence was available at the scene. Mr Wesche contacted other significant organisations (e.g. QBuild and Qld Education) seeking information. It was during a later telephone call to S/Constable Topp that Mr Wesche discovered the scene had been concreted over. In the absence of death or suspicious circumstances, police have no such powers.

At about 9.45am Mr Wesche received a fax from police identifying relevant witnesses and their contact details. At 11.45, Mr Wesche was notified of the transfer of Mr Patterson to Townsville Hospital with severe head injuries. Mr Wesche conducted telephone interviews with Mr Polley and Mr Johnston during the morning. The statements that were prepared from these interviews are brief and not helpful in understanding the dynamics of what happened, particularly for the purpose of identifying the possible contributing factors.

During the afternoon, Mr Wesche had a telephone conversation with Mr Dunne of Paynter Dixon about his knowledge of the incident.

During the following days, most of the investigation was conducted by way of telephone calls. It was not until Wednesday 6 June 2007 that Mr Wesche attended the scene. The investigation then appeared to take a pedestrian course over the following months. On reviewing the statements obtained during that period, a clear picture does not emerge about what hazard was involved in the incident.

The first contact with police seeking assistance by way of a copy of photographic evidence was telephone contact on 7 August 2007. An investigation report was submitted to the Regional Investigations Manager of WHSQ in September 2007 while investigations continued.

Statements were obtained from all witnesses who were at the scene except Mr Polley who declined to be interviewed on legal advice. Most of the witness statements were prepared based on telephone interviews, with a draft forwarded to the witness for checking. If accepted as accurate, for signing and return. Clearly, this process is not the preferred means of obtaining a statement.

On reviewing the statements and investigation reports prepared for the Regional Investigation Manager and through him, the Prosecution Unit; no mention is made of hose whip as the hazard responsible for this fatality. The existence of possible contributors to hose whip are not addressed in the statements or reports.

Mr Wesche did not pursue a copy of the concrete pump operations manual, stating that it wasn't considered an integral part of the investigation.

There appeared to be no investigation of the nature of the concrete ordered and who ordered it. The type of concrete subsequently proved to be a contributing factor. This fact was referred to in a report prepared at the request of Mr Polley by Mr Beere and provided to WHS, presumably with a view to minimising his contribution to the incident. At that stage, the WHS investigation was essentially complete.

No enforcement action was taken against Mr Polley.

During his evidence, Mr Wesche said he identified hose whip as the relevant hazard involved in this incident as soon as he took the telephone call that morning but considered it a rare occurrence. He was able to list potential contributing factors to hose whip. He also outlined how, as an investigator, he informed himself about potential contributing factors for the purpose of an investigation including accessing expertise within WHS.

In summary, there were a number of challenges that confronted Mr Wesche during this investigation:

- The distance to the scene (150km) meant that early strategic decisions had to be made about the need to visit the site;
- The timing of the incident, mid way through a concrete pour, meant that time was of the essence;
- There was limited available information about the nature and dynamics of the incident (slip, trip and fall or something more complex) and the severity of the injury to Mr Patterson; and
- The witnesses were geographically mobile, not local and moving from site to site.

During his evidence Mr Wesche said that in the 10-12 years of investigation experience, there was only one other occasion that he had not attended the scene of a workplace incident.

What use was made of the information gathered during this investigation to reduce the risk of a similar incident?

Mr Stuart Davis, an Engineer in the employ of WHSQ, was the key technical person responsible for the preparation of the Concrete Pumping Code of Practice 2005. He was also the co-cordinator of and primary source of technical information for the 2009 Concrete Pumping Campaign. Mr Davis provided considerable detail about past audits and campaigns designed to educate concrete pump operators about the safety requirements and enforce relevant standards. The audits and educational programs

generated considerable literature to assist the inspectors in conducting the audits and to provide information to the operators as part of the educational phase of these programs. However, on reviewing that material, no reference is made to the hazard of hose whip in the context of concrete placement. It is interesting that the Concrete Pumping Campaign Report 2009, within the section headed “Purpose of the campaign”, makes specific reference to a hose whip fatality, this incident in fact. However, no lessons to be learnt from this investigation were extracted and disseminated to industry either in the course of the audits or educational campaigns.

Further, although it does not purport to be exhaustive, the Concreting Code of Practice does not acknowledge the existence of this hazard. During examination of Mr Davis, he acknowledged that the Code of Practice did not refer to hose whip in the context of concrete placement and only referred to the danger in the context of line cleaning after use. Mr Davis said that although he was aware of the fact that entry of air into the hopper may cause hose whip, it was not identified as a key safety issue. He thought that there were limits to what might be disseminated and understood by concrete pump operators and therefore they had to strike a balance between what were safety critical issues, the volume of material offered and the likely comprehension of that material by concrete pump operators. On examination by Counsel for WHSQ, Mr Davis highlighted what might be regarded as key safety issues, namely matters that have been the subject of numerous incidents of serious injury or fatality. When asked if he researched the hazard of hose whip and to outline his methodology, Mr Davis reported that he was alerted by email to a Canadian incident and viewed an instructional video about the incident. The video was later admitted into evidence. He conceded he had not looked at the American Concrete Pumping Association alerts.

Mr Davis acknowledged that he was aware of this incident at the time of preparing the material for the concrete pumping campaigns including the educational and audit programs but did not ‘check the file’ to gain a deeper understanding of the incident or the hazards involved.

The reluctance of WHSQ to accept that hose whip was and remains a significant safety risk was reflected in an objection from Counsel for WHS during evidence in which he stated:

> “ ... you are not dealing with an incident where anybody in the construction industry would've said, "There is a risk of a fatality here from hose whip".

He then asserted:

> " Any statistical analysis would reveal that these incidents are so isolated that it's not fair to apply some risk assessment process where, "Oh, yes, hose whip can lead to a fatal injury." You go, "Yes, in an isolated incident where a fall has occurred, well, it might", and that might happen when someone is using a ladder or a nail gun or an air compressor or anything at a construction site."

Mr Davis conceded that no-one had done a statistical analysis of the risk of harm analogous to that which WHS would expect industry to undertake by application of the WHSQ Risk Management Code of Practice.

Mr Davis said he was familiar with the hazard and listed the factors that he thought contributed to hose whip. However, the matters he described did not suggest a level of knowledge commensurate with that reflected in publications tendered into evidence.

WHSQ provided written submissions on completion of the hearing. WHSQ acknowledged that hose whip presented a risk of death but asserts that prior to this coronial investigation it was not aware of any fatalities attributable to hose whip. Accordingly, the Concrete Pumping Code of Practice and other publications reflected this status of knowledge.

However, WHSQ indicated that it intended to take action to remedy the situation. It will issue an alert to relevant industry groups about the hazard of hose whip and the control measures that might be used to minimise the risk of injury. It will amend the Concrete Pumping Code of Practice to include a description of the risk of hose whip, the contributing factors and the means of reducing the occurrence or potential of hose whip. The implementation of a suggested exclusion zone for workers (at times where the risk of hose whip is present) will be considered after industry and expert consultation. The amendments to the Code of Practice will also include a requirement that all persons engaged in concrete pumping work involving an overhead boom must wear appropriate PPE at all times, including hard hats. The amendments will highlight the obligation of anyone conducting a concrete pumping operation (including the pump operator) to ensure equipment and concrete mix is suitable for the requirements of the site considering the factors relating to hose whip. That obligation might extend to refusal to provide pumping services if risk factors are not appropriately addressed. It will also highlight the proper selection of pump type and boom length to reduce handling of the delivery line.

In addition WHSQ will consider further auditing in conjunction with an information campaign targeting the concrete pumping industry in relation to the new Safety Alert and amendments to the Code.

WHS also reports:

> "From 1 January 2012, national harmonised Workplace Health and Safety legislation should be enacted by all States and Territories. That legislation will involve a number of changes to current Queensland safety related Acts and Regulations. Currently, the harmonised laws (in draft Bill form) provide for Codes of Practice to remain as a means for obligation holders to identify industry specific risks. National Codes of Practice will be developed in order of priority. Concrete pumping has not been identified as a priority code. Until such time as a national code is developed, the Queensland Code will remain current. In any event, as a result of this inquest, WHSQ will raise the issue of hose whip for inclusion in the National Code to be developed."

While WHSQ maintains that its decision about enforcement action was correct, in my opinion it has demonstrated considerable maturity as an organisation to reflect on opportunities for improvement, in particular, how it might have better extracted lessons to be learnt from the circumstances of this death and disseminated that information to industry with a view to reducing the risk of a recurrence. Through reflection, it has demonstrated leadership and behaved in a manner consistent with its expectation of industry.

In these circumstances, I am satisfied that WHSQ will act in accordance with its stated intentions and it is not necessary for me to make recommendations in support of its planned action.

Conclusion

I find that Gregory Clifford Paterson died at Townsville Hospital on 15 June 2007 due to pulmonary thromboemboli, due to deep vein thrombosis, due to immobility, due to head injury, due to an industrial accident. Mr Paterson suffered the head injury on 4 June 2007 at a construction site at Proserpine State School when he was struck on the head by a concrete pump hose that had blocked and self released causing hose whip. He fell backwards striking his head on the base plate at the foot of a steel post. The concrete pump was pumping an excessively wet or bony concrete that caused an earlier blockage. The concrete pump had relocated and the incident occurred shortly after recommencing pumping, a point known to have a heightened risk of blockage. There was an opportunity to substantially reduce the exposure of workers in the vicinity of the hose from hose whip by warning and directing them to keep clear on restarting the pumping operation. This was not done. If Mr Paterson had stood clear of the hose on restarting, he is unlikely to have sustained a head injury. There was and remains a serious lack of awareness within

the concrete pumping industry of the potential for hose whip to cause a fatal injury. I am satisfied that WHSQ is taking sufficient steps to address this lack of awareness.

Kevin Priestly
Northern Coroner
18 October 2010

Appendix A