

FINDING OF CORONER UNDER CORONERS ACT 1988

I, TREVOR LESLIE SAVAGE Coroner at Invercargill hereby certify that at an inquest completed on the 17th day of September 2007, at the District Court House, Don Street, Invercargill having enquired into the time, place, causes and circumstances of how SUSAN MARGARET GUNTHER of 15 PARKVIEW AVENUE, GREENSBOROUGH VICTORIA 3088 AUSTRALIA, CREDIT OFFICER died I found:

She died accidentally on 6th January 2007 at Blanket Bay, Doubtful Sound, Fiordland, New Zealand from breathing in and aspirating salt water while commencing a SCUBA dive, possibly precipitating an asthmatic attack, but resulting in hypoxemia and a terminal cardio-respiratory arrest.

and pursuant to section 15(1)(b) of the Coroners Act 1988 I make the following recommendations or comments (if any): See annexed decision

Dated at Invercargill this 17th day of September 2007

NOTE - This form, together with the depositions, the prohibitions on publication and, where applicable, a certificate of registration of death, must be forwarded to the Chief Executive of the Department for Courts by the Coroner completing the inquest.

IN THE CORONERS COURT HELD AT INVERCARGILL
IN THE MATTER of an Inquest into the Death of SUSAN MARGARET GUNTHER

Hearing: 17 September 2007

Before: Coroner T L Savage

Present: Constable G Nimmo for the Police Witnesses
Family Members and Interested Parties Media Representative

FINDING OF CORONER T L SAVAGE

Background and History.

[1] Susan Margaret Gunther aged 49 was a lady from Australia who, with her husband, was holidaying in New Zealand in January 2007. On 5 January she was a member of a party of eight on a five day diving trip on the vessel "Miss Akaroa" in Doubtful Sound, Fiordland.

[2] Mrs Gunther had qualified as a SCUBA diver in Australia in 1984, but she gave up when she became pregnant with her son, who is now aged 20 years. She has done little diving in the intervening years, although she did approximately ten dives in Australia in preparation for her New Zealand holiday, six of them in the weeks just prior to Christmas 2006. She purchased new diving gear and some near new second hand gear in Australia, which she brought with her.

[3] Mrs Gunther had been asthmatic all her life, although her husband says she had never been known to have an asthma attack. She carried an inhaler with her all the time. She was a non smoker.

No Charter

[4] Bruce Pascoe, a part owner of the "Miss Akaroa" was one of the party. He was a friend of the Gunther's and I accept his evidence that the trip was a friendly one for which no payment was made; it was not a charter trip. The "Miss Akaroa" was not surveyed for charter.

First Dive.

[5] On 5 January 2007 Mrs Gunther, her husband, and Mark Bryden an Australian friend who was one of the party, went for a dive in Bradshaw Sound. The gear used by Mrs Gunther was her own, except for a dive tank which came from the "Miss Akaroa" and weights which were incorporated into her buoyancy compensator device (BCD). The dive

lasted only 20 minutes, and while the two Marks were successful in catching some crayfish, Mrs Gunther was unable to get below the surface due, she thought, to her not having enough weights. She spent the time on the surface and appeared to suffer no discomfort.

Fatal Dive.

[6] The weather the next day prevented diving until late in the afternoon. This time the dive was between Bauza and Utah Islands where the party, again consisting of Mark Gunther, Mark Bryden and Mrs Gunther, could dive next to a sloping underwater drop-off. They entered the water at about 3.45pm and finned on the surface out from the boat approximately 20 metres to the edge of the sloping wall of the island. Mark Bryden and Mark Gunther descended below the surface, but were not followed by Mrs Gunther. Bruce Pascoe on board the vessel said he heard Mrs Gunther yell for help and saw that she was high in the water with her head arched back, a common position for a person to be in when in difficulty. From a depth of about five metres Mark Gunther saw his wife still on the surface and returned to her to find her standing up with her head and shoulders out of the water with her hands against the wall of the island to prevent her being knocked against it by the swell. When asked by Mr Gunther if she was all right she nodded, took the regulator out of her mouth and said "yes"; she attempted to continue speaking but was told to put the regulator back in her mouth.

[7] Mark Gunther and Mrs Gunther began to surface swim towards the "Miss Akaroa", Mark helping by holding Mrs Gunther's first stage regulator and towing her. Mark Bryden saw what was happening and ascended to the surface to assist. He described Mrs Gunther's movements as "very weak, struggling with her body movements and posture in the water" and said that "her eyes were dilated". As they towed Mrs Gunther back to the vessel against the swell she was no longer assisting with kicking and observers saw her head going under the water 'on a couple of occasions'. At the back of the vessel Bruce Pascoe fell into the water during the recovery attempt and Mrs Gunther was submerged for approximately five seconds. Once she was recovered onto the back of the "Miss Akaroa" she was described as being "blue in the face, expressionless, motionless, and her eyes were wide open and much dilated".

[8] Emergency Services were summoned and cardio-pulmonary resuscitation was administered as the boat made its way to Blanket Bay where there was a suitable place for a helicopter to land. During the journey a qualified nurse from a nearby boat assisted with CPR. A helicopter with a Police Officer and medical staff arrived at Blanket Bay at 4.50pm where resuscitation attempts continued, but at 5.11pm Doctor Stephen Hoskin certified that Mrs Gunther had died.

Equipment

[9] Most of the diving equipment used by Mrs Gunther was seized for examination. The dive cylinder was found to be turned on and full. The equipment was later examined by Senior Sergeant Bruce Adams of Police National Dive Squad and parts of it were also examined by ESR. A detailed report by Senior Sergeant Adams was produced in evidence. His examination identified the following faults:

1. Three holes in the alternative second stage regulator diaphragm.
2. The regulator operating below manufacturers specifications.
3. Excess buoyancy weight being carried.
4. The cylinder contents were slightly contaminated with excess methane, carbon monoxide and moisture.
5. The dive cylinder being used was out of inspection for use.

Other items of equipment were found to be in order, or non contributory to the death and will not be mentioned.

Dive Cylinder:

[10] The dive cylinder used by Mrs Gunther came from the "Miss Akaroa". It was an aluminum cylinder, lighter than the steel cylinders the Gunthers used in Australia. The cylinder had been filled at an earlier date (unknown) by a compressor on the "Miss Akaroa" and was 'topped up' by it following the dive on 5 January.

[11] A Scuba cylinder is required to be pressure tested every two years and have a visual. inspection on alternate years. This cylinder was last tested in December 2003 and so was out of date at the time of the incident. Stamps on the

cylinder would have shown this but they were not noticed by either Mr or Mrs Gunther. However, I find that the condition of the cylinder was not a contributing factor to the death.

[12] The contents of the cylinder were examined by the Institute of Environmental Science and Research (ESR) and found not to comply with standards for methane, carbon monoxide, and moisture. While the contamination cannot be excluded as a contributing factor to the death, I am satisfied that if it contributed at all the contribution was not significant.

Servicing of Equipment:

[13] All of the equipment used by Mrs Gunther was of a reputable brand and suitable for her. Enquiries made by Senior Sergeant Adams established that the regulators had been serviced at the Melbourne Dive Centre in Heidelberg, Melbourne, on 2 December 2006 and had not been used after service before Mrs Gunther came to New Zealand. Because the equipment had been purchased only relatively recently Mrs Gunther had a limited opportunity to become familiar with it.

First Stage Regulator:

[14] The role of the first stage regulator is to attach to the cylinder valve and alter the high pressure in the cylinder to a lower working pressure for the second stage regulator, which in turn delivers air to the diver's mouth on demand and he or she inhales. The working pressure of Mrs Gunther's first stage regulator was found to be above that recommended by the manufacturer, and although this did not cause the regulator to fail, it created a slight free flow which would have been annoying and a nuisance for her, and also led to a large rush of air or free flow from the second stage regulators. These consequences of the raised intermediate pressure were established by a test dive by Police National Dive Squad.

[15] The raised intermediate pressure of the first stage regulator was not a contributing factor to the death, although the resulting leak and free flowing effect would be of annoyance and, being unexpected, could possibly have caused alarm or stress to Mrs Gunther. The raised intermediate pressure and free flow should have been identified and corrected in the servicing of the equipment.

Second Stage Regulator – Primary

[16] The second stage regulator delivers air at a breathable pressure to the diver. A small amount of white sand was found inside the body of the end plug of the second stage regulator - primary, and tests completed by a certified scuba technician showed that it free flowed slightly and was harder to breathe from when compared to the alternative second stage regulator. A test dive completed by Police National Dive Squad confirmed that the effort to breathe from the primary second stage regulator was harder than expected and there was a slight free flow which was of annoyance.

[17] The sand, established by ESR testing as not coming from Fiordland and probably coming from Melbourne, and the free flow should have been revealed by the Melbourne servicing.

[18] The evidence satisfies me that Mrs Gunther was not in fact using the primary second stage regulator during the planned dive on 6 January, but was using the second stage alternative regulator. This was because she found the alternative regulator easier to breathe from.

[19] Second Stage Regulator -Alternative.

[20] The role of the alternative second stage regulator is to provide a reserve regulator which the diver can use should the primary one fail during a dive. It can also be given to a second diver during a dive should the diver run out of air with his or her own cylinder.

[21] On examination the alternate regulator was found to free flow slightly and to be the easier of the two second stage regulators to breathe from. Normally this is the other way around. The slight free flow occurred as a result of the raised working pressure supplied from the regulator first stage.

[22] Examination also revealed that the diaphragm from the alternative second stage regulator had three slit shaped holes in it, and it exhibited traces of the white sand identified as probably coming from Melbourne. Testing showed that the diaphragm had no vacuum seal and would allow water to be inhaled into the diver's mouth when breathed from. A second test dive found that under normal breathing effort air supply was provided, but a constant mist of water was also inhaled and under heavy breathing the amount of mist increased.

[23] The servicing technician for Melbourne Diving Services described to the Police his procedure for inspection of second stage diaphragms. The technique described did not include stretching the diaphragm while holding it up to light to find holes in the diaphragm. The latter is common practice and would definitely have identified the holes found in the diaphragm of Mrs Gunther's alternative second stage regulator. The service records also show that only one second stage regulator service kit was used. Two should have been used, indicating that possibly only one of the second stage regulators was serviced. ESR tests could not definitively identify how the slits in the diaphragm arose, although the test that gave the most similar damage was when the diaphragm was hammered onto the sealing ring. This produced circumferential slits, but also shattered the sealing ring and produced full thickness striations on the resultant damage. Such damage would only occur when the diaphragm and sealing ring were removed from the regulator body.

[24] Mr Gunther stated that he assisted his wife by completing pre-dive checks of her equipment, but those checks did not include checking by inhaling on the regulators with the air supply turned off. This would not have allowed the user to confirm the correct function of the unit. When tested by Police National Dive Squad in the correct manner, Mrs Gunther's alternative second stage did allow ambient air to enter through the holes in the diaphragm. This mode of checking and use of the alternative second stage rather than the primary indicated to Senior Sergeant Adams a lack of experience on the part of Mrs Gunther.

Buoyancy Compensator Device (BCD):

[25] The role of a BCD is to assist a diver in maintaining and managing different states of buoyancy above and below the surface. It also secures the dive cylinder to the diver's back.

[26] Mrs Gunther's BCD had been purchased by her privately in October 2006. It was a standard vest style for a female wearer and was an inflatable vest with integrated buoyancy weights. Additional weights are to compensate for the positive buoyancy created by the diver's wet suit or dry suit and weight carrying systems are fitted with a quick release feature to allow the diver to ditch or jettison weights in the case of an emergency. Air can be added to or removed from the BCD by the diver and the technique of being properly weighted is a core skill learnt on any recreational entry level dive course. Excess weight would require the diver to work harder in movements both on the surface and while in the water from having to move the weight about. A fully inflated BCD becomes very tight about the torso and chest area of the user and can hamper breathing.

[27] After her difficulties in getting below the surface on her dive on 5 January Mrs Gunther increased the weights on her BCD by some 2kg to a total that is now known to have been 12.8kg. This is more than would normally have been expected for a person of her height and build.

[28] I am satisfied by the evidence detailed in the dive report that on the fatal dive Mrs Gunther was over-weighted and that her BCD was fully inflated, giving her a large amount of positive buoyancy. There was nothing wrong with her BCD, but her use of it, including her inability to check that she was correctly weighted, her failure to inflate or deflate to achieve correct buoyancy, and her failure to jettison weights when she first began to be in trouble all indicate a lack of experience and familiarity with her equipment. I accept Senior Sergeant Adam's opinion that the weight carried and the inflation or use of the BCD may have been a contributing factor by:

- Additional effort required to move the weight around.
- Not allowing the dive to be completed.
- Promoting stress and panic.
- Hampering breathing.
- Failing to abandon weights possibly contributing to submersion during rescue attempts.

Post Mortem Examination:

[29] A post mortem examination of Mrs Gunther's body was conducted by Doctor A T Shogun a pathologist at Southland Hospital on 8 January 2007. He found no life threatening conditions, although microscopic examination of material found in the right bronchus showed fragments of plant material. The exact cause of death was not clearly obvious to Doctor Shogun, but he thought a probably scenario was that Mrs Gunther became stressed in the water due to unknown reasons and it caused her to aspirate water contents that further escalated into more hypoxemia resulting in terminal, cardiac arrhythmia and arrest. The presence of plant material blocking the right major bronchus could have been a significant factor in contributing to the hypoxemia, but it could also have been the result of terminal agonal aspiration of stomach contents or water from the Sound. Doctor Shogun regarded the medical history of bronchial asthma as significant.

Professor Gorman.

[30] The circumstances of this fatality were referred to Professor Des Gorman, Head of School at the University of Auckland, and a member of the Naval Hyperbaric Medical Unit at the Navy Hospital in Auckland. Senior Sergeant Adams described Professor Gorman as a leading authority on diving medicine in New Zealand.

[31] Professor Gorman reviewed copies of Mrs Gunther's medical records obtained from Australia, and although they were barely legible he did derive from them that Mrs Gunther consulted her GP on a number of occasions with active asthma. This indicated to him that Mrs Gunther's asthma was apparently not well controlled. Professor Gorman also had access to a workplace health assessment undergone by Mrs Gunther on 6 March 2006, which indicated that Mrs Gunther's forced vital capacity rating for lungs was below average, that her expiratory volume rating was poor, and that her expiratory ratio rating was also poor.

[32] Professor Gorman commented on asthma as follows:

"Asthma is important in diving. First, asthma impairs exercise tolerance and work capacity. Second, there are many factors in diving that can both induce and aggravate asthma (breathing a dry cold gas and, conversely, a salt water aerosol, exercise, being cold, anxiety, work, breathing against a resistance etc). Third, by virtue of the impaired work capacity asthma comprises the safety of the diver and their buddies. Asthmatics are over represented in the diving death statistics, although the latter are not sound enough to enable a confident relative risk to be cited. Most asthmatics that die when diving do so on the surface. This is not to say that someone with asthma cannot dive within acceptable risks; what is required is that they take a regular preventative medicine and that this be shown to be effective in provocative tests such as hypertonic saline challenge.

The history of asthma here is important. The question as to what extent the likely cause of death was salt water aspiration per se, and to what extent it was salt water aspiration, exercise, cold, and anxiety- induced asthma and secondary drowning. The latter is probably the most likely formulation "

Mrs Gunther had never undergone a hypertonic saline challenge.

[33] Professor Gorman thought that if Mrs Gunther was breathing through the regulator with a perforated diaphragm (and I have found that she was) salt water aspiration would have been inevitable. Professor Gorman thought that irrespective, the induction of salt water aspiration as a consequence of anxiety and hyperventilation was also inevitable. The scenario that he postulated was that of a 49 year old novice diver in cold water and using equipment with which she was not well acquainted, some basal anxiety, breathing a salt water aerosol, induction of asthma, increasing anxiety and stress, hyperventilation and increasing salt water aspiration both through and around the regulator mouthpiece, increasing asthma and salt water aspiration and so on.

[34] In a supplementary report Dr Shogun agreed with this scenario. The absence of finding at PM examination changes due to acute asthmatic attack did not exclude that definitively and the airways did show features of chronic airway disease.

Conclusions.

[35] Section 15 Coroner's Act 1988 requires a Coroner at Inquest to establish, so far as is possible, the circumstances of the death. In this case the evidence does not establish with certainty all of the circumstances, but certainty is not

required. It is enough that the circumstances are established by the evidence, or proper inference from it, to the reasonable satisfaction of the Coroner. In this case I find that all of the scenarios accepted by Doctor Shogun and Professor Gorman are made out by the evidence, except for that of an acute asthma attack. The hypothesis that there was an acute asthma attack is very persuasive, but not to the extent that satisfies me that Mrs Gunther did in fact have an acute attack. The remainder of the postulated scenarios provide a highly probable explanation of the death.

[36] The formal finding of the Court is that Susan Margaret Gunther of 15 Parkview Avenue, Greensborough, Victoria 3088, Australia, credit officer, died accidentally on 6 January 2007 at Blanket Bay, Doubtful Sound, Fiordland, New Zealand, from breathing in and aspirating salt water while commencing a scuba dive, possibly precipitating an asthmatic attack, but resulting in hypoxemia and a terminal cardiorespiratory arrest.

Recommendations:

[37] I adopt the statement by Senior Sergeant Adams in his report. "This incident does highlight the need for divers:

1. To use equipment in good condition and serviced annually by a reputable technician.
2. The need for trainer and refresher training if absent from the sport for some time.
3. To use cylinders that are inspected annually.
4. To use air from trained fillers and maintained facilities that are audited and tested.
5. The need for divers to be familiar with all equipment used.
6. To always dive in pairs or groups and to monitor those you are with.
7. To complete pre and post dive checks on dive equipment.
8. To maintain health and fitness for the sport, to have a diving specific medical completed on entry to the sport with a diving doctor, and to have a check-up should your health change.
9. The need for a plan should anything go wrong."

[38] I would add, to have a check-up should a diver re-enter the sport after some years absence, or on reaching around 45 years of age.

[39] The owners of the "Miss Akaroa" and operators of the compressor on it to fill the dive cylinders have since undertaken corrective action and training. They are now part of a Nationwide programme to maintain correct purity of breathing air.

[40] I have found that faults with the equipment should have been revealed and corrected on servicing. This raises serious issues about the servicing, but they are not issues for a Coroner's Court; rather they are matters within the province of Regulatory Authorities, in this case in Australia.

[41] I direct that copies of this decision be distributed to the persons and bodies listed in Paragraph 10 at page 55 of the Police Dive Squad Report.

1

T L Savage Coroner