



IN THE CORONERS COURT
OF VICTORIA
AT MELBOURNE

Court Reference: COR 2017 3566

FINDING INTO DEATH WITH INQUEST

Form 37 Rule 60(1)

Section 67 of the Coroners Act 2008

INQUEST INTO THE DEATH OF SONIA SOFIANOPOULOS

Delivered On: 22 August 2018

Delivered At: 65 Kavanagh Street
Southbank, Victoria, 3006

Hearing Date: Monday 28 May – 1 June 2018 and 18 June 2018

Findings of: CORONER JACQUI HAWKINS

Counsel Assisting the Coroner: Detective Leading Senior Constable Sonia Reed, Police
Coronial Services Unit

Representation: Mr Paul Lamb of counsel representing the Sofianopoulos
family
Mr Stephen O’Meara QC together with Mr Morgan
McLay of counsel representing the Director of Housing
and the Department of Health and Human Services
Mr Robert Taylor of counsel representing Climate
Technologies Pty Ltd

Mr Daniel Wallis of counsel representing Valley
Maintenance Services Pty Ltd

Mr Timothy Messer of counsel representing Mr Daniel
Fasoli and Lindsay Haysom

Mr John Murphy of counsel representing Energy Safe
Victoria

Mr Abi Mukherjee of counsel representing the Australian
Gas Association

Mr Gary Bath representing the Master Plumbers
Association (Victoria)

Mr Peter Matthews of counsel representing the Victorian
Building Authority

Catchwords

CARBON MONOXIDE TOXICITY,
CARBOXYHAEMOGLOBIN, VULCAN/PYROX
HERITAGE HEATERS, OPEN FLUED GAS HEATERS,
DHHS CONTRACTOR MANAGEMENT ISSUES,
ENERGY SAFE VICTORIA, SAFETY ISSUES,
CARBON MONOXIDE SPILLAGE, NEGATIVE
PRESSURE, ADVENTITIOUS VENTILATION,
RECOMMENDATIONS

CORONER HAWKINS:

SUMMARY

1. On Saturday 22 July 2017, Mrs Sonia Sofianopoulos was found deceased in her unit located at Unit 8, 38 McDowell Street, Greensborough. It was initially assumed her death was due to natural causes. However, after an autopsy was performed and many weeks later, her toxicology results became known, which established her cause of death to be carbon monoxide toxicity. This led to a thorough coronial investigation and this inquest to ascertain the circumstances of her death, namely the origin and cause of the carbon monoxide.

BACKGROUND

2. Mrs Sofianopoulos was aged 62 years at the time of her death. She was born in Greece and was one of seven siblings. Mrs Sofianopoulos immigrated to Australia in 1973. She is survived by two daughters Mrs Helen (Eleni) Kontogiorgis and Ms Stella Sofianopoulos.
3. Mrs Sofianopoulos was described by her daughter as a happy, generous, kind and thoughtful woman. She was known to be very active and took good care of herself. She was generally in good health however suffered from diabetes, osteoporosis and arthritis.
4. She moved into Unit 8 of 38 McDowell Street, Greensborough (Unit 8) on 16 May 2010 as a tenant of the Department of Health and Human Services (DHHS).
5. In June 2017, Mrs Sofianopoulos started feeling unwell and attended an appointment with her general practitioner. A series of blood tests were ordered however they were never undertaken.
6. On 21 July 2017 at 7.47am, Mrs Sofianopoulos called her partner Mr Sioros and they spoke briefly. She invited him over for coffee later that morning. At 9.00 am whilst watering her garden, Mrs Sofianopoulos had a brief conversation with a neighbour who she also invited over for coffee later in the morning.
7. As planned, Mr Sioros attended at the home of Mrs Sofianopoulos but formed the belief that she was not home and must have gone out with her sister. He then left the address.
8. The next day, after being unable to contact her mother, Stella Sofianopoulos, together with her partner, Jose Guzman attended Mrs Sofianopoulos' unit and used a key to gain entry at

around 10.00pm. On entry, they described the heat inside the unit to be intense and Stella found it hard to breathe. The 'Vulcan' gas heater was observed to be on high.

9. Mrs Sofianopoulos was located naked, lying face down on a towel, on the floor in the bathroom, deceased. It was apparent she had showered.
10. Mr Guzman ran across the road to the Greensborough Police Station to notify police.
11. Emergency services also attended and confirmed that Mrs Sofianopoulos was deceased.
12. On 8 November 2017, Mrs Kontogiorgis received the Medical Examiners Report and was notified of her mother's cause of death, which was carbon monoxide toxicity. This prompted her to notify the DHHS due to concerns for the new tenant.
13. On 9 November 2017, DHHS raised an urgent work order for Unit 8 to check the appliances and carbon monoxide levels. Work contract orders were also raised in relation to the other units in the complex. These works were carried out around 16 November 2017 by All Gas Plumbers Pty Ltd (All Gas Plumbers). As a result of this testing, the heaters of Unit 1 and 6 were found to be spilling carbon monoxide and were subsequently disconnected. All other heaters in the complex passed testing.
14. On 21 November 2017, Energy Safe Victoria (ESV) were notified and requested to assist in the coronial investigation into Mrs Sofianopoulos' death. Arrangements were made for them to attend Unit 8 to examine and test the gas appliances in the unit.
15. On 28 November 2017, ESV attended Unit 8 and inspected and tested the Vulcan Heritage Gas Space Heater Series 48 - Open Flued Gas Heater (Unit 8 Heater). ESV began testing other appliances within the complex, which comprised 16 units, 14 of which had a Vulcan Heritage Open Flued Gas Space Heaters (OFG heater) installed. All units with that type of heater failed carbon monoxide spillage testing when exhaust fans were in operation, which indicated the presence of negative pressure. Negative pressure is created when the pressure in the room is lower than the outside atmosphere. The exceptions were Unit 4, which had a room-sealed heater and Unit 10, which had no gas heating.
16. On 30 November 2017, ESV with DHHS representatives and their plumbing contractors conducted further demonstration testing in Unit 8 and Unit 5. A video recording was made of

both demonstration tests. A total of four heaters, including the Unit 8 heater, were ultimately removed for independent laboratory testing.

17. On 15 January 2018, ESV purchased a new Pyrox Heritage OFG heater for testing. As a result of the testing on 8 February 2018, Climate Technologies Pty Ltd (Climate Technologies) were notified by the Australian Gas Association (AGA) that Product Certificate #4949 had been suspended and that all existing stock was to be quarantined and withdrawn from sale.

THE PURPOSE OF A CORONIAL INVESTIGATION

18. Mrs Sofianopoulos' death constituted a '*reportable death*' pursuant to section 4 of the *Coroners Act 2008* (Vic) (Coroners Act), as her death occurred in Victoria and was unexpected.
19. The jurisdiction of the Coroners Court of Victoria (Coroners Court) is inquisitorial¹. The purpose of a coronial investigation is to independently investigate a reportable death to ascertain, if possible, the identity of the deceased person, the cause of death and the circumstances in which death occurred.
20. It is not the role of the coroner to lay or apportion blame, but to establish the facts.² It is not the coroner's role to determine criminal or civil liability arising from the death under investigation.
21. The "cause of death" refers to the medical cause of death, incorporating where possible, the mode or mechanism of death.
22. The circumstances in which death occurred refers to the context or background and surrounding circumstances of the death. It is confined to those circumstances that are sufficiently proximate and causally relevant to the death.
23. The broader purpose of coronial investigations is to contribute to a reduction in the number of preventable deaths, both through the observations made in the investigation findings and by the making of recommendations by coroners. This is generally referred to as the 'prevention' role.

¹ Section 89(4) *Coroners Act 2008*

² *Keown v Khan* (1999) 1 VR 69

24. Coroners are also empowered:
- (a) to report to the Attorney-General on a death;
 - (b) to comment on any matter connected with the death they have investigated, including matters of public health or safety and the administration of justice; and
 - (c) to make recommendations to any Minister or public statutory authority or entity on any matter connected with the death, including public health or safety or the administration of justice. These powers are the vehicles by which the prevention role may be advanced.
25. All coronial findings must be made based on proof of relevant facts on the balance of probabilities. In determining these matters, I am guided by the principles enunciated in *Briginshaw v Briginshaw*.³ The effect of this and similar authorities is that coroners should not make adverse findings against, or comments about individuals, unless the evidence provides a comfortable level of satisfaction that they caused or contributed to the death.

CORONIAL INQUEST

26. On 20 March 2018, I held a directions hearing and indicated my intention to hold an Inquest.
27. On 30 April 2018, a further directions hearing was held to determine the scope and the witnesses required for the inquest.
28. The Inquest commenced on Monday 28 May 2018 and ran for six days, including a day of submissions.

Witnesses

29. The following witnesses were called to give *viva voce* evidence:
- a) Eleni Kontorgiorgis, daughter of Mrs Sofianopoulos
 - b) Stella Sofianopoulos, daughter of Mrs Sofianopoulos
 - c) Eileen Kelly, Resident at 38 McDowell Street, Greensborough
 - d) Terrence Bevans, Assistant Director, Asset Maintenance Unit, DHHS
 - e) Sergeant Mark Chetcuti, Victoria Police

³ (1938) 60 CLR 336

- f) Gary Caddy, Director, Valley Maintenance Services Pty Ltd
 - g) Daniel Fasoli, Director, All Gas Plumbers Pty Ltd
 - h) Lindsay Haysom, Gas Fitter and Plumber, All Gas Plumbers Pty Ltd
 - i) David Harrison, Case Investigator, Energy Safe Victoria
 - j) Timothy O'Leary, Chief Executive Officer, Climate Technologies Pty Ltd
30. The following expert witnesses participated in giving concurrent evidence:
- a) Enzo Alfonsetti, Manager, Type A Gas Appliances and Components, Energy Safe Victoria
 - b) Tyler Mason, Gas Engineer, Energy Safe Victoria
 - c) Ibrahim Tas, Program Manager, Gas Products Certification, Global Mark
 - d) Ian Pewtress, Licenced Gas Fitter, Master Plumbers Association (Victoria)
 - e) John McNair, Consultant Engineer
 - f) Sean O'Halloran, Team Leader, Vipac Engineers and Scientists Ltd
 - g) Matthew Wilson, Senior Technical Advisor, Victorian Building Authority
 - h) Samantha Adrichem, Manager, Registration and Policy, Victorian Building Authority
 - i) Susan Gaylor, Manager of Knowledge and Experience Assessment, Victorian Building Authority
 - j) Joseph Archibald, Registered Mechanical Engineer, Chem Mech Engineering Pty Ltd
 - k) Chris Wealthy, Chief Executive Officer, Australian Gas Association

IDENTITY OF THE DECEASED

31. On 22 July 2017, Mrs Sofianopoulos was visually identified by her daughter, Stella Sofianopoulos. Her identity was not in dispute and required no further investigation.

MEDICAL CAUSE OF DEATH

32. On 25 July 2017, Dr Essa Saeedi, Forensic Pathology Registrar at the Victorian Institute of Forensic Medicine performed an autopsy on the body of Mrs Sofianopoulos and reviewed the Form 83 Victoria Police Report of Death, the post mortem computed tomography (CT) scan and the medical records of Templestowe District Medical Centre.

33. Toxicological analysis of blood detected elevated carboxyhaemoglobin of 64% saturation. No other alcohol, common drugs or poisons were detected. According to Dr Saeedi, carboxyhaemoglobin detected at this level is indicative of breathing carbon monoxide gas during life while being in an environment that is saturated with the gas (due to a faulty appliance or fire), and is considered to be fatal.
34. Carbon monoxide is a poisonous gas and when inhaled displaces oxygen from haemoglobin, reducing the ability of blood to retain oxygen. The degree of displacement is typically quantified as percent saturation. That is the percent of haemoglobin bound to the carbon monoxide. At 50% saturation carbon monoxide has displaced half of the oxygen bound to haemoglobin. Once bound to haemoglobin the carbon monoxide is only slowly removed, with a half-life of about five hours at normal atmospheric pressure and normal air composition. Normal concentrations of carbon monoxide in non-smokers living in an urban environment are generally less than 2%. In heavy smokers, concentrations may reach 6%.
35. Dr Saeedi provided an opinion that the medical cause of death was 1a) CARBON MONOXIDE TOXICITY. I accept this as the cause of death.

CIRCUMSTANCES IN WHICH THE DEATH OCCURRED

Scope of the Inquest

36. The purpose of the inquest was to investigate the following issues:
 - a) Circumstances surrounding Mrs Sofianopoulos' death;
 - b) DHHS installation, maintenance, service and repair history for Unit 8 OFG Heater;
 - c) Investigation into the Unit 8 OFG heater;
 - d) The cause and extent of the carbon monoxide spillage;
 - e) Response to Mrs Sofianopoulos' death; and
 - f) Risk mitigation and prevention opportunities.

Section A - Circumstances surrounding Mrs Sofianopoulos' death

37. Mrs Sofianopoulos was last seen at approximately 9.00am on 21 July 2018 before she was found deceased in the bathroom, the following evening. It appears she had just had a shower prior to her collapse. In the kitchen, on the stove top on a low heat was a saucepan of food

that was still cooking. It had been burnt to charcoal. The evidence of her two daughters was that their mother used the exhaust fans in the bathroom when she showered and in the kitchen when she cooked.⁴ Mrs Kontorgiorgos commented “*she always had it on when she was having a shower, ... always. She didn’t like ... fogging up ... the bathroom.*”⁵

38. Sergeant Mark Checuti attended the unit when Mrs Sofianopoulos was discovered. His evidence was that he could not recall if the exhaust fans were on.⁶ A number of other police officers, ambulance paramedics and family attended that night and commented on the intense heat in the unit, but did not specifically recall whether or not the exhaust fans were on, except First Constable Jamie Crossan who, later that night, took photographs and observed the fan switch was off.⁷ The importance of this information was not realised until months later.
39. Submissions on behalf of the Sofianopoulos family were that “*from an early time until after 9.30am and thereafter, negative pressure conditions prevailed in the unit because one or both fans were on.*”⁸ Counsel for the Sofianopoulos family submitted that the daughters gave evidence in strong terms as to Mrs Sofianopoulos’ habits and processes in relation to the use of exhaust fans.⁹ Further, as she was found deceased in the bathroom, it was likely the bathroom fan was on.¹⁰
40. Submissions on behalf of DHHS stated the ‘habit evidence’ of the family members could not displace direct evidence. Further, the experts did not have direct evidence and were only able to refer to ‘possible’ causes.¹¹
41. DHHS submitted that ultimately it was a matter for me to determine the issue of whether the fans were operating, thus causing negative pressure. However, they noted “*the evidence of habit is important because it tends to support that there must’ve been something on this particular day because of Mrs Sofianopoulos’ habit was to always use the fans, then why is it that after five years, ... on this particular day that it happens?*”¹²

⁴ Transcript of evidence, p13 & p15

⁵ Transcript of evidence, p13 & p15

⁶ Transcript of evidence, p78 & p79

⁷ Exhibit 49 - Statement of First Constable Jamie Crossan dated 12 December 2017, coronial brief, p59

⁸ Written submissions on behalf of the Sofianopoulos family, p1

⁹ Transcript of evidence, p645

¹⁰ Transcript of evidence, p646

¹¹ Written submissions on behalf of DHHS dated 15 June 2018, p1

¹² Transcript of evidence, p667

Section B - DHHS installation, maintenance, service and repair history for Unit 8 OFG Heater

42. DHHS was responsible for the installation, maintenance, service and repair of the Unit 8 heater. DHHS records indicate the heater was installed around the time of construction of the unit in approximately 1993. At the time of installation, DHHS required all gas appliances to be appropriately installed and certified by appropriately qualified gas plumbers.¹³
43. The Unit 8 heater would have been installed pursuant to Installation Code AG 601. The evidence of Mr Tas is that the Unit 8 heater complied with the certification and installation standards at the time of installation.¹⁴ The consensus of the expert panel was that the Unit 8 heater was a suitably sized heater for the unit at the time of installation.¹⁵
44. At the time of Mrs Sofianopoulos' death, DHHS had a five year service cycle for gas appliances.¹⁶ This was in addition to whenever a DHHS tenant required service of a gas appliance or vacated the property, which would trigger a vacant works order be performed.
45. DHHS has approximately 75,000 properties in Victoria.¹⁷ Around 7000-8000 heaters are serviced annually and the rest are scheduled for service, which equates to approximately 12,000 heaters being serviced per annum.¹⁸ To date, DHHS have identified that there are 6,525 Vulcan OFG heaters in DHHS housing and they are aware there are more.¹⁹

DHHS service and maintenance contracts

46. DHHS contracts the service and maintenance of public housing to seven head contractors. This includes the service and maintenance of all heaters. When a tenant reports a fault, a job order is raised by the DHHS housing call centre to go to the relevant head contractor, who then arranges the relevant trade to attend.²⁰
47. Valley Maintenance Services Pty Ltd (Valley Maintenance Services) successfully tendered and was awarded the contract for maintenance services of the Greensborough area including

¹³ Exhibit 6 – Statement of Terrence Bevans dated April 2018, coronial brief, p836

¹⁴ Exhibit 40 - Expert report of Ibrahim Tas dated 23 May 2018, coronial brief, p1971

¹⁵ Transcript of evidence, p461

¹⁶ Transcript of evidence, p42-43

¹⁷ Transcript of evidence, p29

¹⁸ Transcript of evidence, p60

¹⁹ Transcript of evidence, p40

²⁰ Transcript of evidence, p32

38 McDowell Street. The contract commenced on 1 July 2014. Much of Valley Maintenance Services work was on a reactive basis, meaning the maintenance was undertaken in response to job orders being raised by the DHHS call centre.²¹

48. After any work is done by its contractors and subcontractors, DHHS conducts audits on all vacant works that are conducted prior to being handed back to DHHS. They may also from time to time conduct audits in response to regular maintenance.²² Quality assurance and property condition audits are also performed on approximately four to five per cent of works.²³ Audits are conducted by looking at and cross-checking documentation including the job order, a site inspection and test plan from the contractor, which indicates whether a carbon monoxide test was completed.²⁴ There is no audit system that specifically relates to checking the carbon monoxide emissions.²⁵
49. Valley Maintenance Services audit 10 per cent of their own work and employ someone full time to do the audits.²⁶
50. The contract between DHHS and Valley Maintenance Services requires the contractor and its subcontractors to comply with all Trade Specifications & Schedule of Rates 2014 (Trade Specifications),²⁷ all statutory and regulatory requirements, and DHHS Superintendent Directions issued from time to time.²⁸ Specifically, Section B14-1 of the Trade Specifications requires that when servicing a gas heater, testing for carbon monoxide be carried out in accordance with ESV – Gas Information Sheet No 38, issued in August 2011 (GN38 08/11).²⁹
51. ESV as the gas regulator of Victoria, will periodically issue guidance notes in accordance with Australian Standards and make efforts to inform gasfitters of any changes. GN 38 is a guidance document for testing gas appliances for carbon monoxide spillage using appropriate detection equipment. GN38 is revised whenever ESV identifies circumstances that would warrant a revision based upon changes within the Australian Standards and when ESV is

²¹ Transcript of evidence, p32

²² Transcript of evidence, p50

²³ Transcript of evidence, p69

²⁴ Transcript of evidence, p59

²⁵ Transcript of evidence, p59

²⁶ Transcript of evidence, p90

²⁷ Exhibit 49, Coronial brief, p240

²⁸ Transcript of evidence, p71

²⁹ Exhibit 49, Coronial brief, p271-272

made aware of any set of circumstances that may lead to carbon monoxide spillage that is not adequately covered by the document.³⁰

52. A Superintendent Direction was issued on 28 May 2012. It required contractors to adhere to GN38 08/11. The Superintendent Direction provided that when requested to service gas heaters, contractors were required to check flue integrity and effectiveness, test levels of carbon monoxide and record the reading on the Inspection and Test Plan.³¹
53. Valley Maintenance Services subcontracted to All Gas Plumbers and was required to supervise and ensure that their subcontractors employed appropriately qualified staff.³² Daniel Fasoli is the director of All Gas Plumbers. He employed Lindsay Haysom as a registered gas plumber. The evidence is they were required to service the Unit 8 heater in March 2015 and conduct a vacant works order in August 2017, in accordance with the contract, Trade Specifications and all legislative and regulatory requirements.

Service and repair history of Unit 8 heater

54. The Unit 8 heater was subject to repair and maintenance both before and after Mrs Sofianopoulos' death.
55. In March 2015, Mrs Sofianopoulos reported the Unit 8 heater was making a loud noise and an unusual smell was emanating from it. The heater was serviced by Gatehouse Plumbing (now known as All Gas Plumbers) on 1 April 2015.³³
56. Despite the fact that ESV had issued two intervening updates, on 1 April 2015, GN38 08/11 was the guideline that was used by the contractor, Mr Haysom, on that day to test for carbon monoxide. GN38 08/11 required five minutes of testing in ordinary conditions, in addition to three or four minutes under negative pressure conditions (with extraction fans in operation), using a carbon monoxide detector. His evidence was that he tested for carbon monoxide using a TPI detector, in accordance with GN38 08/11.³⁴ Mr Haysom claimed the TPI detector returned a reading of zero parts per million (OPPM) which was recorded on the work order.³⁵

³⁰ Exhibit 38 – Statement of Enzo Alfonsetti, coronial brief, p507

³¹ Exhibit 6 – Statement of Terrence Bevans dated April 2018, coronial brief, p841

³² Transcript of evidence, p101-102 & p106

³³ Exhibit 22 – DHHS Schedule Contract Order to VMS dated 25 March 2015, coronial brief, p213

³⁴ Exhibit 28 – Statement of Lindsay Haysom dated 2 March 2018, coronial brief, p86

³⁵ Exhibit 22 – DHHS Schedule Contract Order to VMS dated 25 March 2015, coronial brief, p213

57. Mr Haysom's evidence about whether he conducted carbon monoxide testing in accordance with GN38 08/11 was strongly disputed at Inquest. Submissions for the family were that Mr Haysom was "*a profoundly unimpressive witness, who, under oath, made a number of unlikely or likely false statements.*"³⁶ Counsel for the family submitted that it is likely that Mr Haysom only performed the first part of GN 38 08/11 and therefore, a finding of contribution to Mrs Sofianopoulos' death should be made.³⁷
58. Submissions on behalf of Mr Fasoli, Mr Haysom and All Gas Plumbers stated that even if Mr Haysom is mistaken about testing for carbon monoxide, strictly in accordance with the GN38 08/11 standard in April 2015, there is no evidence that any such testing using the TPI Detector would have returned anything other than a result of 0PPM.³⁸

Amendment to GN38 in June 2016

59. In June 2016, GN 38 was further revised (GN38 06/16)³⁹ to be consistent with amendments made to Appendix R of the AS 5601.1:2013 - *Gas Installation* (AS5601). This revision changed the carbon monoxide testing method to include a smoke test. This test was introduced to detect whether smoke is drawn away from the appliance by extraction fans, which indicates negative pressure. This new testing methodology specifically related to installation and not servicing. Accordingly, ESV issued GN38 06/16 to inform gasfitters because it had direct relevance to their work.
60. The implication of the change was that an appliance that may have been tested under GN38 08/11 where the appliance is turned on first before the exhaust fans, may not show if there was a spillage issue.⁴⁰
61. It became apparent during the Inquest that some confusion arose around the knowledge of the changes to this GN38 06/16 by DHHS, Valley Maintenance Services and All Gas Plumbers which included Mr Fasoli and Mr Haysom when they conducted the vacant works order.
62. There was evidence that Mr Fasoli had been advised of the new method of testing for carbon monoxide. He was party to an email in September 2016 in relation to some carbon monoxide

³⁶ Written submissions on behalf of the Sofianopoulos family, p3

³⁷ Transcript of evidence, p652

³⁸ Written submissions on behalf of Mr Fasoli, Mr Haysom and All Gas Plumbers, p4

³⁹ Exhibit 49 – coronial brief, p521-522

⁴⁰ Transcript of evidence, p474

testing which had been undertaken in Derby St, Fawkner, which used the GN38 06/16 method.⁴¹ However, Mr Fasoli's evidence was that he was not aware of the change to the testing method. He believed the GN38 08/11 procedure was the appropriate version⁴² and was unaware the testing procedure had changed.⁴³ His evidence was that he had watched the ESV video that depicted GN38 08/11 hundreds of times⁴⁴ and always just referred to the video for the procedure.⁴⁵ Despite evidence alluding to the change in procedure, Mr Fasoli did not take any proactive actions to investigate whether GN38 08/11 had been amended.

63. The evidence is that despite DHHS being aware of the change to GN38 06/16 they did not notify Valley Maintenance Service, and Valley Maintenance Service did not notify All Gas Plumbers.⁴⁶ Regardless, the evidence of Enzo Alfonsetti of ESV and Matthew Wilson from the Victorian Building Authority (VBA) was that the regulators expect all plumbing practitioners and gasfitters to keep up-to-date with all relevant standards and codes.⁴⁷
64. It is no surprise that there was some confusion surrounding the knowledge of GN 38 06/16 because the evidence demonstrates that ESV's communication about the new procedure was not optimal. For example, in late 2017 Mr Fasoli requested a video of the new procedure be sent to his office. ESV sent out a video depicting the old 08/11 procedure.⁴⁸ In fact, ESV had GN38 08/11 on its website until May 2018. When that was discovered, the superseded video was removed. No video was ever produced which demonstrated the new method of testing, nor did the change feature in any relevant ESV newsletter.⁴⁹ DHHS submitted that "*when the [impending] change was advised to [DHHS] at a Gas Safety Committee meeting in March 2016 it was described as a 'slight modification' and with no explanation as to any particular significance in the proposed change.*"⁵⁰

Vacant repair works to Unit 8 after Mrs Sofianopoulos' death

65. The evidence is that All Gas Plumbers did not service the heater between 1 April 2015 and 22 August 2017. A vacant works order was requested and performed by All Gas Plumbers after

⁴¹ Exhibit 20 – Email chain including Tyler Mason, Mr Fasoli and Mr Caddy, coronial brief, p2239

⁴² Transcript of evidence, p163 & p172

⁴³ Transcript of evidence, p174

⁴⁴ Transcript of evidence, p151

⁴⁵ Transcript of evidence, p179

⁴⁶ Transcript of evidence, p64

⁴⁷ Transcript of evidence, p476 & p480

⁴⁸ Transcript of evidence, p218

⁴⁹ Exhibit 33 – ESV Newsletters

⁵⁰ Written submissions of DHHS dated 15 June 2018, p3

Mrs Sofianopoulos' death on 22 August 2017.⁵¹ The evidence of Mr Fasoli is that he received the order for vacant repair works and attended Unit 8 to see what was required to service the heater.⁵²

66. At the time of the vacant works service in August 2017, the Unit 8 heater was found to have a cracked heat exchanger and cracked radiants, which were replaced.⁵³ A second hand heatproof seal which surrounds the glass front was also replaced.⁵⁴
67. Standard procedure required a carbon monoxide test be performed when a heater was serviced.⁵⁵ Mr Fasoli explained "*a CO test would have been done at the completion of all the works on the heater.*"⁵⁶ Mr Fasoli stated that as a result of testing, no carbon monoxide was detected,⁵⁷ even though no result was recorded on the work orders.
68. Mr Haysom's evidence was that he always conducts a carbon monoxide test. He said he tested for carbon monoxide using a TPI Detector in accordance with GN38 08/11⁵⁸ and the TPI Detector returned a recording of zero parts per million (0PPM)⁵⁹. During cross-examination, he later conceded that there was no carbon monoxide testing done on 22 August 2017.⁶⁰ He assumed Mr Fasoli had done the test when he had earlier attended, prior to ordering the parts.⁶¹ Under cross-examination, Mr Fasoli admitted that he did not conduct a carbon monoxide test prior to the vacant works being done.⁶²
69. Ian Pewtress from the Masters Plumbers Association, with the consensus of all the experts, believed that the vacant works carried out in August 2017 were not reasonable or appropriate due to inadequate record keeping of the service. He explained there was limited description of the works carried out, there was no record of the actual faults observed with the heater and the service mainly focussed on the replacement of parts. Further, there was no mention of the performance of the heater, its state of dilapidation, or a point score of where it was at in its

⁵¹ Exhibit 23 – DHHS Work Order dated 11 August 2017, coronial brief, p216

⁵² Transcript of evidence, p138

⁵³ Transcript of evidence, p140 & p234

⁵⁴ Transcript of evidence, p140

⁵⁵ Transcript of evidence, p143

⁵⁶ Transcript of evidence, p144

⁵⁷ Transcript of evidence, p201

⁵⁸ Transcript of evidence, p227, 316

⁵⁹ Exhibit 22 – DHHS Schedule Contract Order to VMS dated 25 March 2018, coronial brief, p214

⁶⁰ Transcript of evidence, p238

⁶¹ Transcript of evidence, p238

⁶² Transcript of evidence, p264

life, along with some of the other mandatory requirements in accordance with the appropriate servicing standards.⁶³

70. DHHS submitted that it appears that All Gas Plumbers did not undertake the servicing and maintenance of the Unit 8 heater adequately, nor with the appropriate equipment. It was submitted that DHHS had no reason to doubt the competency or proficiency of Valley Maintenance Services or All Gas Plumbers prior to that time. Therefore, it follows that no adverse finding should be made concerning DHHS.⁶⁴
71. Counsel for Valley Maintenance Service submitted that as the head contractor, it discharged its duty by:
- sub-contracting to appropriately qualified gas plumbers to perform the work;
 - providing sub-contractors with relevant DHHS Trade Specifications, which included GN38 08/11; and
 - auditing 10% of all work including quality workmanship and compliance with specifications.⁶⁵
72. It was further submitted that there was no evidence to support a finding that any actions undertaken by Valley Maintenance Service caused or contributed to Mrs Sofianopoulos' death.
73. Counsel for All Gas Plumbers, Mr Fasoli and Mr Haysom, submitted that *"the Coroner cannot, with respect, feel a comfortable satisfaction that any shortcomings on the part of Haysom, or any other All Gas personnel, contributed to the death of the deceased."*⁶⁶ Therefore, there should be no finding that Mr Fasoli, Mr Haysom and All Gas Plumbers caused or contributed to the death.
74. Submissions for DHHS stated it was evident that *"Mr Fasoli, Mr Haysom and All Gas Plumbers had deficiencies in training, knowledge and proficiency in CO testing, the correct operation of the correct testing equipment and the correct assessment and installation of*

⁶³ Transcript of evidence, p475

⁶⁴ Written submissions on behalf of DHHS dated 15 June 2018, p4

⁶⁵ Written submission on behalf of VMS dated 15 June 2017, p2

⁶⁶ Written submissions on behalf of Mr Fasoli, Mr Haysom and All Gas Plumbers, p5

ventilation.”⁶⁷ DHHS submitted however, that there was no causal significance because there was no testing of the Unit 8 heater between June 2015 and the date of the incident.⁶⁸

Section C - Investigation of the Unit 8 OFG Heater

75. Once Mrs Sofianopoulos’ cause of death became known, I asked ESV to investigate the cause of the carbon monoxide spillage. This investigation was initially compromised, due to the fact that it occurred approximately four months after Mrs Sofianopoulos’ death, after a vacant works order service had been conducted by All Gas Plumbers and a new tenant had moved into the premises. There was evidence that the Unit 8 heater had been serviced, modified and had some parts replaced. This means the exact condition of the heater at the time of Mrs Sofianopoulos’ death will never be known.
76. The flue terminal had been replaced after the incident. Therefore, there was no information on the condition of the flue terminal at the time of the incident.⁶⁹
77. The Unit 8 heater is a Vulcan Heritage that was originally manufactured by Vulcan Australia/Southcorp Heating and Cooling, and is now manufactured by Climate Technologies who have applied their “Pyrox” brand to the Heritage appliance.⁷⁰ The Unit 8 heater is a Type A gas appliance. These appliances are governed by the *Gas Safety Act 1997 (Vic)* and Australian Standards that exist to ensure their safety and performance.
78. Tyler Mason, Gas Engineer with ESV and David Harrison, Investigator with ESV conducted carbon monoxide spillage tests on the heater as part of the ESV investigation and made the following findings:
- a) The Unit 8 heater, when tested with the kitchen and bathroom exhaust fans in operation and all external windows and doors closed from start-up, was found to be spilling carbon monoxide into the living space at a level in excess of 1000 parts per million (PPM).
 - b) The installation as tested was found to be immediately unsafe.
 - c) Independent testing confirmed:

⁶⁷ Written submissions of DHHS dated 15 June 2018, p3

⁶⁸ Transcript of evidence, p678

⁶⁹ Exhibit 40 - Expert report of Ibrahim Tas dated 23 May 2018, coronial brief, p1964

⁷⁰ Exhibit 39 – Statement of Tyler Mason dated 8 April 2018, coronial brief, p481

- i. The presence of a negative pressure in Unit 8 with external doors and windows closed and with both exhaust fans operating; and
 - ii. The heater continued to spill carbon monoxide when tested for an extended period.
- d) Of the 16 units at 38 McDowell Street, 14 were fitted with a Vulcan Heritage OFG heater. All units with a Vulcan Heritage OFG failed carbon monoxide spillage testing when the units' fans were operating.
- e) All four of the Vulcan Heritage OFG heaters that were removed for independent laboratory testing failed to comply with the flue performance test under down draught/negative pressure conditions.⁷¹

79. As part of their independent investigation, ESV engaged Vipac, an independent laboratory, to conduct testing on the appliance. Vipac conducted on site testing at Unit 8 and made the following key findings:

- a) That a negative pressure was present when one or both exhaust fans were operated; and
- b) That continued operation of the appliance resulted in ongoing spillage of carbon monoxide whilst both exhaust fans were in operation.⁷²

80. In January 2018, the AGA conducted a down draught test on a newer model of the OFG heater. *“When the downdraught velocity of less than 2.0 metres per second was applied to the flue, the heater emitted unsafe and unacceptable levels of carbon monoxide.”*⁷³ The AGA immediately suspended the Vulcan Heritage OFG heater's product certification and directed the manufacturer to immediately quarantine stock.⁷⁴

81. Mr McNair suggested that all the tests indicated that it was the environment and not the heater itself that was at fault.⁷⁵

⁷¹ Exhibit 39 – ESV Investigation Reports dated 21 February 2018, coronial brief, p90

⁷² Exhibit 39 – ESV Investigation Reports dated 21 February 2018, coronial brief, p116

⁷³ Exhibit 47 – Statement of Christopher Wealthy dated 26 April 2018, coronial brief, p530 & p174-180

⁷⁴ Exhibit 47 – Statement of Christopher Wealthy dated 26 April 2018, coronial brief, p530

⁷⁵ Exhibit 42 – Statement of John McNair, coronial brief, p750

Integrity of ESV and VIPAC investigation

82. Mr McNair questioned the integrity of the ESV and Vipac investigations. He said ESV never saw the heater in its original condition⁷⁶ and the tests were not conducted in accordance with strict guidelines.⁷⁷
83. Mr Tas was also critical of the on-site testing due to the fact that:
- a) The heater had been modified and the flue terminal replaced;
 - b) Outside temperatures on the day of the incident ranged between 3 and 13 degrees Celsius, whereas the temperature on the day of the testing was 37 degrees Celsius. At the likely time of Mrs Sofianopoulos' death, the temperature was near the minimum, 3 degrees Celsius, with above average wind gusts; and
 - c) On the day of testing, the flue was already warm before the heater was started, and coupled with low air density, the conditions were ideal to draw combustion products through the flue passageway at the start of the testing which were contrary to the conditions at the time of the incident.⁷⁸
84. Mr Tas commented the laboratory results give some indication about the performance of the modified heater however it is hard to ascertain how close the results would be due to the modification of the heater.⁷⁹ Mr Mason believed the repairs that were carried out would not have affected the selection of the tests and may have affected the outcome of those tests.⁸⁰ He noted that if the heater was operating in a dilapidated state prior to the repairs, it would have been expected to perform in a worse manner. Mr Alfonsetti also commented that ESV undertook testing of a brand new Pyrox/Heritage Heater which included down draught testing. The results were indicative of the results with the Unit 8 heater in that it failed down draught testing at low velocity.
85. As part of the concurrent evidence, Mr Mason stated that ESV requested Vipac to test in accordance with the current standard in accordance with Vipac's accreditation. In any event, it

⁷⁶ Transcript of evidence, p487

⁷⁷ Transcript of evidence, p489

⁷⁸ Exhibit 40 - Expert report of Ibrahim Tas dated 23 May 2018, coronial brief, p1968

⁷⁹ Exhibit 40 - Expert report of Ibrahim Tas dated 23 May 2018, coronial brief, p1968

⁸⁰ Transcript of evidence, p499

was his opinion that the change to the standard would not have affected the outcome.⁸¹ Mr Mason said ESV has no issue with the conduct of Vipac in testing on site or in the laboratory.⁸² Further, the testing was not intended to be in compliance with GN38 06/16.⁸³ He explained that ESV had been asked to assess the installation of the appliance at that time and not to correct ventilation issues. Further, it would have undermined what they had been asked to do.⁸⁴

86. Mr Alfonsetti stated that ESV, as the technical regulator for gas safety in Victoria, has the discretion to ask a laboratory to undertake testing not strictly in accordance with the standard. The reason that ESV did not ask for the updraft test to be done is because updraft was not an issue in the circumstances surrounding Mrs Sofianopoulos' death.⁸⁵ Mr Wealthy agreed that the updraft test was really not relevant to the circumstances.⁸⁶

Section D - The cause and extent of the carbon monoxide spillage

The extent of carbon monoxide

87. One of the central issues associated with the inquest was to investigate the cause and extent of the carbon monoxide spillage.
88. Carbon monoxide is a colourless, non-irritant, odourless and tasteless toxic gas. It is not detectable by humans either by sight, taste or smell. It is a gas that occurs naturally in the air at low levels of approximately 0.2 parts per million.⁸⁷ It is a poisonous, highly flammable gas that is potentially deadly to humans if absorbed in large quantities. Carbon monoxide is toxic because it combines with the haemoglobin of the blood to the exclusion of oxygen. *"The bond to haemoglobin for carbon monoxide is about 245 times as strong as that for oxygen."*⁸⁸ Thus, carbon monoxide is not quickly and easily dissociated from its haemoglobin bond, i.e. it remains bound for longer. This means that carboxyhaemoglobin continues to

⁸¹ Transcript of evidence, p490

⁸² Transcript of evidence, p498

⁸³ Transcript of evidence, p490

⁸⁴ Transcript of evidence, p490

⁸⁵ Transcript of evidence, p493

⁸⁶ Transcript of evidence, p494

⁸⁷ General Information on carbon monoxide and carboxyhaemoglobin, by Mr Tas dated 3 June 2018

⁸⁸ General Information on carbon monoxide and carboxyhaemoglobin, by Mr Tas dated 3 June 2018

increase with continued exposure, and leaves progressively less haemoglobin available for carrying oxygen.⁸⁹

89. According to Mr Tas, a level of 64% saturation of carboxyhaemoglobin could be reached within a short period of time. Mr Tas believed that should the concentration of carbon monoxide be about 1% (10,000ppm) or over, death is almost immediate.⁹⁰ Mr Tas concluded that *“if Mrs Sofianopoulos collapsed by or before 9.30am on 21 July 2017 because of elevated [carboxyhaemoglobin] levels in her blood, she must have been exposed to very high levels of [carbon monoxide].”*⁹¹
90. In this case, the most likely source of the carbon monoxide was the heater. It was suggested that the carbon monoxide could have come from another source such as the small gas oven in the kitchen or the hot water service. However, Mr Tas stated that the carbon monoxide contribution to the room atmosphere from the cooker must have been small.⁹² The expert evidence was that the stove and hot water service would have had only a “marginal impact”.⁹³
91. Carbon monoxide is a stable molecule, which means that once it is released into the indoor environment, it accumulates and will not be destroyed or removed by any mechanism other than the ventilation made available to that space.⁹⁴
92. To assist with understanding the operation of the heater, Mr Wealthy very helpfully outlined generally how OFG heaters function:
- a) An OFG heater draws combustion air from inside the habitable room and exhausts the products of combustion to outside via a flue.
 - b) The heater draws in room air from the internal habitable space which then passes over a heat exchanger. The heated room air is then expelled back into the room, typically via louvre vents at the top of the appliance.
 - c) The by-products of combustion, such as carbon monoxide, are conveyed up the flue and safely discharged into the external atmosphere.⁹⁵

⁸⁹ General Information on carbon monoxide and carboxyhaemoglobin, by Mr Tas dated 3 June 2018

⁹⁰ Exhibit 40 - Expert report of Ibrahim Tas dated 23 May 2018, coronial brief, p1970

⁹¹ Exhibit 40 - Expert report of Ibrahim Tas dated 23 May 2018, coronial brief, p1970

⁹² Exhibit 40 - Expert report of Ibrahim Tas dated 23 May 2018, coronial brief, p1970

⁹³ Transcript of evidence, p501

⁹⁴ Transcript of evidence, p507 and General Information on carbon monoxide and carboxyhaemoglobin, by Mr Tas dated 3 June 2018

93. Some of the main issues that were considered as part of this investigation in determining the possible causes of the carbon monoxide spillage were as follows:

- a) The age and condition of the Unit 8 heater;
- b) Inadequate adventitious ventilation;
- c) Negative pressure environment; and
- d) The draught diverter.

The age and the condition of Unit 8 heater

94. The Unit 8 heater was 25 years old at the time of Mrs Sofianopoulos' death. It cannot be determined what the actual condition of the heater was like at the time of the incident. The only evidence as to the condition of the heater, closest to the time of death, was the evidence of the service and vacant works performed on 22 August 2017.

95. The evidence is that Mr Haysom replaced the radiants which were cracked.⁹⁶ Radiants are usually replaced when they are broken, cracked or discoloured.⁹⁷ If radiants do not distribute heat properly, they can give off a carbon monoxide reading.⁹⁸ Mr Mason, with the consensus of the experts, considered that the replacement of the radiants was of little significance, although he conceded it would have caused poor operation of the heater.⁹⁹

96. The glass seal required changing as it was either damaged or not sealing the heater and combustion chamber correctly.¹⁰⁰ However there was no discussion from the expert panellists about the relevance of this to the working condition of the heater.

97. The flue terminal had been replaced after the incident, however there is no information on the condition of the flue terminal at the time of the incident.¹⁰¹ This would have been an important piece of information. The ESV Investigation Report did not make reference to the flue of the Unit 8 heater. The only person who made reference to the condition of the flue

⁹⁵ Exhibit 47 – Statement of Christopher Wealthy dated 26 April 2018, coronial brief, p524

⁹⁶ Transcript of evidence, p234

⁹⁷ Transcript of evidence, p143

⁹⁸ Transcript of evidence, p234

⁹⁹ Transcript of evidence, p472

¹⁰⁰ Transcript of evidence, p140

¹⁰¹ Exhibit 40 - Expert report of Ibrahim Tas dated 23 May 2018, coronial brief, p1964

was Mr McNair. Unfortunately, the condition of the flue was not something that was tested in evidence by the expert panellists.

98. On inspection by ESV, the heat exchanger was found to have minor cracks to both sides of the top of the heat exchanger. According to Mr Mason, the cracks appeared to be superficial and his opinion was that he would not expect them to affect the operation of the down draught diverter.¹⁰² However, given continued operation, these cracks would be expected to become failure points in the heat exchanger which would result in carbon monoxide spillage under all operating conditions rather than only in an environment subjected to a relative negative pressure.¹⁰³ Mr McNair agreed, and stated that if the cracks got bigger it would definitely cause carbon monoxide spillage. However, he said *“it can only really leak CO if there is CO in the firebox and we have no proof that ... much of it is generated in normal combustion.”*¹⁰⁴ Mr Archibald took the view that a cracked heat exchanger would have a very marginal effect.¹⁰⁵
99. Submissions made on behalf of Climate Technologies were that by July 2017, the unit 8 heater *“exhibited a number of very significant defects such that it was operating in a dilapidated state”*.¹⁰⁶ Further, *“the most likely reason for the CO production was the dilapidated state of the heater.”*¹⁰⁷ According to submissions made by Counsel for DHHS, this presumably relied on the evidence of Mr Fasoli, when he stated that based on the repairs, the heater may not have been operating properly and could have been leaking carbon monoxide.¹⁰⁸ Mr Mason’s evidence was that *“if the heater had been operating in a dilapidated state prior to the repairs, it would have been expected to be performing worse.”*¹⁰⁹
100. Counsel for the Sofianopoulos family submitted that the condition of the heater was likely to have had a minimal impact.¹¹⁰
101. The consensus evidence of the experts was that the expected life of an appliance such as this is indefinite, as long as it is serviced and maintained regularly. There is no trigger that would

¹⁰² Transcript of evidence, p470

¹⁰³ Transcript of evidence, p470

¹⁰⁴ Transcript of evidence, p471

¹⁰⁵ Transcript of evidence, p471

¹⁰⁶ Written Submissions on behalf of Climate Technologies, p3

¹⁰⁷ Written Submissions on behalf of Climate Technologies, p4

¹⁰⁸ Exhibit 21 - Statement of Daniel Fasoli dated 6 March 2018, coronial brief, p82

¹⁰⁹ Transcript of evidence, p499

¹¹⁰ Transcript of evidence, p647

require its replacement. According to Mr Mason, it was still operable.¹¹¹ Contrary to the submissions of Climate Technologies, Mr McNair's evidence was that the Unit 8 heater was in a good condition and in "*relatively good nick for its age.*"¹¹²

Inadequate adventitious ventilation

102. To operate effectively, OFG Heaters need adventitious ventilation. Mr Tas believed that at the time of Mrs Sofianopoulos' death "*the unit must have been sealed tight, had very little room for natural ventilation, also known as adventitious ventilation*".¹¹³
103. The evidence is that at the time the Unit 8 heater was installed in 1993, there was adequate ventilation for the heater. In 2008, DHHS replaced kitchen exhaust fans and removed, cleaned and reinstalled the exhaust fan in the bathroom.¹¹⁴ As part of the 2008 upgrade works, Unit 8 had weather seals installed on the front and rear doors, as well as aluminium framed windows.¹¹⁵ In 2012, DHHS completed upgrade works to Unit 8 which included the installation of a new gas oven. The exhaust fan for the oven was removed and reinstalled in the same location as part of these works.¹¹⁶
104. In November 2017, Unit 8 was fitted with three 100mm vents through the ceiling into the roof cavity located in the living room, kitchen and bathroom/laundry.¹¹⁷ The vents that were installed mainly vented to the sealed roof space.¹¹⁸ Unit 8 is constructed with a flat steel roof and the roof cavity does not provide adequate ventilation to atmosphere.¹¹⁹
105. These days housing is much more energy efficient, particularly since energy provisions were introduced into the Building Code of Australia, which discourages ventilation.¹²⁰ Consistent with this, Mr Alfonsetti stated that due to the design of the heater, under a negative pressure environment, it would be probable that carbon monoxide would enter into a house where there

¹¹¹ Transcript of evidence, p469

¹¹² Transcript of evidence, p511

¹¹³ Exhibit 40 - Expert report of Ibrahim Tas dated 23 May 2018, coronial brief, p1964

¹¹⁴ Exhibit 49 - coronial brief, p943

¹¹⁵ Exhibit 39 - ESV Investigation Reports dated 21 February 2018, coronial brief, p94 Exhibit 49 - coronial brief, p894, 895, and 943

¹¹⁶ Exhibit 6 - Statement of Terrence Bevans dated April 2018, coronial brief, p837

¹¹⁷ Exhibit 21 - Statement Daniel Fasoli dated 6 March 2018, coronial brief. p82, Exhibit 39 - ESV Investigation Reports dated 21 February 2018, coronial brief, p94

¹¹⁸ Transcript of evidence, p603

¹¹⁹ Exhibit 39 - ESV Investigation Reports dated 21 February 2018, coronial brief, p94

¹²⁰ Transcript of evidence, p463

is a lack of ventilation.¹²¹ Mr Alfonsetti commented that an “*open flued appliance, whatever brand, is not going to work in modern housing. The flue just can’t operate if all those extraction fans are on.*”¹²²

106. Mr McNair opined that Mrs Sofianopoulos’ death:

was primarily caused by the faulty condition of installation, in that the adventitious ventilation in the house, although sufficient for combustion, was insufficient to supply enough air to the exhaust fans, forcing them to depress the room air pressure, thus reversing the natural flue operation from gases up, to gases down.”¹²³

107. Further, Mr McNair said that if there had have been effective ventilation in the unit, the death would have been prevented.¹²⁴

Negative pressure environment

108. Mr Alfonsetti asserted that the carbon monoxide spillage was not caused by the heater, but by a negative pressure environment.¹²⁵ Negative pressure is an event where air from outside is drawn back down the flue of the heater and back into the room, taking with it products of combustion.

109. Possible causes of negative pressure, as suggested by Mr Mason, were the operation of the kitchen and bathroom exhaust fans, or the possibility of the temperature from weather or other phenomenon, and the lack of ventilation to relieve the effect of the exhaust fans.¹²⁶ Mr Tas’ statement is consistent with Mr Mason’s view. He opined that it could be the operation of the extraction fans, freak weather conditions or a combination of both.¹²⁷

110. When asked what he believed caused the negative pressure, Mr Mason stated “*I think in all likelihood it was the effect of the two exhaust fans being operated in conjunction with each other.*”¹²⁸

111. Counsel for the Sofianopoulos family submitted “*it’s likely the fans were on*” which led to the negative pressure situation.¹²⁹ Further, their written submissions indicated that the Unit 8

¹²¹ Transcript of evidence, p502

¹²² Transcript of evidence, p504

¹²³ Exhibit 42 – Report of John McNair dated 26 April 2018, coronial brief, p786

¹²⁴ Transcript of evidence, p602

¹²⁵ Transcript of evidence, p510

¹²⁶ Transcript of evidence, p522

¹²⁷ Exhibit 40 - Expert report of Ibrahim Tas dated 23 May 2018, coronial brief, p1968

¹²⁸ Transcript of evidence, p637

¹²⁹ Transcript of evidence, p651

heater, in negative pressure conditions, was therefore the source of most or all of the carbon monoxide at levels that were likely around 1500ppm.¹³⁰ Counsel for the Sofianopoulos family further submitted that the issue about the weather was ruled out by the experts¹³¹ and the weather and wind gusts were essentially a red herring.¹³²

112. The submission on behalf of DHHS was that “*there is an issue concerning whether any and if so what ‘negative pressure’ was present in the Unit. That issue must depend on the exhaust fans.*”¹³³ Further, the expert evidence also could not determine the issue directly, and accordingly, could reliably refer only to ‘possible’ causes.¹³⁴
113. Written submissions on behalf of Climate Technologies submitted that the installation deficiencies caused, inter alia, a significant negative pressure to develop in Unit 8 while the exhaust fans were in operation and with the external doors and windows closed.¹³⁵ Further, it was submitted that modifications to Unit 8 by DHHS resulted in a negative pressure environment.¹³⁶

Draught diverter

114. OFG heaters are fitted with a draught diverter, which is intended to divert any down draught away from the burner and therefore not impact the operation of the heater.¹³⁷
115. AS5601 requires a flued appliance to not spill its combustion products into the space where it is installed, and this must be tested immediately following installation. Further to this requirement, the Standard establishes specific requirements surrounding air movement systems including exhaust fans:

Gas appliances shall not be installed where the operation of any ventilation system, fan, or air blower could under any circumstance:

- a) *Deprive the gas appliance of the air required for combustion and draught diverter dilution; or*
- b) *Otherwise adversely affect the operation of the gas appliance.*

¹³⁰ Written submissions on behalf of the Sofianopoulos family, p1

¹³¹ Transcript of evidence, p646

¹³² Transcript of evidence, p649

¹³³ Written submissions on behalf of DHHS dated 15 June 2018, p1

¹³⁴ Written submissions on behalf of DHHS dated 15 June 2018, p1

¹³⁵ Written submissions on behalf of Climate Technologies dated 15 June 2018, p2

¹³⁶ Written submissions on behalf of Climate Technologies dated 15 June 2018, p5

¹³⁷ Exhibit 47 – Statement of Christopher Wealthy dated 26 April 2018, coronial brief, p525

NOTE: Extraction fans ... lower the pressure in a building which can cause the spillage of combustion products from flued appliances. This applies particularly to modern buildings which are much more airtight than older buildings and allow much less ventilation through adventitious openings. In buildings with flued appliances and extraction fans, the appliances should be able to operate without combustion product spillage whether or not such fans are running. refer to Appendix R.

116. When there is a down draught and air is being blown into or down the flue into the draught diverter, the way the draught diverter is configured in the Unit 8 OFG heater is such that it should deflect the draught back out of the appliance, rather than allow it to enter into the combustion chamber and affect the burner flame.¹³⁸ The combustion chamber is the area inside the heater behind the glass where the burner and the radiant tiles sit.¹³⁹
117. Mr Mason stated that the intent of the draught diverter is to divert draughts away from the burner to prevent incoming or outgoing updrafts or down draughts affecting the burner or gas.¹⁴⁰ It is specifically designed to prevent the down draught from affecting the burner.¹⁴¹

Down draught test

118. A down draught test is a laboratory test where a draught caused by outdoor wind is simulated by forcing air down a flue connected to the appliance. The appliance performance is then monitored by measuring carbon monoxide and carbon dioxide to check the ability of the draught diverter to effectively counteract the effects of the flue no longer extracting combustion products in the way required.¹⁴² The sole purpose of the down draught test is to assess whether the down draught causes unsafe levels of carbon monoxide to spill from the appliance into the habitable room.¹⁴³
119. A down draught test was conducted on the Unit 8 heater and a newer model of the heater and was found to produce at low velocity down draught pressure, very high amounts of carbon monoxide. Therefore it failed the down draught test.¹⁴⁴ Mr Alfonsetti commented that given this, if negative pressure was established within a home that simulated those low down draught pressures, it would result in increased amounts of carbon monoxide entering into a

¹³⁸ Transcript of evidence, p513

¹³⁹ Transcript of evidence, p514

¹⁴⁰ Transcript of evidence, p512

¹⁴¹ Transcript of evidence, p513

¹⁴² Transcript of evidence, p485

¹⁴³ Exhibit 47 – Statement of Christopher Wealthy dated 26 April 2018, coronial brief, p525

¹⁴⁴ Transcript of evidence, p500

living space.¹⁴⁵ In evidence, Mr McNair agreed that the draught to which this heater reacts is very low, at 1.8km.¹⁴⁶

120. Mr Alfonsetti stated that *“if the draught diverter is not working properly, you’re actually blowing air or blowing wind down into the combustion chamber and ... that draft or wind would then make the flame unstable. An unstable flame would then produce more carbon monoxide than if it wasn’t under a pressured environment.”*¹⁴⁷
121. Mr Tas explained that at a very low level of down draught, whether created by wind or positive pressure on the flue terminal, or by a suction in the room, the heater appeared unable to move the combustion product away from its combustion chamber.
122. According to Mr Tas, this means that the combustion air is dissipated by the flue products, whether it is carbon monoxide, carbon dioxide or the vapour, and that means some percentage of oxygen normally available to the air for the combustion for the heater is being replaced by the flue products.¹⁴⁸ Thus, combustion is not at a maximal or optimal level. When the combustion is incomplete, carbon monoxide is not converted to carbon dioxide. He explained that is why at some stage the Unit 8 heater must have produced very high levels of carbon monoxide into the room atmosphere.¹⁴⁹ Further, when the pressure causing the down draught is low, the spilled combustion products can stay around the heater and hence contaminate the combustion air of the heater by reducing the oxygen content in the air that the heater uses to combust the fuel. This leads to much higher carbon monoxide production by the heater. He stated that if this near stagnant condition prevail for some time, the carbon monoxide production will increase exponentially.¹⁵⁰
123. Mr Alfonsetti stated that at very high velocity head pressures, the draught diverter of this heater actually works. He explained that if there is a very slight down draught, instead of it being deflected out the back of the heater, it actually pressurises the combustion chamber, which in turn, impacts the flame. Once the combustion chamber is pressurised, the flame

¹⁴⁵ Transcript of evidence, p502

¹⁴⁶ Transcript of evidence, p504

¹⁴⁷ Transcript of evidence, p514-515

¹⁴⁸ Transcript of evidence, p519

¹⁴⁹ Transcript of evidence, p519

¹⁵⁰ Exhibit 40 - Expert report of Ibrahim Tas dated 23 May 2018, coronial brief, p1968

becomes unstable, and impinges on various parts of the combustion chamber. This then quenches the flame which results in increased carbon monoxide production.¹⁵¹

124. Mr McNair stated that he had seen a similar situation with the Rinnai heaters: “*under the influence of internal fans they produced a down draught and they produced carbon monoxide at the heater, at very low down draughts.*”¹⁵² This means they discharged carbon monoxide into the room, under a low pressure caused by exhaust fans.¹⁵³ However, testing conducted on a Rinnai heater in the field by ESV,¹⁵⁴ indicated that this particular appliance was able to overcome a negative pressure environment caused by exhaust fans within a matter of minutes.¹⁵⁵

125. Mr Wealthy on behalf of the other experts stated “*we believe ... the circumstances that led to the death of Mrs Sofianopoulos was induced down draught by these extraction fans*”.¹⁵⁶ Mr Alfonsetti, Mr Mason, Mr Tas, Mr O’Halloran, Mr Wealthy, and Mr Archibald all agree with this.¹⁵⁷ Mr McNair dissented.

126. Mr McNair’s view was that carbon monoxide is not generated by a fault in the draught diverter. The hot flue gases escape out of the draught diverter, pool along the top, skid along the top inside the heater and get discharged in the fan air.¹⁵⁸ The room air sucks from the lower part to the heater “*so the room fan and the draught diverter work in concert and force the products of combustion clean down, into an area in the lower case. Unfortunately, in these designs, ... the lower case is the burner inlet*”¹⁵⁹

127. Mr McNair opined that normal products of combustion of that heater are carbon dioxide, water and other trace elements.”¹⁶⁰ Further if:

we take away the heat, we’re getting complete combustion. Hence, it discharges it out of the draught diverter. We know there’s no active flue, because the down draught has negated the effect of the flue. It gets pulled again out of the draft diverter. Some of it

¹⁵¹ Transcript of evidence, p514

¹⁵² Transcript of evidence, p505

¹⁵³ Transcript of evidence, p506

¹⁵⁴ Coronial brief of evidence, p2240

¹⁵⁵ Transcript of evidence, p628

¹⁵⁶ Transcript of evidence, p486

¹⁵⁷ Transcript of evidence, p521

¹⁵⁸ Transcript of evidence, p517

¹⁵⁹ Transcript of evidence, p517

¹⁶⁰ Transcript of evidence, p516

*gets ingested in the fan air into the room, some of it goes back down and goes through two or three times, so we end up with a micro vitiation effect.*¹⁶¹

128. In other words, this results in a depletion of active oxygen in the combustion air for the heater. He stated that the down draught has forced products of combustion, normally quite clean, into the burner and that's the mechanism, in his opinion, as to how this heater was producing carbon monoxide.¹⁶²

Was the product at fault?

129. In evidence, Mr Alfonsetti stated that *"the CO spillage was not caused by the heater. The CO spillage was caused by a negative pressure environment."*¹⁶³ The only aspect of the heater that failed the down draught test, is that under a down draught condition, it would produce higher levels of carbon monoxide.¹⁶⁴

130. Mr McNair agreed that the heater failed down draught tests. He said the tests showed this heater to suffer from exhaust gas or flue gas recirculation into the burner. Further, it was his firm opinion that this caused the carbon monoxide spillage,¹⁶⁵ however he disputes it was a fault with the heater.¹⁶⁶ Mr McNair said *"there is no specific fault in that heater that would cause this high generation of carbon monoxide. It's a characteristic of that type of appliance."*¹⁶⁷

131. Mr McNair asserted even if the heaters did not produce carbon monoxide as shown in the ESV tests, fatalities could eventually occur in long term down draught conditions. The reason is because if 'clean' combustion, high in carbon dioxide, is recirculated into the burner, it instantaneously produces carbon monoxide. He explained this inlet air is 'vitiating' or low in oxygen, and will produce carbon monoxide no matter what.¹⁶⁸

132. Mr Alfonsetti considered the heater to be faulty, and the fault with the heater was that it fails down draught testing at low velocity head pressures.¹⁶⁹ Mr Mason also believed the product was at fault. He explained *"the draught diverter in that circumstance would be converting*

¹⁶¹ Transcript of evidence, p518

¹⁶² Transcript of evidence, p518

¹⁶³ Transcript of evidence, p510

¹⁶⁴ Transcript of evidence, p510

¹⁶⁵ Transcript of evidence, p489

¹⁶⁶ Transcript of evidence, p518

¹⁶⁷ Transcript of evidence, p512

¹⁶⁸ Exhibit 42 – Report of John McNair dated 26 April 2018, coronial brief, p786

¹⁶⁹ Transcript of evidence, p510

products of combustion into the primary aeration, which in itself is a fault."¹⁷⁰ In addition, Mr Mason added that in his experience working in product certification and as an officer of ESV, he had not seen the behaviour exhibited by the Vulcan or Pyrox Heritage in any other heater.¹⁷¹

133. Counsel for Climate Technologies submitted that:

*the assertion made by Mr Alfonsetti ..., that the draft diverter in the Heritage Heater is in some way responsible for deflecting products of combustion, at very slight levels of down draught, with the effect that the combustion chamber becomes pressurised, thereby, impacting the flame and resulting in increased CO production was just that*¹⁷²[an assertion].

134. It was further submitted that the coroner should not place any reliance upon this theory, as it is pure speculation.¹⁷³ I find that this submission appears to be at odds with the consensus of the panel of experts, including their own expert, Mr McNair.

Section E - Response to Mrs Sofianopoulos' death

135. A number of Government departments and agencies, as well as Climate Technologies have taken some proactive steps in response to Mrs Sofianopoulos' death. I have provided a short summary below of some of these remedial actions.

DHHS

136. It was submitted that DHHS have undertaken a number of risk mitigation steps since Mrs Sofianopoulos' death.

137. According to Mr Nicholas Foa, Deputy Secretary of Housing, Infrastructure, Sport & Recreation, the DHHS have been working closely with ESV in respect of investigations into the cause of the carbon monoxide spillage and actions required to ensure the safety of tenants of public housing who may have OFG heaters.¹⁷⁴

¹⁷⁰ Transcript of evidence, p518

¹⁷¹ Transcript of evidence, p505

¹⁷² Written submissions of Climate Technologies dated 15 June 2018, p4

¹⁷³ Written submissions of Climate Technologies dated 15 June 2018, p4

¹⁷⁴ Exhibit 49 – coronial brief, p824

138. On 21 January 2018, DHHS announced they changed their five year heater servicing regime to every two years which was due to commence in March 2018.¹⁷⁵
139. On 1 February 2018, the Minister for Housing, Disability and Ageing, Mental Health and Equality, the Honourable Martin Foley and Mr Foa met with the Sofianopoulos family and expressed their condolences.¹⁷⁶
140. On 27 March 2018, Mr Foa sent a letter to 6,525 public housing tenants with a Vulcan or Pyrox OFG heater installed in their residences and informed them of the following, that:
- a) the product certification of the OFG heater had been suspended;
 - b) tenants were not to use their OFG heater;
 - c) a housing hotline had been set up if urgent alternative heating was required;
 - d) an inspection program was being arranged by the DHHS;
 - e) references to websites with information about gas heater safety; and
 - f) tenants were to seek medical advice if suffering from any carbon monoxide exposure symptoms.
141. Mr Foa also advised that all new DHHS properties will have single electrical flue appliances and as part of the annual housing upgrade program, old OFG heaters will be replaced with new powered flue gas heaters or electrical split system units where required.¹⁷⁷
142. Mr Foa also instructed DHHS staff to advise other relevant State and Territory Government housing departments of the risks associated with carbon monoxide poisoning from OFG heaters.¹⁷⁸
143. On 13 April 2018, Mr Foa sent a letter to 46,602 public housing tenants with gas heaters installed in their residence, advising that DHHS needed to confirm the actual type and model of any heater installed in their residence.¹⁷⁹

¹⁷⁵ Exhibit 49 – coronial brief, p824

¹⁷⁶ Exhibit 49 – coronial brief, p824

¹⁷⁷ Exhibit 49 – coronial brief, p825

¹⁷⁸ Exhibit 49 – coronial brief, p826

¹⁷⁹ Exhibit 49 – coronial brief, p826

ESV

144. ESV submitted that they will continue to work cooperatively with Government departments and agencies, and industry participants to investigate and resolve safety concerns and issues and take regulatory action if required.
145. In addition, ESV will conduct further investigations and analysis to determine whether OFG heaters are a viable option for modern and energy efficient housing and provide advice to Government to enable an appropriate regulatory response.¹⁸⁰
146. On 5 April 2018, Gas Safety Alerts were published in *The Age* and *The Herald Sun*.

AGA

147. On 8 February 2018, AGA notified Climate Technologies that Product Certification #4949 of the Pyrox Vulcan 28 Series Space OFG Heater was suspended, quarantined and should be removed from sale until compliance with the safety requirements could be assured.

Climate Technologies

148. As soon as Climate Technologies were advised of the product suspension they:
- a) Withdrew all heaters from sale;
 - b) Arranged for all Heritage Heaters to be quarantined;
 - c) Notified all affected customers who may have held unsold stock of the Heritage Heater;
 - d) Ceased production of the Heritage Heater;
 - e) Worked with ESV to publish a series of alerts for members of the public about the risks of carbon monoxide spillage under certain conditions;¹⁸¹
 - f) Set up a hotline for the public;¹⁸²
 - g) Entered into a confidential deed of agreement with ESV;

¹⁸⁰ Written submissions of ESV dated 15 June 2018, p4

¹⁸¹ Transcript of evidence, p 367.

¹⁸² Transcript of evidence, p 367

- h) Agreed upon a compensation arrangement for customers,¹⁸³ and
- i) Commenced testing of 278 heaters throughout Victoria.¹⁸⁴

Section F - Risk mitigation and prevention opportunities

149. Due to the potential public health and safety issues to the broader Victoria community, this inquest focussed on risk mitigation and prevention opportunities. The following topics were discussed.

The importance of service and maintenance of OFG Heaters to test for carbon monoxide spillage

150. The importance of regular servicing of OFG heaters became particularly apparent after the deaths of Chase and Tyler Robinson in 2010¹⁸⁵. After the deaths of these little boys, ESV recommended that OFG heaters should be serviced every two years and led a targeted public awareness campaign.¹⁸⁶

151. There is currently no legal requirement to service an OFG heater. Even the manufacturer's installation instructions of the Pyrox/Vulcan Heritage Heaters do not recommend regular servicing and maintenance. Yet Mr O'Leary stated that the "*greatest potential safety concern associated with the operation of Heritage Heaters is the failure of their owners to properly service and maintain their heaters.*"¹⁸⁷ If this is the case, in my opinion, servicing requirements should be more well-known and understood.

152. In 2011, DHHS undertook to service OFG heaters in their public housing system, every five years. DHHS provided evidence that no other State or Territory of Australia has this approach.¹⁸⁸ In March 2018, DHHS modified this approach and now requires that OFG heaters in public housing be serviced every two years.¹⁸⁹

153. I commend this approach.

¹⁸³ Exhibit 34 – Statement of Timothy O'Leary, coronial brief, p819

¹⁸⁴ Exhibit 35 – Supplementary Statement of Timothy O'Leary, coronial brief, p2212

¹⁸⁵ Finding into the death of Tyler Robinson dated 30 July 2013 and Finding into the death of Chase Robinson dated 30 July 2013 by Coroner Jacinta Heffey

¹⁸⁶ Transcript of evidence, p558

¹⁸⁷ Ex 35 – Supplementary statement of Timothy O'Leary, coronial brief, p2215

¹⁸⁸ Exhibit 7 - Statement of Terrence Bevans dated May 2018, coronial brief, p1938

¹⁸⁹ Exhibit 49 – Coronial brief, p824

DHHS audit of all OFG Heaters

154. The evidence of DHHS was that in 2011 when they conducted industry meetings after the deaths of the Robinson boys, it was recommended that DHHS identify OFG heaters in public housing residences.¹⁹⁰ The evidence was that this was never done.
155. Given that the people living in public housing include some of the most vulnerable in our community, it is important that the State Government and in particular, DHHS, who provides that housing, understand the extent of this issue to ensure they are providing safe living conditions and have a register of their assets, such as OFG heaters. I acknowledge that DHHS has implemented a number of remedial actions as previously discussed in this finding. The evidence of Mr Bevans was that DHHS is currently arranging for all OFG heaters to be inspected and tested for carbon monoxide spillage.¹⁹¹
156. I endorse this program of works and consequently have not made a recommendation.

Phase out OFG Heaters

157. A number of expert witnesses, including Mr Alfonsetti gave evidence that they believe due to the current energy efficient housing, OFG heaters are old technology and should be phased out. He suggested the alternative is room-sealed heaters, where the air, or combustion of the appliance, is taken from the outside atmosphere and has little to no interaction, with the operation of internal exhaust fans.¹⁹²
158. Mr Alfonsetti advised that ESV has budgeted for the 2018-2019 financial year to conduct a regulatory impact statement to look at phasing out not only OFG heaters, but all open flued gas appliances.¹⁹³
159. The AGA agreed and suggested they should be phased out as quickly as possible given their incompatibility with high energy efficient housing and extraction fans, which are prone to

¹⁹⁰ Exhibit 49 – Coronial brief, p1998

¹⁹¹ Exhibit 49 – Coronial brief, p846

¹⁹² Transcript of evidence, p589

¹⁹³ Transcript of evidence, p589

create negative pressure environments and thus, carbon monoxide spillage.¹⁹⁴ The AGA also recommends the installation of room sealed gas heaters in such environments.¹⁹⁵

160. Master Plumbers submitted that they too would support phasing out of OFG heaters.

161. I support this approach and have made a recommendation to this effect. Please see RECOMMENDATION ONE.

Mandatory continuing professional development training for gas plumbers and fitters

162. There is currently no requirement for continuing professional development training (CPD) for gas plumbers and fitters in Victoria. Having up-to-date knowledge of the industry in which plumbers and fitters work is of utmost importance, including knowledge about the most appropriate and effective means to test for carbon monoxide spillage. This was an issue at this inquest, particularly given the evidence of Mr Fasoli and Mr Haysom. Their evidence was that they very rarely kept up-to-date with regulatory or legislative changes in their industry, read the ESV newsletters or attended training events. Mr Fasoli thought mandatory training was a good idea.

163. Samantha Adrichem from VBA advised that there are no requirements for gas plumbers and fitters to undertake any mandatory training in order for a licence or a registration to be renewed.¹⁹⁶ Ms Adrichem stated that the *Building Act* (1993) (Building Act) does not give authority for the VBA to mandate that gas plumbers and fitters attend training. However, it does give them the power to require them to pass an examination before the VBA will renew them.¹⁹⁷

164. There was overwhelming support for mandatory CPD for gas fitters and plumbers that would include undertaking regular carbon monoxide training. Mr Pewtress acknowledged that given there are continual changes and fluidity in the regulatory regime, CPD every two years would be of enormous benefit.¹⁹⁸ Mr Alfonsetti's opinion was that it should be mandatory.¹⁹⁹ Susan

¹⁹⁴ Written submissions of AGA dated 15 June 2018, p2

¹⁹⁵ Written submissions of AGA dated 15 June 2018, p2

¹⁹⁶ Transcript of evidence, p579

¹⁹⁷ Transcript of evidence, p580

¹⁹⁸ Transcript of evidence, p578

¹⁹⁹ Transcript of evidence, p563

Gaylor from VBA stated there was a reasonable case for ongoing mandatory CPD training.²⁰⁰ Master Plumbers and DHHS also supported this recommendation.

165. Given the serious potential consequences associated with using outdated equipment or techniques in this area, the VBA submitted they would support a recommendation for mandatory ongoing training in carbon monoxide testing and other areas of competency for all practitioners registered or licenced as gas fitters or in Type A Appliance Servicing.²⁰¹ They consider it would increase the quality of plumbing, increase practitioner compliance, knowledge, skills and competence, and increase consumer confidence.²⁰²
166. The VBA submitted that recent amendments to the Building Act, which became effective on 1 July 2017, mean that when considering whether to renew the registration of a registered builder, the VBA may have regard to whether the applicant has complied with any prescribed CPD requirements. A similar legislative amendment could be considered with respect to plumbers. The VBA would support such a recommendation.
167. The submissions suggested alternatively, the VBA could use its power under the Building Act to require all members of a particular class of licenced or registered plumbers to pass an examination prior to the renewal of their licence or registration. It was submitted this would require the VBA to test around 21,000 gasfitters over a period of around three and a half years and would require the assistance of industry with the examination process. The VBA is currently developing a proposal for such an examination.²⁰³ Ms Adrichem commented that the VBA would probably need to do a regulatory impact statement, which would most appropriately be conducted by the Department of Environment Land Water and Planning (DELWP).²⁰⁴
168. I agree and have made a recommendation in line with this. Please see RECOMMENDATION TWO.

²⁰⁰ Transcript of evidence, p577

²⁰¹ Submissions on behalf of the VBA dated 15 June 2018, p3

²⁰² Transcript of evidence, p583

²⁰³ Submissions on behalf of the VBA dated 15 June 2018, p4

²⁰⁴ Transcript of evidence, p579

Manufacturer warnings

169. DHHS submitted that the manufacturers of OFG heaters should provide a warning in the manufacturer's installation instructions of the risk of carbon monoxide spillage, which might give rise to serious injury or death if such a heater is not properly installed and regularly serviced.²⁰⁵ Despite the submissions of Climate Technologies that stated the importance of servicing and maintenance of OFG Heater,²⁰⁶ the evidence of Mr O'Leary was that there are no warnings about the importance of servicing and maintaining OFG heaters in their installation instructions.²⁰⁷
170. Master Plumbers submitted that servicing information held by manufacturers has historically been difficult to access by plumbers who carry out this work. Given the uniqueness of individual appliances, it was submitted that this can be difficult to perform properly without the appropriate information from the manufacturer. It was also submitted by the Master Plumbers that consideration ought to be given to developing and maintaining a centralised repository of manufacturer appliance servicing information.²⁰⁸
171. In light of my recommendation that OFG heaters be phased out, I do not propose to make a recommendation to Climate Technologies that they should introduce a warning in their installation instruction manual. However, I do consider it is extremely important that Climate Technologies advise their suppliers, retailers and customers about the risks associated with the Vulcan/Pyrox OFG Heaters, particularly when there is a negative pressure and lack of adventitious ventilation.
172. I consider Climate Technologies has an obligation to inform and educate members of the public who may have these heaters installed in their homes about the importance of these heaters being regularly serviced and maintained to ensure that they operate in a safe and efficient manner, and do not expose residents to carbon monoxide.
173. Therefore, I have made such a recommendation to Climate Technologies. Please see RECOMMENDATION THREE.

²⁰⁵ Written submissions of DHHS dated 15 June 2018, p5

²⁰⁶ Written submissions of Climate Technologies dated 15 June 2018, p5

²⁰⁷ Transcript of evidence, p400

²⁰⁸ Written submissions of Master Plumbers Association dated 15 June 2018, p3

Appropriate CO spillage testing equipment

174. During the Inquest there was some discussion about the importance of using appropriate carbon monoxide spillage testing equipment. Mr Alfonsetti stated that ESV's advice to gasfitters is that when using equipment to detect carbon monoxide, it should have a sampling probe. This means that the probe can be put in the hot air stream of the heater.²⁰⁹
175. DHHS submitted ESV should mandate the use of approved CO testing devices.
176. While I see the merits of this approach, I consider it would probably require legislative change, however I consider it can be addressed by way of information and education.
177. Due to the importance of using appropriate carbon monoxide detection equipment, I have made a recommendation. Please see RECOMMENDATION FOUR.

VBA Certificate of Compliance

178. The VBA is responsible for licencing and registration of plumbing practitioners in Victoria, for monitoring compliance with the Building Act and plumbing regulations, and for taking appropriate enforcement and disciplinary action against plumbers or owners where required.
179. Currently, there is no requirement to lodge a Certificate of Compliance for jobs under \$750.²¹⁰ It was apparent that the servicing works conducted by All Gas Plumbers did not require a Certificate of Compliance to be lodged with the VBA. The VBA submitted that given the potentially serious consequences of sub-standard servicing of Type A appliances, they considered that a compliance certificate should be mandatory for all such servicing work, irrespective of value. This would mean that the work would become subject to the VBA's risk-based auditing program.
180. The VBA submitted they would support any recommendation that consideration be given to amending section 221ZH of the Building Act to mandate the issue of a compliance certificate for all servicing of Type A appliances, irrespective of the costs of the work. It was submitted that this would ensure that all such servicing would be incorporated in the VBA's risk based

²⁰⁹ Transcript of evidence, p560

²¹⁰ Transcript of evidence, p539

audit program. The program involves auditing plumbing work that is the subject of a compliance certificate lodged with the VBA.²¹¹

181. Master Plumbers had an alternative view and submitted that to mandate a Certificate of Compliance for gas service work would burden the consumer with additional costs at a time when we are encouraging regular servicing of gas appliances.²¹² Instead they suggested:
- a) A specific audit of gas servicing work that is not triggered by a compliance certificate be developed in consultation with the industry and regulators;
 - b) A regulatory audit be undertaken on individuals who hold this class of work, at a minimum looking at their currency of information and equipment; and
 - c) Tags or stickers be placed in prominent positions such as an electrical metre box to indicate the date of service and plumbers licence number.²¹³
182. DHHS submitted that the VBA should review its requirements for the provision of certificates of compliance to the extent that they relate to the servicing and/or testing of OFG heaters.
183. I agree with the submission of DHHS and have made a relevant recommendation. Please see RECOMMENDATION FIVE.

Amendment of AS:4575- 2005 Australian Standard - Gas Appliances – Quality of Servicing

184. This Inquest heard evidence about Appendix R of AS:5601 which is an installation standard and the reason behind the development of GN 38, due to the acquired knowledge of negative pressure and adventitious ventilation. The evidence made it apparent that the servicing standard - *AS:4575-2005 - Australian Standard - Gas Appliances – Quality of Servicing* (AS4575) needed to be amended to incorporate this state of knowledge. According to the experts, AS:4575 has been under technical review for two years.
185. I agree and have made a recommendation accordingly. Please see RECOMMENDATION SIX.

²¹¹ Written submissions on behalf of the VBA, p2

²¹² Written submission of the Master Plumbers Association, p2

²¹³ Written submission of the Master Plumbers Association, p2

ESV Communications

186. As the regulator for gas safety in Victoria, ESV plays an important role in providing education, information and knowledge about gas safety. The experts agreed that there is an expectation that gas fitters should keep informed of the trade in which they practice. This case has highlighted the importance for plumbers to be aware of key legislative and regulatory requirements.
187. The evidence made it clear that ESV's methods of communicating with gas plumbers and fitters could improve. For example, when Mr Fasoli requested a copy of a video that depicted how to perform carbon monoxide spillage testing, he was sent an outdated copy by ESV. Another example of the evidence was that Mr Fasoli rarely looked at the ESV website or newsletters that were sent to him. Further, Mr Fasoli admitted that he was a practical person and agreed that instructional videos were preferred, as it was something that could be checked on a phone at a worksite.
188. DHHS submitted that ESV should review its methods of disseminating the significance and effect of changes made to its Gas Information Sheets in order to give effect to a process that is consistent and is likely to be used and understood by gas fitters, particularly with appropriate and up-to-date instruction videos that can be viewed on their websites.²¹⁴
189. Mr Mason stated all of the 53 ESV information sheets are now accessible on mobile devices.²¹⁵
190. I agree that gas plumbers and fitters have an obligation to keep up-to-date with legislative and regulatory changes and that ESV is one of the best sources of providing this information and therefore I have made a relevant recommendation. Please see RECOMMENDATION SEVEN.

Public awareness campaign

191. Whilst this Inquest focussed on public housing, there is still a broader issue of informing private residential and tenanted homes that have OFG heaters. There is a great need for the public to be informed about the dangers of OFG heaters, especially in combination with

²¹⁴ Written submission on behalf of DHHS, dated 15 June 2018, p5

²¹⁵ Transcript of evidence, p633

negative pressure and inadequate ventilation, and the importance of service and maintenance. It is also critical that the public be informed of the importance of regularly servicing and maintaining these types of heaters. ESV has run successful media campaigns in the past and therefore, I have made a recommendation for ESV to implement a public safety awareness campaign. Please see RECOMMENDATION EIGHT.

FINDINGS

192. The standard of proof to apply in the coronial jurisdiction is articulated in *Briginshaw v Briginshaw* which requires me to be satisfied on the balance of probabilities. Latham CJ said “No court should act upon mere suspicion, surmise or guesswork in any case ... The standard of proof required by a cautious and responsible tribunal will naturally vary in accordance with the seriousness or importance of the issue.”²¹⁶ It requires “clear, cogent and exact” proof.²¹⁷ It is important “to consider all of the facts together at the conclusion of a case.”²¹⁸

193. Justice Tadgell in *Longmuir* provided excellent instruction on how best to consider circumstantial evidence:

*whether the evidence paints a picture to be derived from an accumulation of detail. The overall effect of the detailed picture can sometimes be best appreciated by standing back and viewing it from a distance, making an informed, considered, qualitative appreciation of the whole. The overall effect of the detail is not necessarily the same as the sum total of the individual details.*²¹⁹

194. Having investigated the death of Mrs Sonia Sofianopoulos and having held an Inquest in relation to her death between Monday 28 May – 1 June 2018 and 18 June 2018 at Melbourne, I make the following findings, pursuant to section 67(1) of the *Coroners Act 2008*:

- (a) that the identity of the deceased was Sonia Sofianopoulos born on 28 August 1954; and
- (b) that Mrs Sofianopoulos died on 21 July 2017 at Unit 8, 38 McDowell Street, Greensborough from 1a) CARBON MONOXIDE TOXICITY.

195. Carbon monoxide is a silent killer. It is not detectable by humans either by sight, taste or smell. It is a poisonous, highly flammable gas that is lethal if absorbed by the blood in large

²¹⁶ *Briginshaw v Briginshaw* (1938) 60 CLR 336 at p343-344

²¹⁷ *Blashki v Anderson* [1993] 2 VR 89 at p96

²¹⁸ *Chamberlain v The Queen (No2)* (1984) 153 CLR 521

²¹⁹ *Transport Industries Insurance co Ltd v Longmuir* [1997] 1 VR 125 at 141

amounts. Depending on the level of exposure to carbon monoxide, symptoms can range from headache, nausea, confusion, muscular weakness, dizziness, unconsciousness and death.

196. Mrs Sofianopoulos was exposed to fatal levels of carbon monoxide. There were three potential sources of carbon monoxide leakage into the room; the OFG heater, the stove and the hot water service. The evidence of the majority of the expert witnesses was that the stove and the hot water service would have had a marginal impact to the production of carbon monoxide in the room. Therefore, I find the source of the carbon monoxide was from the Unit 8 OFG heater.
197. I accept that the investigation of the Unit 8 heater was initially compromised due to the delay in the knowledge of the cause of death. I also acknowledge that the exact condition of the heater at the time of Mrs Sofianopoulos' death will never be known. However, conclusions are able to be made when the evidence is considered as a whole.
198. The Unit 8 heater was 25 years old and required some repairs and modification after Mrs Sofianopoulos' death, which may have compromised the integrity of the investigation. I placed significant weight on the evidence of the expert panel, which was comprised of specialists across a number of disciplines and fields. Despite the repairs and modifications, the evidence of the experts was that the heater was in relatively good condition at the time of the investigation. Accordingly, I find the investigation by ESV and Vipac was reasonable and appropriate in the circumstances, and assisted me in obtaining an understanding of the complex issues associated with the heater and its involvement in the death.
199. I find that there was no one single factor involved in the death of Mrs Sofianopoulos but a confluence of events that proved to be fatal.
200. The evidence of Mr Tas and Mr McNair was that there was a lack of adequate adventitious ventilation in Unit 8. DHHS had conducted upgraded works on the unit in 2008 and installed weather seals on the base of the front and back doors. Ventilation was later installed after Mrs Sofianopoulos' death in November 2017 to overcome a lack of ventilation in the unit. I find that with the windows and the external doors closed, the unit would have been sealed tight. I am comfortably satisfied that at the time of Mrs Sofianopoulos' death there was inadequate adventitious ventilation in Unit 8.

201. Mrs Sofianopoulos was last seen at approximately 9.00am on 21 July 2017. It is apparent that on that morning she had started to cook some food before she collapsed in the bathroom after having a shower. The evidence of Mrs Sofianopoulos' daughters was that their mother's habit was to always turn the exhaust fans on when she showered and/or cooked. I acknowledge that there is no direct evidence of whether the exhaust fans were in operation on the day of her death. In the circumstances and having considered all of the evidence, I am comfortably satisfied that either the bathroom and/or the kitchen fan were in operation at the time of Mrs Sofianopoulos' death. According to the expert witnesses this would have contributed to a negative pressure environment in her unit.
202. As part of the coronial investigation, the Unit 8 heater and a new OFG heater that had been purchased were laboratory tested by Vipac and ESV. The investigation identified that the design of the draft diverter caused the Unit 8 heater and the new heater to fail down draught testing under low velocity. Low velocity down draught can be caused by negative pressure. Possible causes of negative pressure include lack of ventilation in conjunction with the use of internal exhaust fans. Negative pressure causes the burner to be impacted by the draught, in that it quenches the flame of the burner. This means the burner does not effectively burn the products of combustion. When combustion is incomplete, the carbon monoxide is not converted to carbon dioxide and the negative pressure draws it back into the room air. This releases a high level of carbon monoxide into the room.
203. Having considered the totality of the evidence as a whole, and being persuaded by the majority of the expert panellists, I am comfortably satisfied that the combination of the draught diverter of this heater, under low velocity down draught, induced by a negative pressure environment in the room, caused this heater to produce poor combustion, resulting in high levels of carbon monoxide in the flue products which were introduced into the room air by the down draught. I find the confluence of these events are inextricably linked and contributed to Mrs Sofianopoulos' death. I am unable to determine why this combination of factors led to her death on this particular day, as opposed to any other day.
204. The design of the down draught diverter in the Unit 8 heater in this instance may have complied with Australian Standard's testing and installation requirements 25 years ago, but the design of the Australian home has fundamentally changed in an effort to become more energy efficient. New and renovated housing, commonly characterised by a reduction in

ventilation, together with the use of internal exhaust fans, can be a deadly combination when an OFG heater is installed and operating.

205. This type of OFG heater, both new and old, releases high levels of carbon monoxide under low velocity down draught which induces negative pressure. When there is inadequate ventilation, combined with the use of internal exhaust fans, this type of heater is not only unsuitable for use in these conditions, but potentially, life threatening.
206. I find that Climate Technologies, as the manufacturer and ESV as the regulator, each have a positive obligation to inform and educate the public about this current state of knowledge and I have made relevant recommendations.
207. I turn now to the issue of whether carbon monoxide was adequately tested by All Gas Plumbers. I found Mr Haysom to be a wholly unreliable witness in this Inquest. He was unable to explain how he conducted the carbon monoxide testing. I accept he may have conducted some form of carbon monoxide test at the April 2015 service, however I find the testing was sub-optimal and did not comply with GN38 08/11. Regardless of how the tests were carried out, I do not consider the 2015 service was sufficiently proximate to Mrs Sofianopoulos' death to be causally related.
208. I find that a carbon monoxide spillage test was not conducted by Mr Fasoli or Mr Haysom at the August 2017 vacant works service. However, as the test was conducted after Mrs Sofianopoulos' death, I find there was no causal relationship.
209. In relation to the DHHS contractor issues, I make no adverse findings in relation to DHHS, Valley Maintenance Services or All Gas Plumbers.
210. I acknowledge and commend ESV, VBA, AGA, Master Plumbers, DHHS and Climate Technologies for their proactive responses to this important public health and safety issue.
211. I wish to express my gratitude to the experts who participated in the concurrent evidence. Their professionalism and expertise enabled me to better understand the technical and scientific evidence in this case.
212. Finally, I would like to convey my sincerest sympathies to the Sofianopoulos family. There is nothing I can say that will relieve the heartache, pain and grief you have endured as a result of your mother and grandmother's death.

RECOMMENDATIONS

213. Pursuant to section 72(2) of the Coroners Act, I make the following recommendations connected with the death:

RECOMMENDATION ONE:

I recommend that Chris Wealthy, the Chief Executive Officer of Australian Gas Association and Paul Fearon, the Chief Executive Officer of Energy Safe Victoria, collaborate to implement a strategy and a plan to phase out all OFG heaters.

RECOMMENDATION TWO:

I recommend that John Bradley, the Secretary of Department of Environment Land Water and Planning, conduct a Regulatory Impact Statement to consider the implementation of a system of mandatory continuous professional development training for Type A Gas Appliance plumbers and fitters as a condition of being registered or licenced.

RECOMMENDATION THREE:

I recommend that Timothy O'Leary, the Chief Executive Officer of Climate Technologies Pty Ltd, as the manufacturer of the Vulcan/Pyrox Heritage OFG Heater, publish an article in *The Age* and the *Herald Sun* warning the public, especially those that have this type of heater installed in their homes, about the necessity of regular servicing and maintenance. This is to ensure that it operates in a safe and efficient manner and does not expose residents to carbon monoxide poisoning under the conditions that have been identified in this Inquest.

RECOMMENDATION FOUR:

I recommend that Paul Fearon, the Chief Executive Officer of Energy Safe Victoria, publish an article in their quarterly newsletter about the importance of testing for carbon monoxide spillage and provide guidance as to the appropriate detection equipment to use to obtain the most accurate results and to ensure the safety of the users.

RECOMMENDATION FIVE:

I recommend that Sue Eddy, the Chief Executive Officer of the Victorian Building Authority, consult with relevant industry stakeholders and review its requirements for the provision of Certificates of Compliance to the extent that they relate to the servicing, testing and maintenance of OFG heaters.

RECOMMENDATION SIX:

I recommend that Enzo Alfonsetti, as Chairman of the Standards Australia - Committee Responsible for Australian Standard: 4575 *Gas Appliances – Quality of Servicing* to consider amending that standard to incorporate Appendix R of AS5601 as soon as practicable.

RECOMMENDATION SEVEN:

I recommend that Paul Fearon, the Chief Executive Officer of Energy Safe Victoria, conduct a review on the best way for Energy Safe Victoria to communicate guidelines, changes to legislation and industry updates to relevant industry stakeholders using all forms of modern technology including phone applications, social media, and YouTube videos.

RECOMMENDATION EIGHT:

I recommend that Paul Fearon, the Chief Executive Officer of Energy Safe Victoria, conduct a widespread media and public awareness campaign on the dangers associated with OFG heaters, especially in the context of negative pressure and lack of adventitious ventilation and the need and importance of servicing and maintaining OFG heaters.

214. Pursuant to section 73(1) of the Coroners Act 2008, I order that this Finding be published on the internet.

215. I direct that a copy of this finding be provided to the following:

- Sofianopoulos family
- Mr Chris Wealthy, Chief Executive Officer, Australian Gas Association
- Mr John Bradley, Secretary of the Department of Environment, Land, Water and Planning
- Mr Paul Fearon, Chief Executive Officer, Energy Safe Victoria
- Mr Timothy O’Leary, Chief Executive Officer, All Climate Technologies Pty Ltd
- Ms Sue Eddy, Chief Executive Officer, Victorian Building Authority
- Mr Enzo Alfonsetti, Chairman of Standards Australia – Committee Responsible for Australian Standard 4575 - *Gas Appliances - Quality of Servicing*
- Mr Nicholas Foa, Deputy Secretary of Housing, Infrastructure, Sport & Recreation of DHHS
- Mr Tyler Mason, Gas Engineer, Energy Safe Victoria
- Mr Ibrahim Tas, Program Manager, Gas Products Certification, Global Mark
- Mr Ian Pewtress, Licenced Gas Fitter, Master Plumbers Association (Victoria)
- Mr John McNair, Consultant Engineer
- Mr Sean O’Halloran, Team Leader, Vipac
- Mr Matthew Wilson, Senior Technical Advisor, Victorian Building Authority
- Ms Samantha Adrichem, Manager, Manager, Registration and Policy, Victorian Building Authority
- Ms Susan Gaylor, Manager of Knowledge and Experience Assessment, Victorian Building Authority
- Mr Joseph Archibald, Registered Mechanical Engineer, Chem Mech Engineering Pty Ltd
- Mr Gary Caddy, Valley Maintenance Services Pty Ltd
- Mr Daniel Fasoli, Director, All Gas Plumbers Pty Ltd
- Mr Gary Bath, Master Plumbers Association (Victoria)
- Ms Deborah Glass, The Victorian Ombudsman

Signature:


JACQUI HAWKINS
CORONER

Date: 22 August 2018

