Ministry for the Environment
Manatū Mō Te Taiao

National Wood Burner Performance Review

Phase 2

Ministry for the Environment
in partnership with
Environment Canterbury and Nelson City Council

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New Zealand Government

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Contents

Tables

Executive Summary

The Ministry for the Environment, partnered with Environment Canterbury and Nelson City Council, conducted a performance review of wood burners under the national environmental standards for air quality. This report details the results of Phase 2 of the review in which 10 wood burners were purchased for testing of emissions and efficiency as well as a design verification test. This report follows the report on Phase 1 of the review published in June 2007.

Phase 2 of the review revealed poor compliance:

- six burners demonstrated compliance with the NES for air quality emission test
- four burners demonstrated compliance with the NES for air quality efficiency test
- one burner passed design verification test.

All three tests contribute to the overall review and this translates to an overall 'pass' rate of only 20 per cent.

The response to the review by manufacturers varied significantly. Some were swift to fix identified faults and take remedy actions, some immediately disputed findings, and some were slow to respond or undertake follow-up action.

The review was carried out in accordance with a protocol developed in consultation with representative manufacturers from the New Zealand Home Heating Association. The protocol specifies that serious failures be reported to the Commerce Commission. At time of publication, this is underway.

The review further identified some discrepancies with the methodologies employed by the testing laboratory, Applied Research Services. At time of publication, these have been referred to International Accreditation New Zealand.

Key points for regulators

- Compliance was poor and future reviews are strongly recommended.
- Quality assurance amongst manufacturers varies significantly.
- Councils issuing building consents for wood burners are advised to consult the Ministry for the Environment web list of authorised burners. This list has been updated following the review and is the only national, independently verified list available.

Key points for consumers

- Quality assurance amongst manufacturers varies significantly. The Masport LE 4000 Provincial was the only burner to pass design verification testing.
- This is the second part of the first national review of performance of wood burners. The review revealed poor compliance with respect to the national environmental standards for air quality and burner authorisations. The Ministry and partner councils are working with industry to resolve the identified issues.

- People intending to purchase a wood burner are advised to consult the Ministry for the Environment web list of authorised burners. This list has been updated following the review and is the only national, independently verified list available.

Key points for manufacturers

- The review revealed poor compliance with respect to the national environmental standards for air quality and burner authorisations.
- The overall lack of compliance in this review means that additional reviews will be necessary. Future reviews are likely to increase costs for those manufacturers who fail to demonstrate compliance as they will also face an increased likelihood of actions such as suspension of burners from the authorised list.
- The intent of the review is to support a 'level playing field' for business and to publicise information on compliance for consumers. These reviews therefore, reward not only compliance but also proactive, responsible behaviour in response to identified compliance issues.

1 Introduction

The purpose of the review was to ascertain compliance and provide information to consumers, retailers and installers on the products they purchase and install.

The review was conducted by the Ministry for the Environment in partnership with Environment Canterbury and Nelson City Council. The review was carried out in two phases:

- **Phase 1:** involved testing the design of 35 wood burners in-store
- **Phase 2:** involved testing the design, emissions and efficiency of 10 (purchased) wood burners.

This report describes the process and the results of **Phase 2** of the performance review. The report for Phase 1 of the review is available at: http://www.mfe.govt.nz/publications/air/national-wood-burner-review-jun07/index.html.

1.1 National environmental standards for air quality

The *Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins and Other Toxics) Regulations 2004* were promulgated on 6 September 2004. For the purposes of this report, these regulations will hereafter be referred to as "the NES for air quality".

The NES for air quality requires that from 1 September 2005 all new wood burners installed on properties less than two hectares must have a discharge of less than 1.5 grams of particles for each kilogram of dry wood burnt, and a thermal efficiency at least 65 per cent as tested under a specified standard. Under the Resource Management Act 1991 responsibility for enforcing the NES for air quality is devolved to regional councils and unitary authorities.

Under the NES for air quality, a wood burner is defined as:

> *(a) a domestic heating appliance that burns wood; but*
>
> *(b) does not include –*
>
> *i. an open fire; or*
>
> *ii. a multifuel heater, a pellet heater, or a coal burning heater; or*
>
> *iii. a stove that is –*
>
> *(A) designed and used for cooking; and*
>
> *(B) heated by burning wood.*

The NES for air quality does not apply to burners installed in properties over two hectares. This means that it is not illegal to manufacture or sell non-compliant burners in New Zealand, provided they are not sold for installation in properties smaller than 2 hectares. It is however, illegal to sell or advertise that a wood burner meets the NES for air quality if it does not.[1]

[1] This is false or misleading representation under the Fair Trading Act 1986.

1.2 New Zealand regulatory context

Currently in New Zealand, wood burners are authorised for installation by either Environment Canterbury or Nelson City Council in accordance with the rules in their respective regional plans.[2] The Ministry publishes burners authorised by these councils on a national list for the benefit of consumers, retailers, district, city and regional councils in the rest of New Zealand.

To be authorised, a burner must be tested in accordance with required test methods and then physically checked and approved by Environment Canterbury or Nelson City Council. The required test methods are:

- Australian/New Zealand Standard AS/NZ 4013:1999, Domestic solid fuel burning appliances – Method for determination of flue gas emissions, and
- Australian/New Zealand Standard AS/NZ 4012:1999, Domestic solid fuel burning appliances – Method for determination of power output and efficiency.

During the authorisation process burners are physically inspected and documentation for the burners is reviewed. This documentation includes installation and operating instructions, design drawings, and manufacturing design tolerances. In addition, the appliance is checked to ensure there are no parts that are likely to fail during in-home use, or be easily modified by the owner, and labelling is checked to ensure it is correct and meets Environment Canterbury or Nelson City Council requirements.

Environment Canterbury requires that burners have a maximum particle emission of less than 1.0 g/kg and Nelson City Council requires emissions to be less than 1.5 g/kg.[3] To avoid duplication the two councils have agreed that any burners authorised by Environment Canterbury (ie, that emit less than 1.0 g/kg) are also adopted by Nelson City Council. Nelson City Council authorises burners that emit between 1.0 and 1.5 g/kg.

The Ministry for the Environment (the Ministry) publishes a list of all wood burners authorised by both Environment Canterbury and Nelson City Council on their website – this is called the 'authorised list'.

Other burners, with test results that meet the NES for air quality requirements but that have not been authorised, may exist. While these burners may comply with the NES for air quality there is no independent verification that the burner being sold is the same as that which was tested. There has further been no assessment of the burner design to avoid issues such as tamperability or in-home failure.

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[2] These limits apply to specific areas. For full details refer to Environment Canterbury: http://www.ecan.govt.nz/Our+Environment/Air/Approved+burners/Wood-burner-rules.htm and Nelson City Council: http://www.nelsoncitycouncil.co.nz/environment/air_quality/burners-approved-table.htm.

[3] As measured in accordance with AS/NZS 4013:1999.

Previously, the Ministry published a 'tested list' on their website. Burners on the tested list had a test certificate demonstrating their emissions and efficiency met the NES when tested in accordance with AS/NZS 4012/4013. However, burners on the tested list had not been authorised by Environment Canterbury or Nelson City Council. Following the poor results of Phase 1 of this review, the tested list was removed from the Ministry's website. Now wood burners must go through the independent and rigorous 'authorisation' process before they are published on the Ministry's website as compliant with the air quality standards.

Local authorities in New Zealand only grant building consent for wood burners they are satisfied meet the NES for air quality. The Ministry for the Environment strongly recommends that councils only approve burners that are listed on the Ministry's website.

1.3 The performance review (Phase 1 and 2)

In April 2006, the Ministry began a national performance review of wood burners under the NES for air quality.

Environment Canterbury and Nelson City Council are national leaders in regulating wood burners. It was, therefore, appropriate for the review to be carried out in partnership with these councils. The Ministry provided the funding for the project, with Environment Canterbury and Nelson City Council providing considerable resources in kind (staff with relevant expertise in the authorisation of low-emission wood burners).

Phase 1 – Design verification

Phase 1 involved design verification on 35 randomly selected wood burners. Design verification testing is a physical inspection of a burner for comparison with its original design as described in the emissions and efficiency test report. All burners were checked in-store by an independent engineer with verification undertaken in accordance with a review protocol (further details in Section 2).

Overall, Phase 1 of the performance review found poor compliance. Only 37 per cent of burners passed, while 54 per cent of burners failed the performance review. In addition, 9 per cent of results were undetermined ie, it could not be determined whether the burners passed or failed.

Phase 2 – Design verification, emissions and efficiency tests

Phase 2 of the review incorporated design verification as well as full emissions and efficiency testing of 10 randomly selected wood burners.

The 10 burners were purchased by Environment Canterbury and Nelson City Council (five each). The burners were then submitted to an accredited laboratory for design verification and emissions and efficiency testing in accordance with the required test methods. Emissions and efficiency testing was carried out to determine compliance with the NES for air quality.

Emissions and efficiency testing was contracted to two laboratories currently accredited with International Accreditation New Zealand as follows:

- Spectrum Laboratories (for the Yunca Finz)
- Applied Research Services (for the remaining nine burners).

The inclusion of Spectrum Laboratories was to provide (limited) inter-laboratory accreditation. The results of this aspect of testing have been made available to International Accreditation New Zealand.

1.4 Industry input

Before the introduction of the NES for air quality, the wood burner industry was not regulated for emissions in most areas of New Zealand (ie, there were no emission limits other than the voluntary limits present in AS/NZS 4013:1999). Therefore, it was expected that compliance issues could arise in the review.

It was important that such a review provide transparency and fairness to the industry. The Ministry met with the New Zealand Home Heating Association (NZHHA) executive and manufacturers in April 2006 to outline the intention to carry out a performance review. At that time a date for the review was not specified. The industry therefore had no warning, other than general notice, that a review would be undertaken at some stage in the next two years.

The Ministry extended the opportunity for NZHHA to provide technical input into the design of the review. The NZHHA formally endorsed the review and offered their support by providing:

- co-operation in requesting retailers make burners in retail showrooms available for inspection (design verification testing only)
- co-operation in requesting member manufacturers make test reports available
- informing all members (particularly retailers) of the upcoming review
- technical input into the design of the review protocol.

In addition to this, a sub-committee was set up to develop a protocol to govern the performance review (discussed in more detail in Section 2).

2 Methodology

The project methodology involved a number of discrete processes, including:

- random selection of wood burners to test
- development of a protocol for verifying wood burner compliance
- communication with interested parties
- purchasing the 10 wood burners
- testing design, emissions and efficiency.

Burner selection, protocol development, and project communication are discussed in more detail below.

2.1 Random selection of wood burners

Wood burners randomly selected for inclusion in the performance review were sourced from the lists of 'authorised' and 'tested' wood burners published on the Ministry website.[4]

At the time the review began these lists contained 66 authorised and 44 tested wood burners, respectively. There were some wood burners on both lists that were identical, and these duplicates were removed before the random sampling took place. Where there were any doubts as to whether the same wood burner was on both lists (ie, if they had only slightly different names) it was initially assumed they were different.

The objective of the sampling process was to randomly select two lists of wood burners to include in the performance review. One list was to comprise 40 wood burners for the design verification testing and the other list to comprise 10 wood burners for the full emissions testing process.

2.2 Protocol for determining compliance

The review protocol is the agreed process by which the design verification testing was carried out and the classification of failures undertaken. This protocol was developed by John Yolland, an independent engineer with many years experience with wood burners, in association with the project partners. Technical input was also provided by industry representatives.

The objectives of the protocol are to:

- introduce the rationale for determining compliance
- specify the basis for selecting wood burners for inclusion in the review
- specify the dimensions that will be measured and the allowable tolerances

[4] The tested list has now been removed from the website as a consequence of Phase 1 of the performance review. See the phase 1 report for further details http://www.mfe.govt.nz/publications/air/national-wood-burner-review-jun07/index.html.

- provide examples of verification failure
- provide classifications of failure and recommended remedial actions.

Given the potentially sensitive nature of this work it was considered to be important to have the support of the industry. The design protocol was reviewed by a working group of the New Zealand Home Heating Association before being finalised. A copy of the protocol is attached as Appendix 1.

The failure classifications according to measured outcomes are provided in Table 1.

For Phase 2, in which both design verification and emissions and efficiency testing were carried out, there arises the possibility of conflicting outcomes. For example, a burner may suffer a 'minor' failure in the design verification but have resulting emissions that would be classified as a 'moderate' failure in accordance with the review protocol. It is further important to acknowledge the limits of accuracy of the test methods AS/NZS 4012:1999 and AS/NZS 4013:1999.

Table 1: Failure classification

Standard	Result	Classification
Emissions standard = 1.5/kg	**Limits of accuracy ± 0.29 g/kg**	
	< 1.5	Pass
	1.5–1.79	Undetermined
	1.79–2.0	Minor
	2.0–3.0	Moderate
	3.0–4.0	Serious
	> 4.0	Very serious
Efficiency standard = 65%	**Limits of accuracy ± 5%**	
	> 65	Pass
	60–65	Undetermined
	55–60	Moderate
	50–55	Serious
	< 50	Very serious

Note: Because the limits of accuracy are substantial, there is no 'minor' category for efficiency failures.

Overall classification of failure was determined on a case-by-case basis. In general, however, priority was afforded to results of actual performance (ie, emissions and efficiency testing). For example, a burner that suffered a serious failure in the design verification but only a minor failure for actual efficiency, would be classified as a minor failure.

Whilst unlikely, it is conceivable that a burner could suffer a failure in design verification and still pass the emissions and efficiency standards. This occurred for the Lady Kitchener. The approach in this instance was to notify the failure but not to request any remedial action.

2.3 Communication with interested parties

As mentioned above, it was important to carry out this project in consultation and co-operation with interested parties. The prime concern for the main project partners was to determine whether wood burners offered for sale match the wood burners for which approvals had been granted and/or test reports issued. However, it is also important for retailers to know they are selling wood burners that are legally able to be installed in the various regions around New Zealand. It is further necessary to inform potential consumers about the status of burners in the review – particularly in the case of burners suspended from the list.

The results of the review were published in two reports – Phase 1 in June 2007 and Phase 2 in this report. In addition to this the Ministry made detailed review information to interested parties upon direct request. For example, consumers wishing to purchase a burner that was temporarily suspended from the authorised list were informed of the reasons behind the suspension and the status of the burner. Similarly, full technical information was provided to councils considering consent applications and retailers querying burner status. The commercial considerations of manufacturers subject to requested remedial actions were not ignored; such information was only provided verbally and upon direct request.

3 Test Results

Tables 2 and 3 provide summary results of Phase 2 of the performance review ie, whether the wood burners passed or failed. Full results for all burners are provided in Tables 4–6.

Failure classification is outlined in the protocol (see Appendix 1) and discussed in section 2 in more detail. Is it worth mentioning here that an unexpected problem arose during this phase, in that in one case the burner supplied wasn't the burner ordered (Kent Quantum Max) but was a different product with a similar name but higher emissions.

As can be seen from Table 2, only 20 per cent of wood burners selected for the review passed the emissions and efficiency testing. This was due, in large part, to changes made to the burners since authorisation; 90 per cent of the burners selected for the review failed the design verification test.

Table 2: Phase 2 results summary

Test	Pass	Fail	Undetermined	Total
Design verification	1	9	–	10
Emissions test	6	3	1	10
Efficiency test	4	2	4	10
Overall classification	**2**	**6**	**2**	**10**

Table 3: Phase 2 results summary by burner

Burner	Manufacturer / retailer	Type	Water heater	Overall classification
Contessa AG – clean air (wet)	Hewitsons	FS	Yes	Fail
Firenzo Insert Flush AG (Forte)	Hewitsons	I	No	Fail
Kent Logfire Max	BBQ Factory	I	No	Fail
Kent Quantum Max	BBQ Factory	FS	No	Fail
Lady Kitchener	Hewitsons	FS	No	Pass
Masport LE 4000 Provincial	Glen Dimplex	I	No	Undetermined
Metro Eco Wee Rad	Pioneer	FS	No	Pass
Osburn 2200	Glen Dimplex	FS	Yes	Fail
Woodsman Matai ECR	WH Harris	FS	No	Fail
Yunca Finz	Yunca Gas	FS	No	Fail

Notes: FS = Freestanding; I = Insert.

As with Phase 1, the response by manufacturers varied significantly. Some were swift to fix identified faults and take remedy actions, some immediately disputed findings, and some were slow to respond or undertake follow-up action.

The most notable feature of Phase 2 is the significant variation in quality assurance between manufacturers. A successful design verification test is a strong indication of good quality assurance. The Masport LE 4000 Provincial did well in design verification testing. The project partners note that this burner also has engineering drawings prepared to a very high standard.

The overall lack of compliance in this review means that additional reviews will be necessary. Future reviews are likely to increase costs for those manufacturers who fail to demonstrate compliance as they will also face an increased likelihood of actions such as suspension of burners from the authorised list.

Another, unforeseen, outcome of the review has been the discrepancies with the methodologies employed by the testing laboratory, Applied Research Services. At the time of writing these have been referred to International Accreditation New Zealand.

In the case of serious non-compliance the protocol developed with industry specified notification to the Commerce Commission. At time of writing this is underway.

The details of each failure and the responses by the manufacturers are discussed in detail below.

Table 4: Phase 2 detailed results by burner

Burner	Manufacturer/ retailer	Type	Water heater	Design verification	Efficiency	Emissions	Overall classification
Contessa AG – clean air (wet)	Hewitsons	FS	Yes	Fail – serious	Fail – moderate	Pass[1]	Fail – moderate
Firenzo Insert Flush AG (Forte)	Hewitsons	I	No	Fail – serious	Pass	Fail – moderate	Fail – moderate
Kent Logfire Max	BBQ Factory	I	No	Fail – minor	Undetermined	Fail – minor	Fail – minor[2]
Kent Quantum Max	BBQ Factory	FS	No	Fail – very serious	Pass	Fail – serious	Fail – very serious
Lady Kitchener	Hewitsons	FS	No	Fail – serious	Pass	Pass	Pass[3]
Masport LE 4000 Provincial	Glen Dimplex	I	No	Pass	Undetermined	Pass[1]	Undetermined
Metro Eco Wee Rad	Pioneer	FS	No	Fail – moderate	Pass	Pass[1]	Pass
Osburn 2200	Glen Dimplex	FS	Yes	Fail – moderate	Fail – moderate	Pass	Fail – moderate
Woodsman Matai ECR	WH Harris	FS	No	Fail – minor[4]	Undetermined	Pass	Fail – minor
Yunca Finz	Yunca Gas	FS	No	Fail – serious	Undetermined	Undetermined	Fail – serious

Notes: FS = Freestanding; I = Insert.

1 This burner meets some or all of the NES criteria but, due to design changes, is incompatible with its authorisation with Environment Canterbury and exceeds the standard of 1.0 g/kg for which it is authorised.

2 This burner was initially classified as a moderate failure. For full details see text.

3 This burner meets the NES for air quality criteria but, due to design changes, is incompatible with its authorisation with Nelson City Council.

4 The design verification was initially classified as a moderate failure. For full details see text.

Table 5: Phase 2 emission testing results

Burner	Manufacturer / retailer	Type	Water heater	Authorised emissions (g/kg)	Tested emissions (NES = 1.5g/kg)	Result
Contessa AG – Clean Air	Hewitsons	FS	Yes	0.86	1.39	Pass [1]
Firenzo Insert Flush AG (Forte)	Hewitsons	I	No	0.8	2.53	Fail – moderate
Kent Logfire Max	BBQ Factory	I	No	1.2	1.97	Fail – minor
Kent Quantum Max	BBQ Factory	FS	No	0.54	3.51	Fail – serious
Lady Kitchener	Hewitsons	FS	No	1.42	0.63	Pass[2]
Masport LE 4000 Provincial	Glen Dimplex	I	No	0.62	1.11	Pass[1]
Metro Eco Wee Rad	Pioneer	FS	No	0.88	1.23	Pass[1]
Osburn 2200	Glen Dimplex	FS	Yes	1.2	1.15	Pass
Woodsman Matai ECR	WH Harris	FS	No	0.8	0.8	Pass
Yunca Finz	Yunca Gas	FS	No	1.33	1.65	Undetermined

Notes: FS = Freestanding; I = Insert.

1 This burner meets the NES for air quality criterion but, due to design changes, is incompatible with its authorisation with Environment Canterbury and exceeds the standard of 1.0 g/kg for which it is authorised.

2 This burner meets the NES for air quality criterion but, due to design changes, is incompatible with its authorisation with Nelson City Council.

Table 6: Phase 2 efficiency testing results

Burner	Manufacturer / retailer	Type	Water heater	Authorised efficiency (%)	Tested efficiency (NES = 65%)	Result
Contessa AG – Clean Air	Hewitsons	FS	Yes	66	59	Fail – moderate
Firenzo Insert Flush AG (Forte)	Hewitsons	I	No	67	72	Pass
Kent Logfire Max	BBQ Factory	I	No	66	61	Undetermined
Kent Quantum Max	BBQ Factory	FS	No	69	73	Pass
Lady Kitchener	Hewitsons	FS	No	74	70	Pass
Masport LE 4000 Provincial	Glen Dimplex	I	No	67	61	Undetermined
Metro Eco Wee Rad	Pioneer	FS	No	70	66	Pass
Osburn 2200	Glen Dimplex	FS	Yes	68	58	Fail – moderate
Woodsman Matai ECR	WH Harris	FS	No	72	64	Undetermined
Yunca Finz	Yunca Gas	FS	No	65	60	Undetermined

Notes: FS = Freestanding; I = Insert.

3.1 Contessa AG

Test results for the Contessa AG with wetback are provided in Table 7.

Table 7: Contessa AG with wetback test results and outcomes

Test	Authorisation	Test result	Rating
Design verification	–	Fail	Fail – serious
Emissions test	0.86 g/kg	1.39 g/kg	Pass[1]
Efficiency test	66%	59%	Fail – moderate
Overall result			**Fail – moderate**

1 This burner meets the NES for air quality criterion for emissions but exceeds the standard of 1.0 g/kg for which it is authorised by Environment Canterbury.

The Contessa AG with wetback was classified overall as a **'moderate failure'** due to a failure to meet the minimum efficiency requirement and a serious failure of the design verification test. In accordance with the review protocol, the project partners notified Hewitsons of the failure, requested immediate remedy action and temporarily suspended the burner from the authorised list.

Hewitsons disputed the findings of all tests and queried discrepancies with the design verification testing. At time of writing, the laboratory had undertaken to reissue the report to rectify some of the discrepancies, however, a number of issues were not able to be resolved. These unresolved matters have been referred to International Accreditation New Zealand.

Following notification of failure and with the project partners' permission, Hewitsons undertook to inspect the burner itself. Bryan Storey of Hewitsons identified an incomplete seal between the primary air tube and the deflector plate that he considered responsible for the reduced efficiency performance. The seal was repaired and the unit retested. At time of publication, the results of the retesting had not yet been made available to the project partners.

Irrespective of the discrepancies identified with design verification, the Contessa AG with wetback did not demonstrate compliance with the NES for air quality efficiency standard. Emissions were also significantly higher than those upon which the burner was authorised. At time of publication, the burner remains suspended from the Ministry's authorised list.

3.2 Firenzo Insert Flush AG (Forte Fascia)

Test results for the Firenzo Insert Flush AG (Forte Fascia) are provided in Table 8 (initial results and Table 9 (retesting results).

Table 8: Firenzo Insert Flush AG (Forte Fascia) test results and outcomes

Test	Authorisation	Test result	Rating
Design verification	–	Fail	Fail – serious
Emissions test	0.8 g/kg	2.53 g/kg	Fail – moderate
Efficiency test	67%	72%	Pass
Overall result			**Fail – moderate**

The Firenzo Insert Flush AG (Forte Fascia) burner was classified overall as a **'moderate failure'** due to an exceedance of the NES emission limit and a serious failure of the design verification test. Departures from the design specifications included:

- variation in firebox dimensions
- variation in position of flue spigot
- omission of primary air holes in door sill (serious).

In accordance with the review protocol, the project partners notified Hewitsons of the failure, requested immediate remedy action and temporarily suspended the burner from the authorised list. The Firenzo Insert Flush AG is a base model burner with two fascia options, the Forte and the Athena, both of which have the same authorisation. In light of this, the project partners also suspended the Firenzo Flush Insert AG (with Athena fascia) burner from the authorised list.

Hewitsons were extremely concerned about the missing air holes and notified all retailers that the burners were not to be sold or installed. With the project partners' permission, Bryan Storey of Hewitsons then undertook his own inspection. Bryan then drilled the missing holes and commissioned Applied Research Services to retest the burner. The repairs and retesting were carried out under observation by Richard Frizzell of Nelson City Council as representative of the project partners. The results of the original authorisation, testing and retesting are presented below in Table 9.

Table 9: Firenzo Insert Flush AG (Forte Fascia) emissions retesting

Test	Report no.	Emissions (g/kg) (NES = 1.5g/kg)
Authorised	05/1137	0.8
Performance review test	06/1484	2.53
Repair and retest	07/1608	1.2

The repaired burner demonstrated compliance with the NES for air quality emission limit. The retest report itself, however, provided new discrepancies between the original authorising test report, the design verification report, and the performance review test report. These discrepancies were unable to be resolved through communication with the laboratory and have been referred to International Accreditation New Zealand. At time of writing, these issues had yet to be resolved.

The project partners understand that the Firenzo Insert Flush AG has been withdrawn from the market.

3.3 Kent Logfire Max

Test results for the Kent Logfire Max are provided in Table 10 (initial results) and Table 11 (final results).

Table 10: Kent Logfire Max Initial Test Results and Outcomes

Test	Authorisation	Test result	Rating
Design verification	–	Fail	Fail – moderate
Emissions test	1.2 g/kg	1.97 g/kg	Fail – minor
Efficiency test	66%	61%	Undetermined
Overall result			**Fail – moderate**

The Kent Logfire Max was initially classified overall as a **'moderate failure'** due to reduced efficiency, an exceedance of the NES for air quality emission limit and a failure of the design verification test. Departures from the design specifications included:

- variation in firebox dimensions
- primary air inlet minimum opening reduced
- secondary air tube diameter outside tolerance
- label – serial number burnt off.

In accordance with the review protocol, the project partners notified the BBQ Factory of the failure, requested immediate remedy action, and temporarily suspended the burner from the authorised list. As an aside, whilst Dallas Metals manufactures the Kent Logfire Max, authorisation with Nelson City Council is held by the BBQ Factory hence all communication was through the BBQ Factory.

The BBQ Factory engaged their lawyers Kensington Swan to dispute the accuracy of the test results, query discrepancies between test reports, and threaten litigation against Nelson City Council for earnings lost as result of the burners' (temporary) suspension from the Council's approved list.

In responding, the project partners noted that the testing had been carried out by a laboratory accredited with International Accreditation New Zealand (IANZ) and in accordance with a protocol that had been developed with specific, technical input from a BBQ Factory representative. The partners further noted that, notwithstanding assertions of inaccuracy, the project partners' primary responsibility was to the consumer and that they could not, in good faith, list a burner as authorised which they have found to be inconsistent with the council authorisation and non-compliant with the NES for air quality.

There followed extensive correspondence between the project partners, the BBQ Factory and the testing laboratory. In summary, the following conclusions can be drawn:

- Due to incorrect assembly of the air control outer cover and loosening of the air control spigot nuts and bolts, the burner suffered a reduction in primary air during operation. This was held to be the primary cause of the reduction in efficiency and exceedance of the NES for air quality emission limit. The BBQ Factory asserted that this fault occurred during testing and provided an independent inspection of five other models for which the fault was not present. Applied Research Services denied that they had caused the incorrect assembly. Irrespective of how or where the fault occurred, the outer cover has since been redesigned so that removal or tampering with the outer cover does not disturb the air-slide control settings.
- Upon remeasurement, it was concluded that the hole punching process had rendered the secondary tube an oval and not a circle. The project partners accepted that the cross-sectional area of the tube was not significantly changed.
- The burned label was due to the failure to remove a clear cover film which, when heated, caused the ink and printing to fail. The project partners understand that the label is now stamped with the serial number and Nelson City Council authorisation number so that loss of these data is no longer possible.
- The variation in firebox dimensions was unable to be resolved. This issue was complicated by discrepancies between consecutive Applied Research Services test reports for this burner. These discrepancies were unable to be resolved through correspondence with the laboratory and have been referred to International Accreditation New Zealand (IANZ) as a matter of complaint.
- In view of the above, the project partners reclassified the failure as 'minor' and it was returned to the authorised list. At time of writing, however, the issue of depth (acknowledged by the BBQ Factory to have changed) remains unresolved.

The final results for the Kent Logfire Max are provided in Table 11.

Table 11: Kent Logfire Max final test results and outcomes

Test	Authorisation	Test result	Rating
Design verification	–	Fail	Fail – minor
Emissions test	1.2 g/kg	1.97 g/kg	Fail – minor
Efficiency test	66%	61%	Undetermined
Overall result			**Fail – minor**

3.4 Kent Quantum Max

Test results for the Kent Quantum Max are provided in Table 12.

Table 12: Kent Quantum Max test results and outcomes

Test	Authorisation	Test result	Rating
Design verification	–	Fail	Fail – Very serious
Emissions test	0.5 g/kg	3.51 g/kg	Fail – serious
Efficiency test	73%	69%	Pass
Overall result			**Fail – very serious**

The Kent Quantum Max was classified overall as a **'very serious failure'** due to a large exceedance of the NES for air quality emission limit and a very serious failure of the design verification test. Departures from the design specifications included:

- increased firebox depth
- changed position of flue spigot
- decreased maximum opening for primary air inlet control
- primary air inlet minimum opening able to be completely closed (very serious)
- decreased primary air inlet distributor width
- secondary air distributors – two tubes replaced with firebox wall holes (very serious)
- decreased refractory lining thickness.

In accordance with the review protocol, the project partners notified Dallas Metals of the failure, requested immediate remedy action, and temporarily suspended the burner from the authorised list. Whilst Dallas Metals manufactures the Kent Quantum Max, the burner in question was purchased from the BBQ Factory. Subsequent communications were with both parties.

Dallas Metals responded by asserting that the project partners had purchased an incorrect burner and carried out the review in error. Dallas noted the date of manufacture of the unit tested (serial number 24788) was July 2004 and therefore, this burner was not a Kent Quantum Max as this model was not introduced until 2006.

The project partners clarified for Dallas Metals that the burner they selected for purchase from the BBQ Factory website was indeed a Kent Quantum Max; it was invoiced as a Kent Quantum Max and advertised as "Clean Air" on the BBQ Factory website. At this point, Dallas accepted that there had been an error in the supply chain and referred the matter to the BBQ Factory.

The BBQ Factory maintained the Kent Quantum Max purchased from the internet was assigned an incorrect identification number at point of sale; in this case the identification number for a Kent Quantum non clean air burner (as opposed to a Kent Quantum Max clean air burner). This resulted in the wrong (non clean air) burner being dispatched for delivery. The BBQ Factory maintained such incorrect dispatch would not occur with store sales and further, that the project partners' purchase was the only internet sale all year.

The project partners accepted there had been a supply chain error but noted the net result was that a high emission burner could have been installed on a property under 2 hectares. The partners requested Dallas Metals demonstrate to the partners the necessary changes that would be made to ensure this problem could not reoccur. The partners further queried apparently conflicting statements made by the BBQ Factory as to where the burner was dispatched from.

Following this, the BBQ Factory recalled all remaining stock of non clean air Kent Quantum Max burners. These were relabelled by Dallas Metals as "Kent Quantum Max Non Clean Air" with additional marking that they should only be installed on properties over 2 hectares. Dallas Metals further advised that they were ceasing manufacture of the Kent Quantum Max Non Clean Air model.

The partners were satisfied that the actions by Dallas Metals would protect the integrity of the future supply chain for the Kent Quantum Max. The partners noted, however, that the Kent Quantum Max (Clean Air) burner was not included in the review.

Finally, and in accordance with the protocol, the very serious failure and associated supply chain problems require notification to the Commerce Commission. At time of writing this was underway. Environment Canterbury has also requested a full refund of the purchase price, in exchange for the return of the burner.

3.5 Lady Kitchener

Test results for the Lady Kitchener are provided in Table 13.

Table 13: Lady Kitchener test results and outcomes

Test	Authorisation[1]	Test result	Rating
Design verification	–	Fail	Fail – serious
Emissions test	NA	0.63 g/kg	Pass
Efficiency test	NA	70%	Pass
Overall result			**Pass**

1 Authorisation for the Lady Kitchener is based on test data for a wetback model, supplemented with an opinion from the testing laboratory.

The Lady Kitchener was classified overall as a **'pass'** despite a serious failure of the design verification test. Departures from the design specifications included:

- variation in firebox cabinet dimensions
- variation in firebox dimensions
- variation in position of flue spigot
- variation in primary air inlet controls (decreased maximum, increased minimum setting)
- variation in secondary air tube position and hole orientation
- decreased baffle plate thickness
- decreased refractory lining thickness.

In light of the compliant emissions and efficiency performance of the burner, the project partners notified Hewitsons of the design verification failure but did not request any remedy action. It should be noted that whilst this burner meets the NES for air quality, the burner is substantially altered from that authorised by Nelson City Council.

3.6 Masport LE 4000 Provincial

Test results for the Masport LE 4000 Provincial are provided in Table 14.

Table 14: Masport LE 4000 Provincial test results and outcomes

Test	Authorisation	Test result	Rating
Design verification	–	Pass	Pass
Emissions test	0.62 g/kg	1.11 g/kg	Pass[1]
Efficiency test	67%	61%	Undetermined
Overall result			**Undetermined**

1 This burner meets the NES for air quality criterion for emissions but exceeds the standard of 1.0 g/kg for which it is authorised by Environment Canterbury.

The Masport LE 4000 Provincial was classified as '**undetermined'** due to the limits of accuracy of testing for efficiency (ie, within ± 5%). The burner passed the design verification test and is compliant with the NES for air quality emission limit.

Accordingly, the project partners notified Glen Dimplex of the results of the performance review and did not request any remedy action.

Glen Dimplex holds the authorisation for the Masport LE 4000 Provincial. Glen Dimplex previously traded as MetalFab Industries (for whom a number of failures were noted in the Phase 1 report).

3.7 Metro Eco Wee Rad

Test results for the Metro Eco Wee Rad are provided in Table 15.

Table 15: Metro Eco Wee Rad test results and outcomes

Test	Authorisation	Test result	Rating
Design verification	–	Fail	Fail – moderate
Emissions test	0.88 g/kg	1.23 g/kg	Pass[1]
Efficiency test	70%	66%	Pass
Overall result			**Pass**

1 This burner meets the NES fro air quality criterion for emissions but exceeds the standard of 1.0 g/kg for which it is authorised by Environment Canterbury.

The Metro Eco Wee Rad was classified overall as a '**pass'** despite a moderate failure of the design verification test. Departures from the design specifications included:

- variation in firebox cabinet dimensions (minor)
- variation in firebox dimensions (minor)
- variation in position of flue spigot
- substitution of refractory lining across rear surface (moderate).

In light of the compliant emissions and efficiency performance of the burner, the project partners notified Pioneer of the design verification failure but did not request any remedy action.

Pioneer responded that their internal audit (initiated following Phase 1 of the review) had uncovered similar design variations to those identified above. Pioneer further offered to undertake additional emissions and efficiency testing on alternative refractory linings. At time of publication, the results of the retesting had not been made available to the project partners.

3.8 Osburn 2200

Test results for the Osburn 2020 are provided in Table 16.

Table 16: Osburn 2200 test results and outcomes

Test	Authorisation	Test result	Rating
Design rerification	–	Fail	Fail – moderate
Emissions test	1.2 g/kg	1.15 g/kg	Pass
Efficiency test	68%	58%	Fail – moderate
Overall result			**Fail – moderate**

The Osburn 2200 (wet) was classified overall as a **'moderate failure'** due to a failure to meet the minimum efficiency requirement and a failure of the design verification test. Departures from the design specifications included:

- increase in pedestal height (minor)
- position of flue spigot centre
- variation in primary air opening.

In accordance with the review protocol, the project partners notified Glen Dimplex of the failure, requested immediate remedy action and temporarily suspended the burner from the authorised list.

Glen Dimplex responded that they have withdrawn the Osburn 2200 from the market pending design changes and a new application for authorisation.

Glen Dimplex holds the authorisation for the Osburn 2200. Glen Dimplex previously traded as MetalFab Industries (for whom a number of failures were noted in the Phase 1 report).

3.9 Woodsman Matai ECR

Test results for the Woodsman Matai ECR are provided in Table 17 (initial results) and Table 18 (final results).

Table 17: Woodsman Matai ECR initial test results and outcomes

Test	Authorisation	Test result	Rating
Design verification	–	Fail	Fail – moderate
Emissions test	0.8 g/kg	0.8 g/kg	Pass
Efficiency test	72%	64%	Undetermined
Overall result			**Fail – minor**

The Woodsman Matai ECR was classified overall as **'minor failure'** due to undetermined efficiency performance and a moderate failure of the design verification test. Departures from the design specifications included:

- variation in firebox dimensions
- increase in refractory lining thickness.

In accordance with the protocol, the project partners notified WH Harris of the design verification failure and requested remedy action.

WH Harris responded that the baffle plate appears to have moved in transit and this would explain the drop in efficiency. WH Harris queried several dimensions in the emissions test report, noting discrepancies with some of the measurements recorded by the testing laboratory. WH Harris advised their Promat board supplier had changed specifications two years ago but that the original board was now available again and future manufacturing would be in accordance with the authorised design.

The project partners raised the discrepancy issues with the laboratory, Applied Research Services. In response, the laboratory reissued the emissions report. This resolves the issues identified by W H Harris with the burner measurements, but it raised new issues with the laboratory testing procedures. The matter has been referred to International Accreditation New Zealand. At time of writing, these issues remain unresolved.

Due to the above, the project partners reclassified the design verification test result as a '**minor failure**'. Final test results for the Woodsman Matai ECR are given in Table 18.

Table 18: Woodsman Matai ECR final test results and outcomes

Test	Authorisation	Test result	Rating
Design verification	–	Fail	Fail – minor
Emissions test	0.8 g/kg	0.8 g/kg	Pass
Efficiency test	72%	64%	Undetermined
Overall result			**Fail – minor**

3.10 Yunca Finz

Test results for the Yunca Finz are provided in Table 19.

Table 19: Yunca Finz test results and outcomes

Test	Authorisation	Test result	Rating
Design verification	–	Fail	Fail – serious
Emissions test	1.3 g/kg	1.69 g/kg	Undetermined
Efficiency test	65%	62%	Undetermined
Overall result			**Fail – moderate**

The Yunca Finz was classified overall as a '**moderate failure'** due to failure to demonstrate compliance with the emissions and efficiency NES for air quality limits and a serious failure of the design verification test. Departures from design specifications included:

- decreased number of secondary air tube holes (serious)
- secondary air tube position.

In accordance with the review protocol, the project partners notified Yunca of the failure, requested immediate remedy action and temporarily suspended the burner from the authorised list.

Yunca response was swift and thorough. Within days of receipt of notification, Yunca responded with the results of an investigation into the cause of the problem and notified the partners of their intention to withdraw this unit, permanently, from the market.

4 Conclusions

The Ministry, partnered by Environment Canterbury and Nelson City Council, conducted a performance review of wood burners under the national environmental standards for air quality. This report details the results of Phase 2 of the review in which 10 wood burners were purchased for testing of emissions and efficiency as well as a design verification test. This report follows the report on Phase 1 of the review published in June 2007.

Overall, Phase 2 of the review revealed poor compliance:

- six burners demonstrated compliance with the NES emission limit
- four burners demonstrated compliance with the NES efficiency limit
- one burner passed the design verification test.

All three tests contribute to the overall review and this translates to an overall "pass" rate of only 20 per cent.

The response to the review by manufacturers varied significantly. Some were swift to fix identified faults and take remedial actions, some immediately disputed results and some were slow to respond or undertake follow-up action.

The review was carried out in accordance with a protocol developed in consultation with representative manufacturers from the New Zealand Home Heating Association. The protocol specifies that serious failures be reported to the Commerce Commission. At time of writing, this is underway.

The review further identified some discrepancies with the methodologies employed by the testing laboratory, Applied Research Services. At time of publication, these have been referred to International Accreditation New Zealand.

4.1 Key points for regulators

- Compliance was poor and future reviews are strongly recommended.
- Quality assurance amongst manufacturers varies significantly.
- Councils issuing building consents for wood burners are advised to consult the Ministry for the Environment web list of authorised burners. This list has been updated following the review and is the only national, independently verified list available.

4.2 Key points for consumers

- Quality assurance amongst manufacturers varies significantly. The Masport LE 4000 Provincial was the only burner to pass design verification testing.
- This is the second part of the first national review of performance of wood burners. The review revealed poor compliance with respect to the national environmental standards for air quality and burner authorisations. The Ministry and partner councils are working with industry to resolve the identified issues.
- People intending to purchase a wood burner are advised to consult the Ministry for the Environment web list of authorised burners. This list has been updated following the review and is the only national, independently verified list available.

4.3 Key points for manufacturers

- The review revealed poor compliance with respect to the national environmental standards for air quality and burner authorisations.
- The overall lack of compliance in this review means that additional reviews will be necessary. Future reviews are likely to increase costs for those manufacturers who fail to demonstrate compliance as they will also face an increased likelihood of actions such as suspension of burners from the authorised list.
- The intent of the review is to support a 'level playing field' for business and to publicise information on compliance for consumers. These reviews therefore, reward not only compliance but also proactive, responsible behaviour in response to identified compliance issues.

Appendix 1: Review Protocol

1.0 Compliance verification

1.1 Wood burners that have demonstrated compliance with the current efficiency and emissions requirements of the national environmental standards through testing by a laboratory in accordance with AS/NZS 4012:1999 and AS/NZS 4013:1999 may be required to demonstrate continuing compliance by means of random inspections. The compliance verification will verify that the design, materials and manufacture of a randomly selected production wood burner are not materially changed from the prototype that underwent the efficiency and emissions testing and that the tests undertaken accurately indicate compliance with the national environmental standards.

1.2 Compliance verification shall be conducted on wood burners on the basis of the following three aspects.

- Design verification testing shall be undertaken on a randomly selected number of production units that have current test reports indicating compliance with the national environmental standards, in accordance with the Design Verification Test outlined below.
- Assessment that the emissions test as described in the laboratory test report for the wood burner has been performed in compliance with the test procedure of AS/NZS 4013:1999. Further that the calculation and assessment of emmission levels has been accurately determined in accordance with the test procedure.
- Assessment that the efficiency test as described in the laboratory test report for the wood burner has been performed in compliance with the test procedure of AS/NZS 4012:1999. Further that the calculation and assessment of efficiency has been accurately determined in accordance with the test procedure.

2.0 Design verification test

2.1 Forty wood burners shall be chosen for the design verification test using a statistically valid, random selection. This shall be undertaken by an independent project manager. Wood burners shall be selected from the Ministry published website lists (tested and authorised).

2.2 Production model wood burners selected for the design verification test will be examined for reference against the design, materials, components and assembly of the wood burner that was originally tested to the emissions and efficiency standards.

2.3 The design verification examination shall be carried out by an independent testing engineer, with well-established experience in the field of both general product testing and the manufacture and testing of wood burners.

2.4 Verification examination shall be undertaken on production model wood burners identified and located by the independent testing engineer in accordance with the random selection process.

2.5 Wherever possible, production model wood burners shall be examined in locations away from the point of manufacture, preferably in the premises of a distributor or retailer. Prior to the examination taking place, the agreement of the retailer, distributor or manufacturer shall be obtained from either:

- the retailer, distributor or manufacturer directly; or
- a representative of the retailer, distributor or manufacturer (eg, the New Zealand Home Heating Association).

2.6 Verification examination shall be undertaken at an unspecified time but after 1 May 2006 and before 1 May 2008.

2.7 Compliance with the efficiency and emissions requirements is dependent on many factors in the design, materials and construction of a particular wood burner. Verification that the production model being examined is materially identical to the prototype tested is, therefore, essential.

2.8 Information on the design, materials, components and assembly of the prototype wood burner will be supplied by either the authorising agency or the test laboratory and will include:

i. test reports, including a detailed set of drawings of the prototype wood burner, that were certified by the test laboratory undertaking the efficiency and emissions as being an accurate representation of the design, materials and dimensions of the wood burner

ii. copies of the operating and installation instructions that were available for the prototype

iii. colour photographs of the prototype that were included in the test reports held by the test laboratory.

2.9 Critical parameters in achieving the required efficiency and emissions standards include the arrangement and dimensions of the combustion air systems, the firebox and the heat exchange sector. Verification of a production model wood burner against a prototype tested therefore requires an accurate assessment that the design parameters are within manufacturing tolerances.

2.10 The following construction details require to be measured and assessed against the dimensions and drawings in the test reports certified by the test laboratory undertaking the emissions and efficiency tests, with reference to photographs of the prototype as a cross-check:

- firebox cabinet dimensions – tolerances ± 5 mm
- pedestal height – tolerances ± 25 mm
- overall firebox dimensions – tolerances ± 2 mm
- firebox material thickness – tolerances ± 0.25 mm
- position of flue spigot centre – tolerances ± 2 mm

- primary air inlet control openings – number and size
  - height and width of slot – ± 0.5 mm up to 20 mm dimension
    – ± 1 mm above 20 mm dimension
  - minimum opening – ± 0.5 mm
- primary air inlet distributor – position ± 2 mm
- secondary air distributor(s) – position ± 2 mm
  – angle
- number and size of holes – hole sizes ± 0.1 mm
- baffle plate – dimensions, material thickness ± 2 mm
  – material, angle, position, shape, attachments
- refractory linings, insulation – material, number, position
  – size, thickness ± 2mm
- convection air distribution – dimensions of openings ± 5% of area
- firebox door – glass size and shape (± 2mm)
  – door profile sloped or vertical
- wetback, heat recirculating fan or other accessory – type, associated controls, dimensions, position

2.11 Measurement of dimensions listed in 2.10 shall be undertaken with appropriate measurement equipment with traceable accuracy to national standards:

- dimensions greater than 100 mm – approved make steel rule or certified steel tape
- dimensions up to 100 mm – vernier or digital calliper calibrated against certified gauge blocks or bars.

Hole diameters less than 10 mm using standard set of metric and/or imperial drills, checked against vernier or digital calliper.

2.12 The engineer shall critically examine the appliance against the test documents and photographs of the prototype, and note any obvious changes in the appearance, construction or design or the appliance and its components. The engineer shall accurately record all observations and measurements on a pro-forma test sheet, identifying any measurements that are outside of the agreed tolerances, and return a copy of this with his report to the project manager. The report shall further include an assessment on whether any variations in dimensions or changes in the appliance are significant and likely to vary the previous emissions and efficiency test compliances.

2.13 All details on the attached manufacturer's identification plate, including manufacturer's name and address, model and serial number shall be recorded. Where a separate identification plate is attached showing the current compliance certification details, this information shall also be recorded.

2.14 The engineer shall check emissions calculations provided in the test report.

2.15 The engineer shall check efficiency calculations provided in the test report.

2.16 The engineer shall check the heater was tested in accordance with manufacturer's instructions for the prototype, and whether current instructions contain any information that is contrary to the compliance of the appliance.

2.17 The engineer shall provide interpretation of any design features that may substantially impact upon emissions performance (tamperability, durability, etc).

2.18 Assessment Pass/Fail (refer section 4.0).

3.0 Emissions and efficiency testing

3.1 Ten wood burners shall be chosen for emissions and efficiency testing using a statistically valid, random selection. This shall be undertaken by an independent project manager. Wood burners shall be selected from the Ministry published website lists (tested and authorised).

3.2 Production model wood burners selected for emissions and efficiency testing will be purchased by the programme partners (Environment Canterbury, Nelson City Council) and sent to an accredited testing laborotory for the following tests:

- design verification test in accordance with the protocol outlined in section 2.0
- emissions testing in accordance with AS/NZS 4013:1999
- efficiency testing in accordance with AS/NZS 4012:1999.

3.3 Assessment Pass/Fail (refer section 4.0).

4.0 Review outcomes

4.1 All outcomes will be notified in writing to each manufacturer or distributor on an initially confidential basis (results will eventually be made public).

4.2 Examples of failures are provided in Table 20.

Table 20: Examples of failure

Failures	Example
Label errors	Either not on the model being checked, inaccurate (ie, different to label on test report) or inadequate (ie, fuel type not visible when opening door).
Quality of drawings	Exclusion of tolerances, specificity to enable correct identification of major design features for design verification.
Documentation	As required in Section 8.2 and 8.3 of AS/NZS 4013.
Installation instructions	Installation instructions do not match model.
Operating instructions	Appliance tested with wood oriented contrary to operating instructions (s5.4.2 and 6.2.2 of AS/NZS 4012). Variance between tested procedure and operating instructions (s6.7.1 of AS/NZS 4012). Reference to a wetback for a model which is not authorised to have one.

Failures	Example
Physical dimensions	Number of holes, or their dimensions, in airtube different to that in tested report. Components of the appliance (eg, wrong airslide, fire bricks not in place).
Flue type	Change from manufacturer's specifications (eg, plain to crimped flue).
Wetbacks	Variation between model supplied in shop and what was authorised.
Fitness and tamperability	'Looseness' of fit of moving parts; eg, variation in actual size of opening due to sloppy fit of air slide in its tracks. Alternatively a loose fit in an appliance that may be easily knocked out of position with a resulting change in the burn characteristics (eg, baffle plate).
Emissions test	Not meeting stated emission factor within ± 0.29 g/kg. Not meeting NES design standard of 1.5 ± 0.29 g/kg.
Efficiency test	Not meeting stated efficiency within ± 5%. Not meeting NES design standard of 65 ± 5%.

4.3 Failure may be classified in five ways as follows:

(i) Undetermined

(ii) Minor

(iii) Moderate

(iv) Serious

(v) Very serious.

Examples of different types of failure are provided in Table 21. Note that some of the failures compound or build on each other. So, for example, a couple of minor failures may add up to become a moderate failure. Similarly, tested emissions and efficiency results are graduated by where they are in relation to the minimum requirements. A minor failure is one that exceeds the NES and uncertainty of testing, and a very serious failure is defined as emissions above 4.0 g/kg or efficiency below 50 per cent.

Table 21: Example failure classification

Example	Failure type	Example
Undetermined	Test Test	Emissions above 1.5 g/kg but below 1.79 g/kg. Emissions substantially above stated emission factor but less than 1.5 g/kg.
Minor	Design verification Test	Label on burner different to label on test report. Emissions above 1.79 g/kg.
Moderate	Design verification Design verification Design verification Test	Tolerances out of spec (refer 2.10). Wetback on model different in dimensions to that in tested report. 1–2 minor failures that impact adversely on emissions/efficiency. Emissions above 2.0 g/kg, or efficiency below 60%.
Serious	Design verification Test	2–3 moderate failures that impact adversely on emissions/efficiency. Emissions above 3.0 g/kg, or efficiency below 55%.
Very serious	Design verification Test	4 or more moderate failures that impact adversely on emissions/efficiency. Emissions above 4.0 g/kg or efficiency below 50%.

4.4 Sanctions, or actions taken following failure, are similarly graduated in response to the severity of failure. Depending upon the outcomes, the following sanctions would apply.

- Pass – the Ministry would prepare a letter notifying success.
- Undetermined – tested emissions or efficiency within uncertainty limits of test method. The Ministry would offer manufacturer an opportunity to retest (at the manufacturer's expense). Failure to respond to the request would then trigger sanctions for a minor failure.
- Minor failures – the Ministry would prepare a letter notifying the manufacturer of the failure and requesting it be fixed within 1 month. Failure to respond to the request within the month would then trigger sanctions for a moderate failure.
- Moderate failures – the Ministry would prepare a letter notifying the manufacturer of the failure and requesting immediate remedy action. The burner would be 'suspended' from published web-based lists until such time as remedy actions can be established to have occurred. Failure to respond to the request within five working days would then trigger sanctions for a serious failure.
- Serious failures – the Ministry would prepare a letter notifying the manufacturer of the failure and requesting immediate remedy action. The burner would be immediately removed from published web-based lists. The Commerce Commission would be notified of misleading advertising (ie, burner being advertised for sale does not meet the standard as claimed), who may choose to prosecute. Failure to respond to the request would then trigger sanctions for a very serious failure.
- Very serious failures – the Ministry would prepare a letter notifying the manufacturer of the failure and requesting immediate remedy action. The burner would be immediately removed from published web-based lists. Notification of the failure would be placed on the published websites and copied by letter to the New Zealand Home Heating Association with a request that all members be notified of the failure. The Commerce Commission would be notified of misleading advertising (ie, burner being advertised for sale does not meet the standard as claimed), who may choose to prosecute. Regional councils may require the fault be remedied in existing installations and may undertake prosecution action.

4.5 Depending upon the nature of the failure, remedy action may take the following forms:

- immediate cessation of production and sales of failed model until fault remedied
- recall of existing product
- repair all burners installed in contradiction of regulatory requirements
- removal and/or replacement of burners installed in contradiction of regulatory requirements.