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PREPARED FOR

Nelson City Council

PREPARED BY
Emily Wilton, Environet Ltd
www.environet.co.nz

Environet ltd
Air Quality Specialists

Nelson Air Quality Assessment – Meeting the NES for PM_{10} 2014 update

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EXECUTIVE SUMMARY

The main air contaminant of concern in Nelson is PM_{10}, particles in the air less than 10 microns in diameter. Monitoring of PM_{10} in Nelson commenced in 2001 with the establishment of a permanent air quality monitor in the Nelson South area. Prior to this smoke monitoring, carried out at a number of sites across Nelson, had established the Nelson South area as being the most prone to air pollution.

During 2001 meteorological conditions were particularly conducive to elevated PM_{10} and a total of 81 exceedences of 50 µg/m^3 (24-hour average) and a maximum concentration of around 165 µg/m^3 were recorded. Air quality in Nelson has improved significantly since 2001. However, concentrations of PM_{10} continue to breach National Environmental Standards for Air Quality (NESAQ).

The Nelson area has been segregated into four Airsheds for the purposes of managing air quality, in particulate PM_{10} concentrations. The Nelson South/ Washington area, which comprises Airshed A, maintains its reputation for the worst air quality. Other air quality management areas are Airshed B1 (Tahunanui/ Airport), Airshed B2 (Stoke) and Airshed C (rest of Nelson).

The National Environmental Standard (NES) for PM_{10} specifies a limit of 50 µg/m^3 for PM_{10} (particles in the air less than 10 microns in diameter) which can only be exceeded on one occasion per year. The NESAQ was introduced in 2004 (Ministry for Environment, 2004) and took effect from September 2005. Compliance is required in Airshed A by September 2020. In addition no more than three breaches pre year are allowed by September 2016. Other Airsheds are required to be fully compliant by September 2016.

This report evaluates each Airshed for current compliance with the NES for PM_{10} and identifies any further reductions in PM_{10} required. It evaluates the effectiveness of management options in reducing PM_{10} in Airsheds where further reductions are required and evaluates capacity for relaxing rules relating to new burner installations in Airsheds that are non-compliant.

In Airshed A the reduction required in 2014 PM_{10} concentrations to meet the NES is estimated at 14%. There is no additional capacity for allowing NES compliant wood burners to be installed in new dwellings or existing dwellings currently using other heating methods. Management measures that are likely to be effective in reducing PM_{10} concentrations by 14% include phasing out existing burners that do not comply with the NES design criteria for wood burners and a behaviour change campaign effective in reducing PM_{10} by 20%. Alternatively existing households with NES compliant wood burners could be required to install and maintain emission control technology if it could be demonstrated to be at least 30% effective in reducing PM_{10} concentrations. Tests would need to be done to New Zealand testing protocols to ensure capture of condensable particulate.

In Airshed B1 it is possible that PM_{10} concentrations have been reduced sufficiently that the NES is met for a typical winter exceedance scenario. However, there are a number of uncertainties and it is recommended that additional management measures be considered. These may include a phase out of burner that do not meet the NES design criteria for wood burners and a behaviour change programme. In addition an issue with non winter exceedences is apparent and measures targeting this source at all times of the year is required.

Airshed B2 appears compliant with the NES for PM_{10} and no further reductions in concentrations is required. Allowing NES compliant wood burners to be installed in Airshed B2 will increase PM_{10} concentrations and is likely to compromise attainment of the NES in Airshed B1 as a significant proportion of the concentrations measured in Airshed B1 originate in Airshed B2. Allowing the installation of ultra low emission burners (ULEB) into Airshed B2 may be possible provided concentrations are reduced by sufficient amounts in Airshed B1.

Airshed C also appears compliant with the NES for PM_{10}. While there is sufficient capacity in Airshed C to allow the installation of NES compliant wood burners or ULEB burners into this Airshed, this will impact on PM_{10} concentrations in Airshed A owing to air movements from Airshed C to Airshed A on high pollution days. Additional management of PM_{10} concentrations in Airshed A would be required to enable households to install new wood burners into dwellings that do not currently have them in Airshed C.

1 INTRODUCTION

1.1 Air Quality in Nelson

The main air contaminant of concern in Nelson is concentrations of PM_{10}, particles in the air less than 10 microns in diameter. Monitoring of PM_{10} in Nelson commenced in 2001 with the establishment of a permanent air quality monitor in the Nelson South area. Monitoring was prioritised in this area because historical smoke monitoring indicated this area was the susceptible to air pollution. During 2001 meteorological conditions were particularly conducive to elevated PM_{10} and a total of 81 exceedences of 50 $\mu g/m^3$ (24-hour average) and a maximum concentration of around 165 $\mu g/m^3$ were recorded. Air quality in Nelson has improved significantly since 2001. However, concentrations of PM_{10} continue to breach National Environmental Standards for Air Quality (NESAQ). The Nelson South/ Washington area, which comprises Airshed A for the purposes of managing the issue, maintains its reputation for the worst air quality. Other air quality management areas are Airshed B1 (Tahunanui/ Airport), Airshed B2 (Stoke) and Airshed C (rest of Nelson).

1.2 National Environmental Standards for Air Quality

The NESAQ for PM_{10} specifies a limit of 50 $\mu g/m^3$ for PM_{10} (particles in the air less than 10 microns in diameter) which can only be exceeded on one occasion per year. The NESAQ was introduced in 2004 (Ministry for Environment, 2004) and took effect from September 2005, although compliance for the PM_{10} standard in non-complying airsheds was not required until 2013. At the time the NESAQ was introduced the Nelson City Council were in the process of preparing their air quality management plan.

The management regime proposed by Nelson City Council prior to the introduction of the NESAQ aimed to achieve the target of 50 $\mu g/m^3$ by around 2021. As a result of the tighter timeframes contained within the original NESAQ the plan was modified to achieve reductions earlier. This involved bringing forward phase out dates for older burners to 2010, 2011 and 2013. This was referred to as the accelerated phase out and resulted in the shortening of some burners useful lives to less than the 15 year period originally proposed.

In 2011 the NESAQ were reviewed. A number of changes were made including new compliance dates. An interim target of compliance with three exceedences of PM_{10} was required by 2016 in Airshed A and full compliance with the NES was not required until September 2020. In Airshed B and C full compliance is required by 2016. As a result of this change in timeframes the air plan requirement of phasing out wood burners installed from 2000 to 2003 for Airshed A and B1 was withdrawn.

1.3 The Air Plan

The Nelson City Council's Air Plan was one of New Zealand's first new generation air plans[1] and became operative in 2008. The Plan included numerous management measures targeting domestic home heating as the main source of winter time breaches of the NES. The plan aimed to reduce PM_{10} concentrations in Nelson by 70%. The measures included in the Air Plan were:

i. A ban on outdoor rubbish burning from 2004
ii. Emission limits for new installations of solid fuel burners of 1.5 g/kg and an energy efficiency of 65% (when tested to NZS 4013).
iii. A ban on the use of open fires from January 2008.
iv. A ban on the installation of solid fuel burners in new dwellings or existing dwellings using other heating methods from November 2008.

[1] While many Councils had operative Air Plans under the RMA before 2008, Nelsons Air Plan was the first to seriously tackle the issue of urban air quality and PM_{10} concentrations.

v. Airshed A and B1 - staged phase out of older burners from 2010, 2011 and 2013. The latter phase out date of wood burners installed between 2000 and 2003 was withdrawn following 2011 revisions to the NES. This resulted in approximately 120 burners in Airshed A which did not get phased out and for which no legislative replacement date currently exists.

vi. Airshed B2 – staged phase out of older (pre 1990s burners) by 2010 and pre 1995 burners by 2012.

Some advances in scientific understanding have occurred since the Air Plan was adopted and it is therefore timely to re-evaluate the appropriateness of the Air Plan measures and their likely effectiveness in achieving the NES. In particular technological advancements in wood burner design and control technology may mean that allowing new installations of burners is feasible in some areas. In addition a number of assumptions regarding sources have been refined as a result of increased scientific research. For example, real life testing of emissions suggests the emissions differential between NES compliant burners and older wood burners is less than previously thought and the contribution of natural sources (marine aerosol and soil) to PM_{10} concentrations is greater than previously estimated. Both scenarios would decrease the likelihood of existing Air Plan measures being sufficient to achieve the NES. The interaction between different Airsheds, in particular the contribution of one Airshed to another is better understood as a result of Airshed modelling work carried out by Golder Associates,(2012).

1.4 Objectives

The purpose of this report is to evaluate the extent to which the current air quality management regime, as specified in the Air Plan, is likely to result in compliance with the NESAQ for PM_{10} in each of Nelsons four Airsheds and the likely impact of alternative management scenarios in any Airshed requiring intervention. In addition it examines the potential for relaxing rules relating to the installation of wood burners in new dwellings or existing dwellings using alternative heating methods. The following scenarios were assessed:

- Allowing the installation of ultra-low emission wood burners in new and existing dwellings that do not currently use wood burners (all Airsheds).
- Implementation of a behaviour change programme aimed at reducing PM_{10} by 10 and 20 percent (all Airsheds).
- Introduction of secondary technology to reduce PM_{10} emissions by 30% percent (Airsheds A and B1)
- Require the replacement of NES compliant wood burners with ultra-low emission wood burners (Airshed A).
- Allowing the installation of NES compliant burners (Airshed B2 and C).

2 REDUCTIONS REQUIRED

2.1 Airshed A

The reductions required in PM_{10} concentrations in Airshed A was originally evaluated at around 70% based on the maximum measured PM_{10} concentration in Airshed A which was 165 µg/m^3 (24-hour average) in 2001. Selection of the maximum concentration (as opposed to the second highest concentration) from which to calculate reductions required was the preferred approach in areas where there was limited monitoring data. At the time this evaluation was made there was less than five years of monitoring data available.

To determine the reduction in PM_{10} concentrations that has occurred since 2001 and to evaluate the extent of any further reduction required Wilton & Zawar Reza, (2014) carried out an assessment of trends in PM_{10} concentrations whilst minimising for the impact of meteorological conditions. Figure 2.1 from this analysis shows changes in PM_{10} concentrations from 2001 to 2014 on days when meteorological conditions were most conducive to elevated PM_{10}. Results suggest a reduction in PM_{10} concentrations of around 66% (mean concentrations) to 69% (90th percentile concentrations) from 2001 to 2014 with the majority of this reduction occurring between 2001 and 2010.

Figure 2.1: Trends in PM_{10} concentrations for days when meteorological conditions were conducive to elevated PM_{10} concentrations (from Wilton & Zawar Reza, 2014).

Wilton & Zawar Reza, (2014) indicate that meteorological conditions on the days when PM_{10} concentrations were second highest were similar for a range of years with respect to pollution potential. The year 2003 was estimated as likely to represent the worst case year for meteorological conditions for the purposes of determining the reduction required based on 2014 emissions. An estimated 14% reduction in 2014 emissions was calculated.

Airshed modelling from Golder Associates, (2012) indicates that Airshed C can contributed around 20-30% of the PM_{10} in Airshed A based on 2006 emissions. An assessment of the reduction in Airshed C contribution is required and any ongoing contribution needs to be factored into the reduction required in Airshed A and Airshed C emissions.

2.2 Airshed B1

The reductions required in PM_{10} concentrations in Airshed B1 was originally evaluated at around 45% based on the maximum measured PM_{10} concentration in Airshed B1 during 2002 which was 91 µg/m^3 (24-hour average). Selection of the maximum concentration (as opposed to the second highest concentration) from which to calculate reductions required was the preferred approach in areas where there was limited monitoring data. At the time this evaluation was made there was less than five years of monitoring data available.

To determine the reduction in PM_{10} concentrations that has occurred since 2002 and to evaluate the extent of any further reduction required an assessment of trends in PM_{10} concentrations whilst minimising for the impact of meteorological conditions was made for Airshed B1 based on the days used in the trends analysis for Airshed A (Wilton & Zawar Reza, 2014). Figure 2.2 shows changes in PM_{10} concentrations from 2002 to 2014 on days when meteorological conditions were most conducive to elevated PM_{10}. Results suggest a reduction in PM_{10} concentrations of around 54% from 2002 to 2014. However there is a larger degree of uncertainty around this reduction owing to the absence of data for 2001 and 2003. In addition smaller datasets for the years 2002 to 2005 increase the uncertainty around trends during this time. A better statistic to base the reductions assessment from is 2006 (35% reduction required based on 77 μg/m^3). Analysis suggests a reduction in average PM_{10} concentrations of around 40% from 2006 to 2014 suggesting Airshed B1 may already be compliant with respect to typical wintertime exceedences.

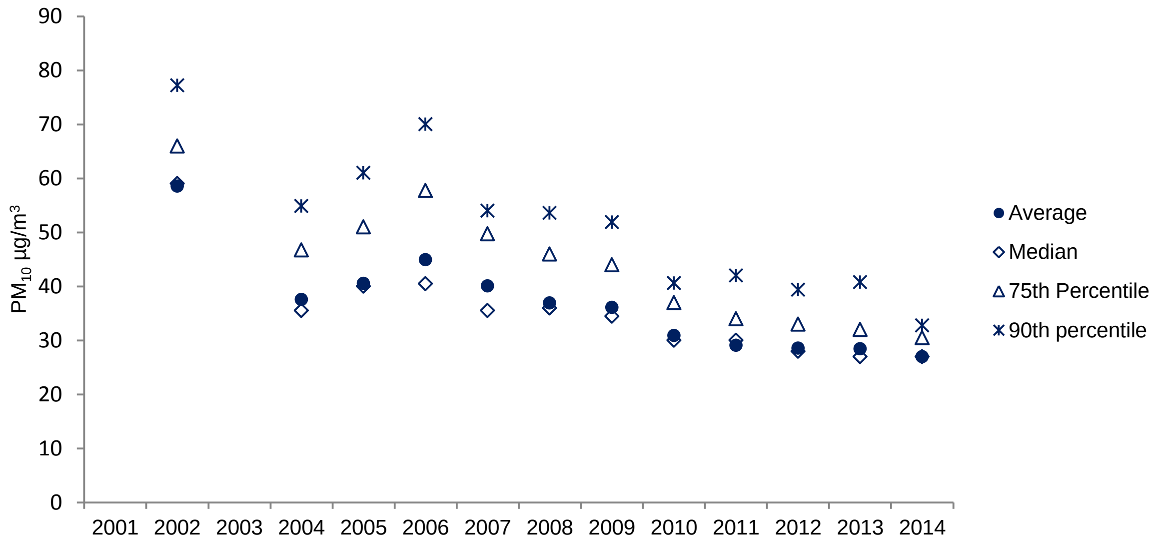

Figure 2.2: Trends in PM_{10} concentrations in Airshed B1 for days when meteorological conditions were conducive to elevated PM_{10} concentrations in Airshed A.

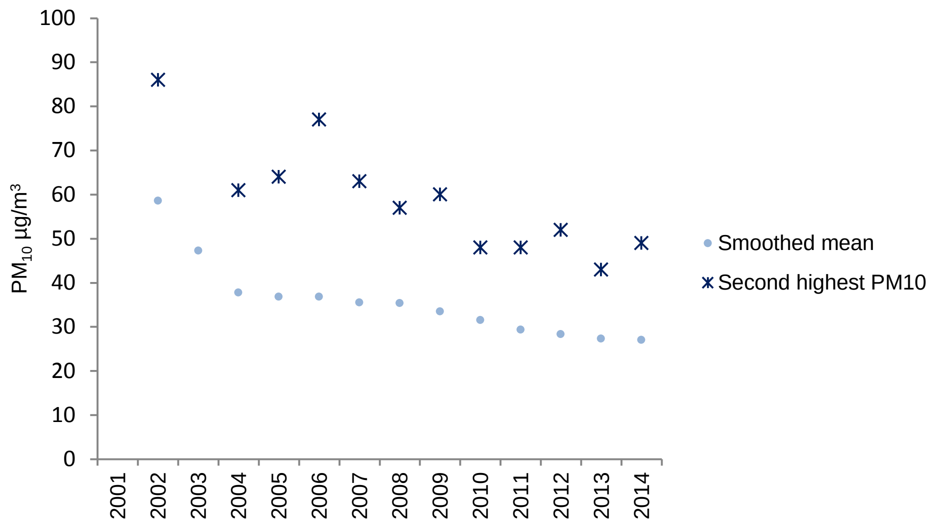

Figure 2.3: Comparison of second highest PM_{10} concentrations to the smoothed mean PM_{10} concentrations in Airshed B1 for days when meteorological conditions were conducive to high pollution.

Figure 2.3 suggests that 2006 was likely the worst case year for meteorological conditions (for the second highest PM_{10} concentration) in Airshed B1. The reduction in PM_{10} concentrations required based on the 2006 concentration of 77 µg/m^3 is 35% of 2006 concentrations (or 52% of 2002 levels). Trend analysis suggests that concentrations have reduced by slightly more than this amount in Airshed B1 since 2006 suggesting that the Airshed B1 may already be compliant with the NES. Further consideration of this is given in the projections analysis section of this report.

2.3 Airshed B2

The reduction required in PM_{10} concentrations in Airshed B2 was estimated at 24% based on air quality monitoring carried out in 2002. This monitoring indicated a maximum PM_{10} concentration of 66 µg/m^3. Higher concentrations were measured in 2004 at a site in Nayland Road. However, the site was located almost in the B1 part of the Airshed and therefore has not been included in this assessment. There is some uncertainty about the reduction required owing to limited monitoring data. Correlations with Airshed A suggest higher concentrations may have occurred in 2001 but it is possible that extreme events may also be worse. Air quality monitoring of PM_{10} in Airshed B2 has been carried out during 2010 at a site in Marsden Reserve (548 Main Road Stoke). The maximum measured PM_{10} concentration was 40 µg/m^3, which suggests that the site is likely to be compliant with the NES for PM_{10} (50 µg/m^3 – 24-hour average) and that no further reductions in PM_{10} concentrations are likely to be required.

2.4 Airshed C

Air quality monitoring in Airshed C has been carried out in a range of locations including Dodson Valley, The Brook and Halifax Street. The original reduction required in PM_{10} concentrations was set at 24% based on correlations between concentrations measured in Airshed C and those in Airshed A. These suggested a maximum PM_{10} concentration of 66 µg/m^3 was likely for the Brook. The most recent monitoring was carried out during 2008 and 2009 at Brook Street. This monitoring indicated a maximum PM_{10} concentration of 40 µg/m^3. It is likely that concentrations of PM_{10} in Airshed C are compliant with the NES for PM_{10} and that no further reductions in PM_{10} concentrations are required. The analysis section for Airshed C in this report focuses on Airshed capacity and the potential for rules prohibiting the installation of wood burners in new dwellings and existing dwellings using non-solid fuel alternatives. A key consideration also, however, is the contribution of emissions from Airshed C to Airshed A which requires further reductions.

3 AIRSHED A

3.1 Airshed Capacity

A further reduction in PM_{10} concentrations in Airshed A is required to meet the NES for PM_{10}. The reduction required has been estimated at around 14% of 2014 levels.

3.2 Baseline Assessment

3.2.1 Domestic heating

Baseline projections for domestic heating were based on the 2014 inventory assessment of households using different heating methods and fuels. Changes in the use of solid fuel heating with time was assumed to be minimal as most households will have replaced older more polluting wood burners with lower emission burners (NES burners) as required under the air plan. Some households may not have replaced older burners as required under the air plan and a small number of households with burners installed between 2000 and 2003 (when Council emission limits for wood burners came into effect) can legitimately use non NES compliant burners.

Typically an assessment of this type would include an assumption that households would replace wood burners at the end of their useful life (often assumed to be 15 or 20 years). In Nelson the replacement technology would currently be the same as the existing technology so no assumptions are made for improvements with time.

Assumptions underpinning the emissions and baseline emissions projections for domestic home heating are:

- An average emission factor of 4.5 g/kg for NES compliant wood burners.
- The average fuel use for wood burners in Airshed A is 18 kilograms per day (from Wilton, 2014).

3.2.2 Motor vehicles

Motor vehicle emissions were estimated based on the 2014 emission inventory assessment for Airshed A. The emission estimate of seven kg/day from the inventory is based on Ministry of Transport (MOT) data on VKTs by census area unit (CAU) and PM_{10} emission factors from the Vehicle Fleet Emission Model (VFEM version 5.0). The model was adapted for location specific vehicle fleet characteristics, an average vehicle speed of 42 km/hr and local average temperatures.

The 2021 motor vehicle emissions were estimated using the VFEM (version 5.0) with input data as per 2014 with the exception of the output year which was changed to 2021. The model estimates PM_{10} tailpipe emissions from the vehicle fleet will decrease by a third by 2021. Projections in vehicle kilometres travelled are difficult to extrapolate and in fact an evaluation of changes in VKT in Nelson since 2006 suggests no significant changes in VKTs in Nelson since 2006 (Wilton, 2014). A conservative approach would be to assume some increase in VKT in Airshed A by 2021. If the VKTs are estimated to increase by 10% by 2021 the PM_{10} emission estimate from motor vehicles for 2021 would be around five kilograms per day. If the VKT were estimated to increase by 50% by 2021 the PM_{10} motor vehicles emission estimate for 2021 would be around seven kilograms per day.

The projections include a value of five kilograms of PM_{10} from motor vehicles for 2021 based on the assumption of a 10% increase in VKT in Airshed A by 2021.

3.2.1 Industry

Industrial and commercial activities with PM_{10} emissions were assessed for 2014 in the 2014 emission inventory (Wilton, 2014). The Airshed A emission estimate was eight kg/day and was based on a total of seven industrial or commercial discharges (including school boilers) in the Nelson South area.

The 2021 industrial and commercial PM_{10} emissions were estimated based on the assumption of a zero percent increase in PM_{10} emissions from this source in Airshed A.

3.2.1 Natural sources – marine aerosol and soils

The contribution of natural sources (primarily marine aerosol and soil) to concentrations of PM_{10} in Airshed A was evaluated by Ancelet, Davy, & Trompetter, (2013). Spreadsheets of source apportionment outputs were provided by the authors for this study. These indicated average daily contributions of natural sources on days when PM_{10} concentrations were elevated of around 6.7 µg/m^3 of PM_{10}.

3.2.2 Other Airshed contributions

The baseline assessment also includes a contribution of 25% from Airshed C based on a 20-30% contribution indicated in Golder Associates, (2012). The contribution from other airsheds is much smaller on average but occasionally Airshed B2 does make a notable contribution. Because this is not consistent it has not been included in the baseline assessment. However a separate evaluation of the likely impact based on projected reductions in PM_{10} concentrations in Airshed B2 has been made to ensure potential impacts are considered.

3.3 Implementation of Air Plan

The status quo for Airshed A is full implementation of the existing air plan including compliance checks for households to ensure conversions to NES compliant burners have been carried out where required. Figure 3.1 compares the original air plan reductions adjusted for differences in emission factors (Wilton, 2014a) and the reductions in PM_{10} concentrations in Airshed A (after minimising for the impact of meteorology) and the 2014 emission inventory results (Wilton, 2014b). This shows good consistency in trends in PM_{10} between the different tools used to evaluate changes. It also provides perspective on the further reductions in PM_{10} to meet the NES relative to 2001 PM_{10} concentrations and emissions.

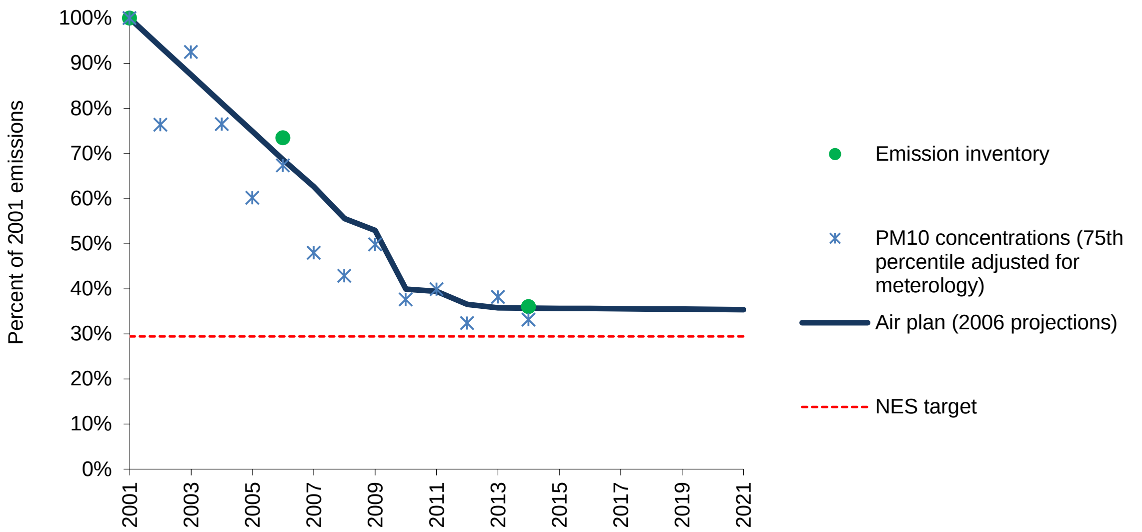

Figure 3.1: Comparison of original air plan projections for PM_{10} (adjusted for changes in emission factors) with trends in concentrations and emission inventory PM_{10} estimates for 2001, 2006 and 2014.

3.4 Phase out of non NES compliant wood burners

A number of burners that do not comply with the NES design criteria for wood burners (emission limit of 1.5 g/kg and efficiency of 65% when tested to NZS 4012 and 4013) can legitimately be used in the Nelson Airshed A area as a result of the final phase out date (burner installed between 2000 and 2003) being removed from the Air Plan after the 2011 review of the NES. The youngest of these burners will reach a 15 year life at the end of 2017. It is likely that some of these burners will be replaced through natural attrition around this time. However, including regulatory requirements around the upgrading or removal of these burners will provide greater certainty in achieving reductions in PM_{10}. Figure 3.2 shows the projected impact of this option on PM_{10} concentrations in Airshed A. While this option appears close to achieving the NES PM_{10} target at the St Vincent Street monitoring site, additional options should be considered to bridge the remaining gap and because of uncertainties in the projections.

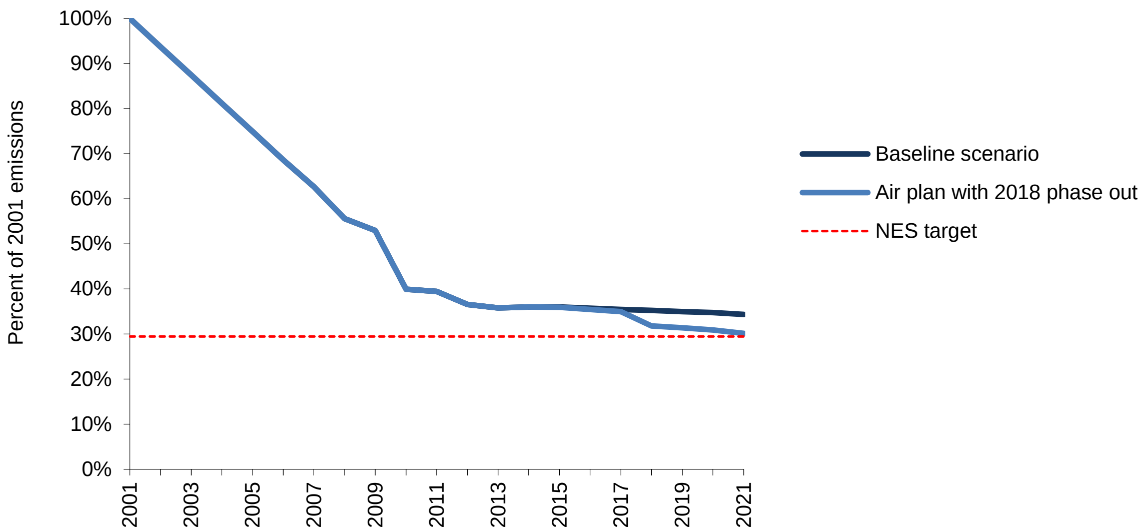

Figure 3.2: Projected improvement in PM_{10} concentrations in Airshed A as a result of phasing out wood burners installed between 2000 and 2003 in 2018.

3.5 Phase out non NES compliant wood burners and behaviour change programme

A behaviour change programme is a non-regulatory approach to reducing PM_{10} emissions from domestic home heating by changing burner operating behaviours. Environment Canterbury are in the process of developing a wood burner behaviour change programme which may be available to other Councils if funding documentation and development of the programme is obtained. The programme promotes the concept of a smoke free chimney with the key message being that no visible smoke is achievable if a burner is operated well. Advice on how to operate a burner to achieve a smoke free chimney has been well researched as have ways of affecting behaviour change. The advantages of this option are that significant reductions in PM_{10} emissions are possible through improvements in burner operation. Its effectiveness is difficult to quantify and depends on implementation and ongoing commitment of householders toward burner operation. Figure 3.3 shows the impact on projections for PM_{10} if a behaviour change programme were 10% and 20% effective in reducing PM_{10}. Figure 3.4 shows the same projections for at 2014 start point and projected to 2025.

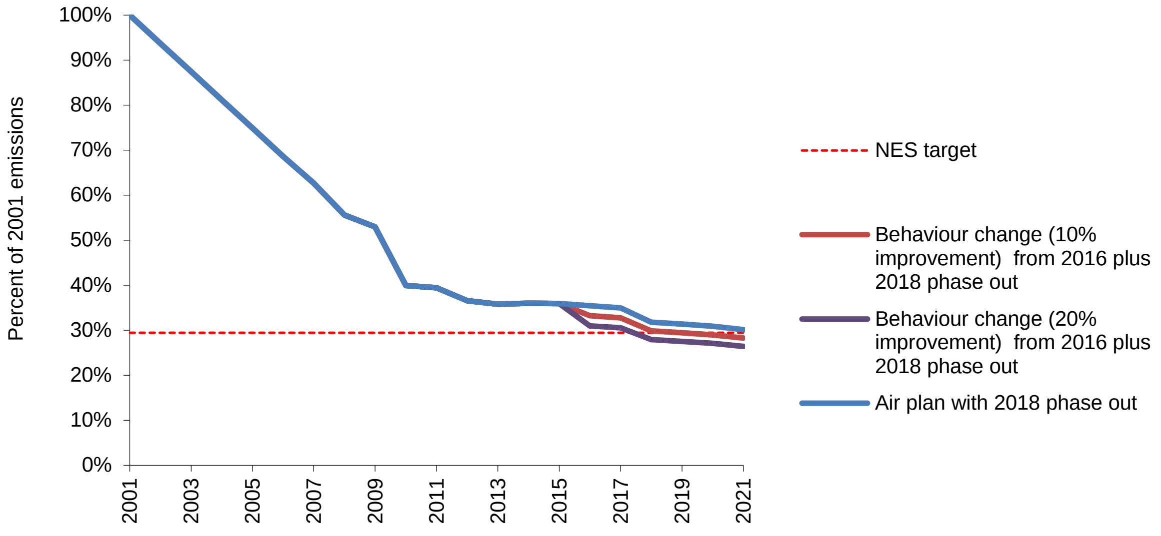

Figure 3.3: Projected improvement in PM_{10} concentrations in Airshed A as a result of phasing out wood burners installed between 2000 and 2003 and a behaviour change programme.

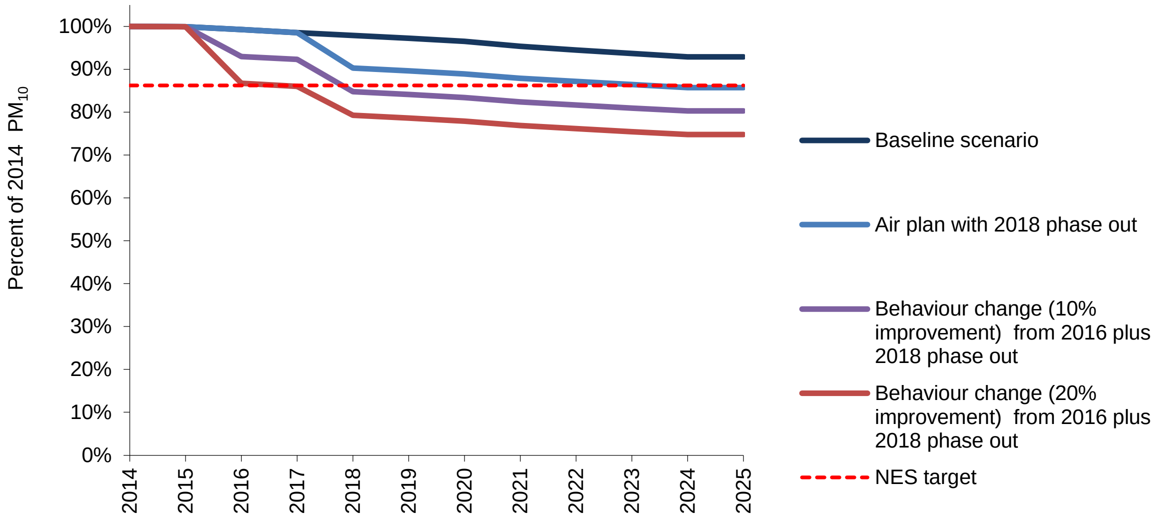

Figure 3.4: Projected improvement in PM_{10} concentrations in Airshed A as a result of phasing out non complying wood burners and a behaviour change programme (2014-2025)

3.6 Allow new installations of ultra-low emission burners

Figure 3.5 shows the impact of allowing new ultra low[2] emission burners into households in Airshed A including in new dwellings and existing dwellings using other heating options.

[2] An ultra low burner as defined by Environment Canterbury as one that meet an emission limit of 1.0 g/kg of particulate when tested to a "real life" test regime

The analysis illustrates projections for a maximum of 940 burners and assuming all households including new dwellings install ULEB. An emission factor of 1.0 g/kg was selected for the ULEB despite the test criteria being "real life" and an emission limit of 0.5 g/kg because of difficulties in developing a "real life" test regime. The 940 is based on the assumption that no more than 60% of dwellings in total in Airshed A would choose to use wood burners. Table 3.1 shows that 60% is the proportion of dwellings using wood in the early 1990s when wood burning was most popular.

In the 940 burner installation scenario the reduction that would have occurred as a result of a reduction in PM_{10} emissions from other sources (as indicated by the air plan (no last phase out) projection is offset by the increase in emissions from the installation of ultra-low emission burners (ULEB). The reduction in emissions from the status quo scenario occurs as a result of a decreasing contribution from Airshed C. If all households were to install ULEB burners emissions in Airshed A would increase.

Table 3-1: Proportion of households using wood for space heating

	1991	1996	2001	2006	2013
Airshed A	60%	56%	54%	46%	34%
Airshed B1	51%	48%	47%	42%	27%
Airshed B2	59%	55%	53%	43%	34%
Airshed C	51%	48%	46%	46%	36%

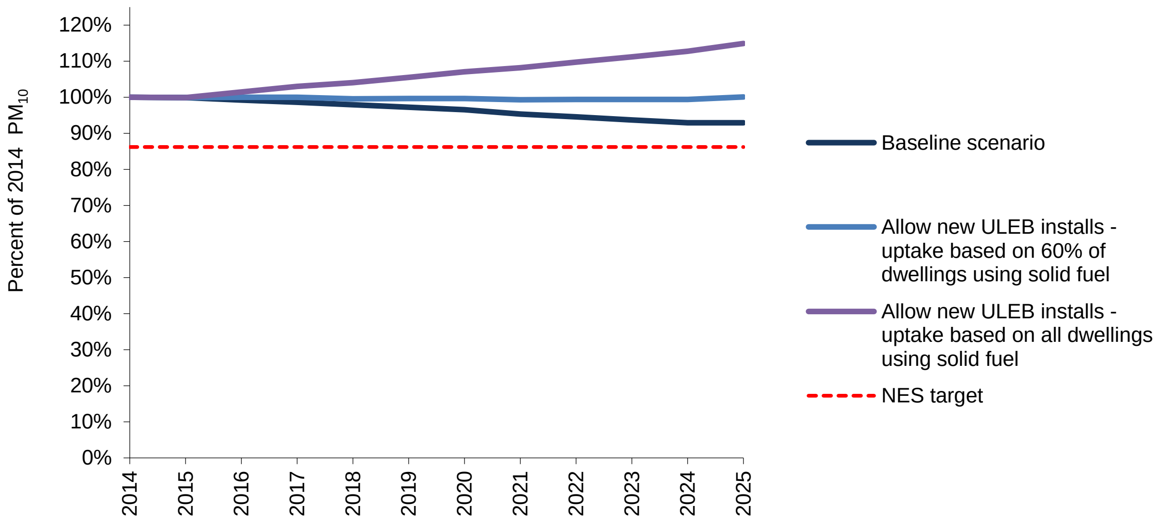

Figure 3.5: Allow the installation of ultra-low emission wood burners

Figure 3.6 shows the impact of the combination of phasing out non NES compliant wood burners in 2018 and allowing the installation of new ULEB burners in Airshed A (940 burner installation scenario). This suggests that the decrease in PM_{10} that may be achieved through the phase out of non NES compliant burners would be offset by the installation of new ULEB burners.

Figure 3.6: Phase out non complying wood burners and allow installation of ultra-low emission wood burners (limit 940)

The combination of the phase out of 2001-2003 wood burners, a behaviour change programme aimed at a 20% reduction in PM_{10} and allowing new installations of ultra-low emission burners (assuming an uptake of around 940 and an emission factor of 1 g/kg for these burners) is shown in Figure 3.7. This suggests that it may be possible to allow the installation of new ultra low emission burners in Airshed A if an education campaign to reduce PM_{10} emissions by 20% was successful and non-NES compliant wood burners were all phased out. However this would increase the risk of future non-compliance.

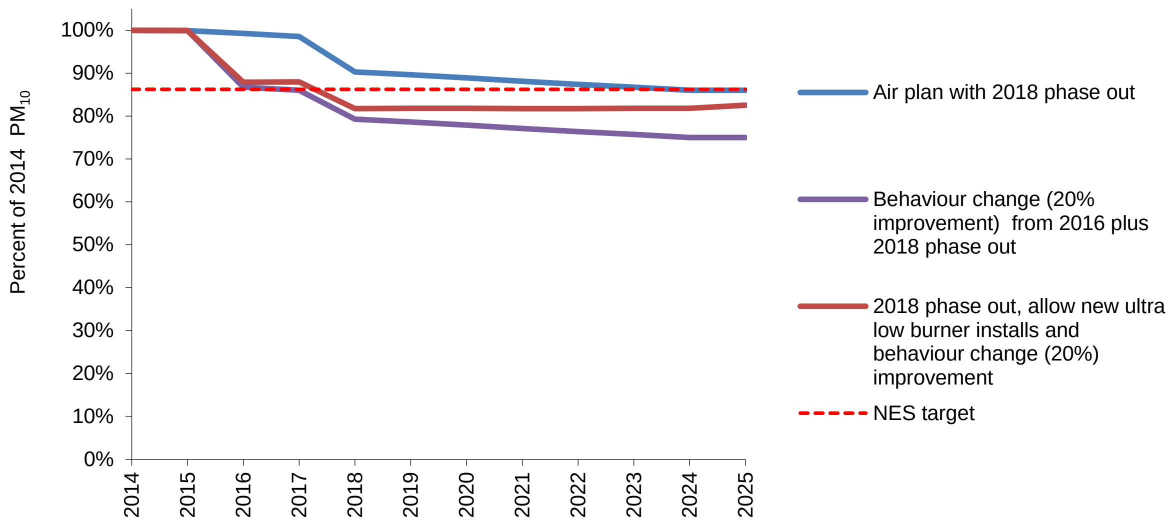

Figure 3.7: Projected improvement in PM_{10} concentrations in Airshed A as a result of phasing out non complying wood burners and a behaviour change programme (2014-2025) plus allow installation of ultra low emission wood burners (limit 940)

3.7 Phase out non NES compliant wood burners, retrofitting emission control technology and allow new installations of ultra-low emission burners

Figure 3.8 shows the estimated projections in PM_{10} relative to the NES target line if non NES compliant burners were phased out in 2018, emission control technology with a minimum of 30% effectiveness were introduced for all existing wood burners and if new ultra low emission burners were allowed in new dwellings or existing dwellings currently using other heating methods.

At present emission reduction technology suitable for domestic scale application is available (e.g., Oekotube). However there is uncertainty around its effectiveness with wood burners. Limited testing has been carried out by Environment Canterbury but further work is required. A value of 30% has been used in the modelling below as initial results would suggest that this technology may achieve this. Further confirmation is required. Emission test data from overseas test methods are seldom equivalent to the requirements of New Zealand testing, which includes collection of condensable particulate so any technology considered under this approach must be tested in accordance with New Zealand requirements.

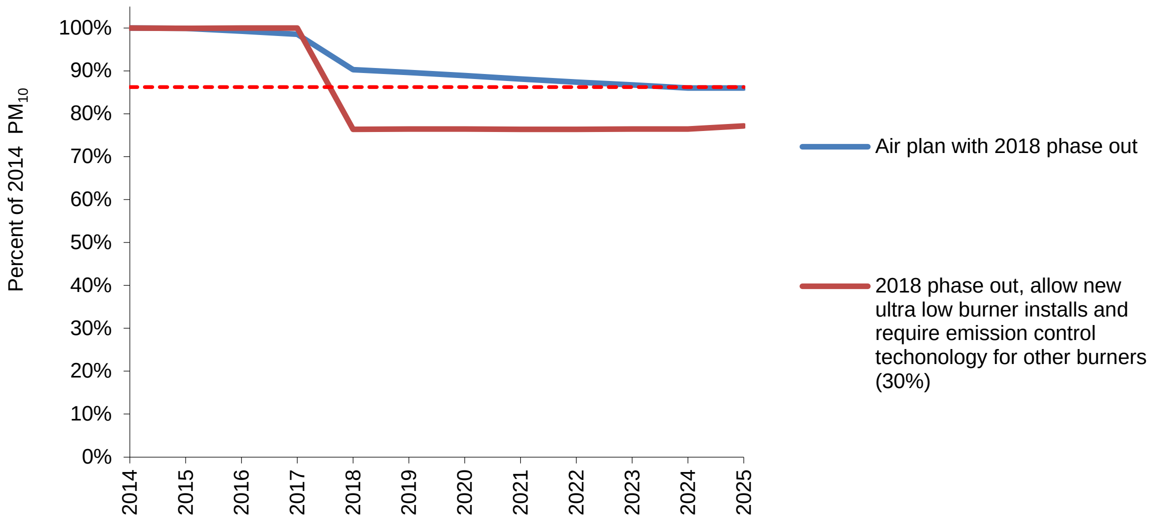

Figure 3.8: Phase out non complying wood burners, allow installation of ultra low emission wood burners (limit 940) and require all other burners install emission control technology capable of a 30% reduction in PM_{10}

3.8 Phase out existing burners and allow only replacement with ultra low emission burners

Figure 3.9 shows the impact of phasing out existing NES compliant wood burners (graph illustrates phase out dates of 2022 and 2025 for pre 2009 and 2009-2015 burners respectively) and allowing new ultra low[3] emission burners into households in Airshed A including in new dwelling and existing dwellings using other heating options. It assumes installation of a maximum of 940 burners in new dwellings and existing dwellings currently using other heating methods, that all households with NES compliant burners will replace them with ultra low emission burners and that the real life emission rate from these burners would be 1.0 g/kg of particulate on average.

[3] An ultra low burner as defined by Environment Canterbury as one that meet an emission limit of 1.0 g/kg of particulate when tested to a “real life” test regime

Figure 3.9: Phase out NES compliant wood burners (e.g., pre 2009 in 2022 and 2009-2015 in 2025) and allow replacement with ultra low emission wood burners

4 AIRSHED B1

4.1 Airshed Capacity

The reduction in PM_{10} concentrations required based on the 2006 concentration of 77 µg/m^3 is 35% of 2006 concentrations (or 52% of 2002 levels). Trend analysis suggests that concentrations have reduced by slightly more than this amount in Airshed B1 since 2006 suggesting that the Airshed B1 may already be compliant with the NES. Thus while there is unlikely to be any spare capacity for emissions in Airshed B1 it is possible that no further reductions are required. There is greater uncertainty around the assessment for Airshed B1 owing to the different nature of emissions sources in this Airshed. It is also important to note that the assessment relates only to typical winter high pollution days and that fugitive emissions not typically captured in emissions assessments result in breaches of the NES in Tahunanui on occasion including during non winter months and can contribute to NES breaches during the winter. Management of this source of emissions is not considered in this evaluation but must be carried out for the Airshed to achieve compliance.

4.2 Baseline Assessment

4.2.1 Domestic heating

Baseline projections for domestic heating were based on the 2014 inventory assessment of households using different heating methods and fuels. Changes in the use of solid fuel heating with time was assumed to be minimal as most households will have replaced older more polluting wood burners with lower emission burners (NES burners) as required under the air plan. Some households may not have replaced older burners as required under the air plan and a small number of households with burners installed between 2000 and 2003 (when Council emission limits for wood burners came into effect) can legitimately use non NES compliant burners.

Typically an assessment of this type would include an assumption that households would replace wood burners at the end of their useful life (often assumed to be 15 or 20 years). In Nelson the replacement technology would currently be the same as the existing technology so no assumptions are made for improvements with time.

Assumptions underpinning the emissions and baseline emissions projections for domestic home heating are:

- An average emission factor of 4.5 g/kg for NES compliant wood burners.
- The average fuel use for wood burners in Airshed B1 in Nelson is 20 kilograms per day.

4.2.2 Motor vehicles

Motor vehicle emissions were estimated based on the 2014 emission inventory assessment for Airshed B1. The emission estimate of four kg/day from the inventory is based on Ministry of Transport (MOT) data on VKTs by census area unit (CAU) and PM_{10} emission factors from the Vehicle Fleet Emission Model (VFEM version 5.0). The model was adapted for location specific vehicle fleet characteristics, an average vehicle speed of 42 km/hr and local average temperatures.

The 2021 motor vehicle emissions were estimated using the VFEM (version 5.0) with input data as per 2014 with the exception of the output year which was changed to 2021. The model estimates PM_{10} tailpipe emissions from the vehicle fleet will decrease by a third by 2021. Projections in vehicle kilometres travelled are difficult to extrapolate. A conservative approach would be to assume some increase in VKT in Airshed A by 2021. If the VKTs are estimated to increase by 10% by 2021 the PM_{10} emission estimate from motor vehicles for 2021 would be around three kilograms per day. If the VKT were estimated to increase by 50% by 2021 the PM_{10} motor vehicles emission estimate for 2021 would be around four kilograms per day.

The projections include a value of three kilograms of PM_{10} from motor vehicles for 2021 based on the assumption of a 10% increase in VKT in Airshed A by 2021.

4.2.3 Industry

Industrial and commercial activities with PM_{10} emissions were assessed for 2014 in the 2014 emission inventory (Wilton, 2014). The Airshed B1 emission estimate was 65 kg/day. The 2021 industrial and commercial PM_{10} emissions were estimated based on the assumption of a zero percent increase in PM_{10} emissions from this source in Airshed B1.

4.2.4 Natural sources – marine aerosol and soils

The contribution of natural sources (primarily marine aerosol and soil) to concentrations of PM_{10} in Airshed B1 was evaluated by Ancelet, Davy, Trompetter, & Markwitz, (2010). Spreadsheets of source apportionment outputs were provided by the authors for this study. These indicated average daily contributions of natural sources on days when PM_{10} concentrations were elevated of around 4 $\mu g/m^3$ of PM_{10} with a maximum contribution of around 6 $\mu g/m^3$. The latter value was used in this study owing to the small number of high pollution events during sample days.

4.2.5 Other Airshed contributions

The baseline assessment also includes a contribution of 50% from Airshed B2 based on modelling by Golder Associates (2012).

4.3 Implementation of Air Plan

Figure 4.1 compares the original air plan projections (updated for revised emission factors) with the trend in PM_{10} concentrations estimated in section two of this report, the emission inventory emission estimate for 2014 and the revised projections based on the inventory assessment. Data suggests this Airshed may be compliant with the NES as concentration reductions are just below the target and emission estimates about on target. Given the proximity of the line to the target and the uncertainties around the estimates further options for reducing PM_{10} are evaluated below.

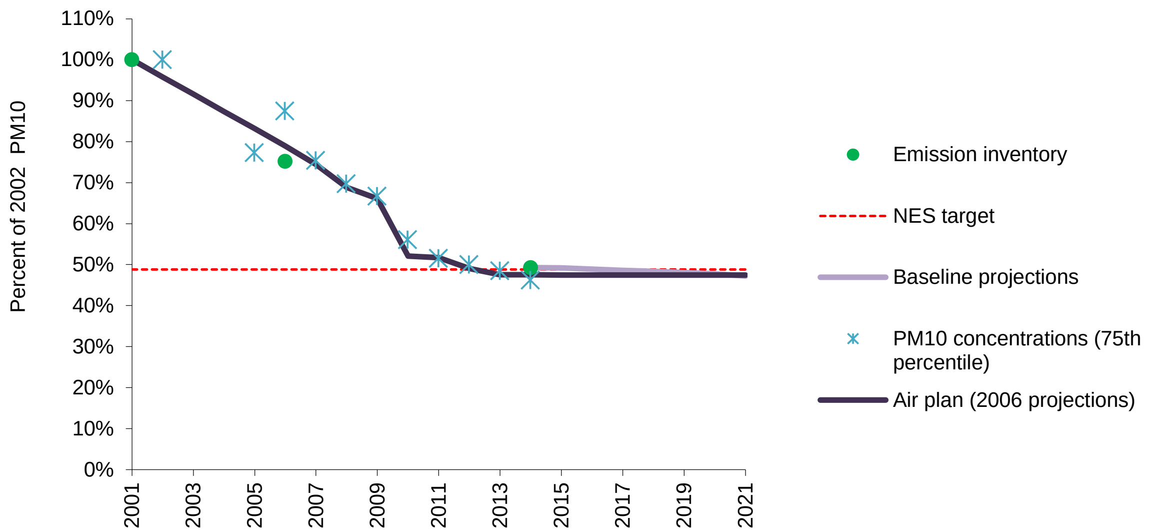

Figure 4.1: Comparison of trends in PM_{10} concentrations with original projections, 2014 emission inventory estimates and revised projections assuming no phase out of non NES compliant burners

4.4 Phase out of non-NES compliant burners

Figure 4.2 shows the estimated impact of phasing out non-NES compliant wood burners in Airshed B1 for two different phase out scenarios. The maroon line represents a 20 year replacement scenario whereby burners installed in 2001 are replaced by 2021 and those installed in 2003 are replaced in 2023. The alternative scenarios (in blue) is that modelled for Airshed A which is a phase out of all 2001-2003 burners in 2018.

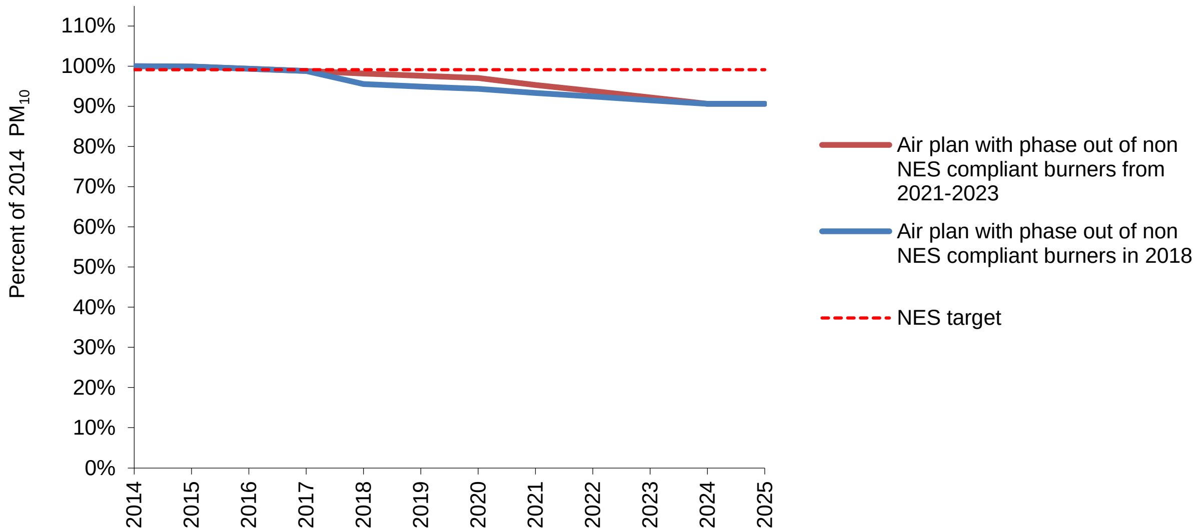

Figure 4.2: Phase out non-NES compliant wood burners in Airshed B1.

4.5 Phase out non NES compliant wood burners and implement behaviour change programme

The impact of a behaviour change programme with and without the phase out of wood burners installed between 2000 and 2003 is shown if Figure 4.3.

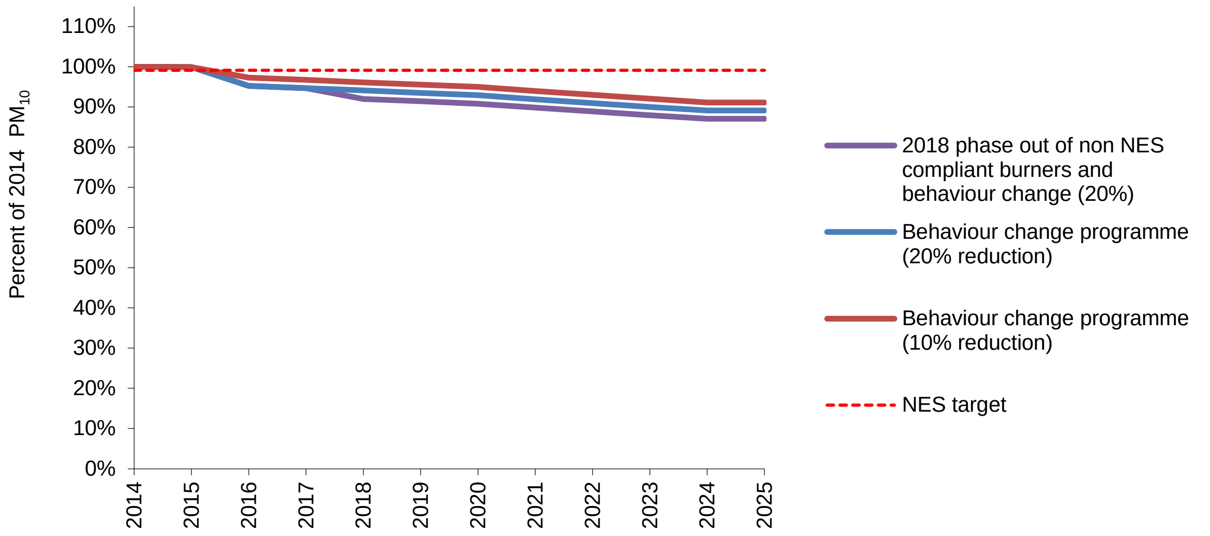

Figure 4.3: Behaviour change programme targeting a 10 and 20% reduction in PM_{10} emissions from domestic heating and combined with the phase out of non NES compliant burners.

4.6 New installations of ULEB burners

Figure 4.4 shows the impact of allowing new installations of ULEB burners in all households in Airshed B1 and based on a maximum of 51% of households using solid fuel (Table 3.1) an additional 316 households choosing to install ULEB burners in new dwellings and existing dwellings currently using other heating methods. The same scenarios combined with the phase out of non NES compliant burners is shown in Figure 4.5.

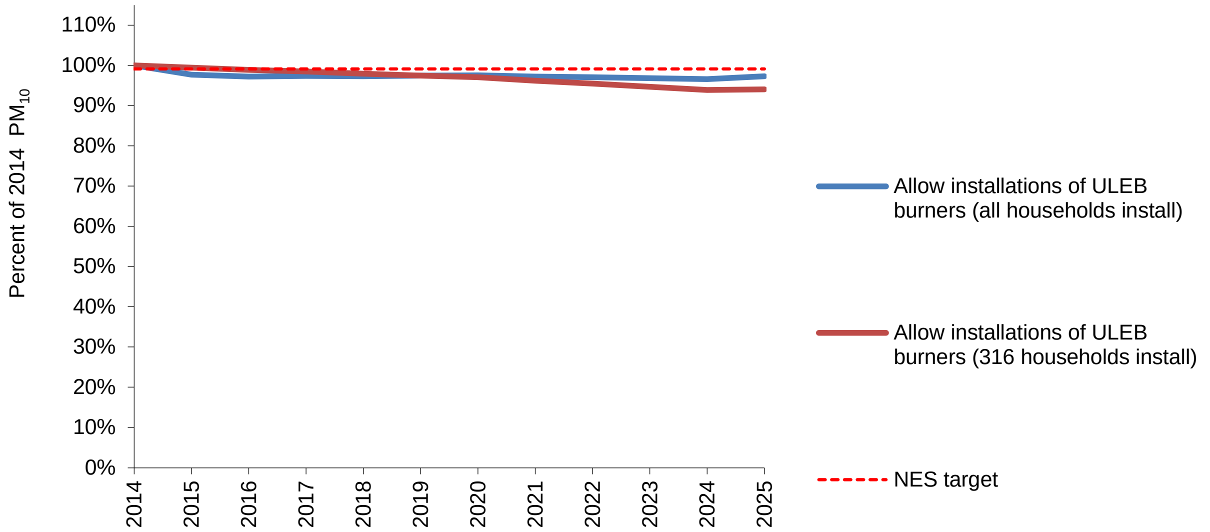

Figure 4.4: Allow the installation of ULEB burners.

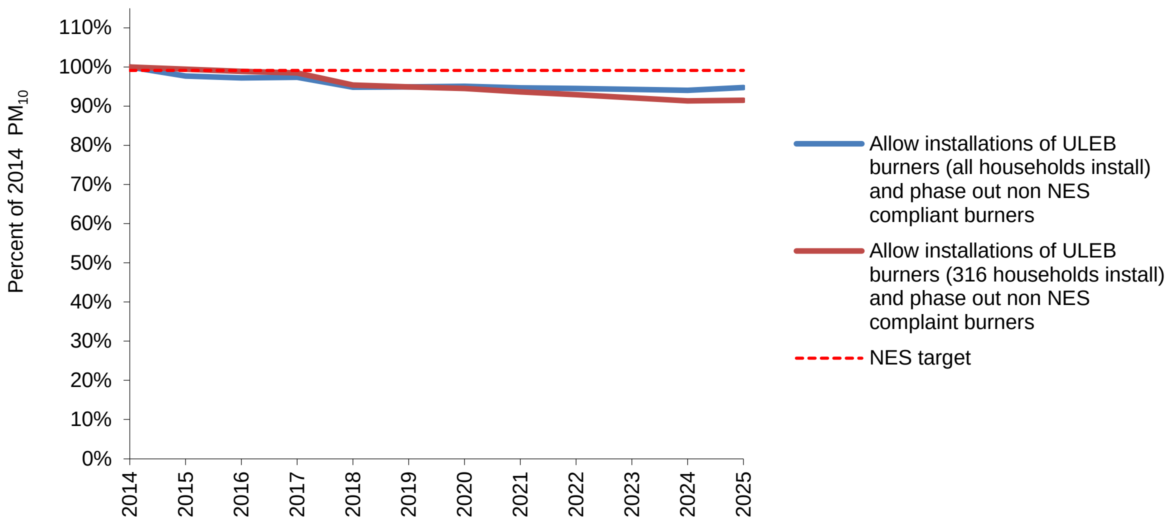

Figure 4.5: Allow the installation of ULEB burners and phase out non NES compliant burners.

4.7 Retrofitting emission control technology and allow new installations of ultra-low emission burners

Reductions in PM_{10} concentrations may be possible if emission control technology with a minimum of 30% effectiveness were available and introduced for all existing wood burners. The impact of this scenario is shown in Figure 4.6 with and without the phase out of non NES compliant wood burners (2001-2003 installations). The impact of allowing new ultra low emission burners in new dwellings or existing dwellings currently using other heating methods in conjunction with this option is also presented.

As indicated in section three emission reduction technology suitable for domestic scale application is available (e.g., Oekotube). However there is uncertainty around its effectiveness with wood burners. Limited testing has been carried out by Environment Canterbury but further work is required. A value of 30% has been used in the modelling below as initial results would suggest that this technology may achieve this. Further confirmation is required. Emission test data from overseas test methods are seldom equivalent to the requirements of New Zealand testing, which includes collection of condensable particulate so any technology considered under this approach must be tested in accordance with New Zealand requirements.

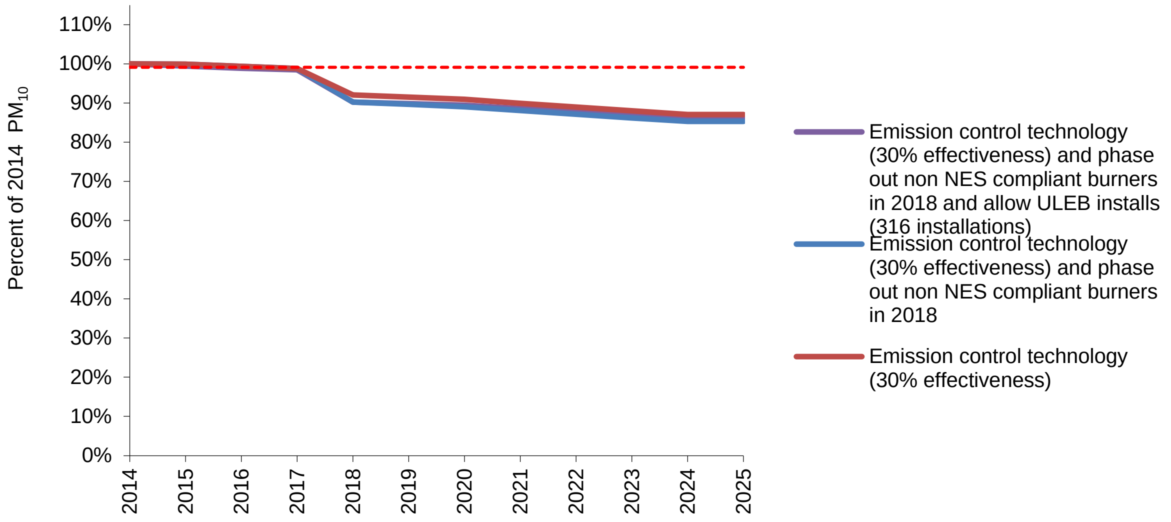

Figure 4.6: All existing non ULEB burners install emission control technology capable of a 30% reduction in PM_{10} in combination with a phase out of non NES compliant burners and allowing the installation of ULEB burners.

5 AIRSHED B2

5.1 Baseline Assessment

5.1.1 Domestic heating

Baseline projections for domestic heating were based on the 2014 inventory assessment of households using different heating methods and fuels. Under the Air Plan only burners installed prior to 1995 were required to be phased out. Typically these would have been assumed to have been replaced through natural attrition after 15 or 20 years. In the baseline scenario any existing wood burners in Airshed B2 that do not meet the NES design criteria emission limit of 1.5 g/kg are assumed to be replaced through natural attrition after 20 years.

Assumptions underpinning the emissions and baseline emissions projections for domestic home heating are:

- An average emission factor of 4.5 g/kg for NES compliant wood burners.
- The average fuel use for wood burners in Airshed B2 in Nelson is 18 kilograms per day.

5.1.2 Motor vehicles

Motor vehicle emissions were estimated based on the 2014 emission inventory assessment for Airshed B2. The emission estimate of 10 kg/day from the inventory is based on Ministry of Transport (MOT) data on VKTs by census area unit (CAU) and PM_{10} emission factors from the Vehicle Fleet Emission Model (VFEM version 5.0). The model was adapted for location specific vehicle fleet characteristics, an average vehicle speed of 42 km/hr and local average temperatures.

The 2021 motor vehicle emissions were estimated using the VFEM (version 5.0) with input data as per 2014 with the exception of the output year which was changed to 2021. The model estimates PM_{10} tailpipe emissions from the vehicle fleet will decrease by a third by 2021. Projections in vehicle kilometres travelled are difficult to extrapolate. A conservative approach would be to assume some increase in VKT in Airshed A by 2021. If the VKTs are estimated to increase by 10% by 2021 the PM_{10} emission estimate from motor vehicles for 2021 would be around seven kilograms per day. If the VKT were estimated to increase by 50% by 2021 the PM_{10} motor vehicles emission estimate for 2021 would be around 10 kilograms per day.

The projections include a value of seven kilograms of PM_{10} from motor vehicles for 2021 based on the assumption of a 10% increase in VKT in Airshed A by 2021.

5.1.3 Industry

Industrial and commercial activities with PM_{10} emissions were assessed for 2014 in the 2014 emission inventory (Wilton, 2014). The Airshed B2 emission estimate was eight kg/day. The 2021 industrial and commercial PM_{10} emissions were estimated based on the assumption of a zero percent increase in PM_{10} emissions from this source in Airshed B2.

5.1.4 Natural sources – marine aerosol and soils

The contribution of natural sources (primarily marine aerosol and soil) to concentrations of PM_{10} in Airshed B1 was evaluated by Ancelet et al., (2010). Spreadsheets of source apportionment outputs were provided by the authors for this study. These indicated average daily contributions of natural sources on days when PM_{10} concentrations were elevated of around 4 $\mu g/m^3$ of PM_{10} with a maximum contribution of around 6 $\mu g/m^3$. The latter value was used in this study owing to the small number of high pollution events on sample days and was applied also to Airshed B2.

5.1.5 Other Airshed contributions

The modelling carried out by Golder Associates (2012) did not evaluate contributions from other airsheds to PM_{10} concentrations in Airshed B2.

5.2 Airshed Capacity

Figure 5.1 compares the baseline projections including the emission inventory emission estimates. Because of limited PM_{10} monitoring at this site no trend analysis for PM_{10} concentrations is possible. However, the start point represents PM_{10} concentrations as does the 2010 point for the dashed grey line. Further monitoring is required to confirm the additional reductions predicted for the post 2010 period, particularly if management options that may use some Airshed capacity are considered.

The NES target illustrated in Figure 5.1 is based on a reduction in 2002 concentrations of around 24%. The second dashed blue line represents the maximum concentrations measured in 2010 of around 40 $\mu g/m^3$. Emission inventory data suggests concentrations have further reduced in Airshed B2 since 2010. If this "capacity" is to be used by allowing the installation of new burners into Airshed B2 it is recommended that only a proportion of the potential capacity be allocated for three reasons.

1. Monitoring in the Airshed is limited and it is possible that 2010 doesn't represent worst case meteorological conditions. There is therefore uncertainty around the magnitude of the capacity.
2. Health impacts data indicates that PM_{10} is a no threshold contaminant and a recent review by WHO suggests that guidelines for PM_{10} and $PM_{2.5}$ may be revised.
3. Dispersion modelling indicates that emissions from Airshed B2 contribute to PM_{10} concentrations in Airshed B1.

A possible approach to allocating capacity in Airshed B2 would be to set a limit at the 2010 emission levels (grey dashed line). However, before allocating this capacity it is recommended that one year of air quality monitoring be carried out at this site to ensure reductions in concentrations predicted by the emissions assessments illustrated in Figure 5.1 have occurred. In addition the impact on Airshed B1 should be considered (section 7).

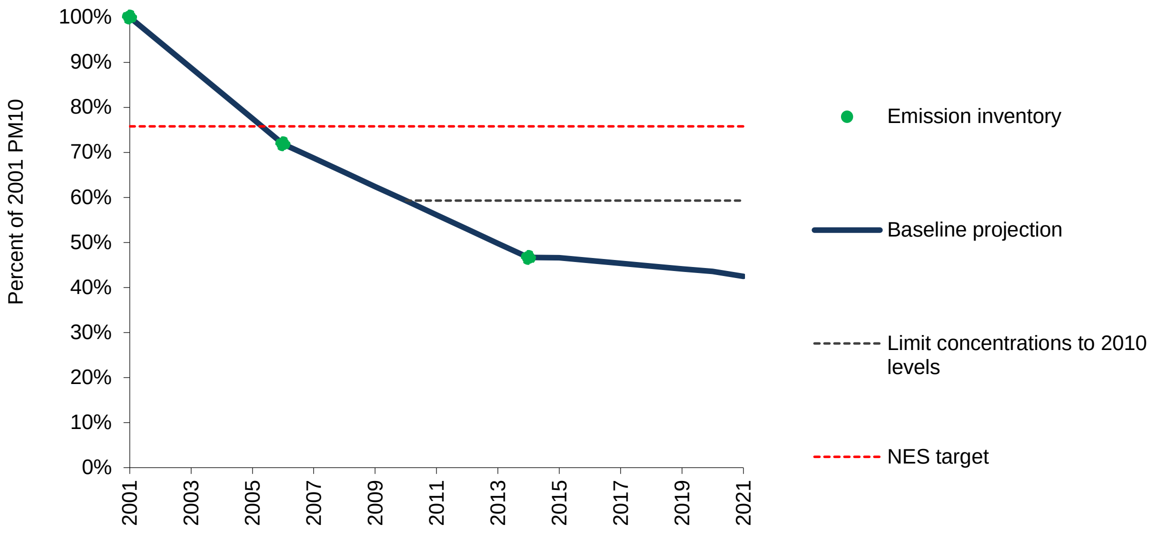

Figure 5.1: Comparisons of trends in PM_{10} emissions and concentrations (indicated by dashed line for 2010 levels) assuming no phase out of non NES compliant burners

5.3 Allow the installation of NES compliant burners

Figure 5.2 shows the estimated impact of allowing NES compliant wood burners in new dwellings and existing dwelling using other heating options in Airshed B2. A likely conservative estimate of the number of new installations can be made using the proportion of households with wood burners in Airshed B2 up to the 1991 proportion of 59% (1900 installations). The impact of all households in Airshed B2 using wood burners is also illustrated. This option would result in the installation of a further 3500 burners. The analysis indicates that there is some capacity for allowing the installation of NES compliant wood burners into Airshed B2 without compromising attainment of the NES for PM_{10}. However, the number of burner installations would need to be limited to around 1400 if the Airshed capacity was set at 2010 levels and 2400 if the Airshed capacity was set to the NES level of 50 µg/m^3 PM_{10}. If allocating Airshed capacity to allow for the installation of new burners into Airshed B2 is considered a number of broader issues should also be considered. These include health impacts of particulate pollution which occur at concentrations below the NES limit, potential for future revisions of guidelines, the potential for the introduction of $PM_{2.5}$ standards, annual average standards and likely compliance as well as the costs of not allowing new wood burners in this area.

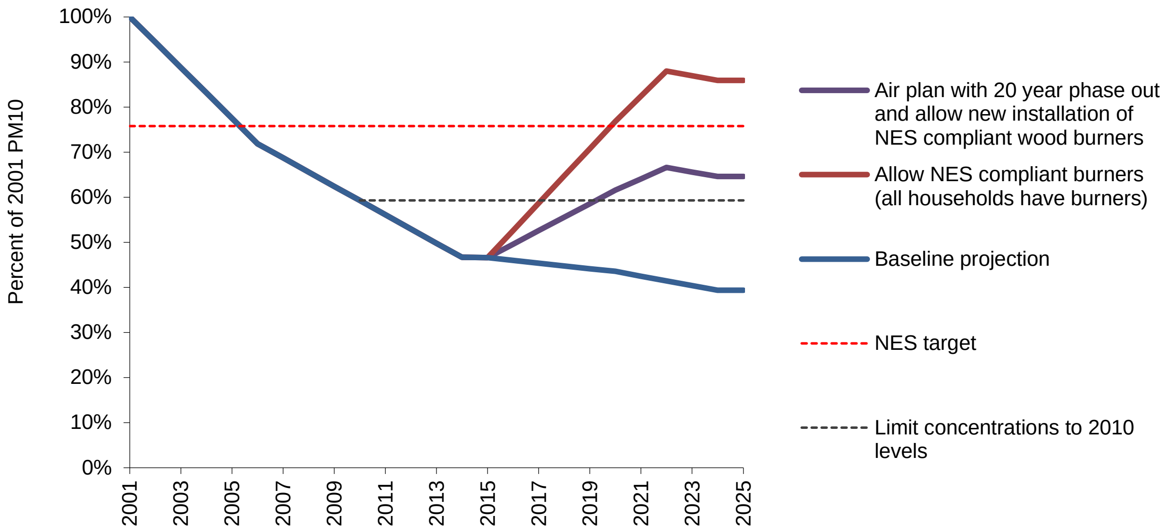

Figure 5.2: Allow installations of NES compliant wood burners in new dwellings and existing dwellings that currently use other heating methods.

5.4 Allow the installation of ultra low emission burners

Figure 5.3 shows the estimated impact of allowing ultra low emission wood burners in new dwellings and existing dwellings using other heating options in Airshed B2. As with the previous scenario, modelling has been carried out based on 1900 households that would not otherwise have been able to install a wood burner (ULEB) doing so and all households in Airshed B2 installing ULEBs. Both options are likely to be conservative in terms of the number of ULEB burner installations as it is likely that ULEB burners will more expensive to purchase than a standard wood burner.

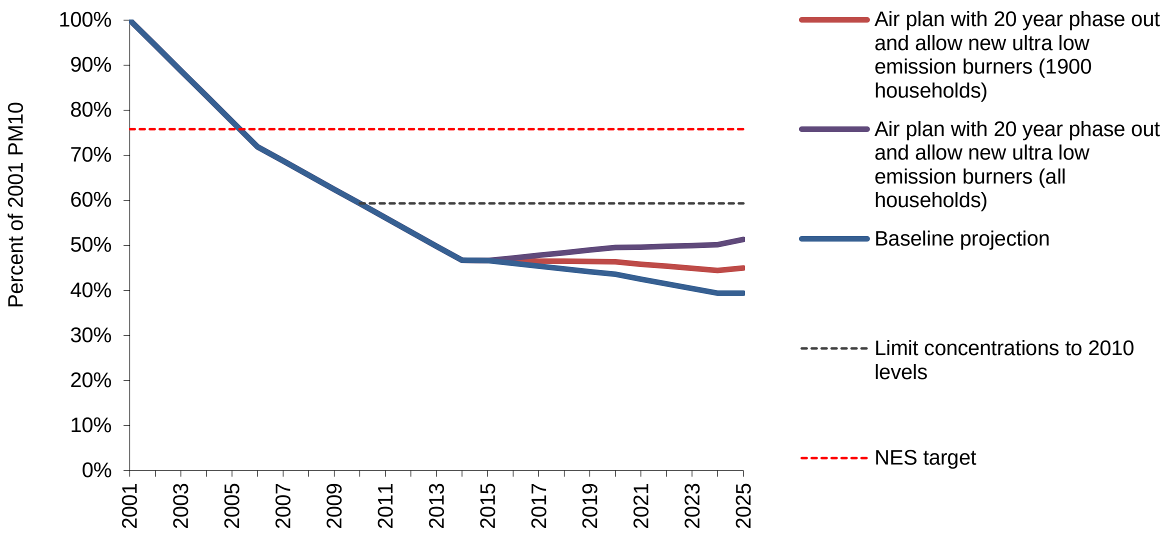

Figure 5.3: Allow installations of ultra-low emission wood burners in new dwellings and existing dwellings that currently use other heating methods in Airshed B2.

5.5 Implement behaviour change programme

The impact of improving PM_{10} emissions from domestic home heating by 10% or 20% through behaviour change programmes targeting visual emissions is illustrated in Figure 5.4. This shows additional improvements in PM_{10} concentrations in Airshed B2 which reduce concentrations further below NES targets. The impact of the behaviour change programme in conjunction with allowing households to install NES compliant burners assuming an upper limit of around 1900 burners would be installed is shown in Figure 5.5.

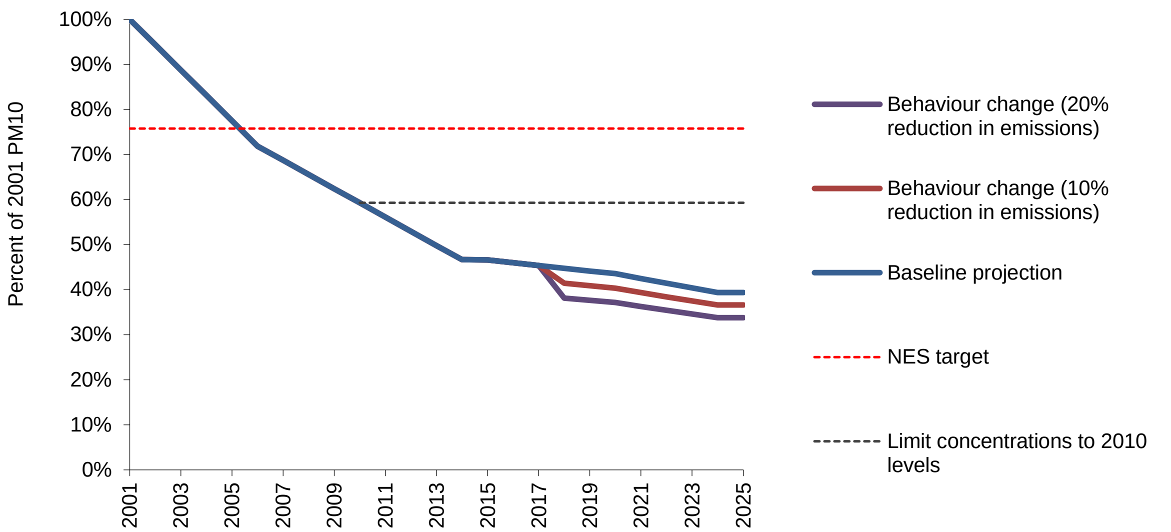

Figure 5.4: Implement behaviour change programme to reduce PM_{10} emissions by 10% and 20%

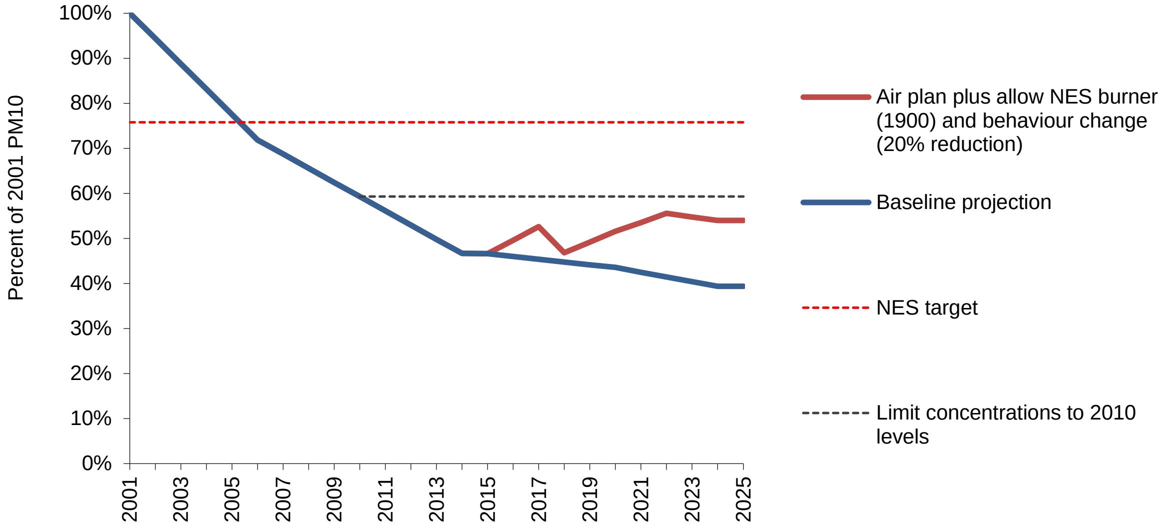

Figure 5.5: Implement behaviour change programme to reduce PM_{10} emissions by 20% and allow the installation of NES compliant wood burners in Airshed B2.

6 AIRSHED C

6.1 Baseline Assessment

6.1.1 Domestic heating

Baseline projections for domestic heating were based on the 2014 inventory assessment of households using different heating methods and fuels. Under the Air Plan only open fires were required to be phased out in Airshed C. In the baseline scenario any existing wood burners in Airshed C that do not meet the NES design criteria emission limit of 1.5 g/kg are assumed to be replaced 20 years after installation through natural attrition.

Assumptions underpinning the emissions and baseline emissions projections for domestic home heating are:

- An average emission factor of 4.5 g/kg for NES compliant wood burners.
- An average emission factor for pre 2004 wood burners of 9 g/kg.
- Around 618 households with pre 2004 wood burners as per the emission inventory survey.
- The average fuel use for wood burners in Airshed C in Nelson is 17.5 kilograms per day.

6.1.2 Motor vehicles

Motor vehicle emissions were estimated based on the 2014 emission inventory assessment for Airshed C. The emission estimate of eight kg/day from the inventory is based on Ministry of Transport (MOT) data on VKTs by census area unit (CAU) and PM_{10} emission factors from the Vehicle Fleet Emission Model (VFEM version 5.0). The model was adapted for location specific vehicle fleet characteristics, an average vehicle speed of 42 km/hr and local average temperatures.

The 2021 motor vehicle emissions were estimated using the VFEM (version 5.0) with input data as per 2014 with the exception of the output year which was changed to 2021. The model estimates PM_{10} tailpipe emissions from the vehicle fleet will decrease by a third by 2021. Projections in vehicle kilometres travelled are difficult to extrapolate. A conservative approach would be to assume some increase in VKT in Airshed A by 2021. If the VKTs are estimated to increase by 10% by 2021 the PM_{10} emission estimate from motor vehicles for 2021 would be around five kilograms per day. If the VKT were estimated to increase by 50% by 2021 the PM_{10} motor vehicles emission estimate for 2021 would be around seven kilograms per day.

The projections include a value of five kilograms of PM_{10} from motor vehicles for 2021 based on the assumption of a 10% increase in VKT in Airshed A by 2021.

6.1.3 Industry

Industrial and commercial activities with PM_{10} emissions were assessed for 2014 in the 2014 emission inventory (Wilton, 2014). The Airshed C emission estimate was five kg/day. The 2021 industrial and commercial PM_{10} emissions were estimated based on the assumption of a zero percent increase in PM_{10} emissions from this source in Airshed C.

6.1.4 Natural sources – marine aerosol and soils

The contribution of natural sources (primarily marine aerosol and soil) to concentrations of PM_{10} in Airsheds A and B1 were evaluated by Ancelet, Davy, & Trompetter, (2013). Spreadsheets of source apportionment outputs were provided by the authors for this study. These indicated average daily contributions of natural sources on days when PM_{10} concentrations were elevated of around 4 $\mu g/m^3$ of PM_{10} with a maximum contribution of around 6 $\mu g/m^3$ in Airshed B1 and an average of around 6.7 $\mu g/m^3$ in Airshed A. The latter value was used in this study for Airshed C to provide a more conservative approach.

6.1.5 Other Airshed contributions

The modelling carried out by Golder Associates (2012) did not evaluate contributions from other airsheds to PM_{10} concentrations in Airshed C.

6.2 Airshed Capacity

Figure 6.1 compares the baseline projections including the emission inventory estimates for Airshed C. Because of limited PM_{10} monitoring at this site no trend analysis for PM_{10} concentrations is possible. However, three points on the graph in 2001, 2008 and 2014 provide an indication of changes in maximum measured PM_{10} concentrations. These only provide a rough indication of potential changes in concentrations owing to year to year variations in the impact of meteorological conditions.

The NES target illustrated in Figure 6.1 is around 24% and is based on early measurements of PM_{10} in Airshed C with adjustments for worst case meteorological conditions based on relationships with Airshed A. The dashed blue line represents the maximum concentrations measured in 2008 of around 40 µg/m^3. Emission inventory data suggests concentrations have further reduced in Airshed C since 2010 and this is supported by monitoring data for 2014 which gave maximum concentrations around 20 µg/m^3 (per comm Paul Sheldon, 2014). The monitoring data suggests a greater reduction in PM_{10} concentrations than predicted by the inventory but this may occur as a result of less conducive meteorological conditions during 2014.

The analysis indicates there is additional "capacity" in Airshed C relative to the NES. If this is to be used by allowing the installation of new burners into Airshed C it is recommended that only a proportion of the potential capacity be allocated for three reasons.

4. Monitoring in the Airshed is limited and it is possible that 2008 doesn't represent worst case meteorological conditions. There is therefore uncertainty around the magnitude of the capacity.
5. Health impacts data indicates that PM_{10} is a no threshold contaminant and a recent review by WHO suggests that guidelines for PM_{10} and $PM_{2.5}$ may be revised.
6. Dispersion modelling indicates that emissions from Airshed C contribute to PM_{10} concentrations in Airshed A.

A possible approach to allocating capacity in Airshed C would be to set a limit at the 2008 emission levels (blue dashed line). However, before allocating this capacity, the impact on Airshed A should be considered (section 7).

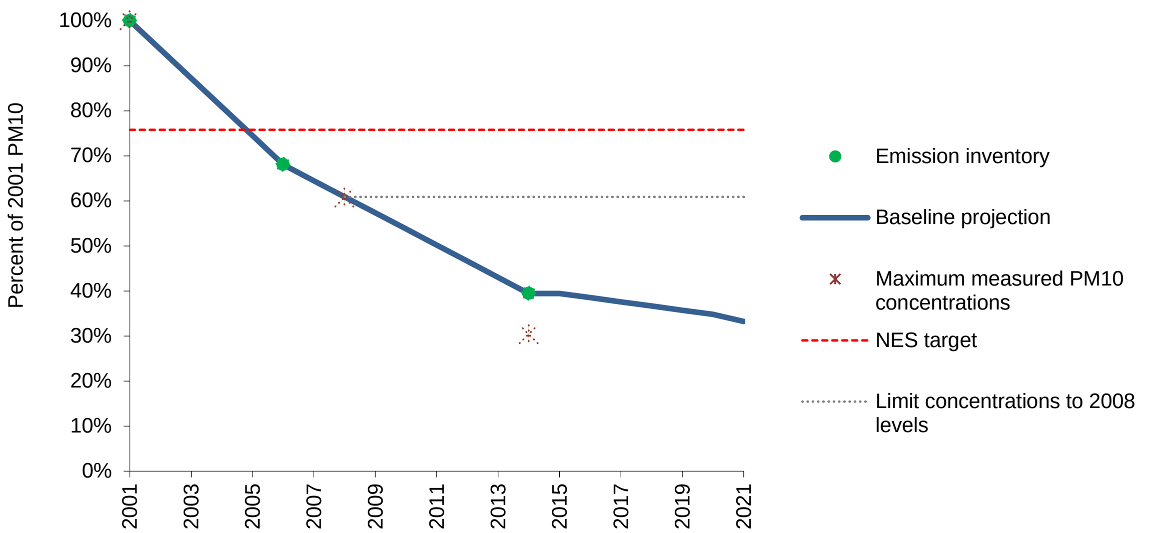

Figure 6.1: Comparisons of trends in PM_{10} emissions and concentrations (indicated by dashed line for 2008 levels) assuming no phase out of non NES compliant burners.

6.3 Allow the installation of NES compliant burners

The impact of allowing NES compliant wood burners in new dwellings and existing dwelling using other heating options in Airshed C is shown in Figure 6.2.

A likely conservative estimate of the number of new installations can be made using the proportion of households with wood burners in Airshed C up to the 1991 proportion of 51% (1900 installations). The impact of all households in Airshed C using wood burners is also illustrated. This option would result in the installation of a further 3500 burners. The analysis indicates that there is capacity for allowing the installation of NES compliant wood burners into Airshed C without compromising attainment of the NES for PM_{10} in Airshed C. However, consideration of the impact on Airshed A as well as a broader assessment of health costs and benefits would be required.

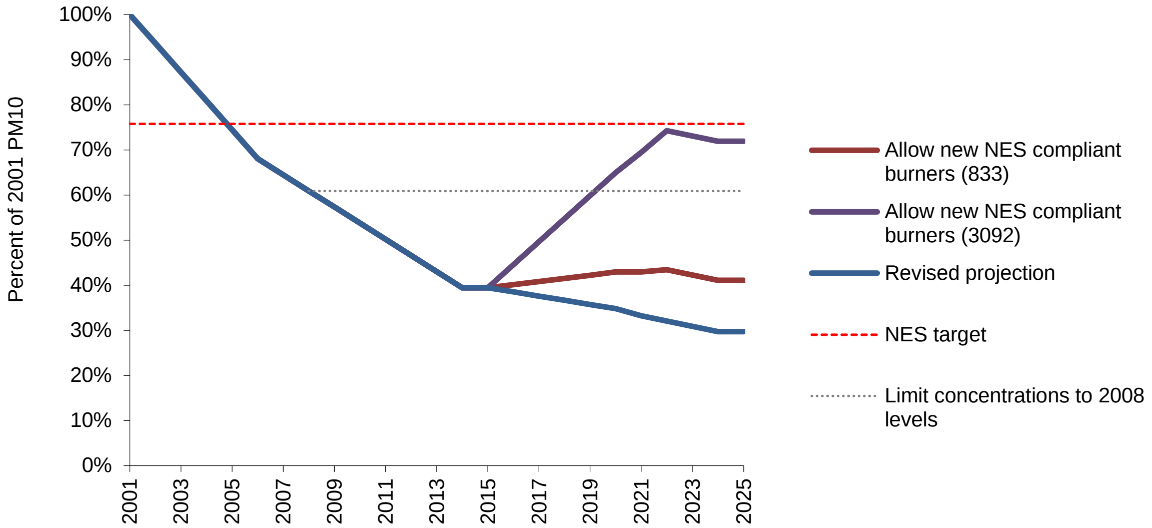

Figure 6.2: Allow installations of NES compliant wood burners in new dwellings and existing dwellings that currently use other heating methods.

6.4 Allow the installation of ultra -low emission burners

Figure 6.3 shows the estimated impact of allowing ultra-low emission wood burners in new dwellings and existing dwelling using other heating options in Airshed C. As with the previous scenario, modelling has been carried out based on 833 households that would not otherwise have been able to install a wood burner (ULEB) doing so and all households in Airshed C installing ULEBs. Both options are likely to be conservative in terms of the number of ULEB burner installations as it is likely that ULEB burners will more expensive to purchase than a standard wood burner.

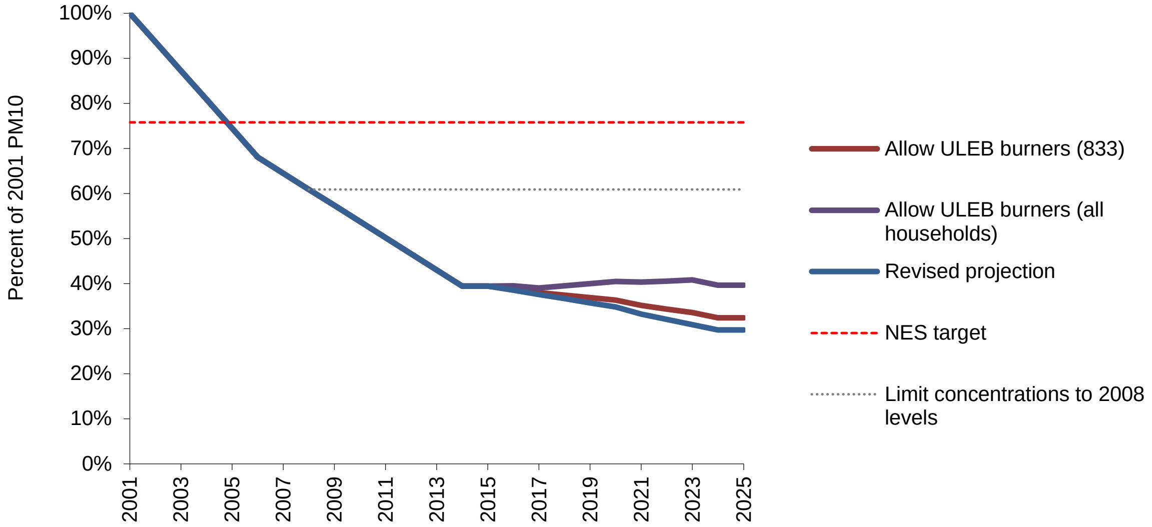

Figure 6.3: Allow installations of ultra-low emission wood burners in new dwellings and existing dwellings that currently use other heating methods in Airshed C.

6.5 Implement behaviour change programme

The impact of improving PM_{10} emissions from domestic home heating by 10% or 20% through behaviour change programmes targeting visual emissions is illustrated in Figure 6.4. This shows additional improvements in PM_{10} concentrations in Airshed C which reduce concentrations further below NES targets. The impact of the behaviour change programme in conjunction with allowing households to install NES compliant burners assuming an upper limit of around 833 burners would be installed is shown in Figure 6.5.

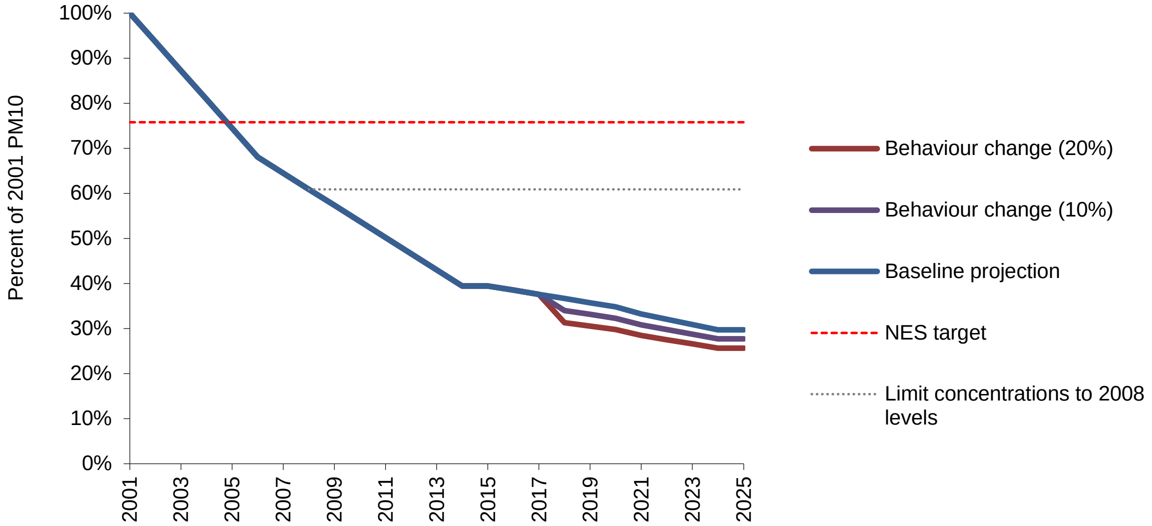

Figure 6.4: Implement behaviour change programme to reduce PM_{10} emissions by 10% and 20%

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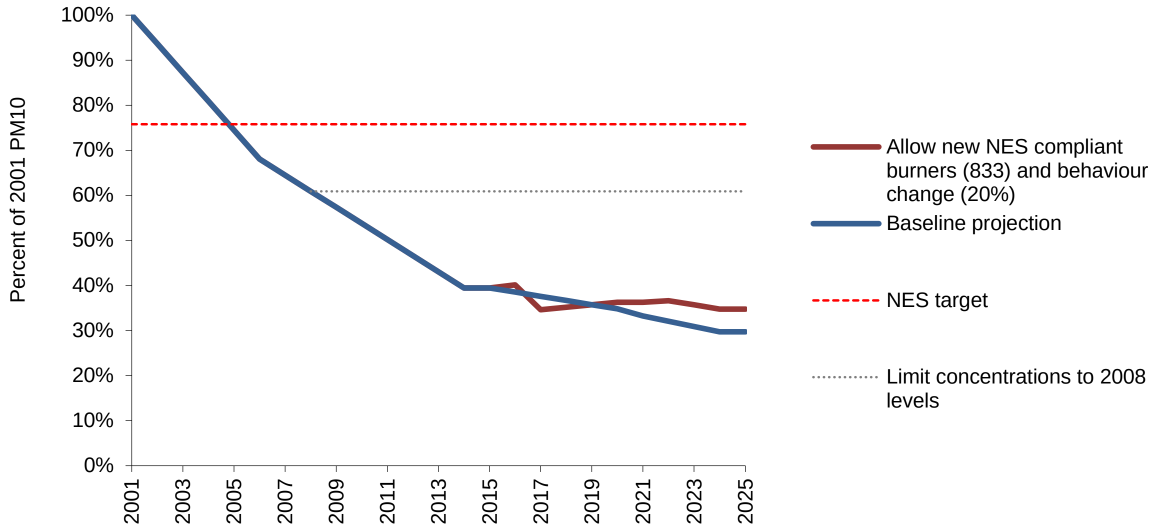

Figure 6.5: Implement behaviour change programme to reduce PM_{10} emissions by 20% and allow the installation of NES compliant wood burners in Airshed C.

7 IMPACTS OF ALLOWING NEW INSTALLATIONS OF NES COMPLIANT BURNERS IN B2 AND C ON AIRSHEDS A AND B1

7.1 Airshed A

The impact of allowing the installation of NES compliant wood burners in Airshed C on achievement of the NES in Airshed A is shown in Figure 7.1. The purple line (bottom line) represents the impact of a behaviour change programme that is effective in reducing PM_{10} concentrations by 20% in Airshed A in addition to phasing out burners installed prior to 2004 which are not compliant with the NES design criteria for wood burners. The Airshed C contributions to this line are based on the status quo for Airshed C which does not allow the installation of NES compliant wood burners in new dwellings or existing dwellings using other heating methods. The blue and maroon line represent the same management option for Airshed A (phase out of non NES compliant burners and behaviour change) but for different Airshed C scenarios. The maroon line represents a scenario for Airshed C where NES compliant burners are allowed (and 833 are installed) with no additional air quality management and the blue line the same Airshed C scenario except behaviour change is also implemented and is effective in reducing emissions from Airshed C by 20% also.

Results suggest that allowing NES compliant burners into Airshed C is unlikely to compromise NES compliance in Airshed A provided non NES compliant burners are phased out in Airshed A and a behaviour change programme is effective in reducing PM_{10} emissions by 20%.

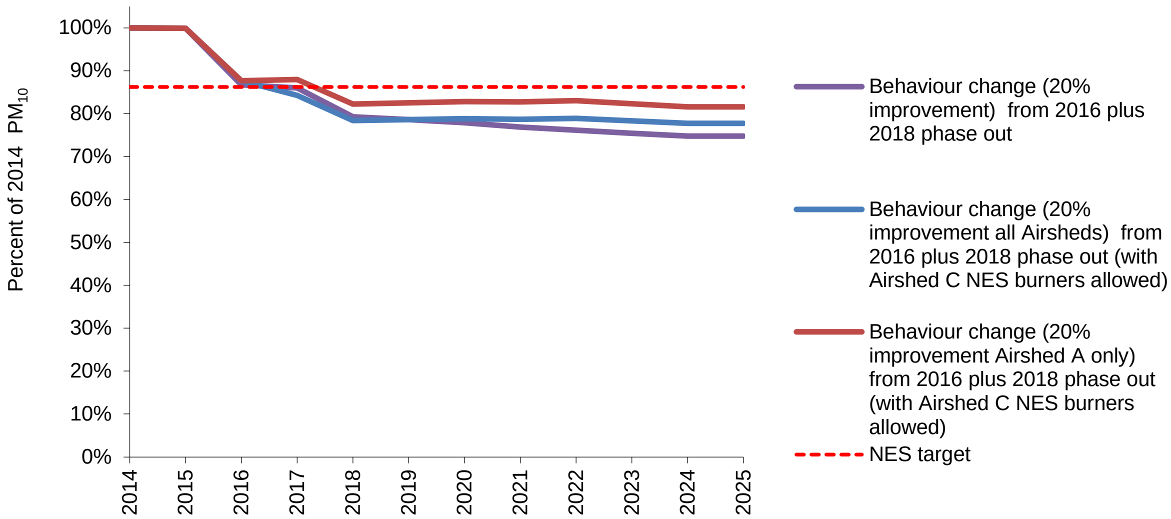

Figure 7.1: Implement behaviour change programme to reduce PM_{10} emissions by 20% and phase out non NES compliant wood burners in Airshed A and allow the installation of NES compliant wood burners in Airshed C.

7.2 Airshed B1

Air dispersion modelling for Nelson indicates emissions from Airshed B2 contribute to PM_{10} concentrations in Airshed B1. If regulations were changed to allow NES compliant wood burners or ULEBs into Airshed B2 there would be implications for Airshed B1.

An estimate of the impact of allowing the installation of NES compliant wood burners in Airshed B2 on achievement of the NES in Airshed B2 is shown in Figure 7.2.

Two scenarios show the impact of allowing the installation of NES compliant wood burners into Airshed B2 on PM_{10} concentrations in Airshed B1. In these scenarios relaxing the regulation for NES complaint burners in Airshed B2 compromises the attainment of the NES for PM_{10} in Airshed B1. The third scenario, allowing the installation of ULEB in Airshed B2 has minimal impact on PM_{10} concentrations in Airshed B1.

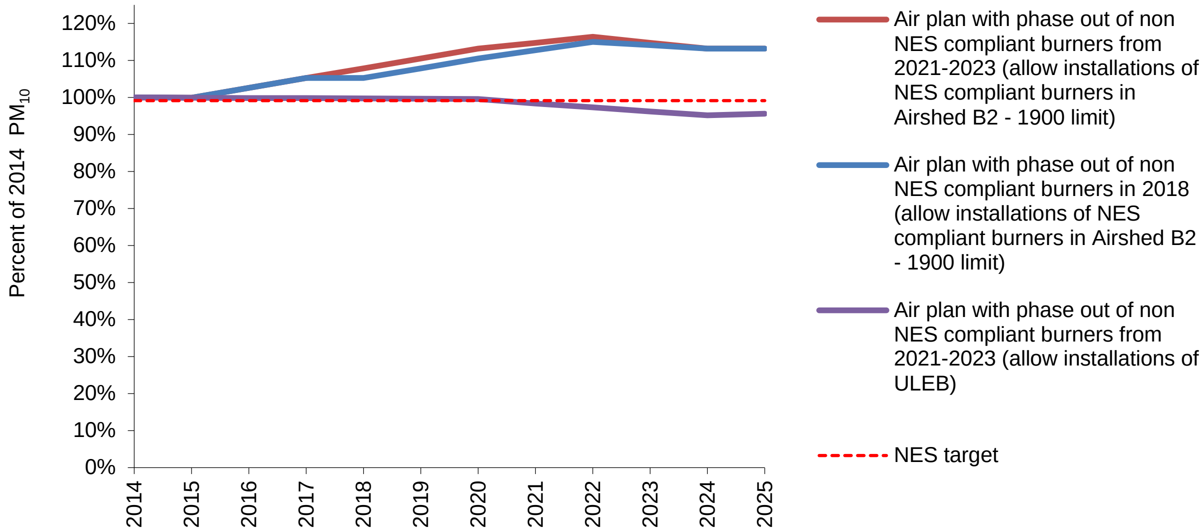

Figure 7.2: Impact of allowing the installation of NES compliant wood burners in new dwellings and existing dwellings using other heating options in Airshed B2 on PM_{10} in Airshed B1.

8 CONCLUSIONS

This report evaluates Airshed capacity relative to compliance with the NES for PM_{10} in four Airsheds in Nelson.

While significant reductions in PM_{10} concentrations have occurred in Airshed A since 2001, additional reductions of around 14% of 2014 emissions are estimated to be required to meet the NES for a worst case year in terms of meteorological conditions. This assessment is based on meteorological conditions experienced from 2001 to 2014 and it is possible that worse meteorological conditions could still occur.

An assessment of the effectiveness of management options for Airshed A indicates the following options may be sufficient to meet the NES for PM_{10} in Airshed A:

- Phase out of burners installed prior to 2004 that do not meet the NES design criteria for wood burners (remaining non compliant burners) and a behaviour change programme that is effective in reducing PM_{10} concentrations by 10% or 20%.
- Phase out remaining non-compliant wood burners and require NES compliant burners install emission control technology effective in reducing PM_{10} by 30%. Tests of emission control technology would need to be done to New Zealand testing protocols to ensure capture of condensable particulate.
- Phase out NES compliant wood burner and allow replacement with ULEB.

Airshed B1 is more complex in terms of source contributions. The modelling is based on a typical winters days with minimal contribution of dusts and natural sources of PM_{10}. However, breaches of the NES have occurred in Airshed B1 as a result of fugitive sources of particulate which appear to be dust type events potentially industry related. This source is not considered in this report but must be managed for ongoing compliance with the NES.

An evaluation of capacity in Airshed B1 suggests emissions may have reduced sufficiently and that further regulation may not be required. There are uncertainties in the assessment however, and further measures may be adopted to provide additional certainty of ongoing compliance. Options such as a behaviour change programme or phasing out of remaining non-compliant wood burners could be considered. Allowing the installation of NES compliant burners in new dwellings and existing dwellings using other methods of heating in Airshed B2 is very likely to compromise attainment of the NES in Airshed B1. Allowing the installation of ULEB burners in Airshed B2 is less likely to compromise attainment of the NES for PM_{10} in Airshed B1 but will result in some degradation of air quality in both areas.

All available evidence suggests reductions in PM_{10} concentrations in Airsheds C and B2 and compliance with the NES for PM_{10} as well as additional capacity relative to the NES for PM_{10}. In Airshed C there is capacity to allow households to install NES compliant wood burners with limited risk of breaching the NES. Reducing PM_{10} concentrations below the NES will have health benefits and allowing this capacity to be used by allowing the installation of NES compliant wood burners or ULEB burners may result in health impacts. These would need to be weighed against the benefits of allowing households to use wood as a fuel for home heating.

While up to 1400 NES compliant burners may be installed in Airshed B2 without compromising the NES, air flows from B2 to B1 on high pollution days and the increase in PM_{10} in Airshed B2 would compromise attainment of the NES for PM_{10} in Airshed B1. Allowing the installation of ULEB burners in Airshed B2 is less likely to compromise the NES for PM_{10} in Airshed B1 and may be able to be considered if management measures such as the phase out of remaining non-compliant burners and a behaviour change programme in Airshed B1.

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