

Non-road Diesel Air Emission Case Study



Figure 1: Blacktown City Council Rooty Hill Council Works Depot. Photo Courtesy of BCC.

Introduction

A modern bustling city of 48 residential suburbs, Blacktown City is home to 332,424 people, making it the largest city by population in NSW and the third largest council in Australia. Blacktown City Council (Council) employs nearly 2,000 staff and owns about 370 major plant items, 270 leaseback cars and approximately 1,000 minor plant items with the total plant and equipment worth approximately \$40 million.

Blacktown City Council depot

The Council depot is situated just north of the Rooty Hill station and was officially opened by Premier Wran on 3 September 1983. The depot houses council's plant, equipment, workshops, trades buildings, waste and administration. Council operates approximately 370 items of plant and equipment valued in excess of \$34 million.

'I am open to and will proactively implement any program and/or new equipment that will reduce emissions.'

JON BANNISTER,
Manager Plant & Energy Blacktown City Council

Context and key drivers

In 2008 Council launched its City Vision Blacktown City 2030 that provides a strategic framework for Council to operate within over the next decade and beyond. A key outcome of Blacktown City 2030 was the development of the Blacktown Environmental Sustainability Framework in 2010. Blacktown City Council's Environmental Sustainability Framework encompasses many of the established environmental policies of Council, identifies future emerging environmental issues, and includes partnerships and collaborative approaches. The Environmental Sustainability Framework outlines Council's plan of action for implementing the broad principles of the environmental sustainability focus areas of Blacktown City 2030; one being related to Council assets as follows: 'When considering the procurement of plant and equipment consider the most practical, economical and environmentally sustainable option'.

Council has also made a public commitment to ensure the health, safety and welfare of workers and others at Council. Council is committed to providing a safe and healthy working environment for its workers by providing information, instruction, training and supervision as may be necessary to ensure health and safety of its employees at work. Council has also committed to maintain its plant and equipment so that it is safe and without risks to health when used appropriately.

Diesel equipment has been an integral part of council's plant and fleet vehicles. Council has been cognisant of evidence linking diesel combustion and emissions of diesel particulate matter, specifically fine particles having an aerodynamic diameter of less than 2.5 micrometres (PM2.5), to adverse human health impacts. These fine particles can be transported deep into the alveoli of the lungs and may cause effects ranging from acute effects, such as respiratory irritation and neurophysiological symptoms, to chronic effects such as chronic respiratory inflammation and lung cancer. Council has responded by addressing potential air quality impacts from diesel emissions from their non-road diesel fleet to minimise impacts on the community, environment and workers.

In keeping with its commitment to ensure the health, safety and welfare of its workers and deliver practical and environmentally sustainable solutions for council and community, Council has implemented a number of measures leading to a consistent reduction of its fleet's diesel emissions over time.

A manager's perspective

Jon Bannister Manager, Plant & Energy Blacktown City Council



Figure 2: Jon Bannister, Manager Plant & Energy. Photo Blacktown City Council

'My initial focus was on minimising health impacts on council workers and the community in Western Sydney, and also having an audited maintenance system ensuring we are incorporating best practice, in line with the NSW Government's Clean Fleet Initiative, which we were the inaugural council to join. This provided me with a lever to look at other processes and make recommendations to improve our leaseback fleet emissions by offering incentives (lower fees) for smaller cars and/or fuel efficient cars to staff. When I was introduced to the Clean Machine Program, it was in-line with what we had already been working on. We did quite a bit of work, some of which took time to implement, but we achieved the goal of reducing our diesel emissions. I am open to and will proactively implement any program and/or new equipment that will reduce emissions. My current venture is staff education and training being delivered through a series of toolbox talks by our driver educator.'



Figure 3: Entrance to Blacktown City Council's Rooty Hill works depot

Diesel management strategies

From 2008 to 2015, Council implemented a host of measures, some with support from various initiatives including the [NSW Government's Cleaner Fleet Initiative](#) and the [EPA's Clean Machine Program](#). The projects included:

- Retrofitting a number of non-road plant equipment with partial Diesel Particle Filters to a reduction in diesel exhaust emissions up to 50% from in-service equipment. These reductions should generally last the remaining life of the equipment or vehicle provided they are maintained properly.
- Retrofitting older on-road vehicles with Diesel Oxidisation Catalyst (DOC) converters to upgrade to Euro 4 emission standards. This included retrofitting twenty-two vehicles.
- Reducing the use of diesel by introducing bio-fuel B20 (20% biodiesel and 80% petroleum diesel) for 30 different types of plant and vehicles.
- Conducting bulk fuel filtration by attaching filters to the B20 fuel bowsers so filtering fuel to 2 micron (normal engine fuel filters are about 10 micron).

Procurement of new equipment and retrofitting older equipment

Council decided in 2011 that its non-road plant and equipment should meet USEPA Tier 4/EU Stage IV and on-road fleet vehicles meet Euro 4 emissions standard where practicable. Council ensured new tenders included a weighting which preferred the highest EU or US emissions standard available for non-road plant and equipment, including that supplied, hired and operated by contractors. To reduce overall particle emissions from in-service diesel plant and equipment the council retrofitted DOC's on a number of older diesel machinery. The retrofitting of technology was partially supported by a range of programs run by the NSW Government, including the EPA Clean Machine Program.

In order for the diesel retrofit program to be successful, factors considered were the vehicle's age and type, mechanical condition, emission performance levels and the remaining life of the equipment. If the vehicle was nominated for replacement within the current financial year, no action was taken to fit filters. Retrofit of diesel equipment alone saved about 105 kilograms of diesel PM emissions per year from Blacktown's non-road plant equipment as shown in Table 1.

Machine	Year	Machine make/model	Horsepower (Hp)	Annual PM emissions (kg/year)	Annual PM reduction (kg/year)
Mitsubishi grader	1999	MGO 430-E	157.76	33.73	16.87
Kolbelco excavato	2006	SK210-6	149.6	10.32	5.16
Caterpillar grader	2002	120H	141.44	21.74	10.87
John Deere backhoe	2004	315 SG	93.84	13.22	6.61
John Deere backhoe	2004	315 SG	93.84	5.18	2.59
John Deere backhoe	2004	315 SG	93.84	11.65	5.83
Caterpillar backhoe	2001	428D	84.32	13.42	6.71
Caterpillar backhoe	2001	428D	84.32	5.43	2.72
Caterpillar backhoe	2001	428D	84.32	18.96	9.48
Isuzu Swatz street sweeper	2006	FRR500	175.44	24.06	12.03
Street auxillary motor	2006	VM	126.48	10.55	5.28

Table1: Reduction of DPM emissions from Blacktown City Council plant equipment. Source: Environment Protection Authority

Sweeper aux motor



Sweeper main exhaust motor



Figure 4: Partial Diesel Particulate Filters fitted to a Blacktown City Council street sweeper; main and stationary engine. Photo: John Bannister, Blacktown City Council

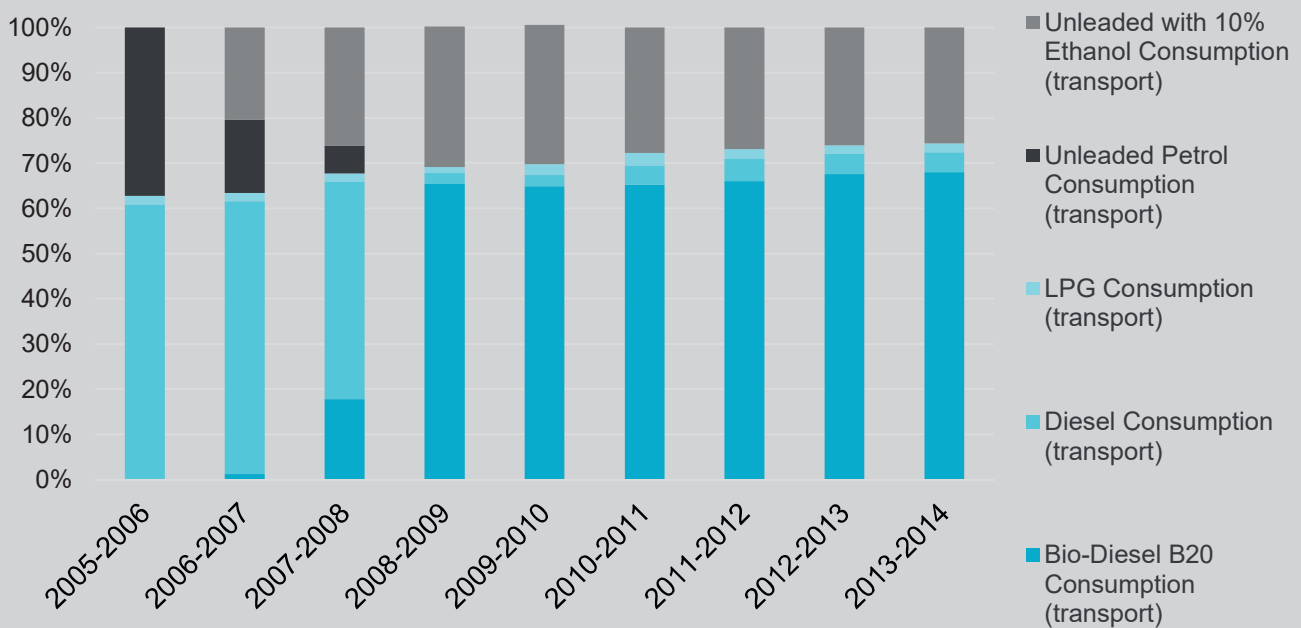


Figure 5: The reduction in the use of diesel for Blacktown City Council plant and fleet vehicles from 2005 to 2013 due to the switch to B20. Source: Blacktown City Council

Substitution of diesel with biodiesel

In 2007, Council identified that a reduction in diesel fuel use could be an effective first step towards reducing diesel emissions. Particle emissions from plant or machinery using B20 are known to reduce by at least 10%. A trial was conducted where B20 was used by 30 plant and fleet vehicles. The trial results showed a high reduction in diesel emissions without impacting on fuel consumption or equipment efficiency. In 2008, Council extended its use of B20 to all 370 of council's plant and vehicles. For fleet, E10 (ethanol-based unleaded petrol) was introduced to all unleaded petrol cards except those using small diesels and was monitored using fuel cards.

Proactive maintenance and scheduled replacement program

Council has in place an audited best-practice fleet management system. This system ensures that diesel plant and equipment are regularly inspected and maintained, fuel consumption is reported and poorly performing equipment is promptly repaired. Council has a scheduled replacement program for both minor and major diesel equipment.

Council also introduced bulk fuel filtration to encourage consistent and reliable diesel engine operation. Water and particulates can impact engine service life and performance

by being abrasive to fuel system and engine components. A major cause of this fuel contamination occurs during the fuel handling process. Prevention of water and particulates from entering through the transport and storage process is extremely difficult.

Additional filters were attached to the B20 fuel bowsers filtering fuel to 2 microns. Normal engine filters filter fuel to about 10 microns. This avoided the need for contamination removal from on-engine filters resulting in fewer emergencies, fuel maintenance incidents and extending vehicle operational time. Also, by adding bulk fuel filtration, the fuel was cleaner, offering increased protection to critical and sensitive diesel engine components such as fuel injectors and control valves.

Diesel awareness training

Implementing a diesel emission reduction program would be incomplete if the equipment is not used appropriately. Driver and staff awareness of the reasons behind these measures is another key factor that helps reduce emissions. An administrative program was implemented for broader engagement with depot staff that resulted in development of a regular driver training and a toolbox meeting schedule to bring all vehicle drivers and equipment operators on-board with the changes.

In 2015, Council introduced regular toolbox meetings and employed a driver and equipment operator educator to keep staff using the vehicles and equipment up to date on the emissions reduction projects implemented by Council and the appropriate use of both retrofitted and new equipment. Toolbox meetings are held weekly and attended by all operational staff. They are delivered by the driver educator.



Figure 7: Idling prevention stickers around the depot



Figure 6: Idling-free zone reminders



Figure 8: Blacktown City Council's windshield stickers for non-road plant and equipment reminding drivers to alter their operating behaviours. Photos: Jon Bannister. Blacktown City Council

Achievements

The combined retrofit efforts of Council and their contractors have resulted in a continual reduction of particle emissions per annum in the Blacktown area. The new and on-going initiatives including more driver/operator awareness, are contributing to improving air quality in Western Sydney and in turn benefitting the health of council's workers and the community.

Since 2008, Council has introduced a variety of measures to reduce diesel emissions and continually implemented any improvements based on past mistakes. This has led to amendment of Council's procurement guidelines for new and hired equipment. Council hires equipment from a list

of 'tendered' contractors to help the construction section complete major road works and building tasks. The tender includes higher weighting for lower emission vehicles and equipment. Council has reduced its dependence on diesel by substituting almost 90% of its diesel with B20 biodiesel and leasing of electric vehicles. Council is also leasing 9 Mitsubishi PHEV Outlanders from Mitsubishi. Electricity used to charge these vehicles is supplemented by photovoltaic solar systems located at the Civic Centre and the Rooty Hill Depot. A public charging station has also been fitted at the Blacktown Library. Last but not least, Council has introduced a highly successful driver training program through regular ongoing toolbox talks.



Figure 9: Electric vehicles charging at the Rooty Hill depot: Photo: BCC



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