

# Upgrading City Buses to Reduce NOx Emissions



**Janet Brown**

**City of Edinburgh Council**



**Eminox**

**Kathye Henderson**

**Eminox**



**Eminox**

# About EminoX

- EminoX was established in 1978
- We employ around 220 people in 6 countries
- We design and manufacture exhaust and emission control systems for heavy duty diesel engines
- We have supplied over 70,000 emission control systems to date
- Our systems are used across Europe and further afield for Air Quality clean up programmes



**EminoX**

# City Pollution



- Particulate Matter (PM) and Nitrogen Oxides (NO<sub>x</sub>) are damaging to health and the environment
- Many cities across Europe are failing to meet legal limits for PM and NO<sub>x</sub>
- There is no safe limit for exposure to PM (World Health Organisation)
- There is overwhelming evidence of a link between PM (black carbon) and global warming



Eminox

# Benefits of Retrofit



- New vehicles are now manufactured with technology that reduces their emissions of PM and NOx
- There are many older buses still in service – reducing pollution from these buses can have a major impact
- These can be retrofitted with emissions reduction systems at a fraction of the cost of new buses
- With SCRT technology 15 buses can be upgraded to Euro V for the cost of 1 new bus



**Eminox**

# SCRT® Retrofit Programmes



- Eminox SCRT has been used in Europe's largest retrofit programmes
- Belgium - 247 buses upgraded for bus operator DeLijn
- Spain - 363 buses upgraded for Barcelona bus operator TMB
- Sweden – around 300 systems fitted to meet local traffic emissions requirements for PM and NOx
- Edinburgh 43 Lothian buses upgraded



# About City of Edinburgh Council



- Edinburgh is Scotland's capital city. It is relatively compact, with a population of c. 475,000, and a hinterland in the Lothians of c.780,000
- Has one of the highest proportions in the UK of it's inhabitants living in the city centre
- Relatively narrow roads bounded by tenemental housing – create 'urban canyons' which inhibit pollutant dispersal
- Large number of buses operate in the city and virtually all services pass through the central Air Quality Management Area



Eminox

# About City of Edinburgh Council

- Edinburgh was nicknamed 'Auld Reekie' in the last century due to acrid air pollution from coal smoke





# About City of Edinburgh Council

- Although not nearly as obvious as in 'Auld Reekie' times, air pollution visible over the city when atmospheric temperature inversions occur



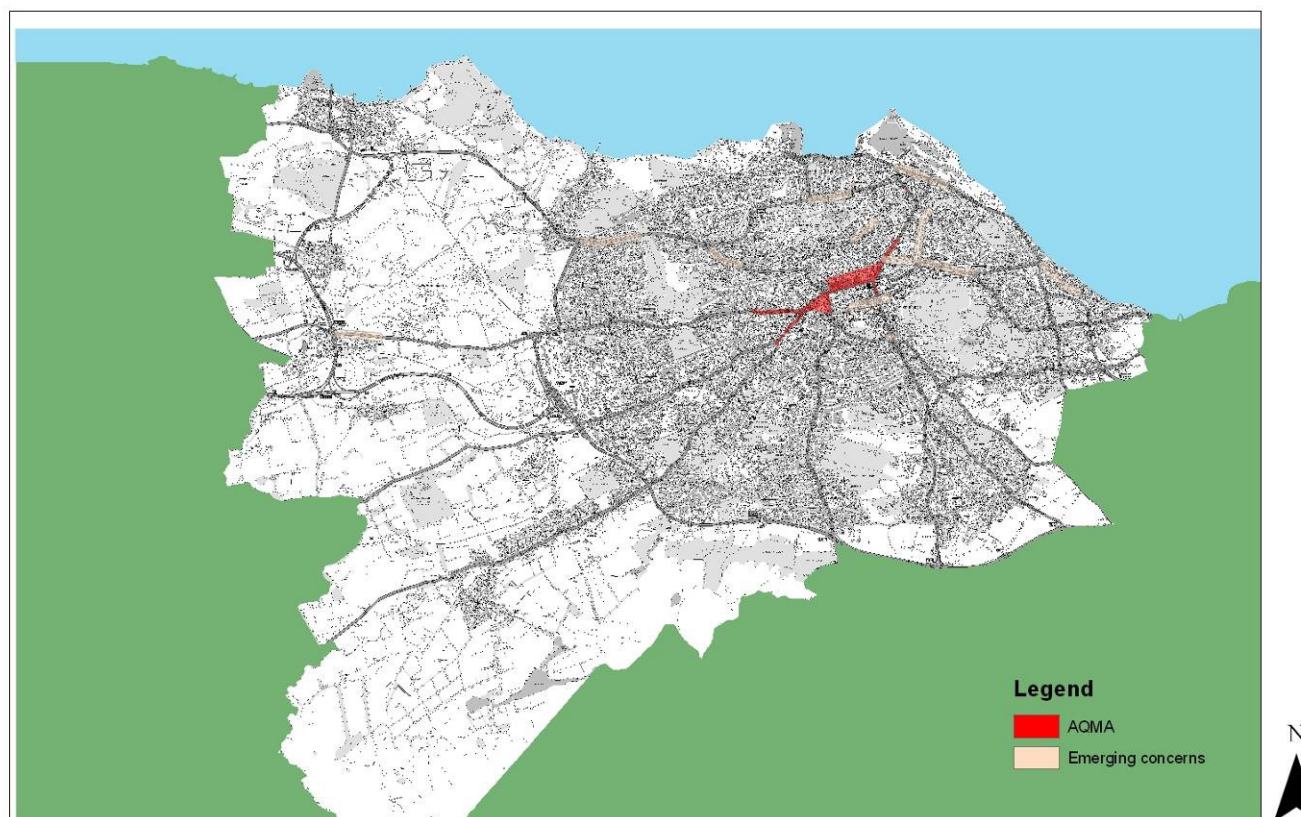
Eminox



# About City of Edinburgh Council

Edinburgh has 3 Air Quality Management Areas (NO<sub>2</sub>) and latest monitoring identifies further problems; extensions and/or additional AQMAs Council's Air Quality Action Plan focuses on reducing impacts from 2 key road transport polluters: Buses & HGVs

Traffic Related Air Quality Management Issues



Reproduced by permission of Ordnance Survey on behalf of HMSO.  
© Crown Copyright and database right 2010. All rights reserved.  
Ordnance Survey Licence Number 100023420.

# About City of Edinburgh Council

- City of Edinburgh Council's strategy to encourage voluntary improvements to fleets; however without significant financial support, operators struggling to find sufficient resource.
- Following trial in 2009, Lothian Buses committed to retrofit up to 20 Euro 2&3 single deck buses with Eminox SCRT units - if the Council could secure 30% support funding from Scottish Government.
- Council bid was successful – CEC allocated of £100,000 funding from Scottish Govt's Emissions Reduction Grant Scheme. Lothian Buses / Eminox SCRT retrofit programme commenced early 2010.
- Feb 2011 Scottish Government made 'surprise' announcement of additional £250,000 match-funding (50%) for retrofitting buses in Edinburgh. Lothian Buses took up the offer – enabled a further 34 SCRT units to be fitted.
- Improvements being evidenced in worst affected areas eg. St John's Road corridor – reduction by over 60% in the last 3 years in breaches of the **hourly** mean for NO<sub>2</sub> (200ug/m<sup>3</sup>)
- More to do though as Air Quality still not where it should be. Council took decision last week (29/11/11) to move to stakeholder consultation in 2012 on feasibility of introducing LEZ in Edinburgh for Buses and HGVs



**Eminox**

# Lothian Buses Field Trial



**Trial Bus - Euro II Dennis Dart**



# SCRT® System



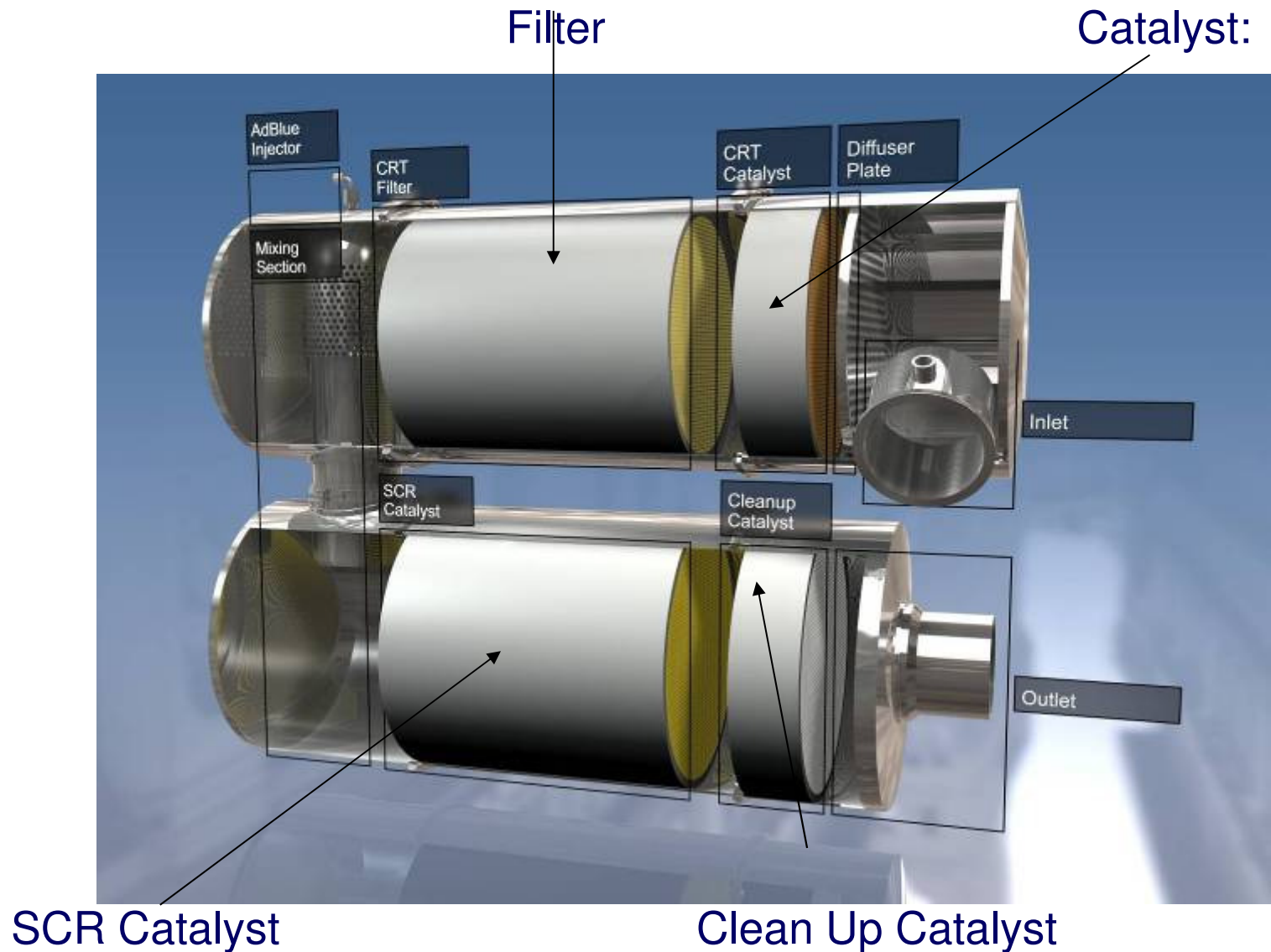
- Combines two technologies:  
CRT® (Continuously Regenerating Trap)  
SCR (Selective Catalytic Reduction)
- Same technology as used for Euro V, EEV and Euro VI
- Advanced emissions technology reduces
  - particulate matter
  - nitrogen oxides
  - hydrocarbons
  - carbon monoxide



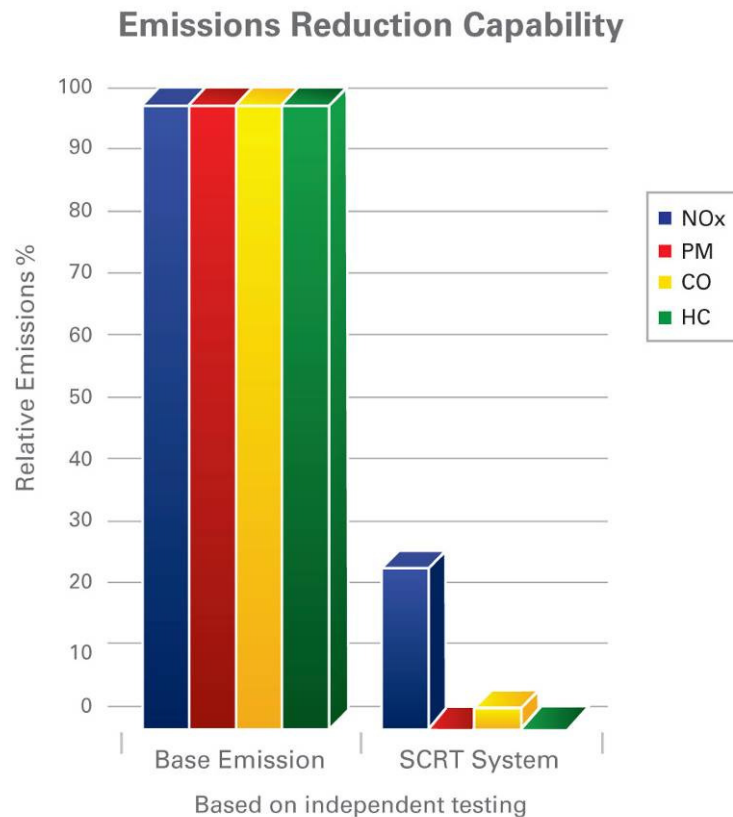
**Eminox**

# SCRT<sup>®</sup> System Schematic

[..\..\Eminox SCRT animation English hi res.wmv](#)



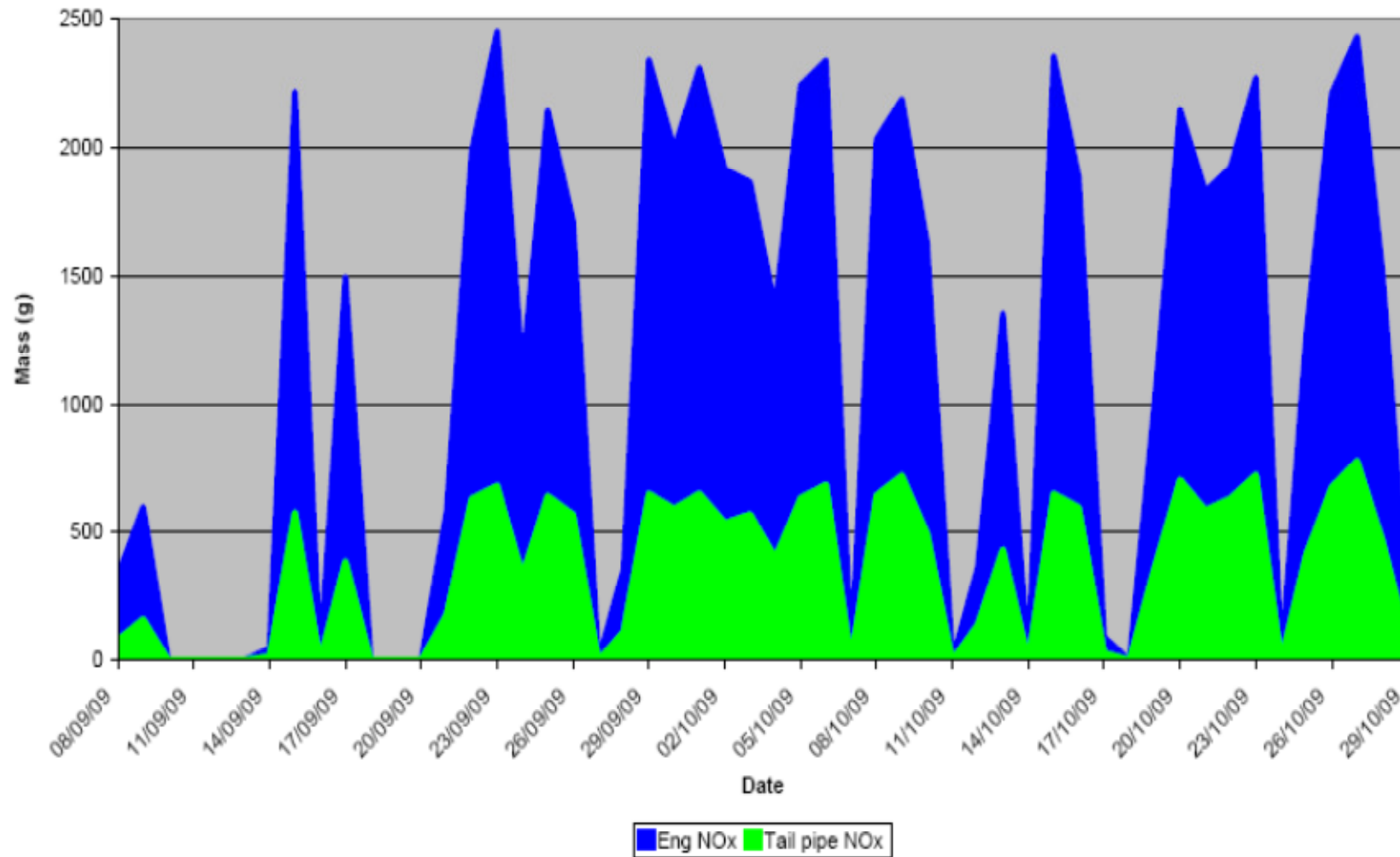
# SCRT® System Capability



- Vehicles as old as Euro II can be upgraded to the latest Euro V emissions standards
- This requires  
71% reduction in NOx  
86% reduction in PM
- In independent tests the Eminox SCRT achieved equivalent reductions



# Engine Out NOx v Tailpipe NOx



Eminox

# Lothian Buses SCRT® Deployment



- 43 SCRT systems retrofitted to variety of Euro II & III Buses
- 8 Dennis Darts on Route 36
- This route alone reducing 10.7 tonnes NOx/year
- 34 Volvos
- + Routemaster
- Taking them all to today's emissions standards (Euro V)
- Branded 'auld but not reekie'

# SCRT® Developments



- New SCRT system used for pilot project
- New catalysts and software
- Test results from Dennis Dart
- 88% NO<sub>x</sub> Reduction
- 50% NO<sub>2</sub> Reduction
- On urban operating cycle
- Up to 1000 buses will be upgraded



# Summary



- Retrofit of SCRT Systems is a cost effective route to upgrading vehicles:
  - Euro II to Euro IV
  - Euro III to Euro V and EEV
- Upgrade 15 buses for the cost of 1 new bus
- Tailored for urban driving conditions – delivering reliable NOx reduction on city buses
- Proven in independent tests and real world application



Thank you for your attention

