SUSTAINABILITY & CONSENTS

Non-Road Mobile Machinery (NRMM) Dispensation Proforma Guidance

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Contents

1 Purpose 3
2 Dispensation completion guidelines 3
3 Appendices 8
Annex A) Dispensation proforma 8
Annex B) Good example of completed proforma 9
Annex C) Indicative costs for passive wallflow DPF retrofits on typical construction equipment 11
4 Reference Documents 13
5 Standard Forms/ Templates 13

1 Purpose

This guidance is related to dispensation proforma guidance only. If you require further information on either the field guide for identification of compliant and non-compliant Non-Road Mobile Machinery (NRMM) across Crossrail construction sites refer to CR-XRL-T1-GUI-CR001-50006 or for information on Crossrail's requirements relating to the control of diesel engine emissions from NRMM and retrofitting with Diesel Particulate Filters (DPF's) refer to CR-XRL-T1-GUI-CR001-50005.

This guidance has been developed to support Crossrail Tier 1 contractors in the completion of a dispensation proforma, as part of the NRMM dispensation request made to the Crossrail Project Manager or their delegate.

The guidance is intended to ensure a proportional and consistent approach to dispensation decision making for qualifying plant. A proforma has been developed in **Annex A** and each section of the proforma will be clarified in this guidance to help explain what information constitutes an acceptable response.

Annex B is provided as a good example of a completed dispensation proforma. **Annex C** provides Indicative costs for passive wallflow DPF retrofits on typical construction equipment.

2 Dispensation completion guidelines

It is recommended that the process of sourcing compliant NRMM commences as soon as the need for the NRMM is identified. Where dispensation applications become necessary, always allow sufficient time for the review, response, clarifications and importantly provide a window of opportunity to modify purchase or hire arrangements.

Dispensations will only be granted on a valid and logical understanding of the rationale. To avoid potential clarification or rejection, evidence of the steps undertaken should be detailed in the proforma **(Annex A).** The following provides a step by step breakdown of the quality and quantity of information required.

Quick reference - Points 1 to 5

Points 1-4 of the proforma (Annex A) are deemed self explanatory. In point 5 '**type of NRMM including model number'** provide details including what that plant is, for instance telehandler, dump truck or generator the make i.e. Merlo, Caterpillar or JCB and specific model number i.e. P24.6, CKE1350 or LR1100.

Quick reference – Points 6 to 7

Point 6-7 requests the **'engine type'** and **'engine power/torque'.** Disclosing this detail is important as many hired NRMM have had their original engines removed and thus it can't always be inferred from the plant model number. Include name, model number and emission control stage i.e. Kubota V3307 Stage IIIA and 55/75 kW or 1400 RPM.

Quick reference – Point 8

Point 8 **'DPF suppliers'** section should only be completed if discussions have been held with DPF suppliers. This may be that the DPF was either physically trialled or at least investigated through detailed inquiries. This information is critical to Crossrail developing a better understanding of the reasons behind retrofitting success and failure. If enquiries where made

and for instance the DPF supplier was clear that the temperature from the duty cycle was too low for regeneration and active regeneration is financially prohibitive then state these reasons.

Quick reference – Point 9 to 11

Point 9 is self explanatory with NRMM hired or purchased for the contract. In terms of points 10-11 the **'NRMM need identified date'** is the date when the construction methodology was confirmed and equipment specified. Generally a lag between the 'need' and 'delivery' date indicates good forward planning leaving room for discussion and debate on alternative plant and alternative work methodologies. Any unexpected changes or findings that led to an almost instantaneous need and delivery dates should be described and clarified i.e. additional work scope or necessity to carry out emergency work.

Quick reference – Point 12 to 13

Point's 12 **'estimated number of day on site'** and 13 **'will the NRMM be returning to site in the future'** are deemed self explanatory and should be used in conjunction in deciding the appropriate level of retrofitting pressure to be applied. For instance acceptance without NRMM compliance is more plausible for plant used for a short duration (30 – 60 days) and not returning to site for future works. .

Quick reference – Point 14

The justification used in response to point 14 **'can an alternative compliant NRMM be used? If not explain why?'** is a key determinant in the dispensation request acceptance or rejection procedure. This is where the plant selection should be reviewed and challenged were practicable. For instance can the crane be exchanged for a compliant alternative, or could an alternative smaller capacity compliant generator be sourced? The justification should set out why specific types of plant are required.

Quick reference – Point 15

In point 15 the proforma asks **'how many suppliers have been contacted and over what time period'.** It is possible to infer the level of effort made in seeking compliance by the answer given. In normal circumstances the expectation would be for at least two or three companies to be approached. If the procurement team has advised appropriate subcontractor and supplier opportunities through CompeteFor this should be indicated in this section.

Quick reference – Point 16

A dispensation may sometimes be granted where there is a lack of compliant plant on the market, however, this may be subject to periodic review to determine whether compliant plant has become available. These requests may be granted where a review period is provided. The response to **'dispensation review date'** is dependent on the specific NRMM and strongly linked to market availability, Table 1 below as a guideline shows approximated review times for typical construction plant.

Table 1: Recommended dispensation review dates

NRMM	Recommended dispensation review data
Compactor/roller	6 months
Compressor >37.5 kW	6 months
Concrete sprayer > 37.5 kW	6 months
Crane – Crawler >100T	6 months
Dump truck	3 months
Dumper 6-10T	3 months
Excavator tracked large > 30T	3 months
Excavator tracked medium 20 – 30T	3 months
Excavator tracker small 10 – 20T	3 months
Excavator tracked mini <10T	3 months
Loading shovel (tracked)	6 months
Loading shovel (wheeled)	3 months
Telehandler	3 months
Tractor	3 months
Tunnelling equipment	6 months

Quick reference – Point 17

The response to **'can the NRMM be retrofitted with a DPF, if no explain in detail why?'** is fundamental to understanding and accepting the dispensation justification. Broadly the justification will correspond to one or a combination of the barrier factors.

- **Time/programme**
- **Safety critical**
- **Cost**
- **Technical**

Time/programme factors

If the programme has significantly altered due to unforeseen circumstances (e.g. ground conditions, buried structures ect) that has caused programme delivery constraints then due to lower stock availability of Crossrail complaint NRMM it might not be possible to source compliant plant in the timeframes. Justification for this will be reviewed on a case by case basis. If plant is hired, correspondence from the plant hire suppliers justifying plant unavailability should be retained and provided as evidence in the proforma.

Safety critical factors

Where the NRMM is required for a safety critical operation, there may be concerns relating to reliability or availability that means the use of compliant plant is not applicable. Information on the use of the NRMM and the nature of the works that are safety critical will be required.

An example of typical tasks that may be regarded as safety critical is presented in the table below. The tasks shown in the table is for illustrative purposes only and not an exhaustive nor definitive list.

Table 2: Example safety critical factors

Driving plant on the running rail line
Driving plant inside a possession
Driving a plant within a siding
Crane slewing in close proximity to a running rail line
Axillary plant/equipment supporting the health and safety of construction workers
Crane used for emergency man riding duties only

Cost factors

Where the dispensation is requested due to the cost of procuring compliant plant, details of the costs should be provided. This should include the following:

- For plant that is hired, details of the uplift in hire costs for procuring compliant plant. Evidence of approaching more than one plant Hire Company is expected to demonstrate an effort to provide compliant plant.
- For plant that is owned, details of the cost of purchase for complaint plant and/or of retrofitting with a suitable DPF should be provided. Costs associated with increased maintenance frequency should be provided where this is applicable.

Dispensations relating to warranty are unlikely to be accepted because a correctly certified and installed DPF will not have impact on engine warranty as Stage IIIA or older engines are no longer covered by an OEM warranty.

Technical factors

Where there are technical difficulties in providing retrofitted NRMM, this should be explained with evidence from a DPF supplier. The following bullet points provide examples of common technical factors that could limit the potential of NRMM reaching emission compliance:

- Engines ranged below 65kW (especially constant speed) can experience difficulties for retrofit including low exhaust temperatures and availability of space, though is limited to specific cases and equipment
- Hired crawler cranes with lifting capacities over 150 tonnes can be difficult to retrofit due to variable work cycles and long periods of idling
- Retrofitted plant that is used in confined spaces i.e. exposed DPF's casing clashing with the tunnel edge
- Engine compartment accessibility and space
- Frequency of active regeneration that is having a direct impact on productivity

Evidence of discussions with DPF suppliers to find a compliant solution will be required, including the use of trials where appropriate.

Quick reference – Point 18 to 19

Point 19 **'DPF supplier type and model'** indicate the name of the DPF supplier i.e. Pryoban and specific technology type i.e. full-flow passive and the model number. Point 20 is deemed self explanatory.

If you have any queries in completing the NRMM dispensation proforma please either speak with your Crossrail Environmental Advisor or air quality specialist.

3 Appendices

Annex A) Dispensation proforma

1. CCM REFERENCE	
2. CONTRACT	
3. CONTRACTOR	
4. INITIAL DISPENSATION SUBMISSION DATE:	
5. TYPE OF NRMM INCLUDING MODEL NUMBER	
6. ENGINE MODEL	
7. ENGINE POWER/TORQUE	
8. NRMM SUPPLIER	
9. IS PLANT HIRED OR PURCHASED?	
10. NRMM NEED IDENTIFIED DATE	
11. NRMM SITE DELIVERY DATE	
12. ESTIMATED NUMBER OF DAYS ON SITE	
13. WILL THE NRMM BE RETURNING TO SITE AGAIN IN THE FUTURE? Y/N UNKNOWN	
14. CAN AN ALTERNATIVE COMPLIANT NRMM BE USED? IF NO EXPLAIN WHY	
15. HOW MANY SUPPLIERS HAVE BEEN CONTACTED AND OVER WHAT PERIOD? **STATE SUPPLIER FEEDBACK ON THE AVAILABILITY OF STAGE IIIB (OR BETTER NRMM) OF DPF RETROFITTED PLANT AND ARRANGEMENTS FOR EXCHANGE WHEN AVAILABLE**	
16. DISPENSATION REVIEW DATE:	
17. CAN THE NRMM BE RETROFITTED WITH A DPF? IF NO EXPLAIN IN DETAIL WHY?	
18. DPF SUPPLIER TYPE AND MODEL	
19. PREPARED BY	

Date proforma completed for the first time

When was the requirement for that specific NRMM initially flagged by the construction and procurement departments?

Anticipated delivery date to site

Reasons guidance

Time

If a DPF could not be fitted because of insufficient time explains why the equipment is needed so quickly and why was it not procured earlier?

Safety critical

Is the NRMM required for a safety critical operation?

Cost

If the DPF can not be retrofitted because of cost what is the cost? If NRMM is hired is the entire cost of the DPF being charged to the contractor or rental uplift?

Technical

If a DPF could not be retrofitted because of technical difficulties provide evidence from DPF suppliers to why.

Any other reasons please provide

Date in the future (usually 3 or 6 months) contractor will revisit the dispensed NRMM for changes in market availability

Annex B) Good example of completed proforma

CCM REFERENCE	CXXX-CCM-00XXX
CONTRACT	CXXX
CONTRACTOR	XXX
INITIAL DISPENSATION SUBMISSION DATE:	23.10.2014
TYPE OF NRMM INCLUDING MODEL NUMBER	Merlo Panoramic P25.6 telescopic handler 2.5 tonne (2012 model)
ENGINE MODEL	Kubota V3307 / 4 cylinder (Stage IIIA)
ENGINE POWER/TORQUE	55/75 Kw
NRMM SUPPLIER	PURItech DAS/DBS type A12 708 (Active DPF) - Registered with TfL Low Emissions Certificate (LEC)
IS PLANT HIRED OR PURCHASED?	Purchased
NRMM NEED IDENTIFIED DATE	01.10.2014
NRMM SITE DELIVERY DATE	23.10.2014
ESTIMATED NUMBER OF DAYS ON SITE	58
WILL THE NRMM BE RETURNING TO SITE AGAIN IN THE FUTURE? Y/N UNKNOWN	Yes
CAN AN ALTERNATIVE COMPLIANT NRMM BE USED? IF NO EXPLAIN WHY	No. Space restrictions due to tunnel width.
HOW MANY SUPPLIERS HAVE BEEN CONTACTED AND OVER WHAT PERIOD? STATE SUPPLIER FEEDBACK ON THE AVAILABILITY OF STAGE IIIB (OR BETTER NRMM) OF DPF RETROFITTED PLANT AND ARRANGEMENTS FOR EXCHANGE WHEN AVAILABLE	NRMM was purchased in advance explicitly to assist with the tunnelling project. It was retrofitted but suffered technical difficulties. Merlo does not currently manufacture this model with a Stage IIIB engine.
DISPENSATION REVIEW DATE:	23.04.2015
HAVE THE PROCUREMENT TEAM USED COMPETEFOR TO REVIEW OPPORTUNITIES	N/A – Purchase direct

CAN THE NRMM BE RETROFITTED WITH A DPF? IF NO EXPLAIN IN DETAIL WHY?	**Technical reason** NRMM retrofitted with a DPF that was mounted on the rear of the machine in a position outside the machines periphery. This is a well suited to the plant application as the machine tends to sit in one spot, and is effectively used as a static crane. However due to the tunnels being very narrow the device got flattened against the tunnel wall when the machine was turned around a corner into a passage, causing significant problems to the injection system of the engine resulting in over-fuelling issues and excess black smoke in the tunnel.
DPF SUPPLIER TYPE AND MODEL	Fitted by xxxx agents for the xxx & xxx equipment
PREPARED BY	XXX

Annex C) Indicative costs for passive wallflow DPF retrofits on typical construction equipment

For excavators, telehandlers and dumpers there the retrofit costs are proportional to the size of the engine (table 3), with larger more powerful engines costing more expensive. This linear relationship between the costs as a function of the engine's rated power can be expressed as:

Cost of retrofitting a particulate trap = £2100 + £18 x engines rated power

Source: Ricardo- AEA GLA NRMM LEZ scheme

Table 3: Indicative wallflow passive DPF retrofit financial costs for excavators, telehandlers and dumpers

Power range – Low (kW)	Power range – High (kW)	Median Price (£)
37	80	3,100
60	140	3,450
110	180	4,000
140	210	4,400
160	260	4,700
170	300	5,250
250	360	6,000

More specialist plant like crawler cranes and piling rigs do not follow this linear cost relationship and are much more expensive to retrofit and less likely to gain support from the supplier as the DPF's are more prone to failure due to variable work cycles and or long periods of idling where the exhaust temperatures are not sufficiently high enough to burn off the particulates trapped on the filters. This problem can be overcome by fitting an active system that regenerates using electric heaters or raw fuel heaters to burn off the particulates, but plant suppliers are extremely reluctant to this as it is either too costly or not commercially feasible.

Table 4: Indicative wallflow passive DPF retrofit financial costs and fitting for crawler cranes and piling rigs

Power range – Low (kW)	Power range – High (kW)	Median Price (£)
60	140	10,000+
110	180	15,000+
140	210	20,000+
160	260	25,000+
170	300	30,000+
250	360	35,000+

An alterative to retrofitting is engine substitution for a newer engine with improved emission control. The feasibility of this is dependent on accessibility and the space in the engine compartment. In most cases for specialist plant the cost of engine replacement is equivalent to that of DPF retrofit with the former preferred by the supplier as there is less potential for technical issues to develop. The average cost of fitting a new engine to a piece of off-road equipment can be assumed to be:

Cost of fitting a new specification engine = £9,000 + £100 x engine's rated power

Source: Ricardo- AEA GLA NRMM LEZ scheme

4 Reference Documents

Ref:	Document Title	Document Number:
1.	Field guide for identification of compliant and non-compliant Non-Road Mobile Machinery (NRMM)	CR-XRL-T1-GUI-CR001-50006
2.	Crossrails requirements relating to the control of diesel engine emissions from NRMM and retrofitting with Diesel Particulate Filters (DPF's)	CR-XRL-T1-GUI-CR001-50005

5 Standard Forms/ Templates

Ref:	Document Title	Document Number:
A.	None	
B.		