Appendix A11.1: Air Quality – Dust Risk Assessment

1 Introduction

1.1 Activities carried out on construction sites can give rise to emissions of dust that could cause annoyance or damage to vegetation due to the soiling of surfaces. These activities can also lead to increased short-term and long-term concentrations of fine particulate matter (e.g. PM_{10} and $PM_{2.5}$) at off-site locations which may affect human health, unless the appropriate mitigation measures are implemented.

1.2 This appendix supports Chapter 11 (Air Quality) of the Environmental Impact Assessment (EIA) Report for the A985 Kincardine Bridge Refurbishment Piled Viaduct Replacement scheme (hereafter referred to as the proposed scheme) and outlines a procedure developed by the Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction (IAQM 2016) (hereafter referred to as 'IAQM guidance') for the assessment of dust-related air quality impacts arising from construction activities. The following sections outline the methodology, the dust risk assessment to identify the risk of dust impact at sensitive human and ecological receptors and recommended site-specific mitigation measures.

2 Assessment Methodology

Outline of Method

2.1 The methodology for the assessment of the construction impacts is based on a five-step approach as set out in Diagram 1.

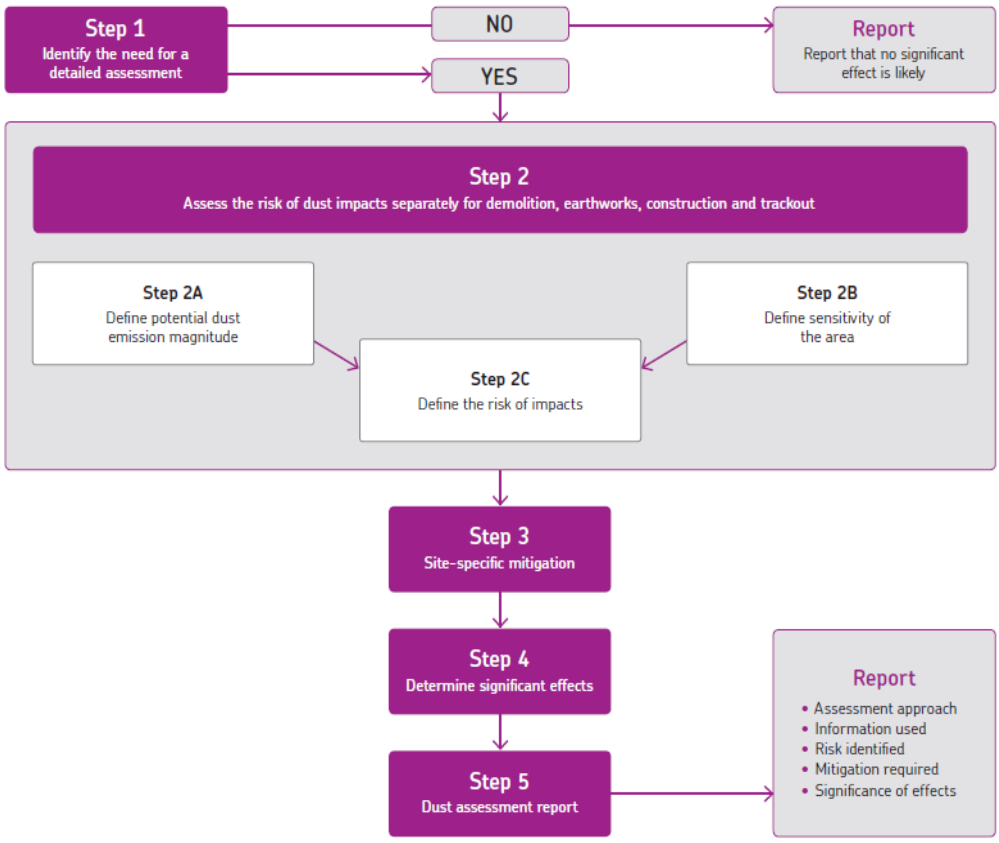

Diagram 1 : Structure of the Dust Risk Assessment

Step 1 - Identify the Need for a Detailed Assessment

2.2 An assessment would normally be required where there is:

- a human receptor within 350m of the proposed scheme and/or within 50m of the access route(s) used by construction vehicles on the public highway, up to 50m from the study area site exit(s) for small sites, up to 200m from the study area site exit(s) for medium sites and up to 500m from the study area site exit(s) for large sites; and/or
- an ecological receptor within 50m of the proposed scheme and/or within 50m of the access route(s) used by construction vehicles on the public highway, up to 50m from the study area site exit(s) for small sites, up to 200m from the study area site exit(s) for medium sites and up to 500m from the study area site exit(s) for large sites.

2.3 The requirement for a dust risk assessment can be screened out where the above criteria are not met, therefore it can be concluded that the level of risk is Negligible and any effects would be not significant. If there are human or ecological receptors within the distance criteria set out in Step 1, then Steps 2 to 4 should be undertaken, as shown in Diagram 1.

Step 2 - Assess the Risk of Dust Impacts

2.4 A site is allocated to a risk category on the basis of the scale and nature of the works (Step 2A – Define potential dust emission magnitude) and the sensitivity of the area to dust impacts (Step 2B – Define sensitivity of the area). These two factors are combined (Step 2C - Define the risk of dust impacts) to determine the risk of dust impacts before the implementation of mitigation measures. Risks are described in terms of there being a Low, Medium or High risk of dust impacts for each of four separate potentially dust emitting activities (demolition, construction, earthworks and trackout). Site-specific mitigation would be required, proportionate to the level of risk identified.

<u>Step 2A - Define the Potential Dust Emission Magnitude</u>

2.5 The potential dust emission magnitude is based on the scale of the anticipated works and is classified as Small, Medium or Large. Table 1 presents the dust emission criteria outlined for each construction activity.

Table 1: Potential Dust Emission Magnitude Criteria

Construction Activity	Large	Medium	Small
Demolition	Total building volume >50,000m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20m above ground level.	Total building volume 20,000m^3 – 50,000m^3, potentially dusty construction material, demolition activities 10-20m above ground level.	Total building volume <20,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.
Earthworks	Total site area >10,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, total material moved >100,000 tonnes.	Total site area 2,500m^2 – 10,000m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4m – 8m in height, total material moved 20,000 tonnes – 100,000 tonnes.	Total site area <2,500m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <20,000 tonnes, earthworks during wetter month.
Construction	Total building volume >100,000m^3, on site concrete batching, sandblasting.	Total building volume 25,000m^3 – 100,000m^3, potentially dusty construction material (e.g.	Total building volume <25,000m^3, construction material with low potential for

Construction Activity	Large	Medium	Small
		concrete), on site concrete batching.	dust release (e.g. metal cladding or timber).
Trackout	>50 Heavy Duty Vehicles (HDV) (>3.5t) outward movements[1] in any one day[2], potentially dusty surface material (e.g. high clay content), unpaved road length >100m.	10-50 HDV (>3.5t) outward movements[1] in any one day[2], moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m.	<10 HDV (3.5t) outward movements[1] in any one day[2], surface material with low potential for dust release, unpaved road length <50m.

1 A vehicle movement is a one-way journey. i.e. from A to B and excludes the return journey.
2 HDV movements during a construction project vary over its lifetime, and the number of movements is the maximum not the average.

Step 2B - Define the Sensitivity of the Area

2.6 The sensitivity of the area is described as Low, Medium and High and takes a number of factors into account:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- the local background PM_{10} concentrations; and
- site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

2.7 Table 2 presents indicative examples of classification groups for the varying sensitivities of people to dust soiling effects, to the health effects of PM_{10} and the sensitivities of receptors to ecological effects. A judgement is made at the site-specific level where sensitivities may be higher or lower, for example a soft fruit business may be more sensitive to soiling than an alternative industry, such as coal mining, in the same location. Section 7.3 within the IAQM guidance (IAQM 2016) outlines more detailed parameters for defining sensitivity.

Table 2: Indicative Examples of the Sensitivity of Different Types of Receptors

Sensitivity of Receptor	Sensitivities of People and Ecological Receptors		
	Dust Soiling Effects [1]	Health Effects of PM_{10} [2]	Ecological Effects [3]
High	Dwellings, museums and other culturally important collections, medium and long-term car parks and car showrooms.	Residential properties, hospitals, schools and residential care homes.	Locations with an international or national designation and the designated features may be affected by dust soiling (e.g. Special Area of Conservation (SAC)/Special Protection Area (SPA)/Ramsar site). Locations where there is a community of a particularly dust sensitive species such as vascular plant species included in the Red Data list for Great Britain.
Medium	Parks, places of work.	Office and shop workers not occupationally exposed to PM_{10}.	Locations where there is a particularly important plant species, where dust sensitivity is uncertain or unknown. Locations with a national designation where the features may be affected by dust deposition (e.g. Site of Special Scientific Interest (SSSI)).
Low	Playing fields, farmland, footpaths, short-term car parks and roads.	Public footpaths, playing fields, parks and shopping streets.	Locations with a local designation where the features may be

Sensitivity of Receptor	Sensitivities of People and Ecological Receptors		
	Dust Soiling Effects [1]	Health Effects of PM_{10} [2]	Ecological Effects [3]
			affected by dust deposition (e.g. Local Nature Reserve (LNR).

1 People's expectations would vary depending on the existing dust deposition in the area.
2 This follows the Department for Environment, Food and Rural Affairs (Defra 2016) guidance as set out in Local Air Quality Management Technical Guidance (LAQM.TG (16)).
3 A Habitat Regulation Assessment of the site may be required as part of the planning process if the site lies close to an internationally designated site (i.e. SACs/SPAs) designated under the Habitats Directive (92/43/EEC) and Ramsar sites.

2.8 The IAQM guidance (IAQM 2016) advises consideration of the risk associated with the nearest receptors to each phase of work. Where there are multiple receptors in a single location, a worst-case representative receptor location is considered and the highest risk applicable is allocated.

2.9 The receptor sensitivity and distance are then used to determine the potential dust risk for each dust effect for each construction activity as shown in Table 3, Table 4 and Table 5. It is noted that distances are between the dust source to the nearest receptor so a different area may be affected by trackout than by on-site works.

2.10 It should be noted IAQM guidance recommends that the receptor distance is based on the distance from the source rather than the site boundary. This assessment was undertaken on the basis that all activities (i.e. demolition, earthworks, construction and trackout) take place at the construction boundary. This represents a conservative assumption, as in practice most activities would not take place at the site boundary, thus increasing the distance between the source and the receptor.

2.11 For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site specific mitigation, trackout may occur from roads up to 500m from large sites, 200m from medium sized sites and 50m from small sites (see Table 1), as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50m from the edge of the road. Based on the dust emission magnitude for trackout the site is considered a Medium site (see Table 1). Therefore, an assessment would be required where there is a human receptor within 50m of the route used by construction vehicles up to 200m from the site exit(s) (as per the IAQM guidance (IAQM 2016)).

Table 3: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 4: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

Table 5: Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Step 2C - Define the Risk of Impacts

2.12 The dust emission magnitude is then combined with the sensitivity of the area to determine the overall risk of impacts with no mitigation measures applied. The matrices in Table 6 provide a method of assigning the level of risk for each activity. These can then be used to determine the level of mitigation that is required.

Table 6: Risks of Dust Impacts

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High risk	Medium risk	Medium risk
Medium	High risk	Medium risk	Low risk
Low	Medium risk	Low risk	Negligible risk
Earthworks			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible risk

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
Construction			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible risk
Trackout			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Low risk	Negligible risk
Low	Low risk	Low risk	Negligible risk

Step 3 - Site Specific Mitigation

2.13 Step 3 of the IAQM guidance identifies appropriate site specific mitigation. These measures are related to whether the site is a Low, Medium, or High risk site. The highest risk category of a site (of all activities being undertaken) is recommended when considering appropriate general mitigation measures for the site. Where risk is assigned as 'negligible', no mitigation measures beyond those required by legislation are required. However, additional mitigation measures may be applied as good practice.

2.14 A selection of these measures has been specified for Low risk to High risk sites in IAQM guidance (IAQM 2016) as measures suitable to mitigate dust emissions from activities.

Step 4 - Determine Significant Effects

2.15 Following Step 2 (Assess the risk of dust impacts), and Step 3 (Site-specific mitigation), the significance of the potential dust effects can be determined. The recommended mitigation measures should normally be sufficient to reduce construction dust impacts to a not significant effect.

2.16 The approach in Step 4 of IAQM guidance (IAQM 2016) (Determine significant effects) has been adopted to determine the significance of effects with regard to dust emissions. The guidance states the following: *'For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'.'*

2.17 IAQM guidance (IAQM 2016) also states that:

> *'Even with a rigorous DMP [Dust Management Plan] in place, it is not possible to guarantee that the dust mitigation measures will be effective all the time, and if, for example, dust emissions occur under adverse weather conditions, or there is an interruption to the water supply used for dust suppression, the local community may experience occasional, short-term dust annoyance. The likely scale of this would not normally be considered sufficient to change the conclusion that, with mitigation, the effects will be 'not significant'.'*

2.18 Step 4 of IAQM guidance (IAQM 2016) recognises that the key to the above approach is that it assumes that the regulators ensure that the proposed mitigation measures are implemented. The management plan would include the necessary systems and procedures to facilitate on-going checking by the regulators to ensure that mitigation is being delivered, and that it is effective in reducing any residual effect to 'not significant' in line with the guidance.

3 Construction Dust Assessment

3.1 This section sets out the construction dust assessment following the five steps described in the methodology section above. The assessment of potential demolition, earthworks, construction and

trackout impacts was undertaken in accordance with the IAQM methodology described earlier and as set out in Chapter 11 (Air Quality).

Step 1 - Identify the Need for a Detailed Assessment

3.2 The first step is Step 1, where the need for a detailed assessment is determined based on the location of receptors within the vicinity of the study area.

Human Receptors

3.3 There are human receptors within 350m of the study area; therefore, further assessment is required. An approximate count of sensitive relevant human receptors was carried out as recommended in IAQM guidance (IAQM 2016) in order to determine the highest level of area sensitivity.

3.4 There are two residential properties north of the Higgins Neuk roundabout within the 350m study area. These receptors are approximately 110m north-west of the proposed scheme main construction works and within 50m of the temporary site access. As outlined in paragraph 2.10, IAQM guidance (IAQM 2016) recommends an approximate Trackout count (i.e. those receptors within 50m of the route(s) used by construction vehicles on the public highway, up to 200m from the site exit(s)) also be undertaken. The residential properties described above are the only human receptors within 50m of the local road network up to 200m from the site exit during the works associated with the construction of the proposed scheme. The location of these receptors is presented in Figure 11.2.

Ecological Receptors

3.5 The effect of construction dust on ecological designations has also been considered. The proposed scheme is located within the Firth of Forth Ramsar, SPA and SSSI and these designations have therefore been considered in this assessment. As recommended by the IAQM guidance (IAQM 2016) (see Box 8, page 18), the advice of an ecologist (undertaking the assessment for the proposed scheme) was sought to identify the sensitivity of the ecological receptor to dust impacts in accordance with the example sensitivities set out in the IAQM guidance (IAQM 2016). After consideration of the likely effect and value of the ecological assets, the Firth of Forth Ramsar, SPA and SSSI designations have been classified as a Medium sensitivity receptor. The absence of other ecological sites within 50m of the site boundary or within 50m of the route used by construction vehicles on the public highway up to 200m from the site exit(s), means that no other ecological receptors were considered in the assessment.

Step 2 – Assess the Risk of Dust Impacts

Step 2A - Define the Potential Dust Emission Magnitude

3.6 The works associated with the construction of the proposed scheme are likely to be split into several stages, which could potentially involve different periods of demolition, earthworks, construction, trackout and activity levels of which would not necessarily peak simultaneously.

3.7 The dust emission magnitudes of each activity have been specified with reference to the definitions of dust emission magnitudes in Table 1 and using professional judgement in line with IAQM guidance (IAQM 2016). These are summarised below:

Demolition

3.8 Following the temporary diversion of the carriageway, demolition of the existing piled viaduct (consisting of five sections, each spanning approximately 15m long) would involve the use of mechanical heavy cutting equipment with material removed from site to a suitable disposal area. The deck of the existing viaduct would likely be removed by cutting it into sections using a wire saw, and then lifting or lowering the cut sections onto lorries located on the adjacent working platform to the south. The existing piles

and piers (approximately 90) would be cut off at 1m below the ground level. The volume of existing pile waste and concrete waste to be removed is 41m^3 and 622m^3 respectively, and may contain potentially dusty construction material. The removal of the temporary bridge structure will generate 4,972m^3 of concrete waste and 916m^3 of pile waste. Demolition activities will be less than 10m above ground height. As the total demolition volume is likely to be significantly less than 20,000m^3, the assessment for demolition is based on a dust emission class of 'Small'.

Earthworks

3.9 Earthwork activities include the formation and then removal of the temporary raised working platform which comprises primarily aggregate material totalling 43,097m^3. Further earthwork activities include the removal of the waste material bored from the pile locations (1,292m^3) and site preparation to facilitate the construction of the site compound. The indicative area required for temporary works and construction is 38,696m^2. Although the site area is greater than 10,000m^2, it is anticipated 69,219 tonnes of soil/fill will be imported to site and there are likely to be less than five heavy earth moving vehicles active at any one time and there may potentially be a dusty soil type (e.g. clay). On this basis, the assessment of earthworks is based on a dust emission class of 'Medium'.

Construction

3.10 The proposed scheme includes the construction of a new piled viaduct replacement structure to replace the existing piled viaduct. The piles to support the new piled viaduct would be installed using conventional piling techniques and equipment. On completion of piling works, the new piers and superstructure would be constructed using conventional construction techniques. The construction would involve boring and casting approximately 90 reinforced concrete piles with rock sockets. Reinforced concrete pile caps would then be constructed on top of the piles. The concrete for the footings and piles could be brought to the site from off-site concrete suppliers by concrete wagon and pumped from the working platform. To facilitate traffic flow during construction, a temporary diversion structure alongside the existing piled viaduct is required to maintain two-way traffic during demolition and reconstruction. Additional construction activities include the site compound to be located northeast of the sustainable drainage system (SUDS) pond and accessed from the existing bellmouth off the Higgins Neuk Roundabout. As the total building volume is likely to be less than 25,000m^3 with pre-mixed concrete being utilised during construction, the assessment of construction is based on a dust emission class of 'Small'.

Trackout

3.11 The maximum number of daily outward movements of HDVs is anticipated to be between 10 and 50 in any one day. Although unpaved road(s) are likely to be greater than 100m in length and the surface material is likely to be dusty, the number of anticipated HDV movements means the assessment for trackout is based on a dust emission class of 'Medium'.

3.12 Table 7 presents a summary of the dust emission magnitude for each activity based on the criteria set out above.

Table 7: Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	Small
Earthworks	Medium
Construction	Small
Trackout	Medium

Step 2B - Define the Sensitivity of the Area

3.13 The Kincardine Bridge crosses the Firth of Forth between Higgins Neuk in Falkirk Council area and the town of Kincardine in Fife Council area.

3.14 If the proposed activities were to produce excessive dust emissions, it is possible that significant impacts may be experienced at nearby sensitive receptors if suitable mitigation measures are not employed. Table 8 displays the sensitivities of the surrounding area to demolition, earthworks, construction and trackout based on the criteria set out in Table 3 and Table 4: .

Table 8: Sensitivity of the Proposed Scheme Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low	Low	Low	Low
Human Health	Low	Low	Low	Low
Ecological	Medium	Medium	Medium	Medium

Step 2C - Define the Risk of Impacts

3.15 Using the dust emission magnitudes for the various activities in Table 7 and the sensitivity of the area provided in Table 8, the definition of the risks for each activity within the study area is provided in Table 9 for dust soiling, human health impacts and impacts on ecological designations.

Table 9: Dust Risk at Human and Ecological Receptors

Potential impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Negligible risk	Low risk	Negligible risk	Low risk
Human Health	Negligible risk	Low risk	Negligible risk	Low risk
Ecological	Low risk	Medium risk	Low risk	Low risk

3.16 For potential dust soiling impacts and human health impacts, there is predicted to be a Negligible risk from demolition and construction activities and a Low risk from earthworks and trackout activities.

3.17 The results in Table 9 indicate that at the Firth of Forth Ramsar, SPA and SSSI, there is predicted to be a Medium risk from earthwork activities and a Low risk from demolition, construction and trackout activities.

Step 3 - Site-Specific Mitigation

Recommended Mitigation Measures

3.18 Based on the highest risk identified in the assessment for each of the construction activities (i.e. a Medium risk level identified ecological impacts as shown in Table 9), the results indicate that the dust risk from construction activities associated with the proposed scheme have the potential to be Low risk for dust soiling and human health impacts and a Medium risk for ecological impacts. Mitigation measures would be needed to reduce the potential for dust emissions to potentially lead to significant dust effects in the vicinity of the proposed scheme. The suggested mitigation measures, based on the level of risk identified which should be adopted for the proposed scheme, are set out below.

3.19 The mitigation measures have been derived from those specified in the IAQM guidance (IAQM 2016) and where possible at this stage, adapted to the activities associated with construction of the proposed scheme. Measures such as those specified in the guidance would normally be sufficient to reduce

construction dust nuisance, risks to human health or effects on ecological sites to a 'not significant' effect. These measures are listed in Table 10 to Table 15 with a recommendation as to whether or not they should be applied based on the risk levels identified in the dust assessment. Some of the mitigation measures listed within IAQM guidance (IAQM 2016) for trackout (mitigation numbers 44, 46, 47 and 48) were considered to represent general on-site activities and operation of haul roads, and were moved to the 'Operations' section (see Table11) of the general mitigation measures required for all sites. The general mitigation measures were specified based on their highest risk category (i.e. based on the Medium risk) as recommended by IAQM guidance (IAQM 2016).

3.20 As specified above, the measures to control dust emissions taken forward from this assessment, derived from the highly recommended or desirable measures (see Table 10 to Table 15), and the monitoring of the effectiveness of the mitigation, would be included in the air quality management strategy set out in the DMP (Dust Management Plan). These would be delivered during construction.

3.21 When applying the mitigation measures, IAQM guidance (IAQM 2016) states the following:

> *'The most important aspects of the Dust Management Plan are assigning responsibility for dust management to an individual member of staff of the principal contractor, training staff to understand the importance of the issue, and communicating with the local community. Good dust management practices implemented at high risk sites have resulted in no or minimal complaints, which illustrates the value of the recommended approach.'*

3.22 The mitigation measures set out in Table 10 to Table 15 do not specifically include assigning responsibility for dust management to a staff member or training staff on the importance of dust management and awareness of dust issues. However, these would be included within the proposed mitigation measures.

Table 10: Mitigation for All Sites: Communications

Mitigation Controls	Highly Recommended/Desirable/Not Required
1. Develop and implement a stakeholder communications plan that includes community engagement before work commences on the site.	Highly recommended
2. Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	Highly recommended
3. Display the head or regional office contact information.	Highly recommended

Table 11: Mitigation for All Sites: Dust Management

Mitigation Controls	Highly Recommended/Desirable/Not Required
4. Develop and implement a DMP, which may include measures to control other emissions, approved by the local authority. The level of detail will depend on the risk, and should include, as a minimum, the highly recommended measures in this assessment where practicable. The desirable measures should be included as appropriate for the site.	Highly recommended
Site Management	
5. Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner and record the measures taken.	Highly recommended
6. Make the complaints log available to the local authority when asked.	Highly recommended

Mitigation Controls	Highly Recommended/Desirable/Not Required
7. Record any exceptional incidents that cause dust and/or air emissions, either on-site or off-site, and the action taken to resolve the situation in the log book.	Highly recommended
8. Hold regular liaison meetings with other high-risk construction sites within 500m of the site boundary to ensure plans are coordinated, and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.	Not required
Monitoring	
9. Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby to monitor dust and record inspection results and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces for example checking of street furniture, cars and window sills around the site boundary.	Desirable
10. Carry out regular site inspections to monitor compliance with the DMP, record inspection results and make an inspection log available to the local authority when asked.	Highly recommended
11. Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	Highly recommended
12. Agree dust deposition, dust flux or real-time PM_{10} continuous monitoring locations with the local authority. Where possible, commence baseline monitoring at least three months before work commences on site or, if at a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.	Highly recommended
Preparing and Maintaining the Site	
13. Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	Highly recommended
14. Erect solid screens or barriers around dusty activities, or the site boundary, which are at least as high as any stockpiles on site.	Highly recommended
15. Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.	Highly recommended
16. Avoid site runoff of water or mud.	Highly recommended
17. Keep site fencing, barriers and scaffolding clean using wet methods.	Highly recommended
18. Remove materials that have a potential to produce dust from the site as soon as possible, unless being re-used on site. If they are being re-used on-site, cover as described below.	Highly recommended
19. Cover, seed or fence stockpiles to prevent wind whipping.	Highly recommended
Operating vehicle/machinery and sustainable travel	
21. Ensure all vehicles switch off engines when stationary – no idling vehicles.	Highly recommended
22. Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable.	Highly recommended

Mitigation Controls	Highly Recommended/Desirable/Not Required
23. Impose and signpost a maximum speed limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).	Desirable
24. Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	Highly recommended
25. Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking and car sharing).	Desirable
Operation	
26. Where applicable, only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. "suitable local exhaust ventilation systems".	Highly recommended
27. Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	Highly recommended
28. Where applicable, use enclosed chutes and conveyors and covered skips.	Highly recommended
29. Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	Highly recommended
30. Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	Highly recommended
44. Avoid dry sweeping of large areas.	Highly recommended
46. Inspect on-site haul routes for integrity and instigate any necessary repairs to the surface as soon as reasonably practicable.	Highly recommended
47. Record all inspections of haul routes and any subsequent action in a site log book.	Highly recommended
48. Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers, and regularly cleaned.	Highly recommended
Waste Management	
31. Avoid bonfires and burning of waste materials.	Highly recommended

Table 12: Mitigation Measures Specific to Demolition

Mitigation Controls	Highly Recommended/Desirable/Not Required
32. Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	Not applicable
33. Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	Highly recommended

Mitigation Controls	Highly Recommended/Desirable/Not Required
34. Avoid explosive blasting, using appropriate manual or mechanical alternatives.	Highly recommended
35. Bag and remove any biological debris or damp down such material before demolition.	Highly recommended

Table 13: Mitigation Measures Specific to Earthworks

Mitigation Controls	Highly Recommended/Desirable/Not Required
36. Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	Desirable
37. Use hessian fabric, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.	Desirable
38. Only remove the cover in small areas during work and not all at once.	Desirable

Table 14: Mitigation Measures Specific to Construction

Mitigation Controls	Highly Recommended/Desirable/Not Required
39. Avoid scabbling (roughening of concrete surfaces) if possible.	Desirable
40. Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	Desirable
41. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	Not required
42. For smaller supplies of fine powder materials, ensure bags are sealed after use and stored appropriately to prevent dust.	Not required

Table 15: Mitigation Measures Specific to Trackout

Mitigation Controls	Highly Recommended/Desirable/Not Required
43. Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.	Desirable
45. Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	Desirable
49. Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud) prior to leaving the site where reasonably practicable.	Desirable
50. Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	Not required
51. Access gates to be located at least 10m from receptors where possible.	Not required

Step 4 - Determine Significant Effects

3.23 The assessment has identified that there are potentially sensitive human receptors located near to the proposed scheme. The sensitivity of the area, which takes into consideration the number and distance

of human receptors from the site and baseline conditions, is summarised as being low sensitivity with respect to changes in dust deposition rates and low sensitivity with respect to emissions of PM_{10} within the study area. For ecological receptors, the sensitivity of the Firth of Forth Ramsar, SPA and SSSI is considered a 'Medium' sensitivity receptor.

3.24 The scale of the activities associated with construction of the proposed scheme has been used to judge the dust emission magnitude for the different types of potential dust generating activities (categorised into demolition, earthworks, construction and trackout). Prior to mitigation measures being implemented, demolition and construction activities are considered a small dust emission magnitude and earthworks and trackout activities are considered a medium magnitude.

3.25 When combining the sensitivity of the area and the dust emission magnitudes following the IAQM guidance (IAQM 2016), for potential dust soiling effects, there is predicted to be a Low to Negligible risk from demolition, earthworks, construction and trackout activities as there is the potential for infrequent, short term episodes when baseline dust deposition rates could be increased by an amount that residents could perceive. For human health effects, the proposed demolition, earthworks, construction and trackout activities associated with the construction of the scheme are predicted to be a Low to Negligible risk for as there is limited potential for emissions of PM_{10} to increase baseline concentrations to a value that is above the AQO set for the protection for human health. For the Firth of Forth Ramsar, SPA and SSSI, there is considered to be a Medium risk from earthworks activities and a Low risk from demolition, construction and trackout activities.

3.26 The dust risks summarised above for each activity were used to identify the recommended level of mitigation (see Table 10 to Table 15).

3.27 IAQM guidance (IAQM 2016) notes that, with the application of mitigation measures of the type available for use on this project, the environmental effect will not be significant at any off-site receptor. IAQM guidance (IAQM 2016) also notes that, even with a rigorous package of mitigation measures in place, such as is proposed above, occasional impacts may occur.

3.28 In summary, with the mitigation measures applied as specified above, the likely effect of dust emissions on human health and amenity and ecological receptor during construction is concluded to be not significant.

4 References

Department for Environment, Food and Rural Affairs and the Devolved Administrations (Defra) (2016). Local Air Quality Management: Technical Guidance (TG16).

Institute of Air Quality Management (IAQM) v1.1. 2016. Guidance on the Assessment of Dust from Demolition and Construction. London: Institute of Air Quality Management.