



**METRO NORTH
ORAL HEARING**

PROOF OF EVIDENCE

Martin Hogan

Human Health

Wednesday 15th April 2009



Metro North Oral Hearing

Proof of Evidence

Human Health Effects

Dr Martin Hogan

1.0 NAME, QUALIFICATIONS AND ROLE IN PROJECT

- 1.1 I Dr Martin Gerard Hogan hold a primary medical degree from University College Cork Degree: MB. BCh BAO (1987).
- 1.2 I hold post graduate qualifications including an M.I.C.G.P 1991 and M.R.C.G.P 1991. I trained as a specialist in Occupational Medicine in the University of Manchester and hold the qualifications AFOM (RCP Lond) and MFOM (RCPI) 1995. I was made a Fellow of the Faculty of Occupational Medicine (FFOM) (RCPI) in 2001. I am a Fellow of the Royal College of Physicians of Ireland (FRCPI).
- 1.3 I am a registered specialist in occupational medicine with the Irish Medical Council. I am currently a full time Consultant Occupational & Environmental Physician and director of Employment Health Advisers Ltd.
- 1.4 I am the National Speciality Director for occupational medicine and Vice Dean of the Faculty of Occupational Medicine. I am occupational physician to University College Cork and a Lecturer in occupational medicine, University College Cork. I am a specialist trainer in occupational medicine since 1997. I am an examiner with the Faculty.
- 1.5 My areas of special interest are, Toxicology, Environmental Health effects of Industry, Occupational Asthma, Health effects of Noise and Occupational Hygiene.
- 1.6 I have prepared human health sections on many Environmental Impact Statements on projects as diverse as landfills, incinerators, airport runways and composting. I have given evidence in oral hearing on many occasions.

2.0 INVOLVEMENT WITH THE PROJECT

- 2.1 I was invited to perform a human health assessment largely in response to the expression of concerns by the general public as part of consultation initiatives. Amongst other activity I consulted with the HSE to discuss the appropriate format that an assessment of the potential human health effects of the proposed project. I then prepared an assessment of the potential

human health effects of the proposed line. This was included in the EIS. In assessing the potential effects I have relied on my own knowledge and experience. I reviewed evidence available in the literature. I have also relied on the information contained in the EIS.

3.0 GENERAL INTRODUCTION

Human Health

- 3.1 The World Health Organisation (WHO) defines health as complete physical, psychological and social wellbeing and not simply in terms of absence of disease or infirmity. It is with this in mind I made the assessment.

4.0 METHODOLOGY

- 4.1 For reasons, detailed in the EIS, we used predicted changes to the environmental baseline to assess the potential impacts of Metro North on human health. It is of note that the Health Service Executive has endorsed the use of this methodology with respect to the proposed scheme.
- 4.2 A literature search was completed to analyse any known effects of any similar projects anywhere in the world.

5.0 HUMAN HEALTH EFFECTS

The potential human health effects of the Metro North project during construction and during operation have been assessed. I will now summarise this assessment under the relevant topics.

5.1 *Noise Induced Hearing Impairment*

During the construction and operational phases of the proposed scheme environmental noise levels sufficient to cause Noise Induced Hearing loss simply will not occur. Therefore there is no risk of noise induced hearing loss due to noise from environmental exposure as a result of Metro North.

5.2 *Interference with Speech Communication*

Most important communication takes place indoors, for example, in schools, which is separately referred to below. A background noise level of 45dB Leq indoors is very unlikely to interfere with communication. This corresponds to much higher levels outside due to the attenuation of the building. While this will vary, depending on the age and the design of the building one can expect a minimum of 15dB attenuation even with windows open and often much more in practice. However noise levels significantly above this may not have any significant impact on communication. For example intermittent noise excursions will not normally significantly interfere with communication. In the event of occasional words being misunderstood they will simply be repeated. In this respect railway noise, which by its nature is intermittent, is unlikely to interfere with communication.

Construction noise can be of a more constant nature. It will however typically be for defined and relatively short periods of time. Temporary effects on communication may be experienced in areas identified as having a Leq significantly in excess of 60 dB. However simple local mitigation measures such as closing windows will allow efficient communication.

Based on the predicted results presented in the noise evidence no ongoing adverse effects either in the construction or operational phases of the proposed scheme are predicted.

5.3 *Schools*

Schools are amongst the most sensitive receptors of all when it comes to environmental noise. This is because of the importance of communication in the process of education but also the inherent distractibility of children. The EPA (USA) suggested that sound pressure levels indoors in schools of 45dBA would be acceptable as this is compatible with 100% comprehension at normal speech levels

This figure is also quoted by WHO but the latter body has also stated that ideal levels are as low as 35dB during teaching of young children.

5.3.1 This lower level has also been stated by ANSI (American National Standards Institute) as well as the British Standards Institute. It is important to note the

purpose of WHO, ANSI and BSI was to give guidance to designers of schools. They do not state that the 45dB threshold was wrong but rather that the 35dB is ideal. It is certainly true that many if not most school rooms in this country are above this lower threshold. The key point is there is no evidence of any deleterious effect at 45dB. No organisation is stating that this level is less than satisfactory.

- 5.3.2 In the UK it is generally accepted that noise levels up to 65dB outside of the school are acceptable during the construction phase of a project. There are several studies on the effect of environmental noise on education. However most of these relate to airport noise and to a lesser extent traffic noise. There is far less evidence relating to rail noise. From studies available, school learning may be the factor most affected by environmental noise. Following exposure to aircraft noise, schoolchildren in the vicinity of Los Angeles airport were found to be deficient in proof reading, and in persistence with challenging puzzles.
- 5.3.3 The finding that children's cognitive skills can be affected by very high noise levels were given further credence by the RANCH (Road traffic and Aircraft Noise Exposure and Children's Cognition and Health).
- 5.3.4 As the name suggests this did not study railway noise. While showing little new it suggests a small detrimental effect of noise on reading comprehension in 9-10 year old primary school children across 3 countries. It also stated "Neither aircraft noise nor traffic noise affected sustained attention, self-reported health, or overall mental health." It was surprising that the study suggested significantly improved memory function in children exposed to high levels of traffic noise. This appears inconsistent with findings of other studies and intuitively difficult to understand.
- 5.3.5 Again there is little evidence of railway noise, particularly of a light railway system, would be as significant as aircraft noise these studies are quoted here because they are applicable to transport noise in general.
- 5.3.6 Most schools in any sort of proximity to the proposed line are not going to be adversely affected at all. My colleague Steve Mitchell will address those with potential impacts in his evidence on noise.

5.3.7 One school with a potential impact during the construction phase not identified in the EIS is the Gaelscoil in Parnell Square. While this had not been specifically identified as a school but there is a noise monitoring location right next door and the whole row would be classified as sensitive receptors, MN107-C4. This school currently exists in a busy, and therefore noisy city, centre street. Nevertheless the construction will add somewhat to this but the overall impact of this increase may be less than if the school was in a quieter area. I met with the school representatives and personally viewed the premises. I am very confident that mitigation measures will ensure no significant noise increases in the classroom over existing levels.

5.4 *Sleep Disturbance*

5.4.1 Sleep disturbance is considered to be a major environmental noise effect. It is however estimated that 80-90% of the reported cases of sleep disturbance in noisy environments are for reasons other than noise originating outdoors.

Sensitive groups include the elderly, shift workers, persons especially vulnerable to physical or mental disorders and other individuals with sleeping difficulties.

5.4.2 There is evidence that habituation to night-time noise events occurs, and that noise-induced awakening decreases with increasing number of sound exposures per night. Studies have also shown that the frequency of noise-induced awakenings decreases for at least the first eight consecutive nights.

5.4.3 In simple terms people get used to the noise. For the proposed scheme any possible effect on sleep disturbance will be during noisy work during the construction phase and during the operational hours of the proposed scheme when built.

5.4.4 As stated most of the published research has been related to aircraft noise but in a recently published paper which studied some 23,000 subjects the authors concluded that at the same average night time noise-exposure level, aircraft noise is associated with more self-reported sleep disturbance than road traffic, and road traffic noise is associated with more sleep disturbance than railways. In other words railway noise is the least likely to affect sleep. This of course is applicable only to the operational phase.

- 5.4.5 People also sleep during the daytime, for example shift workers, but ambient noise levels are much greater at this time anyway so it is less likely that an additional noise source will have a significant effect.

Levels of night time noise during the construction phase greater than the ambient levels or greater than 45dB are considered significant. Obviously the construction period will be of limited duration. Effects of short duration are less likely to have a human health effect than ongoing noise sources.

- 5.4.6 In general levels of night-time noise between 2200 to 0800, in excess 48 dB L_{Aeq} are considered significant in so far as there is a potential effect on sleep. The ambient in some areas in the city is greater than this due to traffic etc. These night-times will include operational hours. I repeat that the nature of the noise is also relevant and with respect to transport noise railway noise is the least obtrusive. During the operational phase, after mitigation, no significant noise impacts are predicted in any section of the line.

During the construction phase the EIS identifies some areas where noise is modelled to be significant enough to have an effect on sleep if the work is carried out during night time hours. Some works may need to happen outside of regular working hours to facilitate the works i.e. – concrete pours, delivery of rails etc and the potential effects associated with this. In addition some works may be scheduled at night or at certain times to minimize other effects. Mitigations measures are suggested. With these in place the impact on sleep would not be significant enough to expect an effect on health.

5.5 *Cardiovascular and Physiological Effects*

Based on the predicted results no adverse human health effects either in the construction or operational phases of the project are predicted.

5.6 *Mental Health Effects and Effects on Performance*

Environmental noise is not believed to be a direct cause of mental illness, but it has been assumed that it accelerates and intensifies the development of latent mental disorder. Again there are very few studies of railways. Based on the predicted results no adverse human health effects either in the construction or operational phases of the project are predicted.

5.7 *Effects of Noise on Residential Behaviour and Annoyance*

5.7.1 Noise annoyance is a global phenomenon. It is estimated that at least 20% of the population of the EU live in areas of significant annoyance due to noise levels. A definition of annoyance is “a feeling of displeasure associated with any agent or condition, known or believed by an individual or group to adversely affect them”.

Studies have shown higher annoyance levels from aircraft and traffic noise than from railway noise.

5.7.2 The higher noise levels associated with construction will undoubtedly be of some annoyance as virtually all construction projects can be. This will be of limited duration and mitigation measures will reduce this. It is also true that people will accept higher levels of noise when they know it has an end point, that is completion of construction. Human health effects are not predicted in the construction phase.

With the mitigation proposed significant annoyance effects are not predicted for the operational phase.

5.8 *Potential Health Impacts of Vibration (including ground borne noise)*

5.8.1 Vibration in buildings can interfere with activities and affect human occupants in many ways. The quality of life can be reduced as also can working efficiency. There are many and complex factors determining human response to vibration, and there is also a paucity of consistent quantitative data

5.8.2 Vibration can be transmitted to the human body as a whole through the supporting surface: through the feet when standing, the buttocks when seated, or the supporting area when reclining.

5.8.3 Also the building may vibrate with resulting reactions of the occupants. These are typically fear of damage to the structure or its contents, startle, and interference with sleep, conversation, or other activities.

5.8.4 The vibration emissions from the construction and operational phases of the proposed scheme will be quite different. Construction, by its nature, will be time defined and may be for quite limited periods for any single receptor, for example in the case of tunnelling the boring machine moves daily. Higher

vibration levels may be associated with lesser effects if they are for relatively short periods of time. By contrast operational vibration can be assumed to continue indefinitely so lesser effects may be significant.

- 5.8.5 Certain activities particularly the tunnelling phase of construction may be associated with significant local vibration for a limited period of time. From a health perspective however it is very likely that any potential effect will be mitigated by the relative short duration of exposure. It is for example likely that no single residence will be exposed to significant vibration for prolonged periods as in simple terms the tunnelling will move day by day. Tunnelling is predicted to advance at a rate of 75m per week. Annoyance is probably the most likely effect.
- 5.8.6 It is worth noting that most humans can not even feel vibration of less than 300µm in velocity. Some areas are predicted to have an effect during the construction phase which will be of relatively short duration. Because of this no health effect is predicted. Modelling predicts no significant effect from the operational phase either in terms of groundborne noise, vibration effect in humans and vibration affecting sensitive equipment. Based on this no adverse effect on human health is predicted.
- 5.8.7 A concern was raised about the potential effects of vibration on human embryos which are stored in the HARI clinic. I did a literature search and perhaps not surprisingly found little or no information on this. Nobody has any reason to expose human embryos to vibration and there are ethical reasons why one would not do it as an experiment. We have some information on embryos from other species but at levels of vibration far in excess of those predicted here. It is fair to say that no reason for concern has been raised from these limited studies that may impact on human embryos. Perhaps more importantly we know that embryos in their mother's bodies would be exposed to some degree of vibration from every day life such as travel, walking and other normal activity of the mother as well as normal physiological activity such as gas movement in the bowel of the mother. Ultrasound has been used safely for many years yet this has the potential to induce small amounts of vibration. Even in vitro embryos will be exposed to vibration anyway from for example people walking around or the machinery of the incubators or

refrigeration. All this means that it is extremely unlikely that there could be a detrimental effect.

5.9 *Potential Health Effects of Radon (Soil and Geology)*

The local geology makes a detrimental change in Radon levels unlikely. In the event that it would occur it will be detected in monitoring being carried out in the construction phase. If necessary, mitigation measures will be put in place.

No residual negative impacts on human health because of increase in radon exposure are predicted in the operational phase.

5.10 *Potential Health Effects of Electromagnetic Interference and Radiation*

5.10.1 Electromagnetic compatibility (EMC) is the branch of electrical sciences which studies the unintentional generation, propagation and reception of electromagnetic energy with reference to the unwanted effects that such energy may induce. Emissions, such as Electric and Magnetic Fields (EMF) are related to the unwanted generation of electromagnetic energy.

5.10.2 The World Health Organisation guidance states that EMF is sometimes cited for potential health effects. Concerns expressed in the past include childhood leukaemia, brain tumours and other cancers. The concerns are normally related to high tension electricity transmission cables. Laboratory experiments have provided no reliable evidence that electromagnetic fields are capable of producing cancer, nor do human epidemiological studies suggest that they cause cancer in general.

5.10.3 Some non cancerous adverse health effects are claimed to be associated with power frequency electromagnetic fields. These include miscarriages, reproductive and developmental abnormalities, depression and suicide, allergy and neurological disease. However the Health Promotion Agency in the UK stated in November 2007 that “there is little scientific evidence to support these claims and the current body of evidence does not show that exposure to EMF below guideline levels presents a human health hazard.”

5.10.4 Electric fields are created by differences in voltage: the higher the voltage, the stronger will be the resultant field. Magnetic fields are created when electric current flows: the greater the current, the stronger the magnetic field. An

electric field will exist even when there is no current flowing. If current does flow, the strength of the magnetic field will vary with power consumption but the electric field strength will be constant. In terms of the proposed scheme the voltages will be low in relation to transmission cables.

Given the relatively low voltages and currents used in the proposed scheme no detrimental effects from EMC are predicted in the construction or operational phases of the proposed scheme.

5.11 *Potential Human Health Impacts of Construction/ Operational Dust (Air Quality)*

5.11.1 A very significant element of the proposed scheme is underground. Construction of this will involve tunnelling. There will be large amounts of material excavated. Other sections will involve cut and cover techniques and the rest will be above ground. Spoil removal is necessary for all of these methods and will generate some dust. Much of this construction dust by its nature is quite heavy and disperses over a very confined area as it falls to ground rapidly. The construction process itself is not expected to generate large quantities of smaller size dust such as PM 10 and PM 2.5 which are more important in terms of environmental health effects. There will be an element of disturbance or resuspension of some PM10. Again however any resuspension is likely to be confined to a short period of time and over a small area. Mitigation measures in terms of dust control on the construction site will minimise any effects. It is extremely unlikely that the construction activities will result in Air Quality Standards being exceeded over any significant period of time in the environment outside the construction sites. We therefore can be confident that there will be no significant health effects.

The nature of the dust will depend on the nature of the soil. As part of the soil and geology baseline evaluation soil sampling was undertaken. This indicates that high levels of pollutants such as heavy metal will not be expected as this soil is moved. Some of the most vulnerable subjects to changes in dust levels may be patients in hospitals along the route. Again because the magnitude of changes in dust levels are so small and transient no detrimental health effects are predicted. The majority of the long term predicted air quality impacts

result from changes in road traffic. In the operational phase these changes are largely positive by replacing road journeys by rail travel.

5.11.2 In summary no detrimental effects are expected from the construction activities. No environmental release of pollutants such as heavy metals is predicted. With mitigation no detrimental effects from spoil removal is predicted.

Changes in traffic have been modelled for the construction and operational phases which overall suggest no significant detrimental effect in overall air quality during the construction or operational phases. There have been no significant health effects reported from dust in operational underground railways else where in the world and none are expected from dust underground in the operational phase of Metro North. Some submission have raised concerns about emissions from vents. It is of course important to point out that as the trains are electric there will be no emissions from fuel. Again no dust will be generated during operation but simply moved around. Again the impact above ground would be less than a vehicle driving on the road. Indeed it is only in the very unlikely event of a fire, for which extensive precautions exist that any significant vent emissions would arise and this would equate to having a fire anywhere.

5.12 *Potential Psychosocial Health Effects (Human Beings)*

5.12.1 Annoyance and railway noise has been discussed above. Other factors deserving consideration include the issues of suicide and violence. These are issues likely to be largely related to the operational phase of the proposed scheme. The psychosocial impact of the construction is likely to be similar to any major construction proposed scheme. While one might argue about annoyance effects if one is caught in increased traffic jams related to road closures to facilitate construction, the issue of traffic disruption is more properly dealt with in the traffic section.

5.12.2 Suicide is a problem experienced by railway networks worldwide. It should be stated that there is no evidence that the presence of an underground or for

that matter surface railways increases the rate of suicide but it may affect the chosen method.

5.12.3 Violence is always possible where groups of people meet. This may be more likely late at night or in the presence of alcohol or drugs. The presence of Gardai, security staff and or the use of CCTV may be expected to reduce this risk. There is however no evidence that the presence or absence of a railway line have any effect on the nature or the amount of violence. This is dependent on society issues.

5.12.4 Currently Dublin has a very significant traffic problem. Apart from the impact of this on air quality it also results in stresses to individuals and families.. It is important to note that there are likely to be considerable psychosocial and societal benefits from having an effective public transport system. These include improvements in vehicle emissions with potential benefits for local air quality and global environmental concerns. There are also likely reduced stress levels in travelling by train rather than driving on overcrowded roads and seeking parking in busy and expensive airport and city car parks.

To give a practical example of this from a human health perspective, many may put off important journeys, for example to the doctor or to hospital because of fear of being stuck in traffic. This may be particularly true for people coming from outside of Dublin who may be unfamiliar with one way systems etc. The fact the line serves major hospitals including being immediately adjacent to the Mater and Rotunda complexes will be of benefit to patients travelling to these important health care centres. Health care staff will benefit too and it has the potential to allow them to arrive at work fresher and less stressed.

Many of the aspects of construction can give rise to some worry. These could be as diverse as worries about effects from vibration on property, traffic changes, vermin etc. The actual risks associated with most of these are not significant and while most will be reassured with information how ever some may continue to worry. Usually all worries disappear once the activity has started with the realisation that the actual impact is less than that feared

5.12.5 Concern is associated with virtually any change anywhere, with most construction projects and certainly all of this size. The important point is that

while we can not stop all worry it is a considerable jump to translate this concern to that of a health impact. Worry itself is not a medical condition. There is no evidence from elsewhere or indeed from Ireland from similar projects that there is a significant impact on psychological health.

The overall impact of the proposed scheme in the operational phase on psychosocial health is likely to be beneficial.

5.13 *Aspergillus Fumigatis*

5.13.1 *Aspergillus fumigatus* is a fungus and one of many microorganisms which bring about the everyday decay of leaves, wood and other organic matter in our environment. It may be found virtually everywhere on earth, and, although we are all exposed to it regularly, it does not normally cause disease. Our bodies' immune system normally acts as if it were an innocent visitor, unless it invades tissues. In that event, the immune system responses will protect us.

Aspergillus spores (also called conidia) are very light in weight and therefore are easily spread by air currents.

5.13.2 Construction and renovations are associated with dust generation. In association with this there can be increased *Aspergillus* levels in air. While we have do not have good data on infective doses of these organisms, it is reasonable to expect that increasing the potential dose increases the likelihood of eliciting a response, even in otherwise normal people. Therefore, in preventing or reducing health risks from *Aspergillus*, it is considered important to control exposure to spores by utilizing a set of best management practices.

There are individuals who, due to special circumstances, may be at higher risk. It is impossible for any individual no matter how vulnerable to completely avoid exposure to *Aspergillus* as *Aspergillus* is ubiquitous in the environment.

5.13.3 There is no doubt that the individuals most vulnerable to *Aspergillus* as an infective organism are the immunocompromised. These are often but not always hospital based. It is of course true that as well as being vulnerable to

Aspergillus they are usually vulnerable to a multitude of other organisms as well.

The *National Guidelines for the Prevention of Nosocomial Invasive Aspergillosis During Construction/Renovation Activities* were issued in 2002 by the National Disease Surveillance Centre (NDSC).

These are summarised in the EIS. All ground breaking construction work will have the potential to temporally increase the ambient air levels of Aspergillus in the immediate environs, that is within 200 metres of the site. Within this 200 metre area however the highest level are going to be within 50 metres. The proposed scheme is no different from any construction work in this respect. Other activities such as composting and even grass cutting can be associated with greater increases. For the vast majority of people this is not an issue. The relevant institutions for this project are the Mater Misericordiae and the Mater Private Hospitals. Mitigation measure proposed in above guidelines minimise the potential for any detrimental effect. These will be followed and therefore there will be no significant risk of a detrimental effect.

5.13.4 There has been extensive consultation with the Mater Private in particular with regard to this. With the completions of the upgrade work in isolation rooms in the Mater Private, which were necessary regardless of this project, the added risk associated with the proposed construction are not deemed to pose a significant treat to the patients. The implementation of good dust control measures on site during the construction phase of the Mater Stop box will minimize risks to all other areas of the hospital to non-significant levels.

5.14 *Leptospirosis (Weils Disease)*

Leptospirosis is transmitted by the urine of an infected animal, and is contagious as long as it is still moist. Rats and mice are important primary hosts. Humans become infected through contact with water, food, or soil containing urine from these infected animals. This may happen by swallowing contaminated food or water or through skin contact. Prevention measures include good sanitation particularly rodent control. The risks are related to rodent numbers. There are rodents everywhere. Construction work will result

in breaking of ground and will expose some rodents for a short period of time. Nothing in the construction phase however will encourage an increase in rodent numbers. There is for example no food source to encourage population growth. The same is true for the operational phase although rodent control measures will be necessary in, for example, tunnels. Indeed with control measures in place during the construction and operational phases a reduction in rodent population is more likely. Overall because of no increase rodent population no significant impact on the incidence of Leptospirosis or its associated human health impacts is predicted.

5.15 *Groundwater and Surface Water*

There is no significant risk of contamination of potable water supplies which by and large comes from some distance away for the population around the proposed scheme.

5.16 *Landfill sites*

There are no licensed landfill sites along the proposed scheme. By their nature of being unlicensed it is impossible to predict with absolute accuracy that there will not be sites exposed during excavation but current evidence suggests that this is not likely. In the event of a significant landfill site being exposed it will be a matter for the Environmental Protection Agency (EPA). Any mitigations measures required by the EPA will be instituted. With this no human health impacts are predicted.

6.0 *Impacts arising from Changes to the Railway Order*

I have considered the Railway Order changes and found them to be of no consequence on issues of human health.

7.0 BENEFITS

While touched on above, where I primarily dealt with potential detrimental effects there can be no doubt that the overall health effect of an efficient operational public transport system such as is proposed will be major benefits in terms of the environment. This will be both local by taking traffic off the road and global in terms of climate change. The psychological benefits from

easier, quicker transport, convenience, improved property values are impossible to measure but undoubtedly significant.

8.0 CONCLUSION

Relatively minor inconveniences/ annoyances are to be expected during the construction phase. These relate to sleep disturbance, noise, vibration etc. None of these are however predicted to have a significant health effect. The operational phase is not predicted to be associated with any significant detrimental effect. There are definite benefits to human physical and psychological health from an operational line. Overall the predicted impact of the project on human health is going to be positive.

Railway Procurement Agency
Ghníomhaireacht um Fháil Iamróid
Parkgate Business Centre,
Parkgate Street, Dublin 8, Ireland
Phone +353 1 646 3400
Fax +353 1 646 3401
www.rpa.ie

Responsible for

LUAS METRO

Integrated
Ticketing
System

With funding and
support from

transport21
progress in motion

