Occupational Hygiene at the Olympic Park and Athletes' Village

Can workplace health management be cost effective?

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Institute for Employment Studies

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Park/Village Health

Park/Village Health was established as the ODA's central provider of occupational health support on the Olympic Park and Athletes' Village construction projects. The multi-disciplinary team of occupational health and occupational hygiene professionals provided a comprehensive service to those working on the site which aimed to prevent and treat work-related ill-health.

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Contents

Executive Summary

This project was commissioned by the Olympic Delivery Authority (ODA) and conducted by the Institute for Employment Studies (IES) with the support of the occupational hygienists from Park and Village Health. These occupational hygienists worked as part of a multi-disciplinary team providing Occupational Health support during the construction of the Olympic Park and Athletes' Village. A more extensive report is available as the result of a joint ODA and Health and Safety Executive (HSE) funded project to evaluate the service (HSE Research Report 921). This provides further details on the approach to occupational health taken on the Park and Village and an assessment of the economic returns from the clinical elements of the service.

Research approach

The aim of the research was to quantify the benefits of the occupational hygiene service provided during the Olympic build.

The research had three key phases:

1. Collaboration with occupational hygienists from Park/Village Health and ODA to identify the likely scale of impact and costs. The report also draws on data collection undertaken as part of HSE Research Report 921, including surveys and interviews with managers and workers, where relevant.

2. A review of other sources of data which would allow these impact estimates to be converted into a cost–benefit assessment.

3. Analysis of both the costs and likely benefits of the occupational hygiene programme based on the best available data.

The completion of the cost–benefit calculations required a range of assumptions to be made. There are undoubtedly other ways in which the estimates could have been made which would affect the results. The figures in this report are therefore not put forward as a definitive estimate, but as a useful starting point for debate about the benefits of occupational hygiene (or preventative Occupational Health) programmes.

The role of Park and Village Health

The construction of the Olympic Park and Athletes' Village was a major and complex project. The site extends over 500 acres of formerly mixed-use land, including industrial, residential and 'brown field' sites. The construction phase involved creating major venues for use during and after the events of 2012 (eg Aquatic Centre, Olympic Stadium), as well as extensive infrastructure development and the landscaping of new parklands. The peak workforce was estimated to be around 12,000 people and around 46,000 people worked on the Park and Village over the lifetime of the project. Health and safety management was extremely effective, with a very low accident rate achieved for the site (an Accident Frequency Rate of 0.16 on the Park and Village compared to an estimated 0.52 for the industry as a whole)[1].

Park Health (and later Village Health) was established to provide a comprehensive Occupational Health service which would help ODA and contractors meet their requirements with regard to workplace health management. The occupational health provision was given equal priority and prominence as measures aimed to drive up safety standards. Park/Village Health provided a range of services and an integrated approach to health risk prevention and risk management. Park and Village Health included a clinical service staffed by occupational health nurses and physicians working together with an occupational hygiene team. Whereas occupational health clinical staff are competent in recognition, assessment and treatment of *the worker*, occupational hygienists are competent in the science of recognition, evaluation and control of factors or stresses arising in, or from, *the workplace* which may cause ill-health.

On the Park and Village the occupational hygienists provided strategies to prevent work-related ill-health from occurring. The team were involved at a leadership level on site, being regular attendees at all senior team health and safety meetings helping to ensure that all site initiatives for safety also included consideration of how to protect worker health. Regular and competent occupational hygiene support on site was provided so that as all design work, method statements and

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[1] The rate on the Park/Village was calculated as the number of reportable accidents per 100,000 working hours for the period 2005 to 2011. HSE industry data taken from LFS estimates for the construction industry as a whole averaged over the period 2008/9 to 2010/11 was used as a comparison. LFS calculations, however, are reportable accidents per 100,000 workers. To convert this into a comparable figure, the rate of 1,090 reportable accidents was divided by an accepted proxy for the average number of working hours in a construction year (2,100) to arrive at the figure of 0.52. Table INJINDI_3YR on the HSE website provides more detail on these figures.

risk assessments were being compiled, assessed and adjusted there was an adequate focus on eliminating and reducing exposure to health risks *in the workplace*. However, there was greater potential for the team to become involved in design decisions, and for their involvement to occur much earlier in the design process in order for risks to be 'designed out' more effectively before reaching the site. The services were available and free to all contractors and workers on the site.

Details of the occupational hygiene work

Park/Village Health adopted a 'health like safety' approach to working with contractors which used existing approaches to safety management as the basis for health management. This encouraged contractors to embed workplace health management into their day-to-day work practices. The aim was to achieve the same high standards for health as were expected for safety.

The work of the occupational hygiene team involved a range of elements, including:

- Assuring standards in partnership with the ODA's delivery partner.
- Engaging contractors with the need for and benefits of workplace health management. This helped contractors meet their key performance indicators set by ODA and produce occupational health risk registers for each project. The occupational hygienists could then examine possible upcoming exposure issues and use the principles of prevention to eliminate or reduce them.
- Enabling contractors to improve workplace health management through risk assessment reviews and the production of risk management plans which contractors were encouraged to implement themselves.
- Establishing a presence at regular health and safety meetings across the site allowing access to senior and other managers by the occupational hygiene team, and which encouraged contractors to benchmark their performance on occupational hygiene with each other.
- Designing tools which helped contractors monitor their occupational hygiene performance and the effectiveness of their control measures.

The service received a very positive reaction from workers and managers and received a number of awards recognising its achievements. Managers in particular learned a lot from working with occupational hygienists and from implementing the 'health like safety' approach.

Examples of cost-effective occupational hygiene solutions

Park/Village Health has a number of case studies which highlight how they worked with specific contractors on emerging issues. The case studies set out how economic benefits could be seen by having a fully briefed occupational hygiene team working as part of the approach to health and safety management. Specifically the examples demonstrated that:

- Following the identification of potential methacrylate exposure, the on-site occupational hygiene team was able to save a contractor an estimated £20,000 through speedy identification of the problem, and the introduction of a simple, but effective control regime.
- Having knowledge of likely contaminants on the site allowed the occupational hygiene team to quickly identify that irritating odours that were causing discomfort to the operatives were sulphide based and these would be unlikely to cause any significant health effects. As a result, the contractor was able to save an estimated £98,000 as works could continue without disruption.
- The ability to offer immediate access to tailored asbestos awareness training allowed the hygiene team to save one contractor an estimated £656,000 as its large workforce were able to quickly return to work following site closure after the identification of asbestos containing materials.

The case studies show that having occupational hygienists working as part of the health and safety management team meant they were able to respond more quickly, with access to better information about the site, and provide a more appropriate response than would be the case if occupational hygienists were brought in on an ad hoc basis. An on-site team can help to reduce the likelihood of unforeseen risks emerging and provide cost-effective solutions when they do. This can be extremely important in keeping projects on track in terms of timetable and budgets.

Estimated economic benefits of the whole service

A cost–benefit analysis (CBA) of the work of the occupational hygiene team was conducted. This used existing data relating to the costs of the service provision and the costs and scale of sickness absence and ill-health within construction and put forward a number of scenarios for how much difference having hygienists made for the Olympic workforce. A range of assumptions were made to allow reasonable estimates to be calculated. If all the costs and benefits were fully monetarised, the calculations presented here could be very different. The study is therefore subject to a number of limitations, including that the calculations:

- Are not based on actual observations of the benefits of the programme.
- Are only able to estimate the potential reduction in absence rates as employer data on actual absence rates was not available.
- Assume a static workforce for the purposes of making calculations whereas on the site, and within construction generally, there is a great deal of worker movement between and across sites.
- Do not consider the issue of presenteeism.
- Do not reflect cost savings from prevention of future case management, compensation and litigation arising from diseases such as Chronic Obstructive Pulmonary Disease (COPD) and cancers due to exposures to hazards such as silica and asbestos.

CBA requires that a counterfactual position is established, in this case what outcome would have occurred in the absence of the occupational hygienists. It is then possible to compare the counterfactual with what was observed in relation to the provision of the occupational hygiene elements of the Park/Village Health service. The difference is considered to be the net benefit of the service. The counterfactual in this case is construction industry norms for work-related sickness absence and occupational ill-health, and the assumption is that having the on-site hygienists and focus on occupational health issues improved the situation compared to these norms.

The Park/Village Health occupational hygiene team cost ODA £1.1m to run between June 2008 and July 2011. Assumptions with regard to the benefits of the programme were that the site had the equivalent of a workforce of 9,500 working on the site for three years. The service, therefore, cost around £37 per worker per year to run. The production daily added value associated with each worker were provided by ODA at a level of £490 a day.

Reduced sickness absence

The first calculation considered the costs of sickness absence. The assumptions used in the CBA calculations were that exposure to occupational health risks were reduced by two-thirds on the Park, compared to industry averages, and that reduced exposure on site led to directly proportionate reductions in work-related sickness absence. Also that the results were in line with what would have been achieved for a static workforce. Although not quantified, this would also lead to reductions in future litigation and claims from diseases with long latency periods.

Health and Safety Executive (HSE) data states that the construction industry has a work-related sickness absence rate of 0.87 days. The anticipated costs of work-

related sickness absence on the Park/Village without any interventions would therefore have been £12.1m. In order for the occupational hygiene service to cover its costs through reduced work-related sickness absence, a reduction of just 30 minutes per worker would need to be achieved. If we assume that the preventative programme led to a reduction in health risk exposure of two-thirds (in line with the achievements on safety), and that this relates directly to a reduced sickness absence rate, the absence rate on the Park would be 0.29 (a reduction of 0.58 days per worker). It was not possible to validate this assumption using actual on-site absence data as there were a huge number of contractors working, and no centralised record of absence. However, we have tried to make a reasonable assumption based on the available data which does show that reduced exposure does reduce absence. Using this model the net benefits of providing the service were around £7.0m. It should be noted that the cost–benefit models constructed in this study take no account of the costs of presenteeism to the industry, which could be significant.

Reduced ill-health

A second set of calculations was made which attempted to estimate the economic benefits of reducing new incidences of work-related ill-health. The figures produced are best viewed as what could be achieved if health risks were well managed across the whole of construction. In such a situation (ie cases of new ill-health were prevented through good workplace practice), an estimate of the potential scale of benefits for a workforce the size of that working on the Olympic build can be made. Estimates of the annual incidence of new cases of ill-health occurring amongst construction workers were taken from HSE published data based on the self-reported work-related illness (SWI) and workplace injuries component of the Labour Force Survey (LFS).

Two different calculations were made:

- Using HSE appraisal values for ill-health of £16,100 per case, a net benefit of £6.4m would be achieved if all new cases of ill-health could be prevented through good occupational health management, for this workforce over three years.
- Using estimates of the lifetime costs of occupational asthma (which are estimated to be £176,000 per case) gives a much higher value to the net benefits of a programme like that run on the Park and Village. These cost estimates are some of the best available with regard to the true costs of illness, but similar data does not yet exist for other conditions. Using this data a figure of £80.7m net benefits could be achieved for this workforce over three years.

Therefore if a workforce the size of that on the Olympic Park and Athletes' Village could, via reduced levels of exposure, be prevented from contracting occupational disease, the return on an annual investment of just £350,000 a year would be substantial. A simple calculation of the return on investment from preventing illness amongst the workforce suggests that the returns could be as high as £74 per £1 spent. It is difficult to construct an accurate estimate as we are dealing with a short-term project which we presume will have lasting benefits which cannot easily be estimated.

Overall, therefore, there are substantial benefits to employers in preventing work-related sickness absence, and substantial benefits to society and individuals in preventing work-related illness. In both cases, the potential benefits of using an occupational hygiene team to implement good occupational hygiene controls is likely to far outweigh its cost.

Future work to refine these estimates

The calculations presented here have a number of limitations, not least the difficulties involved in estimating the potential impact of a preventative service. The deficiencies in this analysis cannot therefore be adequately addressed without access to better data. We suggest the following for future research:

- The collection of better data on both exposure and health effects, including comparisons of exposures with current health-based exposure limits together with an epidemiological study of health effects to allow the impact of their work to be assessed with more confidence.
- Greater data sharing by employers with regard to exposure and sickness absence data.
- Investment in longer term exposure and health monitoring studies, or better analysis of available data to gain a more informed long-term view of the impact of improved workplace health management on illness and absence levels.
- Drawing together the wide range of existing case study material to develop a model of how preventative workplace health management programmes impact on workforce health so that impact can be assessed at each stage of the model. Such models would also be useful for employers in deciding how to improve standards.
- Establishing a better understanding of the true costs of ill-health for a wider range of conditions.
- Calculating the costs of presenteeism in a UK context, for a broader range of industries and a wider range of health conditions.

It is important that there is further investment in research which continues to establish these benefits in economic terms.

Main conclusions

The estimates of the savings resulting from the use of occupational hygienists to support the construction of the Olympic Park and Athletes' Village presented in this paper strongly suggest that preventative workplace health management can be cost effective. The paper contains specific examples of how occupational hygienists have assisted individual contractors on the site as well as estimating the overall benefits of their work. All of the examples and calculations provided demonstrate a **strong return on investment**.

The estimates presented of how cost effective such work is are not definitive, and there is certainly scope for further research to challenge or validate the figures. However, we believe that the paper does present a useful way to start debate about the business case for preventative workplace health management. This debate should involve representatives of employers, government, workers, researchers and insurance providers amongst others, as all these parties have a vested interest in realising the potential economic returns which would emerge from preventing work-related sickness absence and ill-health.

1 Research Details

The Institute for Employment Studies (IES) was commissioned by the Olympic Delivery Authority (ODA) to investigate whether the work of occupational hygienists during the construction phase of the Olympic Park and Athletes' Village was cost effective. IES worked with the occupational hygiene staff to analyse existing data available about their work on the Park and Village, and examined other sources of data which would allow the potential economic benefits of this work to be estimated. This report sets out the results of this work, with this first chapter describing the methods used.

This research was commissioned to explore the potential returns on investment from an occupational hygiene team working on the Park and Village. The occupational hygienists worked as part of a multi-disciplinary team providing a comprehensive occupational health service on the site. The service provided was known as Park and Village Health. The research took place between November 2011 and May 2012.

1.1 Research aim

The main aim of the research was to attempt to quantify the value of the benefits of an occupational hygiene programme in order to assess whether these benefits outweigh the economic cost of the programme and hence, whether the programme provided value for money.

1.2 Research methods

The research had three key phases:

1. Collaboration with occupational hygienists from Park/Village Health. This identified what data was available to attempt to estimate the impact of their service. This also identified a number of examples of the work of the occupational hygiene team which were used to provide cost–benefit case

studies. This initial phase also involved ODA supplying details of the costs of the service and the economic impact of hours lost due to workers not being available to work. Both of these were used in the cost–benefit assessment.

2. A review of other sources of data which would allow these impact estimates to be converted into a cost–benefit assessment, and a simple return on investment model. This involved consultation with a range of experts and searches of the available literature. The evidence review did not in any way constitute a full literature search of the area. However, from our consultations with experts in the field, it was clear that the best sources of information available about the scale of the impact of illness and absence on the construction industry came from HSE published statistics. HSE estimates of work-related illness and absence were then scaled to fit the size of the workforce on the Park and Village.

3. Data analysis of both the costs and likely benefits based on the best available data. The final phase required a range of assumptions to be made as the actual benefits of the programme were not measured. In fact it would be very difficult to do this without extensive commitment of resources over the long term, due to the latency of much occupational ill-health. The cost–benefit assessment presented here should therefore be viewed as a starting point for debating how best to estimate the potential impact, and benefits, of preventative occupational health interventions.

2 The Olympic Park and Athletes' Village, and the Role of Park and Village Health

This chapter provides the reader with some background to the Olympic Park and Athletes' Village construction projects.

2.1 The 'Big Build'

ODA was the public body responsible for developing and building the new venues and infrastructure for the London 2012 Olympic and Paralympic Games and their use after 2012. One of the key responsibilities of ODA was building the Olympic Park, where much of the action in 2012 will take place. ODA was established by the London Olympic Games and Paralympic Games Act, which received Royal Assent in March 2006. The London 2012 construction programme encompassed the Olympic Park, the largest regeneration project in Europe, the Olympic Village, Europe's largest new housing project, and several other sites.

From securing the land to build the Olympic Park in 2005 to completion of the 'big build' in 2011, a remarkable transformation took place in east London. The area was developed into a spectacular urban park with world-class venues and new infrastructure links. The site extends over 500 acres of formerly mixed-use land, including industrial, residential and 'brown field' sites. The Park area was originally fragmented, polluted and divided by waterways, overhead pylons, roads and railways. The removal of the overhead electricity pylons and the placing of power underground unlocked the area for development.

In addition to all of the complex management arrangements associated with a major project, several phases of work were incorporated within the construction programme. These included enabling work to prepare the site for development; venue and infrastructure work to provide the facilities for the Games; deconstruction of the temporary structures at the end of the Games and legacy work to transform the sites to meet criteria for future use.

The construction phase involved creating major venues for use during and after the events of 2012 (eg Aquatic Centre, Olympic Stadium), as well as extensive infrastructure development and the landscaping of new parklands, involving the largest planting project ever undertaken in the UK. The peak workforce was estimated to be around 12,000 people and around 46,000 people worked on the Park and Village over the lifetime of the project.[2]

2.2 Health and safety management on the site

Heath and safety for the construction phase was considered to be an integral part of the project due to moral commitments, legal obligations and control of risks (of hazards, to reputations and of missing deadlines). ODA appointed a delivery partner to manage the construction programme for venues and infrastructure in the Park. The delivery partner was responsible to ODA for ensuring that the construction work was delivered on time, to budget and to the specified quality (including to the expected standards of health and safety), as well as being the Principal Contractor for some areas of the Park.

2.2.1 Health, safety and environment standard

The ODA produced a clear statement to inform those delivering the project of their aspirations in the form of a Health, Safety and Environment (HS&E) Standard. This outlined the procuring of designs, appointment of contractors and the building of the new venues and infrastructure work in relation to health, safety and the environment. It set out minimum requirements (for example Membership of Considerate Constructors, to work in line with Respect for People and use a behavioural safety programme) for those wishing to work on the project and key performance indicators (eg zero fatalities, and accident frequency rate (AFR) benchmarked against one in a million[3]). The HS&E standard reminded contractors of their responsibilities under the Construction Design and Management (CDM) regulations and informed them that a CDM integrator must work with the CDM coordinators to produce a consistent approach across the separate projects.

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[2] Taken from: *Learning Legacy Communications Guide* (2011), produced by ODA.

[3] The one in a million target was adopted having first been used as a benchmark on the construction of Terminal 5 at Heathrow Airport (although this was not achieved during that build). It is a very stretching target, representing a much lower accident rate than the average of all UK employment rather than construction. One in a million was chosen as it sounded simple, understandable and was very challenging.

2.2.2 Tools and monitoring

As part of the aspirations of the Games, construction work was required to incorporate six key themes (design and accessibility, employment and skills, equality and inclusion, health, safety and security, sustainability, and legacy) across all of the projects during every phase.

A formal scorecard system was used, as well as an accident/investigation reporting arrangement (both web-enabled). Principal Contractors, Designers and CDM Coordinators were all required to self-monitor and submit monthly reports on their efforts to achieve high HS&E standards, and accidents, incidents and significant near misses.

As part of their commitment to high standards of occupational health, ODA appointed, managed and paid for the services of occupational health and occupational hygiene staff who came together in an integrated service called Park/Village Health. The Park/Village Health team introduced a system of monitoring Health Impacts (the Health Impact Index) to enable the reporting systems to adequately cover health incidents and exposures. The team worked closely with the web system provider to create a web enabled tool to capture health impacts which was similar in look and feel to the existing safety tool. This is the first time that a system to capture health impact rates has been produced for any industry.

Part of the ODA standard required Principal Contractors to have a behavioural safety management system in place. Some of the worker engagement aspects to be adopted included:

- a no-blame culture
- daily activity briefings for workers
- the production and use of method statements
- allowing workers the opportunity to question the work
- toolbox talks to brief workers on issues and develop their awareness and skills
- site wide health and safety briefings.

Health and safety information was communicated to the workers on a daily basis mainly through the worker engagement processes (Daily Activity Briefings (DABs), toolbox talks and encouraging workers to speak up about their concerns). DABs for example, ensured that all work teams understood their tasks for the day and any associated health, safety and environment implications/requirements.

Opportunities existed for communication across projects through a number of forums including: Project Leadership Teams; Health, Safety and Environment Leadership Teams, and; Health, Safety and Environment Forums. These meetings allowed key personnel from the Principal Contractors and their suppliers to share health and safety information. Documents were also used across the projects such as Health, Safety and Environment Bulletins to provide feedback to the project teams on overall performance and the Common Standards which are produced by all parties to continually deal with emerging health, safety and environment issues. Occupational hygiene was integral to all of these tools and techniques.

2.2.3 High standards of safety achieved

ODA had excellent monitoring data regarding the health and safety performance of contractors on the site. Analysis of these data demonstrates how effective the health and safety management had been. ODA's health and safety close-out report[4] outlines how, by July 2011, construction on the site accounted for nearly 70 million working hours. During this time the accident frequency rate (AFR)[5] was 0.16. Comparable figures for the construction industry as a whole are in the region of 0.52.[6] The site achieved 31 periods of one million working hours, five periods of two million hours, two periods of three million hours and one period of four million hours worked without a RIDDOR-reportable injury.[7]

A survey undertaken on the Park and Village[8] explored the views of managers about the standards achieved. Just over 40 per cent rated the availability of personal protective equipment (PPE), work design and welfare facilities on the Park and Village as much or a little better than other sites they had worked on. In addition, almost 70 per cent of managers felt that various welfare provisions (ie

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4 Olympic Delivery Authority Health and Safety Priority Theme Close Out Report, Executive Summary.

5 AFR = number of accidents x 100,000/total hours worked.

6 This latter figure is obtained by taking the average three year figure for 2008/9 to 2010/11 from Labour Force Survey data of 1,090 reportable accidents per 100,000 workers employed and using an adjustment factor of 2,100 hours per year worked by the 'average' construction worker to convert this into an AFR.

7 RIDDOR = Reporting of Injuries, Diseases and Dangerous Occurrences Regulations. A RIDDOR-reportable injury is one in which a major injury (eg fracture) is sustained or where the individual is away from work as a result for more than three days.

8 As part of Tyers C and Hicks B (2012) *Research into Occupational Health performance on the Olympic Park and Athletes' Village*, Health and Safety Executive Research Report 921.

washing facilities, barrier creams, shelter, availability of hot and cold drinks and use of breaks to vary routine) were much or a little more common when compared to other sites. There was therefore clearly a view amongst managers that conditions for workers on the Park and Village were good.

Survey and interview data from managers and workers[9] also demonstrated that they did intend to carry forward learning from their time on the Park and Village. Managers, in particular, learned a lot from working with occupational hygienists, and from the 'health like safety' approach. Where there was senior management commitment to the principles of good occupational hygiene management, learning from the Olympic Park was more likely to have been embedded in company policies.

Another survey on the site, this one of workers[10] demonstrated that the vast majority felt consulted on most aspects of health and safety (over 60 per cent, but up to 80 per cent depending on the specific aspect of health safety being referred to). In addition, 66 per cent of workers felt comfortable raising health and safety issues on the project, and 79 per cent felt their awareness of health and safety issues had improved since their work on the Park.

2.3 Park and Village Health

As part of their commitment to achieving excellent standards of health and safety, the ODA also provided a comprehensive occupational health (including occupational hygiene) service which both prevented and treated cases of work-related ill-health, as well as promoting well-being. The specific aims for this occupational hygiene provision on the Olympic build were set out in the ODA's HS&E Standard, and were therefore given equal priority and prominence as measures aimed to drive up safety standards. The service was called Park Health, and later Village Health was added, reflecting its coverage of all areas of the site. The aims were that the Park/Village Health team would provide a range of services and offer an integrated approach to prevention and risk management. The occupational hygiene team advised the ODA and their delivery partner on the development of its workplace strategy and worked with the Park and Village supply chains to help them meet and understand ODA workplace health

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9 Tyers and Hicks (op. cit.).

10 Undertaken as part of Lucy D, Tamkin T, Tyers C and Hicks B (2011) *Leadership and Worker Involvement on the Olympic Park*, Research Report 896, Health and Safety Executive.

standards. Park/Village Health services were available and free to all contractors and workers on the site.

2.3.1 Scope of the service

A project brief for Park and Village Health sets out three underlying priorities for their service, which were:

- ill-health prevention – limiting the impact of work on people's health – the primary focus of the occupational hygiene team;
- clinical health intervention – limiting the impact of a person's health on their work;
- health promotion – the use of the workplace environment to promote healthy behaviours.

These three elements were intrinsically linked in the way the service was designed and delivered. Health promotion was seen as a key tool, for example, in promoting workplace, as well as general, health behaviours. Joint campaigns, for example on reducing exposures to dust and smoking cessation, linked all three elements of the service together. A strategic plan for the service was established and reviewed annually. The plan was endorsed by representatives of ODA, their delivery partner and principal contractors. It focused on the main occupational health risks facing workers in construction (exposures to hazardous substances, noise, vibration and manual handling) alongside emerging or topical issues (eg use of sun protection in summer months). The service was staffed by a multidisciplinary team.

Clinical services

The clinical service was staffed by Occupational Health nurses and physicians and physiotherapists. This operated from two facilities, one on the Park and one on the Village, both of which offered consulting rooms and equipment required to conduct health surveillance and checks. In addition, dedicated emergency response vehicles were available on site.

The clinical services included:

- Pre-employment medical screening. This occurred when new workers arrived on the site, as part of the ODA induction. Copies of fitness to work certificates were kept on the worker's file throughout their time on the Park or Village.
- Briefings for workers and managers on a wide range of workplace health and well-being issues. This was undertaken jointly by the clinical and occupational hygiene team. Topics were related to the risk profile of work at the time,

emerging issues from contractors and/or the service strategy for that time period. Briefings were delivered to a total of 3,675 participants.

- Well-being initiatives related to annual health promotion plans. These included smoking cessation clinics, contents and activities designed to engage the workforce (eg 'strong man' contest across all venues to raise awareness of upper limb disorders), and activities targeting common health problems (eg mental health week and body mapping to identify musculoskeletal problems).
- Drug and alcohol testing for around ten per cent of the workforce.
- A free walk-in treatment centre for all injuries, whether they occurred on site or not. The service dealt with minor injuries and referred individuals on for further treatment as necessary.
- Health surveillance and general health checks.

Occupational hygiene services

The occupational ill-health prevention service was staffed by occupational hygienists who worked closely with clinical staff. Occupational hygienists are skilled in the recognition of occupational health hazards, then the evaluation and control of occupational health risks. All occupational hygienists working on the site were qualified under the British Occupational Hygiene Faculty of Occupational Hygiene Certificate scheme or equivalent qualification. The ODA's Head of Health and Safety was also a professional occupational hygienist, and member of the Faculty of Occupational Hygiene. On the Park and Village they provided strategies to avoid work-related ill-health from occurring and their service focused on the following elements:

- Proactively engaging in design meetings, health and safety leadership interventions and in the initial phase of introducing contractors to site thus ensuring that ill-health prevention was an integral part of the projects strategy.
- Working with contractors to highlight the importance of ill-health prevention being built into any behavioural safety initiatives so that it became an integral part of on-site behaviours.

Specific occupational ill-health prevention strategies on site included:

- Early engagement with all planned on-site works.
- Initial risk assessment and method statement reviews by occupational hygienists leading to the compilation of specific occupational health risk registers and monitoring strategies for improvement.

- Assistance with any occupational health risks identified as needing further action to enable risk reduction such as:
  - Noise assessment, Hand arm vibration assessment, Measurement of hazardous substances in air, Assistance with COSHH assessment, etc.
- Assistance with any health incident or accident investigation to evaluate existing exposure controls and suggest improvements where necessary.

There were not many opportunities to work with designers to engineer or design out problems, but if this effort had been more extensive and successful it would have offered significant other benefits through healthy by design.

The clinical services provided by the Park/Village Health team were well integrated with those of the occupational hygiene team. This allowed the identification of health problems by the clinical team to be passed onto the hygienists who could then investigate any work-related cause, and provide health risk management solutions for the contractors and workers involved. Similarly, hygienists could identify risks involved in upcoming work and alert the clinical team to this. The occupational hygiene team worked closely with the safety assurance team to ensure that all possible health-related issues were identified and closed out successfully. The team attended weekly assurance team meetings, assisted with health-focused assurance visits to sites and met with the assurance team to identify health hazards in upcoming works on a quarterly basis.

More details of the work of the occupational hygienists are provided in Chapter 3.

3 Occupational Hygiene Work by Park and Village Health[11]

3.1 The 'health like safety' approach

Park/Village Health adopted a 'health like safety' approach to working with contractors. This attempted to use existing approaches to safety management as the basis for health management by developing occupational health strategies and indicators for health alongside safety systems, which encouraged contractors to embed workplace health management into their day-to-day work practices. The aim was to achieve the same high standards for health as were expected for safety.

The service had a specific role as a key tool in ensuring that the standards for safety management were mirrored in the way that health risks were controlled.

3.2 Assuring standards

Park/Village Health worked closely and proactively with the ODA's delivery partner to ensure that contractors were meeting the expected standards for workplace health. A quarterly forward planning risk profile was created to ensure that emerging risks were identified and risk management plans put in place. The involvement of the occupational hygienists ensured that health risks were treated with the same priority as safety risks. These profiles then shaped the next quarters' assurance visits. The hygienists also carried out joint visits with the Assurance Team with the occupational hygienists briefing the delivery partner about issues

[11] This chapter draws heavily on a description of the service originally produced in Tyers and Hicks (op. cit.)

emerging from their recent engagements with the different project teams. The occupational hygiene team supported the Assurance Team with any concerns or queries following site visits or project reviews.

3.3 Working directly with contractors

In order to influence and engage the contractors across site in the work of the ill-health prevention team and influence attitudes and behaviours, there were two main stages to the work.

3.3.1 Engaging contractors with the need for and benefits of workplace health management

In the initial stages of their presence on site, Park/Village Health activities focused on making contact with contractors, understanding the main issues on the site and producing simple and easy-to-use occupational hygiene solutions. This allowed them to establish a useful presence on the site and help contractors demonstrate their performance against key performance indicators (KPIs) set by ODA and their delivery partner (DP).

The occupational hygiene (prevention) and clinical teams often visited parts of the site together to encourage contractors to see the approach to occupational health on the Park as involving the occupational hygienists as well as clinical staff. Each project was provided with a single point of contact, which was a named on-site hygienist. This hygienist was responsible for visiting their assigned sites, working with contractors to understand the potential health risks of the work schedule, and provide support in embedding health risk management in day-to-day work.

Occupational health risk registers were produced for each project, outlining the different tasks and related risks for each phase of works. The occupational hygiene team was then able to focus on ongoing works looking at possible upcoming exposure issues and using the principles of prevention to eliminate or reduce these. Health surveillance could also be tailored specifically to each project. Regular visits from the occupational hygienists would then check progress against the risk registers and further support could be provided to help contractors meet the required standards.

To further assist contractors, Park/Village Health created a simple Red/Amber/Green mapping system for potential health exposures such as noise and contaminated land. This enabled contractors to plan works to avoid exposures or properly control exposures which they were unable to avoid (the boxed example provides further detail on this approach).

Simple and easy-to-use solutions: the Red/Amber/Green (RAG) rating system

The RAG (Red/Amber/Green) rating system uses visual prompting to make workplace health management decisions consistent and easier to understand. The RAG system can establish when hazardous substances, contaminated land and occupational noise could have an adverse effect on workers and outline the steps necessary to reduce the risks. It should be used in conjunction with effective risk assessment procedures.

On the Park, hazardous substances were assessed through an online Control of Substances Hazardous to Health (COSHH) management system, where the name of a product was typed in along with the activity being undertaken. The contractor could then, with the support of the occupational hygiene team, quickly assess the risks by checking the RAG rating (eg one principal contractor changed their paint primer from one containing lead (Red rating) to one without lead content (Green rating)).

Contaminated land is assessed through RAG maps, which use site investigation data to map where hazardous substances – such as mercury or benzene – are present in the soil. A Red area is heavily contaminated and requires a site-specific risk assessment, Amber areas require additional hygiene requirements – provided on a checklist – and Green areas require the usual site standard of protection. The maps are an innovative method of assessment of occupational risk from contaminated land and are used to ensure that workers have adequate protection and controls in place before the ground is broken.

Results of occupational noise assessments can be expressed through a RAG target system. Once a noise assessment of a specific task (eg piling) has been carried out, a three-layer 'bull's eye' target of inner, secondary and outer rings can be established. The innermost ring is the Red area, where hearing protection must be worn; workers in the secondary (Amber) circle should be offered hearing protection; no additional protection is needed for workers in the outer (Green) circle. This means that hearing protection zones around noisier operations can be easily delineated, reducing the risk to staff, whilst allowing quieter operations to be planned in areas within the Green circle. These RAG targets were used on a major venue to establish a system enabling quieter works to be undertaken away from piling operations and also to establish where pedestrian routes could be marked out, so that operatives were not exposed to excess noise whilst walking around the site.

This initial stage was concerned with demonstrating to contractors the potential benefits of using the Park/Village Health services, and explaining to them how using the services could help them manage their project. This was felt to be a key stage in the success of the service as, without it, engagement levels of contractors with the occupational hygiene team were likely to have been much lower.

3.3.2 Enabling contractors to improve workplace health management

The second stage of work was to target the available resources to help others implement a 'health like safety' approach into their day-to-day activities. This mainly involved conducting risk assessment reviews and producing action plans for Principal Contractors, then encouraging them to implement the measures themselves. Sub-contractors were also targeted where access was possible through the Principals.

The occupational hygiene team evaluated workplace health hazards from risk assessments and method statements. Hazards were then evaluated with the contractor, using the principles of prevention. This process actively sought ways in which the risks could be eliminated or controlled at source before looking at monitoring or health surveillance.

During this stage of their work Park/Village Health also established a presence at regular health and safety forum meetings. These fora allowed contractors to discuss emerging health and safety concerns and solutions. Park/Village Health brought occupational hygiene issues onto the agenda at these meetings, including those involving contractors' senior managers. This allowed contractors to benchmark their occupational health management performance against others, as well as discuss how best to manage and control health risks. Contractors were therefore encouraged to take workplace health issues seriously, take action themselves and share good practice or learning with others. Whilst it was common for the contractors involved to consider and discuss safety issues in this way, adopting the same practice for occupational health was relatively new.

As a result of their work, the occupational hygienists recognised a need for contractors to take a more proactive and ongoing approach to occupational health risk assessment, monitoring and ill-health prevention work. Education and awareness-raising activities about occupational health and occupational hygiene remain necessary even amongst senior managers. This was particularly true with regard to effective health surveillance and the need to consider health issues at the design stage.

3.4 Occupational health in design

The work of the hygienists also aimed to:

> *'work with integrated project teams, meeting with designers and others to encourage a constructive dialogue and effective processes to minimise health risks during construction, use and maintenance'*[12].

This proved difficult to achieve in practice. The hygiene team only became a significant presence on the Park and Village in mid-2008 during the construction phase. By this time the main design decisions had been taken, sometimes as much as three years prior to the start of construction. From this point on, hygienists did attend quarterly meetings with the Construction Design and Management Co-ordinators (CDMCs) and design team to raise awareness of occupational hygiene hazards. The occupational hygienists needed to be involved much earlier in the process, however, for them to have a real impact on the design process.

The occupational hygienists were able to provide advice about the substitution of materials, processes and equipment, such that the healthiest solutions could be found on-site. Ideally in future projects, earlier involvement of occupational hygienists could help to more effectively design out risks before they arrive on-site.

3.5 Developing usable occupational hygiene tools

As part of their drive towards a 'health like safety' approach, the occupational hygiene team developed two tools to help contractors manage workplace health risks. These tools provide a way to measure the improvements made to occupational health management systems, and a simultaneous check that the arrangements provided adequate protection at workforce level.

3.5.1 Occupational Health Maturity Matrix

The ODA produced a behavioural safety maturity matrix for use on the site. The occupational hygiene team used this as the basis for developing a similar tool which focused on workplace health rather than safety – the Occupational Health Maturity Matrix (OHMM). The OHMM includes the necessary leadership, supervisor, worker and subcontractor actions for good occupational hygiene management, and enables subcontractors to work towards a mature occupational health status. The focus of the matrix is on the extent to which there is a

[12] As set out in ODA's Health, Safety and Environment Standard.

demonstrated commitment to occupational health provision at the workplace, to the worker and to workplace well-being.

The OHMM allowed an assessment of:

- How far occupational hygiene was integrated into the normal site health and safety and operational procedures. This was achieved through a mixture of auditing and questioning of both Principal contractors and their sub-contractors.
- How compliant contractors were with their legal duties, systems and procedures relating to occupational health.
- Principal Contractors and their supply chains, categorising them depending on how well they performed on a number of measures related to the health of the worker, the appropriateness of workplace control and the focus on well-being.

Following audits, implementation plans were supplied to all contractors to enable them to judge their own performance and make improvements where necessary. These plans also helped to focus Park/Village Health interventions.

The OHMM has the potential to work as a benchmarking tool within the construction industry with regard to occupational health and occupational hygiene standards. It allows improvements to be measured and rolled out across different projects, thus ensuring that the same approach is used in a standard way throughout an organisation and is not dependent on site or location.

3.5.2 Health Impact Index

The Health Impact Index (HII) involved hygienists conducting regular site visits on projects participating in a pilot scheme. Their observations of behaviour, work methods or practices and processes allowed them to develop a numerical indicator of potential health impacts in the same way as an accident frequency rate (AFR) is calculated (Appendix 2 provides a screen shot of the database used to record the data). The resulting data was called the Health Impact Frequency Rate (HIFR). The approach taken was to record health impacts in the same way as near misses where the potential consequence could be an accident. Thus, health issues could be given equal prominence to safety. The occupational hygienists then worked with management to control exposures to the health risks identified. Where particular trades or individuals were identified as being regularly affected, this could be directly addressed.

A health impact was defined as an individual event which can cause any one occupational disease if the current working method is maintained. A single

activity can generate any number of health impacts. For instance, if a carpenter was using a circular saw to cut timber, this could create exposure to:

- excessive noise levels if no hearing protection is available
- excessive vibration if the tool is used for prolonged periods of time
- wood dust if the control measures to suppress or reduce airborne dusts are not present; and
- increased risk of manual handling strain if the tool is used whilst the operative is bent double, or the workbench is at an inconvenient height.

Similarly, a health impact would also be documented for each operative affected by the risk: if four other operatives were working around the carpenter without hearing protection, four individual health impacts would be recorded.

With every health impact there will be a number of different controls that will have failed; it will rarely be just one factor. Using this observational method, a judgement can only be made for any particular health impact on whether an individual doing a particular job at a particular time is being exposed to a significant occupational health risk. For example, an operative not wearing suitable gloves for pouring concrete will be categorised as a failure to wear suitable personal protective equipment (PPE). Whether that operative is actually following an incorrectly defined control strategy in the COSHH assessment would not be picked up by the HII and neither would the HII highlight whether the failing lies in the fact that the concrete could have been pre-cast off site.

The HII therefore only addressed the immediate failing that caused the health impact, which invariably would be a failure of the last line of defence, PPE. It should therefore form part of a continual checking procedure, and should be used with other approaches which attempt to influence occupational hygiene management in a more strategic way. Therefore using both the OHMM for the management and procedures along with HII to look at on-site behaviours was a way to capture the entire process.

3.6 Reactions to the service

A key part of the service was to influence the behaviours of workers and managers whilst they were working on the site. A broader aim was that this would continue into other projects in the future. A HSE and ODA funded research project examined reactions of those working on the site to the occupational health (including occupational hygiene) services using both survey and case study work.

The results demonstrate that the service was well received by both managers and workers[13].

The key survey results from this work were that:

- 71 per cent of managers on the site felt that access to Occupational Health services was better for their workforce on this site than on others they had worked on.
- 69 per cent of managers felt that the quality of the Occupational Health service was better than on other sites.
- 86 per cent of managers felt that the attention given to Occupational Health risks was better on this site than others.
- 78 per cent of workers believed that the Occupational Health provision available on the Park and Village was a little or much better than on other sites.
- 80 per cent of workers felt that more attention was given to health risks on this site.

In addition, 86 per cent of workers felt that their awareness of Occupational Health (OH) issues had improved whilst working on the Park or Village and 78 per cent of workers felt that, since working on the Park and/or Village, they had made changes to the way they worked in order to better look after their health.

In case studies, the general consensus was that Park/Village Health provided a 'first rate service' which was appreciated by all those interviewed. The facility was seen as excellent and supplied everyone on the Park with a range of facilities which they could use and which were easily accessible.

It should be noted that not all contractors and workers fully engaged with the service, but those that did appreciated the facilities on offer and many changed their views and behaviours as a result. All contractors on the site had some engagement with the Park/Village Health team, although the level of this varied, and no-one opted out. A survey undertaken on the Park suggests that around two-thirds of the workforce had engaged with the OH service in some way whilst working there.[14]

The work of Park/Village Health was also recognised externally through a number of awards. These included two in 2011:

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[13] Tyers and Hicks (op. cit.)

[14] Tyers and Hicks (op. cit.)

- The Wilf Howe Award from the Faculty of Occupational Medicine in recognition of occupational health good practice.
- The Astor Trophy awarded by the Royal Society for the Prevention of Accidents (ROSPA) for the organisation with the best-managed occupational health programme.

4 'Health Like Safety' in Action

This chapter presents a series of case studies which highlight the ways in which having an on-site occupational hygiene team benefited contractors on-site. In each example the health issue is described alongside the work of the Park/Village Health team to identify and/or control the risks. To estimate the potential benefits of having the team available, we present an alternative, hypothetical situation where the same health issue arose, but where the on-site team was not available (ie we present a possible counterfactual position).

4.1 Estimating the economic benefits

The actual time taken to deal with the problem by the on-site team is set out using records of the event. This is compared with the potential time taken in the absence of the team. The latter is an estimate and is therefore subject to potential inaccuracies. However, making this comparison allows at least a discussion of the benefits of having a fully briefed hygiene team working alongside contractors with what might have happened if occupational hygienists were called in on an ad hoc basis. In both cases the 'downtime' involved is estimated (ie the amount of time during which work would need to be stopped in order for a solution to the problem to be found).

A value is then placed on this downtime to allow the time saved data to be monetarised. We have used an estimate of the "production daily value added" or "lost value added" for each working hour. That is, the loss of the work value added by a full day's work by an "average" construction worker. When this value is not added because of work-related ill health absence, it becomes the cost of that ill health absence. These costs were estimated by ODA to be £490 a day per worker

and this figure is taken directly from ODA calculations[15]. The figure is larger than would be the case for wages lost because it takes account of the broader contribution of a worker to the project than is reflected in wages alone. We have also assumed an equal cost for managers and workers to simplify the calculations.

Calculating the actual costs of the Park/Village Health occupational hygiene team in each case is difficult. Their services were actually free to contractors as the ODA covered the costs. It is also not possible to isolate the costs of the team involved in dealing with each incident as they operated under a much broader contract to support contractors on the site (Chapter 5 provides details of the costs of this contract). We have therefore provided an estimate of hygienist time taken to deal with each of the issues raised in the case studies and costed this in the same way as we have the services of a hypothetical off-site team called to site. We have estimated a £500 daily rate for occupational hygienists qualified at this level, which we put forward as a likely 'average' of the rates of individuals at this level conducting tasks of varying complexity. In fact, as discussed, the costs to the contractor were nil, and the costs to ODA covered under their existing contract.

In the case of the Park and Village, the scale of the project meant it was possible to have occupational hygienists working on the site on a regular basis. However, this does not have to be the case for smaller projects. The main benefits of an 'on-site' team are principally that they are fully aware of the background to the project, have established relationships with contractors, and are fully up to date with emerging risks and the schedule of works. Thus many of the benefits discussed here could be achieved without a literal on-site presence, and with a fully briefed occupational hygiene team on standby.

4.2 Case study 1: Methacrylate exposures

This case study demonstrates the benefits of having an integrated clinical and occupational hygiene team working together. This approach resulted in a co-ordinated approach between clinical staff that identified a health problem, and then immediately alerted the occupational hygiene team so that the cause could be established, and control measures introduced.

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[15] The calculation for lost productivity is based on an internal study undertaken by the ODA's Delivery Partner which identified that, on average, a worker produces £100,000 per year of value in built assets. The range provided for value/productivity per man hour on this basis was £60 to £80. We have taken the central estimate of £70 per hour for use in our calculations. Assuming a 7 hour working day, the figure per day of work is therefore £490.

4.2.1 Background

The Park/Village Health clinical team were visited by two contractors engaged in fit out works on a major venue on the Olympic Park. Both men had complained of nose bleeds. After receiving treatment from nursing staff, the occupational hygiene team were immediately contacted to investigate whether their symptoms could be work related.

4.2.2 Park/Village Health Actions

After being alerted by nursing staff, a Park/Village Health hygienist visited the venue in question to discuss the issue with the contractors involved. This allowed them to locate the possible source of the health problems and put in place control measures to prevent it from happening again.

Identifying the problem

The immediate reaction of the contractor was to stop work completely and undertake extensive monitoring to identify the source of the possible health exposures. However, the Park/Village Health occupational hygiene team decided that it was unnecessary to stop all work, as they were able to bring their knowledge of the work programme, the substances being employed and the project, to the problem. The occupational hygiene team were able to immediately demonstrate that the chemicals and materials being used directly by the operatives in question had no significant inhalation risk.

An investigation of the works happening around the individuals was undertaken. This revealed that there were three adjacent works, two of which were using paints which could have caused the nose bleeds. The hygienist reviewed the existing risk assessments of these works and workers were questioned about the operations they were performing during the works. As a result, it was established that the use of acetone/methacrylate based aerosol paint was the most likely cause of the nose bleeds and this was confirmed following further discussion with workers. Whilst the workers responsible for using these paints were wearing appropriate respiratory protective equipment, those working in areas adjacent to them were not.

Introducing controls

A practical but effective control measure was sought. The works in question were restricted so that that they were only performed when all other trades had finished and left the site. This was immediately implemented. Taking this action meant that a team of 20 or more operatives was able to continue working.

Benefits from having an on-site occupational hygiene team available

The links between the clinical and occupational hygiene teams ensured that the incident was investigated and the cause quickly identified. The investigation was assisted by knowledge of the work practices of the principal contractor and the specific project. This knowledge had developed over time during which a single point of contact in the occupational hygiene team had been working on the project and with the contractors involved.

The contractor's initial action was to stop all works in the surrounding area. The benefit of having the on-site occupational hygienists was that they were able to quickly isolate the causal works so that all other works in the area could continue as planned.

4.2.3 What would have happened without the on-site team?

It is not possible to say with certainty what would have happened in the absence of the on-site occupational hygiene team. However, in order to estimate the benefits of having the hygienists on-site, we have set out what we believe would have been the likely scenario.

The first problem for any site would be to identify the cause of the nose bleeds. Without an on-site occupational hygiene team this could take some time. The health and safety manager would be likely to approach clinical staff for help. They would take some time to investigate themselves, but would be likely to approach the issue in a different way to occupational hygienists. Clinical staff are likely to initially focus on the worker (ie their medical history), whereas hygienists immediately look for workplace causes. The clinical team may have called in the hygienists to investigate the workplace only once they had eliminated other potential causes but many other clinical services would in all probability not have recognised the need for or value of occupational hygienists. The first stage in the process of establishing the cause of workplace health problems on sites where there is no occupational hygiene team is therefore to identify the need for a hygienist.

The next stage would be to identify the possible workplace cause of the symptoms. Without knowledge of the site, it is likely that any hygienist would take more time to establish what was happening in the affected area and would likely have less access to other areas of the site. If they did identify the need for widening the investigation, time would have been lost in establishing the wider activities and seeking permissions to investigate. If the hygienist had experience of working within construction, they might be able to hypothesise a worse case scenario and allow work to continue on that basis. In this case that may have involved all operatives wearing respiratory protective equipment until the

occupational hygienist had gained access to the necessary information and work areas to confirm the root cause of the problem. This would inevitably involve delay and could involve an exposure monitoring survey to help confirm or characterise the nature of the problem. In this case, the hygienist would be likely, legitimately, to wait for the results of the monitoring before recommending work re-commence.

One likely result would therefore be that the two operatives with nose bleeds, and the two painters engaged in the task which created the exposure risk would have been asked not to work until the testing results came back. Over 20 other operatives working in the area would also need to be reassigned to other work or be asked to operate with potentially restrictive protective equipment. This would inevitably result in some stoppage time, and would require managerial time to organise.

Our estimate of the likely scenario in the absence of an on-site hygienist is therefore that it would take:

- Three days to highlight the need for a hygienist (compared to the immediate notification of the team that actually occurred in this case through the feedback loop established with the occupational health team). This consists of: one day for management to identify the problem and pass it over to occupational health; another day for occupational health to conduct their tests and analysis; a further day for them to feedback their findings and recommend a hygienist; and for a manager to identify and contact an appropriate hygienist.
- Two days for a hygienist to come to site. In all likelihood there would not be a hygienist immediately available and they would need to schedule the work.
- Five days for the hygienist to survey and interview staff and conduct monitoring. This includes a day for survey and/or monitoring, three days for the tests to come back and another day for the hygienist to analyse these results and present a control regime. During this time, we assume that the two operatives with nose bleeds, and the two painters directly involved in the causative work would be asked not to work, pending results.
- Half a day for the manager to reschedule works for 20 other operatives working in the vicinity, or on similar tasks, who we have assumed would all be required to stop work until new tasks could be found.

4.2.4 What difference did Park/Village Health make?

Table 4.1: Projected savings made by having on-site occupational hygiene team available to deal with methacrylate exposures

Action	Actual time taken by Park/Village Health	Estimated time taken in absence of on-site occupational hygiene team (days)
Identifying the need for a hygienist	-	3
Bringing a hygienist to site	-	2
Analysis, monitoring and results	-	5
Time where workforce not able to work	12 days (This consists of 0.5 days each for the 24 workers affected whilst the hygienist introduced a control measure)	50.5 days (This consists of 10 days each for the 4 workers immediately affected, 0.5 days managerial time to re-sequence works, 0.5 days each for 20 operatives who were required to stop work until they could be found other tasks)
Costs of downtime	*£5,880*	*£24,745*
Costs of hygienist time	*£250* *(0.5 days work for discussions and creation of control regime)*	*£1,500* *(3 days work to monitor, analyse results and present control regime)*
Total costs	***£6,130***	***£26,245***

The **net benefit** of the on-site occupational hygiene team in this case is therefore estimated to be somewhere in the region of **£20,115**. The scale of the return is something like £80 per £1 spent[16] if we compare the £250 spent on the occupational hygiene team and the potential benefits of this. This does assume that the costs of the occupational hygiene team relate only to the time spent managing this particular issue whereas in fact they had spent more time on-site as part of their broader ODA contract. The actual scale of return on investment is therefore likely to be somewhat lower, but still substantial.

[16] Using the simple formula: Return on Investment = amount of financial gain/ total investment amount. This formula is useful when calculating an uncomplicated figure for investments over the short term (here we are looking at only the immediate benefits of reduced downtime).

4.3 Case study 2: Sulphide exposures

The nature of the land on which the Park and Village have been built was that contaminants were a major issue during the ground works and construction phases of the build.

Having specially constructed maps available of the likely contaminants present across the whole site, and an on-site occupational hygiene team to consult meant that the works proceeded as effectively as possible despite the many contaminants present.

4.3.1 Background

Park/Village Health was initially notified of a possible health risk when excavation work for service pipe work released a pungent odour. The contractor immediately ceased work and called on Park/Village Health hygienists to investigate.

4.3.2 Park/Village Health Actions

There had been an assessment of the entire Park by the Park/Village Health occupational hygiene team using an approach called RAG (Red/Amber/Green) during the ground works phase. This is a rating system which used visual prompts to make occupational health decisions consistent and easier to understand. Contaminated land was assessed through the production of RAG **maps**, which used site investigation data to map where hazardous substances (such as mercury or benzene) were present in the soil. One of Park/Village Health's first tasks was to interpret the contaminated land analysis that had been performed on hundreds of borehole samples across the Olympic Park. Park/Village Health established the RAG classification system and applied it to each borehole, using a combination of the classification systems established in European levels, the Dutch List, the Kelly Indices and the Chemicals (Hazard Information and Packaging for Supply) Regulations (CHIP regulations). A Red area was heavily contaminated and required a site-specific risk assessment, Amber areas required additional occupational hygiene requirements – provided on a checklist – and Green areas required the usual site standard of protection.

Different areas of the site were affected by different contaminants and to varying degrees, but initial analysis of the data revealed that sulphates and sulphides were likely to be present in the areas involved in this specific case. There were around ten operatives working on this section of land.

The soil in this case had not been identified as significantly contaminated in the RAG mapping exercise since, although sulphide contamination was identified, it was not considered to be a significant health risk. Due to the nature of site

investigation, although most contaminants are discovered it is still possible to uncover further more significant pockets of contamination during excavation.

Identifying the problem

Park/Village Health performed air monitoring and consulted with chemists and other specialists. This identified that the irritating odours that were causing discomfort to the operatives were sulphide based and these would be unlikely to cause any significant health effects.

Introducing controls

Working with the principal contractor, Park/Village Health hygienists were able to identify a number of controls which appeared to be effective, including damping down and allowing time for the odours to disseminate from the ground before working in that area. Operatives were also issued with inorganic vapour masks or multi-gas filter masks as appropriate to the level of odour present. The choice of respiratory protection was an output of the occupational hygienist being able to visit contaminated areas and compile a suitable risk assessment for the contaminants operatives were exposed to. This was performed using the chemical analysis data for each area as well as site and soil observations.

Benefits from having an on-site occupational hygiene team available

The RAG mapping work meant that there was already knowledge of the likely contaminants present in the site. Having an on-site team allowed this mapping to happen and meant that when this particular problem emerged, there was some existing knowledge of the likely contaminants to work with. The availability of the hygienists also meant that the relevant professionals were immediately brought in to allow works to re-start as quickly as possible without putting workers at risk.

Whilst the investigation of the initial problem was fairly typical, the benefit of Park/Village Health being on-site was the sharing of information across all of the projects. Sulphide exposures began to regularly occur across the Olympic Park and from the initial incident Park/Village Health had gained the knowledge and experience to provide advice on the issue and offer ways in which to control the exposure. Although the initial investigation took time to perform, once completed Park/Village Health were in a position to quickly resolve similar issues on at least six occasions in other areas of the Park. Without the findings from the initial investigation and the site knowledge of the hygienists, these further cases may have caused delays to works as they would each have needed separate investigation.

4.3.3 What would have happened without the on-site team?

We have made some assumptions about what would happened in the absence of Park/Village Health to allow us to compare this with the response of the on-site team.

No RAG maps would be available without the on-site team, so when the smell was first noticed, more work would need to be done to identify whether the problem needed a hygienist. In all likelihood, any health and safety manager would take at least a day to determine this and may in fact call in support from an environmentalist first to take contaminated soil samples. This is because managers would tend to assume that the issue of contaminated land does not relate to COSHH[17]. It would then be around 15 working days before the test results became available. Only then might the services of a hygienist be called in, if ever.

Our estimate of the likely scenario in the absence of an on-site hygienist is therefore that it would take:

- Two days to identify an appropriate environmentalist, contact them and for them to arrive on site.
- Around a day of managerial time during this period to sort out the problem and work with the environmentalist.
- A day during which the environmentalist would collect soil samples.
- Fifteen days during which the land could not be worked on whilst the environmentalist waited for the results of their tests. Fifteen days is the normal turnaround time for most laboratory analysis, particularly as samples need to be dried prior to analysis and the wide variety of testing and verification methods that need to be applied to each sample. During this time we have assumed that the ten operatives affected would be unable to work on the site.
- A day for the manager to receive test results, identify the need for a hygienist and find one.
- Two days for a hygienist to come to the site. In all likelihood there would not be a hygienist immediately available and they would need to schedule the work.

From there, the hygienist would most likely take the same course of action as the Park/Village Health team.

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[17] Control of Substances Hazardous to Health.

4.3.4 What difference did Park/Village Health make?

Table 4.2: Savings made by having an on-site occupational hygiene team available to deal with sulphide exposures

Action	Actual time taken by Park/Village Health	Estimated time taken in absence of on-site occupational hygiene team (days)
Bringing an environmentalist to site	-	2 days
Environmentalist analysis, monitoring and results	-	16 days
Bringing a hygienist to site	-	2 days
Hygienist analysis, monitoring and results	3 days	3 days
Time where workforce not able to work	30 days (3 days downtime for 10 people)	230 days (23 days downtime for 10 people)
Costs of downtime	*£14,700*	*£112,700*
Costs of hygienist time	*£1,500 (3 days work to monitor, analyse results and present control regime)*	*£1,500 (3 days work to monitor, analyse results and present control regime)*
Total costs	***£16,200***	***£114,200***

The **net benefit** of the on-site occupational hygiene team in this case is therefore **£98,000**. The scale of the return is something like £65 per £1 spent[18] if we compare the £1,500 spent on the occupational hygiene team and the potential benefits of this. As in case study 1, this does assume that the costs of the occupational hygiene team relate only to the time spent managing this particular issue whereas in fact they had spent more time on site as part of their broader ODA contract, particularly in the production of the RAG maps. However, we have not included the costs of an environmentalist in the alternative scenario in an attempt to balance this out a little.

[18] Using the simple formula: Return on Investment = amount of financial gain/ total investment amount. This formula is useful when calculating an uncomplicated figure for investments over the short term (here we are looking at only the immediate benefits of reduced downtime).

Compared to case study 1, the relative returns are smaller, but the actual savings are potentially much greater. This is particularly true when we consider that at least six other projects faced the same problem and used Park/Village Health to deal with it.

4.4 Case study 3: Asbestos in soil

Having the Park/Village Health team on site helped contractors to deal appropriately with any asbestos, providing protection for their workforce, but also to continue works wherever possible due to the introduction of adequate controls. In all the monitoring of asbestos fibres in air, both personal and static (environmental) that have been undertaken on site there were no results which would cause concern[19].

4.4.1 Background

On a heavily contaminated site such as the Olympic Park there was a high probability that asbestos would be present in some form. This was in the soil and as debris from former works on the site. Although there is an accepted level of asbestos in soil for environmental purposes and information on control of asbestos when working with asbestos materials, information on occupational exposure and controls during excavation of soil that contains low levels of asbestos fibre is patchy and difficult for contractors to access.

Early in July 2008, a number of small pieces of suspect material were found on one of the major venues. These were sampled by a laboratory and on 2 July 2008 were confirmed as asbestos containing materials (ACMs). As a precautionary measure the site was closed on the afternoon of that day and it was decided that amongst other measures the minimum requirement before the site could re-open would be for all site staff to be trained in asbestos awareness. This would involve the training of more than 200 site staff to the necessary level and giving appropriate information on any health risks and controls.

4.4.2 Park/Village Health Actions

Members of the Park/Village Health team were contacted during the afternoon of 2 July 2008 immediately following the confirmation of ACMs on the site.

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[19] The majority of samples resulted in levels of fibre in air <0.01f/ml for static samples and 0.016f/ml for personal samples.

Identifying the problem

In consultation with HSE and with the knowledge of the on-site team a customised asbestos awareness course was devised and ready to be presented by 08.00am on the following day. The course was designed to cover all the required elements stipulated by the Control of Asbestos at Work Regulations so that operatives could safely return to work with the knowledge needed to protect themselves. However, it focused on elements of asbestos awareness training that were directly relevant to the specific site. As a result, a course that would normally run over half a day could be delivered in just one hour. This meant that large numbers of workers could be put through the training in a short space of time. Two Park/Village Health staff worked simultaneously, delivering training to an average of 15 people each. They were therefore able, between them, to train around 120 people a day.

Introducing controls

Altogether 250 members of Team Stadium site staff and management were trained in asbestos awareness during the next 48 hours. The site was able to partially re-open when half of the operatives involved had received the training, at which point (4 July) these operatives could return to work. All staff were back at work by the following Monday morning (7 July). This timely response helped to ensure that there was as little disruption as possible to the timetable of the venue.

Benefits from having an on-site occupational hygiene team available

The on-site team had an in-depth knowledge of the site in question through their ongoing contact with the principal contractor and subcontractors. They were therefore able to provide a tailored asbestos awareness course in a very short space of time. As they were on site, they were also able to deliver that course immediately to ensure that works could recommence as soon as safely possible.

4.4.3 What would have happened without the on-site team?

The main difference in terms of the response of the contractor without an on-site team is likely to have been the speed of response from hygienists and the extent to which a tailored course could be offered within the same kind of timeframe.

The same assessment of the problem would have taken place, so the contractor would have been required to stop work and look for a consultant to provide asbestos awareness training in the same way as our example sets out. However, without on-site specialists, the manager would have needed to find an asbestos awareness trainer. It is likely that the course would have involved half a day of training. Without knowledge of the site, it is unlikely that a tailored, yet still HSE

approved course could have been prepared anywhere near as quickly. We have also estimated that the maximum number of people that any asbestos awareness training company could deal with at this short notice would be around 15 people per session like Park/Village Health (therefore around 60 people a day). We have also assumed that, like Park/Village Health, another firm would be able to supply two trainers to work simultaneously.

Our estimate of the likely scenario in the absence of an on-site hygienist is therefore that it would take:

- Two days to identify an appropriate asbestos awareness trainer and for them to decide what training was needed and familiarise themselves with the issues.
- Three days for the trainer to become available and arrive on site.
- Each course would take three hours to run, if an immediate start was required (ie there would not be time for an off-site training company to tailor the course to a one hour session, and start running it, within this timeframe).
- The site could partially re-open on day 7, but that it would take a further two days to train the entire workforce, using two trainers delivering training simultaneously.

The amount of downtime involved for a workforce of this size is therefore substantial.

4.4.4 What difference did Park/Village Health make?

The **net benefit** of the on-site occupational hygiene team in this case is therefore **£655,650**. The scale of the return is something like £262 per £1 spent[20] if we compare the £2,500 spent on occupational hygiene team and potential benefits of this. As in the previous case studies, this does assume that the costs of the occupational hygiene team relate only to the time spent designing and delivering the training whereas in fact they had spent more time on site as part of their broader ODA contract.

[20] Using the simple formula: Return on Investment = amount of financial gain/ total investment amount. This formula is useful when calculating an uncomplicated figure for investments over the short term (here we are looking at only the immediate benefits of reduced downtime)

Table 4.3: Savings made by having an on-site occupational hygiene team available to deliver tailored asbestos awareness training

Action	Actual time taken by Park/Village Health	Estimated time taken in absence of on-site occupational hygiene team (days)
Identification of problem and need for asbestos awareness training established	1 day	2 days
Bringing a trainer to site	-	3 days
Training delivered	2 days	4 days
Time where workforce not able to work	~585 days (2 days downtime for all 250 staff a further day for 120 staff who could then return to work the remaining 130 staff return at intervals on day 3)	~1,920 days (7 days downtime for all 250 staff 120 staff return on day 8, another 30 after 8.5 days, a further 30 on day 9, 30 more after 9.5 days and the remaining 40 on day 10)
Costs of downtime	*£286,650*	*£940,800*
Costs of hygienist time	*£2,500* *(1 day to design specific course and 4 person days to run the training)*	*£4,000* *(8 person days to run the training)*
Total costs	***£289,150***	***£944,800***

Compared to the other case studies, the returns and amount saved is much greater due to the size of the workforce involved. As with case study 2, this is just one example of a larger number of projects which received support from Park/Village Health in dealing with asbestos-related issues.

4.5 Discussion of results

These case studies clearly demonstrate that having occupational hygienists working as part of the health and safety management team on a construction site has a range of potential benefits. They are able to respond more quickly, with access to better information about the site, and provide a more appropriate response than would be the case if occupational hygienists were brought in on an ad hoc basis.

There are costs involved in having occupational hygienists work as part of the management team. In the case of the Olympic Park and Athletes' Village, these costs were higher than would be necessary or appropriate for smaller and/or less

complex sites (although a very small proportion of the overall spend on the project). It would be entirely appropriate to scale down the amount of time spent by the occupational hygienists on site in accordance with the specific nature of the project in question. Their involvement does not need to be costly or disproportionate to the costs of the actual work. The examples provided here may be larger in scale, in both the savings and costs involved, than would be the case on other sites, but clearly highlight the benefits of an integrated occupational hygiene provision working with construction management.

Having a fully briefed team on standby to respond to any incidents has clear financial benefits. The occupational hygienists could be viewed as an insurance policy against the high costs involved when a health risk is identified with the result that work has to stop. A fully briefed team will also help to reduce the likelihood of unforeseen risks emerging in the first place as they will be part of risk profiling work on an ongoing basis. However, if risks do emerge as work progresses, a fully briefed occupational hygiene team will be able to provide cost effective solutions which both minimise the risks to the workforce and allow work to proceed with as little disruption as possible.

5 Does this Type of Service Pay for Itself?

Cost–benefit analysis (CBA) is a standard framework for evaluating interventions.[21] Its purpose is to quantify the value of the benefits of a programme in order to assess whether these benefits outweigh its economic costs and, hence, whether the programme provides value for money. In this case, the aim of the exercise was to consider the extent to which the investment made by the ODA in the Park and Village Health occupational hygiene service resulted in financial returns for employers using the service. In addition, we provide simple return on investment calculations.

This analysis has been undertaken using data already available relating to the costs of the service provision and the costs of sickness absence and ill-health within construction. No specific data collection was undertaken to directly answer this question. As such a number of assumptions have been made to allow reasonable estimates to be calculated. If all the costs and benefits were fully monetarised, the estimates presented here could be very different. We would recommend further research to verify or challenge the figures presented here, but hope that they provide a useful starting point for discussion.

In contrast to the examples provided in Chapter 4, in this chapter we examine the impact of the whole service, ie across the Park and Village, rather than focusing on specific incidents.

[21] The HM Treasury Green Book

5.1 Data sources

The main data sources for the CBA of Park/Village Health were:

- ODA records of the costs involved in running the Park/Village Health occupational hygiene team.
- HSE data on the incidence of illness and sickness absence amongst the construction workforce, and estimates of the related costs.
- data provided by ODA of the costs involved in constructing the Park and Village so that the costs of potential downtime due to sickness absence could be estimated.

5.2 Limitations of the data

The benefits estimation is limited to a fairly narrow view of the potential impact of the Park/Village Health service. This is because access to data which would allow us to make an accurate assessment of the impact of the preventative team was simply not available. The study is therefore subject to a number of limitations including:

- The calculations are **not based on robust observations** of the benefits of the programme. Ideally this would involve a longitudinal study which compares the health outcomes of those on the Park and Village with those working on other sites using different approaches to occupational health. This would measure the long-term impacts of different levels of exposure to occupational hygiene risks. The complex logistics and costs of such a study make it extremely unlikely that it will ever be commissioned, and such observations were beyond the scope of this project. We are therefore reliant on published data on the average incidence of ill-health and sickness absence within construction, and required to make assumptions about the extent to which a preventative programme could reduce these rates.
- The calculations, in particular, are only able to **estimate the potential reduction in absence rates** as employer data on actual absence rates was not available. Absence recording within construction is notoriously poor, and it was beyond the scope of this research to compile the absence records of all contractors working on the site, even if access to such records had been possible.

- The calculations **assume a static workforce** for the purposes of making calculations whereas on the site, and within construction generally, there is a great deal of worker movement between and across sites.
- The issue of **presenteeism[22] is not dealt with**. There are no accepted data related to levels of presenteeism in construction within the UK, although literature from the US suggests that the costs of presenteeism in other industries can be as high as two to four times those of the medical and pharmacy costs related to illness[23].
- The costs of **long latency diseases** such as occupational cancers (eg lung cancer as a consequence of exposure to respirable crystalline silica) are inadequately estimated at present. Costs in terms of reduced quality of life for such individuals and those affected by other serious occupational illness are not included. Reduced occupational exposure is likely to reduce these negative effects as well, but is not included in our calculations.

5.3 General CBA methodology

Conducting a CBA requires all relevant costs and benefits to be taken into account. This can be achieved through the following three stages:

1. Defining the counterfactual, ie identifying the outcome that would have prevailed had the programme not been implemented.
2. Identifying all relevant costs and benefits.
3. Measuring these costs and benefits and estimating net benefits (ie benefits minus costs).

In this case we have operated with limitations at all three stages and a number of assumptions have been made to allow the analysis to proceed. These are described throughout. It is commonly accepted[24] that one of the greatest difficulties in cost benefit is capturing benefits and providing prices when there are no established

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[22] Whilst there is debate about the precise definition of presenteeism, here we use the term to mean productivity losses associated with employees' illness that occur while the employee is still at work but impaired due to the health problems.

[23] For example: Loeppke R, Taitel M, Haufle V, Parry T, Kessler RC, Jinnett K (2009) Health and Productivity as a Business Strategy: A Multiemployer Study, *Journal of Occupational and Environmental Medicine,* Volume 51, Number 4, April 2009.

[24] See for example Weimer DL and Vining AR (2004) *Policy Analysis: Concepts and Practice,* Prentice Hall.

mechanisms like markets of public budgets. Social net benefits are therefore generally seriously underestimated because monetisation is often not possible. To overcome this we have been required to make a series of assumptions which allow us to proceed using the data available.

5.3.1 Defining the counterfactual

Defining the counterfactual is necessary to identify the added value of any programme, in this case the relevant counterfactual is what outcome would have occurred if the Park/Village Health occupational hygiene service had not operated. Once a counterfactual has been identified, it is then possible to compare it with what was observed in relation to the provision of the occupational hygiene elements of the Park/Village Health service.

The counterfactual in this case has been defined as the level of absence and illness observed for the construction industry as a whole in 2010/11[25]. The assumption is that by having the occupational hygiene team on site, levels of exposure to occupational risks were reduced on the Olympic Park and Athletes' Village compared to this industry average, and that reductions in levels of new cases of occupationally related absence and illness resulting from work on the Park would be observed. The counterfactual is therefore industry norms.

Ideally, similar information on counterfactual costs would be available, ie how much would have been spent on providing occupational hygiene services, or some other approach to the prevention of ill-health, in the absence of the Park/Village Health team. That would help us understand whether the Park/Village Health costs are comparable with what is typically spent by contractors. There are also no available data on the time and money spent by contractors implementing work practices and procedures recommended by the hygienists. Establishing the scale of both these costs was beyond the scope of the current research project. We have therefore set such costs at zero in these calculations, but future research could usefully estimate these.

An important point is that the cost of providing the service was incurred by ODA with no financial contribution from employers. This is an unusual circumstance, and normally the contractors and not the client in construction would provide occupational hygiene services. In our calculations, therefore, the returns are to employers but the spend is by ODA. However, it is reasonable to assume that the

[25] HSE (2011) *Construction: Work-related Injuries and Ill-health*, Health and Safety Executive.

same hypothetical returns would be demonstrated by a similar, employer funded, service.

5.3.2 Identifying the relevant costs and benefits

It is important to identify and take into account all the costs and benefits associated with the occupational hygiene elements of Park/Village Health as far as is practically possible.

Costs

The costs of providing the occupational hygiene input on the Park and Village fell mainly on ODA. They arose because ODA paid for the facilities and staff on the Park and Village. In addition, employers will have incurred costs because contractors working on the site needed to invest in ensuring that their health and safety procedures met ODA standards. As stated, these costs have not been estimated by this research.

The costs to ODA of providing the occupational hygiene elements of Park/Village Health included:

- the costs of all occupational hygiene staff working on behalf of the ODA on the Park
- the costs of test analysis (eg occupational exposure measurements)
- any equipment purchased specifically for use on the Park
- ODA contract management.

The costs of providing the Park/Village Health on-site clinical treatment facility, including staff time, is not included. Whilst the work of the hygienists and clinical staff was integrated on this site, the benefit calculations are made solely on the basis of the work of the occupational hygiene team. Their work could, and on other sites would, be conducted without access to office or treatment space. A separate CBA is available on the clinical elements of Park/Village Health.[26]

Benefits

Measuring the actual observed benefits of a preventative service is difficult. As discussed, such a study would ideally provide longitudinal data which allows an

[26] Tyers C and Hicks B (2012) *Research into Occupational Health Performance on the Olympic Park and Athletes' Village*, Health and Safety Executive Research Report 921.

absence of occupational ill-health to be measured amongst those benefiting from an occupational hygiene service when compared to those who were not. The costs and complexity involved in conducting such a study is prohibitive. It has therefore been necessary to make a number of assumptions about the impact of the preventative programme on the Park and Village.

Assumption 1: Exposure to occupational health risks are reduced on the Park, compared to industry averages

There was an extremely low incidence of health incidents recorded on the Park (almost zero). This was calculated from the centralised recording system of incidents. The ill-health frequency rate was calculated from hours worked and the number of reported occupational illnesses. However, occupational illnesses can take many years to show themselves, so this type of data has only limited usefulness and will not reflect the impact of long latency diseases which should also be similarly impacted. The view of over three-quarters of managers and workers surveyed, however, was that the attention given to health risks on the site was greater than that on other sites.[27] There is therefore some, albeit subjective data, that the low rate does reflect better management practices.

Further data is available from Park/Village Health's own analysis of the data collected as part of the HII exercise (described in more detail in Chapter 3) which examines potential exposure to health risks at workforce level. This demonstrates that following interventions by the occupational hygiene team on a number of different sites there was a drop in the rate of observed health impacts.[28] The rate of reduction varied according to the particular site and issue in question but was somewhere between 58 and 70 per cent depending on the measurement used (further details are available in Appendix 3 of the HII observations used to calculate these reduction estimates).[29] Again these estimates have their limitations, and reflect reductions in exposure on only a small number of sites, but do provide a good indication that the work of the hygienists did have some impact on exposure levels.

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27 Tyers C and Hicks B (2012) op. cit.

28 The number of observations made by the hygienists of potential exposure to risks associated with the specific intervention taking place (eg use of specific personal protective equipment to reduce exposure risks) in the three weeks following the intervention when compared to the three weeks before the intervention.

29 The rates differ according to whether a single incident is recorded in relation to each observed exposure, or whether an estimate is made of the number of people affected by the incident and this figure used in the calculations. The latter produces the lower figure.

We also know that the accident rate on site was very low. This was calculated by ODA and a comparison made with industry average data compiled by HSE[30]. The AFR for the Park/Village was 0.16, achieved on the Park and Village for the period 2005 to 2011. HSE calculations of the average AIR for all construction over the period 2008/9 to 2010/11 were 1,090 per 100,000 workers. When this is divided by a conversion factor of 2,100, the AFR is therefore 0.52. However, there is an acknowledged problem of under-reporting across the construction industry[31]. On conservative estimates, the true AFR for construction should be about 50 per cent higher than reported in these statistics. On the Park and Village, however, the level of near miss reporting and other site culture surveys suggests that there was a very low or negligible level of under-reporting on the site. The ODA therefore estimate that their accident rate is *at most* one-third of that of the construction industry as a whole.

The very low recorded accident rates for the site therefore demonstrate that excellent procedures were in place for safety, where the direct consequences are easier to measure. As the ODA prioritised health in the same way as safety, it is therefore realistic to assume that high standards were also achieved in occupational hygiene management although this cannot be directly measured in the same way.

Assumption 2: Reduced exposure on the site leads to reductions in work-related sickness absence

In the calculations we have made the assumption that if there is a reduction in health risk exposure on the Park and Village, then there will be a proportionate reduction in work-related absence. The figures used to estimate absence rates are published by HSE for the construction industry and are considered to be relatively

30 The HSE publishes Accident Incident Rates annually, and the ODA converted this using an estimate of the annual working hours of an average construction worker. Initial estimates based on CBI, BIS and Construction Skills published data gave a conversion factor between AIR (accidents per 100,000 workers employed, on average, over a year) and AFR (accidents per 100,000 hours worked) of 1,971. Subsequent revisions and "safety factors" suggested that 2,000 to 2,200 hours should be used as the correction. This was presented to HSE economists and statisticians in various reports, and in general they concurred with the approach but have not in writing indicated a validation of the actual numbers used.
See www.hse.gov.uk/statistics/lfs/injind1_3yr.xls. This provides the reportable accident injury rate averaged for the three year period 2008/9 to 2010/11 in terms of the rate per 100,000 workers.

31 HSE's Construction Intelligence Report states that whilst the UK has reliable information on fatal injuries, non-fatal RIDDOR reports are subject to significant under-reporting. Estimates of the true level of accidents are around 30,000 reportable construction accidents each year, rather than around 4,600 major and 8,000 over 3-day accidents actually reported.

robust. There is no reason to assume that workers on the Park are systematically different from the average workforce represented in the data.

Our calculations also assume an immediate reduction in work-related sickness absence. In fact, the effects of an occupational hygiene programme may take longer to materialise. Without making this assumption, however, constructing any reasonable estimates would have been more difficult. Clearly there is scope for future research to focus on resolving this issue more satisfactorily.

Assumption 3: The results are in line with what would have been achieved for a static workforce

The nature of construction is that most workers are present on a single work site for only a limited amount of time. The figures presented in this cost benefit relate to a hypothetical, annual, static Olympic workforce. Constructing such a hypothetical annual workforce then allows the use of published HSE data on accident rates and incidence of work-related illness which are presented on the basis of a certain workforce size.

We know from surveys carried out on the site[32] that 32 per cent of workers and 48 per cent of managers (in 2010) had been working on the Park for a year or more (see Appendix 1, Table A1 for further details). The assumption of a stable workforce does therefore hold for a significant proportion of workers, but not for everyone.

The potential implications of this are that the non-static nature of the labour force results in an externality problem. This means that the benefits of the intervention can be achieved in later periods and at different sites for the same employers because the acquired knowledge of how to handle hazardous situations and prevent them will improve behaviour in the future as well as today. This implies that the costs of providing the service will decrease over time as one day, everyone will have gained the knowledge necessary to manage health risks as the service matures. The benefits, on the other hand, will remain the same or even increase. As such, the estimates here for the static workforce may be an underestimate of what the actual benefits will be over time.

5.3.3 Measuring the costs and benefits

After all costs and benefits are identified, they need to be expressed in the same units, preferably in monetary terms, to allow the net benefits of the programme to be calculated.

[32] Tyers C and Hicks B (2012) op. cit.

Costs

The costs of the provision can be taken directly from the spending profiles of ODA on the service. The Park/Village Health occupational hygiene team cost ODA £1,051,000 to run between June 2008 and July 2011[33].

Benefits

Estimating the benefits is much more difficult and, as discussed, requires assumptions to be made that allow us to quantify these benefits in economic terms. In constructing our estimates we have assumed that:

1. Levels of exposure to occupational hygiene risks were lower than on an average site. There is no way to accurately estimate how much lower. The accident rate on the site is estimated to be about one-third that of the average for the construction industry as discussed. We have therefore used this as our guide for the estimation of the maximum amount by which exposure to health risks could have been reduced. This is also in line with specific data from Park/Village Health about the impact of interventions on individual contractors, where a reduction somewhere in the region of two-thirds was evidenced after their inputs. In addition, we provide a calculation of how much time would need to be saved in order for the service to break even.
2. Lower exposure levels result directly in reduced absence and illness rates for the workforce and that this happens in line with the exposure levels. We therefore assume that the absence rates and ill-health on site could be as little as one-third of that observed for the construction industry as a whole.
3. The impact on the workforce of improved occupational hygiene standards on site is the same as could be assumed for a hypothetical, static, workforce equivalent in size to the full-time man hours actually worked on site. Details of how these figures were calculated are provided in Appendix 1.

These assumptions are therefore sweeping and all are subject to likely inaccuracies. However, they are necessary to allow at least a **basic estimate** of the possible scale of benefits from a preventative programme. We believe that the assumptions made are one logical way of presenting a business case for occupational hygiene. We make no claims that this is the only way of making such

[33] There was an on-site presence prior to this, from 2006, but the detailed cost benefit analysis has been conducted on the three year period for which data was most accessible.

an argument, or that different approaches would not provide different estimates. We do, however, hope that they are a useful starting point for debate.

The benefits of the programme are therefore expressed in non-monetary terms (eg reduced sickness absence amongst workers) and a monetary value has to be placed on this. We have focused on the estimated value added per working day in converting the time saved in reduced absence rates into a cost saving for employers. This figure is higher than wage costs as it takes into account the full costs of completing the work associated with each operative, including factors other than wages associated to the build.

The extent of the work of the occupational hygienists is described in earlier chapters. As such the estimates of benefits in this chapter relate solely to the potential reduction in work-related sickness absence or illness amongst the workforce. Further consideration should be given to the examples provided in Chapter 4 for how good occupational hygiene and health risk management can also save money in other ways in order to provide a better view of the full economic returns of the service.

5.4 Cost-benefit analysis

This section sets out estimates of the benefits of offering Park/Village Health occupational hygiene services. These are compared with the actual costs of providing the service and used to calculate the services' net benefits.

The costs include all those associated with running the occupational hygiene team for the three-year period June 2008 to July 2011, and the benefits apply to this time period also.

5.4.1 Potential benefits of reducing work-related sickness absence

The first possible benefit of the preventative occupational hygiene programme on the Olympic Park and Athlete's Village that we have considered is reducing sickness absence through reduced exposure to health risks. The average level of work-related sickness absence amongst the construction industry as a whole is estimated by HSE to be 0.87 days per worker[34]. It is impossible to quantify the extent to which reductions to exposure would reduce levels of disease, but it is likely that there would be an impact on incidence levels. However, no matter what action is taken now, it is likely to be the next generation of workers who stand to

[34] HSE (2011) *Construction: Work-related Injuries and Ill-health* op. cit.

benefit the most because of the long latency of many occupational diseases, including occupational cancer. Evidence suggests, however, that focusing efforts on improving compliance now is the most effective way to reduce long latency diseases (rather than, for example, reducing the exposure standards further).[35]

The precise number of full-time full day workers on the Park and Village is not known, but taking the man hours worked on the site across the three-year period of interest, we estimate that this is equivalent to around 9,500 workers per year[36] based on a 41-hour average working week[37]. We know that the peak workforce on site was around 12,000 so an 'average' workforce of this size is realistic.

We have used an average production daily added value per worker per hour estimate provided by ODA (of £70 per hour) to convert this days saved data into projected economic benefits. We have assumed a seven-hour working day, giving us a daily cost estimate of £490. This differs from the 41 hour a week estimate of the working hours used, but is in line with guidance from ODA about how the cost estimates were calculated.

We can therefore make the following calculation to represent the **counterfactual**:

- for a workforce of 9,500 working on the site for three years
- which costs £490 a day
- with an average work-related sickness absence rate of 0.87 days per worker per year
- the costs of work-related sickness absence on the Park/Village without any interventions would have been £12,149,550 over three years.

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35 Hutchings S and Rushton L (2011) Toward Risk Reduction: Predicting the Future Burden of Occupational Cancer, *American Journal of Epidemiology*, Volume 173, Issue 9.

36 Calculated from a total of 62,306,980 hours worked over the period between June 2008 and July 2011 of 160 weeks, giving an average of 389,419 weekly hours worked.

37 Office for National Statistics bulletin December 2011, *Hours worked in the labour market – 2011.* This suggests that construction workers tend to work some of the longest hours in the UK at an average of 41.2 hours per week.

We have made two further calculations using these assumptions, but changing the work-related absence rate to reflect potential reductions from the implementation of a preventative service.

Calculation 1: The reduction in work-related sickness absence rates necessary for the service to cover its costs

The first calculation made was to determine by how much work-related sickness absence rates would need to be reduced for the service to 'break even' ie for the economic benefits of reduced sickness absence levels to match the costs involved in providing the service.

The equation used to estimate the costs of work-related sickness on the Park/Village *without* occupational hygiene intervention is therefore:

0.87 x 9,500 (workforce size) x 3 (number of years) x 490 (production daily added value)
= £12.1m

To reach the break-even point for the costs of the service, the calculation is that a reduction equivalent to the following would need to be achieved:

0.08 x 9,500 (workforce size) x 3 (**number** of years) x 490 (production daily added value) = £1.1m (the costs of the occupational hygiene service)

The counterfactual absence costs, at around £12.1m are therefore 11.55 times the size of the cost of the occupational hygiene team. The work-related sickness absence rate would therefore need to be only one-twelfth of the average rate to bring the saved sickness absence costs to an amount equivalent to the costs of the occupational hygiene service. This means that only around 30 minutes per worker would need to be saved as a result of the work of the occupational hygiene team in order for them to cover their costs. The full results are presented in Table 5.1.

Table 5.1: CBA analysis of break-even point for service provision

CBA of occupational hygiene programme	£
Costs	1.1m
Benefits of occupational hygiene service (based on a reduction in work-related sickness absence of 0.08 days per worker over three years)	1.1m
Net benefits of occupational hygiene service	0.0

Calculation 2: The economic benefits of reducing work-related sickness absence levels by two-thirds

This second calculation takes the same estimates of workforce size and the costs per day of production as calculation 1, but assumes a greater reduction in work-related sickness absence.

The work on improving safety standards led to an observed accident rate that was only one-third that of the industry average. If we assume that the preventative programme led to a reduction in health risk exposure of two-thirds (in line with the achievements on safety, and their own measurements of the impact of some examples of their work), and this relates directly to a reduced sickness absence rate, the absence rate on the Park would be 0.29, a reduction of 0.58 days per worker. This means that a total of 16,530 days of sickness absence could be saved during the period June 2008 to July 2011 on the Park and Village[38].

Using this model the net benefits of providing the service are around £7.0m. This is set out in Table 5.2 below.

Table 5.2: CBA analysis of occupational hygiene provision based on a reduction in work-related sickness absence of two-thirds

CBA of occupational hygiene programme	£
Costs	1.1m
Benefits of occupational hygiene service (based on a reduction in absence rates of 0.57 days per worker over three years)	8.1m
Net benefits of occupational hygiene service	7.0m

In order to make this calculation more meaningful for different employers, for **every pound invested by the ODA in the occupational hygiene service, there was a return of £7.36** in reduced or lost added value[39]. This is if the absence rate that was reduced by two-thirds compared to the industry average. These benefits would have accrued to employers who used the service for free.

Sensitivity analysis

It is also good practice to examine how sensitive the results of the CBA are to changes in assumptions/underlying estimates. While some elements of the

[38] Calculated as 0.57 days per worker, for 9,500 workers.

[39] Using the simple formula: Return on Investment = amount of financial gain/ total investment amount. This formula is useful when calculating an uncomplicated figure for investments over the short term (here we are looking at benefits only over the course of the build and not beyond)

analysis can be measured directly (eg costs of the Park/Village Health occupational hygiene team), other elements involve estimations (ie absence rates across the site and the possible reduction in these compared to other sites) or assumptions (ie that a reduction in exposure to health risks leads to a measurable, immediate reduction in absence rates). It is therefore necessary to assess how the results would change with changes to these parameters.

The main areas where the estimates could be different are:

- the extent to which health risk exposure was reduced
- the size of the hypothetical static workforce
- the monetary value attached to the hours saved.

If there were changes in any of these, there would be consequences for the cost–benefit estimates. Table 5.3 provides an overview of the results of our sensitivity analysis which takes each of the assumptions in turn and adds +/- 50% to each whilst holding the others constant. All figures present the economic benefits resulting from the altered assumptions.

Table 5.3: Results of sensitivity analysis on key data (reducing levels of sickness absence calculations)

	Economic benefit (£)		
Variable in CBA estimates	**-50%**	**Central estimate**	**+50%**
Reduction in exposure to health risks (central estimate assumes this is two-thirds the average for the construction industry as a whole)	4.0	8.1	12.1
Size of hypothetical workforce (central estimate assumes this is 9,500 per year)	4.0	8.1	11.9
Monetary value attached to costs of absence (central estimate assumes that £490 per day is equivalent to the production daily added value associated with an average work day)	4.0	8.1	11.9

As demonstrated, therefore, changes to any of these variables do result in changes to our estimates of the benefits involved. The most significant change is evidenced when the assumption about the extent of exposure levels is altered. However, even if the reductions in absence rates were only half what we have assumed in our main calculations, the net benefits are still in the region of £2.9m.

5.4.2 Potential benefits of preventing work-related ill-health

The calculations above focus solely on the potential benefits of reducing work-related sickness absence. This is because these are the main costs associated with ill-health which employers are required to cover. Another way of looking at the potential benefits of a preventative occupational hygiene programme is to consider the reductions in new incidences of ill-health that would result if exposure levels were reduced. The costs of ill-health fall mainly on individuals and society, with employers' costs representing a relatively small proportion of the total figure.[40] Increasing litigation may, however, begin to claw back some of these costs from employers.

In making assumptions about the prevention of ill-health, it is necessary to acknowledge the role of prolonged exposure to health risks in the causation of work-related ill-health. We therefore do not claim that our calculations can be attributed to the efforts of any one preventative programme. Rather, if the construction industry as a whole were to adopt the standards implemented on the Olympic Park and Athletes' Village, over time, these are the type of benefits that might be expected, calculated to represent the costs and benefits involved for a project of the scale of the Olympic build.

Our calculations of the wider benefits of preventing new cases of ill-health in relation to a project the size of the Olympic Park and Athletes' Village therefore rest on the following assumptions:

- The annual costs involved of providing a comprehensive, preventative occupational hygiene service, for a workforce of 9,500, would be £350,49041, or the equivalent of just £36.80 per worker.
- New cases of work-related ill-health can be prevented through the use of such a programme.

Two sources of published data have been used to calculate the likely scale of the economic benefits from a programme like this in preventing new cases of ill-health. These are:

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[40] HSE (2011) *Costs to Britain of Workplace Injuries and Work-related Ill-health: 2009/10 update*, Health and Safety Executive.

[41] The total cost of the occupational hygiene team on the site was £1,051,468 which covered service provision over a period of three years.

1. Estimates of the incidence of new cases of ill-health occurring amongst construction workers. This is taken from HSE published data based on the self-reported work-related illness (SWI) and workplace injuries component of the Labour Force Survey (LFS).[42]

2. Estimates of the average costs of each case of ill-health. There are two potential sources of information on this:

- Estimates by HSE, called 'appraisal values'[43] which aim to estimate the costs of common ill-health complaints resulting from current working conditions. These include a wide range of costs including: for individuals – loss of income, compensation payments; for employers – sick pay costs, production disturbance, administrative and legal costs, and; for government – health and rehabilitation, benefits, reduced tax/NI payments. However, there is recognition that further work is required to estimate the costs of less common work-related illnesses (around 80 per cent of new work-related illness each year is related to either stress or musculoskeletal conditions).
- The results of a detailed analysis of the true costs of occupational asthma (OA) [44]. This is considered by HSE to be the best source of data on OA, and demonstrates that the true costs of illness are far greater than HSE appraisal values would suggest, at least for this condition.

The appraisal values do not differentiate between cases of ill-health of differing levels of seriousness, or the extent to which the illness profiles in different industries are more or less likely to lead to ill-health retirement. The appraisal values may therefore substantially underestimate the true costs of occupational illness, particularly serious conditions which can result from exposure to construction industry risks. About half (almost 4,000 per year) of occupational cancer deaths, for example, are attributable to exposure to carcinogens (eg substance or occupational circumstance) in the construction industry[45].

Given these limitations, we present two calculations which estimate the potential benefit of investment in preventative occupational hygiene. These calculations assume that all cases of new work-related ill-health can be eliminated through

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[42] Further information can be found at http://www.hse.gov.uk/statistics/lfs/index.htm in Table WRIIND4. This presents data for the 2010/2011.

[43] HSE (2011) *Costs to Britain of Workplace Injuries and Work-related Ill-health* op. cit.

[44] Boyd R, Cowie H, Hurley F and Ayres J (2006) *The true cost of occupational asthma in Great Britain*, Health and Safety Executive Research Report 474

[45] HSE (2011) op. cit.

comprehensive risk control procedures. Each calculation uses a different estimate of the costs of ill-health.

It should be noted that both these calculations and the previous calculations of the benefits of reducing absence include an estimate of the costs to employers of sick pay. The two figures therefore cannot be summed, and should be treated as two different ways of calculating the potential benefits.

Calculation 3: Scale of potential benefits from eliminating new cases of occupational ill-health using HSE appraisal values

The appraisal value for ill-health is £16,100 per case, equivalent to £4,000 to the employer, £4,100 to the government and £8,000 to the individual. The projected rate of new occupational illness for a workforce of 9,500 is 155 cases per year based on SWI data from the LFS[46]. At a cost of £16,100 per case, this equates to £2,495,500 per year savings for society, individuals and employers or a total of £7,486,500 saved over the three years.

Applying this to the costs of providing the occupational hygiene service, there is a net benefit of around £6.4m (Table 5.4).This equates to a return on investment of £6.82 for every pound spent.

Table 5.4: CBA of preventing new cases of work-related ill-health (using HSE appraisal values)

CBA of occupational hygiene programme	£
Costs	1.1m
Benefits of occupational hygiene service (based on preventing 155 cases of work-related ill-health per year for three years, at a cost of £16,100 per case)	7.5m
Net benefits of occupational hygiene service	6.4m

Given that it is likely employers will be asked to cover the costs of occupational hygiene staff, it is also worth considering what the direct benefits are to them. Using the costs to employers estimate of £4,000, preventing 155 cases of work-related ill-health each year for the three years in question would lead to benefits of £1.9m. Accounting for the costs of the occupational hygiene service, this means net benefits to employers of £800,000 of funding a service of this type for a workforce

[46] This suggests that there were 1,630 cases of new ill-health per year, per 100,000 employees in construction in 2010/11. This equates to 155 cases per 9,500 employees.

of this size. This equates to a direct return on investment for employers of £1.73 for every one pound spent.

Calculation 4: Scale of potential benefits from eliminating new cases of occupational ill-health using lifetime costs of OA

The results of a comprehensive study on the true costs of OA demonstrated that the lifetime costs of each new case of OA, for men, is as much as £176,000[47]. For this analysis we have assumed that the lifetime costs of the other conditions experienced by construction workers will be similar to this (some will actually cost more, some less, but we feel this is a good starting point for analysis given that comparable cost data for other illnesses is not available). The projected rate of new occupational illness for a workforce of 9,500 is 155 cases per year based on SWI, LFS data[48]. At a cost per case of £176,000 this equates to a saving of £81.8m if all the projected cases of new work-related ill-health could be prevented for a workforce the size of that working on the Olympic Park and Athletes' Village.

The net benefit of providing preventative occupational hygiene that stops new cases of occupational ill-health occurring could therefore be as high as £80.7m (Table 5.5).

Table 5.5: CBA of preventing new cases of work-related ill-health (taking lifetime costs of OA)

CBA of occupational hygiene programme	£
Costs	1.1m
Benefits of occupational hygiene service (based on a reduction in work-related sickness absence of 0.073 days per worker over three years)	81.8m
Net benefits of occupational hygiene service	80.7m

The **return on the investment could therefore be as high as £74.36 per £1.00 spent** on preventative occupational hygiene in the long term[49]. The OA study also

[47] Boyd et al. (2006) op. cit.

[48] This suggests that there were 1,630 cases of new ill-health per year, per 100,000 employees in construction in 2010/11. This equates to 155 cases per 9,500 employees.

[49] Using the simple formula: Return on Investment = amount of financial gain/ total investment amount. This formula is useful when calculating an uncomplicated figure for investments over the short term (here we are looking at benefits only over the course of the build and not beyond).

suggests that about 47 per cent of these costs fall on tax payers, so the return on an investment of £1 of ODA money into preventative occupational hygiene has the potential to deliver a direct return of £34.95 in reduced health care costs. This is quite apart from the wider benefits to individuals and employers.

Sensitivity analysis

As with the sickness absence calculations we have also examined how sensitive our reducing new cases of illness calculations are to changes in the underlying assumptions. The main areas where the estimates could be different are:

- the extent to which new cases of ill-health can be reduced
- the size of the hypothetical static workforce
- the monetary value attached to the hours saved.

If there was a change in any of these, there would be consequences for the cost–benefit estimates. Tables 5.6 and 5.7 provide an overview of the results of our sensitivity analysis which takes each of the assumptions in turn and adds +/- 50% to each whilst holding the others constant. All figures present the economic benefits resulting from the altered assumptions.

Table 5.6: Results of sensitivity analysis on key data
(reducing incidence of ill-health calculations using **HSE appraisal values**)

	Economic benefits (£ millions)		
Variable in CBA estimates	**-50%**	**Central estimate**	**+50%**
Number of new cases of work-related ill-health prevented (central estimate assumes this is 155 cases)	3.7	7.5	11.2
Monetary value attached to costs of work-related illness (central estimate assumes £16,100 per case)	3.7	7.5	11.2

Table 5.7: Results of sensitivity analysis on key data
(reducing incidence of ill-health calculations using lifetime costs of **OA estimates**)

	Economic benefits (£ millions)		
Variable in CBA estimates	**-50%**	**Central estimate**	**+50%**
Number of new cases of work-related ill-health prevented (central estimate assumes this is 155 cases)	40.9	81.8	122.6
Monetary value attached to costs of absence (central estimate assumes £176,000 per case)	40.9	81.8	122.8

As demonstrated, therefore, changes to any of these variables result in substantial changes to our estimates of the benefits involved. All changes, however, still result in a positive net benefit of some magnitude.

Alternative sources of data on illness rates

The calculations using the SWI figures produce extremely high estimates of the benefits of preventing occupational ill-health. There are other sources of data which could be used in place of this to estimate the likely rate of new occupational illness which would set the estimates much lower. New cases of prescribed work-related ill-health each year in construction is available based on the Industrial Injuries Disablement Benefit (IIDB) data.[50] This demonstrates that the main diseases within construction are related to asbestos exposure (ie asbestosis, mesothelioma and diffuse pleural thickening), as well as vibration white finger, occupational deafness, musculoskeletal disorders, dermatitis and asthma.

The actual levels of some of these diseases may actually be much higher than is represented in the prescribed rate figures in the IIDB data as not all workers will seek medical treatment for their symptoms (eg musculoskeletal conditions and deafness). We know, for example, from a survey conducted on the Olympic Park in 2010, that 20 per cent of workers were not registered with a GP.[51]Also, not all conditions affecting construction workers are covered (eg Chronic Obstructive Pulmonary Disease which can be caused by work).

We have made a number of alternative calculations using IIDB data rather than SWI data. These are presented in full in Appendix 4. These provide much more conservative estimates of the net benefits to employers. Whilst they offer a valid, alternative estimate, in our opinion, they are too low, as they focus on too few illnesses, and only on those where a formal diagnosis exists. One critique of the available data on occupational illness[52] highlights how compensation or benefits are often payable for a list of prescribed diseases, whereas there are a range of illnesses that arise which are related to, even if they cannot be wholly attributed

[50] Table IIDB10 provides the average rate of new assessments of prescribed diseases in 2007-2009 per 100,000 employees in different industries and is available on the HSE website.

[51] Tyers C and Hicks B (2012) op. cit.

[52] Drummond A (2007) A Review of the Occupational Diseases Reporting System in the Republic of Ireland, Health and Safety Authority.

to, work. For prevention purposes, monitoring of this wider set of illnesses is therefore recommended.

Whilst the SWI may overestimate the benefits, use of the IIDB, in our opinion, would lead to a significant underestimate of the problem, and we have therefore focused on our analysis of SWI data in this report.

5.5 Discussion of results

The costs of providing a comprehensive occupational hygiene service on the Olympic Park and Athletes' Village construction project was around £37 per worker per year. The potential returns on this investment could be significant. Our estimates suggest that by reducing work-related sickness absence by as little as 30 minutes per employee per year, compared to the industry average rate, the service would cover its costs.

We cannot say for certain how much sickness absence rates were actually reduced on site by the work of the occupational hygiene team. However, if absence rates were reduced by the same degree as accidents (the accident rate is estimated to be just one-third that of the industry average) then the net benefit of the service would be £6.9m. This represents a return of £7.27 for every £1.00 invested in preventative occupational hygiene.

Going a step further, we have estimated the potential benefits of investing in preventative occupational hygiene in terms of eliminating occupational illness. This would require long-term investment and long-term reduction in exposure to materialise. However, if a workforce the size of that on the Olympic Park and Athletes' Village could, via reduced levels of exposure, be prevented from contracting occupational disease, the return on an annual investment of just £350,000 a year would be substantial. Preventing 155 cases of ill-health per year (which is what would be expected for a workforce of this size over three years according to the average work-related illness rates for the construction industry published by HSE) would result in lifetime net benefits of as much as £80.7m. Whilst the vast majority of these savings would be felt by society and individuals the employers responsible for funding the service would also more than recoup their costs in the longer term.

Employers are estimated to incur only around four per cent of the total lifetime costs of occupational ill-health[53]. The economic argument, already presented, that

[53] Boyd et al. (2006) op. cit

such an investment will result in reduced absence costs may therefore be more convincing to employers as it has a more immediate impact on business. Research within the US[54], and increasingly the UK[55] has also demonstrated that the costs of presenteeism can be substantial for employers. Further work to quantify these costs for construction could therefore be a useful next step.

Overall, therefore, there are substantial benefits to employers in preventing work-related sickness absence, and substantial benefits to society and individuals in preventing work-related illness. In both cases, the potential benefits of using an occupational hygiene team to implement good health risk controls is likely to far outweigh their cost.

The cost–benefit calculations made here require us to make a large number of assumptions as there is a lack of objective data which measures the scale of impact of preventative occupational hygiene either on the Olympic build or more broadly. We have attempted to make these assumptions based on robust data sources where possible, but there is inevitably some degree of error in what we suggest. We see these estimates as a useful starting point for discussion. In the next chapter we set out some of the ways in which future work could become more precise. Data which provides levels of exposure measurements against published standards, for example, would allow a leading, rather than lagging (such as ill-health) indicator to be developed, and this should be encouraged to allow further estimates to be made on the basis of more robust data.

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[54] For example: Loeppke R, Taitel M, Haufle V, Parry T, Kessler RC, Jinnett K (2009) Health and Productivity as a Business Strategy: A Multiemployer Study, *Journal of Occupational and Environmental Medicine,* Volume 51, Number 4, April 2009.

[55] SCMH (2007) *Policy Paper 8: Mental Health at Work: Developing the business case*. London: The Sainsbury Centre for Mental Health.

6 Priorities for the Future

The calculations presented here do have a number of limitations, not least the difficulties involved in estimating the potential impact of a preventative service. The deficiencies in this analysis cannot therefore be adequately addressed without access to better data.

6.1 The role of occupational health and occupational hygiene providers and employers

Occupational health providers, specifically occupational hygienists need to collect and analyse the data they hold about reductions in exposure levels as a result of their work. There is also a need for such data to be collected in a way that allows analysis across different employers, and that the data is in a form that can be easily shared. More data to show existing levels of exposure measurements against published standards such as EH40[56], for example is necessary. Limit values are intended to be health based and provide a leading indicator of effectiveness in controlling exposure rather than depend on lagging indicators of ill-health.

Employers need to work with occupational hygiene providers to collect and share better data in relation to impact that these reduced exposure levels associated with different preventative regimes have on absence rates. Developing a more detailed understanding of how preventative workplace health management impacts on the health of individuals in the short term will require employers and clinical and occupational hygiene professionals to work together to provide more robust research outputs and monitoring data.

[56] http://www.hse.gov.uk/pubns/priced/eh40.pdf provides access to guidance and advice about these exposure limits

Longer term monitoring is problematic, due to the resources and planning involved, the long latency of occupational disease and for a mobile workforce such as construction attributing levels of exposure to different employers or jobs. A sensible first step would therefore be to analyse as much existing data as possible, before commissioning new work. This may require that different government departments, academics, insurance providers and employers work together, and attempt to overcome any data protection limitations or concerns about data sharing.

6.2 Drawing together case study evidence

At the moment, the available research is largely limited to case studies such as this one. A useful step forward would be a review of this case study evidence. It would also be useful to move towards a more comprehensive overview of what the economic benefits of a preventative programme can look like, particularly for smaller organisations or construction sites. Developing a model of the impact of preventative programmes would be an important first step, such that it is possible to outline at each stage in the process what data could and should be collected to facilitate a better assessment of impact and economic returns. The model would also be useful for employers in deciding what actions they need to take to improve workplace health management at different stages in their work processes.

6.3 Better data on the costs of ill-health

At the moment, we understand little about the true costs of ill-health, with the exception of the referenced study on the lifetime costs of Occupational Asthma. The costs associated with different work-related conditions could therefore be more fully explored. This would allow business case messages to be better tailored to industries with differing profiles of occupational illness, with them becoming more meaningful as a result.

For employers, the business arguments could also be substantially strengthened if the costs of presenteeism could be accurately estimated. These are likely to be substantial, and there is a considerable and growing body of evidence in the US about the business benefits from improving productivity through preventing ill-health. When added onto absence costs, the business argument would become even stronger. There are emerging techniques for measuring presenteeism, and it would seem a useful next step to link this with any changes to workplace health management measures.

6.4 Getting the message out that Occupational Hygiene - preventative Occupational Health - is cost effective

The estimated benefits of reducing work-related sickness absence rates begin to set out a convincing business case for employers. Not only should an effective preventative programme easily cover its costs, but there are also returns on this investment. The potentially huge benefits from reducing new cases of occupational ill-health, however, present a less effective business case. At present, the costs of providing a preventative programme of occupational hygiene falls primarily on employers whereas the main benefits are for society and individuals. Further consideration should therefore be given to incentivising investment in workplace health management which goes beyond presenting a direct business case to employers. There is a clear rationale, however, for the government to consider ways in which it can contribute to the provision of preventative occupational hygiene for more workers as the long-term returns could be considerable.

More should also be done to inform and educate employers about occupational hygiene and the benefits that occupational hygiene services can offer in terms of reduced sickness absence and costs. Occupational hygiene is noticeable by its absence in most business texts on health and safety, with few managers even having heard of it, let alone understanding what it is and how it can help them. This gap in business knowledge needs to be addressed.

Appendix 1: Estimating the Size of an Annual Workforce

Calculating the size of an 'annual' workforce

1. Data is not available from the site about the actual number of individuals who worked on it every day (although the average number of workers on site is accurately estimated it does not account for repeat daily movements on/off site during working hours, or the actual hours spent working productively). ODA do have, however, an accurate record of the hours worked by the workforce, and this is the best estimate of the scale of the labour force available.

2. A total of 62,306,980 man hours were spent on the Olympic Park between June 2008 and July 2011, the three years included in the cost–benefit calculations. Assuming that the average working week for an operative is 41 hours, and that 160 working weeks are involved, this equates to a full-time workforce equivalent to 9,498.

3. This calculation has been made to allow some estimate of the likely benefits of reduced annual sickness absence across the site and the potential rates of reduced new ill-health incidence as a result of good occupational hygiene management on the site.

Average time spent working on the Park

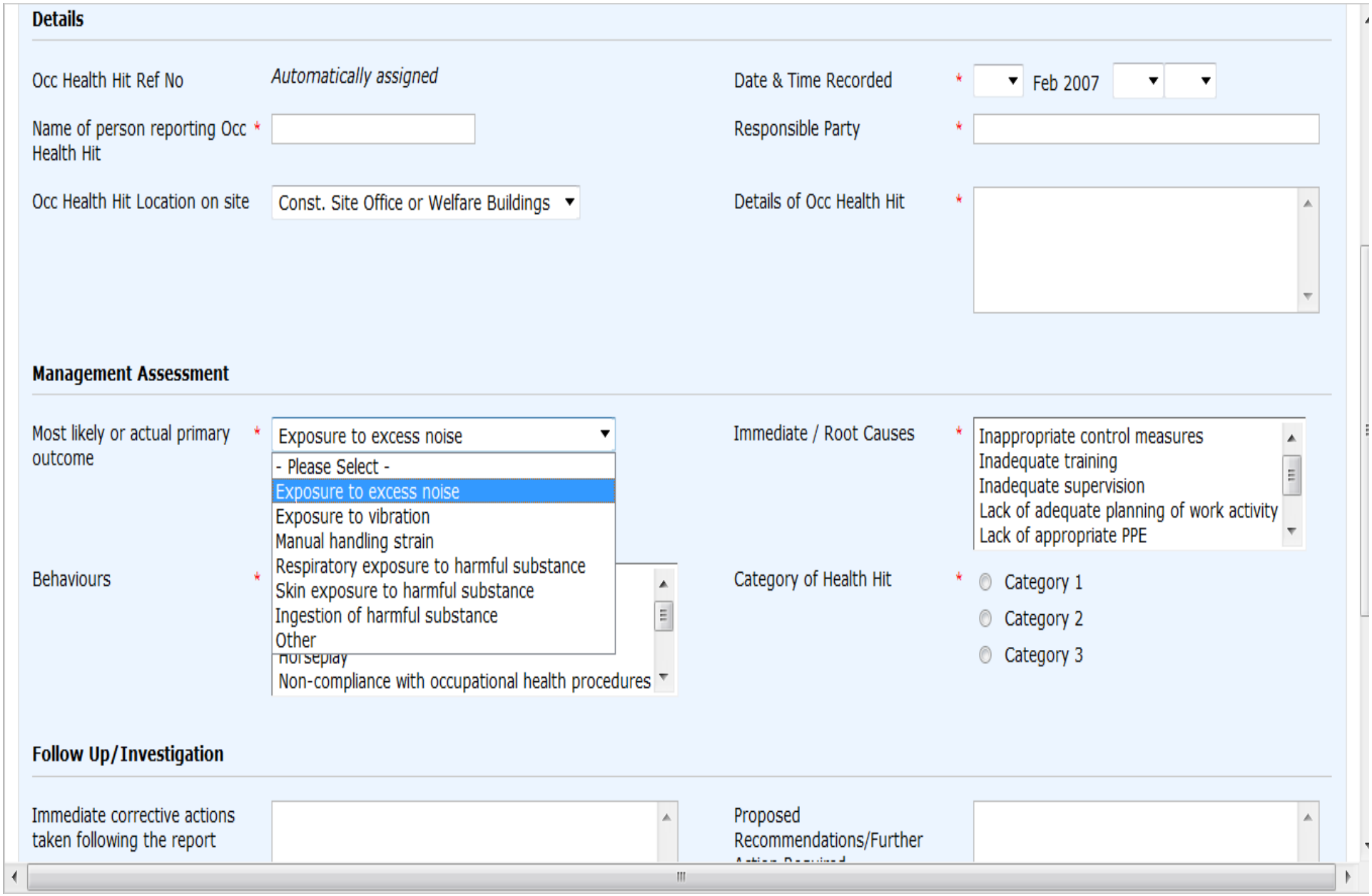
Table A1: Length of time people have spent working on the Park and/or Village

Length of time spent on Park and/or Village	Managers %	Workers %
Six months or less	13.6	47.2
7 to 12 months	38.9	20.6
13 to 24 months	30.8	22.2
More than 2 years	16.7	10.4
No. of responses on which %s are based (N)	*162*	*1,141*
Missing (N)	*2*	*42*
Total (N)	*164*	*1,183*

Source: IES/Employment Research Ltd Survey of Managers and Supervisors 2010

Note: data collected as part of Tyers C and Hicks B (2012) Research into Occupational Health performance on the Olympic Park and Athlete's Village, Health and Safety Executive Research Report 921

Appendix 2:
Screenshot of HII Database Input


Details
Occ Health Hit Ref No
Automatically assigned
Date & Time Recorded *
Feb 2007
Name of person reporting Occ Health Hit *
Responsible Party *
Occ Health Hit Location on site
Const. Site Office or Welfare Buildings
Details of Occ Health Hit *
Management Assessment
Most likely or actual primary outcome *
Exposure to excess noise
- Please Select -
Exposure to excess noise
Exposure to vibration
Manual handling strain
Respiratory exposure to harmful substance
Skin exposure to harmful substance
Ingestion of harmful substance
Other
Immediate / Root Causes *
Inappropriate control measures
Inadequate training
Inadequate supervision
Lack of adequate planning of work activity
Lack of appropriate PPE
Behaviours *
Horseplay
Non-compliance with occupational health procedures
Category of Health Hit *
Category 1
Category 2
Category 3
Follow Up/Investigation
Immediate corrective actions taken following the report
Proposed Recommendations/Further

Appendix 3: Evidence of Reduced Exposure Levels through the Work of Park/Village Health

Results of Health Impact Index analysis

Table A3.1: Park/Village Health HII indicator observations and how this changed over time (all observations made during 2010)

Issue	Park/Village Health intervention		3 observations prior to intervention			Total	3 observations following intervention			Total	Mean reduction
Use of gloves	Meetings with contractors and toolbox talks provided to Primary contractor mid August 2010	Date of observations	16/07	30/07	06/08		16/08	20/08	27/08		
		No. of observations made	1	6	2	9	0	2	0	2	77.8
		No. of health hits*	1	6	2	9	0	2	0	2	77.8
Use of gloves	Toolbox talks provided to Primary contractor early August 2010	Date of observations	09/07	16/07	30/07		06/08	16/08	20/08		
		No. of observations made	5	0	20	25	3	1	15	19	24.0
		No. of health hits	1	0	20	21	3	1	3	7	66.7
Use of respiratory protection	Tool box talks and meetings held mid June 2010	Date of observations	21/05	28/05	03/06		14/06	18/06	24/06		
		No. of observations made	10	8	7	25	0	0	7	7	72.0
		No. of health hits	2	3	3	8	0	0	3	3	62.5
Use of respiratory protection	Site based monitoring, toolbox talks and meetings with contractors held mid June 2010	Date of observations	28/05	03/06	11/06		18/06	24/06	02/07		
		No. of observations made	5	1	6	12	0	0	5	5	58.3
		No. of health hits	1	1	2	4	0	0	1	1	75.0

Note: * This is the number of observations made multiplied by the estimated no. of people affected

Results of monitoring tests conducted by Park/Village Health

The tables below detail eight different circumstances where Park/Village Health were able to categorically demonstrate that they had improved the occupational health exposures in relation to noise, vibration and hazardous substances. These examples are presented because they are the circumstances where clear figures for a before and after comparison were available. Each example is listed with the type and date of survey, the basic readings taken and comments on the circumstances of the report. For airborne hazard monitoring we have listed upper and lower limits for each survey. These represent the highest and lowest personal exposures detected during each survey.

Table A3.2: Noise/vibration hazard monitoring results

Noise/Vibration hazard monitoring				
Survey details	**Date**	**Vibration readings**	**Noise readings**	**Comments**
Vibration for fixing of decking on bridge	04/05/2010	2 m/s2	-	This measurement was for the tool that was intended for use for the bridge decking operation
		1.6 m/s2	-	This measurement was for the tool that was proposed as an alternative for use for the bridge decking operation
		0.8 m/s2	-	This measurement was for the tool that was ultimately used for use for the bridge decking operation on recommendation by Park/Village Health
Noise and vibration for seat fixing	22/04/2010	4.2 m/s2	89.2 dB(A)	This measurement was for the tool that was intended for use for the seat fixing operation
		1 m/s2	92 dB(A)	This measurement was for the tool that was proposed as an alternative for use for the seat fixing operation
		1.5 m/s2	88.2 dB(A)	This measurement was for the tool that was ultimately used for use for the seat fixing operation on recommendation by Park/Village Health
Noise and Vibration for Orbit - bolt fixing	13/05/2011	3.0 m/s2	114.1 dB(A)	This measurement was for the Impact wrench which was used fairly frequently because there was not enough torque guns available. Its use was phased out after survey
		0.4 m/s2	84.6 dB(A)	This measurement was for the Torque Gun. Following the survey more of this tool was bought in to reduce the usage of the Impact Wrench

Noise/Vibration hazard monitoring				
Survey details	**Date**	**Vibration readings**	**Noise readings**	**Comments**
Steel cutting with Chop Saw	07/2011 - 08/2011	-	114.0 dB(A)	This saw was used to cut steel on site. This measurement represents the exposure to the operatives before input by Park/Village Health
		-	111.6 dB(A)	This saw was used to cut steel on site. This measurement represents the exposure to the operatives after implementing some recommendations made by Park/Village Health
		-	108.8 dB(A)	This saw was used to cut steel on site. This measurement represents the exposure to the operatives after implementing all of the recommendations made by Park/Village Health
Exposure to use of Chop Saw by workers adjacent to operations	07/2011 - 08/2011	-	94.7 dB(A)	This measurement represents the exposure to the adjacent workforce from the Chop Saw operations prior to Park/Village Health intervention
		-	92.8 dB(A)	This measurement represents the exposure to the adjacent workforce from the Chop Saw operations after implementation of all of the Park/Village Health recommendations
		-	83.8 dB(A)	This measurement represents the exposure to the adjacent workforce from the Chop Saw operations after implementation of all of the Park/Village Health recommendations

Table A3.3: Airborne hazard monitoring results

Airborne hazard monitoring				
Survey details	**Date**	**Upper Limit detected**	**Lower Limit detected**	**Comments**
Warmafloor Floor Laying/Cutting - Wood Dust exposure	18/03/2011	22.96 mg/m2	5.08 mg/m2	These figures represent the upper and lower exposures of operative to wood dust without Park/Village Health intervention
	08/04/2011	16.89 mg/m2	7.27 mg/m2	These figures represent the upper and lower exposures of operative to wood dust following implementation of some of Park/Village Health's recommendations
	27/04/2011	6.86 mg/m2	3.38 mg/m2	These figures represent the upper and lower exposures of operative to wood dust following implementation of all of Park/Village Health's recommendations
Stott Carpentry Floor Laying/Cutting - Wood Dust exposure	22/03/2011	6.09 mg/m2	6.08 mg/m2	These figures represent the upper and lower exposures of operative to wood dust without Park/Village Health intervention during periods of reduced workload
	18/04/2011	21.14 mg/m2	11.04 mg/m2	These figures represent the upper and lower exposures of operative to wood dust without Park/Village Health intervention during periods of normal workload
	08/06/2011	30.61 mg/m2	10.69 mg/m2	This survey was a direct comparison between operations not using Park/Village Health recommendations (the upper limit) and the same operation with all of Park/Village Health's recommendations (the lower limit)
Welding fume exposure to operatives	22/10/2010	10.19 mg/m2	4.54 mg/m2	These figures represent the upper and lower exposures of operative to welding fume without Park/Village Health intervention
	14/12/2010	1.77 mg/m2	0.8 mg/m2	These figures represent the upper and lower exposures of operative to welding fume following implementation of all of Park/Village Health's recommendations

Appendix 4: Alternative Estimates of the Benefits of Reducing Ill-health using Industrial Injuries Disablement Benefit (IIDB) Estimates

The Industrial Injuries Disablement Benefit (IIDB) is paid to compensate those who have suffered disablement from a loss of physical or mental facility caused by an industrial accident or prescribed disease. Benefit is normally payable if the disablement is assessed at 14 per cent or more and is paid as a weekly pension. The scheme covers more than 70 diseases, including:

- a disease caused by working with asbestos
- asthma
- chronic bronchitis or emphysema
- deafness
- pneumoconiosis (including silicosis and asbestosis)
- osteoarthritis of the knee
- prescribed disease A11 (previously known as vibration white finger).

The number of qualifying conditions is therefore more limited than the full range of work-related ill-health covered by other data sources such as the Labour Force Survey's Self-Reported Work-related Illness modules (which are used to provide the estimates throughout the rest of the report).

Calculation 5: Scale of potential benefits from eliminating new cases of occupational ill-health using HSE appraisal values

The projected rate of new occupational illness for a workforce of 9,498 is 9.6 cases per year based on IIDB data[57].

The appraisal value for ill-health is £16,100 per case, equivalent to £4,000 to the employer, £4,100 to the government and £8,000 to the individual. At a cost per case of £16,100, this equates to £154,560 per year savings for society, individuals and employers or a total saving of £463,680.

Applying this to the costs of providing the occupational hygiene service, there is a negative net benefit of around £0.5m (Table A4.1).

Table A4.1: CBA of preventing new cases of work-related ill-health
(using HSE appraisal values)

CBA of occupational hygiene programme	£
Costs	1.1m
Benefits of occupational hygiene programme (based on preventing 9.6 cases of work-related ill-health per year for three years, at a cost of £16,100 per case)	0.5m
Net benefits of treatment service	-0.5m

Calculation 6: Scale of potential benefits from eliminating new cases of occupational ill-health using lifetime costs of OA

The results of a comprehensive study on the true costs of OA demonstrated that the lifetime costs of each new case of OA, for men, is as much as £176,000[58]. For this analysis we have assumed that the lifetime costs of the other conditions experienced by construction workers will be similar to this (some will actually cost more, some less, but we feel this is a good starting point for analysis given that comparable cost data for other illnesses is not available). The projected rate of new occupational illness for a workforce of 9,500 is 9.6 cases per year based on IIDB data[59]. At a cost per case of £176,000 this equates to a saving of £5,068,800 if all the

[57] This suggests that there are 101 cases of new ill-health per year, per 100,000 employees in construction, which applied to a workforce of 9,500 means 9.6 cases a year

[58] Boyd et al. (2006) op. cit.

[59] This suggests that a rate of 101 cases of new ill-health per year, per 100,000 employees in construction, which applied to a workforce of 9,500 means 9.6 cases a year.

projected cases of new work-related ill-health could be prevented for a workforce the size of that working on the Olympic Park and Athletes' Village.

The net benefit of providing preventative occupational hygiene that stops new cases of occupational ill-health occurring could be as high as £4m (Table A4.2).

Table A4.2: CBA of preventing new cases of work-related ill-health
(taking lifetime costs of Occupational Asthma)

CBA of occupational hygiene programme	**£**
Costs	1.1m
Benefits of occupational hygiene programme (based on a reduction in work-related sickness absence of 0.073 days per worker over three years and a cost per case of £176,000)	5.1m
Net benefits of treatment service	4.0m