

Rochdale Metropolitan Borough Council

Former Turner Brothers Asbestos Plant

Asbestos Environmental Review of Outline
Planning Submission D44701

Non Technical Summary Report

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1. INTRODUCTION

GENERAL

- 1.1 An outline planning application has been received by Rochdale Metropolitan Borough Council (RMBC) from Countryside Properties (the applicant), who are proposing to redevelop the former Turner Brothers Asbestos (TBA) Plant at Rooley Moor Road, Rochdale (outline planning application number D44701).
- 1.2 Atkins was appointed by RMBC to carry out a peer review of the outline planning application and to advise on the adequacy of the application and proposals in relation to ground contamination. Other aspects such as traffic impacts were not covered in the review undertaken by Atkins, but the review covered solely the issues relating to the assessment of the environmental condition of the site in accordance with current good practice and regulatory guidance. The Atkins review considered whether the proposed redevelopment plans for the site are acceptable given the known and potential levels of environmental risk associated with ground contamination.
- 1.3 The review for RMBC was separated by Atkins into on-site non asbestos and asbestos related contamination on site. It was considered by Atkins that asbestos is a unique contaminant which warranted a separate more detailed appraisal of its health effects and toxicity. Two separate peer review reports have therefore been prepared, as follows:
 - “Asbestos Environmental Review of Outline Planning Permission D44701” (report reference 077_30506) dated June 2006; and
 - “Non Asbestos Environmental Review of Outline planning Permission D44701” (report reference 077_30507), dated June 2006.

These reports will be referred to in this summary as the “asbestos report” and “non asbestos report” respectively.

- 1.4 It is understood that the site is to be redeveloped predominantly for residential use with some small commercial operations to be situated in the southern part of the site. In addition, the majority of the existing woodland areas in the northern and western portions of the site are to be developed as public open space.
- 1.5 A separate non technical summary report has been prepared for the “non asbestos report”. Reference should therefore be made to this summary document (report reference 077_30850 dated July 2006) and associated full “non asbestos report” for a review of the non asbestos issues at the site.

ASBESTOS PEER REVIEW

- 1.6 The “asbestos report” presents a detailed review of asbestos ground contamination issues at the site and within existing factory buildings. Information was assessed against current UK regulatory requirements relating to the assessment and redevelopment of contaminated land.
- 1.7 The UK takes a risk-based approach to dealing with land contamination. This approach follows a tiered framework; starting with simple desk based risk assessments and progressing through to more complex computer based numerical risk assessments. This leads to a progressive and iterative assessment of environmental risk, which enables a contaminated sites “suitability for use” to be assessed. The different levels of risk assessment have not been described in detail in this non-technical summary. However, the reader should be aware of the principal issues which require review in relation to an outline planning application for a site with known and suspected asbestos contamination present:
- Assessment of the risks to human health posed by redeveloping the site is considered to be a priority. During redevelopment works, this is generally concerned with exposure risks for construction workers, nearby residents and other visitors to site. Following redevelopment, this is generally concerned with long term exposure risks to future residents, commercial workers, school children or other less frequent visitors of the site. Atkins was requested by RMBC to consider the risks to human health both during the redevelopment of the site, and following the redevelopment of the site.
 - Asbestos is insoluble and an inert substance which generally does not pose a significant direct ecotoxic risk to groundwater and surface waters. However, the mechanism of transportation of asbestos off site

via surface waters was considered to be an important aspect of human health risk and was included in the review.

- Asbestos is not considered to pose a direct risk to built structures in the same way as aggressive soils which contain contaminants which may impair a buildings material quality.
- Risks posed to ecological receptors from exposure to asbestos have not been considered directly in terms of flora and fauna, but the effects of bioturbation and burrowing animals has been considered in the context of future asbestos exposure across the site and likely soil disturbances.

1.8 The following issues that are relevant to assessing potential exposure of asbestos in the environment have been summarised in the “asbestos report”:

- A review of the current situation in the UK regarding the assessment criteria for asbestos on contaminated sites. A review of relevant worldwide knowledge and application of different criteria for asbestos in air and soil was undertaken. The UK regulatory approach to asbestos was summarised, and compared with the UK contaminated land regulations and other guidance relating to the assessment of risks to human health.
- A review of the physical and chemical properties of asbestos and the likely human exposure routes which may be critical to the site. This includes an appraisal of the significance of different forms of asbestos and how this relates to the site;
- A review of asbestos health effects, including a summary of how the critical dimensions of asbestos fibres influence the risks to human health;
- A review of relevant asbestos measurement, sampling and analysis techniques, and how this relates to previous analysis works undertaken on samples recovered from the site. Air, soil and building measurement methods were all reviewed, as these are all considered to be important when considering the sites redevelopment;
- A review of the current knowledge and understanding of the transfer of asbestos fibres from soils to air. This is considered to be one of the critical aspects of the asbestos peer review, and where possible,

relevant knowledge was taken forward to assist in the assessment of risks from soils which contain asbestos.

- 1.9 It should be noted that the full “asbestos report” provided by Atkins was based on the information submitted with the outline planning application and supplemented with anecdotal evidence obtained during a site visit and interviews conducted with ex-TBA employees. Atkins did not undertake any site investigations, laboratory analysis or complete any specific risk assessments which could inform any remediation and redevelopment works. However, Atkins did critically appraise the site investigations, analysis methods undertaken and any risk assessment and remedial measures recommended in the documentation submitted in support of the outline planning application.

NON TECHNICAL SUMMARY

- 1.10 The purpose of this summary is to provide a synopsis of the findings of the “asbestos report”. This summary includes an overview of the completeness of previous environmental assessment works undertaken in support of the outline planning application and the assessment of land condition in the context of “suitability for use” in general accordance with the Planning Policy Statement 23 Annex 2: Development on land Affected by Contamination (usually referred to as PPS23).
- 1.11 The full “asbestos report” should be consulted in parallel with this summary for more details or expansion of technical themes. This is particularly the case where the reader needs to gain an understanding of asbestos type, toxicology, health effects and the current UK regulatory approach to conducting the assessment of human health risks on contaminated sites from exposure from asbestos.
- 1.12 It should be noted that the hazards posed by exposure to different types of asbestos are reasonably well understood. However, Atkins wishes to make it clear that the assessment of human health risk, which takes into account the likelihood of exposure to a contaminant, is not as clearly understood for asbestos as for other contaminants. This will be discussed in relevant sections of this summary, to provide the reader with a clear understanding of the difference between hazard and risk in the context of asbestos.

1.13 For the purposes of this summary, the following should be noted:

- Environmental risk for asbestos is limited to the risks posed to human health. Other receptors such as controlled waters (groundwater, surface waters) and built structures (buildings, services etc) are not considered to be at direct risk from asbestos. Ecological receptors have not been considered directly but the affects of bioturbation (soil disturbance) by fauna has been included as part of the review.
- Common regulatory phrases which relate to the assessment of human health risk associated with the redevelopment of contaminated land have been omitted from this summary. However, Atkins will refer to “exposure” to asbestos. “Exposure” does not automatically imply that there is an unacceptable risk to human health. The reader will be referred to relevant sections of the full “asbestos report” for clarification.
- The definition of “risk” in the context of the UK regulatory approach to the redevelopment of contaminated land has been carried forward into this summary.

1.14 As defined by DEFRA, the definition of risk is as follows:

- The probability, or frequency, of occurrence of a defined hazard (for example, exposure of a property to a substance with the potential to cause harm); and
- The magnitude (including the seriousness) of the consequences.

1.15 It should be noted that asbestos fibres may be present in different forms within a soil matrix on site, either as individual fibres entrained within the soil matrix itself, clumps of fibres undergoing weathering to separate bonded fragments containing asbestos such as cement bonded sheet.

1.16 It should also be noted that asbestos may be present in buildings on site, either bonded within the building fabric or as dusts within buildings where fibre opening and processing took place.

2. SITE ZONING

2.1 The site and its previous industrial land uses are large and complex, with many different historical and current industrial land uses and hence potential sources of contamination. These have been described in detail in Atkins “asbestos report” dated June 2006. For convenience the site has been divided into eight discrete zones that are broadly based on historical uses, current activities, proposed end uses and/or topography, as follows:

- Northern Woodland Zone: the former asbestos tipping area to the north of the central factory area, which is to remain as woodland and public open space;
- Lodge Zone: area located to the west of the River Spodden, the southern part of the lodge is proposed for residential end use with the green belt to remain and be integrated into the Northern Woodland Zone;
- Lower Tier Zone: comprising the demolished factory area which is proposed for residential use;
- Middle Tier Zone: most of the existing occupied factory units which is proposed for residential use;
- Upper Tier Zone: the old boiler house and adjacent, which is proposed for residential use;
- Flexitallic Zone: the units and area occupied by Flexitallic Ltd, which is proposed for part residential and part commercial end use;
- Southern Zone: the area to the south of the River Spodden, which is proposed for commercial use with a neighbourhood centre (doctors surgery, nursery etc); and

- Hollows Wood Zone: the western woodland area, containing car parks and existing leisure facilities, part of which is proposed for residential end use (the area currently occupied by the bowling green).

2.2 The above zones are generally consistent with the site divisions provided in the outline planning application submitted by Countryside Properties. For details of the proposed developments within each of these zones, refer to section 3 of Atkins' "asbestos report".

3. SITE BACKGROUND

- 3.1 The site is situated approximately 2 miles to the north of Rochdale town centre, and is approximately 30ha in area. The site is contained within the steep sided valley of the River Spodden and comprises areas of dense woodland, industrial units (former asbestos works) and derelict land (demolished asbestos works). The woodland areas are green belt, and are classified as a site of biological interest.
- 3.2 The site is dominated by the central factory area, with the Northern Woodland Zone, Lodge Zone and Hollows Wood Zone being retained predominantly for open space / green belt around the periphery of the proposed redevelopment areas.
- 3.3 The site is surrounded by established residential neighbourhoods to the south and west (Rooley Moor Road), east (Shawclough) and south east (Fallowfield Drive).
- 3.4 The site has historically been occupied by a variety of industrial land uses, which include cotton mills, woollen and velvet mills, allotments, asbestos plant and solvent (hydrocarbon) recovery plant. However, the asbestos/rubber works used predominantly for the manufacture of asbestos containing products have dominated the industrial history of the site, particularly in the central factory areas to the east of the River Spodden. It should be noted the central factory has been proposed for redevelopment predominantly for residential use.
- 3.5 Currently the site is occupied by a variety of businesses that manufacture bullet proof vests, woven glass fibre products, heat resistant laminate pressings and gaskets/seals (this process involves solvent recovery), warehouses, refurbishment of boilers and repackaging of electronic components. Associated with these activities can be a variety of contaminants, such as petroleum hydrocarbons, oils, solvents, metals, sulphate and ammonia.

- 3.6 The River Spodden runs through the centre of the site and flows in a north to south direction.
- 3.7 The site is underlain by both man made materials (“made ground”) and natural materials. Substantial thicknesses of made ground have been identified by Encia in the southern and eastern parts of the site, as a result of previous earthworks undertaken to enable the asbestos factory to expand from its origins along the River Spodden, eastwards towards what is now residential areas around Fallowfield Drive. Several platforms of factories resulted in this expansion, which took place between the 1930s and 1950s.
- 3.8 Natural soils beneath the site comprise granular alluvial deposits which are underlain by glacial clay deposits. The alluvium deposits have been identified within the general floodplain of the River Spodden within the Southern, Lower Tier Zone and parts of the Flexitallic Zone. Lower Coal Measures’ mudstones, sandstones and coal measures make up the solid geology beneath the site. The coal seams beneath the site have been mined and there are four known mine shafts located on site, one of which has been capped. Two mineshafts have yet to be located.
- 3.9 Details of the site geology, hydrogeology and their importance in assessing environmental risks is provided in Section 11 of the “asbestos report”.

4. SITE HISTORY & CONTAMINANT SOURCES RELEVANT TO OUTLINE PLANNING REVIEW

- 4.1 In order to gain an understanding of the assessment of “suitability for use” for the redevelopment of the site, the main identified and suspected contaminative processes have been summarised below. A detailed review of site history, the individual asbestos sources and their site wide distribution, reference should be made to Section 12 of Atkins full “asbestos report”.
- 4.2 The key findings from the historical review which are appropriate to the outline planning review in relation to asbestos contamination are as follows:
- It is possible that all zones across the site may have received airborne emissions of dusts containing asbestos fibres, which was reported to have previously occurred during asbestos manufacture. Windblown dusts containing fibres could have been deposited on both operational and non operational areas of the site over long periods of time, particularly those down gradient of prevailing wind directions. This may particularly be the case for long established landscaped areas.
 - Asbestos was imported to rail sidings situated to the east of what is now the Northern Woodland Zone. A ropeway was used to deliver raw asbestos in Hessian sacks to Harridge Mill. Later conveyors delivered the raw asbestos direct to factory buildings in the Middle Tier Zone. Harridge Mill was demolished some time in the 1970s.
 - Asbestos contamination is considered to be extensive in the northern woodland zone, where it is known to have been disposed of in large quantities. Some asbestos wastes have been disposed of in close proximity to the River Spodden. Bagged asbestos filter wastes are also understood (anecdotally) to have been disposed of in close proximity to the River Spodden, although the exact location has not been confirmed.

- Photographic evidence of the Northern Woodland Zone confirms that asbestos wastes have been tipped in close proximity to the River Spodden (received courtesy Save Spodden Valley Residents Group).
- Significant earthworks, which took place as part of major factory expansion from the 1930s to 1950s, may have resulted in the redeposit of potentially contaminated material in non operational areas of the site. This may have affected the southern and eastern areas of the site (Hollows Wood, Upper, Middle Tier Zone, Southern Zone), as materials deposited in these areas may have contained asbestos fibres and asbestos containing materials (ACMs).
- The majority of the historical mill buildings (Harridge Mill, Spotland Mill, Clod Mill) were used for asbestos storage, fibre opening and manufacture, although the precise manufacturing processes are not known. These mills were situated in the Southern and Northern Woodland Zones, and have now been demolished.
- Asbestos disposal is understood to have taken place down abandoned mineshafts. Four shafts are present on site, two of which could not be located. It is understood one such shaft is located in the Hollows Wood Zone, within an area proposed for residential redevelopment.
- Asbestos cement slurry wastes are understood to have been disposed of to surface water drains. It is considered probable that asbestos wastes may be present in abandoned or existing surface water drains, and possibly sediments within the River Spodden.

4.3 It is generally considered by Atkins that the presence of asbestos contamination cannot be ruled out across much of the site, due to the various stages of industrial development across the site and the fact that emissions to air of dusts which are assumed to contain asbestos, are known to have occurred. The landscaped areas, some of which have been generally unchanged since the site first manufactured asbestos products, may therefore have received airborne deposits of asbestos for some time, which may now be entrained within the upper soil surface. Asbestos is likely to be widespread in the disposal areas in the Northern Woodland Zone and within the vicinity of mineshafts.

5. ASBESTOS SITE INVESTIGATIONS & ANALYSIS

ASBESTOS SITE INVESTIGATIONS

- 5.1 Several phases of intrusive site investigations have taken place across the site, which generally commenced in 1994. The majority of early investigations into the presence of asbestos contamination took place in the Northern Woodland Zone and the northern part of the Lodge Zone to the west of the River Spodden.
- 5.2 Later intrusive investigations took place across the central factory area included the analysis of soil samples for asbestos. In all a total of seven phases of investigation have taken place across the site, most of which have included the screening for the presence of asbestos in soils. A detailed review of previous intrusive investigations relating to asbestos contamination is presented in Section 13 of Atkins full “asbestos report”.
- 5.3 It is noted that the majority of previous intrusive site investigations considered both asbestos and non asbestos contamination, with the exception of some minor investigations conducted in the Southern Zone alongside Rooley Moor Road and the coverage of the Northern Woodland Zone, which concentrated on asbestos contamination in soils.
- 5.4 Building surveys were undertaken in existing factories on site to identify the presence of asbestos. It is acknowledged by the applicant that further inspections are required to confirm the initial building survey findings, and expand this to in accessible areas such as ceiling areas and building voids.
- 5.5 The main review findings from the asbestos site investigations undertaken to date are provided below:
- Asbestos wastes up to 4.5 metres thick have been reported in the Northern Woodland Zone, within the vicinity of the former Harridge Mill (now demolished). Key areas of asbestos identification include the area of land previously occupied by the aerial ropeway in the Northern Woodland Zone, and areas of asbestos disposal in the central and

eastern portions of the Northern Woodland Zone. The Northern Woodland Zone has been the subject of the greatest sample density. It should be noted that a phase of asbestos removal works took place in 1996. The current status of asbestos contamination is not reliably known.

- Asbestos has been identified along steep side slopes in the extreme northern portion of the Northern Woodland Zone. It is noted some of these areas are potentially unstable geotechnically, with recent asbestos exposure being identified at the surface as a result of tree and woodland soil instability.
- Localised occurrences of asbestos have been identified in the Lodge Zone. Based on its history, the Lodge Zone will potentially have the least asbestos contamination present, although sampling density to date is low.
- Asbestos has been identified inside buildings during previous building surveys. However, the applicant acknowledges that the coverage of these surveys is limited, as several of the buildings are currently still occupied and used for commercial purposes. Atkins notes that several buildings used to contain filter galleries to manage fibre emissions inside operational factory areas. Asbestos dusts may be present within the filter galleries, which are known to have existed in several factory buildings.
- Asbestos has been identified in the Hollows Wood Zone. Again, Atkins considers sample density is considered to be low, and some areas have not been sampled to date, particularly the existing woodland areas.
- Several areas of potential asbestos contamination are considered to be present in the Southern Zone. It is possible that infilled mill races (reservoirs) may contain asbestos contamination.
- Significant ground disturbance has taken place as the factory expanded in the central factory area. This may have resulted in asbestos contamination being redeposited on the southern and eastern fringes of the site (Upper Tier and Hollows Wood Zone).

- Brown, blue and white asbestos has been identified on site, with blue asbestos (crocidolite) being identified in the ropeway area of the Northern Woodland Zone.
- Very little near surface sampling (ie < 0.2m) of soils has been undertaken to confirm the presence of asbestos.
- At the time of writing the “asbestos report”, Atkins understands that crushed concrete stockpiles were present within the Lower Tier Zone. The precise source of the stockpile materials is not known, but analysis indicated one stockpile contained asbestos. It is understood some of these stockpiles have been recently removed.
- Some areas of the central factory area that are proposed for residential development have not been investigated, due in part to access restrictions and the presence of obstructions in areas still occupied or the presence of deep basements which may preclude safe investigations. Asbestos wastes might have been placed beneath floor slabs of buildings when factories have expanded. These materials may have been placed along strip footings or used to provide general fill to the underside of concrete floor slabs.
- The majority of site investigations for asbestos have not been targeted on the potential sources identified (with the exception of the Northern Woodland Zone). Some areas of the final development have much more sensitive uses than others, and the investigations have not been sufficiently targeted with regards the proposed end use of the site.

ASBESTOS ANALYSIS TECHNIQUES

- 5.6 A detailed review of asbestos screening techniques has been provided by Atkins for both air and soil analysis methods. Reference should be made to section 6 of the “asbestos report” for further details. The main findings of this review were to recommend appropriate analysis techniques which could be more reliably linked to the assessment of human health risk. This included the analysis of soil samples by polarised light microscopy (PLM), by wet sample preparation methods. Wet sample preparation methods are considered to improve the identification of asbestos fibres.

- 5.7 Lower levels of detection are considered necessary to inform more reliable assessment of risks. Atkins considers that the majority of analysis methods may not have detected the presence of asbestos in soils at levels sufficient resolution to inform a risk assessment.
- 5.8 Electron microscopy techniques have advantages in environmental sampling as they can differentiate between asbestos and non-asbestos fibres, distinguish between asbestos types and detect fibres with smaller diameters. This may more reliably inform the risk assessment process in the event optical test methods for soil samples detect asbestos fibres.
- 5.9 It is also concluded by Atkins that phase contrast optical microscopy (PCOM) test methods are most appropriate when conducting air sampling. In order to achieve the laboratory reporting limits needed to enable risks to human health to be assessed, improvements in sample volumes and sizes would be required, which are considered possible. It should be noted that PCOM is a non-specific technique and any fibres conforming to the required size and shape dimensions are included in the air sample fibre count, regardless of whether they are asbestos fibres or not. The advantages of other air sample test methods such as electron microscopy have been highlighted in the “asbestos report”, as they can differentiate between different types of asbestos.
- 5.10 To date, Atkins notes no background air quality data has been collected at the site.
- 5.11 The asbestos analysis techniques used during the seven main intrusive investigations to date are summarised in details in Section 14 of Atkins “asbestos report”. Atkins makes the following general comments regarding the asbestos analysis / screening methods used to date:
- The majority of previous asbestos analysis techniques for soil screening have used optical identification techniques. The majority of samples were analysed to a detection limit of 0.01% by weight of soil, with the most likely sample preparation using “dry” methods. Atkins considers the level of reporting may have omitted detectable concentrations of asbestos in soil below these levels which may pose a risk to human health. Atkins considers the detection limits to date are not sufficient to inform a human health risk assessment. This is generally considered to be the case where asbestos has not been identified.

- Increasing levels of sophistication have been applied to later rounds of asbestos sampling and analysis completed in 2005, with laboratory reporting limits of 0.001% being achieved in some cases. However, it is noted that only a few samples were completed during this analysis round.
- In general, a wide variety of asbestos screening techniques and laboratory detection limits have been adopted during previous investigations concerning soils. It is therefore difficult to assess the significance of asbestos “non detections” in samples recovered from many parts of the site, as detection limits vary widely. It should be noted that the identification of asbestos in soil comes under the Control of Asbestos at Work Regulations.
- It is considered by Atkins that soil type and moisture content were not confirmed during screening of soil samples for asbestos. It is considered that soil type and moisture content can significantly affect the potential risk of fibre release from soils to air.
- No site specific air sampling and analysis has been undertaken at the site.

RECOMMENDATIONS

5.12 Atkins has identified items of work which are recommended to enable a more reliable assessment of asbestos human health risks to be undertaken:

- 1 Further more targeted asbestos investigations are recommended in the areas proposed for residential and / or more sensitive land uses than those currently in existence. It is considered by Atkins that more surface sampling is generally required across the site to reflect the proposed end use and final site levels.
- 2 Clarification of asbestos contamination is required in the Northern Woodland Zone, since the majority of asbestos sampling and analysis was conducted prior to asbestos removal works being undertaken in 1996.
- 3 Additional asbestos sampling and analysis should be conducted in areas of the site where no redevelopment is proposed, such as landscaped areas and woodland areas. It is considered that the density

of sampling required in these areas should reflect the likely activities which may give rise to future soil disturbance (and hence exposure). For this reason, sampling and analysis of near surface soils should be undertaken. For soils, polarised light microscopy techniques using wet sample preparation methods should be adopted and reported to the lowest commercially available laboratory detection limits, as this is considered to reflect the sensitivity of the proposed land use.

- 4 Consideration should be given to the collection of soil classification data during future investigations. Soil type and moisture content may influence the risk assessment process.
- 5 Background air quality data should be collected for the site, particularly in areas of the site where asbestos has previously been identified. PCOM techniques are considered to be an appropriate test method, but sample volumes should reflect the benchmark air quality standards which Atkins has proposed for the site in the “asbestos report”.
- 6 Atkins recommends dusts should be sampled in key void areas in existing factory buildings known to have contained asbestos fibre opening and processing operations.

6. CONCEPTUAL SITE MODEL

GENERAL

- 6.1 A key stage in developing a clear understanding of the environmental risks posed by asbestos contamination across the site is to develop a “likely” contaminant exposure assessment model showing how the contaminant sources may come into contact with receptors. Such an exposure assessment model is commonly referred to as a conceptual site model (CSM), and used for providing a framework within which to assess environmental risk and hence “suitability for use” following the sites redevelopment.
- 6.2 As part of our commission, RMBC requested Atkins to develop a CSM for the following exposure scenarios:
- During redevelopment scenario. The main exposure routes include site workers and trespassers being exposed to asbestos on site, and emissions of asbestos to air which might pose a risk to nearby residents.
 - Post redevelopment scenario. The main exposure routes include residents in garden areas who may disturb soils, public access to woodland areas and commercial workers on site.
- 6.3 The Atkins asbestos CSM is provided in Section 16 of the “asbestos report”. The CSM was used to critically assess the CSMs previously presented by Encia and assist in the evaluation of human health exposure and risk assessment models.
- 6.4 Encia did not present a detailed CSM which summarised potential asbestos exposure at the site. It is therefore considered that important exposure scenarios may have been omitted.

- 6.5 Atkins developed a likely exposure scenario for individual and grouped asbestos sources across the site. This was completed to enable the priority exposure scenarios to be identified (see section 16 of the asbestos report).

RECOMMENDATIONS

- 6.6 Atkins recommends the applicant should develop a series of CSMs on a zone by zone basis which outline the various exposure scenarios which may occur both during redevelopment and post redevelopment. The results of more detailed intrusive investigations and analysis should be compared to the exposure models identified in the detailed CSMs. The list of potential exposure scenarios summarised by Atkins for both the “during” and “post” redevelopment scenarios should be used as a basis for prioritising future investigations and more detailed human health risk assessments.
- 6.7 It is considered that individual CSMs are required to identify the likely activities which may give rise to future exposure to asbestos on site. The CSM's developed by Atkins can be used as a guide to prioritising exposure scenarios for the site. This will assist in finalising risk assessment and remediation objectives for the site.

7. HUMAN HEALTH RISK ASSESSMENT

GENERAL

- 7.1 Following the development of zone specific CSMs for asbestos exposure, Atkins then reviewed the extent and completeness of human health risk assessments undertaken by Encia as part of the outline planning application.
- 7.2 The first stage in Atkins review process was to summarise the criteria which were used to quantify the human health risks posed by the presence of asbestos contamination.
- 7.3 Exposure to asbestos is associated with lung fibrosis, lung cancer and mesothelioma as well as some less severe health effects. Because of the physical characteristics of asbestos, it is difficult to predict human exposure rates with a high degree of confidence. In addition, the toxicology of asbestos compounds, whilst well documented, is incompletely understood and there is limited understanding of how risks can and should be quantified. It is clear however that direct inhalation of airborne fibres of asbestos provides the only contribution to the total asbestos related health risk.
- 7.4 There are currently no definitive UK regulatory criteria for the occurrence of asbestos in soil. It is understood the Environment Agency is currently in consultation with other government bodies (HSE, HPA) regarding the possible derivation of “acceptable” concentrations in soil.
- 7.5 Due to the uncertainties in reliably quantifying the risks to human health from the presence of asbestos in soil, it is considered the principles of “as low as reasonably practical” (ALARP) should be applied as a priority when considering exposure to asbestos, particularly in residential development areas of the site. It is considered exposure to asbestos should be avoided or minimised where practicable. This is considered to be in general accordance with current UK human health regulatory guidance which has been published by DEFRA.

- 7.6 Where ALARP cannot be practicably applied, Atkins considers an appropriately robust set of risk assessments, based on the likely exposure models identified from the detailed CSMs, should be undertaken to enable the sites suitability of use to be assessed in more detail. The extent of detailed human health risk assessment is dependent upon many factors, including:
- The risk exposure scenarios derived from the CSMs.
 - The extent of design measures to prevent exposure. For example, hardstand areas may prevent future exposure.
 - The level of remediation works proposed in the Northern Woodland Zone.
- 7.7 For the purposes of providing a human health risk assessment framework to work with, Atkins completed a review of regulatory criteria for acceptable asbestos fibre detection levels in air, and recommend a concentration based on UK and WHO guidance documents as a benchmark to compare results for the TBA site with. This fibre concentration in air includes the conservative assumption that all measurable fibres are the most toxic of the different forms of asbestos.
- 7.8 There is some degree of uncertainty about the transfer of fibres in soil to air, and there is little data in the literature to support a conclusion on any relationships. It is considered that this uncertainty requires the need to apply caution and conservatism when attempting to quantify human health risk.
- 7.9 Atkins presented an approach to quantifying risk assessment, which would enable the exposure duration of a particular hypothetical event to be estimated. This would require the use of published data and appropriate risk functions which have previously been reported by the World Health Organisation (WHO). This methodology could be adopted for the numerous exposure scenarios which may present themselves both during redevelopment and following redevelopment. Specific details of the recommended approach to undertaking risk assessments for asbestos exposure is summarised in section 17 of Atkins Asbestos Technical Peer Review (Report Reference 077_30506 dated June 2006).
- 7.10 As there are no definitive UK Regulatory criteria which can be adopted for screening asbestos contaminated soils in the same way as generic criteria can be applied to non-asbestos contamination in soil, it is considered the derivation of any such suitable soil screening criteria would have to be

defensible, and should only be used to identify and prioritise areas of the site requiring more detailed human health risk assessment and potentially remediation. Atkins considers that the identification of asbestos in soils above current minimum laboratory reporting limits is sufficient to trigger the need for more detailed risk assessments.

HUMAN HEALTH RISK REVIEW FINDINGS

- 7.11 Atkins notes that no detailed human health risk assessment for asbestos exposure was undertaken by the applicant in support of the outline planning application. Soil analysis data which has indicated the presence of asbestos has not been screened against any assessment criterion, presumably due to the fact no guideline level for asbestos in soil exists in the UK. This does not enable to assess the suitability of many areas of the site for its intended use, particularly in more obvious areas of the Northern Woodland Zone where significant quantities of asbestos are present (possibly at the surface).
- 7.12 No attempt has been made to assess the different exposure scenarios which may occur during redevelopment stages and post redevelopment stages for the site. It is considered exposure levels may be very different during the redevelopment works (ie demolition of buildings, removal of foundations) than compared to the long term post redevelopment uses when the residential and commercial properties have been constructed. Atkins therefore provided a summary of some of the likely exposure scenarios for the “during” and “post” redevelopment stages, and how predicted airborne fibre concentrations should be used to predict the level of risk a certain activity poses. This extends from simple earthworks during redevelopment works to future residents living on the site for many years after the development has been completed.
- 7.13 Several remediation measures have been proposed in the outline planning application to limit or prevent future exposure to asbestos contaminated soils. These include the provision of appropriate clean cover soil layers in residential areas and the provision of soil capping layers in parts of the Northern Woodland Zone. A generic soil cover thickness of 600mm has been proposed in the residential garden areas. However, Atkins notes this proposed soil cover thickness is not based on the likely disturbance depths which might be anticipated in different zones of the site, particularly the future development of residential properties with gardens.

7.14 Several areas within the Northern Woodland Zone have been proposed for soil capping, which includes the provision of geotextile covers to prevent the future exposure of soils contaminated with asbestos. Several different designs were proposed, depending upon the final gradient of the land. Proposals to install soil cover systems of different designs were initially proposed during the early investigations undertaken in the mid 1990s and varied depending upon the gradient of the slopes. These proposals were carried through to the outline planning application stage without any modifications. Whilst Atkins considers capping can significantly reduce the likelihood of exposure to asbestos, more detailed appraisal of capping proposals is required to demonstrate capping structure effectiveness over the short and long term.

RECOMMENDATIONS

7.15 The following additional information is required to inform and finalise the assessment of human health risks at the site:

- 1 Following completion of the revised asbestos CSM by Atkins, the priority contaminant exposure scenarios should be summarised for both the “during” and “post” redevelopment stages. It may be possible to demonstrate that many of the exposure scenarios could be “designed out” by providing appropriate details of any mitigation measures.
- 2 Due to the uncertainties in reliably quantifying the risks to human health from exposure to asbestos, Atkins considers the principles of ALARP should be applied across the site as a priority (ie: to reduce potential exposure to asbestos to a level “as low as reasonably practicable”), particularly for areas of the final development within and beneath the footprint of proposed residential garden areas. This is in general accordance with current UK guidance.
- 3 Due to the absence of any UK regulatory guidance regarding generic screening criteria for asbestos contamination in soil, it is recommended by Atkins that a conservative approach should be adopted when using and applying site specific derived soil screening criteria. It is considered the use of soil screening criteria should only be considered in areas of the site where asbestos exposure cannot be practicably prevented or minimised (subject to exposure based risk assessment). Different levels of exposure will be present on site and the risk assessment should consider this when identifying practical measure to mitigate exposure to asbestos, including dusts generated from woodland areas. Any soil screening criteria derived

for other areas should be based on robust risk assessments, the results of which may in any case inform the need for remediation works.

- 4 Appropriate human health risk assessments should be undertaken for the exposure scenarios summarised in (1) above. These risk assessments should take account of the likely exposure duration of the various exposure scenarios which may occur on the site. Atkins considers there is a requirement to assess the risks to residents on site and will inform the areas of the site which require mitigation measures.
- 5 Consideration should be given to assessing the risks to nearby residents during the redevelopment works. Many activities may give rise to the emission of dusts (potentially containing asbestos) to atmosphere. Consequently, the potential impacts of these emissions on nearby residents' should be considered.
- 6 The potential risks of exposure should extend to consideration of the exposure of construction workers during redevelopment of the site.

The findings of the additional site investigations, subject to the review of relevant data gaps, should be used to justify the extent of risk assessment required across the site. The principles of minimising future exposure where possible and practicable, by designing appropriate measures to prevent future exposure to asbestos, is considered to be the priority and may reduce the need for risk assessment in some areas (eg below hardstand areas).

8. REMEDIATION & REDEVELOPMENT

GENERAL

- 8.1 A detailed remediation and redevelopment strategy was presented in several reports submitted by the Applicant in support of the outline planning application. These generally detail the mitigation of exposure to asbestos by provision of clean soil cover layers, both in the proposed residential areas and Northern Woodland Zone.
- 8.2 The areas of the site have been identified predominantly in the Northern Woodland Zone, where six individual capping scenarios have been presented in the outline planning application. The six different capping zones are generally distinguished by changes in topography and the original hazard areas identified in the original investigations undertaken by Wimpey Environmental in 1994 (refer to section 19 of Atkins' full "asbestos report").
- 8.3 Soil cover systems have also been proposed in residential garden areas. It is noted that factory buildings, including foundations, will be removed as part of the development works. It is intended that identifiable asbestos would be removed during this redevelopment stage.
- 8.4 It is noted that demolition and foundation materials from the existing factory buildings are to be processed and incorporated into the final development levels. It is probable demolition materials may contain asbestos fibres, as it is noted from building surveys that several buildings are known to contain asbestos. Demolition materials are to be placed across existing soil surfaces following the demolition of factory buildings prior to the placement of clean soil cover systems, and used as fill in the Lower Tier Zone.

REVIEW FINDINGS

- 8.5 The remediation and redevelopment plans submitted by the applicant to date are not detailed. It is acknowledged that the level of detail required at outline planning application stage is limited. However, a more detailed strategy will need to be developed to allow successful development of the site.

- 8.6 For the Northern Woodland Zone, it is considered that more detailed assessment of potential geotechnical stability of proposed capping systems, are required. The proposed capping systems are not based on the completion of detailed design calculations. The stability of the soil cover systems should be considered in parallel with the selection of appropriate soil cover thicknesses to support woodland vegetation.
- 8.7 Atkins considers a more detailed remediation strategy is recommended for Northern Woodland Zone, which should incorporate details of any long term public access proposals and finalisation of the extent of capping works. Atkins considers that a long term remediation and redevelopment strategy should takes into account the long term stability of steep woodland slopes and vegetated slope areas, whilst avoiding the need for any long term maintenance works within these areas. Atkins considers that asbestos exposure can best be mitigated on steep slopes by reducing gradients in the most unstable areas.
- 8.8 The thickness of soil cover systems in proposed residential areas should consider the likely disturbance depths, as this is likely to affect the exposure duration for potentially contaminated soil beneath clean cover systems. The final development levels should reflect the requirements of mitigating asbestos exposure as the priority.

RECOMMENDATIONS

- 8.9 Construction activities during redevelopment should be designed and sequenced based on the likely dust generation rates of individual activities. Appropriate management controls should be designed into key activities such as demolition, clearance of foundations and processing of crushed concrete to minimise dust emissions to air. Appropriate occupational monitoring is recommended to assess fibre emissions, particularly within material processing areas.
- 8.10 Atkins considers that demolition materials sourced from the on site factory buildings might contain asbestos. As such, appropriate surveys should be undertaken after the factory buildings have been vacated. In order to redeposit these materials for construction purposes, appropriate validation testing should be proposed. Atkins recommends that, as a minimum, the fines content of any processed fill sourced from demolition materials should be sampled and analysed for the presence of asbestos at a frequency of 1 sample every 50m³.

- 8.11 Atkins recommends that the final location of any processed, crushed and screened materials to be deposited on site should consider the likely future exposure levels to this material, based on likely soil disturbance depths. Due to the materials granular non cohesive nature and the fact this material has been proposed as a fill layer between existing soils and proposed clean cover soil layers, it is considered this material should be incorporated into risk exposure models.
- 8.12 For proposed residential areas, the developer should finalise the cover soil thicknesses based on estimations of future asbestos exposure durations, which take into account the potential disturbance depths anticipated following the sites redevelopment. The principles of ALARP should be applied to avoid, or minimise to robustly justified levels, potential future exposure to asbestos contaminated soils.
- 8.13 A detailed strategy for the long term remediation and redevelopment of the Northern Woodland Zone is required, to avoid the need for long term management of asbestos exposure in these areas. Appropriate technical solutions should be designed into a final scheme for this woodland area, to take account of the topography, future public access and proximity of asbestos wastes to the River Spodden. The developer will need to demonstrate appropriate flood mitigation measures will not result in future exposure and possible transportation of asbestos from site.
- 8.14 The extent of permanent capping systems should be confirmed by the applicant for the Northern Woodland Zone. Appropriate regrading of steep slopes, particularly in the northern portion of the Northern Woodland Zone, should be considered as part of a potential long term solution to mitigate future exposure of asbestos at the surface. Atkins considers the long term stability of wooded areas on steep slopes needs to consider long term stability of soil cover systems.