

WORKING GROUP ON ACTION TO CONTROL CHEMICALS

WATCH/MIN/2008/1

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Minutes of the 12th meeting of the Working Group on Action to Control Chemicals held on 14th February 2008 in the Globe Room, HSE, Rose Court, London

Members Present

Steve Fairhurst (Chair)
Steve Bailey
Robin Chapman
David Farrar
Rosemarie Hutchinson
Steve Williams
Steve Binks
Martie van Tongeren
Ching Aw
Alastair Hay

Apologies

Len Levy
Tony Fletcher

Ad hoc members

Julian Peto

Invited speakers

Ken Donaldson
Craig Poland

Officials Present

Nicola Gregg (Secretariat)
Hayley Keating (Secretariat)
Anna Rowbotham (Secretariat)
Andrew Darnton
John Cocker
Rob Turner
Mike Wright
Gareth Evans
Dil Sen
Ian Indans
John McAlinden

1	Introductions and apologies
1.1	The Chairman welcomed everybody to the 12 th meeting of the committee.
1.2	Apologies were received from Len Levy and Tony Fletcher
2	Administrative issues
2.1	The Chairman asked for any declarations of interest related to the items on the agenda.
2.2	WATCH secretary Dr Nicola Gregg reminded WATCH members to send in their 07/08 declarations.
2.3	Dates for next meeting The Secretary informed WATCH that several provisional dates had been booked at the proposed venue, the NEC Crowne Plaza in Birmingham, for the 14 th meeting to be held in the Autumn 2008. The committee discussed the various options available and expressed preference for 23th and 24th October 2008. These dates were confirmed during the meeting

2.4	<p>Adoption of agenda</p> <p>WATCH members agreed to adopt the proposed agenda (WATCH/Agenda/2008/1).</p>
3	<p>Minutes of 11th meeting</p>
3.1	<p>Members had commented by correspondence on the draft minutes of the 11th meeting. As a result a few small editorial changes needed to be made to the version presented here (WATCH/Min/2007/3). Members agreed that the Secretariat would make these changes and then the minutes would be deemed to be finalised.</p>
3.2	<p>Matters arising/Secretary's report</p> <p>The Secretary summarised the actions that arose at the 11th WATCH meeting in November 2007 and provided an update on the progress that had been made:</p> <p>(i) HSE action plan for progressing with WATCH the issue of assessing the risks from low level exposures to asbestos – the Secretary referred members to WATCH/2008/3 to be presented at this meeting.</p> <p>(ii) In relation to point 7.23 regarding dusts, the Chairman informed WATCH that he had been unable to seek a steer from ACTS at the 15th November 2007 ACTS meeting on what direction should be taken for any further work by WATCH on the topic of poorly soluble dusts. This was because the ACTS meeting had been in the week after 7-8 November WATCH meeting, giving insufficient time to clear with WATCH members the WATCH position emerging from the 7-8 November meeting such that it was available for presentation to ACTS. The Secretary informed WATCH that the timing of WATCH and ACTS meetings had been raised with the Secretariat for ACTS and that future meetings would be better aligned. The “dusts” issue would be taken to ACTS at its next meeting.</p> <p>(iii) In relation to point 9.10, the Secretary referred WATCH to the programme of work on metal working fluids that had been distributed to members in advance of the meeting.</p> <p>(iv) The Secretary informed WATCH that a WATCH horizon-scanning activity was currently being considered for the Autumn 2008.</p>
3.3	<p>ACTION : In response to a suggestion made at this meeting, the WATCH Secretariat committed to investigate the scope for synchronising a WATCH horizon scanning event with a British Occupational Hygiene Society (BOHS) event of this nature taking place at HSL, Buxton in October 2008.</p>
4	<p>Cancer risks from use of Azo Dye Penetrants</p>
4.1	<p>The Chairman opened this item by referring WATCH to the cover paper on the use of CI Solvent Red 164 as a penetrant dye in the detection of cracks in metal components. He introduced Ian Indans (HSE, Chemicals Assessment Schemes Unit) and John McAlinden (HSE, Chemicals Risk Management Unit) who had prepared the background information on this item and had provided toxicological and occupational hygiene inputs respectively.</p> <p>In relation to paragraph 12 of the cover paper, the Chairman informed WATCH that the Health and Safety Laboratory (HSL) was still in the process of analysing for o-toluidine, a biomarker for potential exposure to CI Solvent Red 164, in urine samples from 3 individuals from one formulator exposed to the dye. The outcome of this work was not available at present.</p> <p>The Chairman pointed out an error in paragraph 8 : ‘CI Reactive Red’ should read as ‘CI Solvent Red’.</p>
4.2	<p>The Chairman referred WATCH to the action for this item in Paragraph 17 of the cover paper. He asked WATCH to consider the background information provided and address :</p> <p>(i) What level of concern about potential ill-health consequences is appropriate in relation to the occupational use of CI Solvent Red 164 as a penetrant dye for</p>

	<p>the detection of cracks in metal components ?</p> <p>(ii) Is it appropriate to make a recommendation in relation to potential substitutes?</p> <p>The Chairman opened the item for general discussion.</p>
4.3	<p>Initial comments about extent of data</p> <p>A WATCH member asked whether manufacturers had provided any toxicological information on CI Solvent Red 164 Ian Indans replied that known manufacturers (based outside of UK/EU) had been contacted directly, but they had submitted few data; internet searches had also been carried out but very little relevant information had been identified. He informed WATCH that he had recently received some information from a manufacturer to indicate that a positive Ames test result had been obtained in a study of the mutagenicity of CI Solvent Red 164. A WATCH member commented that since historical data on CI Solvent Red 164 were sparse, he would expect manufacturers to perform some simple tests on the substance, for example to determine whether cleavage of the azo bond (i.e. reductive metabolism) is likely to occur, and to generate structures of toxicological concern such as o-toluidine. The WATCH member commented that such tests would be relatively straightforward to perform and in his view it should be recommended to manufacturers that they are done. The Chairman emphasised that since the manufacture of this azo dye was carried out outside the European Union (EU), these non-EU companies could not be influenced by EU regulatory bodies responsible for chemicals to provide data and regulatory positions in accordance with EU law on chemicals.</p>
4.4	<p>Biological monitoring</p> <p>A WATCH member asked whether any biomonitoring was recommended in relation to occupational exposure to o-toluidine itself. Dr. John Cocker (HSL, Biological Monitoring Section) replied that an established biomonitoring method was not currently available for this substance. Although a method had been developed by HSL in the past, to his knowledge no companies had used it. The WATCH member asked whether this reflected a lack of interest in the substance because exposures were perceived to be low. John Cocker and John McAlinden affirmed this to be the case. Ortho-toluidine is used in fully enclosed systems and the potential for exposure is low.</p>
4.5	<p>Reason for the issue coming to WATCH</p> <p>A member asked how it had come about that this issue was on the agenda for WATCH. He asked who had raised concerns about the issue.</p> <p>The Chairman reminded WATCH of the work done in the Cancer Project within the Disease Reduction Programme (DRP), aimed at identifying priorities for intervention activity to reduce exposure to carcinogens and the risk of occupational cancer. A Stakeholder Workshop was held by HSE in June 2007 to help with this process. Following the workshop, HSE had received a number of submissions from interested parties on issues they felt the HSE had overlooked in its deliberations. One of these submissions raised concerns over the potential for exposure to CI Solvent Red 164 to pose a threat of cancer. As a consequence, WATCH was being asked to consider if, based on the available information, this issue warranted serious concern and intervention activity, for example advocating the use of alternatives in place of CI Solvent Red 164.</p>
4.6	<p>In relation to stakeholder concern, a WATCH member referred to the 13 identified cases of bladder cancer reported in the case-control study of the carcinogenic potential of o-toluidine (summarised within Annex 2). He asked if these were in workers exposed recently, thus triggering stakeholder concern about similar possibilities in workers experiencing the potential release of o-toluidine from this azo dye, or if the findings related to workers exposed many years previously. John McAlinden replied that the bladder</p>

	cancers observed in this study related to workers exposed many years previously.
4.7	John McAlinden informed WATCH that the topic of azo dye-containing penetrants was currently being addressed by the Foundry Industries Advisory Committee (FIAC) and would be discussed at a FIAC meeting in February 2008. He said that concerns about the use of azo dye penetrants had been expressed within the industry and an opinion from WATCH would be valuable in this context.
4.8	<p>CI Solvent Red 164 and REACH</p> <p>Several WATCH members commented that CI Solvent Red 164 presented as a problematic substance from the perspective of performing a risk assessment and identifying appropriate risk management. They expected that key issues would emerge when this substance was assessed as part of the REACH process. In this context, there were several aspects that could present problems, including: the location of the manufacturers outside of the EU; the role of EU-based formulators of the penetrant products; and the large number of end-users, with different local circumstances of use. There were interesting questions about who needs to do what, and when. WATCH considered that it would be an interesting case to track in its passage through and its treatment by the REACH process.</p>
4.9	<p>The Chairman pointed out that in terms of when CI Solvent Red 164 would be expected to be evaluated as part of REACH:</p> <ul style="list-style-type: none"> (i) The substance was currently imported into the UK at low tonnage levels, such that Registration might not be required for some considerable time. (ii) At least one supplier has self-classified CI Solvent Red 164 as a category 3 carcinogen (R40). As part of REACH, category 1 and 2 carcinogens are deemed of higher priority and in general it is expected that they will be examined ahead of category 3 carcinogens. <p>Hence much of the impact of REACH might not impinge on this substance for quite a few years. He emphasised that REACH deals with tonnages of substances <i>per manufacturer/importer</i> rather than by aggregating quantities across all interested parties.</p> <p>The WATCH member asked whether there was scope within REACH to move the registration of specific substances forward, ahead of deadline if, for example, there were concerns regarding their toxicity. The Chairman replied that this was not possible under REACH.</p>
4.10	<p>A WATCH member asked on what basis would a supplier self-classify CI Solvent Red 164 as a category 3 carcinogen as opposed to a category 1 or 2 carcinogen?</p> <p>The Chairman reiterated the EU classification and labelling rules, that category 1 carcinogens are substances known to be carcinogenic to humans. Category 2 carcinogens are substances that should be regarded as probably carcinogenic to humans, based generally on convincing positive evidence from experimental animal studies; and category 3 classification is assigned to substances which are possibly carcinogenic in humans, usually because of some positive evidence from experimental animal studies, but where this evidence is insufficiently convincing to place the substance in category 2. He could see how the uncertain potential of CI Solvent Red 164 to liberate o-toluidine, a category 2 carcinogen, had been taken to be commensurate with category 3 classification for the azo dye.</p> <p>The WATCH member asked whether or not, if more data were generated on CI Solvent Red 164 and this indicated that classification as category 1 or 2 was more appropriate for the dye than category 3, would the re-classified dye be considered as higher priority under REACH? The Chairman affirmed that this would be the case.</p> <p>A member informed WATCH that discussions had been held at the EU level, some time</p>

	ago, on how to classify potentially carcinogenic benzidine-based dyes for which there was a paucity of data on the yield of metabolites (the known human carcinogen benzidine being the metabolite of concern in these cases). He recalled that the issue of whether or not such benzidine-based substances should be classified in category 2 on the basis of the yield of metabolites was debated at that time. He suggested that Annex 1 of the Dangerous Substances Directive (67/548/EEC) could be explored to determine whether any precedents regarding classification of benzidine-based azo dyes had already been established that might help with judgements regarding the classification of o-toluidine-based azo dyes.
4.11	A WATCH member pointed out that companies who place products on the market have a duty to provide and communicate information about these products. If appropriate information is not being provided, the companies should be reminded of their obligations. He informed WATCH of his involvement in advising industry on the issue of azo dyes several years previously. At that time it was known that some azo colouring agents produced aromatic amine breakdown products, which had carcinogenic and mutagenic properties. The EU subsequently published a Directive (2002/61/EC) to restrict the marketing and use of some azo colourants in textile and leather products. However, whilst such azo textile dyes are subject to these regulations, others such as CI Solvent Red 164, used for other purposes in oil-based formulations, are not.
4.12	Exposure to CI Solvent Red 164 and potential contaminants A WATCH member asked to what extent CI Solvent Red 164 could be inhaled? John McAlinden replied that the use of the CI Solvent Red 164 was very widespread and included uses in foundries and fairgrounds. It was usually used in an aerosol spray can or an air gun and hence there was potential for inhalation exposure. He added that the residual dye present on dust particles after using the penetrant could be readily inhaled; a situation that could occur for example when these substances are used in foundries.
4.13	A WATCH member noted that the background paper indicated that the dye was incorporated into kerosene at what he considered to be quite a high level (around 3.5%) for a colourant. Although there was a likelihood that users would seek to limit contact, the processes associated with the use of these dyes were likely to be 'messy'. He asked whether HSE had considered the types of work practices that may apply downstream to penetrant formulation. He asked what happened in workplaces to the dye after it had been applied to welds or castings. John McAlinden informed WATCH that surfaces sprayed with the dye would normally go into a cleaning process and the residual dye waste would be disposed of as waste. There was no information available on the potential for exposure to the dye associated with these later stages.
4.14	A WATCH member asked what was known about potential contaminants within commercial CI Solvent Red 164 ? Ian Indans replied that, at least one formulation of CI Solvent Red 164 was known to be manufactured from o-toluidine and hence the potential for contamination of the dye with this substance existed. He pointed out however, that this particular formulation was produced by a company in India and further information would be difficult to obtain.
4.15	A WATCH member commented that based on his occupational hygiene experience, his concern was the control of exposure to CI Solvent Red 164. He asked what was known about exposure control practices in companies involved in the formulation stage of the penetrant dyes? John McAlinden replied that there were indications that occupational hygiene standards associated with these activities may not be to a level adequate for the control of exposures to carcinogens. The WATCH member commented that even if there were indications that inhalation exposures to CI Solvent Red 164 may be low, there could be substantial scope for dermal exposure from tasks involving the use of this dye. However, given that CI Solvent Red 164 is a strong and effective dye, if there was significant dermal contact one would expect red staining of the hands, thus presenting the

	<p>opportunity to gather empirical data on dermal exposure. John McAlinden commented that he had anecdotal evidence of industry awareness that there was dermal exposure to CI Solvent Red 164, noticeable by red staining of the skin.</p>
4.16	<p>Occupational Health Surveillance</p> <p>A WATCH member raised the issue of whether CI Solvent Red 164 would be a candidate for occupational health surveillance. Dr. Dil Sen (HSE, Senior Medical Advisor) pointed out that HSE, as a regulatory body, could only enforce compliance with legal requirements and could not request workplace health surveillance for a situation involving exposure to CI Solvent Red 164 if it fell outside of such requirements. He added that health surveillance of workers with occupational exposure to CI Solvent Red 164 would be difficult to undertake, given that there was no diagnostic criterion to investigate. A WATCH member recalled that the appearance in the urine of exfoliated bladder epithelial cells had been used in the past as an early marker for potential bladder carcinogenicity. Dil Sen replied that this approach was no longer in use.</p>
4.17	<p>Level of concern about potential ill-health associated with occupational use of CI Solvent Red 164.</p> <p>The Chairman summarised the key points expressed by WATCH in the discussion so far :</p> <ul style="list-style-type: none"> (i) Crucial data on CI Solvent Red 164 that was currently lacking, such as metabolism data, could be easily generated and would help inform understanding of the potential for the dye to cause occupational ill-health (ii) CI Solvent Red 164 was an interesting substance in terms of how it would be addressed as part of REACH. WATCH would welcome insights into the progress of its assessment under REACH <p>He then referred WATCH back to the first action in paragraph 17 of the cover paper and invited members to formulate a statement about the level of concern about the potential for the occupational use of CI Solvent Red 164 to pose a threat of ill-health.</p>
4.18	<p>A WATCH member proposed a position that, based on available knowledge of CI Solvent Red 164 and taking into consideration its molecular structure, he would expect this substance to be potentially carcinogenic. He would therefore expect there to be stringent control of exposure to this substance. He added that the lack of exposure data on CI solvent Red 164 was a critical omission from the knowledge base. Whilst some work practices might lead to trivial exposures, there were also expected to be some situations involving significant exposure to this dye. An impression had been created that there was a general ignorance across industry about the potential health threat involved in using this dye and the issue needed to be addressed.</p> <p>There was support from all members for this view and the chairman sought and received confirmation that this was a consensus opinion.</p>
4.19	<p>A WATCH member reiterated the disappointment of the committee that industry had not already carried out appropriate metabolism and toxicity tests on CI Solvent Red 164 to better understand its potential threat to health. He added that regulatory intervention was probably necessary to help industry address the concerns; further information on the exposures workers are likely to encounter would also be helpful.</p>
4.20	<p>Potential substitutes for CI Solvent Red 164</p> <p>The Chairman asked WATCH to consider the appropriateness of making recommendations in relation to potential substitutes for CI Solvent Red 164 and invited Ian Indans to provide an overview of the information HSE had gathered.</p> <p>Ian Indans informed WATCH that there were three types of potential substitutes for CI Solvent Red 164 :</p> <ul style="list-style-type: none"> (i) There were two closely related variants of CI Solvent Red 164 : 164.1 and

	<p>164.2. These variants had slight structural differences to CI Solvent Red 164, such that they were not expected to undergo metabolism to o-toluidine.</p> <p>(ii) Rhodamine B, not an azo-based compound. Ian Indans said that he had become aware of concerns being expressed about the potential carcinogenicity of this substance, but HSE had not yet had the opportunity to investigate this.</p> <p>(iii) Metal complexes involving tightly bound chromium (III), also not azo-based compounds. He informed WATCH that there were manufacturers of these potential substitutes in the EU and that on structural grounds these substances did not raise the same concern as CI Solvent Red 164. However, again HSE had not yet been able to assess their toxicological profile.</p>
4.21	A WATCH member commented that he was reluctant to make any statements in relation to potential substitutes for CI Solvent Red 164 given that very little information available had been made available about them.
4.22	Another member pointed out that if one of the key concerns about CI Solvent Red 164 was the control of exposure, then the straightforward substitution of one substance with another would not necessarily provide a solution to any problems of exposure control.
4.23	A WATCH member asked about the importance of the type of dye used in relation to the effectiveness of the process of detecting metal cracks. John McAlinden replied that the detection of metal cracks could be undertaken using a variety of methods. The use of azo dye containing liquid penetrants however was a simple, cost effective, tried and proven method requiring only a very basic level of skill and was thus frequently used by industry.
4.24	The Chairman reflected that the issue of substitution involved considering both hazard and exposure aspects. In order to make a valid assessment of the relative merits of different substances, sufficient information would need to be available to allow a comparative analysis of these different substances. It was clear that WATCH was not yet in possession of such information. Members signified their agreement with this statement.
4.25	<p>In concluding this item, the Chairman re-affirmed with WATCH that the committee had reached the following conclusions:</p> <ul style="list-style-type: none"> • It considered the paucity of hazard and exposure data on CI Solvent Red 164 to be disappointing. • Based on the limited hazard data available, it was appropriate to consider that this substance might have carcinogenic potential; it should therefore be subject to the same exposure control approach as for other suspect carcinogens. • Exposure data were currently lacking to inform on the degree to which current practices and associated exposures conform to these expectations. • Overall, WATCH considered that the issues required more attention from industry. • In terms of the relative priority that should be given to this issue in the context of intervention activity on carcinogens in general, given the paucity of the data WATCH could not, at the present time, make judgements on the relative priority that should be given to CI Solvent Red 164 used in metal crack detection. • However, WATCH considered that addressing the lack of data and awareness concerning the potential health threat of CI Solvent Red 164 was a priority of a different type that should encompass the pursuit of the following issues : <p>(i) Fulfilment of the responsibilities held by companies involved in</p>

	<p>formulating CI Solvent Red 164 into crack-detecting penetrants - these being to properly characterise and communicate to users the hazardous properties of the components of the formulation, including CI Solvent Red 164.</p> <p>(ii) Fulfilment of the responsibilities of user companies in implementing controls on exposure commensurate with the use of a suspect (category 3) carcinogen within COSHH Essentials</p> <p>(iii) Better awareness and co-ordination across all relevant parties of the work practices involving the use of CI Solvent Red 164, what health issues have been explored and observations made and what awareness-raising activities could be implemented).</p> <ul style="list-style-type: none"> • In relation to potential substitutes for CI Solvent Red 164, WATCH did not consider it appropriate to make a recommendation at this time, given the paucity of hazard and exposure information presented for this substance and potential alternatives.
5	Proposal for a BMGV for Chlorobenzene
5.1	<p>The Chairman opened this item by reminding WATCH that several years earlier the former WATCH committee had discussed the setting of a biological monitoring guidance value (BMGV) for chlorobenzene but at that time had been unable to recommend a value. He referred WATCH to paragraph 14 of the cover paper and invited members to consider</p> <p>(i) Whether it is now appropriate to establish a BMGV for chlorobenzene; and if so,</p> <p>(ii) Whether it is appropriate to set a BMGV of 5 mmol 4-chlorocatechol/mol creatinine in the end-of-shift urine, to correspond with the 1 ppm (8-hr TWA) Workplace Exposure Limit (WEL) value</p> <p>He welcomed Dr. John Cocker (HSL, Biological Monitoring Section) who has prepared Annex 1 to the item. John Cocker informed WATCH that much of the data in Annex 1 had been presented to the committee on the previous occasion referred to above, but some new analyses had also been included.</p> <p>The Chairman opened the item for general discussion.</p>
5.2	<p>General discussion on Annex 1: Overview of biological monitoring data available for chlorobenzene.</p> <p>A WATCH member asked what the relationship was between figures 6 and 7 and the figures 4 and 5 taken from Kumagai and Matsunaga (1994). John Cocker explained that since the value of the WEL of 1 ppm (8-hr TWA) on the X-axis was near the intercept of the X and Y axes, the corresponding values for urinary 4-chlorocatechol and 4-chlorophenol at this airborne concentration were difficult to read from figures 4 and 5 respectively. Figures 6 and 7 were simply expansions of the lower end of the graphs in figures 4 and 5, to assist with the visualisation of the data.</p> <p>A WATCH member suggested that although Figures 6 and 7 had been reproduced from Figures 4 and 5 from Kumagai and Matsunaga, the relationship between low airborne concentrations of chlorobenzene and urinary levels of 4-chlorocatechol would be better represented by a new regression line, fitted to the data, that intercepted the x and y axis at point 0, indicating that no chlorobenzene-derived urinary metabolites would be detected when there is no exposure to monochlorobenzene. Another WATCH member suggested that the sentence on p4 of Annex 1 : ‘ <i>However, examination of the data from each graph.....</i>’ should be reworded to state that no chlorinated metabolites were expected with zero exposure.</p>
5.3	A WATCH member made a point that in Annex 1 different units had been used throughout

	<p>the document and this made the data difficult to interpret. He suggested that standardising the units would be more helpful. John Cocker replied that he had used the units that had been reported in the original papers, but accepted the point.</p>
5.4	<p>Background to the 8-hour TWA WEL for chlorobenzene</p> <p>A WATCH Member asked why a reference occupational exposure level of 1 ppm was being considered in the context of deriving a BMGV for chlorobenzene. The Chairman replied that the value of 1 ppm corresponded to the 8-hour TWA WEL.</p>
5.5	<p>A WATCH member requested clarification on the statement on page viii of Annex 2 (Draft EH64 entry for chlorobenzene) : ‘ <i>It was not necessary to amend the WELs to take account of the revised IOELVs for monochlorobenzene listed in the 2nd Consolidated IOELV Directive...</i> ’ The Chairman informed WATCH that the Scientific Committee on Occupational Exposure Limits (SCOEL) had recommended a ‘health-based’ limit for monochlorobenzene (chlorobenzene). SCOEL had concluded that exposure at 1 ppm (8h TWA) carries no risks to human health. The UK view of this recommendation, expressed via HSE, was to disagree with the approach taken by SCOEL because HSE/WATCH considered that there were uncertainties regarding the <i>in vivo</i> mutagenic potential of the substance and its possible carcinogenic consequences. The previously formed HSE/WATCH position was that it is not appropriate to establish a health-based standard for the substance. Hence the WEL values had been set at ACTS (as maximum Exposure Limits, MELs at the time) based on what level of control was deemed to be reasonably practicable. The chairman conceded that the wording in the draft EH64 for chlorobenzene was not clear in terms of conveying the rationale behind HSE’s decision to not amend the WEL to take account of the SCOEL recommendation.</p>
5.6	<p>The appropriateness of establishing a BMGV for chlorobenzene and on what basis it should be derived.</p> <p>The Chairman asked WATCH whether the committee considered it appropriate (i) to establish a BMGV for chlorobenzene and (ii) to establish such a BMGV in the manner described in the paper. A WATCH member commented that, in his opinion, there was merit in establishing a BMGV for chlorobenzene. Other members agreed that the setting of a BMGV value was appropriate and could be derived from the data available. A member stated that the level at which the guidance value was set was important, in terms of the biomonitoring activities that companies would need to carry out and the interpretation of the results; any BMGV value needed to be justified. He referred to the statement in the summary section of Annex 1 : ‘<i>after exposure to chlorobenzene for 8 hrs, the average urine concentration of 4-chlorocatechol in samples collected at the end of the shift would be around 5 to 10 nmol/mol creatinine</i>’. This statement implied that a range of urinary concentrations of 4-chlorocatechol extending above the proposed BMGV could be expected with exposure to chlorobenzene at the WEL. If individual biological monitoring values above a BMGV should trigger further investigation, then from the data available one might argue for a BMGV of 5 or 10 nmol/mol creatinine. Either would be justifiable and the higher value would trigger fewer follow-up investigations than the lower value. John Cocker replied that, based on the available data, it was not possible to provide a more accurate indication of the urinary concentration of 4-chlorocatechol that would correspond to airborne exposure to chlorobenzene at UK WEL. He confirmed that the statement in the summary of Annex 1 quoted above was accurate.</p>
5.7	<p>A WATCH member commented that in his experience there was a lot of confusion in industry about how a BMGV value should be used in interpreting biological monitoring data. He considered that if a BMGV value for chlorobenzene is established, then within the associated EH64 summary some information should be provided to industry on how the BMGV should be used. John Cocker informed WATCH that the HSE booklet <i>HSG167 Biological monitoring in the workplace</i> provided guidance to industry on how BMGV values should be used and how to carry out biomonitoring. The purpose of a BMGV is to provide</p>

	companies with a means of assessing whether the measures they are adopting to control exposure to substances are adequate or effective, as reflected in the biological monitoring data they obtain. If such data exceed the BMGV on a regular basis, the control measures applying to that workforce should be scrutinised more closely. Rob Turner (HSE, Chemicals Risk Management Unit) agreed that it should be clearly understood by industry that when a BMGV is exceeded, this should indicate that exposure control measures need be re-assessed.
5.8	A WATCH member commented that it was not clear from Annex 1 whether or not in any of the studies there was a potential contribution to body burden and urinary 4-chlorocatechol from dermal exposure; and whether in any instances personal protection equipment had been used. He asked whether the proposed BMGV would be valid for situations in which there could be exposures arising from both dermal and inhalation exposure.
5.9	Given the potential for dermal, as well as inhalation exposure and taking into account the half lives reported in Annexe 1 for the urinary elimination of 4-chlorocatechol, a WATCH member asked whether urine sampling for biomonitoring purposes should be carried out daily, at the end of a working shift, or at the end of a working week in order to account for any accumulation of chlorobenzene. John Cocker replied that there was no clear indication as to whether it was more appropriate to take urine samples daily or weekly, but daily sampling could provide useful insights into fluctuations in exposure. The WATCH member commented that analysis of samples some 2 hours after the end of the shift might provide insights into the contribution from skin contact with chlorobenzene, allowing time for dermal absorption to be completed. John Cocker agreed in principle, but pointed out this would be impractical as workers would be reluctant to wait to provide samples 2 hours after their shifts.
5.10	The Chairman noted that WATCH members seemed to agree that it was now appropriate to establish a BMGV for chlorobenzene. As regards the value of a BMGV, HSE considered that the best available approach for deriving a BMGV was that set out in Annex 1. Based in this analysis, urinary levels of 4-chlorocatechol could range from 5 to 10 mmol /mol creatinine following exposure at the UK WEL of 1 ppm (8h TWA). He asked members to consider the appropriateness of setting the BMGV at either 5 or 10 mmol 4-chlorocatechol/mol creatinine.
5.11	Several WATCH members commented that both the 5 and 10 mmol 4-chlorocatechol/mol creatinine could be regarded as appropriate values based on the available data but the two values could have different implications for companies carrying out biomonitoring activities. A WATCH member commented that in his opinion, he would select the value of 10 mol/mol creatinine. He felt that the data suggested that with good control there might be regular biological monitoring values slightly above 5 mol/mol creatinine and a BMGV at this level would trigger more intervention activity, of questionable justification, on the part of companies. He suggested however that if the BMGV was set at 10 mol/mol creatinine, the corresponding guidance should include appropriate wording that informs that this is the upper range of acceptable values and would be expected for those workers carrying out more active tasks. Another member agreed that a guidance value of 10 mol/mol creatinine would be more acceptable for pragmatic reasons.
5.12	The Chairman noted that whilst on the whole, members considered that both the 5 and 10 mmol 4-chlorocatechol/mol creatinine could be regarded as appropriate values for a BMGV, there was a preference for a value of 10 for the reasons outlined above.
5.13	A WATCH member asked how stable were urine samples in respect of 4-chlorocatechol analysis. John Cocker replied that frozen samples were stable for around 3 months; companies were required to make appropriate arrangements to freeze samples quickly and send them to the laboratory.
5.14	In concluding this item the Chairman reaffirmed with WATCH that its positions

	<p>were:</p> <ul style="list-style-type: none"> (i) It was now appropriate to establish a BMGV for chlorobenzene that was derived by association with the UK 8-hour TWA WEL of 1 ppm. (ii) A BMGV of 10 mmol/mol creatinine should be established. The associated EH64 documentation should explain that this value is at the upper end of the range of urinary levels that correspond to exposure at the WEL; and that interpretation of biological monitoring values against this BMGV should be made in accordance with the guidance in HSG 167 “Biological monitoring in the workplace”.
6	Toxicity of carbon nanotubes: findings from a recent research project.
6.1	<p>The Chairman introduced the item by reminding members that at its 3rd meeting in November 2005, WATCH had considered the general picture regarding the potential occupational health issues raised by nanotechnologies. This consideration had been informed by HSE reviews on the potential hazardous properties of particles arising from nanotechnology and an evaluation of the occupational hygiene aspects of nanoparticle production. He added that the issue of whether nanotechnologies pose risks to human health continues to be of great interest. He reminded WATCH that in the HSE review of the potential hazards of nanoparticles seen by WATCH in 2005 it was stated that there were some similarities apparent in the structural and solubility characteristics of carbon nanotubes and asbestos fibres. The following presentation would elaborate on this theme.</p> <p>The Chairman welcomed Professor Ken Donaldson and Craig Poland from Queens Medical Research Institute (QMRI), University of Edinburgh, who had been invited to the meeting to give presentations on research they had conducted on the inflammatory response of the respiratory tract to carbon nanotubes.</p>
6.2	<p>Presentation</p> <p>Concerns regarding the potential for ‘asbestos-like’ effects of nanotubes: Ken Donaldson informed WATCH that warnings about nanotubes and ‘asbestos-like’ characteristics had been made in a report by the Royal Society in 2004 on the opportunities and uncertainties associated with nanoscience and nanotechnologies. The Royal Society had emphasised that ‘given previous experience with asbestos, nanotubes deserved special toxicological attention’. Following this, in an article in Nature in 2006, Dr. Andrew Maynard and colleagues inferred that fibre-shaped nanomaterials presented a unique inhalation hazard that should be evaluated as a matter of urgency. He warned that failure to do so could have devastating consequences on both human health and the nanotechnology industry.</p> <p>Fibre pathogenicity: As background information, Ken Donaldson presented slides on asbestos related lung disease and the ‘fibre pathogenicity paradigm’ that has been observed for asbestos, glass and ceramic fibre types. He emphasised that there were essentially three crucial factors that determined the pathogenic potential of fibres :</p> <ul style="list-style-type: none"> (i) Diameter: fibres of diameter < 3µm (rats) and <5 µm (humans) can reach beyond the ciliated airways of the lungs and are cleared slowly from these deep lung areas. (ii) Length: whilst short fibres are cleared from the lungs via macrophage phagocytosis, fibres > 20 µm cannot be readily cleared from the lungs by this process. Macrophages attempting to engulf these long fibres go into ‘frustrated phagocytosis’ leading to inflammation and other pathological changes. (iii) Biopersistence: whilst some long, thin fibre types break or dissolve into small fibres that can be effectively cleared from the lungs, other fibre types can persist intact.

	<p>Ken Donaldson informed WATCH that the importance of fibre length had been clearly demonstrated for amosite asbestos fibres in a study by Davis <i>et al</i> (1986). In animals exposed to relatively long amosite fibres, 27.5% and 95% developed lung cancer and mesothelioma respectively, whereas no such cancers were observed in animals exposed to much shorter amosite fibres.</p> <p>In conclusion, he highlighted that the 'dimensions', 'dose' and 'durability' of fibres determined how pathogenic they were to the lung. In essence, the 'fibre pathogenicity paradigm' is that a sufficient quantity of a long thin fibre that persists in the lung can cause lung disease.</p>
6.3	<p>Carbon nanotubes - structures: Craig Poland informed WATCH that carbon nanotubes were a new form of manufactured carbon fibre based on a hexagonal arrangement of carbon atoms built up to form a tube-like structure with a diameter in the nano range. These fibres had extraordinary physicochemical characteristics in terms of strength and electrical and thermal conductance, and were increasingly being used in a number of manufactured products (i.e. sporting goods, electronics, composites and materials). The global market for carbon nanotubes was predicted to grow to over \$1 billion by 2014. He considered that within much of this industry, it is generally perceived that carbon nanotubes are no more harmful than graphite (particulate carbon).</p> <p>Research project - methodology: Craig Poland informed WATCH that a research project had been established at the QMRI to investigate the potential pathogenicity of carbon nanotubes, based upon the 'fibre pathogenicity paradigm'.</p> <p>At the onset of the project, different samples of commercially available carbon nanotubes were examined to determine the proportion of short (or tangled) fibres and long fibres present. On this basis, two commercial samples of short/tangled nanotubes (fibres < 15 µm only) were studied in comparison with short amosite fibres (95.5 % < 15 µm, 4.5 % fibres > 15 µm, including 1% fibres > 20 µm) and two commercial samples of long nanotubes (24-84% fibres > 15 µm, including 12-77% fibres > 20 µm) in comparison with long amosite fibres (50% fibres > 15 µm including 1% fibres > 20 µm).</p> <p>The potential toxicity of short/tangled and long carbon nanotubes versus short and long amosite fibres and nano-particulate carbon black (NPCB) was investigated using a rodent mesothelial exposure model in which mice were injected with 50 µg of particles into the peritoneal cavity. At 24 hours and 7 days, mice were sacrificed. Differential cell counts and total protein was assessed in lavage fluid from the peritoneal cavity and histology and scanning electron microscopy was performed on excised diaphragms.</p> <p>Key findings: An Inflammatory response, indicated by statistically significant elevated levels of polymorphonuclear leucocytes and total protein in lavage fluid, was observed in mice exposed to long amosite and long carbon nanotubes via the intraperitoneal route. Seven days after exposure, statically significant increases in responses in foreign body giant cells (i.e. a fusion of macrophages produced in response to an indigestible particle too large to be phagocytosed) and lesion area were observed in mice who had received exposure to long amosite and long carbon nanotubes. No inflammatory responses or lesions were observed in mice exposed to NPCB, short amosite fibres or short/tangled nanotubes.</p> <p>In interpreting these findings, Craig Poland indicated that the basis for finding no inflammatory response in mice who had had mesothelial exposure to short/tangled nanotubes or amosite fibres stemmed from the likelihood that these fibres would be completely phagocytosed by macrophages and eliminated from the intraperitoneal cavity. In contrast, long amosite and long carbon nanotubes would produce incomplete or frustrated phagocytosis and macrophages would adhere to the long fibres like 'beads on a string'.</p>

	<p>Craig Poland proposed a pathogenic process to explain the inflammatory response and large granulomas observed across much of mouse diaphragm exposed to long amosite fibres or long carbon nanotubes. The long fibre/giant macrophage structures in combination with proteases, oxidants, cytokines and other products that exuded from frustrated macrophages would cause the death of mesothelial cells, and damage to the integrity of the mesothelium. Fibrin formation, fibroblast colonisation and the laying down of an extracellular matrix would then essentially trap the long fibre/giant macrophage structures on the mesothelial basement membrane. This would become overgrown with mesothelial cells. These events were likely to play a crucial role in the mechanism of fibre-induced mesothelial disease.</p> <p>Key points: Craig Poland ended the joint presentation by highlighting a number of key points :</p> <ul style="list-style-type: none"> (i) Carbon nanotubes have been created with varying physical characteristics. (ii) The greater the proportion of longer, straighter 'fibre-like' carbon nanotubes in a given sample, the more likely it was to behave like asbestos. (iii) There was scope for 'engineering-out' the 'asbestos-like' attributes of carbon nanotubes (iv) It is not currently known whether exposure to carbon nanotubes might occur in the workplace/environment at levels sufficient to cause disease. (v) The carbon nanotubes tested displayed a high level of bio-persistence allowing, in theory, for sufficient time for migration through the lung to the mesothelium. A key question in terms of human exposure is whether inhalation exposures of carbon nanotubes could occur at levels that would deliver sufficient long fibres to the mesothelium to bring about mesothelial disease.
6.4	<p>The Chairman thanked Ken Donaldson and Craig Poland for the excellent presentation. He asked WATCH members if they had any questions.</p> <p>A WATCH member asked whether any experimental animal studies with carbon nanotubes had been conducted in which mesotheliomas had been produced? Ken Donaldson replied that a recent Japanese study had reported that multi-walled carbon nanotubes induced mesothelioma, as did the positive control crocidolite, when administered intraperitoneally to p53 knock-out heterozygous mice. He was not aware of any other carcinogenicity studies on carbon nanotubes in animal models.</p>
6.5	<p>Dr. Gary Burdett (HSL, Fibres Section) asked what diameters were typical for carbon nanotubes. Craig Poland replied that diameters were typically 14 or 162 nm. He pointed out that both single and multi-walled carbon nanotubes could be engineered and there was a lot of variation in diameter across these types. Gary Burdett commented that when comparing the effects of carbon nanotubes with asbestos, carbon nanotubes would have a much greater surface area than asbestos fibres. Ken Donaldson replied that if the surface area of carbon nanotubes was a key determinant of their pathogenic potential, the greatest effects would be expected for tangled carbon nanotubes. This was not the case. He emphasised that it was the geometry of carbon nanotubes, rather than their surface area, that determined their pathogenicity. He added that carbon black has a large surface area, but can be readily phagocytosed, such that it is not particularly pathogenic towards the lung.</p>
6.7	<p>A WATCH member asked how the carbon nanotube samples were prepared before they were administered to animals. Craig Poland replied that the carbon nanotubes were generally quite difficult to handle and work with. Carbon nanotubes were obtained from manufactures in a range of forms; some were 'carpet-like' samples, others had more 'fly-away' characteristics. Starting with the commercial samples, heating and sonication processes were used to produce test samples containing short and long carbon</p>

	nanotubes. In some cases this process was problematic since the carbon nanotubes tended to agglomerate into large clumps in solution.
6.8	A WATCH member raised the issue of whether or not people could potentially become exposed to carbon nanotubes. He expressed concerns that people could obtain these materials over the internet and possibly handle them inappropriately, leading to exposure. Ken Donaldson commented that there was currently limited occupational hygiene data on handling carbon nanotubes. As yet there is not a reliable technique for measuring airborne levels. Overall, the levels to which workers may be exposed is not known. The main concerns, in terms of occupational health, should probably be for workers who handle materials containing carbon nanotubes in bulk quantities.
6.9	The Chairman thanked WATCH members and the invited speakers for their comments and brought the discussion to a close. He thanked Ken Donaldson for agreeing to provide WATCH with a copy of the published paper on the research work presented, when it becomes available.
7	The risks of lung cancer and mesothelioma from relatively low-level exposures to different forms of asbestos : Proposal for progressing the issue
7.1	<p><i>Proposed action plan for progressing the issue</i></p> <p>The Chairman opened this item by reminding WATCH members that the cover paper set out a proposed action plan for progressing the exploration by WATCH of what is known about the dose-response relationships for lung cancer and mesothelioma caused by exposure to different forms of asbestos. Four lines of approach were suggested, following on from the recommendations at the November 2007 WATCH meeting:</p> <p>Approach 1 : Identifying the reliability of stated historical exposures in the cohorts investigated; and thereby separating out and putting greater weight on the more reliable studies</p> <p>Approach 2 : Revisiting the overall “Hodgson & Darnton” (H&D) analysis, ten years on</p> <p>Approach 3 : Assessment of specific occupational circumstances – can the risk of asbestos-induced cancer at particular exposure levels be directly “observed”?</p> <p>Approach 4 : “Reality checks” of the predictions of the H&D model for various population subgroups.</p> <p>In terms of timing, the cover paper indicated that work carried out for approach 1 and some of the work for approach 2 could be delivered for the June 2008 WATCH meeting. Approach 3 could be taken forward significantly in time for the November 2008 WATCH meeting. The HSE team needed more time to consider how approach 4 could be taken forward.</p> <p>The Chairman also referred members to the tabled comments received from a WATCH member (see 7.5 below) and invited WATCH to consider and offer thoughts on the proposed plan.</p>
7.2	<p>A WATCH member considered the suggestions made in the proposal to be sensible. In his opinion, the extended session held on this topic at the November 2007 WATCH meeting had thoroughly addressed a range of important issues. He welcomed the proposal.</p> <p>Another member agreed that the action plan was good and reflected well the discussions raised at the November 2007 WATCH meeting. He commented that although the discussions had been lengthy and had addressed many complex issues, he was pleased with the overall outcome of the session and the plans that had emerged for taking this</p>

	<p>further forward. With regard to paragraph 9 of the cover paper, he agreed that in approach 1 it was important to focus on assessing the reliability of the exposure information in the studies most critical to Hodgson and Darnton, thus probably avoiding the need to re-examine every one of the cohort studies.</p> <p>Recognising the indications of members' consent, the Chairman noted that there was consensus agreement from WATCH members that the plan was appropriate for following the proposed plan.</p>
7.3	<p>A WATCH member informed the committee that the International Agency for Cancer Research (IARC) had convened a working group on mesothelioma. Information on incidence rates for mesothelioma for major countries of the world, going back between 2 and 10 years, was now available. He offered to pass any relevant information to HSE.</p> <p>He pointed out that the data showed that there are very few cases of mesothelioma occurring today that are associated with a history of factory work. He remained somewhat doubtful about how relevant historical data, based on workers exposed to very high levels of asbestos in factory situations, is to estimating the risks involved in asbestos exposure scenarios likely to be encountered nowadays. He expressed concerns that the tasks proposed in approaches 1 and 2 would still not provide an adequate explanation for some of the apparent anomalies in the data, for instance the 100-fold difference in cancer risk for chrysotile exposure between textile workers and miners. Because of this, he remained somewhat sceptical that historical high-level factory environment data would provide a good basis for assessing different, contemporary, lower-level exposure situations. He did not know how this problem could be resolved. He added that people today were mostly exposed to asbestos when disturbing materials in buildings and, though not readily available, data on exposures in maintenance workers that could be connected with the mesothelioma experience of such workforces would be of most interest and relevance. Another WATCH member said that he agreed to some extent with these reservations, but nevertheless considered the exercise of further examining the historical cohort data further to be worthwhile, in case some useful insights were revealed: he also felt that currently no viable alternative approach was available.</p> <p>The Chairman commented that the process of following approaches 1 and 2 would be important and worthwhile, even if the outcome was a verdict that the data remained too unreliable to form the basis of predictions for contemporary exposure situations.</p>
7.4	<p>The Chairman informed WATCH that a report was currently being prepared of an expert panel analysis undertaken in Canada in Autumn 2007, examining the risks of exposure specifically to chrysotile. A Canadian contact had agreed to forward the report to HSE when available.</p>
7.5	<p><i>Written comments provided by Robin Howie.</i></p> <p>The Chairman returned to the tabled comments of a WATCH member (see 7.1 above) raising a number of issues in relation to the robustness of the health effects evidence within the historical cohorts of asbestos-exposed workers. He asked members for their thoughts on these comments.</p>
7.5	<p>Several WATCH members expressed agreement with the comments. Andrew Darnton (HSE, Statistics Branch) noted that the comments raised related in the most part to what will need to be done at a later stage in the overall progression of this item, that of considering what assumptions and models could be applied to predict risks for various population groups in various "low level exposure scenarios. There was consensus that the comments were well made and would need to be addressed later in the project.</p>
7.6	<p>The Chairman thanked members for their comments. In concluding the item, he reaffirmed with WATCH that it endorsed the plan for progressing the further exploration of the dose-response relationships for lung cancer and mesothelioma</p>

	<p>caused by exposure to different forms of asbestos. He noted the time-scale involved for each of the four approaches; a substantial time slot on the topic would be scheduled for the June 2008 WATCH meeting to address the outcomes from approaches 1 and 2. He noted that WATCH had agreed that it was important to address the comments tabled from one member, at a later stage in the project.</p>
7.7	<p>ACTION : HSE to plan an item on outcomes from approaches 1 and 2 and prepare an associated package for the June 2008 WATCH meeting (to include the Canadian report on chrysotile, if then available).</p>
8.	<p>Biological Monitoring : A general overview</p>
8.1	<p>The Chairman invited Dr. John Cocker (HSL, Biological Monitoring Section) to give a presentation to WATCH updating the committee on biological monitoring in general; this item was for information.</p>
8.2	<p>Presentation on biological monitoring : past, present and future</p> <p>John Cocker introduced the topic of biological monitoring (BM) by reminding WATCH that BM was an approach to assess the overall exposure of people to chemicals by measurement of the chemicals or their breakdown products in blood, urine and/or breath. Except for lead, BM was not currently required as part of any regulatory schemes for chemicals in the European Union, but was a particularly useful tool when used as part of COSHH Essentials and good occupational hygiene practice.</p> <p>Until January 2005, there were two types of biological monitoring guidance values (BMGVs) - health guidance values and benchmark values. Benchmark values represented reasonably practicable levels of control, set at the 90th percentile of available biological monitoring results collected from a representative sample of workplaces with good occupational hygiene practices. Health guidance values were set at a level at which there was no indication from the scientific evidence available that at that level the substance being measured is likely to be associated with any impairment of health.</p> <p>From 2005, when the new "WEL" occupational exposure limit system was introduced in the UK, the associated HSE guidance document <i>EH40: Occupational Exposure Limits</i> also provided a list of substances for which a corresponding BMGV had been established. In the updated 2007 version of EH40, there are BMGVs for 16 substances, the four most recent values having been established for polyaromatic hydrocarbons (PAHs), nitroglycerin, isocyanates and hexavalent chromium. Beyond the UK there are other organisations involved in deriving biological limits. Chief among these are the American Conference of Governmental Industrial Hygienists (ACGIH), it having established 'Biological Exposure Indices' for 47 substances, and the Deutsche Forschungsgemeinschaft (DFG, a German Research Foundation) having set 'Biological Tolerance Values' for 51 substances.</p> <p>John Cocker described the analytical work HSL's Biological Monitoring Section carries out, mainly for small and medium sized enterprises. Each year the section receives and analyses between 8000 and 10,000 biological samples. These samples are sent to HSL by various types of occupational health providers including occupational hygienists, hospital staff, workplace health and safety officers and workplace managers.</p> <p>John Cocker presented WATCH with case-studies of BM experiences for two chemical substances: 4,4'-methylenebis (2-chloroaniline) [MbOCA] and isocyanates. BM of MbOCA , an aromatic amine with carcinogenic properties, has been carried out in relevant workplaces for some time and in the past, data for this substance had provided a model example for the setting of a 'benchmark' BMGV. Isocyanates are the main cause of occupational asthma in the UK and control of exposure relies of effective use of respiratory protective equipment. BM for isocyanate intake is an important test of the effectiveness of such respiratory protection.</p>

	<p>For each case study, John Cocker discussed how BM had been used in workplaces and the lessons learned. He highlighted a number of key conclusions that had been drawn from these case studies and from other instances of BM:</p> <ul style="list-style-type: none"> (i) BM is a useful tool for assessing the effectiveness of exposure control. (ii) Regular BM against 90th percentile BMGVs can identify lapses in the operation of controls or in individual behaviour (iii) Regular or periodic BM within a workplace regime of increasingly stringent controls having been introduced can show gradual reductions in exposure and risk (iv) A programme of BM-derived exposure assessments for carcinogens would provide an up-to-date picture of current UK industry practice and aid the safe management of workplace carcinogens <p>John Cocker concluded his presentation by informing WATCH that in terms of future activities, biological limits for a number of substances were being considered by ACGIH and DFG. He proposed that a question for the future would address the possible roles of SCOEL, WATCH and other committees and organisations in BM issues and activities.</p>
8.3	<p>General discussion</p> <p>The Chairman thanked John Cocker for the informative presentation and asked WATCH members if they had any questions or comments.</p> <p>A WATCH member commented that although biological limits continued to be set by various organisations and systems - for example SCOEL was currently considering a biological limit for mercury - associated guidance on how biological limits should be used was not being produced. In his opinion, it would be helpful to provide industry with guidance on BM and interpreting biological limits.</p>
8.4	<p>Another WATCH member expressed the frequently aired concern about how one should interpret BM data at the individual level. If the level of the analyte in a biological sample from an individual exceeded the biological limit, how should this finding be interpreted and communicated back to the individual. John Cocker replied that on an individual level, it was important to observe the frequency at which a biological limit was being exceeded. The overall purpose of biological monitoring is to assist companies with exposure control measures. If the level of an analyte in samples from an individual is exceeding the biological limit on a regular basis, this should indicate to the company that the control measures associated with that individual are not effective and need to be assessed.</p>
8.5	<p>Dr. Dil Sen (HSE, Chief Medical Advisor) pointed out that biological monitoring raised a number of important ethical questions. In the first instance, companies needed to reassure their employees that biological samples would only be used for monitoring for exposure to industrial chemicals and occupational hygiene purposes and would not be used for other purposes, for example to test for the use of alcohol or illegal substances. He added that the issue of how companies report the results of biological monitoring tests back to workers was potentially a sensitive one. Some individuals would be highly alarmed and anxious by findings of even relatively low levels of industrial chemicals in their samples, particularly for potentially carcinogenic substances.</p>
8.6	<p>John Cocker emphasised that it was important that companies emphasised to their workers that biological monitoring schemes were about exposure and the results were not intended to infer anything about the health status of individual workers. For example, if 10% of biological samples from a workforce have levels of a chemical of interest above a BMGV, all this should indicate is that better control measures are needed.</p>
8.7	<p>A WATCH member commented that conversely, very low results in biological monitoring tests could give workers false reassurances about their exposure to chemicals that may</p>

	<p>lead to subsequent failure to continue to observe good hygiene practices.</p> <p>Rob Turner re-emphasised that the primary issue with regards to BM was exposure control. Tests results for individual workers should not be treated in isolation but should be considered as part of an overall exposure control and monitoring scheme.</p>
8.8	The Chairman thanked members for their comments and brought the item to a close.
9	Date of next meeting
9.1	<p>The Chairman thanked everybody for their contributions. The Secretary reminded WATCH that the next meeting will be held on the 17th June 2008 at the Town Hall in Bootle.</p> <p>The meeting closed at 15.30</p>