



Department for Work and Pensions

**Social Security Administration Act 1992**

# **Conditions due to Chemical Agents**

Report by the Industrial Injuries Advisory Council in accordance with Section 171 of the Social Security Administration Act 1992 reviewing the prescription of conditions due to chemical agents.

*Presented to Parliament by the Secretary of State for Work and Pensions*

*by Command of Her Majesty*

*February 2002*

**© Crown Copyright 2002**

The text in this document may be reproduced free of charge in any format or media without requiring specific permission. This is subject to the material not being used in a derogatory manner or in a misleading context. The source of the material must be acknowledged as Crown copyright and the title of the document must be included when being reproduced as part of another publication or service.

Any enquiries relating to the copyright in this document should be addressed to HMSO, The Copyright Unit, St Clements House, 2-16 Colegate, Norwich NR3 1BQ. Fax: 01603 723000 or e-mail: [copyright@hmso.gov.uk](mailto:copyright@hmso.gov.uk)

## **INDUSTRIAL INJURIES ADVISORY COUNCIL**

Professor A J NEWMAN TAYLOR, OBE, MSc, FRCP, FFOM, FMedSci

Mr M J CINNAMOND, FRCS(Ed), FRCSI, FRCSLT

Professor D N M COGGON, MA, PhD, DM, FRCP, FFOM, FMedSci

Professor A D DAYAN, BSc, MD, FRCS, FRCPath, FIBiol, FFPM

Mr B FENELON

Dr D GOMPERTZ, MD, PhD, FRCPath, FFOM

Mr R GRAINGER, OBE, FICChemE

Dr D WHITE, BSc (Hons), MRCGP, DIH, FFOM

Mr T W MAWER, LLB, Solicitor

Mr G PYKETT, BA

Mr H ROBERTSON

Dr L RUSHTON, BA, MSc, PhD, CStat

Mrs A RYDE, BA (Hons)

Dr C TAYLOR, MB, ChB, DIH, FFOM

Mr O TUDOR, BA

Secretaries: Mrs A PACKER and Mr H LEIGH

Assistant Secretaries: Mr G ROACH; Mr AJ OSWICK and  
Mrs M CANTELL

Research Librarians: Mr P BANKS; Mr D TAYLOR and Ms A LANNON

## **INDUSTRIAL INJURIES ADVISORY COUNCIL**

*The Rt Hon Alistair Darling MP,  
Secretary of State for Work and Pensions,*

Dear Secretary of State,

### **REVIEW OF THE SCHEDULE OF PRESCRIBED DISEASES**

#### **Conditions due to Chemical Agents**

In February 1997 the Council announced that it would be undertaking a review of the current schedule of occupational diseases for which benefits are paid. The terms of reference for the review are to examine the diseases currently prescribed in the Social Security (Industrial Injuries) (Prescribed Diseases) Regulations 1985. In particular the Council was to confirm that the statutory requirements for prescription continue to be satisfied for each disease, to identify any amendments required to ensure they reflect current scientific knowledge, to identify measures to improve the speed and ease of processing claims, as well as reduce the administrative cost of identifying and paying those entitled to benefit and to review the effectiveness of benefits, given the different circumstances of people with different prescribed diseases.

The Council is aware that this is a major task which will take some time to accomplish. Rather than produce one very long report at some point in the future, we thought it appropriate to bring reports on discrete parts of the list of diseases to you as the Council completes the necessary work.

Although the Review will consider the list of prescribed diseases as a whole, within that, the Council identified that conditions due to chemical agents (the 'C' diseases) needed particularly close examination. Many of the 'C' diseases were prescribed in the early days of the scheme, since when scientific knowledge has advanced. Also, it is important to bring the wording and terminology used up to date.

I enclose our Report which recommends that, in the light of the evidence now available, the terms of prescription for almost all the 'C' diseases be amended. This includes, for the majority of 'C' diseases, a recommendation of a change to the approach to the assessment of these claims which is more compatible with both the science and the circumstances under which people may be exposed to the chemical agents. We consider that a more qualitative judgement towards individual claims should be taken, in which the decision maker must be satisfied that on the balance of probabilities, the individual circumstances of a claim justify attribution of the claimant's illness to the occupational exposure. We acknowledge that this approach may be administratively more burdensome but we believe it is justified in the interest of fairness.

We have also recommended that a number of the currently prescribed diseases should be removed from the list. This recommendation should be seen in the context that the very few claims that have been made for these diseases in the past could have been dealt with more appropriately under the accident provisions of the industrial injuries scheme.

The Council will, of course, continue to keep these conditions under review.

Yours sincerely,

Professor A J Newman Taylor  
*Chairman*

5 July 2001

# Report by the Industrial Injuries Advisory Council Reviewing Conditions caused by Chemical Agents—The ‘C’ Diseases

1	SUMMARY
2	INTRODUCTION
2.1	Background to the Review
2.2	Issues addressed in the Review
3	METHOD OF INVESTIGATION
4	CONSIDERATION OF SPECIFIC DISEASES
5	RECOMMENDATIONS
	Appendix 1: Evidence received
	Appendix 2: Glossary

## 1. SUMMARY

In this report the Council recommends extensive changes to the prescription of diseases caused by occupational exposure to chemicals. It is some years since the prescription of most of these diseases was last reviewed. During this time medical and scientific knowledge has advanced, and the Council's understanding of the legal requirements for prescription has been clarified. Also, new legislation during 1999 changed the processes for decision making and appeals across all social security benefits so that, among other things, deciding whether claimants are eligible for industrial injuries disablement benefit now falls to a lay decision-maker. In view of these developments, it was important to check whether any changes were needed to the list of diseases included in the schedule or the terms in which they were prescribed.

Among all prescribed diseases, those caused by chemicals account for only a small proportion of claims (less than 1% during 1999-00). However, they present an administrative challenge because it is often not possible to specify diagnostic criteria or relevant occupational exposures in simple unambiguous terms, such that cases could reasonably be attributed to work without further consideration. In recommending changes to the terms of prescription, we have tried to be as precise as possible. Nevertheless, we have concluded that for most of the diseases examined, occupational attribution should not automatically be assumed simply because a claimant appears to satisfy the terms of prescription. Rather we recommend that in such cases the lay decision-maker should seek appropriate advice on whether the individual circumstances of the case justify attribution of the claimant's illness to his or her occupational exposure with reasonable confidence.

We recommend that the terms of prescription be reworded for 24 diseases. We further recommend that six diseases be removed from the schedule, either because there is insufficient scientific evidence to support their continued inclusion, or because they are only likely to be attributable to employment in the circumstances of an occupational accident—an eventuality that is already covered by the accident provisions of the industrial injuries benefit scheme. Details of the recommended changes are set out in paragraph 256.

It is possible that some individuals currently receiving benefit would not have been eligible had the proposed changes been in operation at the time they made their claim. In these circumstances we recommend that benefit should not be withdrawn but continue to be paid.

In the course of the review we have identified a need for detailed examination of several other disorders that might be eligible for prescription in relation to exposure to chemicals. These are neuropsychiatric disease in persons exposed to organic solvents, and miscarriage and male infertility in persons exposed to lead and other chemical toxins. Our report would have been considerably delayed had we undertaken such an examination as part of this review. We therefore propose to undertake these investigations as a separate exercise in the near future.

## **2. INTRODUCTION**

### **2.1 Background to the Review**

1. In February 1997 the Council announced that it would be undertaking a review of the current schedule of occupational diseases for which benefits are paid.
2. The terms of reference for the review were to examine the diseases currently prescribed in the Social Security (Industrial Injuries) (Prescribed Diseases) Regulations 1985 (as amended) and, in particular:
  - to confirm that the statutory requirements for prescription continue to be satisfied in respect of each of the prescribed diseases considered;
  - to identify amendments required to the wording, layout and grouping of the diseases prescribed to ensure they reflect current scientific knowledge and clearly express the Council's intention;
  - to identify measures to improve the speed and ease of processing claims for prescribed diseases and reduce the administrative cost of identifying those entitled to benefit, and of assessing and paying benefit;
  - to review the effectiveness of benefits, given the different circumstances of people with different prescribed diseases.
3. In the context of this review we identified the diseases prescribed in respect of exposure to chemicals as a priority. The prescription of most of these diseases was last reviewed in 1981, since when scientific knowledge has advanced and the Council's understanding of the legislation has been clarified.

### **History of prescription of diseases caused by chemical agents**

4. The first schedule of prescribed diseases was introduced by Act of Parliament in 1906 in connection with the Workmen's Compensation scheme. That schedule—as amended—was later inserted into the regulations made under the 1946 Industrial Injuries Act which introduced the present scheme, and included 18 disorders associated with exposure to chemicals. Amendments have continued to be made to the list since 1946 and there are now 30 such disorders prescribed. The diseases and the occupations for which they are prescribed are set out in Schedule 1 of the Social Security (Industrial Injuries) (Prescribed Diseases) Regulations 1985. The Council's recommendation in a report published in 1981 resulted in a restructuring of the list of prescribed diseases so that those caused by exposure to chemicals were grouped together in one section and numbered with a prefix letter 'C'.

### **Claims activity**

5. Currently, there are relatively few claims for benefit in respect of the prescribed diseases resulting from exposure to chemical agents. Estimates based on a 10% sample indicate that for all of the 'C' diseases combined there were approximately 210 claims per year during the two year period 1999-00

(compared with over 41,000 claims in total each year for all the prescribed diseases). Furthermore, only about 10% of claims are assessed as satisfying the terms of prescription, and, as indicated in the table below, few of these are associated with high levels of disablement.

**Number of claims that satisfied the terms of prescription during the 5 year period from 1996 to 2000 according to % disablement—All ‘C’ diseases**

<b>% Disablement</b>	<b>Number of cases</b>
95–100	11
85–94	—
75–84	10
65–74	1
55–64	13
45–54	14
35–44	18
25–34	30
20–24	35
14–19	48
1–13*	66

\* Payments of benefit are not made for cases where assessment of disablement in respect of the ‘C’ diseases is less than 14%, unless they can be aggregated with assessments for other industrial injuries or diseases to give a higher overall assessment.

6. The low number of successful claims for ‘C’ diseases in part reflects growing knowledge of the dangers of chemical hazards in the workplace and the application of effective safety measures to minimise exposure to such hazards. Also, it is possible that some cases of acute poisoning<sup>1</sup> are compensated separately under the accident provisions of the scheme.

**Accident provisions of the industrial injuries scheme**

7. Payment of industrial injuries disablement benefit is made in two circumstances: either when there has been an occupational accident or when a person has contracted a prescribed disease—both from employment as an employed earner. Payments under the accident provisions account for much the larger proportion of the total (78% in 2000). They cover not only relatively immediate, short-term disabling effects of accidents, but also those that do not develop until many years after the original accident.

8. An accident for the purposes of the industrial injuries disablement benefit scheme is any unintended happening or incident that has arisen out of and in the course of a person’s employment as an employed earner, which has resulted in a personal injury. In the course of our review it has become clear that for several of the diseases currently prescribed (for example exposure to oxides of nitrogen)

<sup>1</sup>In acute poisoning illness arises from an episode of exposure to a toxin and develops within minutes, hours or at most a few days.

disablement would only arise from exposure to the particular agent in the circumstances of an 'accident'. The Council is satisfied that the accident provisions provide coverage for disablement caused by these substances and there is therefore no need to provide coverage through prescription.

9. However, not all disablement caused by occupational exposure to chemicals can be satisfactorily covered by the accident provisions of the scheme. Thus it is important that diseases caused by some chemicals continue to be prescribed.

## **The legal requirements for prescription**

10. The Social Security Contributions and Benefits Act 1992 requires that the Secretary of State may prescribe a disease where he is satisfied that the disease:

- (a) ought to be treated, having regard to its causes and incidence and any other relevant considerations, as a risk of the occupation and not as a risk common to all persons; and
- (b) is such that, in the absence of special circumstances, the attribution of particular cases to the nature of the employment can be established or presumed with reasonable certainty.

11. In other words, a disease may only be prescribed if there is a recognised risk to workers in an occupation and the link between disease and occupation can be established or reasonably presumed in individual cases.

12. In addressing this question in respect of any particular condition, the Council looks, in the first place, for a workable definition of the disease. There should also exist a practical way to demonstrate in the individual case that the disease can be attributed to occupational exposure with reasonable confidence. For this purpose, reasonable confidence is interpreted as on the balance of probabilities. As already described, accidental occupational exposure is specifically catered for within the benefit scheme. If, however, the condition can result from a non-accidental occupational exposure, the Council must consider whether it should be included in the list of diseases that are prescribed for benefit purposes. In these circumstances, attribution of the disease to a particular occupational exposure can be demonstrated in two ways.

13. For some diseases attribution to occupation may be possible from clinical features of the individual case. For example, the proof that an individual's dermatitis is caused by his occupation may lie in its improvement when he is on holiday and regression when he returns to work, and in the demonstration that he is allergic to a specific substance with which he comes into contact only at work. It may even be that the disease only occurs as a result of an occupational hazard (e.g. coal workers' pneumoconiosis).

14. Other diseases are not uniquely occupational, and when caused by occupation, are indistinguishable from the same disease occurring in someone who has not been exposed to a hazard at work. In these circumstances, attribution to occupation on the balance of probabilities depends on epidemiological evidence that work in the prescribed job or with the prescribed occupational exposure increases the risk of developing the disease by a factor of two or more. The requirement for at least a doubling of risk is not arbitrary. It follows from the fact that if a hazardous exposure doubles risk, for every 50 cases that would normally occur in an unexposed population, an additional 50 would be expected if the population were exposed to the hazard. Thus out of every 100 cases that occurred in an exposed population, 50 did so only as a consequence of their exposure while the other 50 would have been expected to

develop the disease even in the absence of the exposure. Therefore, for any individual case occurring in the exposed population, there would be a 50% chance that the disease resulted from exposure to the hazard and a 50% chance that it would have occurred even without the exposure. Below the threshold of a doubling of risk only a minority of cases in an exposed population would be caused by the hazard, and individual cases therefore could not be attributed to exposure on the balance of probabilities.

15. The epidemiological evidence required should ideally be drawn from several independent studies, and be sufficiently robust that further research at a later date would be unlikely to overturn it.

## **2.2 Issues addressed in the Review**

16. In the course of its review, the Council considered several questions:

- whether in the light of current scientific evidence the legal requirements for prescription continue to be satisfied for the diseases already prescribed in relation to chemical agents. The Council's understanding of the legislative requirements for prescription has been clarified as the Scheme has evolved, and a steady growth in scientific knowledge has meant that they can now be applied more rigorously than in the past. Historically, some diseases were recommended for prescription on the basis of evidence that would not now be acceptable.
- whether some of the diseases would be adequately covered by the accident provisions of the scheme, in which case they would not necessarily need to remain prescribed.
- whether any other diseases not currently prescribed should be added to the list.
- the precise definition of the diseases prescribed.
- the nature and level of occupational exposures required to satisfy the requirements for prescription.
- the practicality of dealing with claims in relation to proposed terms of prescription.

17. New legislative provisions implemented during 1999 have changed the processes for decision making and appeals across all social security benefits. In particular, responsibility for deciding whether claimants are eligible for industrial injuries benefit now falls to a lay decision-maker acting on behalf of the Secretary of State. For many of the diseases considered in the review, it is difficult to specify the terms of prescription in a way that would allow a lay decision-maker to apply simple rules to determine whether individual cases can reasonably be attributed to work.

18. With some, the problem lies in defining satisfactory diagnostic criteria. The clinical presentation of poisoning by a chemical may vary from case to case, and often the health effects produced can also occur in other diseases. Attribution of an individual case to the chemical will depend on the extent to which the clinical presentation is typical, and also on whether there are other more likely explanations for the illness.

19. For other diseases, the problem is in specifying the circumstances of exposure in which attribution is reasonable. As described in paragraph 14, attribution for many diseases depends on the risk of their occurrence being more than doubled by the work that a person has done. Usually, the risk associated

with a hazard varies according to the extent of exposure, and only exposures above a certain level are sufficient to double risk. For some hazards epidemiological data define the relevant cut-point with reasonable precision, but even where this applies, the available information about the exposure of individual claimants will often be scanty and not in a form that can be compared directly with the cut-point. A more qualitative judgement is therefore required.

20. In view of these difficulties, we have concluded that for most of the diseases considered in this report, occupational attribution should not automatically apply simply because an individual has been in a particular occupation or been exposed to a particular chemical. Rather, we recommend that in such cases the lay decision-maker should seek appropriate specialist advice on whether the individual circumstances of the case justify attribution of the claimant's illness to the occupational exposure on the balance of probabilities. We recommend that this change should apply to all of the prescriptions listed in Chapter 5 of the Report unless stated to the contrary.

21. We recognise that this approach may entail an administrative burden, but we consider this will be justified in the interests of fairness. A similar method is already applied to claims for cancers caused by exposure to ionising radiation. Moreover, we do not think that the costs need be excessive:

- relatively few claims are made for the diseases, and not all will require this approach.
- decision makers should be able to look for advice to the team of doctors that routinely provides medical advice to the Benefits Agency without the need to call on outside consultants.

22. To minimise the need for advice, we have defined the diseases and relevant exposures as precisely as possible. This should allow some claims that are clearly destined to fail to be disallowed at an early stage. In addition, as an aid to lay decision-makers, we recommend that the Department should draw up guidance notes which will indicate the type of expertise that is relevant to decisions on occupational attribution, and particular issues that an expert would be expected to take into account in formulating his/her advice. We are prepared to consider any guidance the Department draws up about those of our recommendations which the Secretary of State decides to implement and to advise whether it reflects our intentions.

23. Many of the 'C' diseases are currently described in the form 'Poisoning by . . .', and this use of the word 'poisoning' has caused difficulties. The term is vague, can cover acute (short-term) as well as chronic (long-term) effects<sup>2</sup>, and does not specify the nature of the illness and disablement caused by the chemical under consideration. The problem was discussed in a report published by the Council in 1958 (Cm 416) and an argument was made for its retention. The report stressed that it was impracticable to define poisoning precisely because the *"necessary descriptions would be excessively lengthy and complex"* and pointed out that the word allows *"due account to be taken of advances in medical knowledge"*. At that time, the Council considered that where appropriate they could limit the scope of the diseases covered by setting out in detail the toxic process they wished to prescribe—as was done in the case of poisoning by compounds of phosphorus. On the other hand the Council did note that the imprecise nature of the word 'poisoning' led to the risk that new diseases might be brought within the schedule *"without proper enquiry"*.

---

<sup>2</sup>Acute effects develop within a few days following an episode of exposure to a toxin. Chronic effects may follow an exposure episode at a longer interval or occur after a prolonged period of exposure at a lower level insufficient to cause acute effects.

24. The Council's current view is that to facilitate decisions on claimants' eligibility for benefit and to avoid inappropriate compensation of disorders that cannot be attributed to an individual's work with reasonable confidence, the use of the general formula 'Poisoning by. . .' should be avoided.

25. A number of the chemicals whose toxic effects were examined as part of the review are organic (i.e. carbon containing) solvents. In recent years some research has suggested a link between long-term exposure to such chemicals and neuropsychiatric disease. The evidence on this question is extensive, complex, and will take some time to review in depth. Therefore, rather than delay this report, the Council has decided to examine the neurotoxicity of organic solvents in a separate inquiry in the near future.

26. Our review has also highlighted a need to examine the case for prescribing certain adverse effects of occupational activities and exposures on reproductive function. Again, this is a complex topic, and we believe that it merits a separate, detailed inquiry.

### **Nomenclature for chemicals**

27. Over the years the nomenclature used to describe chemicals has evolved. This is a potential source of confusion because the same substance may be known by several different names, and sometimes the same name has been applied to more than one substance. A terminology is now agreed internationally by IUPAC—the International Union of Pure and Applied Chemistry). However, the names specified by IUPAC are not always those most commonly used in the UK. In this Report we have denoted chemicals by the names which are best known in the UK, but to avoid ambiguity we also give the IUPAC name when it differs. In addition, other pseudonyms are listed for some chemicals.

### **3. METHOD OF INVESTIGATION**

28. In January 1997 the Council announced that it would be undertaking a review of the schedule of prescribed diseases and asked for evidence concerning the 'C' diseases to be submitted by the end of April. In addition, reviews of the relevant scientific literature were undertaken by the Council's research librarian. Members of the Council's Research Working Group then examined the information obtained from these two sources, as well as other relevant data submitted to the Council before or in the course of the review but not in direct response to its call for evidence. In addition, oral evidence was taken at meetings of the Council's Research Working Group from several experts. A list of all those who provided evidence, either written or oral, is given in Appendix 1.

## 4. CONSIDERATION OF SPECIFIC DISEASES

### C1—LEAD

#### 29. *Current terms of prescription*

Prescribed Disease	Occupation
Poisoning by lead or a compound of lead.	The use or handling of, or exposure to the fumes, dust or vapour of, lead or a compound of lead, or a substance containing lead.

#### 30. *History of prescription*

Poisoning by lead has been a prescribed disease since the start of the scheme in 1948. In 1958 the terms of prescription were extended to include poisoning by compounds of lead.

#### 31. *Number of cases*

During 1998-99 three cases reached the stage where the claimant's disablement was assessed.

#### 32. *Problems*

No difficulties have been experienced with this prescribed disease, and no representations have been made to us concerning its prescription. The use of the word poisoning, however, does not clearly set out the chronic disabling effects for which compensation is appropriate.

#### 33. *Current evidence*

The classical features of lead toxicity include peripheral neuropathy (i.e. malfunction of nerves outside the brain and spinal cord) and neuropsychiatric disorders. These effects only result from heavy exposures well in excess of the Health and Safety Executive's current occupational exposure limits, and are usually reversible following removal from exposure and appropriate therapy. Because toxicity of this type requires exceptional exposures, it should normally fall within the scope of the scheme's accident provisions. However, this will not necessarily apply in all cases, and we therefore believe there is a need for its continued prescription.

34. Another well-established consequence of lead poisoning is anaemia. Anaemia could reasonably be attributed to lead where exposure had been sufficiently high, and a blood film, when examined microscopically, showed punctate basophilia. The latter is a characteristic feature of lead toxicity. In addition, prescription should be restricted to cases of anaemia sufficiently severe to cause significant disability, and for this reason we propose that there be a requirement for a haemoglobin concentration of 9g/dL or lower.

35. Lead poisoning can also lead to intestinal colic. However, we think it is unlikely that long-term disabling intestinal colic will result from lead exposure in the absence of other manifestations of lead toxicity. Furthermore, intestinal colic is a common symptom in the general population, and there is a danger that its prescription in relation to lead exposure could generate spurious claims for benefit and unwarranted administrative costs. Therefore, we propose that intestinal colic should not be prescribed in relation to lead exposure, but that where it increases the disablement associated with other toxic effects that are prescribed, it should be taken into account when the disablement is assessed.

36. Other disorders that have been linked with lead exposure include nephropathy (damage to kidneys), high blood pressure, impaired fertility in men and increased risk of miscarriage in exposed women.

37. We have not found evidence that lead increases the risk of disabling kidney disease sufficiently to allow individual cases to be attributed to the metal with reasonable confidence. Therefore, chronic renal disease cannot at present be prescribed in relation to lead.

38. Epidemiological research has shown a weak but consistent relationship between higher blood lead concentrations and elevation of blood pressure. However, the association is not sufficiently strong that clinical hypertension could reasonably be ascribed to work with lead, even where it occurred in someone with heavy exposure. Therefore, this health effect is not suitable for prescription.

39. It is well established that lead is toxic to male reproductive function with a potential to impair fertility, and also that it can cause spontaneous abortion (miscarriage) in exposed women. However, the scientific literature in this area is complex. For example, most of the relevant epidemiological studies in men have examined effects on semen quality but have not directly quantified the risk of disabling infertility. Moreover, various other industrial chemicals have also been linked with reproductive disorders, and might also be candidates for prescription. In view of this, the Council will consider the case for prescribing any reproductive effects of occupational activities and exposures in a separate enquiry. This will be undertaken once our review of the schedule of prescribed diseases is complete.

40. **Recommendation**

We recommend that the terms of prescription for this disease should be amended as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
(a) Anaemia, with a haemoglobin concentration of 9g/dL or less, and a blood film showing punctate basophilia; (b) peripheral neuropathy; (c) central nervous system toxicity.	Work involving the use or handling of, or exposure to the fumes, dust or vapour of, lead or a compound of lead, or a substance containing lead.

## C2—MANGANESE

### 41. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Poisoning by manganese or a compound of manganese.	The use or handling of, or exposure to the fumes, dust or vapour of, manganese or a compound of manganese, or a substance containing manganese.

### 42. *History of prescription*

Poisoning by manganese has been a prescribed disease since the start of the scheme in 1948. In 1958 the prescription was extended to include poisoning by compounds of manganese.

### 43. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 44. *Problems*

No difficulties have been encountered with this prescribed disease. However, the prescription does not specify what toxic effects result from poisoning by manganese.

### 45. *Current evidence*

A few studies have linked occupational exposure to manganese with an increased incidence of pneumonia and atherosclerosis, but the best established toxic effects are on the nervous system. Features of toxicity include psychomotor disturbances, somnolence, impulsiveness and headache. The main symptoms and signs are staggering gait and tremor (parkinsonism). There appears to be a general pattern of slowing of motor function, increased tremor, enhanced sense of smell, and in some cases memory and intellectual deficits and mood changes. Although removal from manganese exposure at an early stage can reverse damage, recent evidence has confirmed that neurobehavioural effects and parkinsonian symptoms may progress following cessation of exposure. Autopsy reports have described lesions in the globus striatum and pallidum of the brain. Individual susceptibility to the adverse effects of manganese varies considerably. Symptoms in some cases occur at concentrations in air as low as 2 mg/m<sup>3</sup>. Onset of the disease may occur after only a few months or after several years according to the intensity of the exposure. The clinical features of manganese poisoning are not specific, and attribution of disease to manganese exposure depends upon details of the clinical presentation and the extent and timing of exposure.

46. *Recommendation*

We recommend that the prescription should be amended as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
Central nervous system toxicity characterised by parkinsonism.	Work involving the use or handling of, or exposure to the fumes, dust or vapour of, manganese or a compound of manganese, or a substance containing manganese.

## C3—PHOSPHORUS

### 47. *Current terms of prescription*

Prescribed Disease	Occupation
Poisoning by phosphorus or an inorganic compound of phosphorus or poisoning due to the anti-cholinesterase or pseudo anti-cholinesterase action of organic phosphorus compounds.	The use or handling of, or exposure to the fumes, dust or vapour of, phosphorus, or a substance containing phosphorus.

### 48. *History of prescription*

Poisoning by phosphorus has been a prescribed disease since the start of the scheme in 1948. At that time it was prescribed as poisoning by phosphorus, but from July 1958 the prescription was amended to “*poisoning by phosphorus or phosphine or poisoning due to the anti-cholinesterase action of organic phosphorus compounds*”. In October 1983 the wording was changed to read: “*poisoning by phosphorus or an inorganic compound of phosphorus or the anti-cholinesterase or pseudo anti-cholinesterase action of organic phosphorus compounds*”.

### 49. *Number of cases*

During 1998-99 four cases reached the stage where the claimant’s disablement was assessed.

### 50. *Problems*

The main problems with this disease relate to the nature of the injury caused by organophosphorus compounds, and the extent to which such injury falls outside the accident provisions of the scheme.

### 51. *Current evidence*

In addition to reviewing the scientific literature on this disease, we received oral evidence from Professor Blain of Newcastle University, Dr Jamal, then of Glasgow University, and Professor Sedgewick of Southampton University. Also, written evidence was received from Dr Bateman of Newcastle University, the Laboratory of the Government Chemist and Mrs Elizabeth Sigmund.

52. It has long been recognised that chronic exposure to white phosphorus can cause phossy jaw—a suppurative necrosis of the jaw. Although this disorder should not occur with modern working methods, and has not to our knowledge been diagnosed in the UK for many decades, it remains a potential hazard. We therefore recommend that it should continue to be prescribed.

53. Various inorganic compounds of phosphorus (e.g. phosphine) can cause injury following unusually high, short-term exposure, but such poisoning and its sequelae would be covered by the accident provisions of the scheme.

54. Organic compounds of phosphorus that inhibit the enzyme acetylcholinesterase (these include the organophosphate insecticides used in agriculture and sheep-dip) cause well-documented symptoms such as chest tightness, wheezing, muscle weakness, abdominal cramps, vomiting, diarrhoea, increased sweating, salivation and watering eyes in people who have recently

been exposed to unusually high doses. Moreover, there is evidence that in some cases acute poisoning of this type can be followed by long-term deficits in intellectual performance and by peripheral neuropathy. Such toxicity should again fall within the accident provisions of the scheme.

55. Some reports have suggested that similar long-term neurotoxic effects may also occur following doses of organophosphorus compounds that are not obviously toxic in the short-term. We noted, however, a recent report from the Department of Health's Committee on Toxicity (COT), which concluded that the current balance of evidence does not support long-term neurotoxicity or neuropsychiatric effects from organophosphates in the absence of overt acute poisoning. From the evidence that was available to us, we were unable to identify a well defined, disabling disorder for which there was convincing evidence that risk is at least doubled by exposure to organophosphate compounds in the absence of overt acute poisoning, or which could be ascribed to such exposure with reasonable certainty on the basis of clinical findings in the individual case.

56. The current prescription includes reference to the pseudo anti-cholinesterase action of organic phosphorus compounds. This term is no longer used in toxicology. It was intended to cover the mode of action of tri-ortho-cresyl phosphate (IUPAC name tri-*o*-tolyl phosphate), a substance which is not considered to be a true cholinesterase inhibitor. It is now known that this and a number of other organophosphorus compounds have the capacity to inhibit an enzyme known as neuropathy target esterase (NTE). Poisoning by such compounds can result in disabling injury to peripheral nerves (i.e. those outside the brain and spinal cord) with weakness, and tingling or burning in the arms and legs. These effects are usually reversible but not always completely so. In some cases, damage may also occur to nerves in the central nervous system. Toxicity of this sort is rare these days because the compounds known or likely to produce it are not licensed for use in the UK. Furthermore, the onset normally occurs within a short interval from last exposure to the chemical responsible, and if cases did occur, they might well be classifiable as resulting from accidents. However, this may not always apply, and for this reason it is appropriate that peripheral neuropathy, with or without accompanying toxicity to the central nervous system, should be prescribed in relation to organic compounds of phosphorus that are known to inhibit the enzyme NTE.

57. The Council will monitor carefully any future research findings on organophosphate compounds, but does not consider that there is justification at present for prescription of long-term neurotoxic effects other than those associated with NTE inhibitors.

58. ***Recommendation***

In the light of the evidence received we therefore recommend that prescription should be revised as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
(a) Phossy jaw.	Work involving the use or handling of, or exposure to, white phosphorus
(b) Peripheral neuropathy (with or without accompanying toxicity to the central nervous system).	Work involving the use or handling of, or exposure to organic compounds of phosphorus that inhibit the enzyme, neuropathy target esterase.

## C4—ARSENIC

### 59. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Poisoning by arsenic or a compound of arsenic.	The use or handling of, or exposure to the fumes, dust or vapour of, arsenic, or a compound of arsenic, or a substance containing arsenic.

### 60. *History of prescription*

Poisoning by arsenic has been a prescribed disease since the start of the scheme in 1948. In 1958 the terms of prescription were extended to include poisoning by compounds of arsenic.

### 61. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 62. *Problems*

No difficulties have been experienced with this prescribed disease and no representations have been made to us concerning its prescription. However, the terms of prescription do not specify what toxic effects result from poisoning by arsenic.

### 63. *Current evidence*

Arsenic and its compounds have been shown to increase the risk of cancers of the skin, bladder, kidney, liver and lung. However, the findings on cancers of the bladder, kidney and liver have related largely to non-occupational exposures by ingestion of contaminated drinking water.

64. Inhalation is the most common route of exposure encountered in the occupational setting, and occurs, for example, in copper smelting. There is substantial evidence of an increased risk of lung cancer from such exposure. The risk increases with the extent of exposure, and at high cumulative exposures can be more than doubled. In this circumstance, prescription is appropriate.

65. Skin cancers caused by occupational exposure to arsenic and its compounds are considered with other causes of skin tumours under disease C 21.

66. *Recommendation*

We recommend that the prescription should be amended as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
Primary carcinoma of the bronchus or lung.	Work involving exposure to the fumes, dust or vapour of arsenic, or a compound of arsenic, or a substance containing arsenic.

## C5—MERCURY

### 67. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Poisoning by mercury or a compound of mercury.	The use or handling of, or exposure to the fumes, dust or vapour of, mercury, or a compound of mercury, or a substance containing mercury.

### 68. *History of prescription*

Poisoning by mercury has been a prescribed disease since the start of the scheme in 1948. In 1958 the terms of prescription were extended to include poisoning by compounds of mercury.

### 69. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 70. *Problems*

The current terms of prescription do not specify the toxic effects that result from poisoning nor do they distinguish between inorganic mercury and organic mercury compounds.

### 71. *Current evidence*

Cases of acute toxicity resulting from short-term episodes of unusually high exposure to mercury or its compounds should be satisfactorily covered by the accident provisions of the scheme. The toxic effects of longer term exposure are principally in the nervous system and kidneys.

72. The classical features of chronic poisoning by mercury and its inorganic compounds include tremor and neuropsychiatric effects, namely irritability, loss of memory, sleep disturbance and depression. Most of these effects are reversible on cessation of exposure, but recovery may not always be complete. Recent studies have shown that the prevalence of hand tremor in male workers can be more than doubled when the duration of occupational exposure exceeds 10 years. There is thus a case for the prescription of these neurological and neuropsychiatric effects.

73. Long-term occupational exposure to mercury vapour can also cause damage to kidney tubules and glomeruli. However, we have been unable to identify any form of disabling kidney diseases that could be attributed to poisoning by mercury with reasonable confidence in individual cases. Therefore we do not recommend prescription of effects on the kidney.

74. Although most organomercury compounds are acutely toxic to humans, there is little information concerning their chronic effects following long-term exposure. The exception is methylmercury, for which chronic effects have been documented following both occupational and dietary exposure. The predominant effects are on the nervous system.

75. The clinical manifestation of methylmercury poisoning starts with tingling in the fingers. This is followed by general weakness of the limbs and ataxia (incoordination) with difficulty in swallowing and speech. There may also be a loss of peripheral vision. These symptoms reflect damage to the cerebellum and visual cortex. Although this pattern of neurological damage has been consistently observed following both short- and long-term exposure, there is little evidence on the extent of exposure needed to produce it. However, it is likely that in some individual cases the pattern of disease would be sufficiently distinctive to allow attribution to occupational exposure with reasonable confidence.

76. ***Recommendation***

Long-term exposure to elemental mercury vapour is associated with damage to the nervous system. The association has been recognised for many years and is sufficiently specific to form a basis for prescription. Evidence regarding the toxicity of long-term exposure to inorganic salts of mercury is more limited, but it appears to be similar.

77. Although chronic occupational poisoning by methylmercury will be a rare occurrence, a history of exposure to methylmercury followed by a combined cerebellar and cortical degeneration would be sufficiently unusual that such a combination might, on the balance of probabilities, be ascribed to the exposure.

78. We recommend that the terms of prescription should be revised as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
(a) Central nervous system toxicity characterised by tremor and neuropsychiatric disease.	Work involving exposure to mercury or inorganic compounds of mercury for a period of at least ten years in total.
(b) Central nervous system toxicity characterised by combined cerebellar and cortical degeneration.	Work involving exposure to methylmercury.

## C6—CARBON DISULPHIDE (BISULPHIDE)

### 79. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Poisoning by carbon bisulphide.	The use or handling of, or exposure to the fumes or vapour of, carbon bisulphide, or a compound of carbon bisulphide, or a substance containing carbon bisulphide.

### 80. *History of prescription*

Poisoning by carbon bisulphide has been a prescribed disease since the start of the scheme in 1948.

### 81. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 82. *Problems*

The terminology used to describe the chemical is outdated. Also, the prescription does not specify what type of illness it causes.

### 83. *Current evidence*

The standard name for this chemical in the UK is now carbon disulphide (IUPAC name carbon disulfide). The term "compound of carbon bisulphide" has no meaning. The toxic effects of carbon disulphide occur in the nervous system and the cardiovascular system. Central nervous system effects range from psychosis in acutely intoxicated individuals to minor abnormalities in neurobehavioural and psychometric tests. These minor abnormalities have been reported to occur even at currently permitted exposure levels. Peripheral nervous system effects have also been observed, ranging from severe polyneuropathy and myopathy in individuals with high exposures to a small reduction in the conduction velocity of slow motor nerve fibres with long-term low-level exposures.

84. Since the late 1960s several studies have linked occupational exposure to carbon disulphide with an increased risk of coronary heart disease and cardiovascular mortality. Some of these studies have also suggested that the risk declines following cessation of exposure, and as permitted exposure levels have reduced over time, the excess cardiovascular mortality in workers exposed to carbon disulphide has fallen. These findings could be explained if carbon disulphide had a reversible cardiotoxic or thrombotic effect. Current evidence does not indicate that the risk of coronary heart disease from exposure to carbon disulphide is as much as doubled. Therefore, it cannot be prescribed.

85. Any cases of psychosis resulting from episodes of exceptionally high, short-term exposure to carbon disulphide should be adequately covered by the accident provisions of the scheme. Furthermore, although there is consistent evidence linking long-term exposure with effects on the central nervous system and increased cardiovascular disease, the increase in risk has generally been small, and not at a level which would allow individual cases to be attributed to exposure with reasonable confidence. Therefore, on current evidence, the only

toxic effect that requires prescription is peripheral neuropathy. Absorption of carbon disulphide into the body can occur through the skin as well as by inhalation, and there is no reason to think that the risk of peripheral neuropathy is not associated with handling the compound in liquid form as well as exposure to its vapour.

86. ***Recommendation***

We recommend that the terms of prescription be revised as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
Peripheral neuropathy.	Work involving the use or handling of, or exposure to carbon disulphide [carbon disulfide].

## C7—BENZENE

### 87. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Poisoning by benzene or a homologue of benzene.	The use or handling of, or exposure to the fumes of, or vapour containing benzene or any of its homologues.

### 88. *History of prescription*

Poisoning by benzene has been a prescribed disease since the start of the scheme in 1948.

### 89. *Number of cases*

During 1998-99 two cases reached the stage where the claimant's disablement was assessed.

### 90. *Problems*

On occasion the precise meaning of the words 'poisoning' and 'homologue' has caused difficulties in interpretation. No other difficulties have been experienced with this prescribed disease and no representations have been made to us concerning its prescription.

### 91. *Current evidence*

Occupational exposure to high concentrations of benzene (>100ppm) has consistently been shown to cause haematological effects including pancytopenia, aplastic anaemia and myelodysplasia, and there is evidence of less severe haematological effects, such as leukopenia and anaemia, at lower levels of exposure (possibly down to 20ppm). Such exposures are well in excess of those that normally occur in industry today (the Health and Safety Executive's current occupational exposure limit is 3ppm), and the haematological abnormalities are manifest at the time of, or soon after exposure and not as a delayed effect. Therefore any cases of such acute toxicity should be covered by the accident provisions of the scheme.

92. There is a large body of evidence on the longer term adverse health effects of benzene from epidemiological studies of exposed populations in the oil, chemical and rubber manufacturing industries. Benzene is classified as a human carcinogen and has been shown to cause acute non-lymphatic leukaemia (ANLL) (principally acute myeloid leukaemia). The evidence linking benzene to other leukaemias, other lymphohaematopoietic cancers and solid tumours is inconsistent.

93. Relatively few studies have included quantitative estimation of benzene exposure. Prolonged exposure (10 years or more) to concentrations above approximately 20 ppm appears to be associated with a doubling of risk or more of ANLL. Some studies of workers exposed to lower estimated levels of benzene have found evidence for increased risk of ANLL, although these studies have been limited by small numbers of cases and uncertainties in the exposure data.

94. In common with other organic solvents, long-term exposure to benzene and related compounds is suspected of causing neuropsychiatric disease. This is a complex issue, and as described in paragraph 25, it will be examined in detail in a separate report. At this stage, however, we are not convinced that there is a case for prescribing any form of neuropsychiatric illness in relation to benzene.

95. There is no consistent evidence that any compounds which might be classified as homologues of benzene cause leukaemia or any other toxic effects that would not be covered by the accident provisions of the scheme.

96. ***Recommendation***

We recommend that the terms of prescription be revised as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
Acute non-lymphatic leukaemia.	Work involving exposure to benzene.

## C8—NITRO/AMINO/CHLORO DERIVATIVES OF BENZENE

### 97. *Current terms of prescription*

Prescribed Disease	Occupation
Poisoning by a nitro- or amino- or chloro-derivative of benzene or of a homologue of benzene, or poisoning by nitrochlorbenzene.	The use or handling of, or exposure to the fumes of, or vapour containing, a nitro- or amino- or chloro-derivative of benzene, or of a homologue of benzene, or nitrochlorbenzene.

### 98. *History of prescription*

“Poisoning by a nitro- or amido-derivative of benzene or a homologue of benzene” was a prescribed disease from the start of the scheme in 1948. In 1951 the term “amido-derivative” was replaced by “amino-derivative”, and in 1958 the prescription was extended to include chloro-derivatives of benzene and poisoning by nitrochlorbenzene.

### 99. *Number of cases*

During 1998-99 no cases reached the stage where the claimant’s disablement was assessed.

### 100. *Problems*

The present terms of prescription are vague, and difficulties in interpretation arise from the words ‘poisoning’ and ‘homologue’. The prescription could be interpreted as relating to an enormous range of chemicals.

### 101. *Current evidence*

No evidence was submitted in relation to this prescribed disease, and we were unable to identify any toxic effects to which it might apply that would not also be covered adequately by the accident provisions of the scheme.

### 102. *Recommendation*

We recommend that this disease should no longer be prescribed.

## C9—DINITROPHENOL

### 103. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Poisoning by dinitrophenol or a homologue of dinitrophenol, or by substituted dinitrophenols or by the salts of such substances.	The use or handling of, or exposure to the fumes of, or vapour containing dinitrophenol or a homologue of substituted dinitrophenol or salts of such substances.

### 104. *History of prescription*

This disease has been prescribed since the start of the scheme in 1948. In 1958 the term “*a homologue of substituted dinitrophenol or salts of such substances*” was substituted for “*any of its homologues*”.

### 105. *Number of cases*

During 1998-99 no cases reached the stage where the claimant’s disablement was assessed.

### 106. *Problems*

The Laboratory of the Government Chemist has pointed out that the wording of this prescribed disease is vague—particularly the reference to “homologue of dinitrophenol” and “substituted dinitrophenols”. The meaning of the word ‘poisoning’ also gives rise to difficulties of interpretation.

### 107. *Evidence considered*

We found no evidence of any toxic effects to which this prescription might apply which would not be covered satisfactorily by the accident provisions of the scheme.

### 108. *Recommendation*

We recommend that this disease should no longer be prescribed.

## C10—TETRACHLOROETHANE

### 109. *Current terms of prescription*

Prescribed Disease	Occupation
Poisoning by tetrachloroethane.	The use or handling of, or exposure to the fumes of, or vapour containing tetrachloroethane.

### 110. *History of prescription*

This disease has been prescribed since the start of the scheme in 1948.

### 111. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 112. *Problems*

The current prescription does not specify what toxic effects result from poisoning by tetrachloroethane.

### 113. *Current evidence*

Unusually high exposure to tetrachloroethane can cause narcosis and liver damage, but we have found no evidence that these effects could occur other than in the exceptional circumstances of an accident.

114. As with other organic solvents, long-term exposure to tetrachloroethane is suspected of causing neuropsychiatric illness. This is a complex issue, which will be considered in more detail in a future report. At this stage, however, we are not convinced that there is a case for prescribing any form of neuropsychiatric illness in relation to tetrachloroethane.

115. Nor have we found convincing evidence that any other disease could be attributed to occupational exposure to tetrachloroethane in circumstances other than an industrial accident.

### 116. *Recommendation*

In view of these findings we recommend that poisoning by tetrachloroethane be removed from the list of prescribed diseases. We will, however, review the relation of organic solvents (including tetrachloroethane) to neuropsychiatric illness in a future report.

## C11 – DIOXANE (DIETHYLENE DIOXIDE, DIOXAN)

### 117. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Poisoning by diethylene dioxide (dioxan).	The use or handling of, or exposure to the fumes of, or vapour containing diethylene dioxide (dioxan).

### 118. *History of prescription*

This disease has been prescribed since the start of the scheme in 1948.

### 119. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 120. *Problems*

This chemical has several alternative names, which is potentially confusing to claimants. Also, the current prescription does not specify what toxic effects result from poisoning by dioxane.

### 121. *Current evidence*

Dioxane is irritant to the nose and eyes, and exceptionally high exposures are reported to have caused death from nephritis and liver necrosis. Acute toxicity of this sort should be covered by the accident provisions of the scheme. Epidemiological studies have not provided any convincing evidence that regular exposure at lower levels causes long-term toxic effects.

### 122. *Recommendation*

In the absence of convincing evidence for any form of toxicity that would not fall within the accident provisions of the scheme, we recommend that poisoning by dioxane be removed from the schedule of prescribed diseases.

## C12—METHYL BROMIDE

### 123. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Poisoning by methyl bromide.	The use or handling of, or exposure to the fumes of, or vapour containing methyl bromide.

### 124. *History of prescription*

This disease has been prescribed since the start of the scheme in 1948.

### 125. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 126. *Problems*

The current prescription does not specify what toxic effects result from poisoning by methyl bromide.

### 127. *Current evidence*

Accidental high exposure to methyl bromide (IUPAC name bromomethane) can cause various toxic manifestations including burns to the skin, convulsions, congestion of the lungs and sometimes death. These forms of acute poisoning should be covered by the accident provisions of the scheme. In addition, exposure at lower levels can induce peripheral neuropathy (malfunction of the nerves outside the brain and spinal cord) and neuropsychiatric illness. The latter may include problems with vision and impairment of concentration, learning and memory. Such disorders are relatively common in the general population, however, and attribution to methyl bromide would depend on the circumstances of the individual case.

### 128. *Recommendation*

We recommend that the terms of prescription be revised as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
(a) Peripheral neuropathy; (b) Central nervous system toxicity.	Work involving exposure to methyl bromide (bromomethane).

## C13—CHLORINATED NAPHTHALENE

### 129. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Poisoning by chlorinated naphthalene.	The use or handling of, or exposure to the fumes of, or dust or vapour containing chlorinated naphthalene.

### 130. *History of prescription*

This disease has been prescribed since the start of the scheme in 1948. In 1958 the wording of the prescription was modified with deletion of a phrase “excluding the condition known as chlor-acne”.

### 131. *Number of cases*

During 1998-99 no cases reached the stage where the claimant’s disablement was assessed.

### 132. *Problems*

The current prescription does not specify what toxic effects result from poisoning by the group of compounds known as chlorinated naphthalenes.

### 133. *Current evidence*

These compounds have considerable but varying human toxicity, the main effects of long-term exposure being skin disease (chloracne) and cirrhosis of the liver. Occupational causes of chloracne are covered elsewhere in the schedule of prescribed diseases (C30).

### 134. *Recommendation*

We recommend that the prescription be revised as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
Cirrhosis of the liver.	Work involving exposure to chlorinated naphthalenes.

## **EFFECTS OF NICKEL, including:**

### **C14—POISONING BY NICKEL CARBONYL**

### **C22(a)—PRIMARY CARCINOMA OF THE MUCOUS MEMBRANE OF THE NOSE OR ASSOCIATED AIR SINUSES**

### **C22(b)—PRIMARY CARCINOMA OF A BRONCHUS OR OF A LUNG**

#### 135. *Current terms of prescriptions*

<b>Prescribed Disease</b>	<b>Occupation</b>
<b>C14</b> —Poisoning by nickel carbonyl.	Exposure to nickel carbonyl gas.
<b>C22(a)</b> —Carcinoma of the mucous membrane of the nose or associated air sinuses;	Work in a factory where nickel is produced by decomposition of a gaseous nickel compound which necessitates working in or about a building or buildings where that process or any other industrial process ancillary or incidental thereto is carried on.
<b>C22(b)</b> —Primary carcinoma of a bronchus or of a lung.	

#### 136. *History of prescription*

C14 has been prescribed since the start of the scheme in 1948, and C22(a) and (b) were added in 1949. Minor amendments were made to the prescriptions in 1958, 1974 and 1983 when the diseases were transferred to different parts of the schedule.

#### 137. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

#### 138. *Problems*

The use of the word poisoning in C14 does not describe adequately the clinical symptoms experienced as a result of nickel carbonyl poisoning.

139. *Current evidence*

The effects of nickel carbonyl poisoning include headache, vertigo, nausea, vomiting, insomnia and irritability, followed by respiratory symptoms similar to those of viral pneumonia. Pulmonary lesions occur and the liver, kidneys, adrenal glands, spleen and brain are also affected. Such poisoning would only be expected to occur immediately following an episode of high exposure to nickel carbonyl, and should therefore fall within the scope of the accident provisions of the scheme.

140. A high incidence of both nasal and lung cancer has been found in studies of workers involved in nickel refining. This has been attributed to exposure to a mixture of oxides and sulphides of nickel, although increased risk has also been found with exposure to oxides of nickel in the absence of sulphides. Most of the observations of elevated risk come from studies of workers exposed to high levels of nickel compounds through industrial processes that have not been used in Britain for many years, and several investigations have indicated a decline in risk over the years, as improvements and changes in equipment and processes were introduced. In deciding whether an individual case of nasal or lung cancer can reasonably be attributed to sulphides and oxides of nickel, it is important to take account of the extent of cumulative exposure. No excess risk of either nasal or lung cancer has been observed in British nickel refiners first employed after 1950.

141. There is also evidence that water-soluble nickel compounds used in electrolysis and hydrometallurgy departments in nickel refineries can increase the risk of lung and nasal cancers. Exposure to soluble compounds of nickel can also occur in other occupational settings—e.g. in electroplating. However, current evidence does not indicate any occupations outside nickel refining in which the risks from such exposure are as much as doubled. There is no evidence that metallic nickel is associated with increased risks of nasal or lung cancers, and no substantial evidence that occupational exposure to nickel or any of its compounds is likely to produce other forms of cancer.

142. *Recommendation*

We recommend that prescribed disease C14 be removed from the list, and that the prescriptions for C22(a) and (b) be revised as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
C22(a) Primary carcinoma of the mucous membrane of the nose or paranasal sinuses;	Work in the refining of nickel involving exposure to oxides, sulphides or water-soluble compounds of nickel before 1950.
C22(b) Primary carcinoma of the bronchus or lung.	

## C15—OXIDES OF NITROGEN

### 143. *Current terms of prescription*

Prescribed Disease	Occupation
Poisoning by oxides of nitrogen.	Exposure to oxides of nitrogen.

### 144. *History of prescription*

This disease was originally prescribed at the start of the scheme in 1948 as “*poisoning by nitrous fumes*”. The present prescription was introduced in 1983.

### 145. *Number of cases*

During 1998-99 no cases reached the stage where the claimant’s disablement was assessed.

### 146. *Problems*

The current prescription does not specify what toxic effects result from poisoning by oxides of nitrogen.

### 147. *Current evidence*

Inhalation of oxides of nitrogen at high concentrations can lead to chronic lung disease with the development of obliterative bronchiolitis. However, there is no clear evidence that this can occur other than through an episode of exceptional exposure of the sort that would be classified as an accident. Nor is there evidence of any other toxic effects of oxides of nitrogen that would not be covered by the accident provisions of the scheme.

### 148. *Recommendation*

We therefore recommend that this disease be removed from the prescribed list.

## C16—GONIOMA KAMASSI

### 149. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Poisoning by gonioma kamassi (African boxwood).	The manipulation of gonioma kamassi or any process in or incidental to the manufacture of articles therefrom.

### 150. *History of prescription*

This disease has been prescribed since the start of the scheme in 1948.

### 151. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 152. *Problems*

The current prescription does not specify what toxic effects result from poisoning by this material.

### 153. *Current evidence*

No information was submitted about gonioma kamassi in response to our call for evidence. Nor have we found any publications on the topic in recent medical literature. This probably reflects the fact that exposure to the hazard has not occurred for many years.

154. Scientific publications early in the century indicate that gonioma kamassi contains a toxic alkaloid chemical, and that inhalation of its dust can cause cardiac and neurological illness.

### 155. *Recommendation*

Although we are not aware of any usage of gonioma kamassi in the UK in recent decades, poisoning by gonioma kamassi is still a theoretical possibility and for this reason it should remain on the list of prescribed diseases. We recommend, however, that it should be specified as:

<b>Prescribed Disease</b>	<b>Occupation</b>
a) Neurotoxicity; b) Cardiotoxicity.	Work involving exposure to the dust of gonioma kamassi.

## C17—BERYLLIUM

### 156. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Poisoning by beryllium or a compound of beryllium.	The use or handling of, or exposure to the fumes, dust or vapour of, beryllium or a compound of beryllium, or a substance containing beryllium.

### 157. *History of prescription*

This disease was added to the list of prescribed diseases in 1949, and the words “*or a compound of beryllium*” were added to the terms of prescription in 1958.

### 158. *Number of cases*

During 1998-99 no cases reached the stage where the claimant’s disablement was assessed.

### 159. *Problems*

The current prescription does not specify what toxic effects result from poisoning by beryllium.

### 160. *Current evidence*

No information was submitted about beryllium in response to our call for evidence. Inhalation of beryllium in high concentrations can cause acute pulmonary oedema (accumulation of fluid in the lungs) within hours of exposure. This would be covered by the accident provisions. Literature review confirmed that the only important disease caused by inhaled beryllium is chronic beryllium disease. This is a multisystem disorder closely resembling sarcoidosis and associated with the presence of pulmonary granulomata. There is a latent period of up to 10 or 15 years between first exposure and the onset of symptoms which include shortness of breath, fatigue, weight loss, chest and joint pains and cough. There may be skin rashes, enlargement of lymph nodes, liver and spleen, finger clubbing and abnormal findings on examination of the lungs. The disease can follow an episode of accidental over-exposure to beryllium, but in most cases the exposure is long-term with no identifiable incidents of exceptional exposure.

### 161. *Recommendation*

We recommend that the prescription should be clarified in the following terms:

<b>Prescribed Disease</b>	<b>Occupation</b>
Chronic beryllium disease.	Work which involves the inhalation of beryllium or a beryllium compound.

## C18—CADMIUM

### 162. *Current terms of prescription*

Prescribed Disease	Occupation
Poisoning by cadmium.	Exposure to cadmium dust or fumes.

### 163. *History of prescription*

This disease was added to the list of prescribed diseases in 1956 as “*poisoning by cadmium in any occupation involving exposure to cadmium fumes*”. In 1983 exposure to “*dust*” was incorporated into the prescription.

### 164. *Number of cases*

During 1998-99 no cases reached the stage where the claimant’s disablement was assessed.

### 165. *Problems*

The current prescription does not specify what toxic effects result from poisoning by cadmium.

### 166. *Current evidence*

Inhalation of exceptionally high concentrations of cadmium fume can cause pulmonary oedema (accumulation of fluid in the lungs) within 4-10 hours of exposure. This toxic effect would be covered by the accident provisions of the scheme.

167. Literature review confirms that chronic exposure to cadmium fume causes emphysema in a dose-dependent fashion. However, emphysema is common in the general population, and cases could only be attributed to occupational exposure to cadmium where exposure had been heavy and prolonged (at least 20 years).

168. Cadmium is also known to cause renal disease with damage principally to tubules and less commonly to glomeruli, and there is some indication that inhalation of cadmium dust or fume in an occupational setting can cause chronic renal failure. For example, a five-year follow-up study of 23 cadmium workers after cessation of exposure found that renal function declined with age five times more rapidly than would have been expected. On balance, however, the evidence linking occupational exposure to cadmium with renal disease is not sufficient to support prescription in any occupational group.

### 169. *Recommendation*

We recommend that the prescription should be clarified in the following terms:

Prescribed Disease	Occupation
Emphysema.	Work involving inhalation of cadmium fumes over a minimum of 20 years in total.

## C19—ACRYLAMIDE MONOMER

### 170. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Poisoning by acrylamide monomer.	The use or handling of, or exposure to, acrylamide monomer.

### 171. *History of prescription*

This disease was added to the list of prescribed diseases in 1972.

### 172. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 173. *Problems*

The current prescription does not specify what toxic effects result from poisoning by acrylamide monomer.

### 174. *Current evidence*

The toxic effects of acrylamide that have been reported in circumstances other than accidental high exposures are mainly neurological. They include peripheral neuropathy, impaired co-ordination and loss of memory. In addition, skin contact with acrylamide can cause dermatitis, but this is prescribed separately as part of prescribed disease D5 (non-infective dermatitis). Acrylamide is carcinogenic in animals, but there is no convincing evidence of a human hazard of cancer from the compound.

### 175. *Recommendation*

We recommend that the prescription should be clarified in the following terms:

<b>Prescribed Disease</b>	<b>Occupation</b>
a) Peripheral neuropathy; b) Central nervous system toxicity.	Work involving exposure to acrylamide.

## C20—DYSTROPHY OF THE CORNEA

### 176. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Dystrophy of the cornea (including ulceration of the corneal surface) of the eye.	a) The use, or handling of, or exposure to, arsenic, tar, pitch, bitumen, mineral oil (including paraffin) soot or any compound product or residue of any of these substances, except quinone or hydroquinone.  b) exposure to quinone or hydroquinone during their manufacture.

### 177. *History of prescription*

This disease has been prescribed for most of the listed exposures since the start of the scheme. In 1958 arsenic was added, and in 1961 quinone and hydroquinone were added. The current wording of the prescription was set down in 1983.

### 178. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 179. *Problems*

The scientific justification for prescription of corneal dystrophy in relation to arsenic, tar, pitch, bitumen, mineral oil, soot and their compounds and products is unclear. In particular the inclusion of arsenic in the terms of prescription appears to have been an administrative convenience, and not based on evidence that it caused the disease<sup>3</sup>. Also, it is unclear why the prescription for quinone and hydroquinone is restricted to exposures occurring during their manufacture.

### 180. *Current evidence*

We found no evidence that arsenic or arsenic compounds cause corneal disease. Nor did we find any convincing evidence that tar, pitch, bitumen, mineral oil or soot can cause corneal injury other than in the circumstances of accidental splashes or contamination of the eye.

181. Long-term or repeated occupational exposure to hydroquinone and quinone is reported to cause brown discolouration of the conjunctiva and cornea, corneal ulceration, and in some cases associated reduction in visual acuity. At least one case of corneal ulceration has been reported in a worker whose exposure resulted from use of a product that contained hydroquinone.

<sup>3</sup>Report by the Industrial Injuries Advisory Council published in 1958—Cmnd 416.

182. ***Recommendation***

We recommend that the prescription should be amended as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
Dystrophy of the cornea (including ulceration of the corneal surface of the eye).	Work involving exposure to quinone or hydroquinone.

## SKIN TUMOURS

### C21(a)—LOCALISED NEW GROWTH OF THE SKIN, AND

### C21(b)—SQUAMOUS CELLED CARCINOMA OF THE SKIN

#### 183. *Current terms of prescription*

Prescribed Disease	Occupation
C21(a) Localised new growth of the skin, papillomatous or keratotic;	The use, or handling of, or exposure to, arsenic, tar, pitch, bitumen, mineral oil (including paraffin) soot or any compound product or residue of any of these substances, except quinone or hydroquinone.
C21(b) Squamous celled carcinoma of the skin.	

#### 184. *History of prescription*

Both these diseases have been prescribed since the start of the scheme. In 1958 arsenic was added to the prescriptions, and in 1983 it was clarified that quinone and hydroquinone were not included. The current wording of the prescriptions was set down in 1983.

#### 185. *Number of cases*

During 1998-99 six cases reached the stage where the claimant's disablement was assessed.

#### 186. *Problems*

The risk of skin tumours from the prescribed occupational exposures and the confidence with which individual cases can be attributed to work depend on the extent of the exposure. However, the terms of the prescription make no reference to the extent of exposure, and as a consequence anomalies are possible. For example, benefit has been awarded at appeal to a claimant whose exposure was to a pyridine produced from coal tar, although it is doubtful that even very high exposures to the pyridine would increase risk sufficiently to allow attribution of individual cases to the exposure on the balance of probabilities.

#### 187. *Current evidence*

There is clear scientific evidence that arsenic, tar, pitch, bitumen, mineral oil and soot can cause skin tumours. In the case of arsenic and its compounds, there may be concomitant clinical findings, such as increased pigmentation of the skin, which allow an individual tumour to be attributed to the hazard with reasonable confidence. However, tumours caused by the other prescribed exposures do not have any special features which enable them to be distinguished from the same disease when it occurs for other reasons. Thus attribution to these hazards must depend on demonstration that the exposure has been sufficient to allow attribution of individual cases to the exposure on the balance of probabilities.

188. The determinants of whether an exposure is sufficient to double the risk of skin tumours are complex. They include the nature of the hazardous material and the way in which it has been produced or refined, the degree to which the skin has been contaminated by the substance, and the duration and timing of the contamination.

189. *Recommendation*

We recommend that the prescription of skin tumours be revised as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
Primary carcinoma of the skin.	Work involving exposure to arsenic or arsenic compounds, tar, pitch, bitumen, mineral oil (including paraffin) or soot.

**C22(a)—PRIMARY CARCINOMA OF THE MUCOUS  
MEMBRANE OF THE NOSE OR ASSOCIATED AIR  
SINUSES**

**C22(b)—PRIMARY CARCINOMA OF A BRONCHUS  
OR OF A LUNG**

190. The prescriptions for C22(a) and (b) have been considered in conjunction with disease C14 at paragraph 135 above.

## C23—PRIMARY NEOPLASM OF THE LINING OF THE BLADDER OR URINARY TRACT

### 191. *Current terms of prescription*

Prescribed Disease	Occupation
<p>Primary neoplasm (including papilloma, carcinoma-in-situ and invasive carcinoma) of the epithelial lining of the urinary tract (renal pelvis, ureter, bladder and urethra).</p>	<ul style="list-style-type: none"> <li>(a) Work in a building in which any of the following substances is produced for commercial purposes:               <ul style="list-style-type: none"> <li>(i) alpha-naphthylamine, beta-naphthylamine or methylene-bisortho-chloroaniline;</li> <li>(ii) diphenyl substituted by at least one nitro or primary amino group or by at least one nitro and primary amino group (including benzidine);</li> <li>(iii) any of the substances mentioned in sub paragraph (ii) above if further ring substituted by halogeno, methyl or methoxy groups, but not by other groups;</li> <li>(iv) the salts of any of the substances mentioned in the sub paragraphs (i) to (iii) above;</li> <li>(v) auramine or magenta; or</li> </ul> </li> <li>(b) the use or handling of any of the substances mentioned in sub-paragraph (a)(i) to (iv), or work in a process in which any such substance is used, handled or liberated; or</li> <li>(c) the maintenance or cleaning of any plant or machinery used in any such process as is mentioned in sub-paragraph (b), or the cleaning of clothing used in any such building as is mentioned in sub-paragraph (a) if such clothing is cleaned within the works of which the building forms a part or in a laundry maintained and used solely in connection with such works;</li> <li>(d) exposure to coal tar pitch volatiles produced in aluminium smelting involving the Soderberg process (the method of producing aluminium by electrolysis in which the anode consists of a paste of petroleum coke and mineral oil which is baked in-situ).</li> </ul>

192. *History of prescription*

This disease has been prescribed since 1953, and five amendments have been made since then, mostly affecting the description of the disease itself, but also, in 1994, adding work in the Soderberg process to the list of prescribed occupations.

193. *Number of cases*

At March 1999, 330 people were receiving benefit for this disease, and during 1998-99, 34 cases reached the stage where the claimant's disablement was assessed.

194. *Problems*

The chemical terminology in the current terms of prescription is technical and to some extent outdated, making it difficult for claimants and adjudicators to establish whether the criteria are satisfied. Furthermore, the scientific basis for prescription of some of the chemicals that fall within the prescription is unclear.

195. Another problem is that there are no special features of urinary tumours caused by the prescribed exposures which enable them to be distinguished from those that are not so caused. Therefore, attribution of individual cases to occupation depends on establishing that exposure has been sufficient at least to double a person's risk of disease. However, the terms of prescription make no reference to the extent of exposure.

196. *Current evidence*

The compounds alpha- and beta-naphthylamine are now known as 1- and 2-naphthylamine respectively.

*1-naphthylamine, 2-naphthylamine, benzidine, auramine, magenta.*

There is strong epidemiological evidence that in the past, work in the manufacture of 1-naphthylamine, 2-naphthylamine, benzidine, auramine, magenta and their salts has substantially increased people's risk of urothelial tumours. We are informed that most of these products are no longer made in the UK. Nevertheless, because there is often a long latent interval between exposure to the carcinogens concerned and the eventual manifestation of disease, cases continue to occur as a result of their manufacture in earlier years. Continued prescription is therefore appropriate. In a person who only worked in a relevant job very briefly; the exposure might not be sufficient to double risk. However, such cases will constitute only a small minority of all claimants who satisfy the current terms of prescription, and it is reasonable to assume that where a urothelial tumour occurs in a person who has worked in one of these jobs, the disease is attributable to that work.

197. Work involving the use of 1-naphthylamine, 2-naphthylamine and benzidine has also clearly been linked with an increased risk of urothelial tumours, although in the case of 1-naphthylamine, the hazard appears not to arise from the chemical itself but from contaminant 2-naphthylamine. For both 2-naphthylamine and benzidine, the elevation of risk, and therefore the confidence with which individual cases can be attributed to them, is dependent on the extent of exposure.

198. Although auramine has been shown to cause cancer in experimental animals, and a marked excess of urothelial tumours has been reported among workers employed in the manufacture of auramine and magenta, there is doubt as to whether the finished products themselves are responsible, or chemical intermediates used in their manufacture. No new evidence has emerged since this disease was last reviewed that would help to resolve this issue.

199. *Methylene-bis-ortho-chloroaniline (MbOCA)*<sup>4</sup>

Methylene-bis-ortho-chloroaniline is carcinogenic in animals, and two reports have described three cases of bladder tumour among 540 workers exposed to the compound in its manufacture at a plant in Michigan, USA. However, their disease was low-grade and was only detected because they were screened by urine microscopy and cystoscopy. Therefore, it is unclear how remarkable the finding should be considered. More recently, preliminary findings have become available from a cohort study of workers employed in the manufacture of MbOCA in the UK. These data are consistent with a hazard of urothelial tumours from the chemical, and suggest that the risk is at least doubled in process workers engaged in the manufacture of MbOCA continuously or with breaks for a total duration of 12 months or longer. We therefore believe that urothelial tumours should be prescribed for such work.

200. Although levels of exposure to MbOCA occurring in its use (principally in the plastic industry) are generally much lower than those occurring in its manufacture, there is some evidence that occasional high exposures can occur. However, there is no epidemiological evidence which relates such exposure to urothelial tumours. Thus we do not think that urothelial tumours can currently be prescribed in relation to exposure to MbOCA other than its manufacture.

201. *4-aminobiphenyl, orthotoluidine, 4-chloro-o-toluidine*

Of the other chemicals included in the current terms of prescription but not mentioned by name, 4-aminobiphenyl (IUPAC name biphenyl-4-ylamine) is well established as a cause of urothelial tumours in humans, capable of causing a more than two-fold elevation of risk. In addition orthotoluidine has been associated with a marked increase in bladder cancer in three studies of chemical workers involved in its manufacture or use.

202. A significant increase in bladder cancer has also been reported in one study in relation to exposure to a chemical (CAS number 95-69-2) referred to in the published paper as 4-chloro-o-toluidine. Although this nomenclature is in common use, particularly in the USA, this may be ambiguous and the use of the IUPAC name 4-chloro-2-methylaniline will provide an internationally recognised nomenclature. This will avoid confusion such as has arisen by the incorrect use by manufacturers of the term 4-chloro-o-toluidine for a chemical which has a different but very similar structure. This other chemical should have been more correctly named as 5-chloro-o-toluidine (CAS number 95-79-4). There is no evidence that 5-chloro-o-toluidine is a urothelial carcinogen in humans.

203. *Benzidine based dyes*

Some studies have also suggested an excess of bladder tumours among workers using dyes manufactured from benzidine, but this finding has not been consistent.

---

<sup>4</sup>The IUPAC name for Methylene-bis-ortho-chloroaniline (MbOCA) is 2,2'-dichloro-4,4'-methylenedianiline.

204. *Methylenedianiline*<sup>5</sup>

We have received representations that the prescription of urothelial tumours should be extended to include exposure to methylenedianiline (MDA), a chemical not currently covered, but which bears some structural similarities to known causes of bladder cancer such as benzidine. MDA is a proven cause of cancer in laboratory animals, but direct evidence on the risks that it poses to humans is sparse.

205. In the United States, a proportional mortality analysis for workers using MDA in the manufacture of helicopter blades found three deaths from bladder cancer with 0.8 expected, and in another investigation that followed up 10 workers previously poisoned by MDA, one case of bladder cancer was recorded. In contrast, in two more recent studies of occupational populations with potential exposure to MDA, none of the subjects with bladder cancer had a clear history of exposure to the chemical. Thus, at present the evidence is inconsistent and insufficient to justify the prescription of urothelial tumours in relation to MDA.

206. *Coal tar pitch volatiles*

The scientific evidence for an excess of urothelial tumours from exposure to coal tar pitch volatiles produced in aluminium smelting involving the Soderberg process remains convincing. However, the confidence with which cases can be attributed to such exposure will depend upon the level and duration of their exposure. The available data suggest that the risk of bladder cancer is unlikely to be doubled by work in the smelting process for less than five years in total. However, with longer durations of employment it is reasonable to attribute cases of urothelial tumour to the exposure.

207. *Cutting oils*

A number of people who responded to our call for evidence proposed that urothelial cancer should also be prescribed in relation to work with cutting oils in the machining of metal. In particular, it has been put to us that cutting oils have sometimes been contaminated by 2-naphthylamine, although we have not received well-documented evidence on the extent of such contamination. In view of the concerns about cutting oils, we reviewed the epidemiological evidence on the risk of urothelial cancer in occupational groups such as turners and metal machinists, among whom exposure would be expected to occur.

208. Various studies provide relevant data, and most have suggested that risks are increased. However, this may in part reflect biases in publication, positive findings being reported more completely than those that are less remarkable. Moreover, where elevated risks have been described, they have not consistently reached a level that would justify attribution of the disease to occupation on the balance of probabilities in individual cases. Thus, we cannot at present recommend that urothelial tumours be prescribed for work as a turner or metal machinist, or for exposure to cutting fluids in general. If, however, an individual could show that he had been exposed to substantial quantities of 2-naphthylamine as an impurity of cutting oils, compensation might be justified, depending on the extent of exposure.

---

<sup>5</sup>The IUPAC name for methylenedianiline is 4,4' methylenedianiline.

209. *Printing inks*

Another possible cause of urothelial cancer that has been brought to our attention is printing inks. We are informed that certain inks and dyes used in the printing industry have been contaminated by 4-aminobiphenyl. We therefore reviewed the epidemiological evidence on urothelial cancer in printers.

210. As with cutting oils, although some studies have suggested that risk is increased, this has not consistently been to a level that would justify prescription of urothelial tumours in printers as a group. Again, however, compensation might be appropriate in individual cases if it could be shown that their exposure to 4-aminobiphenyl had been sufficiently high.

211. *Recommendation*

In the light of the evidence considered, and in view of the problems with the current terms of prescription, we recommend that urothelial tumours should in future be prescribed as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
Primary neoplasm of the epithelial lining of the urinary tract.	a) Work in the manufacture of 1-naphthylamine, 2-naphthylamine, benzidine, auramine, magenta, or 4-aminobiphenyl; b) Work in the manufacturing process of methylene-bis-ortho-chloroaniline (MbOCA) continuously or with breaks over a total period of 12 months or longer; c) Work involving exposure to 2-naphthylamine, benzidine, 4-aminobiphenyl [biphenyl-4-ylamine] or salts of these compounds, other than in their manufacture; d) Work involving exposure to orthotoluidine, 4-chloro-2-methylaniline, or salts of these compounds; e) Work over a period of at least five years in total that involves exposure to coal tar pitch volatiles produced in aluminium smelting involving the Soderberg process (the method of producing aluminium by electrolysis in which the anode consists of a paste of petroleum coke and mineral oil which is baked in-situ).

We further recommend that in the case of occupational categories a), b) and e) above, occupational causation can reasonably be assumed without further inquiry where the stated occupational criteria are satisfied.

## C24

### (a)—ANGIOSARCOMA OF THE LIVER

### (b)—OSTEOLYSIS OF THE TERMINAL PHALANGES OF THE FINGERS

### (c)—NON CIRRHOTIC PORTAL FIBROSIS

#### 212. *Current terms of prescription*

Prescribed Disease	Occupation
<b>C24(a)</b> —Angiosarcoma of the liver; <b>C24(b)</b> —Osteolysis of the terminal phalanges of the fingers; <b>C24(c)</b> —Non cirrhotic portal fibrosis.	(a) Work in or about machinery or apparatus used for the polymerisation of vinyl chloride monomer, a process which, for the purposes of this provision, comprises all operations up to and including the drying of the slurry produced by polymerisation and the packaging of the dried product; or (b) work in a building or structure in which any part of that process takes place.

#### 213. *History of prescription*

C24(a) and (b) have been prescribed since 1977, and C24(c) was added in 1983.

#### 214. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

#### 215. *Problems*

We have received representations that the current prescription does not adequately specify all of the diseases associated with exposure to vinyl chloride monomer and also that diseases may sometimes result from exposure to polyvinyl chloride.

#### 216. *Current evidence*

Vinyl chloride monomer (VCM) is used primarily in the production of polyvinyl chloride (PVC). PVC is formed by the polymerisation of liquid VCM (boiling point  $-13.5^{\circ}\text{C}$ ) under pressure in reactor vessels. The workers most heavily exposed to VCM have been engaged in cleaning reactor vessels between production runs, at one time being lowered into the vessels which they cleaned manually. Inhaled VCM can cause three diseases: acro-osteolysis, liver fibrosis and angiosarcoma of the liver. In addition, some studies have linked it with other cancers, and others have suggested a hazard also from polyvinyl chloride.

### **(a) Angiosarcoma of the liver**

Angiosarcoma of the liver has been consistently reported to occur in considerable excess in those exposed to VCM inhaled in high concentration at work. The mortality experience of 5498 male workers employed for at least one year during 1940-1974 in the vinyl chloride industry in the UK was analysed to the end of December 1984. This showed a significant excess of primary liver tumours with 11 deaths, of which 7 were angiosarcomas. Similar observations have been made in the United States and other European countries. In 1988, a review of the mortality of men occupationally exposed to VCM concluded that they have experienced a specific hazard of angiosarcoma of the liver.

### **(b) Acro-osteolysis**

Acro-osteolysis is characterised by:

- i) Lytic destruction of bone particularly—but not exclusively— involving the terminal phalanges of the fingers.
- ii) Raynaud's phenomenon—an exaggerated vasomotor response to cold, which primarily involves the hands with blanching of the fingers.
- iii) Sclerodermatous thickening of the skin which often develops in the hands but may also involve skin in other parts of the body, including the face.

### **(c) Fibrosis of the liver**

Liver fibrosis can cause liver failure with portal hypertension. The clinical manifestations include abnormal tests of liver function, enlargement of the liver (hepatomegaly) and of the spleen (splenomegaly) with a reduced number of platelets circulating in the blood (thrombocytopenia).

### **(d) Other cancers**

Several studies have investigated the association between exposure to VCM and cancers other than liver cancer, in particular cancers of the lung and brain, and leukaemia. Although the risk of these cancers has been elevated in some studies, the relative risks have all been less than two and none has been statistically significant.

### **(e) Polyvinyl chloride**

Inhaled PVC dust is phagocytosed by alveolar macrophages and may accumulate in the lungs to cause, in those most heavily exposed, abnormal opacities on the chest radiograph. The findings from surveys of individuals exposed to PVC dust have not been consistent but, in general, the effects of exposure to PVC on lung function have been small, and less than the effects of age and smoking. There is not sufficient evidence to prescribe PVC as a cause of lung disease.

217. **Recommendation**

We recommend that the prescriptions should be amended as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
a) Angiosarcoma of the liver; b) Acro-osteolysis characterised by lytic destruction of bone, particularly involving the terminal phalanges of the fingers; c) Raynaud's phenomenon; d) Sclerodermatous thickening of the skin, particularly but not exclusively of the hands; e) Liver fibrosis.	Work involving exposure to vinyl chloride monomer in the manufacture of polyvinyl chloride.

## C25—OCCUPATIONAL VITILIGO

### 218. *Current terms of prescription*

Prescribed Disease	Occupation
Occupational vitiligo.	The use or handling of, or exposure to, paratertiary-butylphenol, paratertiary-butylcatechol, para-amylphenol, hydroquinone or the monobenzyl or mono-butyl ether of hydroquinone <sup>6</sup> .

### 219. *History of prescription*

This disease was prescribed in 1980.

### 220. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 221. *Problems*

No problems have been experienced with this prescribed disease.

### 222. *Current evidence*

Review of the scientific literature supported continued prescription of this disease and did not indicate any additional occupational exposures that should be added to the terms of prescription.

### 223. *Recommendation*

We recommend the prescription remains as at present present but with clarification of the names of the chemicals involved as follows:

Prescribed Disease	Occupation
Vitiligo.	Work involving the use or handling of, or exposure to, paratertiary-butylphenol (4- <i>tert</i> -butylphenol), paratertiary-butylcatechol (4- <i>tert</i> -butylcatechol), para-amylphenol ( <i>p</i> -pentyl phenol isomers), hydroquinone or the monobenzyl or mono-butyl ether of hydroquinone (4-benzyloxyphenol or 4-butoxyphenol).

---

<sup>6</sup>The IUPAC names for the chemicals listed in the current terms of prescription are as follows:  
paratertiary-butylphenol is 4-*tert*-butylphenol;  
paratertiary-butyl catechol is 4-*tert*-butylcatechol;  
monobenzyl ether of hydroquinone is 4-benzyloxyphenol;  
mono-butyl ether of hydroquinone is 4-butoxyphenol, and  
para-amyl phenol covers all *p*-pentyl phenol isomers.

## **C26—DAMAGE TO THE LIVER OR KIDNEYS DUE TO CARBON TETRACHLORIDE**

### **224. *Current terms of prescription***

<b>Prescribed Disease</b>	<b>Occupation</b>
Damage to the liver or kidneys due to exposure to carbon tetrachloride.	The use of or handling of, or exposure to the fumes of, or vapour containing, carbon tetrachloride.

### **225. *History of prescription***

This disease was first prescribed in 1988.

### **226. *Number of cases***

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### **227. *Problems***

As well as damage to the liver and kidneys, carbon tetrachloride may have other toxic effects.

### **228. *Current evidence***

Short-term high exposure to carbon tetrachloride (IUPAC name tetrachloromethane) can cause various toxic effects including nausea, vomiting, cardiac dysrhythmias, neuropathy, loss of visual fields and narcosis. However, these should all be satisfactorily covered by the accident provisions of the scheme.

229. Longer term exposure can cause damage to the liver, with fatty degeneration and necrosis, and to the tubules of the kidneys. As with other organic solvents, there is suspicion that it may also lead to neuropsychiatric illness. This question will be examined in a separate report, but at present we are not convinced that there is a case for prescribing neuropsychiatric illness in relation to carbon tetrachloride. Prolonged or repeated skin contact with carbon tetrachloride may cause an irritant dermatitis. However, this effect is covered by prescribed disease D5 (dermatitis).

### **230. *Recommendation***

We recommend that the prescription should be re-worded as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
a) Liver toxicity; b) Kidney toxicity.	Work involving the use of or handling of, or exposure to carbon tetrachloride [tetrachloromethane].

## C27—DAMAGE TO THE LIVER OR KIDNEYS DUE TO TRICHLOROMETHANE

### 231. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Damage to the liver or kidneys due to exposure to trichloromethane (chloroform).	The use of or handling of, or exposure to the fumes of, or vapour containing, trichloromethane (chloroform).

### 232. *History of prescription*

This disease was first prescribed in 1988.

### 233. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 234. *Problems*

No problems have been encountered with this prescribed disease.

### 235. *Current evidence*

Short-term high exposures to trichloromethane can cause various toxic effects including damage to the liver and kidneys, cardiac dysrhythmias and narcosis. However, such toxicity should be satisfactorily covered by the accident provisions of the scheme.

236. It is well established that longer term exposure can be toxic to the liver, causing liver enlargement, fatty degeneration and jaundice, but there is little evidence for a risk of kidney damage other than from exceptional exposure incidents. As with other organic solvents, there is suspicion that long-term exposure to trichloromethane may cause neuropsychiatric illness. This question will be examined in a separate report, but at present we are not convinced that there is a case for prescribing such disorders in relation to trichloromethane. Prolonged or repeated skin contact with trichloromethane can cause irritant dermatitis. However, this effect is covered by prescribed disease D5 (dermatitis).

### 237. *Recommendation*

In view of the above considerations, we recommend that the prescription be simplified to:

<b>Prescribed Disease</b>	<b>Occupation</b>
Liver toxicity.	Work involving the use of or handling of, or exposure to trichloromethane (chloroform).

## **C28—CENTRAL NERVOUS SYSTEM AND GASTRO-INTESTINAL DISORDERS DUE TO CHLOROMETHANE**

### **238. *Current terms of prescription***

<b>Prescribed Disease</b>	<b>Occupation</b>
Central nervous system dysfunction and associated gastro-intestinal disorders due to exposure to chloromethane (methyl chloride).	The use of or handling of, or exposure to the fumes of, or vapour containing, chloromethane (methyl chloride).

### **239. *History of prescription***

This disease was first prescribed in 1988.

### **240. *Number of cases***

In 1998-99 one case reached the stage of assessment for disablement purposes.

### **241. *Problems***

No problems have been brought to the Council's attention concerning the prescription of this disease.

### **242. *Current evidence***

Unusually high exposure to chloromethane can cause narcosis and central nervous system damage. Short-term high exposures have also been reported to cause abdominal pain, nausea, vomiting and diarrhoea. We have found no evidence that these effects would occur other than in the exceptional circumstances of an accident. As with other organic solvents, it has been suggested that long term exposure to chloromethane may cause neuro-behavioural changes. This is a complex issue that will be considered in more detail in a future report. At this stage, however, we are not convinced that there is a case for prescribing any form of neuropsychiatric illness in relation to chloromethane. Nor have we found convincing evidence that any other disease could be attributed to occupational exposure to chloromethane in circumstances other than an industrial accident.

### **243. *Recommendation***

In view of these findings we recommend that this prescribed disease be removed from the schedule of prescribed diseases. We will, however, review the relation of organic solvents (including chloromethane) to neuropsychiatric illness in a future report.

## C29—N-HEXANE AND METHYL N-BUTYL KETONE (N-BUTYL METHYL KETONE)

### 244. *Current terms of prescription*

<b>Prescribed Disease</b>	<b>Occupation</b>
Peripheral neuropathy due to exposure to n-hexane or methyl n-butyl ketone.	The use of or handling of, or exposure to the fumes of, or vapour containing, n-hexane or methyl n-butyl ketone.

### 245. *History of prescription*

This disease was first prescribed in 1988.

### 246. *Number of cases*

During 1998-99 no cases reached the stage where the claimant's disablement was assessed.

### 247. *Problems*

No problems have been encountered with this disease.

### 248. *Current evidence*

Current evidence supports continued prescription. The IUPAC name for methyl n-butyl methyl ketone is n-butylmethyl ketone.

### 249. *Recommendation*

We recommend that the prescription should be re-worded as:

<b>Prescribed Disease</b>	<b>Occupation</b>
Peripheral neuropathy.	Work involving the use of or handling of, or exposure to n-hexane or n-butyl methyl ketone.

## **C30—CHROME DERMATITIS & CHROME ULCERATION**

### **250. *Current terms of prescription***

<b>Prescribed Disease</b>	<b>Occupation</b>
Chrome dermatitis, or ulceration of the mucous membranes or epidermis, resulting from exposure to chromic acid, chromates or bi-chromates.	The use of or handling of, or exposure to chromic acid, chromates or bi-chromates.

### **251. *History of prescription***

This disease was added to the prescribed list in 1996 in a restructuring exercise. Before then claims for these toxic effects of chromium compounds could be made under different prescribed diseases.

### **252. *Number of cases***

During 1998-99 five cases reached the stage where the claimant's disablement was assessed.

### **253. *Problems***

No problems have been identified concerning this disease.

### **254. *Current evidence***

Current evidence supports continued prescription. Some chrome compounds cause cancer, and these are covered under prescribed disease D10. This will be looked at when that disease is reviewed by the Council.

### **255. *Recommendation***

We recommend that the prescription should be re-worded as follows:

<b>Prescribed Disease</b>	<b>Occupation</b>
Dermatitis, or ulceration of mucous membrane or epidermis.	Work involving the use of or handling of, or exposure to chromic acid, chromates or dichromates.

## 5. SUMMARY OF RECOMMENDATIONS

256. We recommend that the following six diseases be removed from the schedule of prescribed diseases:

- C8 Poisoning by a nitro- or amino- or chloro-derivative of benzene, or of a homologue of benzene or poisoning by nitrochlorbenzene
- C9 Poisoning by dinitrophenol or a homologue of dinitrophenol or by substituted dinitrophenols or by the salts of such substances
- C10 Poisoning by tetrachloroethane
- C11 Poisoning by diethylene dioxide (dioxan)
- C15 Poisoning by oxides of nitrogen
- C28 Central nervous system dysfunction and associated gastro-intestinal disorders due to exposure to chloromethane (methyl chloride)

This is because either current scientific evidence does not support their continued inclusion, or they are only likely to be attributable to employment with reasonable confidence in the circumstances of an occupational accident, which would be covered by the accident provisions of the scheme.

257. We recommend that the terms of the other 24 diseases prescribed in relation to chemicals should be amended so that the revised schedule would be as set out in the table that follows. We further recommend that, except where indicated in the table below by an asterisk, occupational attribution should not automatically be assumed simply because a claimant appears to satisfy the terms of prescription. Rather the decision-maker should seek appropriate advice on whether the individual circumstances of the case justify attribution of the claimant's illness to the occupational exposure with reasonable confidence i.e. on balance of probabilities.

<b>CONDITIONS DUE TO CHEMICAL AGENTS</b>	
<b>Prescribed Disease</b>	<b>Occupation</b>
<b>C1</b> a) Anaemia with a haemoglobin concentration of 9g/dL or less, and a blood film showing punctate basophilia; b) peripheral neuropathy; c) central nervous system toxicity.	Work involving the use or handling of, or exposure to the fumes, dust or vapour of, lead or a compound of lead, or a substance containing lead.
<b>C2</b> Central nervous system toxicity characterised by parkinsonism.	Work involving the use or handling of, or exposure to the fumes, dust or vapour of, manganese or a compound of manganese, or a substance containing manganese.
<b>C3</b> a) Phossy Jaw.	Work involving the use of or handling of, or exposure to white phosphorus*.
b) Peripheral neuropathy (with or without accompanying toxicity to the central nervous system).	Work involving the use or handling of, or exposure to organic compounds of phosphorus that inhibit the enzyme, neuropathy target esterase.

<b>CONDITIONS DUE TO CHEMICAL AGENTS</b>	
<b>Prescribed Disease</b>	<b>Occupation</b>
<b>C4</b> Primary carcinoma of the bronchus or lung.	Work involving exposure to the fumes, dust or vapour of arsenic or a compound of arsenic, or a substance containing arsenic.
<b>C5</b> a) Central nervous system toxicity characterised by tremor and neuropsychiatric disease.	Work involving exposure to mercury or inorganic compounds of mercury for a period of at least ten years in total.
b) Central nervous system toxicity characterised by combined cerebellar and cortical degeneration.	Work involving exposure methylmercury.
<b>C6</b> Peripheral neuropathy.	Work involving the use or handling of, or exposure to carbon disulphide (carbon disulfide).
<b>C7</b> Acute non-lymphatic leukaemia.	Work involving exposure to benzene.
<b>C8, C9, C10 and C11</b> removed from schedule.	
<b>C12</b> a) Peripheral neuropathy; b) Central nervous system toxicity.	Work involving exposure to methyl bromide (bromomethane).
<b>C13</b> Cirrhosis of the liver.	Work involving exposure to chlorinated naphthalenes.
<b>C14</b> has been combined with <b>C22</b> .	
<b>C15</b> removed from schedule.	
<b>C16</b> a) Neurotoxicity; b) Cardiotoxicity.	Work involving exposure to the dust of gonioma kamassi.
<b>C17</b> Chronic beryllium disease.	Work which involves the inhalation of beryllium or a beryllium compound*.
<b>C18</b> Emphysema.	Work involving inhalation of cadmium fumes over a minimum of 20 years in total*.
<b>C19</b> a) Peripheral neuropathy; b) Central nervous system toxicity.	Work involving exposure to acrylamide.
<b>C20</b> Dystrophy of the cornea (including ulceration of the corneal surface of the eye).	Work involving exposure to quinone or hydroquinone.
<b>C21</b> Primary carcinoma of the skin.	Work involving exposure to arsenic or arsenic compounds, tar, pitch, bitumen, mineral oil (including paraffin) or soot.

<b>CONDITIONS DUE TO CHEMICAL AGENTS</b>	
<b>Prescribed Disease</b>	<b>Occupation</b>
<p><b>C22</b>  a) Primary carcinoma of the mucous membrane of the nose or paranasal sinuses;  b) Primary carcinoma of the bronchus or lung.</p>	<p>Work in the refining of nickel involving exposure to oxides, sulphides or water-soluble compounds of nickel before 1950.</p>
<p><b>C23</b>  Primary neoplasm of the epithelial lining of the urinary tract.</p>	<p>a) Work in the manufacture of 1-naphthylamine, 2-naphthylamine, benzidine, auramine, magenta, or 4-aminobiphenyl *;  b) Work in the manufacturing process of methylene-bis-ortho-chloroaniline (MbOCA) continuously or with breaks over a total period of 12 months or longer*;  c) Work involving exposure to 2-naphthylamine, benzidine, 4-aminobiphenyl (biphenyl-4-ylamine) or salts of these compounds, other than in their manufacture;  d) Work involving exposure to orthotoluidine, 4-chloro-2-methylaniline, or salts of these compounds;  e) Work over a period of at least five years in total that involves exposure to coal tar pitch volatiles produced in aluminium smelting involving the Soderberg process (the method of producing aluminium by electrolysis in which the anode consists of a paste of petroleum coke and mineral oil which is baked in situ)*.</p>
<p><b>C24</b>  a) Angiosarcoma of the liver;  b) Acro-osteolysis characterised by lytic destruction of bone, particularly involving the terminal phalanges of the fingers;  c) Raynaud's phenomenon;  d) Sclerodermatous thickening of the skin, particularly but not exclusively of the hands;  e) Liver fibrosis.</p>	<p>Work involving exposure to vinyl chloride monomer in the manufacture of polyvinyl chloride*.</p>
<p><b>C25</b>  Vitiligo.</p>	<p>Work involving the use or handling of, or exposure to, paratertiary-butylphenol (4-<i>tert</i>-butylphenol), paratertiary-butylcatechol (4-<i>tert</i>-butylcatechol), para-amyphenol (<i>p</i>-pentyl phenol isomers), hydroquinone or the monobenzyl or mono-butyl ether of hydroquinone (4-benzyloxyphenol or 4-butoxyphenol).</p>

<b>CONDITIONS DUE TO CHEMICAL AGENTS</b>	
<b>Prescribed Disease</b>	<b>Occupation</b>
<b>C26</b> a) Liver toxicity; b) Kidney toxicity.	Work involving the use of or handling of, or exposure to carbon tetrachloride (tetrachloromethane).
<b>C27</b> Liver toxicity.	Work involving the use of or handling of, or exposure to trichloromethane (chloroform).
<b>C28</b> removed from schedule.	
<b>C29</b> Peripheral neuropathy.	Work involving the use of or handling of, or exposure, n-hexane or n-butyl methyl ketone.
<b>C30</b> Dermatitis, or ulceration of the mucous membranes or epidermis.	Work involving the use of, or handling of, or exposure to chromic acid, chromates or dichromates.

## **Transitional arrangements**

258. It is possible that some individuals currently receiving benefit would not have been eligible had the proposed changes been in operation at the time they made their claim. In these circumstances we recommend that benefit should continue to be paid and not withdrawn.

## **Operational implications**

259. The Council considers that the recommendations set out in this report should result in more straightforward administration of the relatively few claims that will be made under the amended prescriptions. Decision-makers will have a clearer prescription to deal with, and guidance to hand to help them reach a timely decision. The amendments should result in fewer speculative claims, and allow staff to concentrate on claims where payment is more likely and more appropriate.

## **Prevention**

260. The diseases discussed in this report can all be prevented by elimination or substitution of the toxins concerned from the workplace, or where this is not practical, by ensuring that any exposure of workers is adequately controlled. There is a legal obligation on employers to apply an appropriate preventive strategy as set out in the Control of Substances Hazardous to Health Regulations 1999 and the Control of Lead at Work Regulations 1998. Depending on the circumstances in which the hazard occurs, control measures may include improved engineering, better design of processes, and use of personal protective equipment. It is also important that employees are given the necessary instruction and training to ensure that they do not endanger themselves or others through exposure to hazardous chemicals.

## **Further Research**

261. It is possible that in the future further scientific research will generate new evidence which would enable the list of diseases described in relation to chemical hazards to be extended. We are aware, for example, of on-going research into the long-term toxicity of organophosphates. Also, the evidence linking methylenedianiline with urothelial tumours, although not at present sufficiently strong or consistent to justify prescription, is suggestive of a causal association. New epidemiological data might clarify this relationship. The Council's Research Working Group routinely monitors the scientific literature on occupational diseases, and if new publications emerge on these or other relevant topics, they will be evaluated.

## **Compliance Cost Assessment**

262. Implementing the recommendations made by the Council in this report will incur no extra cost either in time or expense to business. There are very few claims made per year for any of these diseases, and the changes recommended will not alter this.

### **Evidence Received From:**

Dr D N Bateman , University of Newcastle

Mr Tony Benn MP

Professor P G Blain, University of Newcastle

Mr S Clayton

Dr Joan Davies

Ex Vinatex Workers' Support Group

The Health and Safety Executive

Mr B Hudspith, Graphical Paper & Media Union

Dr G A Jamal, University of Glasgow

Laboratory of the Government Chemist

National Union of Knitwear, Footwear & Apparel Trades

North Derbyshire Trade Union Safety Committee

Mr B Odell

Professor E M Sedgwick, University of Southampton

Ms E Sigmund

Ms L Sohawon, MSF Union

Dr T Sorahan, University of Birmingham

Trades Union Congress

**Glossary**

**Acetylcholinesterase**—an enzyme needed for the transmission of nerve impulses

**Alveolar macrophages**—cells in the lungs involved in the immune response against infections and dust particles.

**Angiosarcoma**—a cancer of blood vessels.

**Aplastic anaemia**—anaemia resulting from failed production of cells in the blood.

**Bronchiolitis**—inflammation of the smaller airways of the lungs.

**Bronchus**—a larger airway of the lung.

**Carcinoma**—a type of cancer.

**Cardiotoxic**—damaging to the heart.

**Cardiovascular**—relating to the heart and blood vessels.

**Cerebellum**—the part of the brain controlling muscle co-ordination.

**Chloracne**—a skin disease caused by certain chemicals that contain carbon and chlorine.

**Cirrhosis**—(of the liver), a chronic disease leading to liver failure.

**Conjunctiva**—the membrane covering the front of the eye and lining the eyelids.

**Corneal dystrophy**—degeneration of the transparent front part of the eye.

**Dysrhythmias**—abnormal rhythms of the heart.

**Emphysema**—damage to and loss of the small air sacs of the lungs.

**Fatty degeneration**—(of the liver), fatty change resulting from major chemical damage.

**Glomerulus**—a part of the kidney structure.

**Leucopaenia**—low numbers of immune cells in the blood.

**Lymphohaematopoietic**—concerning the system that produces blood cells.

**Lytic destruction**—breakdown of cells or tissues by enzymes.

**Myelodysplasia**—a disease affecting the formation of certain cells of the blood and immune system.

**Myopathy**—a disease of muscle.

**Necrosis**—cell or organ death.

**Neoplasm**—a tumour, literally “new growth”.

**Nephritis**—inflammatory disease of the kidneys.

**Nephropathy**—disease of the kidney.

**Neurobehavioural**—relating to behavioural responses of the nervous system.

**Neuropsychiatric disorders**—diseases of the mind due to organic damage of the brain.

**Non-lymphatic leukaemia**—a form of leukaemia affecting a particular class of immune cells.

**Pancytopenia**—a deficit of blood cells of all types.

**Papilloma**—a type of benign tumour.

**Paranasal sinuses**—air spaces within the bones of the skull.

**Parkinsonism**—a brain condition causing tremors and stiffness.

**Peripheral neuropathy**—malfunction of the nerves outside the brain and spinal cord.

**Phagocytosis**—the process by which cells of the immune system take in and digest foreign material (e.g. bacteria and dusts).

**Phalanges**—finger bones.

**Platelets**—small blood cells involved in clotting of the blood.

**Portal hypertension**—high blood pressure in the veins leading to the liver from the gut.

**Psychosis**—a type of mental illness.

**Pulmonary granulomata**—a type of inflammation in the lung.

**Punctate basophilia**—microscopic changes seen in red blood cells characteristic of lead poisoning.

**Renal tubules**—the part of the kidney that is responsible for concentrating urine.

**Sarcoidosis**—an inflammatory disease that can affect many parts of the body.

**Sclerodermatous**—involving thickening of the skin.

**Suppurative necrosis**—tissue death with formation of pus.

**Thrombotic**—to do with blood clotting.

**Tremor**—uncontrolled shaking, usually of the hands and arms.

**Urothelial**—to do with the lining of the urinary tract including the kidney and bladder.

**Vertigo**—dizziness

**Visual cortex**—a part of the brain dealing with vision.









*the*  
**Stationery  
Office**

**Published by The Stationery Office Limited**

and available from:

**The Stationery Office**

(Mail, telephone and fax orders only)

PO Box 29, Norwich NR3 1GN

General enquiries 0870 600 5522

Order through the Parliamentary Hotline *Lo-call* 0845 7 023474

Fax orders 0870 600 5533

Email [book.orders@theso.co.uk](mailto:book.orders@theso.co.uk)

Internet <http://www.clicktso.com>

**The Stationery Office Bookshops**

123 Kingsway, London WC2B 6PQ

020 7242 6393 Fax 020 7242 6394

68–69 Bull Street, Birmingham B4 6AD

0121 236 9696 Fax 0121 236 9699

33 Wine Street, Bristol BS1 2BQ

0117 9264306 Fax 0117 9294515

9–21 Princess Street, Manchester M60 8AS

0161 834 7201 Fax 0161 833 0634

16 Arthur Street, Belfast BT1 4GD

028 9023 8451 Fax 028 9023 5401

The Stationery Office Oriel Bookshop

18–19 High Street, Cardiff CF1 2BZ

029 2039 5548 Fax 029 2038 4347

71 Lothian Road, Edinburgh EH3 9AZ

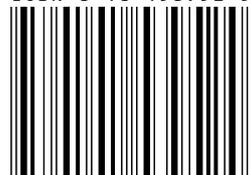
0870 606 5566 Fax 0870 606 5588

**Accredited Agents**

(See Yellow Pages)

and through good booksellers

ISBN 0-10-153952-5



9 780101 539524