



Department for Work and Pensions

**Department for Work and Pensions
Social Security Administration Act 1992**

Hand-Arm Vibration Syndrome

**Report by the Industrial Injuries Advisory
Council in accordance with Section 171 of the
Social Security Administration Act 1992
reviewing the prescription of the vascular and
sensorineural components of Hand-Arm
Vibration Syndrome.**

*Presented to Parliament by the Secretary of State for Work and Pensions
by Command of Her Majesty
July 2004*



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INDUSTRIAL INJURIES ADVISORY COUNCIL

Secretary of State for Work and Pensions

Dear Secretary of State,

REVIEW OF HAND-ARM VIBRATION SYNDROME

Vibration White Finger was added to the list of prescribed diseases in 1985 on the recommendation of the Industrial Injuries Advisory Council. At this time the condition was considered to be due to injury of the small arteries supplying the fingers as a response to Hand-Transmitted Vibration. The diagnosis of the condition was based on the extent of finger blanching.

Further research had shown by the early 1990's that hand-transmitted vibration injured not only the arteries but also the nerves supplying the fingers. IAC reviewed this evidence and recommended, in a report in 1995, that the name of the prescribed disease should be changed to Hand-Arm Vibration Syndrome and the sensorineural changes in the fingers should also be included within the terms of prescription. These recommendations were accepted, but not implemented, by the government of the day. This was, I believe, due primarily to concerns about the reliability and cost-effectiveness of the diagnostic tests proposed for the identification of sensorineural damage but also to lack of knowledge about the number of cases with lone sensorineural damage and the degree of their disablement.

In the interval since that report considerable research has been undertaken which has clarified these issues. It is clear that disabling lone sensorineural damage occurs as a consequence of Hand-Transmitted Vibration. Our estimate is that the inclusion of those cases with sufficient disability to be eligible to claim would increase the total number of successful claimants by some 20%.

There have also been advances in the clinical testing of sensorineural damage, sufficient to allow the use of such tests within the Industrial Injuries Disablement Benefit Scheme.

We have recommended that the terms of prescription should now include lone sensorineural damage caused by Hand-Transmitted Vibration but, because of the properties of the clinical tests which provide objective evidence of sensorineural damage, these should be undertaken only in cases with a history of sensorineural symptoms: application of the tests in all cases would lead to an unacceptably high rate of misleading results. We have also recommended that the terms of prescription should make it clear that, to distinguish the condition from other similar symptoms, the onset of symptoms must follow the first use of the relevant tools.

Yours sincerely,
Professor A J Newman Taylor
Chairman

Date: December 2003

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1. SUMMARY

1. Hand-Arm Vibration Syndrome (HAVS) is a disorder consisting of both vascular and sensorineural components as a result of exposure to Hand-Transmitted Vibration (HTV) in specific occupational groups. The main feature of the vascular component of HAVS, or Vibration White Finger (VWF), is cold-induced, clearly-demarcated, finger blanching occurring episodically (for a full description see paragraphs 28-29). Symptoms of the sensorineural component of HAVS are numbness, tingling, and reduced manual dexterity and sensory perception (for a full description see paragraphs 32-33).

2. Currently, only the vascular disease is recognised as a prescribed disease under the Industrial Injuries Disablement Benefit (IIDB) Scheme - VWF, Prescribed Disease (PD) A11 - although the sensorineural component is taken into account during medical assessments. Based on the views of leading experts in the field and following extensive reviews of the scientific literature undertaken by the Council, IIAC recommends that the prescription for VWF be widened to encompass both the vascular and sensorineural components, with the prescription for PD A11 changing to HAVS. The terms of prescription have been clarified so that the onset of the symptoms of HAVS should follow exposure to HTV in the prescribed occupations in the scheduled list for PD A11.

3. The Council recommends that the terms of prescription for the vascular component of HAVS remain essentially the same as currently listed for VWF, PD A11. However, the pattern and extent of finger blanching has been clarified by including the terms 'cold-induced, clearly delineated' and 'distal phalanges', which were missing from the original prescription.

4. The diagnosis of the vascular component of HAVS remains based on a good clinical history of the kind described in paragraphs 28-29. The cold water provocation test and the finger systolic blood pressure test are of limited value in diagnosis of VWF and the Council do not recommend their use.

5. IIAC recommends that the terms of prescription for the sensorineural component should be (1) persistent numbness or persistent tingling, or both, together with (2) significant and measurable reduction in both sensory perception and manual dexterity.

6. Diagnosis of the sensorineural component of HAVS should be based on a good clinical history. This would normally include a) persistent symptoms of numbness and tingling in the digits, b) difficulty with grip and fine dexterity, c) exclusion of other explanations for these symptoms (such as other causes of peripheral neuropathy) and d) an onset of symptoms which follows the date of first exposure, rather than preceding it. The history should be supported by positive results from all of the following diagnostic tests - vibrotactile, thermal threshold and the Purdue peg board test. The Council recommends that a good clinical history is a prerequisite for the application of these diagnostic tests.

7. The Council has considered evidence about occupational coverage for PD A11 and recommend that the occupational categories currently listed under the terms of prescription for VWF remain appropriate and relevant for both the vascular and sensorineural components of HAVS. Thus, the Council recommends the occupational categories for PD A11 remain unchanged with one exception. Following a Court of Appeal judgement broadening the definition of “forestry”, the Council recommends that the terms of prescription be amended from “the use of hand-held chain saws in forestry” to “the regular use of hand-held chain saws”.

8. On the matter of evidence from other compensation schemes, IIAC’s view is that while claimants are entitled to provide secondary evidence to support their claim for PD A11, the criteria for assessment of PD A11 must be those set within the terms of prescription of the IIDB Scheme, rather than those agreed elsewhere for other purposes.

2. INTRODUCTION

The Industrial Injuries Disablement Benefit Scheme

9. The Industrial Injuries Disablement Benefit (IIDB) Scheme provides a benefit that can be paid to an employed earner because of an industrial accident or Prescribed Disease (PD). The benefit is non-contributory and 'no-fault', and is paid in addition to other incapacity and disability benefits. It is tax-free and administered by the Department for Work and Pensions (DWP).

The Industrial Injuries Advisory Council

10. The Industrial Injuries Advisory Council (IIAC) is an independent statutory body set up in 1946 to advise the Secretary of State for Social Security on matters relating to the IIDB Scheme. The major part of the Council's time is spent considering whether the list of prescribed diseases for which benefit may be paid should be enlarged or amended.

The legal requirements for prescription

11. The Social Security Contributions and Benefits Act 1992 states 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.

12. 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.

13. In seeking to address the question of prescription for any particular condition, the Council first looks for a workable definition of the disease. The Council then searches for 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 being based on the balance of probabilities according to the available evidence in the scientific literature. It may be possible to ascribe a disease to a particular occupational exposure in two ways – from specific clinical features of the disease or from epidemiological evidence that the risk of disease is at least doubled by the relevant occupational exposure.

Clinical features

14. For some diseases attribution to occupation may be possible from specific 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 can be that the disease only occurs as a result of an occupational hazard (e.g. coal workers pneumoconiosis).

Doubling of risk

15. 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 would do 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. 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.

16. The second approach has proved possible where a sufficient body of research indicates a higher risk of the outcome in workers who can be identified by their shared occupational exposure. By this means, Vibration White Finger (VWF) has been prescribed.

PD A11 – Vibration White finger

17. The prescription of VWF has a long history, with Council reports in 1954, 1970, and 1975 in which IIAC had difficulty in recommending the prescription because of concern that no reliable means existed of confirming the diagnosis, distinguishing it from other causes of finger blanching, and establishing occupational attribution; and because of the perceived triviality of the disorder.

18. However, after collecting further evidence on diagnostic methods and disablement, IIAC made a recommendation to Ministers in favour of prescription in 1981 (Cm. 8350) and the disease was added to the list of prescribed diseases on 1 April 1985 (for the current terms of prescription see Appendix 1).

19. The terms of prescription were last reviewed by the Council in 1995 in the report 'Hand-Arm Vibration Syndrome (Vascular and Neurological Components involving the fingers and thumb)' (Cm. 2844). The Council recommended that:

- prescription should be extended to cover the peripheral neurological effects of HAVS on the thumb and fingers;
- the Stockholm classification scale should be used to grade the severity of HAVS;
- the principal diagnostic methods should comprise the finger systolic blood pressure test under cooling (vascular effects) and vibrometry (neurological effects);
- the list of prescribed occupational exposures should be replaced by a list of prescribed tools and rigid materials held against such tools.

20. These recommendations were accepted but not implemented by the government of the day, due to concerns about the reliability and cost-effectiveness of the objective tests suggested for the diagnosis of HAVS.

21. Since the Council last reviewed HAVS in 1995 considerable evidence has accumulated about the occupational risks of this disorder, particularly the contribution of the sensorineural component to functional disability. In addition, further data have accumulated on available test methods.

3. BACKGROUND TO THE REVIEW

22. A formal request to review the disease was made by the Minister, following issues highlighted by members of Parliament, the Trades Union Congress (TUC), and the DWP. Several particular concerns were considered.

a) Prescription of the sensorineural component of HAVS.

Currently, the sensory effects of HAVS are only assessed once the vascular symptoms are severe enough to fulfil the criteria for PD A11. However, sensory-only disease is not uncommon, which means that a significant proportion of people with occupationally-acquired HAVS are ineligible for IIDB. The Council has received many representations on behalf of workers with sensory-only disease. Also, new information on the scale of HAVS, including national estimates of the numbers suffering from sensory-only disease, has recently become available.

b) On-going difficulties with the assessment for PD A11.

The diagnosis of PD A11 is based upon the vascular component of HAVS, including the characteristic episodic blanching of the fingers and hands. However, there have been problems with the interpretation of the term 'blanching', which is misunderstood, and the acceptance of patterns of blanching which are atypical of HAVS. The Council felt it appropriate to provide clarification.

c) Review of diagnostic tests for HAVS.

The diagnosis of PD A11 is made largely on the clinical history. Since the last review, new evidence has emerged concerning the diagnostic tests for the vascular and sensorineural component of HAVS. This report details the Council's recommendations about diagnostic testing for HAVS and its use in the IIDB Scheme.

d) Occupational coverage.

The current terms of prescription list various exposures for which occupational attribution of HAVS can be made. The Council has taken this opportunity to review the occupational coverage to reflect current evidence.

e) Use of medical assessment reports prepared for the Department for Trade and Industry and for civil litigation.

The Department for Trade and Industry (DTI) is currently engaged in an extensive programme of assessments to compensate vibration injury in British coal workers. The diagnostic criteria and medical assessments for VWF differ substantially between the DWP IIDB Scheme and the DTI compensation scheme. The Council wished to provide clarification regarding the use of DTI medical assessment reports or independent reports from civil litigation in assessments for IIDB.

23. In this report the Council has focused on the vascular and sensorineural effects of HAVS. Carpal Tunnel Syndrome and musculoskeletal disorders will be considered in a separate report, as part of a wider review of upper limb disorders. The health effects of whole-body vibration fall outside the scope of the report.

4. SUMMARY OF THE CLINICAL PROBLEM

24. Hand-transmitted vibration (HTV) is a common exposure in British industry. It arises from many sources, including powered percussive hammers, concrete breakers, sanders, powered drills, grinders, polishers, burring tools, chain saws and even motorcycle handlebars.

25. The term 'Hand-Arm Vibration Syndrome', or HAVS, is nowadays used to define collectively the disorders associated with exposure to HTV. In general use, HAVS refers to the well established vascular and neurological components of the disorder. We define HAVS as a syndrome comprising symptoms of episodic finger blanching (vasospasm) and/or numbness and tingling (neuropathy) as a result of HTV exposure in specific occupational groups. A more formal definition of HAVS for the purposes of the Scheme is provided later (paragraph 77).

Vibration White Finger

26. Exposure to cold normally causes a decrease in blood flow to the skin and generally pale extremities. Abnormalities in this apparently simple response were first described by the French clinician Maurice Raynaud in 1862. He observed attacks of cold-induced finger blanching (a more extreme form of pallor) in affected subjects, and considered the phenomenon to be natural or unexplained. However, it later became apparent that identifiable causes of the condition were comparatively common.

27. The first occupationally-related cases were described nearly a century ago in a group of Italian marble miners using pneumatic rock drills. Other reports followed - from quarries in the 1920s, foundries in the 1930s, hand grinding shops in the 1940s, rock mines in the 1950s and the forestry industry in the 1960s. The condition of Raynaud's Phenomenon secondary to the use of powered vibratory tools became known by various names such as 'dead hand', 'traumatic vasospastic disease' and 'white fingers', but nowadays the term 'vibration-induced white finger' is generally preferred.

28. The cardinal feature of VWF is cold-induced, finger blanching. Finger blanching is defined as an intense whiteness[†] with clearly demarcated margins between the affected and non-affected tissue. Typically, when a person first starts to have attacks only the finger-tips of one or two fingers are affected, but as exposure to HTV continues, later attacks become more frequent and involve more fingers. The attacks may spread from the finger tips up the fingers, as far as the palm, and, in rare cases just onto the palm. Blanching usually extends round the circumference of the finger, though it can be confined to the palmar (front), dorsal (back), or lateral (sides) aspect in some cases. The thumb may be involved, but less commonly than the other digits.

29. Blanching occurs in attacks which are normally triggered by exposure to cold or dampness and normally last from five to thirty minutes, but can last two hours or more. Attacks are generally associated with numbness, and their resolution with tingling. The duration, pattern and distribution of attacks can be hard to recall or describe, and unusual patterns of blanching

[†] The appearance can be of pallor in non-caucasian skin.

can sometimes be observed in the resolution phase (e.g. whiteness of the middle phalanx in isolation). In advanced cases, they may also occur in warm conditions where there has been a fall in temperature. Recovery occurs spontaneously, but may be helped by massaging or warming the fingers. Very rarely, episodic blanching may progress to permanent circumferential pallor or blueness, with necrosis of the finger-tips, owing to irreversible damage of the arterial walls.

30. Attacks of cold-induced blanching are a source of discomfort, and can cause varying degrees of disability or lost working time. Only 1.7% of 1100 surveyed chain saw operators employed by the Forestry Commission between 1970-3 changed their occupation because of symptoms, and in a later report only 40 (4.8%) of 827 workers had been forced to give up the work. Similar findings have been described in several other surveys of foresters.

31. However, disability affecting occupational and social activity does arise. For example, people with VWF may not be able to hold cold objects without provoking attacks; or may not be able to feel objects in the fingers due to numbness in cold weather. For some severely affected individuals such limitations may be very frequent or permanent.

Sensorineural disease

32. Sensorineural symptoms are well recognised to occur in individuals with VWF in association with episodes of blanching and recovery. These symptoms are currently taken into account in the assessment for disablement in diagnosed cases of VWF. However, it is now appreciated that the typical symptoms of the sensorineural component of HAVS - numbness, tingling, impaired dexterity and grip - can arise independently of blanching. The sensorineural component of HAVS usually predates the vascular part in onset.

33. Tingling occurring during or immediately following exposure to vibration may be normal and not necessarily indicative of vibration injury. However, in workers with long-term exposure to HTV tingling and or numbness often occur at other times. Initially, symptoms are intermittent, but with continuing exposure they may become protracted, troublesome and irreversible. Symptoms can occur at night. Pain, reduced temperature sensation, weakness and poor manual dexterity are other recognised problems.

34. Electrophysiological tests suggest that damage may arise to the nerves supplying the digits. Impaired sensation to vibration, temperature and touch have all been demonstrated, probably reflecting damage to nerve endings. In advanced cases physical examination may reveal abnormalities of these modalities, but in mild cases the clinical approach may fail to detect all cases or may give inconsistent results. As with finger blanching, more objective assessment methods have been sought (paragraphs 37-39).

35. More disability appears to be experienced from nerve injury than from finger blanching, as evidenced particularly by surveys of Finnish foresters and according to the consensus of experts in the field.

36. The Council has concluded that the sensory-only form of HAVS is an important, and as yet uncompensated part of the total burden of disease arising from occupational exposure to HTV.

Clinical grading of HAVS

37. Most authorities grade cases of HAVS according to two scales (one for vascular and one for neurological effects) proposed in the 1980s by an international meeting of experts. The so-called Stockholm Workshop Scales are presented in Appendix 2.

38. The Stockholm sensorineural scale covers a broad range of symptoms but includes at its upper end (3SN) workers with substantial problems arising from persistently reduced sensation in the digits and functional difficulty in everyday tasks requiring manipulative dexterity. The vascular scale grades those with VWF according to the frequency of blanching attacks and the area of the skin affected.

39. These scales are used widely in epidemiological surveys, and clinical and medico-legal practice, although they do contain some ambiguities. Expressions such as 'occasional attacks', 'frequent attacks' and 'most fingers' in the vascular scale and terms 'intermittent' and 'persistent' in the neurological scale, have not been strictly defined. Appropriate tests and reference standards for grading reduced sensory perception and reduced tactile discrimination in the sensory scale were similarly not defined. Nonetheless, there is broad consensus that the Stockholm scales (see Appendix 2) provide a useful basis for grading the frequency, extent, and impact of HAVS.

5. REVIEW OF THE EVIDENCE RECEIVED

Method of investigation

40. A literature search was undertaken by the research librarian and reviewed by members of the Council's Research Working Group. Oral and written evidence was received from invited experts in the field of hand-arm vibration injury and occupational health. A list of those consulted is provided in Appendix 3. In addition, DWP conducted an analysis of claims activity for PD A11 (see Appendix 4).

Extent and severity of the problem

41. A number of new important strands of information have emerged. A large, nationally representative postal survey of working-aged adults conducted in 1997 and 1998 (the National Survey of Vibration), estimated that over a million British men have weekly exposures to HTV exceeding an action level for introducing control measures and health surveillance proposed by the Health and Safety Executive (HSE). The survey also estimated that VWF with or without sensorineural symptoms is comparatively common, at least in its milder forms, and that the sensory-only pattern of disease is equally common.

42. The sensory component adds substantially to functional difficulty and can interfere with daily activities, even in the absence of blanching. In comparison with those who had no symptoms, subjects from the same survey who reported blanching but no tingling or numbness were four times more likely to have difficulty with buttons; those with tingling or numbness but not blanching were six times more likely to have this difficulty, and those with both components were twenty times more likely.

43. The experts who were consulted agreed that the sensory-only form of HAVS is encountered commonly in clinical and medico-legal practice (being present in about 20% of HAVS patients) and often causes more disability than that due to the vascular component.

44. Sensory-only HAVS is common, but only advanced sensory-only HAVS is disabling and relevant to the IIDB Scheme. In terms of severity, it is the Council's opinion it would be appropriate to prescribe for sensory disease classed at stage 3 on the Stockholm sensorineural scale (3 SN) where disability is severe. The scale in Appendix 2 allows some alternative possibilities at stage 3SN: we propose prescription in workers who have (1) persistent (i.e. continuously present) numbness of the digits or persistent tingling, or both and (2) a significant and demonstrable reduction in both sensory perception and manipulative dexterity. Paragraphs 54-58 review ways in which these terms could be confirmed diagnostically.

Diagnosis and assessment of HAVS

Clinical history

45. Clinicians rarely witness attacks of blanching during their examination of patients. Diagnosis of VWF, therefore, relies substantially on medical opinions of reported symptoms. Generally, a history is sought of characteristic symptoms of the kind described in paragraphs 28 and 29, provoked by cold in a worker with substantial occupational exposure to vibration, and with no other apparent reason for their symptoms. The experts consulted felt that taking an accurate, well-documented, standardised history of exposure and symptoms was reasonable, and the most appropriate way to confirm the diagnosis.

46. It may take as little as six months exposure or more than twenty years exposure to HTV for the onset of attributable finger blanching to occur. It depends on the extent and magnitude of the occupational exposure together with individual susceptibility. The opinion of some experts is that the first attack of blanching due to HTV can occur up to one year after cessation of HTV exposure. Some schemes are more generous, but IAC knows of none that compensate people whose attacks first begin more than two years after their last HTV exposure.

47. Diagnosis of the sensory component similarly requires a careful clinical history to be taken. Important diagnostic features include:

- intermittent or persistent symptoms of numbness and/or tingling in the digits – occurring with sufficient frequency or persistence to be unusual; numbness in the warmth and in the absence of blanching is more significant;
- difficulty with grip and/or fine dexterity; and
- exclusion of other explanations, such as immediate prior exposure to HTV, cold conditions, or other causes of peripheral neuropathy.

48. One difficulty in diagnosis is that the vascular and sensory patterns of symptoms have naturally-occurring counterparts that are common in the general population. Raynaud's disease, the commonest cause of finger blanching, and often indistinguishable from HAVS, has an estimated prevalence of 5-10% in men and 10-20% in women of working age according to recent community surveys. Similarly, 20% of working-aged adults report tingling or numbness in the upper limb lasting at least three minutes during the past seven days according to one representative population survey.

49. To distinguish (as far as possible) between HAVS and other causes of similar complaints (e.g. Raynaud's Phenomenon) it is important to establish that the symptoms first arise after exposure to HTV and do not precede it. Thus, the Council recommends amending the terms of prescription so that the onset of symptoms occurs after work involving the occupational exposures to HTV listed in the schedule for PD A11.

50. A second problem is that sole reliance on history makes it harder to refute a false claim. Great lengths have therefore been taken to develop

objective methods of diagnosis and assessment. The common techniques are listed below, with some preceding general comments. Further detailed information is provided in Appendix 5.

Desirable test parameters

51. In general, diagnostic tests are undertaken to help confirm whether a patient's condition is caused by a particular disease. However, in practice few tests are wholly accurate. Some level of over-diagnosis or under-diagnosis is invariably present. Where a test picks up nearly all the affected individuals it is highly sensitive. Where it excludes nearly all non-affected individuals it is highly specific. In diagnosis of a prescribed disease the sensitivity is not as important for these tests because a properly taken history has high sensitivity in identifying cases. Rather, a diagnostic test needs to be highly specific so that as few people as possible without the disease are diagnosed as having it. A detailed description of desirable test parameters, including sensitivity and specificity can be found in Appendix 6.

52. Therefore, to be applied within the IIDB Scheme, the Council considers that a desirable test for HAVS would:

- have reasonable sensitivity (true positive rate), compatible with high specificity;
- have a high specificity (true negative rate);
- be applied in circumstances of a convincing clinical history;
- be repeatable (give the same result) in circumstances where this can reasonably be expected;
- be acceptable to those tested (e.g. involve a minimum of discomfort);
- be economically balanced and appropriate in cost for the purpose;
- have been evaluated in populations similar to those likely to apply for benefit.

53. The experts who were consulted were asked to provide evidence that could be judged against these criteria. One of those consulted was chosen because of his engagement in a similar review for the Faculty of Occupational Medicine, Royal College of Physicians. In addition, the Council's Research Working Group undertook a limited review of the literature.

Sensorineural tests

54. Information was received on the following tests of sensorineural injury:

- the vibrotactile threshold test
- the thermal threshold test
- the 2 point/depth aesthesiometer test
- the Purdue pegboard test
- the grip strength test
- the pain threshold test
- the Semmes-Weinstein monofilament test
- the nerve conduction velocity test.

55. The Council believes that the vibrotactile, thermal threshold, and Purdue pegboard tests can be used in combination to confirm that sensorineural disease has reached stage 3SN on the Stockholm sensory scale as an objective supplement to clinical history. The vibrotactile threshold test measures the threshold of feeling to a vibratory stimulus in a manner akin to the measurement of hearing threshold in audiometry. The thermal threshold (thermal aesthesiometry) test measures the threshold of feeling hot and cold. The Purdue pegboard is a functional test of manual dexterity. Further information on these tests can be found in Appendix 5.

56. We suggest that these tests should only be undertaken in claimants with an appropriate clinical history (see paragraph 47), and that significant abnormalities (see paragraph 97) in all three tests are necessary to meet the criteria for prescription. The Council considered whether all claimants should undergo sensorineural testing regardless of whether they have sensorineural symptoms or not - the point being that claimants who are turned down without having had the tests might cite this as a breach of natural justice and grounds for an appeal. The appeal tribunal would then feel obliged to obtain test findings anyway. Also, claimants successful under the blanching provisions might appeal against not being given sensorineural tests in the hope of a higher assessment.

57. IIAC appreciates this argument but rejects it on clinical and scientific grounds. A positive test in the absence of symptoms is very likely to be a false positive and a misleading result. So, in defining the terms of prescription we consider the presence of sensorineural symptoms to be a prerequisite for diagnosis. Conducting tests in the absence of such symptoms is not only misleading but may place an unnecessary burden on the person being tested.

58. The Council was informed that the equipment needed to conduct the sensory and dexterity testing (vibrotactile, thermal threshold, and pegboard tests) currently costs some £15,000 per set-up and can process one claimant per hour. Additional investment would be needed to train the test administrators (1 day training) and to perform routine quality control checks and maintain the equipment. Some of the information about standards and normative testing of these procedures can be found in Appendix 5 and paragraph 97.

Vascular tests

59. Sensorineural tests are mostly used in the clinical staging of nerve injury rather than in diagnosis. In direct contrast, the vascular diagnostic test batteries formerly employed for VWF by the DTI coal workers compensation scheme were generally used to determine whether the disease is present or absent, rather than to classify its severity. Several other limitations were identified in the context of the IIDB Scheme (paragraphs 98-102).

60. The Council has concluded that it would be practically difficult, and of limited benefit, to add the two principal vascular tests (finger systolic blood pressure and cold water provocation tests) to the present assessment procedure for PD A11. Details of the diagnostic tests for the vascular component of HAVS are in Appendix 5. Diagnosis and assessment of this disorder should continue to rely on a careful clinical history.

Occupational coverage

61. The Council has been asked to review the current terms of the occupational coverage for PD A11. The present coverage is based on use of prescribed categories of vibratory tool in prescribed occupational activities (Appendix 1).

62. Ideally, coverage would be broader, relating to the extent of exposure to HTV, estimated as a dose. This appears to be too difficult a concept to apply in practice. A tool may generate vibration by design or as a by-product of its operation. However, the magnitude of vibration depends on many physical factors, including: tool properties (e.g. size, weight, balance between reciprocating forces, method of propulsion, and tool drive mechanism); the material worked (e.g. its hardness, roughness and shape); and the type of action at the tool-material interface (e.g. cutting, drilling, grinding). The extent to which vibration is transmitted to the hand-arm is influenced by the type and force of grip used, the orientation of the hand and arm, and other aspects of operator technique. Moreover, it depends on tool maintenance: it is not unusual to observe variations in vibration magnitude of four to five fold between apparently similar tools in different states of repair. Finally, the risk of HAVS relates to the lifetime duration (and possibly the pattern) of exposure, which is often difficult to establish. One recent survey has demonstrated that workers substantially overestimate the duration of their exposure to HTV, especially when they engage in intermittent tasks involving the use of several tools in combination. In practice, it would be very difficult to establish an accurate exposure history in each individual claim.

63. In its last report on HAVS, the Council suggested that coverage might be extended by reference to a longer list of specific tools for which there is good evidence of hazardous levels of vibration. However, the risk of HAVS depends on the duration of use of these tools and not just the magnitude of vibration. Research indicating that such exposures directly translate into a doubling of risk of HAVS in human populations was rather sparse. The recommendations were accepted but not implemented by the government of the day.

64. Since 1995, further epidemiological investigations and case reports have continued to emerge. These have focused mainly on populations with well-established hazards, which are already covered under the terms of PD A11, with only limited evidence on new or overlooked sources of exposure. Recent research has, however, indicated that exposures which in themselves may be within acceptable limits can be injurious in aggregate – in jobs where workers use several tools in combination.

65. Altogether, we identified three epidemiological surveys and two hygiene reports in motor mechanics (from exposures such as nut runners, impact wrenches, and sanders); and a few surveys indicating a possible doubling of risk for vascular and/or neurological effects in carpenters and joiners (one survey), professional gardeners (one survey), police motorcyclists (one survey), snowmobile drivers (one survey), autopsy assistants (one small survey) and builders and labourers (one survey). One case series in operators of high pressure hoses was also reported. In no

instance did there appear to be a sufficient weight of epidemiological evidence to modify the terms of occupational coverage for PD A11, so the Council does not propose to amend the list.

66. There is good evidence of a doubling of risk for sensorineural symptoms of HAVS for several of the prescribed exposures listed currently for PD A11. However, there are gaps in the evidence – epidemiological data were not found for the risk of sensorineural symptoms for every listed prescribed occupation for PD A11. Nonetheless, the Council has concluded that all the prescribed exposures on the current list are likely at least to double risk of sensorineural HAVS - a view supported by expert opinion. Therefore, the Council considers that the current list of prescribed occupations for PD A11 could appropriately be applied in defining the occupational coverage for sensorineural HAVS.

67. There is a need to clarify the meaning of the word ‘forestry’ in the regulations for PD A11. Following Social Security Commissioners’ decisions expressing conflicting views, a Court of Appeal judgement held that the phrase “use of chain saws in forestry” should not be given a narrow definition. The words “in forestry” meant “the management of growing timber” and were not restricted to work in commercial forestry. The Council recommends that the phrase the “use of hand-held chain saws in forestry” be amended to the “regular use of hand-held chain saws”.

Use of secondary data to support claims under the IIDB Scheme

68. In reviewing claims for PD A11 under the IIDB Scheme, Commissioners have sometimes made use of medical assessment reports from the DTI coal workers compensation scheme as well as those assembled to support civil claims. The TUC and some claimants have asked whether reports of this kind, made for other purposes, could be used during routine assessments of disablement for IIDB by decision makers.

69. IIAC’s view is that claimants are entitled to provide whatever evidence they wish to support their case, but those claimants unable to supply such evidence should not feel disadvantaged. The criteria for assessing disablement must be those set within the IIDB Scheme, rather than those agreed elsewhere for other purposes.

70. We recommend that decision makers should evaluate information, such as DTI reports, with the following caveats in mind:

- Vascular tests have been, but are no longer, used in relation to the DTI scheme, and we advise against their use as an indicator of severity of VWF.
- Finger systolic blood pressure is considered to be a reasonably reliable index of diagnosis. Interpretation of the cold water provocation test is potentially more problematic.
- Significant abnormalities of vibrotactile and thermal threshold tests, and the Purdue pegboard test are required in those with an appropriate history (see paragraph 47) to support a diagnosis of grade 3SN sensory HAVS.
- To be useful evidence, these tests should be performed according to an accepted protocol such as identified in Appendix 5 and paragraph 97.

6. PREVENTION

71. The risk from HTV can be minimised by good work practices. Where possible, tasks that entail exposure to HTV should be eliminated. If this is not possible, then steps should be taken to assess and control risk to health as far as is reasonably practicable - for example by using tools which emit less vibration into operators' hands and reducing the duration of use of tools. Workers who are regularly exposed to HTV should undergo health surveillance, and if this identifies development or progression of HAVS managers should immediately review and revise their vibration control programme to overcome any failure in worker protection. Additionally, management controls should be reviewed periodically to ensure they remain effective. The HSE has published guidance on hand-arm vibration and a European Directive on controlling the risks from vibration came into force on 6 July 2002. British Regulations transposing the Directive are expected to come into force by 6 July 2005. The Regulations will set requirements for control of exposure to hand-arm vibration at a prescribed level (an exposure action value) and will also set a limit on daily vibration exposure (an exposure limit value). Further information on the Directive and the British Regulations can be found at HSE's web site <http://www.hse.gov.uk/vibration/index.htm>.

7. RECOMMENDATIONS

72. The Council recommends that the terms of prescription for PD A11 be extended to recognise both the vascular and the sensorineural components of HAVS. The revised prescription reflects the fact that claimants may have vascular-only (VWF) or sensorineural-only HAVS, or both the vascular and sensorineural components of HAVS.

73. To distinguish between HAVS and other causes of similar complaints, such as Raynaud's Phenomenon, it is important that the symptoms first occur after the first exposure to HTV and do not precede it. Thus, the Council recommends clarifying the terms of prescription by specifying that the onset of symptoms should follow work involving one of more of the tools or occupational exposures listed for PD A11 (see sub-paragraph (3) in the recommended terms of prescription in table below).

74. The definition of VWF (i.e. the vascular component of HAVS) remains essentially the same (see table below, sub-paragraph (1)). However, the Council felt clarification of the prescription was necessary and has added 'cold-induced, clearly delineated' and has made reference to inclusion of the distal phalanges.

75. For the vascular component of HAVS, the gold standard for its diagnosis remains a carefully recorded patient history. The Council does not consider the cold water provocation test or the finger systolic blood pressure test to be sufficiently useful to be recommended in medical assessments for IIDB.

76. The Council recommends that terms of prescription for the sensorineural component of HAVS would be satisfied in claimants with a good clinical history (as described in paragraph 47), supported by positive results from the vibrotactile test, the thermal threshold test and the Purdue pegboard test. IIAC recommends that these tests only be applied in claimants with a clinical history of sensorineural symptoms of the kind described in paragraph 47, for the reasons laid out in paragraphs 56-57.

77. The recommended terms of prescription are described in the table below.

Disease number	Name of disease or injury	Type of job
A11	<p>Hand-Arm Vibration Syndrome, being defined as:</p> <p>(1) Cold-induced, clearly delineated, episodic blanching, occurring throughout the year, affecting the distal with the middle or proximal phalanges, or, in the case of a thumb, the proximal phalanx, of –</p> <p>(a) in the case of a person with 5 fingers (including thumbs) on one hand, any 3 of those fingers, or</p> <p>(b) in the case of a person with only 4 fingers, any 2 of those fingers, or</p> <p>(c) in the case of a person with less than 4 such fingers or, one of those fingers as the case may be, the one remaining finger.</p> <p>and/or</p> <p>(2) both of the following -</p> <p>i) persistent numbness or persistent tingling of the digits, or both</p> <p>and;</p> <p>ii) a significant and demonstrable reduction in both sensory perception and manipulative dexterity of the digits.</p> <p>and</p> <p>(3) whose onset occurs after work involving one or more of the tools or occupational exposures listed in the 3rd column of this table.</p>	<p>(a) the regular use of hand-held chain saws; or (b) the use of hand-held rotary tools in grinding or in the sanding or polishing of metal, or the holding of material being ground, or metal being sanded or polished, by rotary tools; or (c) the use of hand-held percussive metalworking tools, or the holding of metal being worked upon by percussive tools, in riveting, caulking, chipping, hammering, fettling or swaging; or (d) the use of hand-held powered percussive drills or hand-held powered percussive hammers in mining, quarrying, demolition, or on roads or footpaths, including road construction; or (e) the holding of material being worked upon by pounding machines in shoe manufacture.</p>

78. The Council is satisfied after carefully review of the evidence, that the current occupational coverage for PD A11 is appropriate and relevant for the sensorineural component of HAVS. However, the terms of prescription have been clarified following a Court of Appeal judgement which has broadened the definition of forestry to work in “the management of growing timber”. Thus, the Council recommends that the terms of prescription be amended from the “use of hand-held chain saws in forestry” to the “regular use of hand-held chain saws”.

79. Medical assessment reports from the DTI coal workers compensation scheme and legal reports may be considered by decision makers during the assessment of claims for IIDB. However, the diagnostic criteria being considered must be in accordance with the criteria used to assess claims for IIDB. Qualification for HAVS under the more lenient DTI scheme, will not inevitably satisfy the terms of prescription for the prescribed disease PD A11 (HAVS). The Council wishes to emphasise that in such cases, claimants would not be refused because they do not have HAVS, but that they do not qualify for the prescribed disease under the terms of prescription for IIDB.

APPENDIX 1: Current terms of prescription for PD A11

Disease number	Name of disease or injury	Type of job
A11	<p>Episodic blanching, occurring throughout the year, affecting the middle or proximal phalanges, or in the case of a thumb the proximal phalanx, of:</p> <ul style="list-style-type: none"> (a) in the case of a person with 5 fingers (including thumb) on one hand, any 3 of those fingers; or (b) in the case of a person with only 4 such fingers, any 2 of those fingers; or (c) in the case of a person with less than 4 such fingers, any one of those fingers or, as the case may be, the one remaining finger. (Vibration white finger.) 	<p>(a) the use of hand-held chain saws in forestry; or (b) the use of hand-held rotary tools in grinding or in the sanding or polishing of metal, or the holding of material being ground, or metal being sanded or polished, by rotary tools; or (c) the use of hand-held percussive metalworking tools, or the holding of metal being worked upon by percussive tools, in riveting, caulking, chipping, hammering, fettling or swaging; or (d) the use of hand-held powered percussive drills or hand-held powered percussive hammers in mining, quarrying, demolition, or on roads or footpaths, including road construction; or (e) the holding of material being worked upon by pounding machines in shoe manufacture.</p>

APPENDIX 2: The Stockholm workshop scales for the classification of Hand-Arm Vibration Syndrome

Vascular stages

STAGE ^a	GRADE	DESCRIPTION
0		No attacks
1	Mild	Occasional attacks affecting only the tips of one or more fingers
2	Moderate	Occasional attacks affecting distal and middle (rarely also proximal) phalanges of one or more fingers
3	Severe	Frequent attacks affecting all phalanges of most fingers
4	Very severe	As in stage 3, with trophic skin changes in the finger tips

^a The staging is made separately for each hand. In the evaluation of the subject, the grade of the disorder is indicated by the stages of both hands and the number of affected fingers on each hand - for example: '2L(2)/1R(1)', '-/3R(4)', etc.

Sensorineural stages

STAGE ^b	SYMPTOMS
OSN	Exposed to vibration but no symptoms
ISN	Intermittent numbness, with or without tingling
2SN	Intermittent or persistent numbness, reduced sensory perception
3SN	Intermittent or persistent numbness, reduced tactile discrimination and/or manipulative dexterity

^b The sensorineural stage is established separately for each hand

APPENDIX 3

Evidence was received from:

Dr Ian Lawson*, Chief Medical Officer, Rolls Royce plc

Professor Michael Griffin, Professor of Human Factors, Institute of Sound and Vibration Research, University of Southampton

Dr Howard Mason, Health and Safety Laboratories

Dr Keith Palmer*, MRC Clinical Scientist, MRC Environmental Epidemiology Unit, University of Southampton

Mr John Cartain, Whittles Solicitors, Manchester

* Evidence received prior to the appointment of Dr Lawson and Dr Palmer to the Council

APPENDIX 4: Claims activity

80. Benefit is paid under one of two circumstances:

- (1) if the assessed disablement from an accident or prescribed disease is 14% or more (with the exception of pneumoconiosis, which is paid at 1%);
- (2) if the assessed disablement is 1-13% but, in aggregation with an injury or another prescribed disease, the total assessed disability is 14% or more.

81. If the assessed disablement is 1% or more and the date of the accident or onset of the prescribed disease predates 1 October 1990 then the claimant may be eligible for Reduced Earnings Allowance (REA) for the duration of the award.

82. Claims activity information was provided by the DWP. Around 14,000 - 15,000 claims for PD A11 (VWF) are made to the scheme annually. In the reporting year 2000/2001 there were 3320 new assessments in those diagnosed with the prescribed disease out of a total of 7630 for all prescribed diseases. Almost all of the claims activity has been in men.

83. In 2000/1, 502 claimants (15% of those assessed or 3.4% of those who claimed) received benefit including 385 who secured benefit through aggregation with another prescribed disease.

84. Figures have only recently been collected and provisionally analysed on REA paid to PD A11 cases. However, in the last nine months of 2002, 93% of men who fell below the 14% threshold, when assessed for their VWF, secured an REA award.

APPENDIX 5: Diagnostic tests for HAVS

Sensorineural tests

85. During the course of this review, the Council evaluated the evidence relating to a variety of diagnostic tests for the sensory-only component of HAVS. Details of these tests are provided for information below.

86. The vibrotactile threshold test and the thermal threshold test were considered to be in common use in the UK for the diagnosis of sensory HAVS and, additionally, the Purdue pegboard test and the grip strength test for the assessment of disability.

87. The vibrotactile threshold test measures the threshold of feeling to a vibratory stimulus in a manner akin to the measurement of hearing threshold in audiometry. The equipment used consists of an accelerometer mounted on a counterbalanced vibration excitor. The finger is placed in contact with the vibrating probe and a constant force is applied. The magnitude of vibration is increased until the subject indicates they can feel it by pushing a response button. Cycles are repeated until a Bekesy trace is recorded (similar to an audiogram). Frequencies at 31.5 and 125 Hz are used which correspond to the sensitive range of skin receptors (meissners and pacinian corpuscles) thought to be damaged in HAVS.

88. In keeping with other sensorineural tests, the vibrotactile threshold test requires claimant co-operation and so is semi-objective. However, some instrumentation makes it possible now to enhance the objectivity by presenting the vibration challenge with a random time delay before each test cycle.

89. Vibrotactile thresholds can be affected by age, finger skin temperature, vibration frequency, and the test configuration (e.g. contact area). The International Organisation for Standardisation has proposed standardised conditions for the vibrotactile threshold test (“Mechanical vibration – vibrotactile perception thresholds for the assessment of nerve dysfunction – Part 1: Methods of measurement at the fingertips”; ISO 13091-1:2001(E). Another currently appropriate standard is set out in the report by Lindsell and Griffin (mentioned in paragraph 97 below).

90. The criterion for positivity is often set using normative data, such that the worst 5% of those tested are considered abnormal.

91. The thermal aesthesiometry (thermal threshold) test measures the threshold of feeling hot and cold. The apparatus consists of a peltier unit and thermocouple covered by a metal plate. This can generate hot or cold stimuli. The temperature of the plate is raised and lowered at a fixed rate until the subject presses a response button to indicate a change in temperature. A mean threshold for hot and cold sensitivity and a temperature neutral zone are calculated.

92. Although there are relatively few published accounts, the experts reported that the vibrotactile and thermal threshold tests are both highly repeatable in healthy volunteers. Less information exists for vibration-exposed populations, including affected patients, but one expert suggested that the variability of repeat assessments was about two to three times greater in cases of sensorineural HAVS.

93. The Council was informed that the degree of abnormality in each test correlated well with the extent of vibration exposure, and in some studies with the reported severity of sensorineural symptoms and reported disability. Vibrotactile thresholds have also been shown to be generally higher in subjects reporting finger blanching.

94. Tests of hand function have been used in post-injury rehabilitation and to assess functional capacity in the elderly and the disabled, before being extended in application to vibration-exposed workers. The Purdue pegboard test is a functional test of manual dexterity. In its commonest form, it requires subjects to place metal pegs in holes in a pegboard as quickly as possible, using each hand in turn and then both hands together. The number of pegs placed in 30 seconds is scored for each hand. The time is compared with a normative range. Similar standardised tests of dexterity, such as the bean transfer test and the button-unbutton test have been used in Japan. The active co-operation of the claimant is required. There are rather few data, but the repeatability of the pegboard test has been found to be reasonable in several studies of working-aged subjects.

95. Grip strength may be measured simply by using a hand dynamometer. Standardised instrumentation and age and sex-specific normative data are available. This test has also been found to be reasonably repeatable in normal subjects of working age.

96. In workers with severe sensorineural HAVS (stage 3 on the Stockholm scale), significant abnormality would be expected in both of the sensory tests (even though they measure different modalities of sensation) and in one or more of the functional tests. This has prompted the Council to recommend that evidence of qualifying sensorineural disease should comprise abnormalities in several of the component tests.

97. Further detail and discussion on the test procedures and sources of normative data can be found in:

- Lindsell CJ, Griffin MJ (1998). Standardised diagnostic methods for assessing components of the hand-arm vibration syndrome. HSE Books. CRR 197/98, ISBN 0 7176 1640 1;
- the proceedings of a diagnostic workshop in HAVS, published in a special supplement of the journal *International Archives of Occupational and Environmental Health* (Volume 75, number 1-2, January 2002).

Vascular tests

98. A variety of diagnostic tests have been employed to measure the vascular component of HAVS.

99. The finger systolic blood pressure (FSBP) test following cooling of the digits can be used to support the diagnosis of the vascular component. This test measures the interruption of digital artery blood flow in response to cold. FSBP is measured by plethysmography in comparison with a reference digit during local cooling.

100. Various test procedures and criteria for abnormality have been used and some have been well standardised. The generally accepted discrimination threshold of FSBP (<60% of that in the reference digit during a finger cooling of 10°C) has a good specificity for VWF (86% – 100%) and a sensitivity of around 85% in published series. However, the technique is relatively expensive, requires a skilled operator, and is likely to be difficult to apply in a high volume compensation scheme.

101. The cold water provocation test has also been widely used in diagnosis. This test measures the vasoconstriction and recovery in skin capillaries following a standard cold challenge. In its crudest form, the test attempts to provoke visual evidence of blanching by making the fingers cold. This provides a very specific test but a very insensitive one, and the approach is not widely advocated

102. A more sophisticated version involves cooling the fingers and measuring their time to rewarm. Skin temperature is used as a surrogate of finger skin blood flow. Test conditions (room temperature, water temperature, duration of challenge, presence or absence of whole-body cooling) have varied widely, leading to inconsistent findings. Inter-individual variability of response is considerable, reflecting the many factors that influence skin blood flow. The test is affected, for example, by season, time of day, emotion, cigarette smoking and extraneous noise. Great care is required in the application of the test for the findings to have diagnostic value.

APPENDIX 6: Desirable test parameters

103. Diagnostic tests are undertaken to increase (or decrease) the likelihood that a patient's illness is caused by a particular disease. The accuracy of a test is usually assessed by measuring its performance in relation to a 'gold standard', which is assumed always to be correct. A wholly accurate test will always be positive in patients with the disease (100% sensitivity) and negative in patients without the disease (100% specificity). This occurs very uncommonly and the majority of tests are not wholly sensitive (i.e. have a number of false negative results) and not wholly specific (i.e. have a number of false positive results). This is shown in the table:

Test result	Disease e.g. HAVS ("Gold standard")	
	+ve	-ve
	+ve	a (true positives)
-ve	c (false negatives)	d (true negatives)

Sensitivity = proportion of those with disease who test positive (i.e. true positive rate)

$$= a / (a + c)$$

Specificity = proportion of those without disease who test negative (i.e. true negative rate)

$$= d / (b + d)$$

104. Ideally the 'gold standard' for a disease is an objective measure, e.g. the characteristic cellular changes in a tissue biopsy of cancer. In HAVS there is no such objective test and the 'gold standard' is usually the opinion of a clinician experienced in diagnosing cases of HAVS. This standard is unlikely to be perfectly accurate or consistent, but in the absence of a better alternative, objective tests are evaluated against it.

105. The sensitivity (true positive rate) and specificity (true negative rate) of a test are related. Increasing the sensitivity (which increases the true positive and reduces the false negative rate) will inevitably reduce the specificity of a test (i.e. decrease the true negative rate and increase the false positive rate) and vice versa. A test that is less sensitive will miss more genuine cases (and in this context under-compensate deserving claimants), whereas a test that is less specific will over-diagnose the disease (hence overcompensate applicants).

106. In terms of this review, most attention was paid to assessing the sensory component, for which the clinical history is considered less diagnostically specific. Here two further difficulties were identified in defining a suitable 'gold standard': (1) there is no clear cut point of abnormality of sensation, it is usually lost gradually; and (2) there is no simple way to confirm or refute a loss of sensation other than by the claimant's account. This means that sensorineural tests are seldom described in terms of their sensitivity and specificity; it is generally thought more appropriate to consider the agreement between different means of assessment and the general consistency of observations instead.



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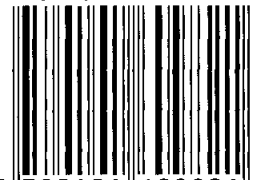
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