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Safe handling of asbestos

PLAINTIFF'S EXHIBIT

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Shell Safety Committee

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Recommendations for the safe handling of asbestos and materials containing asbestos

This publication is issued as a revision to "Recommendations for the safe handling of asbestos and materials containing asbestos" (Group Industrial Safety Committee – April 1970) which it now supersedes.

The terms Group and Shell are used in this publication as a matter of convenience to refer to one or more companies of the Royal Dutch/Shell Group of companies as the context may require.

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TABLE OF CONTENTS

	Page
1. FOREWORD	3
2. INTRODUCTION	3
3. HAZARDS TO HEALTH	3
4. RECOMMENDATIONS	
4.1 General	4
4.2 Sources of exposure	5
4.3 Medical surveillance	6
4.4 Protective clothing and facilities	6
4.5 Respiratory protection	7
4.6 Asbestos operations, indoors	8
4.7 Asbestos operations, outdoors	9
4.8 Storage, transport, disposal	9
5. REFERENCES	9

Appendices

1. Recommendations for acceptable concentrations of asbestos fibre in air
2. Notes on materials containing asbestos
3. Examples of substitutes for packing and insulating materials containing asbestos
4. Measured concentrations of asbestos fibres in work place air during various operations

1. FOREWORD

These recommendations are intended as a guide to Group companies on the safe handling of asbestos and materials containing asbestos. They may serve as a basis for the drafting of more detailed rules and regulations, adapted to local conditions and circumstances at the discretion of the company's management. The recommended precautionary measures should be regarded as minimum requirements. In those countries where statutory regulations concerning the use and handling of asbestos apply, these must of course be observed and should be read in conjunction with the recommendations made in this guide.

Additional information concerning the handling of asbestos may be obtained from the publications listed at the end of this guide.

2. INTRODUCTION

The types of asbestos fibres most commonly encountered in industry are:

1. **Crocidolite** (blue asbestos)
2. **Chrysotile** (white asbestos)
3. **Amosite** (brown asbestos)

The other forms, i.e. tremolite, actinolite and anthophyllite have very little commercial application.

The properties of asbestos which are of practical value are incombustibility, strength and resistance to chemical attack.

Crocidolite (blue asbestos) has been largely used in textiles, packings, thermal and acoustic insulation material, and as a filler in plastic components.

Chrysotile (white asbestos) has been used chiefly in asbestos cement and other building materials.

Amosite (brown asbestos), which has been used least, is sometimes employed in fire resistant boards and insulation material.

3. HAZARDS TO HEALTH

That the inhalation of asbestos dust can be hazardous to health was recognised already at the turn of the century with the observation that pulmonary fibrosis, known as asbestosis, followed prolonged occupational exposure. Afterwards an association was shown between asbestosis and bronchial carcinoma, and this was followed some years later by the observation that exposure to asbestos could be followed by the development of a rare form of cancer, mesothelioma, a malignant tumor arising in either the pleura or peritoneum. The risk of developing such a disease depends on both the level and duration of exposure. The disease may develop as many as 20 to 30 years after exposure has ceased. Overall, exposure to crocidolite (blue asbestos) is considered most dangerous, followed by amosite and chrysotile in this order. The difference in hazard is most likely due to the difference in physical properties, i.e. diameter, length and toughness of the asbestos fibres.

4. RECOMMENDATIONS

In this context "asbestos" refers to raw material – both virgin and waste – and also to all other materials containing it.

4.1 GENERAL

- 4.1.1 The use of asbestos should be prevented as far as reasonably practicable. Asbestos that may give rise to fibrous dust should only be permitted where its use is essential and other safer alternative materials are not available.
- 4.1.2 In no circumstances should crocidolite (blue asbestos) be introduced or specified for use in new or existing operations.
- 4.1.3 Other forms of asbestos should only be permitted after full consideration of substitute materials (see Appendices 2 and 3). In the event that the use of asbestos material is regarded as unavoidable and essential, the material should be clearly marked "ASBESTOS" as a warning to users and to maintenance and demolition personnel.
- 4.1.4 The presence of existing asbestos insulation in buildings and plant is not in itself regarded as a significant risk. Consequently a general policy to remove asbestos without regard to other factors is not considered appropriate. Present evidence suggests that dangers inside buildings arise if asbestos fibres are released when the material is damaged, either accidentally or during maintenance or repair. The risk generated by removal is likely to be much greater than leaving it in place in encapsulated state. Decisions to remove asbestos should, therefore, be preceded by an assessment of the existing risk, the life of the existing material, its condition and the impact of the removal of isolated sections or of complete removal, taking into account the degree of contamination of the work area and surroundings and the extent and feasibility of the final decontamination procedure.
- 4.1.5 All persons handling asbestos should be informed of the hazards and should be fully trained in safe personal and plant hygiene practices. For activities and circumstances where exposure to fibrous asbestos dust may be expected please refer to section 4.2 below: "Sources of Exposure".
- 4.1.6 Each company and location where asbestos materials are or may be handled should have regulations specifying safe methods of application, removal and disposal. These regulations should include provisions to ensure the safety of others working nearby and details of personal protection and hygiene measures to be adopted.

A copy of the regulations should be given to each employee engaged in such work and discussed with them by their supervisor.

- 4.1.7 A Register should be kept of all personnel handling asbestos, or those who are known to have handled asbestos regularly in the past (e.g. ladders) or who have had any exposure to crocidolite. This Register should contain the names of such personnel, length of exposure and details of personal precautions used.

LAM 004678

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The initiation and maintenance of the Register should be the responsibility of Management, who may delegate the responsibility to a designated person. The Safety Officer and Company's Medical Adviser should regularly inspect the Register and advise as necessary.

- 4.1.8 Where Contractor employees are engaged in asbestos work on Company premises, they should observe both statutory and Company Regulations. This should be stated as a condition in the contract.

Although the ultimate responsibility for the health of the Contractor's employees rests with the Contractor, the Operating Company's management should ensure that the Contractor fulfills his obligation. In case the Contractor does not do so, he should be advised in writing of a breach of contract.

Reference is made here to "Contractor Safety" (Shell Safety Committee – March 1980).

- 4.1.9 Exposure to all forms of asbestos should be kept to the lowest practicable level and in no event exceed the concentrations which are specified in Appendix I or in relevant statutory regulations if these are more exacting.

- 4.1.10 Where air sampling is required to determine the level of exposure of personnel to fibrous asbestos dust, the membrane filter/personal sampler method should be used under the supervision of a trained person. Fibres should be counted by the phase contrast optical microscopy technique. For details of these techniques see references 7 and 8.

4.2 SOURCES OF EXPOSURE

Exposure to fibrous asbestos dust may be expected to a greater or lesser extent in the following areas, activities and circumstances.

4.2.1 Spraying of asbestos fibres

The application of asbestos fibres by spraying has been shown to be highly hazardous and therefore should not be permitted.

4.2.2 De-lagging

Exposure to fibrous asbestos dust above the prescribed limits may arise during the removal of dry dusty asbestos insulation material which still may contain crocidolite (blue asbestos), chrysotile (white asbestos) or amosite (brown asbestos), or a mixture, depending on age and manufacture.

4.2.3 Machining

Exposure to fibrous asbestos dust in excess of the recommended concentrations may arise from the cutting, breaking or machining of dry dusty materials such as asbestos board or cement, particularly where high speed tools are used.

4.2.4 Waste

Unacceptable exposure may arise from dry asbestos waste, through direct handling, from contaminated work room surfaces or from contaminated protective clothing.

No appreciable exposure may be expected from the cutting or machining of asbestos-containing materials, such as gaskets. For further information on materials containing asbestos see Appendix 2.

Examples of some typical exposure levels for various operations are given in Appendix 4.

4.3 MEDICAL SURVEILLANCE

All persons previously or currently engaged in work which may give rise to exposure to fibrous asbestos dust should be submitted to a periodical medical surveillance at the discretion of the Company Medical Adviser. Those persons who will be engaged regularly in such work should undergo a medical examination prior to being assigned to such work.

The contents of both the pre-employment and periodical medical examinations should be determined by the Company Medical Adviser, depending on the duration and regularity of the work and the expected and measured levels of exposure, (see section 4.2 above: "Sources of exposure"). If the persons concerned do not agree to these medical examinations they should not be permitted to work with asbestos.

4.4 PROTECTIVE CLOTHING AND FACILITIES

- 4.4.1 Overalls and headgear, close-fitting at the neck, ankles and wrists, should be worn at all times when working with asbestos. This clothing may be made of closely woven terylene/cotton mixture. Alternatively, plastic overalls, which can be washed down before removal or impermeable disposable types may be used.

- 4.4.2 A special decontamination room or portable unit adjoining an existing locker/washroom should be provided for the exclusive use of persons working with asbestos.

This decontamination room/unit should contain its own W.C., urinal, showers, washing facilities, water point, vacuum cleaner and individual lockers exclusively for the protective equipment and clothing used by asbestos workers.

- 4.4.3 Before contaminated work clothing and footwear is taken off it should be vacuum cleaned using a fine filtration apparatus and then stored in the "dirty" lockers provided. Collected dust should be disposed of as described in section 4.8 below: "Storage, transport, disposal". When sent for laundering clothing must be clearly marked "ASBESTOS CONTAMINATED - WET BEFORE HANDLING". Under no circumstances should contaminated clothing or underclothing or footwear be taken home.

LAM 004680

4.4.4 The decontamination room should be kept clean and orderly at all times and during an asbestos handling operation it should be washed down at frequent intervals.

4.4.5 Smoking, eating or drinking should not be permitted while working with asbestos, or in areas where asbestos is handled or manipulated, or until after decontamination. Before meals and at the end of the working day, workers should remove, clean and store protective clothing in the appropriate locker and take a shower.

4.5 RESPIRATORY PROTECTION

When airborne asbestos fibres are likely to be released into the breathing zone in concentrations in excess of those given in Appendix 1, effective respiratory protection can be provided by use of the following types of equipment.

4.5.1 Breathing apparatus

	MESC. No.
Fresh air hose with blower breathing apparatus (Bloman)	96.58.20.110.1
Compressed air line breathing apparatus	96.58.20.178.1
Self-contained breathing apparatus, open circuit compressed air type	96.58.20.150.1

These have a nominal protection factor of 2000 when used correctly.

The term "nominal protection factor" is derived from a maximum allowed inward leakage of breathing protection equipment and is defined as the ratio of the concentration of contaminant present in the ambient atmosphere to the calculated concentration within the face piece at the maximum allowed inward leakage, when the breathing apparatus is being worn.

4.5.2 Other types of respiratory protection equipment have lower protection factors but may be used where the above mentioned breathing apparatus is not available or unsuitable for a particular type of work.

	Protection Factor	MESC. No.
Positive pressure compressed air supplied hood	1000	96.58.10.125.1
Full-face filter respirator	20 – 50	96.58.20.516.1
Half-face filter respirator	7 – 10	96.58.20.533.1

The last two types depend on a filter to remove airborne fibres, and are negative pressure filter respirators. Their effectiveness depends greatly on the efficiency of the facial seal, as the pressure within the face piece falls below atmospheric pressure during inhalation.

In general it can be stated that the effectiveness of respiratory protection depends on the proper use of the equipment and therefore it is essential that users are carefully trained and instructed and undergo regular re-training.

Respirators require careful supervision and maintenance, with regular changing of pre-filters and filters according to the manufacturer's instructions.

Respiratory protections should be issued and fitted on a personal basis and should be cleaned and serviced regularly. Only respirators which have official approval should be used.

Negative pressure filter respirators depend largely upon the tight fit of the face piece and therefore may be uncomfortable when used. Compressed air line and self-contained breathing apparatus can be comfortably used for extended periods.

For more information on respiratory protection please refer to the "Personal Protection Equipment Guide" (Shell Safety Committee – January 1980).

4.6 ASBESTOS OPERATIONS, INDOORS

Should it be necessary to carry out regular work or prolonged operations involving asbestos within a building, the following arrangements should be made.

4.6.1 The area concerned should be designated an asbestos area and be suitably segregated and sign-posted.

4.6.2 Exhaust ventilation with fine filtration, preferably down to $0.5\ \mu\text{m}$ particle size, should be installed at all operational points where asbestos dust may be involved. The collected dust should be disposed of as described in section 4.8 – "Storage, transport, disposal". Where possible the exhaust gases should be discharged away from occupied areas, e.g. by remote venting.

The purpose of exhaust ventilation is not only to protect the operators from exposure to asbestos dust but also to reduce the contamination of the workplace.

4.6.3 The asbestos area should be designed or modified to eliminate structures and equipment which might collect dust or waste. All surfaces should be impervious as far as this is practicable. In particular, the floor should be impervious or plastic-sheet lined, kept damp at all times and periodically washed down. A water point should be available for this purpose.

4.6.4 Non-asbestos workers should be excluded from an asbestos area.

4.6.5 Extraction ventilation systems should be fitted with filters to remove asbestos dust before emission of extracted air. The air vented from these systems must not be recirculated into any workroom.

4.6.6 The extraction and make-up air systems should be tested regularly by a trained person and the performance recorded in a log book.

LAM 004682

DPMC-02320

4.7 ASBESTOS OPERATIONS, OUTDOORS

Where asbestos handling or manipulation is infrequent and outdoors, e.g. de-lagging operations, the following arrangements should be made.

- 4.7.1 The work area should be isolated to prevent the spread of contamination to other areas and persons, by the use of warning notices, suspended plastic sheeting, ground sheeting and barriers. Preferably the work should be carried out in the "still hours".
- 4.7.2 Non-asbestos workers should be excluded from the area. Persons who are temporarily required to enter or approach the area should wear the stipulated protective clothing and respiratory protection.
- 4.7.3 Extraction ventilation should be used whenever feasible and operated as indicated in section 4.6.
- 4.7.4 Wherever possible all operations should be carried out "wet".

4.8 STORAGE, TRANSPORT, DISPOSAL

- 4.8.1 Where applicable, all storage, handling, transport and disposal activities should comply with existing local or national statutory requirements.
- 4.8.2 Each package of asbestos should be separately labelled "DANGER – ASBESTOS – DO NOT INHALE DUST – HANDLE WITH CARE". It should be transported sealed in plastic bags or sheeting.
- 4.8.3 At the end of the work the area, including contaminated plant structures, should be vacuum cleaned using a fine filtration method (preferably down to 0.5 μm particle size) to contain the collected dust, and then, if feasible, washed down.
- 4.8.4 All waste should be dampened and enclosed in plastic bags. These should be sealed, labelled "DANGER – ASBESTOS – HANDLE WITH CARE – DO NOT OPEN" and disposed of by deep burial at a clearly marked place or by Local Authorities advised on the dangers of such wastes.

5. REFERENCES

- 1. "Recommendations for Handling Asbestos" – E.E.U.A. Handbook No. 33, Engineering Equipment Users Association, 20 Grosvenor Place, London SW1.
- 2. "Asbestos – Safety and Control" – Asbestos Information Committee, 10 Wardour Street, London W1V 3HG.
- 3. "Recommended Code of Practice for handling and disposal of asbestos waste materials" – The Asbestos Research Council, 114 Park Street, London W1Y 4AB.

LAM 004683

DPMC-02321

4. "BS4275. 1974 – Recommendations for the selection, use and maintenance of respiratory protective equipment" – British Standards Institution, 2 Park Street, London W1A 2BS.
5. "Final Report of the Advisory Committee on Asbestos" (1979) – Her Majesty's Stationery Office. London.
6. "Asbestos. Work on Thermal and Acoustic Insulation and Sprayed Coatings" – Health and Safety Commission, HMSO, London.
7. "Monitoring of Asbestos in Air" – Health and Safety Commission, HMSO, London.
8. "Reference method for the determination of airborne asbestos fibre concentrations at workplaces by light microscopy (membrane filter method) RTM-1" – Asbestos International Association, 68 Gloucester Place, London W1H 3HL.
9. Personal Protection Equipment Guide – Shell Safety Committee – January 1980.

APPENDIX I

RECOMMENDATIONS FOR ACCEPTABLE CONCENTRATIONS OF ASBESTOS FIBRE IN AIR

Asbestos fibre-in-air concentrations are expressed in terms of fibres per ml and fibre type (i.e. chrysotile, amosite, crocidolite).

Acceptable concentrations, shown in the following table, are based upon 4 hour samples collected in the breathing zone using the membrane filter method (see ref. 7 and 8).

Fibre Type	Fibre Concentrations fibres per ml
Chrysotile	1
Amosite	0.5
Crocidolite	0.2

Criteria for an asbestos fibre: length greater than 5 μm ,
and
diameter less than 3 μm ,
and
length to diameter ratio greater than 3:1

These recommendations correspond with those of the Advisory Committee on Asbestos (UK) (1979) and are in line with the proposed Directive of the Council of the European Communities on the protection of workers from risk related to exposure to asbestos (26 September 1980).

NOTES ON MATERIALS CONTAINING ASBESTOS

The following comments cover items containing asbestos in common use in the petroleum industry. Where substitute materials are available every effort should be made to adopt them.

Discarded stocks of materials containing asbestos should be disposed of as recommended in Section 4.8 of the main text.

1. **Asbestos Gloves.** Permitted for occasional use only; suitable alternatives are aluminised glass fibre gloves, leather gloves, or tongs.
2. **Asbestos Blankets.** Suitable alternatives are mineral wool or glass fibre blankets.
3. **Fire Suits.** Suitable alternatives are aluminised fibre glass suits, although aluminised asbestos suits are also acceptable. The old style asbestos (uncovered) suits should be replaced as soon as practicable.
4. **Asbestos/cement products** (e.g. roof sheeting, drain pipes etc.). These are acceptable provided water or masks are used during manipulation causing dust e.g. cutting, drilling etc. (see Appendix 4).
5. **Filter mats and gauzes.** These cause little hazard from dust. Alternatives to gauze are open mesh metal gauzes or ceramic fibre equivalents.
6. **Asbestos packing and insulating materials.** Alternatives are ceramic and other asbestos-free materials which should be used wherever technologically acceptable (see Appendix 3).
7. **Gooch crucibles.** There is no hazard if dry asbestos is handled within a fume cupboard.
8. **Gaskets and pre-formed packings.** The hazard is minimal. (see Appendix 4).
9. **Asbestos rope and string.** Suitable alternatives are ceramic fibre materials. (see Appendix 3).

**EXAMPLES OF SUBSTITUTES FOR PACKING AND INSULATING
MATERIALS CONTAINING ASBESTOS**

MATERIAL	SUBSTITUTE	MESC
Jointing		
Asbestos Millboard	Ceramic Fibre Paper	85.22.20.006/394
	Ceramic Fibre Board	85.22.20.012/013
Asbestos Cloth	Glass Fibre Cloth	*85.29.
	Ceramic Fibre Cloth	85.22.10.005.1
Insulating Blocks		
Magnesia	Mineral Wool Blocks	85.62.08.010/060
Asbestos	Glass Wool Slabs	*85.62.
	Ceramic Fibre Blocks	85.62.81.013/050
Insulation Pipe Sections		
Magnesia	Mineral Wool Pipe Sections	85.64.08.063/269
Asbestos	Glass Wool	*85.64.
Insulation Cement		
Magnesia	Vermiculite	77.22.30.205/210
	Ceramic Fibre Cement	77.22.30.005/010
Insulation, Rope and Wrapping		
White Asbestos	Glass Fibre Rope	*85.70.12.
	Ceramic Fibre Rope	85.70.08.004/016

Examples of some "Ceramic Fibre" products are:

- | | |
|------------------|--------------------------------------|
| "Fiberfax" | – The Carborundum Co., U.S.A. |
| | – The Carborundum Co., U.K. |
| "Kaowool" | – Babcock and Wilcox Co., U.S.A. |
| "Cerafelt" | – Johns Manville, U.S.A. |
| "Triton Kaowool" | – Morganite Ceramic Fibre Ltd., U.K. |

For additional and more detailed information on available substitutes for asbestos contact Group Materials, SIPM, MAC/4.

* No complete code number available.

APPENDIX 4

MEASURED CONCENTRATIONS OF ASBESTOS FIBRES IN WORK PLACE AIR DURING VARIOUS OPERATIONS

Because of the variability in work situations and in the conditions of use and friability of asbestos material, it is not possible to give firm figures for dust levels. Some indications of the sorts of levels that could be expected in typical operations are shown in the following table.

OPERATION	ASBESTOS FIBRES (fibres per ml)
Sprayed asbestos – spraying	up to 1000
– stripping and removal	
dry	20 – 100
water sprayed	less than 40
after thorough soaking	less than 5
Stripping and removal of asbestos lagging	
dry dusty	5 – 50
soaked	less than 5
Asbestos cement products	
drilling – indoors	1 – 5
outdoors	less than 2
sawing – circular saw/disc	
dry	5 – 35
wet – water flow	less than 2
hand sawing	2 – 10
jig sawing with local exhaust ventilation	less than 0.5
Handling compressed asbestos fibre products	
gaskets	less than 0.1
preformed packing	less than 0.1
Use of asbestos gloves	less than 0.5
Fire fighting aluminised asbestos lined suits	less than 1

LAM 004688

DPMC-02326

SHELL SAFETY COMMITTEE PUBLICATIONS

Including publications issued by the former Group Industrial Safety Committee which are still available.

- Fire-fighting at tanker terminals (1969)
- * Safety Certificates and Work Permits (1969)
- Hand tools and sparking hazards (1969)
- * Recommendations for protection against ionising radiation hazards (1971)
- * Noise Guide (1972)
- * Noise standards and recommendations on hearing conservation (1972)
(Extracts from the "Noise Guide" for general guidance to Operating Companies on hearing conservation in relation to noise control)
- Electrical Safety (1973)
- Safety incentive schemes (1974)
- Gas-freeing and cleaning of oil storage tanks (1975)
- Safety policy statements (1975)
- Static electricity (1976)
- Welding and Cutting (1976)
- Seat belts (1976)
- The Secondary Use of Containers (1978)
- Guide for reporting accidents and injury data (1979)
- Asphyxiation – The hidden danger (1979)
- Personal Protection Equipment Guide (1980)
- Contractor Safety (1980)
- Safe Handling of Asbestos (1981)

SHELL PRODUCT SAFETY AND OCCUPATIONAL HEALTH COMMITTEE PUBLICATION

LAM 004689

Safe Handling of Benzene (revised March 1980)

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* Under revision

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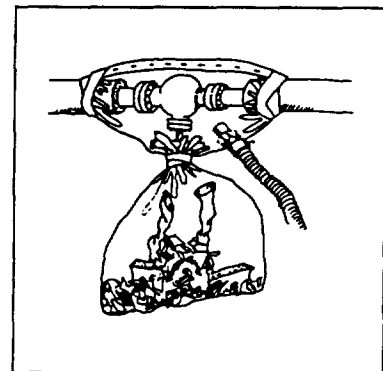
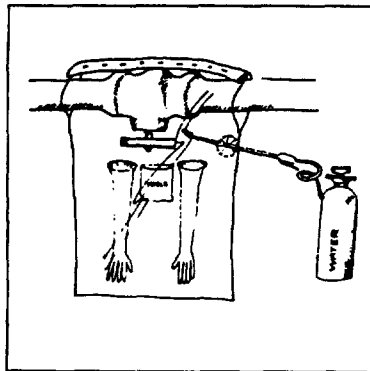
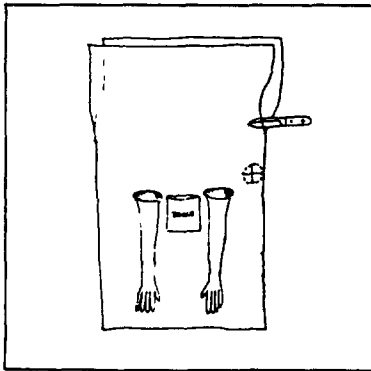
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