Vista Chemical Company

15990 N. Barker's Landing Rd.
Post Office Box 19029

Houston, Texas 77224
Phone (713) 531-3100

XF: Customer Request

November 22, 1985

VISTA

Mr. Ron Bland
Huges Drilling Fluids
10777 Northwest Freeway
Houston, TX 77092

Dear Ron:

This letter is to confirm our discussion regarding the labeling of Vista's ODC Drilling Fluid Base Oil and our hazard determination. You are aware of the OSHA Carcinogenic warning labeling requirement which applies to materials which have been evaluated under valid testing conditions and shown significant positive results or for those which have not been tested but contain greater 0.1% by weight or volume of a known carcinogen. Known carcinogens are defined as those chemicals listed by the National Toxicology Program (NTP), International Agency for Research on Cancer (IARC), Groups I and II, and those which OSHA regulates as a Carcinogen. In some cases evaluation of IARC listed categories is required to determine specific chemicals.

Vista ODC contains no OSHA defined carcinogens, for purposes of the Hazard Communication Standard, at levels greater than 0.1%.

As for the broad categories of "mineral oils", petroleum oils, or other generic classifications of oils which have been indicated to have a carcinogenic potential by various studies we believe the following to be true in respect to Vista ODC. IARC Monograph, Volume 33 (portions attached) classifies petroleum derived oils based on the increasing severity of processing or refinement.

This monograph deals with oils that are predominately lubricant base oils with initial boiling points exceeding 750°F and carbon number distributions of 15 or greater. Vista's ODC has an IBP of 370°F and has a C_{12}-C_{16} carbon number distribution.

Of those oils discussed in the monograph Vista ODC is closest to the white oil (class 5) classification, for which the only evidence for carcinogenicity is of questionable significance to human exposures.

Sincerely,

Thomas G. Grumbles, CIH
Environmental Quality Manager

VVV 000017612

ajo/8
Attachment
cc Dan Plummer, John Nelson, Pat Quinlan

WORLD HEALTH ORGANIZATION
INTERNATIONAL AGENCY FOR RESEARCH ON CANCER

IARC MONOGRAPHS
ON THE
EVALUATION OF THE CARCINOGENIC RISK OF CHEMICALS TO HUMANS

Polynuclear Aromatic Hydrocarbons, Part 2, Carbon Blacks, Mineral Oils (Lubricant Base Oils and Derived Products) and Some Nitroarenes

VOLUME 33

This publication represents the views and expert opinions of an IARC Working Group on the Evaluation of the Carcinogenic Risk of Chemicals to Humans which met in Lyon

7-14 June 1983

April 1984

INTERNATIONAL AGENCY FOR RESEARCH ON CANCER

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IARC MONOGRAPHS

In 1971, the International Agency for Research on Cancer (IARC) initiated a programme on the evaluation of the carcinogenic risk of chemicals to humans involving the production of critically evaluated monographs on individual chemicals. In 1980, the programme was expanded to include the evaluation of the carcinogenic risk associated with employment in specific occupations.

The objective of the programme is to elaborate and publish in the form of monographs critical reviews of data on carcinogenicity for chemicals and complex mixtures to which humans are known to be exposed, and on specific occupational exposures, to evaluate these data in terms of human risk with the help of international working groups of experts in chemical carcinogenesis and related fields, and to indicate where additional research efforts are needed.

This project was supported by PHS Grant No. 1 UO1 CA33193-01 awarded by the National Cancer Institute, DHHS.

ISBN 92 832 1233 9 (soft-cover edition)

ISBN 92 832 1533 8 (hard-cover edition)

PRINTED IN FRANCE

CONTENTS

MINERAL OILS[1]

(LUBRICANT BASE OILS AND DERIVED PRODUCTS)

1. Chemical and Physical Data

1.1 Synonyms and trade names

Mineral oils (general)

Chem. Abstr. Services Reg. No.: 8002-05-9

Chem. Abstr. Name: Petroleum

IUPAC Systematic Name: --

Synonym: Petroleum distillate

In view of problems of nomenclature and of the wide differences in the production, uses and chemical, physical and toxicological characteristics of petroleum refinery materials, a system for defining petroleum crude oil refinery process streams was adopted in 1978 under the US Toxic Substances Control Act (TSCA) and in 1981 under the Commission of the European Communities's Sixth Amendment to the Dangerous Substances Directive - European Inventory of Existing Commercial Chemical Substances (EINECS). Each stream is defined on the basis of petroleum crude oil type, viscosity and process, and is identified by a Chemical Abstract Services (CAS) Registry Number, which identifies its last refining process.

The important refinery streams (most of which are used as lubricant base oils) that are included on the inventories of chemical substances in the USA and Europe are given in Table 1.

[1] A general term that has been used to describe not only material covered in this monograph but crude petroleum and virtually all materials derived from it (e.g., light naphtha, gasoline, kerosene, middle distillates and fuel oils). Within this monograph, the term 'lubricant base oils' is used to refer to the refinery streams and the term 'lubricating oil' to the end product, as marketed, which is sold for lubricating purposes and may or may not contain additives.

Table 1. Properties of lubricant refinery streams as defined by the TSCA Inventory[a]

Chem. Abstr. Name	CAS number[b]	Carbon number distribution	Crude oil type	Viscosity at 40 °C (mm^2/sec)	Boiling range (°C)	Remarks
Crude oil distillation streams						
Light paraffinic distillate	64741-50-0	C15-C30	Paraffinic	<19	-	Contains a large proportion of saturated aliphatic hydrocarbons
Heavy paraffinic distillate	64741-51-1	C20-C50	Paraffinic	≥ 19	-	Contains a large proportion of saturated aliphatic hydrocarbons
Light naphthenic distillate	64741-52-2	C15-C30	Naphthenic	<19	-	Contains few normal paraffins
Heavy naphthenic distillate	64741-53-3	C20-C50	Naphthenic	≥ 19	-	Contains few normal paraffins
Vacuum residuum	64741-49-7	C11-C25	-	-	205-400	
Acid-treating streams						
Acid-treated light paraffinic distillate	64742-21-8	C15-C30	Paraffinic	<19	-	Predominantly saturated hydrocarbons
Acid-treated heavy paraffinic distillate	64742-20-7	C20-C50	Paraffinic	≥ 19	-	Predominantly saturated hydrocarbons
Acid-treated light naphthenic distillate	64742-19-4	C15-C30	Naphthenic	<19	-	Contains relatively few normal paraffins
Acid-treated heavy naphthenic distillate	64742-18-3	C20-C50	Naphthenic	≥ 19	-	Contains relatively few normal paraffins
Acid-treated residual oil	64742-17-2	>C25	-	-	>400	
Chemically neutralized streams						
Chemically neutralized light paraffinic distillate	64742-28-5	C15-C30	Paraffinic	<19	-	
Chemically neutralized heavy paraffinic distillate	64742-27-4	C20-C50	Paraffinic	≥ 19	-	Contains a relatively large proportion of aliphatic hydrocarbons
Chemically neutralized light naphthenic distillate	64742-35-4	C15-C30	Naphthenic	<19	-	Contains relatively few normal paraffins
Chemically neutralized heavy naphthenic distillate	64742-34-3	C20-C50	Naphthenic	≥ 19	-	Contains relatively few normal paraffins
Clay-treating streams						
Clay-treated light paraffinic distillate	64742-37-6	C15-C30	Paraffinic	<19	-	Contains a relatively large proportion of saturated hydrocarbons
Clay-treated heavy paraffinic distillate	64742-36-5	C20-C50	Paraffinic	≥ 19	-	Contains a relatively large proportion of saturated hydrocarbons
Clay-treated light naphthenic distillate	64742-45-6	C15-C30	Naphthenic	<19	-	Contains relatively few normal paraffins
Clay-treated heavy naphthenic distillate	64742-44-5	C20-C50	Naphthenic	≥ 19	-	Contains relatively few normal paraffins
Clay-treated residual oil	64742-41-2	>C25	-	-	>400	
Solvent-refining streams						
Solvent-refined light paraffinic distillate	64741-89-5	C15-C30	Paraffinic	<19	-	Predominantly saturated hydrocarbons
Solvent-refined heavy paraffinic distillate	64741-88-4	C20-C50	Paraffinic	≥ 19	-	Predominantly saturated hydrocarbons
Solvent-refined light naphthenic distillate	64741-97-5	C15-C30	Naphthenic	<19	-	Contains few normal paraffins
Solvent-refined heavy	64741-96-4	C20-C50	Naphthenic	≥ 19	-	Contains few normal

Chem. Abstr. Name

naphthenic distillate
Solvent-deasphalted
dual oil

Solvent-refined resid
oil

Hydrotreating stream
Hydrotreated light pa
nic distillate

Hydrotreated heavy p
finic distillate

Hydrotreated light
naphthenic distillate
Hydrotreated heavy
naphthenic distillate
Hydrotreated residual

White mineral oil
(Liquid paraffin;
pharmaceutical-grade
white oils; food-qualit
oils; technical oils; te
cal white oils)

Petrolatum

Complex-dewaxing streams
Complex-dewaxed ligh
naphthenic oil
Complex-dewaxed hea
naphthenic oil

Extracts
Light paraffinic distilla
solvent extract
Heavy paraffinic distill
solvent extract
Light naphthenic distil
solvent extract
Heavy naphthenic distil
late solvent extract
Residual oil solvent
extract

Solvent-dewaxing strea
Solvent-dewaxed light
paraffinic distillate
Solvent-dewaxed heavy
paraffinic distillate
Solvent-dewaxed light
naphthenic distillate
Solvent-dewaxed heavy
naphthenic distillate

Chem. Abstr. Name	CAS number[b]	Carbon number distribution	Crude oil type	Viscosity at 40 °C (mm^2/sec)	Boiling range (°C)	Remarks
naphthenic distillate			nic			paraffins
Solvent-deasphalted residual oil	64741-95-3	>C25	-	-	>400	Obtained as the solvent-soluble fraction from C3-C4 solvent deasphalting of a residuum
Solvent-refined residual oil	64742-01-4	>C25	-	-	>400	Obtained as the solvent-insoluble fraction from solvent refining of a residuum using a polar organic solvent such as phenol or furfural
Hydrotreating streams						
Hydrotreated light paraffinic distillate	64742-55-8	C15-C30	Paraffinic	<19	-	Contains a relatively large proportion of saturated hydrocarbons
Hydrotreated heavy paraffinic distillate	64742-54-7	C20-C50	Paraffinic	≥ 19	-	Contains a relatively large proportion of saturated hydrocarbons
Hydrotreated light naphthenic distillate	64742-53-6	C15-C30	Naphthenic	<19	-	Contains relatively few normal paraffins
Hydrotreated heavy naphthenic distillate	64742-52-5	C20-C50	Naphthenic	≥ 19	-	Contains relatively few normal paraffins
Hydrotreated residual oil	64742-57-0	>C25	-	-	>400	
White mineral oil (Liquid paraffin; pharmaceutical-grade white oils; food-quality oils; technical oils; technical white oils)	8042-47-5	C15-C50	-	-	-	Obtained by intensive treatment with sulphuric acid and oleum or by hydrogenation
Petrolatum	8009-03-8	>C25	Paraffinic	Semi-solid	-	Predominantly saturated crystalline and liquid hydrocarbons
Complex-dewaxing streams						
Complex-dewaxed light naphthenic oil	64742-76-3	C15-C30	Naphthenic	<19	-	Contains relatively few normal paraffins
Complex-dewaxed heavy naphthenic oil	64742-75-2	C20-C50	Naphthenic	≥ 19	-	Contains relatively few normal paraffins
Extracts						
Light paraffinic distillate solvent extract	64742-05-8	C15-C30	Paraffinic	-	-	Predominantly aromatic hydrocarbons
Heavy paraffinic distillate solvent extract	64742-04-7	C20-C50	Paraffinic	-	-	Predominantly aromatic hydrocarbons
Light naphthenic distillate solvent extract	64742-03-6	C15-C30	Naphthenic	-	-	Predominantly aromatic hydrocarbons
Heavy naphthenic distillate solvent extract	64742-11-6	C20-C50	Naphthenic	-	-	Predominantly aromatic hydrocarbons
Residual oil solvent extract	64742-10-5	>C25	-	-	-	Predominantly aromatic hydrocarbons
Solvent-dewaxing streams						
Solvent-dewaxed light paraffinic distillate	64742-56-9	C15-C30	Paraffinic	<19	-	Obtained by removal of normal paraffins
Solvent-dewaxed heavy paraffinic distillate	64742-65-0	C20-C50	Paraffinic	≥ 19	-	Obtained by removal of normal paraffins
Solvent-dewaxed light naphthenic distillate	64742-64-9	C15-C30	Naphthenic	<19	-	Obtained by removal of normal paraffins
Solvent-dewaxed heavy naphthenic distillate	64742-63-8	C20-C50	Naphthenic	≥ 19	-	Obtained by removal of normal paraffins

Chem. Abstr. Name	CAS number[b]	Carbon number distribution	Crude oil type	Viscosity at 40 °C (mm^2/sec)	Boiling range (°C)	Remarks
Solvent-dewaxed residual oil	64742-62-7	>C25	-	-	>400	Obtained by removal of normal paraffins
Catalytic-dewaxed streams						
Catalytic-dewaxed light paraffinic distillate	64742-71-8	C15-C30	Paraffinic	<19	-	
Catalytic-dewaxed heavy paraffinic distillate	64742-70-7	C20-C50	Paraffinic	≥ 19	-	
Catalytic-dewaxed light naphthenic distillate	64742-69-4	C15-C30	Naphthenic	<19	-	Contains relatively few normal paraffins
Catalytic-dewaxed heavy naphthenic distillate	64742-68-3	C20-C50	Naphthenic	≥ 19	-	Contains relatively few normal paraffins

[a] From US Environmental Protection Agency (1978); TSCA, US Toxic Substances Control Act

[b] CAS number, Chemical Abstract Services Registry Number

1.2 Description

For the purposes of this monograph, the materials described in section 1.1 above and the products derived from them have been categorized into the following eight classes:

Class 1. Vacuum distillates
These may have undergone subsequent finishing steps, such as caustic neutralization, dewaxing, clay treatment and/or mild hydrotreatment. They have not been acid treated or solvent extracted.

Class 2. Acid-treated oils
These may have undergone subsequent finishing steps, such as caustic neutralization, dewaxing, clay treating and/or mild hydrotreatment. They have not been solvent extracted.

Class 3. Solvent-refined-oils (raffinates)
These may have undergone subsequent finishing steps, such as dewaxing, clay treating and/or mild hydrotreatment.

Class 4. Hydrotreated oils

Class 5. White oils and petrolatums suitable for food and/or medicinal use

Class 6. Aromatic oils
6.1 Solvent extracts
6.2 Catalytically cracked oils

Class 7. Miscellaneous materials
7.1 Formulated products
7.2 Used oils

Class 8. Petroleum-derived materials not otherwise classified (not sufficiently described to permit assignment to other classes)

This classification is based on increasing severity of processing or refinement; within each class a range of treatment severities is also possible. Mineral oils in class 7 comprise formulations of various base oils from the previous categories, together with chemical

additives, usually not identified with respect to exact composition. Mineral oils have been assigned to class 8 in cases where they were not sufficiently described for the Working Group to determine a more specific classification.

Throughout this monograph, when the names of lubricant base oils or derived products are used as headings for separate discussions, the class (representing the major processing step) to which the material belongs is given in brackets. In separate discussions of formulated products in which the base oils used to make the products are described, the appropriate classes of those base oils are given.

'Mineral oils' (lubricant base oils and products derived from them) should not be confused with oil distilled from coal and oil-bearing shale. The latter gave rise to the Scottish shale-oil industry from 1850 onwards; however, shale oil was increasingly unable to compete economically with liquid petroleum, although it survived on a small scale until as late as 1960. There was also a small production in Roumania which lasted from 1857 until 1939. Shale-oil production is now minimal, with a small activity in the People's Republic of China, the USA and the USSR.

The refining of petroleum crude oil produces two basic types of product: fuels and lubricating oils. The oils described in this monograph are used primarily as lubricating oils, which are substances intended to reduce friction between surfaces in relative motion. They may also serve other, secondary purposes, including heat transfer, metal processing, corrosion protection, medicinal and food uses, and others. Since the 1930s, nearly all the world's lubricating oils have been produced by refining distillate or residual fractions obtained directly from petroleum crude oils.

Processes used in the refining of lubricant base oils and subsequent product formulation have changed considerably over the years. The trend has been towards highly refined oils with substantially reduced levels of impurities, including polynuclear aromatic compounds. Today, over 74% of lubricant capacity in the USA and Canada is used to produce highly refined base oils.

The chemical composition of lubricant base oils depends both on the original crude substance and on the processes used during refining. With simple refining techniques, the composition of the finished oil used as the base oil in formulated products reflects that of the crude. After severe refining, variations due to crude are less apparent.

Finished base oils are predominantly hydrocarbons but also contain some organic sulphur, oxygen and nitrogen compounds and traces of a number of metal compounds. The hydrocarbons are normally a complex mixture of aromatics, naphthenes (cycloparaffins) and paraffins. The proportions of the different species are responsible for the different characteristics of the base oils. The higher the molecular weights, the more viscous are the oils.

Lubricant refinery streams

Lubricant base oils refined from petroleum crude oils are complex mixtures of straight- and branched-chain paraffinic, naphthenic (cycloparaffin) and aromatic hydrocarbons having carbon numbers of 15 or more and boiling-points in the range of about 300-600°C. Heavier lubricant base oils obtained from residual fractions may have components that boil at as high as 815 °C.

A lubricant refinery stream may be described as generally paraffinic or generally naphthenic, as determined by the source of the crude oil. Paraffinic crude oils are characterized by high wax content, high natural viscosity index (low rate of change in viscosity with temperature) and relatively low aromatic hydrocarbon content. Naphthenic crudes are normally low in wax and relatively high in cycloparaffins and aromatic hydrocarbons.

The various lubricant refinery streams have a wide range of properties. The inventory of chemicals adopted under the US Toxic Substances Control Act (TSCA) and the European Inventory of Existing Commercial Chemical Substances (EINECS) broadly describe the properties of each process stream according to its boiling range, carbon number distribution, crude oil source and viscosity. The properties of the lubricant refinery streams covered by this monograph are presented in Table 1. The viscosity is termed 'light' or 'heavy' on the basis of a maximum viscosity of 20.5 mm^2/sec. (centistokes) at 37.8°C for the 'light' viscosity oils. A stream is further classified according to the last process it has been through; however, such classification does not permit definition of process severity: therefore, it is possible for the same Chemical Abstract Service (CAS) Registry Number to be used for base oils treated to different degrees or by different previous processes (e.g., a hydrotreated distillate may have been either solvent-refined or acid-refined). Consequently, complete characterization of a stream should include its process history (i.e., all the processes it has been through).

White oils [class 5]

Medicinal: Medicinal white oils are highly refined, colourless oils free of all unsaturated compounds, aromatic compounds and other constituents that influence colour, odour, taste and acceptability as a pharmaceutical and food-grade material (World Health Organization, 1982). They can be made from paraffinic or naphthenic crudes with comparable yields; paraffinic medicinal oils generaly have lower specific gravity and volatility than naphthenic oils of the same viscosity (Lecomte *et al.*, 1977) and contain hydrocarbons predominantly with carbon numbers in the range 15-50 (US Environmental Protection Agency, 1978).

Technical-grade: Technical-grade white oils are less refined than medicinal oils; they are colourless oils and are made in several viscosity grades (Shell International Petroleum Company, Ltd, 1966). They can be made from naphthenic or paraffinic crudes (Lecomte *et al.*, 1977).

1.3 Chemical and physical properties

The materials covered by this monograph contain relatively high molecular-weight paraffinic, cycloparaffinic and aromatic hydrocarbons. Consequently, they can undergo a wide variety of characteristic chemical reactions (e.g., oxidation, hydrogenation, halogenation, sulphonation). However, the materials are used primarily for their physical properties, and this section concentrates on those characteristics.

Typical properties of representative lubricant base oils are given in Table 2.

Table 2. Physi

Type
White oils
Paraffinic
Medicinal
Light
Heavy
Technical
Light
Heavy
Naphthenic
Medicinal
Light
Heavy
Base/Process oils
Paraffinic
Light
Heavy
Naphthenic
Light
Heavy
High aromatic
Light
Heavy

[a] Cleveland oper
[b] Viscosity index
number, the less th

1.4 Technical

The compos
1.3, above. Ac
found in lubric
oils are presen

(a) *Medicina*

The majority
controlling the
Pharmacopeia
white oils. The
a viscosity of r

workers were potentially exposed were available in the reports of the epidemiological studies. In another case-control study, an excess of sinonasal cancers was seen in toolsetters, set-up men and toolmakers.

An examination of the incidence of second primary cancer among men with scrotal cancer demonstrated excesses of respiratory, upper alimentary tract and skin cancers; when the occupations were grouped, the excess was largely confined to those with oil exposure.

Excesses of bladder cancer have been reported in case-control studies in several countries among machinists and engineers, who were possibly exposed to cutting oils containing aromatic amines as additives.

With regard to printing pressmen, the Working Group considered the results of three cohort mortality studies (one of these was an extension of another) and two proportional mortality studies. There were three additional proportional mortality studies on manual workers in the newspaper printing industry; one of these included two separately exposed groups at different geographical locations. One of the two cohort studies addressing lung cancer showed an excess (not tested for statistical significance). One of the two proportional mortality studies showed a small, statistically non-significant excess of lung cancer among the newspaper pressmen but no excess among non-newspaper pressmen; the other study did not address lung cancer. One of the three proportional mortality studies on manual workers in the printing industry, not specifically addressing printing pressmen, did not show an increased lung cancer risk, whereas the other two studies (not on independent populations) found a statistically significant excess. One of the two proportional mortality studies of printing pressmen indicated a statistically significant excess of rectal cancers, and the other showed a statistically non-significant increase of colon cancers; the cohort study considering colorectal cancers did not show an increased occurrence. One proportional mortality study among newspaper and other commercial printing pressmen showed a statistically significant excess of cancers of the buccal cavity and pharynx, whereas no such excess was observed in a cohort study. One proportional mortality study among employees in the printing industry (pressmen were not singled out) showed a slight deficit of cancers of the mouth and throat. One case-control study indicated a statistically significant excess of cancers of the buccal cavity and pharynx. The findings regarding other malignancies were inconsistent; scrotal cancers were not mentioned. The type and amount of exposure were usually not described; exposure to both mineral oils and carbon blacks would probably have been involved.

In mortality statistics from the United Kingdom and from Washington State, USA, lung and skin cancer excesses have been registered for jobs entailing exposure to mineral oils; despite limitations of this kind of source as to a causal interpretation, the consistency of such suggestions is worth noting.

4.3 Evaluation[1]

There is *sufficient evidence*[2] for the carcinogenicity in experimental animals of untreated vacuum distillates, acid-treated oils, and aromatic oils, including extracts from solvent treatment of distillates and the high-boiling fraction of catalytically cracked oils [classes 1, 2 and 6].

There is *sufficient evidence*[2] that mildly solvent-refined oils [class 3] are carcinogenic to

[1] See the preamble, pp. 15 and 19 for definitions of italicized terms.

[2] In the absence of adequate data in humans on individual classes of mineral oils, it is reasonable, for practical purposes, to regard fractions for which there is *sufficient evidence* of carcinogenicity in experimental animals as if they presented a carcinogenic risk to humans.

experimental animals. There is *no evidence* that severely solvent-refined oils [class 3] are carcinogenic to experimental animals.

There is *sufficient evidence*[2] that mildly hydrotreated oils [class 4] are carcinogenic to experimental animals; the available data on severely hydrotreated oils [class 4] are *inadequate* to permit an evaluation of their carcinogenicity to experimental animals.

There is *no evidence* for the carcinogenicity to experimental animals of white oils [class 5] when administered by routes other than intraperitoneal injection: when white oils were given by intraperitoneal injection to mice, plasma-cell tumours were produced in repeated experiments. The significance of the latter findings is difficult to interpret.

The data are *inadequate* to evaluate the carcinogenicity to experimental animals of formulated products [class 7.1] as a class, since the possible carcinogenic activity of individual products is dependent upon the severity of processing of the base oils and the nature and concentration of additives.

The data are *inadequate* to evaluate the carcinogenicity to experimental animals of used formulated products [class 7.2] as a class, since the possible carcinogenic activity of individual products is dependent upon the quality of the base oils used, the nature and concentration of additives and contaminants, and the conditions of use.

There is *sufficient evidence*[2] for the carcinogenicity of one sample of used gasoline-engine oil [class 7.2] and *limited evidence* for the carcinogenicity of some cutting oils [classes 7.1 and 7.2] to experimental animals.

There is *sufficient evidence* from studies in humans that mineral oils (containing various additives and impurities) that have been used in occupations such as mulespinning, metal machining and jute processing are carcinogenic to humans.

5. References

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