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Solicitud de patente de Invención denominada **MÉTODO PARA EVITAR PONER EN LIBERTAD ASBESTO DESDE PARTÍCULAS TRANSPORTADAS POR AIRE.**

Solicitantes : Luc BOUCHARD y Lisette VOISINE

Opositor : ETERNIT COLOMBIANA S.A.

Yo, Luis SUÁREZ CAVELIER, obrando como apoderado de los solicitantes lo señores Luc BOUCHARD y Lisette VOISINE en el asunto de la referencia, en atención al Oficio No. 8019 por usted suscrito y notificado por fijación en lista el 28 de Julio de 2006, doy respuesta a la oposición presentada por ETERNIT COLOMBIANA S.A. contra la mencionada solicitud de patente, en los siguientes términos:

1. ETERNIT COLOMBIANA S.A. presentó el 9 de mayo de 2006 oposición contra la solicitud de patente de mis representados, con fundamento en los artículos 14 y siguientes de la Decisión 486, alegando carencia de novedad y altura inventiva.

Aun cuando la Oposición alega la ausencia de los requisitos de novedad y de altura inventiva en la presente invención, resulta pertinente llamar la atención del señor Examinador acerca del hecho de que las argumentaciones en las cuales se fundamenta la oposición no demuestran de ninguna manera cómo y por qué la Invención carece de novedad y nivel inventivo. El Examinador puede notar que el Opositor está más interesado en discutir y desmentir los problemas de

contaminación asociados con los materiales de asbestos, que en controvertir la novedad y la altura inventiva, pues en ninguna parte de su escrito se menciona en qué documento o documentos esta revelada la presente invención o de cuál documento se puede derivar de manera evidente. La oposición no aporta ningún documento como prueba de la alegada falta de novedad y carencia de altura inventiva. El señor Examinador puede comprobar que con el escrito de oposición no se incluyen documentos que constituyan arte anterior de la presente invención, sino que por el contrario, se hace referencia a documentos relacionados con el estudio de los asbestos y su problemática de contaminación. Este hecho resulta relevante en la medida que corrobora que el Opositor no ha podido presentar fundamentos de mérito que puedan desvirtuar la patentabilidad de la presente invención y, por el contrario, sus argumentos desvían la atención a hechos y aspectos que no son discutibles en el momento de analizar la patentabilidad de una invención, como me permito demostrarlo, a continuación.

Primer Argumento del Opositor: la información consignada en la presente invención es equivocada porque los asbestos no son perjudiciales para el ambiente

Afirma el Opositor: ".....La información relacionada en la solicitud de patente, por parte de los peticionarios, es incorrecta, equivocada y se basa en una teoría insostenible e impracticable, induciendo erróneamente a la población a concluir que un producto de alta densidad, como lo es el Crisotilo-Cemento, libera fibras al medio ambiente. Al respecto existen estudios importantes respaldados por la Organización Mundial de la Salud OMS, que demuestran que las mediciones efectuadas en diversos lugares alrededor del mundo, revelan que los techos de cemento - asbestos no emiten fibras al medio ambiente".

Sobre este particular, atentamente me permito señalar al señor Examinador que la información mencionada por el Opositor no existe en ningún aparte de la presente solicitud. En efecto, nada en la descripción

de la presente solicitud hace referencia a la liberación de fibras al medio ambiente de una mezcla de asbestos – cemento, como lo afirma el Opositor. Por consiguiente, es claro que no existe la Intención por parte del solicitante de confundir a la población como lo afirma el Opositor con información que ni siquiera está establecida en la solicitud. De hecho, el señor Examinador puede notar que la página 2 de la descripción de la presente solicitud señala que ***"No obstante, el asbesto sufre de un inconveniente importante: puede originar enfermedades si partículas de asbestos son inhaladas en cantidades críticas mínimas. Puesto que el asbesto es un material frangible que pone en libertad partículas transportadas por aire, las partículas pueden ser inhaladas en cantidades significativas bajo circunstancias específicas"***. Esta cita hace referencia a los Inconvenientes de los **asbestos en general**, no a su mezcla con cemento, como lo afirma de manera incorrecta el Opositor. Este hecho corrobora que el Opositor quiere confundir al Examinador e intenta desviar su atención hacia aspectos que ni siquiera son considerados en la presente solicitud.

Entonces, el señor Examinador se preguntara, ¿por qué el Opositor hace uso de este tipo de argumentación?. La respuesta es sencilla, puesto que con esta afirmación el Opositor tiene la intención de sustentar su cita de un documento de la Organización Mundial de la Salud (OMS) que aparece en la página 4 de la oposición, y en esta medida tratar de asombrar al señor Examinador con supuesta literatura que demuestra que los productos que contienen asbesto no exhiben riesgo para el ambiente o el hombre. Y sobre este particular me permito informar al señor Examinador que se han revisado los contenidos de este documento citado por el Opositor en aras de corroborar la validez de sus informaciones, y hemos encontrado que esta cita del Opositor es tan solo un aparte de dicho documento en el que se realiza una comparación de algunos materiales que contienen asbesto, entre los que se incluye la **mezcla asbesto-cemento** y que son utilizados en la industria de la construcción en donde las concentraciones de fibras liberadas no son superiores a las del medio ambiente (ver página 14, párrafo tercero del documento citado). Ahora bien, si el señor Examinador realiza una

revisión completa de los contenidos de este documento citado por el Opositor, podrá notar que los capítulos 3 a 9 de dicho escrito, (ver índice en las páginas 3 a 5 del documento de la WHO citado por el opositor), se realiza un análisis completo de aspectos relacionados con los efectos en la salud y el medio ambiente de los productos que contienen asbesto. Por ejemplo, si extraemos lo establecido en uno de los apartes de este documento, capítulo 1.5., del Acápite "Efectos sobre animales y células", página 16, párrafo segundo, podemos encontrar que *"En general, los datos toxicológicos disponibles proporcionan evidencia clara de que las fibras de crisotilo pueden causar daño fibrogénico y carcinogénico para los humanos. Los datos, sin embargo, no son adecuados para proporcionar estimativos cuantitativos de los riesgos humanos..."*. Y así, todo el documento citado por el opositor menciona de manera clara los peligros potenciales de los productos que contienen asbesto, lo cual no es un simple mito o un invento del solicitante, sino una realidad sustentada por estudios clínicos, y de notorio conocimiento público. Más aún, si el examinador analiza cuidadosamente el análisis con certificado número 03-013 de fecha 24 de Julio de 2003, que se encuentra en el Anexo B del presente escrito, podrá notar que éste es un análisis cuantitativo de filtros de aire que confirman la presencia de fibras de crisotilo transportadas por aire en un ambiente que contiene fragmentos minerales que contienen crisotilo en estado sólido. Como bien lo puede notar el señor Examinador, las pruebas y los análisis recopilados en este Anexo B están firmados por un Químico certificado. Y en general, cualquier persona sabe muy bien que los asbestos representan un peligro potencial para la salud humana.

Entonces, el señor Examinador puede notar que el Opositor aparentemente centra sus argumentaciones en que el asbesto no constituye un peligro para la salud, pues da la impresión al leer la oposición que el opositor no quiere reconocer que el asbesto libera partículas transportadas por aire nocivas para la salud, pues considera que esto promueve la mala reputación del asbesto. Sin embargo, es un hecho bien reconocido que el asbesto es nocivo para la salud humana, y que algunas aplicaciones han sido prohibidas en algunos países. Por

ejemplo, es sabido que en Canadá, no se permite más el uso de asbestos en construcciones residenciales (por ejemplo, casas).

Ahora bien, si la Oposición se basa en la supuesta carencia de novedad y nivel inventivo de la presente invención, sus alegatos van dirigidos a atacar el problema resuelto por el solicitante, esto es, los peligros de los asbestos para la salud humana y para el medio ambiente. Sin embargo, he de recordar al señor Examinador que el análisis de novedad y nivel inventivo de una invención están reglados por lo establecido en los artículos 14, 16 y 18 de la Decisión 486, y con base en estos preceptos es que se deben orientar los argumentos para demostrar si existen o no **documentos del estado de la técnica** que revelen o puedan hacer obvia la invención. En este orden de ideas, es claro que el documento citado por el Opositor (esto es, WHO-IPCS, ENVIROMENTAL HEALTH CRITERIA 203) no revela, no enseña ni hace obvia la presente invención.

Por lo tanto, solicito al señor Examinador se sirva rechazar esta argumentación del Opositor y el documento citado, toda vez que no constituyen evidencia que pueda desvirtuar la patentabilidad de la presente invención. .

Segundo Argumento del opositor: la información relacionada en la presente solicitud es engañosa dado que el CRISOTILO no es causante de mesoteliomas

En opinión del Opositor, *"Resulta engañosa y equivocada la información relacionada por los solicitantes, en el sentido que el asbesto puede causar mesotieloma, ya que no hace la obligada y necesaria diferencia, que si han hecho las investigaciones técnico científicas, entre los asbestos ANFIBOLES u otras SUSTANCIAS, como el CROSTILO (asbesto blanco) Tipo serpentino, estudios que se encuentran adecuadamente documentados y comprobados internacionalmente y que señalan los ASBESTOS ANFIBOLES como causantes de estas patologías".*

El señor Examinador puede notar que nuevamente el Opositor enfoca su argumentación en el aspecto de desmentir la nocividad del asbesto, sin demostrar cómo es que la presente invención carece de novedad y nivel inventivo con base en documentos del estado de la técnica. Este hecho corrobora que el Opositor no puede sustentar la supuesta carencia de patentabilidad de la presente invención, y solamente recurre a desviar la atención del análisis de patentabilidad a aspectos irrelevantes que nada tienen que ver con la supuesta falta de novedad o la carencia de altura inventiva. En efecto, el Opositor intenta demostrar que los asbestos que presentan peligro son aquellos conocidos como ASBESTOS ANFIBOLES, y no el CRISOTILO que es un asbesto fibroso, en aras de sustentar su argumentación. Sin embargo, para demostrarle al Examinador que esta argumentación también es falsa, me permito llamar su atención sobre los siguientes documentos, de los cuales me permito acompañar copia informal, que señalan que el asbesto, incluyendo el de tipo crisotilo, también exhibe riesgos significativos para la salud humana y el ambiente. Tales documentos son:

(I) Anexo A, en el cual se agrupan varios artículos científicos emanados de la Organización Mundial de la Salud (OMS) y que son representativos de este conocimiento con respecto a los asbestos. Estos artículos son:

- WHO. Hazard prevention and control in the work environment airborne dust WHO/SDE/OEH/99.14, 1999
- Europe Environment and Health Committee. Since 1994 Italy ban production, extraction and commercialization According to Law 257/92.
- Significance of Environmental Asbestos on air Pollution in the Eastern Mediterranean Region. WHO Ammn Jordan, 1999.
- Carcinogenic to humans. Filling, Electromagnetic field and public health (fact sheet No. 263).
- Emergency Preparedness and response Emergency Preparedness and Response. (asbestos-hazards and safe practice for clean-up after tsunami). Filling in WHO.

- WHO Workshop on mechanisms of fibre Carcinogenesis and Assessment of Chrysotile Asbestos substitutes. (8-12 nov. 2005, Lyon, France)

(ii) - Anexo B, en el cual se pueden encontrar los certificados de análisis de laboratorio Nos. 03-013, 03-119, 03-089 y 03-232 realizados por Laboratorios BODYCOTE de Canadá para el solicitante sobre muestras de asbesto, incluyendo crisotilo.

(iii) Boletín informativo publicado en el sitio Web de Internet www.osha.gov/OshDoc/data/AsbestosFacts/asbestos-factsheet-spanish.pdf, Occupational Safety and Health Administration, OSHA, Departamento de Trabajo de los Estados Unidos, Administración de Seguridad y Salud Ocupacional, 2002.

(iv) El documento publicado en el sitio Web de Internet http://www.atsdr.cdc.gov/es/toxfaqs/es_tfacts61.html, Departamento de Salud y Servicios Humanos de los Estados Unidos, Agency for Toxic Substances and Disease Registry (ATSDR), CAS-1332-21-4, Septiembre de 2001.

(v) El documento publicado en el sitio Web de Internet <http://es.wikipedia.org/wiki/Asbesto>, WIKIPEDIA, La Enciclopedia Libre.

(vi) El documento disponible en el sitio Web de Internet <http://www.inchem.org/documents/ehc/ehc/ehc203.htm>, WHO-IPCS. ENVIRONMENTAL HEALTH CRITERIA 203, CHRYSOTILE ASBESTOS, WORLD HEALTH ORGANIZATION, GENEVA, 1998.

(vii) El documento del sitio Web de Internet http://www.who.int/occupational_health/publications/asbestosrelateddiseases.pdf, el cual corresponde a un informe de título "Elimination of Asbestos-related diseases", WHO/SDE/OEH/06.03, Septiembre 2006.

(viii) Internacional Chemical Safety Cards, ICSC 0014, CAS 12001-29-5 Crisotilo, Ficha técnica de seguridad del Crisotilo, disponible en el sitio Web de Internet <http://www.mtas.es/insht/ipcsnspn/nspn0014.htm>.

Por ser asunto notoriamente conocido por el público existen innumerables documentos disponibles que revelan el peligro y la nocividad de los asbestos, incluyendo el crisotilo. Si bien es sabido en el estado de la técnica que los asbestos son materiales fibrosos que se clasifican en dos grupos estructurales generales: los anfíbolos y las serpentinas, a la cual pertenece el crisotilo¹, también es bien sabido que **todos los tipos de asbesto** exhiben peligros potenciales para la salud humana y el ambiente, particularmente cuando las fibras de asbesto son transportadas por el aire. Específicamente, todos los documentos citados anteriormente y los muchos disponibles enseñan claramente que asbestos como el crisotilo producen cáncer en humanos y *mesoteliomas*, lo cual está sustentado por estudios clínicos. Particularmente, de la lectura de los artículos recopilados en el Anexo A se puede colegir que la Organización Mundial de la Salud reconoce que los asbestos son perjudiciales para la salud. De hecho, se puede notar que los asbestos han sido prohibidos en muchos países para muchas aplicaciones.

En este punto de la discusión, el señor Examinador puede notar que el Opositor hace referencia a *"....estudios que se encuentran adecuadamente documentados y comprobados internacionalmente y que señalan los ASBESTOS ANFIBOLES como causantes de estas patologías"*, para lo cual cita documentos de los autores BERRY G y Mc DONALD AD y FRAY, J, para sustentar tal afirmación. Sobre la cita de estos documentos, he de manifestar al señor Examinador que se trata de documentos que no son confiables y son sospechosos, pues provienen de parte interesada y no de una entidad objetiva, toda vez que constituyen soporte bibliográfico para los contenidos de una página Web de Internet disponible de la Industria del Crisolito, la cual es una entidad privada de Canadá que defiende los intereses particulares de las industrias que trabajan con dicho tipo de asbesto. En el medio

¹ MORRIS, C. "DICCIONARIO ENCICLOPÉDICO DE CIENCIA Y TECNOLOGÍA" TOMO I, Letras A-C, 1ª EDICIÓN, PRENTICE HALL HISPANOAMERICANA, S.A. México, 1996, página 177.

económico es bien sabido que Canadá es uno de los mayores productores a nivel mundial de asbesto y el Gobierno Canadiense promueve tal utilización², contradiciendo los lineamientos conocidos sobre los peligros potenciales del empleo de asbesto.

Tercer Argumento del opositor: las afirmaciones de la presente solicitud son ilógicas e inadmisibles.

El Opositor procede a analizar algunos fragmentos de la presente invención para justificar su posición para oponerse a la concesión de la presente invención. Por ejemplo, el Opositor señala que *"La afirmación de los peticionarios para justificar su invento "es entendido en consecuencia que la recolección del asbesto puede ser peligrosa y aún fatal" es inadmisible e ilógica ya que no existen actividades mediante las cuales persona o trabajador alguno se encuentre recolectando fibras de asbesto. Esto puede darse en el supuesto caso de algún accidente evento en el cual ya está estipulado el procedimiento técnico internacional que asegura su control"*.

Es claro que en este caso, el Opositor está tomando totalmente fuera de contexto la afirmación de la solicitud y, por ende, realiza suposiciones y conclusiones falsas como la anterior. Me permito recalcar al Examinador que el solicitante nunca hace referencia a ***la recolección de fibras de asbesto***, como lo señala erróneamente el Opositor. Es obvio que conociendo los peligros toxicológicos potenciales del asbesto, ningún trabajador sería sometido a la recolección de las fibras de asbesto. Es decir, una cosa es la recolección de asbesto por parte del trabajador y otra muy diferente su exposición a fibras de asbesto transportadas por aire. Por consiguiente, es claro que el Opositor intenta confundir con argumentos, tomando fuera de contexto algunos apartes de la solicitud.

Otro de los apartes de la presente solicitud objetados por el Opositor es el que señala: *"que si un objeto hecho con asbesto es dañado durante su uso, puede poner en libertad partículas de asbesto lo cual puede conducir a la inhalación del mismo"*. Sobre este particular, el Opositor

² Kazan-Allen, Laurie, "The Asbestos War", hesa.etulrehs.org, VOL 9/NO 3, JUL/SEP 2003,

manifiesta que vale la pena anotar que en las investigaciones sobre el desprendimiento de fibras, ha surgido la pregunta, de si las propiedades del crisolito pasan por un cambio químico cuando estas se utilizan en productos mezclados con otros materiales. Para sustentar esta argumentación, el Opositor hace uso de las referencias bibliográficas de Jacko Mc et al, EMISIONES DE FRENOS GENERADAS EN LA OPERACIÓN DE VEHICULOS. SOCIEDAD DE INGENIEROS AUTOMOTRICES, REIMPRESIÓN NO. 730-548; 1813-1831; Le Bouffant et al, INFLUENCE D'UN TRAITEMENT THERMIQUE DES FIBRES DE CRISOTILO SUR LEUR COMPARTEMENT DANS LE POUMON. CONTAMINACION ATMOSFERICA 44, MARZO, 1983 ; Pooley FD ASBESTOS BODIES, THEIR FORMATION, COMPOSITION AND CHARACTER, ENVIRONMENTAL RESEARCH 5: 363-369 (1972); y Bridle, J et al., CASITILE, THE NEW ASBESTOS (Bibliografía Incompleta), las cuales menciona en la página 5 de su escrito de oposiciones.

El señor Examinador debe advertir que las referencias de Jacko et al y Bridle J et al, hacen parte del conjunto de referencias bibliográficas que sustentan los contenidos de la página de la Industria del Crisotilo, la cual, como se expuso anteriormente, defiende intereses particulares de la industria del asbesto.

De otra parte, el Examinador puede notar que el párrafo de la solicitud objetado por el Opositor hace referencia únicamente a asbestos, y **no a su mezcla con otros materiales como el cemento**. Si los documentos citados por el Opositor indican que las mezclas de asbesto-cemento han demostrado que se reduce la liberación de fibras de asbesto, también es cierto que el solicitante de la presente invención no está haciendo referencia a las fibras liberadas por mezclas de asbesto, **sino a las fibras liberadas por el asbesto *per se***. En este punto de la discusión, el Examinador puede advertir la intención del Opositor de considerar los párrafos de la presente invención fuera de contexto, el hacer comparaciones erróneas y establecer conclusiones totalmente incorrectas en la Oposición.

Esta argumentación de la Oposición se ha de desestimar porque carece de fundamento, y por cuanto sino porque además intenta atacar los contenidos reales establecidos en la presente solicitud, tergiversándolos al considerarlos fuera de contexto, y presumiendo situaciones falsas.

Cuarto Argumento del Observante: La presente Invención es ilógica e improbable dado que su desarrollo no tiene fundamento.

Continúa el Opositor estableciendo que *"La supuesta invención propone, primero que se moje el asbesto para evitar su volatilidad, pero a continuación procede el calentamiento del asbesto y su incremento subsiguiente de temperatura a diferentes grados, lo que en consecuencia lo secaría de inmediato y continuaría estando volátil, ¿Cuál es entonces en el diagrama la razón para mojarlo primero?"*

Esta argumentación también es completamente falsa y solamente intenta desviar la atención del señor Examinador para mostrar como absurda la solución propuesta por el solicitante,. Sin embargo, para responder a esta argumentación, me permito dirigir la atención del señor Examinador a las páginas 8 y 9 de la descripción en las cuales se señala que cuando el asbesto es recuperado desde sitios de minería, ya sean minas a cielo abierto o de socavón (túneles), éste debe ser empapado con agua durante su extracción, y se deben adicionar grandes cantidades de agua para asegurar el empapamiento adecuado del asbesto que está o se pone en contacto con el aire. Entonces, la razón fundamental para el mojado de este tipo de asbesto extraído de minerías es el hecho de que **el agua previene que el asbesto libere partículas transportadas por aire.** Esta situación es similar a la del polvo que se mantiene en el piso cuando es humedecido. Así, el empapado del material de asbesto en el procedimiento de la presente invención es una etapa temporal empleada principalmente durante el transporte y almacenamiento de los asbestos, antes de que sea sometido térmicamente, de acuerdo con el método descrito en la reivindicación 1. **Claramente que el tratamiento térmico va a generar el secado del material empapado , pero también es cierto**

que con este empapado ya se ha prevenido que se transporten fibras de asbesto en el aire que pueden ser inhaladas por el trabajador. Entonces, a pesar de la intención del Opositor de mostrar el empapado del asbesto como algo innecesario y absurdo, es claro que dentro del contexto de la presente invención dicho empapado tiene una razón técnica justificada.

En el mismo numeral 4 de la Oposición (página 6), el Opositor establece una serie de afirmaciones ilógicas con respecto a costos de producción incrementados en la reducción de la volatilidad de las fibras de asbesto, insinuando que la propuesta del solicitante resultaría ilógica, impracticable y de costos incalculables.

Es incorrecto e inadmisible que el Opositor intente desvirtuar los beneficios y ventajas de la presente invención con base en argumentos que son simples especulaciones, porque estas no reflejan la verdadera dimensión novedosa e inventiva que reviste la presente invención. En efecto, estas afirmaciones del Opositor se alejan considerablemente de lo que realmente sucede en la práctica con la solución propuesta por el solicitante. En efecto, el señor Examinador ha de examinar el contenido de las páginas 9 a 15 de la presente solicitud, en las cuales se enseña a la persona versada en la materia la mejor forma de llevar a cabo la invención y lograr un gran beneficio en la reducción de fibras de asbesto que son transportadas por aire. Además, si en la práctica se requirieran de grandes cámaras, como lo afirma el Opositor, no se entiende como este hecho podría afectar la patentabilidad de la presente invención dado que la Decisión 486 no exige o señala requerimientos especiales sobre la forma como se debe llevar a cabo la invención a nivel industrial, para que esta sea patentable.

Y concluye el Opositor en este mismo numeral 4 de su escrito que *"En conclusión no habría industria usuaria que compraría este tipo de crisotilo ni por precios ni por calidad, razones por las cuales consideramos nos debemos oponer a esta solicitud, que aparte de ser dudosa e improbable, es innecesaria y terminaría siendo utilizada para*

dar mala imagen a una industria que se ha esmerado por estar cumpliendo con toda la normatividad nacional e internacional".

De ninguna manera la presente invención intenta desmeritar el trabajo realizado por la industria del asbesto y sus empleos benéficos en la construcción, frenos, etc. De hecho, el Examinador puede notar en la página 2 de la presente invención que el solicitante reconoce el uso ventajoso del asbesto en numerosas industrias. Si el Opositor hubiera analizado con cuidado la presente invención entendería que su propósito es el de aliviar un problema latente en la manipulación de los asbestos cuando estos liberan fibras transportadas por el aire, y en este sentido, es claro que la presente invención sí sería aplicable y beneficiosa para la industria de asbesto.

De conformidad con lo anterior, es claro que la presente Invención no es dudosa e improbable, dado que fue posible realizarla; y tampoco es innecesaria, como lo afirma el Opositor, porque, de manera contraria, la invención resuelve un problema que demandaba una solución urgente.

Quinto argumento del opositor: estudios técnicos que en su opinión demuestran que los asbestos no representan ningún peligro.

En el numeral 5 de su escrito, el Opositor reseña algunos aspectos técnicos relacionados con el uso del asbesto en mezcla con otras sustancias cuando se emplea en la industria de los frenos. Para tal efecto, el Opositor acude nuevamente a las referencias bibliográficas de Jacko et al y Bridle J et al, citadas anteriormente.

Sobre este particular, me permito reiterar que estas referencias bibliográficas hacen referencia a la mezcla del asbesto con otros materiales, y además hacen parte del sustento del que se vale la Industria del Crisotilo para justificar el empleo del asbesto, particularmente del Crisotilo. Entonces, resulta innecesario entrar a discutir en detalle nuevamente lo expuesto anteriormente con respecto a este tipo de información técnica suministrada por el Opositor.

Además, tampoco es claro cómo esta información del Opositor podría afectar la patentabilidad de la presente invención si nada se dice acerca de la novedad o el nivel inventivo de la misma con base en documentos del estado de la técnica, que es la manera como se debe controvertir mediante la oposición la patentabilidad de la invención.

De otra parte, para el solicitante no es del caso que la solicitud se refiriera a cada uso específico de los asbestos, dado que esto no resulta relevante en vista de la patentabilidad de la presente invención. La cuestión en discusión no es si los asbestos liberarán partículas transportadas por aire después de que está encapsulada en una matriz de cemento, sino que en algunas circunstancias, los asbestos liberarán partículas que representan peligros para la salud. Y esto es, porque a nivel mundial es bien reconocido que los asbestos liberan partículas transportadas por aire que son perjudiciales para la salud en algunas circunstancias y por ende, sería ventajoso tratarlas para prevenir que estas partículas transportadas por aire sean liberadas. Este es el aspecto inventivo de la presente invención y es sobre el cual se deben enfocar los análisis de patentabilidad.

Por consiguiente, esta argumentación del Opositor también carece de fundamento y relevancia para desvirtuar la patentabilidad de la presente invención.

Sexto argumento del Opositor: el procedimiento reivindicado carece de novedad.

Con respecto al procedimiento patentado, el Opositor señala que *"Este procedimiento no tiene nada de novedoso o de invención porque, primero el contenido de dicha teoría es vaga e incierta, no precisa si la partícula es pura (crisotilo) o compuesta, además no hay sustento científico que muestre los cambios o transformaciones alotrópicas garantes de la meta propuesta (volver inocua)"*

El Opositor intenta desvirtuar el procedimiento de la presente invención argumentando que éste no tiene nada de novedoso o de invención con

base en supuestos aún más absurdos y que no tienen nada que ver con los requerimientos de patentabilidad establecidos en la Decisión 486. El artículo 42 de la Decisión 486 permite a terceros que tengan interés legítimo presentar oposiciones contra la patentabilidad de la invención publicada, pero tales oposiciones deben ser fundamentadas para que puedan prosperar. De la misma manera, la Decisión 486, en sus artículos 14, 15 y 16, enseña cuáles son los requisitos de novedad y nivel inventivo que debe cumplir la invención. Entonces, si el Opositor tiene intereses legítimos para oponerse a la presente solicitud, ha debido presentar al Examinador con su Oposición argumentos fundamentados en documentos del estado de la técnica que demostraran que la presente invención estaba contenida en alguno de dichos documentos o que se podía derivar de manera obvia o evidente de los mismos. Sin embargo, el Opositor no lo hizo, no ha presentado un solo documento del estado de la técnica que pudiera poner en riesgo la patentabilidad de la presente invención.

No obstante lo anterior, analicemos cada uno de los fundamentos de esta afirmación del Opositor. Señala que el procedimiento reivindicado no es novedoso porque *el contenido de dicha teoría, es vaga e incierta*. Estas son simples especulaciones, dado que el procedimiento reivindicado si funciona y además es lo suficientemente claro como para que una persona versada en la materia pueda desarrollarlo sin mayor dificultad.

De otra parte, establece que el procedimiento no es novedoso porque *no precisa si la partícula es pura (crisotilo) o compuesta*. Este hecho es irrelevante, dado que la invención claramente está dirigida a solucionar el problema de los asbestos en general. Y como lo indica la solicitud en la página 1, la expresión asbestos es la expresión genérica dada a un grupo específico de seis minerales fibrosos de silicato que existen de manera natural, los cuales incluyen al crisotilo. La invención no está restringida a un tipo específico de asbestos, porque funciona igual para todos los tipos de asbestos.

Finalmente, establece que el procedimiento no es novedoso porque *no hay sustento científico que muestre los cambios o transformaciones alotrópicas garantes de la meta propuesta*. Esta afirmación es incorrecta e irrelevante porque el solicitante sí enseña el mecanismo por el cual se logra el resultado perseguido en virtud de que se altera la polaridad de las fibras de asbesto mediante el tratamiento térmico específico propuesto. En este aspecto, el Opositor debe tener en cuenta que en materia de propiedad Intelectual, las divulgaciones y los resultados presentados por un inventor al Examinador están cobijados por el principio de la buena fe y, por ende, la validez de dichas divulgaciones no pueden ser cuestionadas en una Oposición sin fundamento que carece de toda prueba y que se limita a hacer especulaciones y afirmaciones falsas.

Por consiguiente, atentamente solicito al señor Examinador se sirva desestimar esta argumentación, particularmente porque el Opositor no presenta argumentos ni aporta documentos que permitan determinar porque la presente Invención carece de los requisitos de patentabilidad alegados en la Oposición, como lo requiere expresamente la Decisión 486. De manera contraria, el Opositor alega aspectos que nada tiene que ver con la patentabilidad de la invención.

Séptimo argumento del Opositor: el procedimiento reivindicado no tiene sustento experimental.

El Opositor afirma que la estructura cristalina de los asbestos cambiaría a temperaturas por encima de los 350°C, con el ánimo de sustentar técnicamente la ausencia de un elemento inventivo en el procedimiento de la presente invención.

Sin embargo, me permito manifestar al señor examinador que tampoco puedo estar de acuerdo con esta afirmación del Opositor, toda vez que no es del todo cierto su razonamiento. Para tal efecto, solicito al señor Examinador examinar las pruebas compiladas en el Anexo B, en donde el certificado del análisis No. 03-119 y 03-089, de Abril 24 y Marzo 31/Abril 1 de 2003, respectivamente, muestran fragmentos minerales

que contienen asbestos, los cuales fueron analizados antes de que fueran tratados térmicamente de acuerdo con el proceso de la presente invención. De la misma manera, el certificado de análisis No. 03-232 del 24 de Julio de 2003 muestra los mismos fragmentos minerales que fueron analizados después de que fueron tratados térmicamente de conformidad con el proceso de la presente invención, en el cual se puede observar que los fragmentos minerales han mantenido una composición mayoritaria en asbestos crisotilo. Este hecho experimental refuta claramente la afirmación del Opositor de acuerdo con la cual la estructura cristalina de los asbestos cambiaría a temperaturas por encima de los 350°C; y corrobora el hecho de que el Opositor simplemente se ha limitado a hacer especulaciones sin proporcionar verdadera evidencia experimental que fundamente sus argumentos.

Por ello, la Oposición presentada esta llamada a fracasar, pues sus argumentos carecen de fundamento, y no hay prueba alguna aportada para desvirtuar la patentabilidad de la invención por la supuesta falta de novedad y por una supuesta carencia de altura inventiva. Solamente afirmaciones altisonantes y especulaciones que caracterizan a la Oposición, que en nada pueden afectar la patentabilidad de la presente invención.

CONCESIÓN DE LA PRESENTE INVENCION EN OTRAS JURISDICCIONES

De otra parte, respetuosamente me permito manifestar al señor Examinador que solicitudes correspondientes a la presente solicitud de patente han sido concedidas en muchos países alrededor del mundo, entre los que se incluye las siguientes:

- a) Patente de Estados Unidos de América US 6.929.200 de Agosto 16 de 2005;
- b) Patente Europea No. 1496998 de Agosto 23 de 2006;
- c) Patente de Euroasiática No. 6406 de Diciembre 29 de 2005;
- d) Patente de Sudáfrica No. 2004/7965 de Noviembre 30 de 2005.

Aunque es bien sabido que cada país se rige por su propia legislación en materia de propiedad intelectual, el propósito de la anterior Información es meramente ilustrativo para que el Examinador tenga en cuenta que la presente solicitud si cumple con los requisitos de novedad y nivel inventivo, los cuales son conceptos que cada vez son más estandarizados a nivel mundial, aunque se miren desde legislaciones diferentes. De hecho, hay otras solicitudes de patente pendientes de resolver, y hasta el momento ninguna solicitud de patente ha sido negada.

CONCLUSIÓN

En consecuencia, atentamente solicito a ese Despacho (I) que declare in fundadas las Observaciones impugnadas por carecer de sustentación y de pruebas para demostrar que, efectivamente, la presente invención carece de los requisitos de patentabilidad de los artículos 14, 16 y 18 de la Decisión 486 y (II) que se conceda el privilegio solicitado, dado que la presente invención si posee los requisitos de novedad y nivel inventivo exigidos por la legislación Andina y no fue desvirtuada la patentabilidad mediante la Oposición presentada.

Finalmente, ante los intentos del Opositor por desmentir el peligro potencial de los asbestos, resulta pertinente señalar que en el estado de la técnica el tema de los asbestos es perfectamente conocido por sus riesgos potenciales para producir cáncer en humanos y efectos nocivos al ambiente, de lo cual si existe una amplia lista de documentos disponible.

2. ANEXOS

Anexo me permito presentar ante esa Oficina los siguientes documentos:

(i) Anexo A, en el cual se agrupan varios artículos científicos emanados de la Organización Mundial de la Salud (OMS) y que son representativos de este conocimiento con respecto a los asbestos. Estos artículos son:

- WHO. Hazard prevention and control in the work environment airborne dust WHO/SDE/OEH/99.14, 1999
- Europe Environment and Health Committee. Since 1994 Italy ban production, extraction and commercialization According to Law 257/92.
- Significance of Environmental Asbestos on air Pollution in the Eastern Mediterranean Region. WHO Ammn Jordan, 1999.
- Carcinogenic to humans. Filling, Electromagnetic field and public health (fact sheet no. 263), October 2001.
- Emergency Preparedness and response Emergency Preparedness and Response. (asbestos-hazards and safe practice for clean-up after tsunami). Filling in WHO.
- WHO Workshop on mechanisms of fibre Carcinogenesis and Assement of Chrysotile Asbestos substitutes. (8-12 nov. 2005, Lyon, France)

(II) Anexo B, en el cual se pueden encontrar los certificados de análisis de laboratorio Nos. 03-013, 03-119, 03-089 y 03-232 realizados por Laboratorios BODYCOTE de Canadá para el solicitante sobre muestras de asbesto, incluyendo crisotilo.

(iii) Copia informal del documento publicado en el sitio Web de Internet [www.osha.gov/OshDoc/data AsbestosFacts/asbestos-factsheet-spanish.pdf](http://www.osha.gov/OshDoc/data/AsbestosFacts/asbestos-factsheet-spanish.pdf), el cual corresponde a un boletín informativo de la Occupational Safety and Health Administration, OSHA, Departamento de Trabajo de los Estados Unidos, Administración de Seguridad y Salud Ocupacional, 2002

(iv) El documento publicado en el sitio Web de Internet http://www.atsdr.cdc.gov/es/toxfaqs/es_tfacts61.html, Departamento de Salud y Servicios Humanos de los Estados Unidos, Agency for Toxic Substances and Disease Registry (ATSDR), CAS-1332-21-4, Septiembre de 2001.

(v) WIKIPEDIA, La Enciclopedia Libre, documento publicado en <http://es.wikipedia.org/wiki/Asbesto>,

(vi) El documento citado por el Opositor disponible en el sitio Web de Internet <http://www.inchem.org/documents/ehc/ehc/ehc203.htm>, WHO-IPCS. ENVIRONMENTAL HEALTH CRITERIA 203, CHRYSOTILE ASBESTOS, WORLD HEALTH ORGANIZATION, GENEVA, 1998, páginas 1 a 17.

(vii) El documento del sitio Web de Internet http://www.who.int/occupational_health/publications/asbestosrelateddiseases.pdf, "Elimination of Asbestos-related diseases", WHO/SDE/OEH/06.03, Septiembre 2006.

(viii) Ficha técnica de seguridad del Crisotilo disponible en el sitio Web de Internet <http://www.mtas.es/insht/ipcsnspn/nspn0014.htm>, Internacional Chemical Safety Cards, ICSC 0014, CAS 12001-29-5 Crisotilo.

(ix) Copia Informal de MORRIS, C. "DICCIONARIO ENCICLOPÉDICO DE CIENCIA Y TECNOLOGÍA" TOMO I, 1Letras A-C, 1ª EDICIÓN, PRENTICE HALL HISPANOAMERICANA, S.A. México, 1996, página 177

(x) Copia informal de Kazan-Allen, Laurie, "The Asbestos War", hesa.etuirehs.org, VOL 9/NO 3, JUL/SEP 2003, páginas 1 a 4.

Bogotá, 25 de octubre de 2006.

De la Señora Jefe, atentamente,



Luis SUÁREZ CAVELIER
C.C. No. 19'132.014 de Bogotá
T.P.A. No. 14.441 del C. S. J.

ANEXO A

**Références qui indiquent des danger en ce concerne
l'usage de l'amiante :**

1999 WHO.

***Hazard prevention and control in the work environment airborne dust
WHO/SDE/OEH/99.14***

Europe Environment and Health Committee

***Since 1994 Italy ban production, extraction and commercialization
According to Law 257/92.***

***Significance of Environmental Asbestos on air Pollution in the
Eastern Mediterranean Region.***

WHO Amman Jordan, 1999.

Carcinogenic to humans.

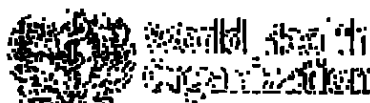
Filling, Electromagnetic field and public health (fact sheet no.263)

***Emergency Preparedness and Response Emergency Preparedness
and Response. (Asbestos-hazards and safe practice for clean-up
after tsunami). Filling in WHO.***

***WHO Workshop on mechanisms of fibre Carcinogenesis and Assessment
Of Chrysotile Asbestos Substitutes.***

(8-12 nov.2005 Lyon France.)

Summary consensus report



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Hazard prevention and control in the work environment: Airborne dust

Executive summary

Purpose

Airborne contaminants can occur in the gaseous form (gases and vapours) or as aerosols, which include airborne dusts, sprays, mists, smokes and fumes. Airborne dusts are of particular concern because they are associated with classical widespread occupational lung diseases such as the pneumoconioses, as well as with systemic intoxications such as lead poisoning, especially at higher levels of exposure. There is also increasing interest in other dust-related diseases, such as cancer, asthma, allergic alveolitis and irritation, as well as a whole range of non-respiratory illnesses, which may occur at much lower exposure levels. This document has, therefore, been produced to aid dust control and the reduction of disease.

Whenever people inhale airborne dust at work, they are at risk of occupational disease. Year after year, both in developed and in developing countries, overexposure to dusts causes disease, temporary and permanent disabilities and deaths. Dusts in the workplace may also contaminate or reduce the quality of products, be the cause of fire and explosion, and damage the environment.

As a matter of social justice, human suffering related to work is unacceptable. Moreover, appreciable financial losses result from the burden of occupational and work related diseases on national health and social security systems, as well as from their negative influence on production and quality of products. All these adverse consequences, which are economically costly to employers and to society, are preventable through measures which have been known for a long time, and which are often of low cost.

The aim of this document is to help educate and train people in the prevention and control of dust in the workplace. It also aims at motivating employers and workers to collaborate with each other, in tandem with occupational health professionals, for the prevention of the adverse effects caused by dust in the workplace. Of course, dust is only one among the many workplace hazards, which include other aerosols (such as fumes and mists), gases and vapours, physical and biological agents, as well as ergonomic factors and psychosocial stresses.

Recognising the problem

Definitions and examples

Dusts are solid particles ranging in size from below 1 µm up to around 100 µm, which may be or become airborne, depending on their origin, physical characteristics and ambient conditions. This document does not deal specifically with other aerosols (such as fumes and mists), with very fine particles resulting from chemical reactions in the air, or with air pollution outside the workplace. However, in many cases similar principles of control apply to these as to dusts.

Examples of hazardous dusts in the workplace include:

- mineral dusts from the extraction and processing of minerals (these often contain silica, which is particularly dangerous);
- metallic dusts, such as lead and cadmium and their compounds;
- other chemical dusts, such as bulk chemicals and pesticides;
- vegetable dusts, such as wood, flour, cotton and tea, and pollens;
- moulds and spores.

Asbestos is a mineral fibre, which is particularly dangerous, and is found, for example, in maintenance and demolition of buildings where it had been used as insulation material.

Size fractions

In occupational hygiene, particle size is usually described in terms of the aerodynamic diameter, which is a measure of the particle's aerodynamic properties. Whether or not an airborne particle is inhaled depends on its aerodynamic diameter, the velocity of the surrounding air, and the person's breathing rate. How particles then proceed through the respiratory tract to the different regions of the lungs, and where they are likely to deposit, depend on the particle's aerodynamic diameter, the airway dimensions and the breathing pattern. If a particle is soluble, it may dissolve wherever it deposits, and its

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[Hazard prevention and control in the work environment: airborne dust \(pdf 1.25Mb\)](#)

The depth of penetration of a fibre into the lung depends mainly on its diameter, not its length. As a consequence, fibres as long as 100 μm , have been found in the pulmonary spaces of the respiratory system.

Dust generation

Unless its generation is prevented or it is removed from the air, dust may move with ambient air and reach even persons who are remote from the source and whose exposure is unsuspected.

Sources of expenditure

- mining, quarrying, tunnelling, stone masonry, construction, and any process which breaks or separates solid materials;
- foundries and other metallurgical processes, especially the cleaning of castings
- sand blasting of moulds;
- any process using abrasive blasting, such removal of paint and rust, cleaning of buildings and small objects, and etching of glass (N.B., use of sand for these processes is often unnecessary, and if uncontrolled can cause serious health impairment, and even fatalities, among the operators, even in a few months);
- manufacture of glass and ceramics;
- handling of powdered chemicals in the chemical, pesticide, rubber manufacturing and pharmaceutical industries;
- agricultural work involving exposure to soil, intensive animal husbandry, dry vegetable products, or agro-chemicals;
- food processing, especially where flour is used;
- any process involving weighing, bagging, bag-emptying or dry transport of powdered or friable materials.

This document is concerned with preventing disease. Nevertheless, safety hazards (which pose immediate danger of accident) cannot be overlooked. Any airborne flammable dust in sufficient concentrations can explode. Combustible dust on the ground may become airborne and increase and propagate an explosion which is started by flammable gas ignition. This can occur with vegetable and organic materials, as well as with metal and other oxidizable dusts. Static electricity can also pose hazards. Preventive measures include good housekeeping to prevent build-up of dust deposits, prevention of ignition, provision of explosion relief valves, dusting with non-flammable dusts, and confinement in low-oxygen environments.

If any dusty process is being carried out, an assessment should be made to establish if people are at risk from dust exposure. This requires looking systematically at the workplace to see whether there is a problem and in general terms what could be done to prevent risk. The assessment should determine:

The walk-through survey will not usually include detailed measurement, although direct-reading instruments may be used to gain a rough picture of the risks present. Obvious and avoidable risks can be dealt with immediately, and schemes exist for using basic substance and use information to decide what controls are appropriate.

The results of quantitative evaluations are usually compared with occupational exposure limits either of the country concerned, or of an international agency, or of some other authority. The evaluation strategy and methods should be those laid down by this authority. The determination of the dust air concentrations to which workers are exposed involves air sampling and further analysis of the collected dust sample, chemically, gravimetrically or microscopically.

Other measurements may be helpful to understand where dust is coming from, or at what moment(s) of the work cycle it is being emitted. These measurements may rely on fast-response direct-reading instruments, but simpler qualitative means such as forward light scattering (dust lamp) techniques to illuminate the dust, or smoke tubes to trace air movement, may be all that is needed. Often, but not always, the workers involved may be able to say where and when dust is emitted. There are systems that combine video imaging with dust concentration measurements, thus allowing the visualization of how exposure changes as workers perform their tasks. This is useful to evaluate the effectiveness of control systems and also to compare different controls (e.g. exhaust ventilation or wet methods).

Control approaches and strategies

- "Plan out" the exposure, by not using hazardous substances, or using them in such a way that no one is exposed;
- If (1) does not completely prevent exposure, then prevent or minimize emission of the substances to the air;
- If it is not possible to prevent exposure by any other method, then give personal protective equipment, including respiratory protective equipment (RPE), to the workers and other persons, as needed.

Control of exposure to dust, alongside other health and safety measures and environmental protection, should be a top priority of the top level management, and workers should continuously be made aware of the risks.

Prevention and control measures should not be applied in an ad hoc manner, but integrated into comprehensive, well-managed and sustainable programmes at the workplace level, involving management, workers, production and occupational health professionals.

Elimination at the source

Elimination at the source can involve three different issues: the production process, the hazardous substance and the work practices. A production process can be changed by applying a production method which generates less dust. This is a sensible approach at the design stage of a production process or when production lines are changed due to the introduction of new product lines.

A hazardous substance may be eliminated by changing the process so that the substance is no longer needed, or by using a less hazardous substance as a substitute. It is, of course, necessary to assess all of the effects of the change, taking into account other hazards such as noise, and any effects on the performance of the product, particularly effects on its safety. If substances are changed, it will be necessary to assess and control any eventual new risks.

If substitution is not feasible, ways should be sought of reducing dust generation. For example, substances might be used as pellets or in liquid suspension, rather than as powders, or, brought in as pre-formed blocks, rather than being cut in the workplace. Any wet method is likely to cause less dust exposure than a dry one. In breaking and drilling, it is much more effective to keep the substance wet at the point of dust generation than to try to capture already airborne dust by spraying it. Moreover, it is necessary to prevent subsequent drying out of dusty material, eventual slipping hazards due to wet surfaces, electrical hazards, and heat stress from the increased humidity. It is also necessary to plan for the adequate disposal of any contaminated liquid effluent.

Containment and ventilation

Containment consists in placing a physical barrier between the substance and people, for example putting a process inside a box. It is usually necessary to have a ventilation system that keeps the enclosure under negative pressure, so that there is no suction at cracks or at points where material moves in or out of the enclosure. The design should be such that maintenance and cleaning can be performed without causing high exposure; unplanned breakdowns, which may tempt workers to open the enclosure, should be foreseen.

It may be satisfactory to partially enclose a process, for example, by having an opening at the front of an enclosure for the operator to reach in (however, the worker's breathing zone should never be between the contaminant source and the hood). Effective design is difficult, because the flow of air into the opening must be sufficient to prevent escape of the airborne material, including when people move across the opening.

Local exhaust ventilation is the removal of airborne contaminants, close to their source of generation or release, before they can spread and reach the worker's breathing zone. For this, it is necessary to ensure that the airflow is sufficient and its direction appropriate, particularly where the process generates air movement, such as a grinding wheel, or a hot process. For the same exhaust volume, the velocity of air being drawn towards the hood opening rapidly decreases with the distance (from the opening); considering that a minimum air velocity is required to ensure the capture of an airborne contaminant, it follows that the hood must be as close as possible to the point of dust generation.

General ventilation is usually desirable to control the temperature and humidity of the environment, and a properly designed system can act as a back-up control of exposure to airborne substances, by providing continual dilution of any accidental emissions. In certain cases, general ventilation can be used to control widely disseminated low toxicity contaminants.

Ventilation must be so designed that movements of personnel and vehicles, or the opening of doors and windows, cannot jeopardise its effectiveness. The design of ventilation systems should always be the responsibility of specially trained professionals. The task is particularly difficult where one fan exhausts from a set of ducts and hoods (multi-hood systems). It is easy to accidentally arrange a system so that very little air is exhausted from one or more of the openings, or to badly design a ductwork system so that it has an unacceptably high resistance to flow. The design of the ductwork must take into account the need for clearing (which may involve exposure of the clearing staff) and the abrasive effect of dust.

It is essential that managers ensure a continual and effective inspection and maintenance programme, so that ventilation systems continue to work as designed, and that workers are properly informed and trained about their use.

It is necessary to ensure that ventilation does not move contaminated air to unsuspecting workers downstream, and that hazardous substances are not exhausted to the general environment in an unplanned and undesirable way. When dealing with toxic contaminants, air cleaning devices must be incorporated in ventilation systems, in order to prevent their discharge to the outside environment, and also to prevent re-circulation to the workplace. The disposal of collected toxic dusts must be controlled so as to minimise exposure of the responsible workers and avoid environmental effects.

Work practices

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workers in good work practices. Video recording of tasks, with simultaneous measurement of airborne concentrations, can be a useful tool for designing and training in adequate work practices. In the case of dusts, it may be effective (and cheaper) to use a dust lamp to make the dust visible, and to use this in conjunction with video filming. Work practices which affect exposure include:

- the manner in which containers are handled and lids removed;
- the care taken in transferring dusty materials;
- work speed; and
- the way in which empty containers are handled.

If the material is likely to offer an ingestion hazard, smoking, eating and drinking in the workplace should be forbidden; such activities should be restricted to designated areas, with adequate washing facilities. Personal care, including tooth brushing, washing hands and cleaning nails, showering and washing hair, before eating and after the work are important measures, whenever there is the possibility of dust contamination. Workers must be properly trained about the hazards and risks from the substances used, the control measures, and any exposure monitoring. The workers are often the people who have the fullest knowledge of what happens during work, and their views should be sought on what leads to exposure and the effectiveness of control.

Personal measures

Every attempt should be made to avoid or minimize exposure by other methods before resorting to personal protective equipment (PPE), especially respiratory protective equipment (RPE). A respirator, particularly of the mask type, is not easy to wear for long periods; it can be very uncomfortable, especially in hot or cramped conditions, and workers may be tempted to remove it. Moreover, uncontrolled airborne dust may spread and affect people who are distant from the task, so it is better to prevent the occurrence of dust exposure in the first place. Another problem is that PPE is fallible, and may not give the protection assumed; moreover, it offers no environmental protection. Finally, PPE and especially RPE must be conscientiously cleaned and maintained to remain effective, which often makes them a costly option; poor maintenance makes any PPE ineffective.

Nevertheless, there may be some operations, such as cleaning and maintenance, where RPE is the only practical control method. It is very important that such equipment be selected by trained personnel, taking into account the type of hazardous materials it should protect from, the nature of the work, the expected exposure, and the facial characteristics of the wearer; proper fit is of paramount importance. Workers, supervisors and maintenance staff must be properly trained in the use, maintenance and limitations of the equipment.

The tasks for which PPE is prescribed should be periodically re-assessed to see if other control measures have become applicable. Gloves and other skin protection are necessary if the dust may pose a hazard through skin absorption or ingestion, or can have a direct effect on the skin.

Substances should only be purchased from suppliers who adequately label containers and who supply adequate material safety data sheets. A management system should ensure that the necessary information is passed on to all who may be potentially exposed. Areas where there is a need for the use of PPE or other precautions should be clearly indicated by warning signs.

Work clothing should not allow the collection of dust; problems such as gathering dust in pockets and shoes should be foreseen. Laundering of clothing contaminated with toxic materials should be done safely, under controlled conditions, never in the homes of workers.

Environmental protection

Prevention and control systems should be designed to protect both workers' health and the general environment. Environmental consequences include the effect of fine particles on atmospheric visibility, damage to buildings, effects on vegetation and animals, and health effects on people outside the plant. As in the workplace, the first priority is to prevent the generation of airborne dust, and, if generation cannot be prevented, then secondly, its removal. Measures that minimize waste generation should be given priority, and any inevitable waste disposal should be so planned as to avoid environmental damage.

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Italy

Chemicals

EU directives on chemicals have been transposed and implemented through decrees issued by the Ministry of Health, which is the national competent authority for chemicals.

Lead

Leaded gasoline is no longer available in Italy.

Hazardous chemicals in toys or other household items
EU Decision 2004/624/CE on banning of PVC toys has been applied, to avoid ingestion of phthalates and other substances in small children. EU directives concerning electric and electronic waste management have also been transposed: they are relevant for children because these categories include products for home entertainment and toys: from July 1st 2006, products containing several heavy metals and hazardous substances will be banned.

Measures to reduce the risks posed by building materials, eg asbestos, creosote, flame retardants etc.
The EU directives concerning these issues (asbestos, flame retardants, creosote) have been transposed.

Asbestos: since 1994 the production, extraction and commercialization of asbestos is banned according to Law 257/92. Asbestos is being eliminated progressively in households and working places and specific laws (DM 2/2/2004 and Deliberation 30 March 2004) have been implemented for workers dealing with the "reclamation of sites". D.M. 248/2004 regulates the management of disposal and technical treatments of waste containing asbestos.

Flame retardants and creosote: the directives on flame retardants have been transposed by DM 17 April 2003, which in particular bans the commercialization, since 15 August 2004, of several substances, including woods containing creosotes; the wood treated with creosote before the ban has restricted uses: it is forbidden to use it on play grounds, inside the households and buildings, in parks and gardens and other spaces open to the public, and to store them near food production areas.

Mercury: a decree by the Ministry of Health in 2003 limits the use of mercury in dental care for small children. It also invites dentists not to use or remove mercury in dental care in pregnant women or in children under 6 years old.

The Rotterdam and the Basel Conventions have been ratified and applied, the provisions of the Stockholm Convention are being

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applied under the framework of the EU Regulation 850/2004, while the ratification is in progress.

Monitoring of levels of chemical contaminants in soil, food and water

- the Italian Legislative Decree Dgls 152/99, modified with the legislative decrees 258/00, foresees the monitoring of chemical substances in inland waters, transitional waters, marine coastal waters and groundwater with the aim to achieve environmental quality objectives for all surface and ground waters.
- The Italian Ministerial Decree 367/03 set environmental quality standard (EQS) for 160 dangerous substances in surface water bodies, the EQS will have to be achieved within two specific deadlines, 2008 and 2015. The 2015 is the same deadline for the achievement of the good chemical status foreseen by the European Water Framework Directive 2000/60/EC.
- The Italian Legislative Decree DL 31/01 foresees the control of chemical substances in drinking water. The Italian Ministerial Decree DM 471/99, regulates the remediation of contaminated sites, foresees the characterisation of contaminated sites through the control of the concentrations of several chemical substances in soil and groundwater.
- On the basis of an agreement between State and Regions, a triennial plan, coordinated by APAT, the national environmental agency, has been approved in 2003 to monitor effects of pesticides in surface and underground waters; a similar initiative has been undertaken by the Ministry of Health to study the exposure of the agricultural population to pesticides and their effects on health.
- The CCM (National Centre of Prevention and Control of Diseases) is instituting an "Observatory on water and health", being the main objective an integrated management of information and monitoring data for a correct assessment of sanitary risk and the surveillance of pathologies.

Monitoring of reproductive health indicators such as congenital malformations, to detect potential hazards. According to the Annual Publication of the State of Health 2003-2004, Italy has six registers of congenital malformations. These registers participate with two international systems of surveillance, the EUROCAT (European Registration of Congenital Anomalies) and the ICBDMIS (International Clearinghouse for Birth Defects Monitoring Systems). A coordination body of these registers collaborates with the National Register of Rare Diseases of the ISS (National Institute of Health).

An important step in acquiring a better overview on the situation was the implementation of Decree no. 349 of 16 July 2001 on the modification of the certification of birth assistance for the gathering of public sanitary data, including malformed births. The CCM intends to strengthen the surveillance of congenital defects.

Other international policies or legislation

The main international policies on chemicals reflected in Italian environmental policy are the following:

- Strategic approach to the international management of

chemicals (SAICM), under definition by UNEP.

- The definition by OECD/UNEP of a harmonized system for classification of chemicals (GHS)
- The REACH regulation proposal by EC for the registration, evaluation and authorization and restrictions of chemicals, currently under examination by the EU Parliament and Council.
- A working group for monitoring of exposure to endocrine disruptors which was established in August 2005, under the framework of the National Commission for Biosafety and Biotechnology: the work will allow to prioritize endocrine disruptors and provide recommendations for further research and possible measures, and will pay a special attention to vulnerable groups such as children.

Radiation

No nuclear power plant has operated in Italy since 1987.

Radon: In April 1998 the previous Department of Prevention of the Ministry of Health instituted a specific "Indoor Commission" with the particular task to elaborate technical guidelines and promote development of prevention activities against indoor pollution.

In September 2001, on the basis of the "Guidelines for the prevention and promotion of health in indoor environments", an agreement among the Ministry of Health, Regions and Autonomous Provinces was established. The agreement consist of three parts/objectives:

- a) description of the territorial situation of indoor pollution with the analysis of the causative factors and actions of prevention or reduction of health risks
- b) programme of indoor pollution prevention, consisting mainly of technical guidelines necessary for the implementation of a National Programme of Prevention
- c) analysis of the actual situation for the management of risk correlated with indoor environment in order to implement the National Programme.

The Environment Agency System (APAT, ARPA, APPA) monitors the indoor radon (According to the Program 2005 of the CCM (National Centre of Prevention and Control of Diseases), and the National Plan of Radon is being implemented.

Noise

A research project committed to ARPAT (Tuscan regional environment agency) is in progress on the issues of exposure to noise assessment methodologies in different exposure scenarios (residential, airport, large infrastructures), to update and review the current procedures. There are also pilot project proposals for the implementation of the methodology in urban areas for noise mapping according to the EU noise Directive. The same environment agency, together with the ASL 10 (Local Health Authority) performed a sample assessment on the noise requirements of secondary schools in the municipality of Florence.

Occupational health

ILO Convention 182 has been ratified with Law 148/2000 and Directive 94/33EC has been transposed by the legislative decree 345/99. This law covers the protection of adolescents ranging from age 15 to 18 in working places.

Child labour is not too big a problem in Italy. According to Italian law, work is forbidden for children less than 15 years old. Sometimes it is possible to find some kind of illegal situations in which children work in agriculture sector or in some commercial activities (mainly restaurants), but this factor has a strict correlation with the economical activity of the head of the family.

Identification of actions, at national level, to reduce the risk factor of occupational health of children and the elimination of child labour is undertaken through a network of the Ministry of Health, the Ministry of Labour, the Ministry of Education, the organizations responsible of children's protection in consultation with stakeholder such as employers, Universities, medical professionals and experts of security.

See the web sites of L'Istituto superiore per la prevenzione e la sicurezza del lavoro - ISPESL; Ministero del Lavoro della Politiche Sociale.

Waste

All EU directives on waste management have been transposed.

Natural disasters and flooding

Five seismic events occurred in different parts of the country, one of which involved some young victims due to the collapse of a school building in San Giuliano, Molise, in 2002. Other natural events occurred which required an emergency response such as:

- Nine cases of hydro-geological instability of which five followed with landslides and one with the collapse of public buildings;
- Six major landslides (excluding the ones mentioned in the previous point);
- Nine big floods;
- One flood in some parts of the Po river.

There were also some volcanic events like the eruption of the Etna (2001-2003) and the Stromboli (2002-2003) volcanoes, the latter accompanied by an abnormal wave due to a landslide of its underwater slope.

Besides the victims of the school in San Giuliano, there are no available data on the impacts of floods or other natural events on children and adolescents.

Early warning system

As far as floods are concerned, Italy has developed an early warning system for hydro- geological risk prevention. This system is foreseen in the Law 27.02.04 (Dir. P.C.M. 27.02.04). The main points of the Law are:

- the definition and creation of a network of the Institutional Authorities competent in activities of forecast and prevention of hydro-geological risk and management of emergencies;
- the establishment of the means and modalities for the collection and analysis of data concerning the rising and evolution of hydro-geological risks and its spread to the competent Authorities;
- organize the national alerting system. See the [Civil Protection website](#).

Skin cancer

Special information campaigns are underway to reduce the exposure of children to UV radiation.

AIRT (Associazione Italiana Registri Tumori) created a cancer registry. AIRT, together with the CCM (National Centre of Prevention and Control of Diseases), is further developing the registry and turning it into a national network, in order to facilitate the gathering of information and to better involve the southern Regions of Italy.



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World Health Organization

World Health Organization
Regional Office for the Eastern Mediterranean
Regional Centre for Environmental Health Activities
CEHA

World Health Organization
Regional Office for the Eastern Mediterranean
Regional Centre for Environmental Health Activities
CEHA
Amman, Jordan, 1999

SUMMARY

An appraisal of the general aspects regarding asbestos fibers in environmental ambient air has been undertaken, taking account of the situation in the Eastern Mediterranean Region where information was available. This was provided through the preparation of a background document giving the broad situation in the Region together with answers received from a questionnaire sent to the Member States in the Region. Asbestos in environmental air has been considered in outdoor as well as indoor situations in relation to exposure to the general public; the situation regarding occupational exposure related to the workplace was excluded. Much of the asbestos being currently used in the Region would appear to be in the form of chrysotile (white) asbestos often as asbestos-cement products where only minimum release of asbestos fibers is probable; some older different types of product will exist providing for the opportunity for possible somewhat higher exposures to chrysotile but more importantly in some cases, to amphibole forms of asbestos including crocidolite and amosite. It could be that aspects of the control of asbestos in the Region involved in manufacturing, in asbestos removal from buildings and asbestos disposal, are in some instances inadequate regarding the release of potentially undesirable quantities of asbestos fibers contaminating the environmental air. The sources of environmental asbestos, types of asbestos and products made and used, potential asbestos air pollution problems, the fate of airborne asbestos, measurement and concentrations in air, exposure of the public to asbestos and possible health risks, and control aspects have each been addressed. Relatively little detailed information was available regarding the countries in the Region which manufacture asbestos products or the products currently being used there and those used in the past. Where good control is utilized it would appear that any risk of possible health effects resulting from present-day exposure to the small quantities of asbestos in environmental ambient air should be exceedingly low; this conclusion is in accordance with what in general the World Health Organization has reported regarding any risk due to asbestos in environmental air as being 'undetectably low'. Taking account of the currently available information on asbestos in environmental ambient air and some knowledge of the situation in the Eastern Mediterranean Region, it seems most unlikely that there would be any widespread undesirable health effects as a result of the general public inhaling environmental asbestos in ambient air. There would appear to be a need however (a) to study the aspects of

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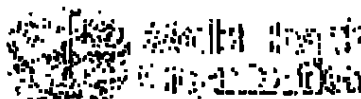
A consensus of standards for wastewater reuse in the Eastern Mediterranean Region. 24/4/2006

A consensus of drinking-water quality standards in the Eastern Mediterranean Region. 24/4/2006

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Fact sheet N°263
October 2001

Electromagnetic fields and public health: extremely low frequency fields and cancer

In 1996, the World Health Organization (WHO) established the International Electromagnetic Fields (EMF) Project to address the health issues associated with exposure to EMF. The EMF Project is currently reviewing research results and conducting risk assessments of exposure to static and extremely low frequency (ELF) electric and magnetic fields. WHO plans to conduct an evaluation of all health effects from ELF field exposure in 2002-3.

Electromagnetic fields and public health: extremely low frequency
Full text

Whenever electricity is conducted through transmission lines, distribution lines or is used in appliances, both electric and magnetic fields exist close to the lines or appliances. The power frequency used is 50 or 60 Hz. Use of electric power has become part of everyday life. However, questions have been raised as to whether these and other ELF fields are carcinogenic.

The International Agency for Research on Cancer (IARC) — a specialized cancer research agency of WHO — has recently concluded the first step in WHO's health risk assessment process by classifying ELF fields with respect to the strength of the evidence that they could cause cancer in humans.

This Fact Sheet updates findings of recent reviews on the health effects of static and ELF electric and magnetic fields conducted by IARC (June 2001), by the Health Council of the Netherlands (May 2001), and by an expert Advisory Group of the National Radiological Protection Board in the United Kingdom (AGNIR) (March 2001).

IARC EVALUATION

In June 2001, an expert scientific working group of IARC reviewed studies related to the carcinogenicity of static and ELF electric and magnetic fields. Using the standard IARC classification that weighs human, animal and laboratory evidence, ELF magnetic fields were classified as possibly carcinogenic to humans based on epidemiological studies of childhood leukaemia. Evidence for all other cancers in children and adults, as well as other types of exposures (i.e. static fields and ELF electric fields) was considered not classifiable either due to insufficient or inconsistent scientific information.

"Possibly carcinogenic to humans" is a classification used to denote an agent for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence for carcinogenicity in experimental animals.

This classification is the weakest of three categories ("is carcinogenic to humans", "probably carcinogenic to humans" and "possibly carcinogenic to humans") used by IARC to classify potential carcinogens based on published scientific evidence. Some examples of well-known agents that have been classified by IARC are listed below:

Classification	Examples of agents
Carcinogenic to humans (usually based on strong evidence of carcinogenicity in humans)	Asbestos Mustard gas Tobacco (smoked and smokeless) Gamma radiation
Probably carcinogenic to humans (usually based on strong evidence of carcinogenicity in animals)	Diesel engine exhaust Sun lamps UV radiation

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Possibly carcinogenic to humans

(usually based on evidence in humans which is considered credible, but for which other explanations could not be ruled out)

Coffee

Skyscrapers

Gasoline engine exhaust

Welding fumes

ELF magnetic fields

DO ELF FIELDS CAUSE CANCER?

ELF fields are known to interact with tissues by inducing electric fields and currents in them. This is the only established mechanism of action of these fields. However, the electric currents induced by ELF fields commonly found in our environment are normally much lower than the strongest electric currents naturally occurring in the body such as those that control the beating of the heart.

Since 1979 when epidemiological studies first raised a concern about exposures to power line frequency magnetic fields and childhood cancer, a large number of studies have been conducted to determine if measured ELF exposure can influence cancer development, especially leukaemia in children.

There is no consistent evidence that exposure to ELF fields experienced in our living environment causes direct damage to biological molecules, including DNA. Since it seems unlikely that ELF fields could initiate cancer, a large number of investigations have been conducted to determine if ELF exposure can influence cancer promotion or co-promotion. Results from animal studies conducted so far suggest that ELF fields do not initiate or promote cancer.

However, two recent pooled analyses of epidemiological studies provide insight into the epidemiological evidence that played a pivotal role in the IARC evaluation. These studies suggest that, in a population exposed to average magnetic fields in excess of 0.3 to 0.4 μT , twice as many children might develop leukaemia compared to a population with lower exposures. In spite of the large number data base, some uncertainty remains as to whether magnetic field exposure or some other factor(s) might have accounted for the increased leukaemia incidence.

Childhood leukaemia is a rare disease with 4 out of 100,000 children between the age of 0 to 14 diagnosed every year. Also average magnetic field exposures above 0.3 or 0.4 μT in residences are rare. It can be estimated from the epidemiological study results that less than 1% of populations using 240 volt power supplies are exposed to these levels, although this may be higher in countries using 120 volt supplies.

The IARC review addresses the issue of whether it is feasible that ELF-EMF pose a cancer risk. The next step in the process is to estimate the likelihood of cancers in the general population from the usual exposures and to evaluate evidence for other (non-cancer) diseases. This part of the risk assessment should be finished by WHO in the next 18 months.

INTERNATIONAL GUIDELINES

International guidelines on exposure limits for all EMF have been developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) - a non-governmental organisation (NGO) in official relations with WHO and a partner in WHO's International EMF Project. While the ICNIRP guidelines for EMF exposure are based on comprehensive reviews of all the science, the limits are intended to prevent health effects related to short-term acute exposure. This is because ICNIRP considers the scientific information on potential carcinogenicity of ELF fields insufficient for establishing quantitative limits on exposure.

SOME NATIONAL RESPONSES

Regulatory policies for agents classified as possible carcinogens vary by country and by particular agent. The carcinogenic evaluation and classification of an agent by IARC does not automatically trigger a national regulatory response. While gasoline exhaust and coffee have been classified as possible human carcinogens, there has been a significant response by government to reduce gasoline engine exhausts, but there has not been any effort to limit intake of coffee.

In response to increasing public concern over health effects from EMF exposure, several countries have established their own scientific reviews prior to the IARC evaluation. Already in 1988, a working group examining the issue for the US National Institute of Environmental Health Sciences (NIEHS) classified ELF magnetic fields as possibly carcinogenic to humans. The US government agency has since recommended "passive regulatory action", described as continual information and education of the public and encouraging power utilities to voluntarily reduce exposure to people where possible.

In the United Kingdom, an Advisory Group on Non-Ionizing Radiation recently reported to the National Radiological Protection Board (NRPB) on the topic of power frequency EMF and the risk of cancer (2000-14 10:1

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to magnetic fields can increase the risk of leukaemia in children. Further, they provided research recommendations. The Health Council of the Netherlands, a major scientific advisory body of the Netherlands government, reached similar conclusions.

WHO'S RESPONSE

While the classification of ELF magnetic fields as possibly carcinogenic to humans has been made, it remains possible that there are other explanations for the observed association between exposure to ELF magnetic fields and childhood leukaemia. In particular, issues of selection bias in the epidemiological studies and exposure to other field types deserve to be rigorously examined and will likely require new studies. WHO therefore recommends a follow-up, focused research programme to provide more definitive information. Some of these studies are currently being undertaken and results are expected over the next 2-3 years.

WHO's EMF Project aims to help national authorities balance the benefits of electrical technology against possible health risks, and to help them decide what protective measures may be needed. It is especially difficult to suggest protective measures for ELF fields because we do not know what field characteristic might be involved in the development of childhood leukaemia and therefore need to be reduced, or even if it is the ELF magnetic fields that are responsible for this effect. One approach is to have voluntary policies that aim to cost-effectively reduce exposure to ELF fields. This has been discussed in the WHO Backgrounder issued March 2000.

Some precautionary measures are outlined below:

FURTHER READING

- **Government and industry:** These entities should be cognizant of the latest scientific developments and should provide the public with balanced, clear and comprehensive information on potential EMF risks, as well as suggestions for safe and low cost ways to reduce exposures. They should also promote research that will lead to better information from which assessments of health risk can be made.
- **Individuals:** Members of the general public might choose to reduce their EMF exposure by minimizing the use of certain electrical appliances or by increasing distance to the sources that can produce relatively high fields.
- **Consultation with local authorities, industry and the public when siting new power lines:** Obviously power lines must be sited to provide power to consumers. Siting decisions are often required to take into account aesthetics and public sensitivities. However, siting decisions should also consider ways to reduce peoples' exposure.
- **An effective system of health information and communication among scientists, governments, industry and the public is needed to help raise general awareness of programmes to deal with exposure to ELF fields and reduce any mistrust and fears.**
- **AGNIR (2001) Advisory Group on Non-ionizing Radiation, Power Frequency Electromagnetic Fields and the Risk of Cancer.** National Radiological Protection Board (UK) 2001.
- **Health Council of the Netherlands (2001).** Electromagnetic fields: Annual Update 2001.
- **ICNIRP (1998) International Commission on Non-ionizing Radiation Protection Guidelines for limiting exposure to time varying electric, magnetic and electromagnetic fields (up to 300 GHz).** Health Physics 74(4), 494-522.
- **Portier CJ and Wolfe MS (eds.),** National Institute of Environmental Health Sciences of the National Institute of Health. Assessment of health effects from exposure to power-line frequency electric and magnetic fields. NIEHS Working Group Report, Research Triangle Park, NC, USA, NIH Publication No. 98-3981, 1998.
- **Rapachelli M and Greenbaum B (eds.),** Interaction of static and extremely low frequency electric and magnetic fields with living systems: health effects and research needs. Bioelectromagnetics 1999; 20: 133-160.
- **WHO Backgrounder on Cautionary Policies, March 2000**

RELATED LINKS

- [The International Electromagnetic Fields Project](#)
- [Electromagnetic fields](#)

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Asbestos - hazards and safe practice for clear-up after tsunami

What is asbestos?

The term "asbestos" is used for a group of naturally occurring minerals that take the form of long thin fibres and fibre bundles. These minerals have great tensile strength, conduct heat poorly and are relatively resistant to chemical attack. Asbestos is non-biodegradable.

The principal varieties of asbestos are chrysotile (known as white asbestos) a serpentine mineral, and crocidolite (blue asbestos), amosite (brown asbestos), anthophyllite, tremolite and actinolite, all of which are amphiboles. The chrysotile form is the one most commonly used now.

How is asbestos used?

Asbestos is widely used throughout the world, particularly in building and insulation materials. Typical uses include:

- :: Boilers and heating vessels
- :: Cement pipe
- :: Clutch, brake, and transmission components
- :: Conduits for electrical wire
- :: Pipe covering
- :: Roofing products
- :: Duct and home insulation
- :: Fire protection panels
- :: Furnace insulating pads
- :: Pipe or boiler insulation
- :: Sheet vinyl or floor tiles
- :: Underlay for sheet flooring.

Why is asbestos a problem?

Damage to asbestos-containing material can result in the release of small asbestos fibres that become airborne and are readily inhaled. These fibres can remain in the lungs for long periods and can cause serious lung disease.

Asbestos is not acutely toxic. Oral intake of asbestos fibres is not known to be harmful to human health.

What are the health concerns?

The principal health concerns are the development of asbestosis, lung cancer, pleural thickening and mesothelioma. These diseases have long latency periods, in the order of 10-50 years.

Asbestosis: This is a slowly developing and progressive scarring of the lungs caused by the inhalation of high concentrations of asbestos dust and/or long exposure. The elasticity of the lungs is reduced and also their ability to exchange gases. The result is decreased lung volume, increased resistance in the airways and reduced oxygenation of blood. It is associated with occupational rather than environmental exposure. Advanced asbestosis is often associated with lung cancer, especially among smokers.

Lung cancer: The risk is related to the nature of the occupational exposure and also to smoking: smokers have a higher risk of developing lung cancer than non-smokers when exposed to asbestos.

Diffuse pleural thickening This is a non-malignant disease in which the lining of the lung (pleura) becomes scarred. Small areas of scarring are called pleural plaques. The disease is a chronic condition with no cure.

Mesothelioma This is a malignant tumour of the pleura or peritoneum. It is linked with exposure to all types of asbestos. As well as being an occupational hazard, it may develop in non-occupationally exposed people living in the same household as asbestos workers or in the vicinity of strong asbestos emission sources.

What is a safe level of exposure?

Asbestos is a proven human carcinogen (IARC Group 1). No safe level can be proposed for asbestos because a threshold is not known to exist¹. The greater the exposure, the greater the risk of developing lung disease, therefore exposure should be kept as low as possible. A number of occupational exposure limits have been set:

The USA Occupational Safety and Health Administration (OSHA) standard for asbestos in the workplace is² 0.1 fibres/ml of air as an 8-hour Time Weighted Average.

The UK Health and Safety Executive has set the following exposure limits³:

- For the amphibole asbestos minerals (amosite, crocidolite, fibrous actinolite, fibrous tremolite and fibrous anthophyllite, or any mixture of these with chrysotile):
 - Short-term exposure limit: 0.6 fibres/ml averaged over any continuous 10 min
 - Long-term exposure limit: 0.2 fibres/ml averaged over any 4 h
- For chrysotile:
 - Short-term exposure limit: 0.9 fibres/ml averaged over any continuous 10 min
 - Long-term exposure limit: 0.3 fibres/ml averaged over any 4 h

What sort of activities will cause the release of asbestos fibres?

Most asbestos materials pose little risk unless they are damaged or disturbed in some way that releases fibres into the atmosphere.

Low-density materials, such as asbestos-containing thermal insulation for pipes and boilers, some wall or ceiling plasters, some ceiling tiles, are friable and can crumble under hand pressure. These materials can release high concentrations of fibres when damaged or disturbed e.g. during maintenance, renovation or demolition work.

High-density, hard materials in which asbestos fibres are embedded in a matrix, such as asbestos cement pipes and sheets, floor tiles, and ceiling materials are less likely to release fibres.

Sawing, drilling, crushing, scraping and sanding asbestos containing materials are particularly likely to release respirable fibres and dust.

Small diameter fibres and particles may remain suspended in the air for a long time and be carried long distances by wind or water before settling down.

Table 1 shows data on likely concentrations of asbestos fibres provided by the UK Health and Safety Executive based on exposure monitoring.

Table 1: Likely fibre concentrations of resulting from different kinds of work on asbestos containing materials³

Job	Likely fibre concentrations (fibre/ml)
Asbestos cement containing only chrysotile	
Machine grinding with exhaust ventilation (LEV)	Up to 2
Hand sawing asbestos cement with LEV	up to 1
Machine cutting asbestos cement without exhaust ventilation	up to 25
Asbestos insulating board (AIB) containing amosite asbestos	

Careful removal of whole AIB	up to 3
Breaking and ripping out AIB	5 to 20
Hand sawing AIB	5 to 10
Asbestos removal and handling	
Well-conducted controlled wet stripping using manual tools (unless a dry patch is hit or lagging becomes detached)	up to 1
Well-conducted controlled wet stripping using power tools (unless a dry patch is hit or lagging becomes detached)	up to 10
Stripping pipe or vessel lagging - partially wetted or dry steam solvent	up to 100

What are the risks in the post-tsunami clean-up?

During the clean-up damaged and destroyed buildings after the tsunami it is likely that there will be a need to handle and break up and dispose of asbestos-containing building and insulation materials. Much of this work may be undertaken by volunteers and local residents who are unaware of the hazards of asbestos and who may be unable to identify asbestos-containing material.

How can risks be minimised?

The main principles of safe handling are to⁴:

- identify the locations of asbestos-containing materials and carry out a risk assessment
- ensure that people involved in clean-up work are adequately informed of the risks and the methods of best practice;
- minimise the disturbance of asbestos containing materials;
- minimise the release of respirable asbestos in the atmosphere by wetting;
- minimise the extent to which people have contact with asbestos; and
- ensure that waste is securely stored and adequately labelled.

Disposal of asbestos-containing materials^{2,4}

These materials should be disposed of by properly trained personnel.

Transport asbestos waste in bulk. During transportation ensure that containers remain covered or sealed so that dust and fibres do not escape.

Asbestos-containing materials can be disposed of in landfill sites provided these have appropriate measures to prevent release of asbestos fibre, e.g. a liner and a system for leachate collection.

Ensure that a record is kept of the location of this waste, including exact geographical coordinates.

NB:

- Do not mix with other waste prior to disposal
- Do not dispose of in a location where there is already asbestos containing material
- Do not dispose of in a location where there may be future construction of landfill components, such as machine hardwells or gas extraction wells.

DO NOT dispose of by burning.

Suggested actions are^{2,4}

Worker protection:

1. Provide simple and easy-to-understand information for people involved in clean-up work that

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describes what asbestos is, where it might be found, what the hazards are, and how to handle and dispose of it safely.

2. Trained personnel should inspect sites where there may be asbestos-containing materials to identify the type of materials, the hazard that they present and the safest course of action (e.g. to seal and leave in place, to remove). Friable materials present a particular hazard and should be removed by trained personnel following accepted procedures, with adequate personal protective equipment.
3. As a minimum provide workers with gloves, goggles, disposable clothing or replacement clothing (so that workers do not take contaminated clothing home) and disposable dust masks. Contaminated clothing and protective equipment should be disposed of in the same way as other asbestos containing materials.
4. Provide washing facilities for workers. Ensure that they are aware of the need to wash before eating, drinking or smoking and before returning home.

General Protection

5. Restrict access to sites where there are piles of building debris, and to demolition sites and waste sites. In particular, keep children away.
6. Try to keep any manipulation of asbestos-containing materials to a minimum. Asbestos structures should be dismantled as gently as possible. If it is necessary to move, saw or break up such materials, keep them thoroughly wet to reduce the amount of airborne fibres and dust. Take particular care with friable materials.
7. Clean surfaces contaminated with asbestos-containing materials using wet methods. Do not dust or sweep or use a domestic vacuum cleaner because this will puff fibres and dust up into the air.
8. Keep piles of asbestos-containing materials covered e.g. with tarpaulins or sheets of plastic until they can be safely stored or disposed of. Wet thoroughly before moving the materials.
9. Store asbestos-containing waste material in suitable containers until it can be disposed of safely. Containers can be drums of metal, plastic or fibre, or strong polyethylene bags (ideally put one bag inside another, sealing each with tape). Label the containers in the local language and a hazard warning, e.g. "DANGER CONTAINS ASBESTOS FIBRES, HARMFUL IF INHALED, MAY CAUSE CANCER, KEEP SEALED, AVOID CREATING DUST".

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3. Health and Safety Executive, 2003, Selection of Suitable Respiratory Protective Equipment for Work with Asbestos (INDG288(rev 1)) <http://www.hse.gov.uk/pubns/indg288.pdf>
4. WHO Regional Office for Europe 2000, Asbestos and Health, 2nd edition. Local authorities, health and environment briefing pamphlet series, 25

Other sources

International Chemical Safety Card 0014: Chrysotile
<http://www.inchem.org/documents/icsc/icsc/icsc0014.htm>

International Chemical Safety Card 1314: Crocidolite
<http://www.inchem.org/documents/icsc/icsc/icsc1314.htm>

Environmental Health Criteria 53, 1986, Asbestos And Other Natural Mineral Fibres
<http://www.inchem.org/documents/ehc/ehc/ehc53.htm>

Environmental Health Criteria 203, 1998, Chrysotile Asbestos
<http://www.inchem.org/documents/ehc/ehc/ehc203.htm>

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Last updated: 03 May 2006

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31 January 2006



WORLD HEALTH ORGANIZATION

**WHO Workshop on Mechanisms of Fibre Carcinogenesis and Assessment of
Chrysotile Asbestos Substitutes
8-12 November 2005, Lyon, France**

SUMMARY CONSENSUS REPORT¹

Introduction

1. The WHO Workshop on Mechanisms of Fibre Carcinogenesis and Assessment of Chrysotile Asbestos Substitutes was convened at IARC in Lyon, in response to a request from the Intergovernmental Negotiating Committee (INC) for the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Annex 1). The substitutes considered by the WHO workshop included the 12 chrysotile substitutes identified by the INC for priority assessment by WHO, 2 substances from a second list provided by the INC to be assessed if resources allow, and one further substance for which data was submitted in response to WHO's public "call for data" for the workshop.

2. The workshop opened on 8 November with a one-day session devoted to taking statements from observers mainly representing various commercial interests, along with some government observers and the Rotterdam Convention Secretariat. In addition a statement submitted by a labour organisation was read by the workshop Secretariat. Observers were invited to submit any comments on the pre-workshop working drafts in writing. Invited specialists and observers did not participate the evaluations of the substitutes (Part 2 of the following report), or the final agreement of Part 1. A list of participants appears at Annex 2.

Part 1: Methodological Aspects

3. The workshop considered the mode(s) of action of fibre carcinogenesis and the developments in the field after the IARC 1996 report, but did not produce a formal assessment of the state of the art. The workshop established a framework for hazard assessment based on: epidemiologic data (whether data are sufficient to determine carcinogenicity); in vivo animal data (whether there is a indication of carcinogenicity or lung fibrosis); mechanistic information (whether critical indicators of carcinogenicity exist, e.g. positive results for genotoxicity in *in vitro* tests); and physico-chemical and biopersistence data as determinants of dose at the target site and possible indicators of carcinogenic potential. The workshop conclusions on each of these factors appear in the following paragraphs.

¹ This report contains the collective views of an international group of experts, and does not necessarily represent the decisions or the stated policy of the World Health Organization.

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4. In light of the workshop scope to assess fibrous forms of the substitutes, the workshop confined its considerations to effects related to cancer, focusing on lung cancer, mesothelioma and lung fibrosis. Further, noting that substitutes may be used in a variety of applications with different exposure potential, either alone or in combination with other substances, the workshop did not embark on risk assessment, but rather, limited its work to assessing the hazard.

5. Epidemiologic studies on fibres have a clear advantage over toxicological studies in that they involve studies of humans. They also have the advantage that they study the effects of exposure in the real world where the effects of these exposures may be mitigated or enhanced by other factors. Despite these obvious advantages, the presence or absence of evidence of risk from epidemiologic studies does not always override contrary findings from toxicological studies. The interpretation of either positive or non-positive epidemiologic findings needs to be carefully considered in light of the strengths and weaknesses of the study design.

6. In *in vivo* animal studies, carcinogenic response (lung cancer, mesothelioma) and fibrosis were considered to be the key effects; epithelial cell proliferation and inflammation were not regarded to be equally important indicators of human health hazard. From studies with asbestos, it is apparent that the sensitivity of the rat inhalation studies to fibre induced lung tumours is clearly lower than that of humans. This holds true when the effect is related to exposure concentrations and lung burdens. The workshop discussed the hypothesis that differences in sensitivity could be due to greater lung mass and/or longer life span in humans, however the question remains open as to whether this sensitivity difference remains if individual or rat or human lung cells are taken as a basis for comparison. In comparison, testing of fibres by intraperitoneal injection represents a useful and sensitive assay, which also avoids confounding effects of particle size.

7. Genotoxic potential in experimental systems can be assessed via cell-free *in vitro* assays, *in vitro* tests with cultured cells, and via *in vivo* studies, usually in mice or rats. Fibres may act in principle on all steps in tumour development. However, of these interactions the *in vitro* genotoxicity tests are mainly indicative of genotoxic effects involved in the first steps of tumour initiation. Effects related to bio-persistence of fibres (such as continuous "frustrated phagocytosis") and secondary genotoxicity arising from reactive oxygen species and reactive nitrogen species and mitogen released by macrophages and inflammatory cells are not detected in routinely used genotoxicity tests. Therefore, negative results indicate a lack of primary genotoxicity, but do not exclude effects on later steps of carcinogenesis. A completely inert fibre that could be used as a negative control in the above-mentioned assays has not been identified.

8. The chemical composition of the substitutes is a key factor influencing structure and physico-chemical properties, such as surface area, surface reactivity, solubility, etc. Attention should be paid not only to the chemical composition of the fibres, their major and trace elements, but also to contaminants or accompanying elements, including their speciation. Fibre-derived free radical generation favours DNA damage and mutations. Surface properties are a determining factor in the inflammatory response. In relation to fibre dimension and deposition, one can assume that there exists a continuous variation on the carcinogenic potency of respirable fibre,

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which increases with length. Biopersistence of a fibre increases tissue burden, and therefore, may increase any toxicity the fibre might possess. For synthetic vitreous fibres, there is evidence in animals that the potential for carcinogenicity increases with biopersistence. This has not been demonstrated however for other fibres.

9. For all fibres, the fibres must be respirable to pose an appreciable hazard. Respirability is usually determined by diameter and density, thus with a given fibre diameter a higher specific density is associated with lower respirability (note the specific density of most organic fibres is lower than the specific density of inorganic fibres).

Part 2: Hazard Assessment

10. The workshop decided to group substances roughly into hazard groupings of high, medium and low. However for some substances there was insufficient information to draw any conclusion on hazard and in this case the workshop categorized the hazard as indeterminate (a category which is not comparable to the other groupings). The hazard groups high, medium and low should be considered in relation to each other, and did not have reference to formal criteria or definitions, as such. For details of each substance, the reader is referred to the full workshop report (to be published subsequently). It is important to note that for each substance, the fibre dimensions of commercially available products may vary and the workshop did not assess this variation. The substances are listed below in alphabetical order.

11. para-Aramid releases respirable fibres with dimensions similar to known carcinogenic fibres. p-Aramid fibres have induced pulmonary effects in animal inhalation studies. Biopersistence was noted. The workshop considered the human health hazard to be medium.

12. Most natural deposits contain attapulgite fibres which are $< 5 \mu\text{m}$ in length and at workplaces the mean fibre length was less than $0.4 \mu\text{m}$. The hazard from exposure to respirable attapulgite is likely to be high for long fibres, low for short fibres. This assessment is mainly based on findings in long-term inhalation experiments in animals, in which tumours were seen with long fibres; no tumours were seen in studies with short fibres.

13. The nominal diameter of carbon fibres ranges from 5 to $15 \mu\text{m}$. Workplace exposure in production and processing is mostly to non-respirable fibres. The workshop considered that the hazard from inhalation exposure to these fibres to be low.

14. Most cellulose fibres are not respirable; for these the hazard is low. For respirable fibres, the available data do not allow the evaluation of the hazard; the hazard is then indeterminate.

15. The dimensions of graphite whiskers indicate high respirability and they have a long half time in the lungs. However in the absence of any further useful information, the hazard from inhalation exposure was considered to be indeterminate.

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16. Magnesium sulphate whiskers did not induce tumours in limited inhalation and intratracheal administration studies, were negative in limited short term tests, and are very quickly eliminated from the lung. It was discussed whether the hazard grouping should be low or indeterminate, and on the basis of the data available, in the time available, consensus was not reached.

17. For respirable polyethylene, polyvinyl chloride, and polyvinyl alcohol fibres, the data was insufficient for hazard classification, and the working group thus considered the hazard indeterminate.

18. In facilities producing polypropylene fibres, exposure to respirable fibres occurs. After intratracheal administration, respirable polypropylene fibres were highly biopersistent, however no fibrosis was reported in a sub-chronic animal study. However the data are sparse and the human health hazard potential was considered to be indeterminate.

19. The workshop considered that respirable potassium octatitanate fibres are likely to pose a high hazard to humans after inhalation exposure. At workplaces there is exposure to respirable fibres. There was a high and partly dose-dependent incidence of mesothelioma after intraperitoneal injection in two species (high incidence indicating high potency). There is evidence of genotoxicity. Biopersistence was noted.

20. Wool-like synthetic vitreous fibres (including glass wool/fibrous glass, mineral wool, special purpose vitreous silicates, and refractory ceramic fibres) contain respirable fibres. For these fibres, the major determinants of hazard are biopersistence, fibre dimensions and chemical/physical properties. It was noted that the available epidemiologic data are not informative, due to mixed (vitreous fibre) exposures or other design limitations. Based on inhalation exposure studies, intraperitoneal injection studies and biopersistence studies, it was concluded that the carcinogenic hazard could vary from high to low, with high for the biopersistent fibres and low for non-biopersistent fibres.

21. Natural wollastonite contains respirable fibres. In occupational settings exposure is mainly to short fibres. In chronic studies wollastonite did not induce tumours after intraperitoneal injection in animals; however, samples of wollastonite were active in different studies for genotoxicity. After considering this apparent discrepancy it was concluded that the hazard was likely to be low.

22. In a limited study with intraperitoneal implantation xonotlite did not induce tumours. After intratracheal injection in a chronic study no inflammatory or fibrotic reaction of the lung was observed. The chemical composition of xonotlite is similar to wollastonite, but it is more rapidly eliminated from the lung. The workshop considered the human health hazard to be low.

Further Information

The full report of this workshop will be published after scientific and language editing.

ANEXO B

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**CERTIFICAT D'ANALYSE
RAPPORT 03-013 VERSION 1.0**

Cliant :	M. Luc Bouchard et Mme Lisette Voisine	Numéro B.C. :	C.O.D.
Notre Projet :	03-180578	Votre Projet :	Non applicable
Date Réception :	Les 17 et 19 juin et 14 juillet 2003	Date Rapport :	Le 24 juillet 2003

**CARACTÉRISATION MINÉRALOGIQUE DE FIBRES (>5µm)
PAR MICROSCOPIE ÉLECTRONIQUE À TRANSMISSION**

Six (6) échantillons sur fibre d'air de cellulose mélangés ont été reçus pour l'analyse de fibres >5µm par microscopie électronique à transmission (MET) et dispersion des énergies en rayons-X.

Les préparations microscopiques ont été obtenues par méthode directe. Un segment du fibre fut clarifié et transféré sur une grille de microscopie électronique (Cu; 200 mesh) en utilisant une résine dans un film de carbone. Les grilles ont été observées dans le mode transmission avec un microscope Philips 420 équipé d'un spectromètre permettant la prise de spectres dispersifs en énergies des rayons-X (Grazing/EDAX) de fibres individuelles. Seule une analyse qualitative est possible pour le type d'échantillons reçus. Les résultats se résument comme suit :

Échantillons d'air :

LB/LV-1	Fibres d'amiant de type CHRYSOTILE ¹	Non applicable	Non applicable
LB/LV-2B	Fibres d'amiant de type CHRYSOTILE ¹	Non applicable	Non applicable
LB/LV-3	Fibres d'amiant de type CHRYSOTILE ¹	Non applicable	Non applicable
LB/LV-4	Fibres d'amiant de type CHRYSOTILE ¹	Non applicable	Non applicable
LB/LV-5	Fibres d'amiant de type CHRYSOTILE ¹	Non applicable	Non applicable
LB/LV-6	Fibres d'amiant de type CHRYSOTILE ¹	Non applicable	Non applicable

¹ Fibres respirables : fibres plus longues que 5 microns et avec un diamètre de moins de 3 microns ainsi qu'un rapport longueur-diamètre supérieur à 3 pour 1.

² Fibres totales : fibres plus longues que 5 microns.

³ Fibres démontrant la morphologie et composition chimique de l'amiant de type chrysotile.

Analysé par :

Marie Gravelle
Marie Gravelle, B.Sc., Chimiste



Notes : Le présent certificat ou rapport appartient aux échantillons analysés. Ce certificat ne peut être reproduit, tout ou en partie, sans la permission écrite de Bodycote Essais de Matériaux Canada Inc. Le laboratoire n'est pas responsable de la validité des résultats lorsqu'un résultat rapporté par le client. Le laboratoire n'est pas responsable de la responsabilité de l'interprétation finale.

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CERTIFICAT D'ANALYSE

RAPPORT # 03-232 VERSION 1.0

Cliant :	Luc Bouchard et Lisette Voisine	Nom du B.C. :	C.O.D.
Nbre Projet :	03-180579	Votre Projet :	Non disponible
Date réception :	Le 19 juin et 14 juillet 2003	Date analyse :	Le 24 juillet 2003

CARACTÉRISATION MINÉRALOGIQUE EN MICROSCOPIE POLARISANTE ET DISPERSION DE COULEURS MÉTHODE IRSST 244-2

Trois (3) échantillons ont été soumis pour fins d'analyse par microscopie polarisante et dispersion de couleurs. Les échantillons ont été préparés et observés en respectant la méthode suivante :

Un fragment de chaque échantillon a été isolé. Selon le cas et afin d'extraire les fibres, les échantillons ont subi un léger broyage mécanique. Les particules et les fibres produites ont été transférées sur lames, recouvertes d'une lamelle et baignées dans des liquides d'indices de réfraction appropriés afin d'observer la dispersion de couleurs. Les propriétés optiques orthoscopiques et conoscopiques des échantillons sont également utilisées si elles permettent de compléter la caractérisation. Les résultats se résument comme suit :

J-3 (Après Traitement)	
Roche grise	
Fibres d'amiante CHRYBOTILE	70 - 75 %
Autres fibres minérales (brucite)	Traces
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	20 - 25 %

J2-2 (Après Procédé)	
Roche grise	
Fibres d'amiante CHRYBOTILE	65 - 70 %
Autres fibres minérales (brucite)	Traces
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	25 - 30 %

VRAC-1 (Après Procédé)	
Matériau friable en vrac gris	
Fibres d'amiante CHRYBOTILE	70 - 75 %
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	20 - 25 %

Analysé par :

Martin Gravelle, B.Sc. Chimiste



Notes : Il est reconnu que l'analyse par M.P. ne peut détecter l'amiante dans un faible pourcentage d'échantillons contenant de l'amiante. Donc, un résultat négatif par M.P. ne peut pas être garanti. Cette méthode analytique est semi-quantitative. La limite d'appreciation de la méthode varie de <1 % à 100 % (M.P.). BNTC signifie que les échantillons analysés sont « non détectés », « traces » ou « 100 % » selon l'analyse par M.P. Le présent certificat ne rapporte seulement que les résultats analysés. Ce certificat ne peut être reproduit, tout ou en partie, sans la permission écrite de BNTC. La responsabilité n'est pas assumée de la précision des résultats lorsqu'une interprétation physique des phases est requise. Le laboratoire n'est pas responsable de la représentativité de l'échantillon (BNTC). Les échantillons sont conservés pour une période de 60 jours à partir des instructions écrites de client.



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CERTIFICAT D'ANALYSE
RAPPORT # 03-119 VERSION 1.0

Cliant :	Luc Bouchard et Lisette Vézina	Nom du B.C. :	G.O.D.
Notre Projet :	03-150579	Votre Projet :	Non disponible
Date réception :	Le 24 avril 2003	Date analyse :	Le 24 avril 2003

**CARACTÉRISATION MINÉRALOGIQUE EN MICROSCOPIE
POLARISANTE ET DISPERSION DE COULEURS
MÉTHODE IRSST 244-3**

Quatre (4) échantillons ont été soumis pour fins d'analyse par microscopie polarisante et dispersion de couleurs. Les échantillons ont été préparés et observés en respectant la méthode suivante :

Un fragment de chaque échantillon a été isolé. Selon le cas et afin d'extraire les fibres, les échantillons ont subi un léger broyage mécanique. Les particules et les fibres produites ont été transférées sur lames, recouvertes d'une lamelle et baignées dans des liquides d'indice de réfraction appropriés afin d'observer la dispersion de couleurs. Les propriétés optiques orthoscopiques et conoscopiques des échantillons sont également utilisées si elles permettent de compléter la caractérisation. Les résultats se résument comme suit :

J2-1	
Roche grise et verte	
Fibres d'amiante CHRYSTOTILE	80 - 85 %
Autres fibres minérales (brucite)	< 1 %
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	1 - 5 %

J2-2	
Roche grise et verte	
Fibres d'amiante CHRYSTOTILE	80 - 85 %
Autres fibres minérales (brucite)	< 1 %
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	1 - 5 %

Bodycote

Client :	Lus Bouchard et Lielle Veillee	Numéro R.C. :	C.O.D.
Nbre Projet :	03-180579	Votre Projet :	Non disponible
Date réception :	Le 24 avril 2003	Date analyse :	Le 24 avril 2003

J2-3	
Roche grise et verte	
Fibres d'amiante CHRYSOTILE	80 - 85 %
Autres fibres minérales (brucite)	< 1 %
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	1 - 5 %

VRAC-1 *	
Matériel en vrac gris	
Fibres d'amiante CHRYSOTILE	70 - 75 %
Autres fibres minérales (brucite)	Traces
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	20 - 25 %

* En raison du volume important de l'échantillon soumis, seule une petite portion a été analysée.

Analysé par :

André Garand
André Garand, Technicien

Vérifié par :

Martin Gravelle
Martin Gravelle, B.Sc. Chimiste



Notes : Il est reconnu que l'analyse par MLP ne peut évaluer l'existence dans un échantillon d'éléments autres que l'amiante. Donc, le résultat négatif par MLP ne peut pas être garanti. Cette méthode analytique est semi-quantitative. La détection d'impuretés de la méthode varie de <1 % à 100 % (pp). SNTD suppose que les concentrations supérieures à ces limites, à l'exception de <1% » sont analysées par ICP. Le présent certificat est approuvé uniquement pour les échantillons analysés. Ce certificat ne peut être reproduit, sauf en totalité, sans la permission écrite de SNTD. La responsabilité n'est pas assumée de la présence des matières lorsqu'une opération physique des échantillons est requise. Le laboratoire n'est pas responsable de la reproduction de l'information fournie. Les échantillons doivent être analysés dans les 60 jours de la date de réception des échantillons.

Bodycote

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CERTIFICAT D'ANALYSE

RAPPORT # 03-089 VERSION 1.0

Client :	Les Bouchard et Lisette Volsine	Numéro B.C. :	C.O.D.
Nbre Projet :	03-180579	Votre Projet :	Non disponible
Date réception :	Le 31 mars 2003	Date analyse :	Le 31 mars et le 1 avril 2003

CARACTÉRISATION MINÉRALOGIQUE EN MICROSCOPIE POLARISANTE ET DISPERSION DE COULEURS MÉTHODE IRSST 244-2

Huit (8) échantillons ont été soumis pour fins d'analyse par microscopie polarisante et dispersion de couleurs. Les échantillons ont été préparés et observés en respectant la méthode suivante :

Un fragment de chaque échantillon a été isolé. Selon le cas et afin d'extraire les fibres, les échantillons ont subi un léger broyage mécanique. Les particules et les fibres produites ont été transférées sur lames, recouvertes d'une lamelle et baignées dans des liquides d'indice de réfraction appropriés afin d'observer la dispersion de couleurs. Les propriétés optiques orthoscopiques et conoscopiques des échantillons sont également utilisées si elles permettent de compléter la caractérisation. Les résultats se résument comme suit :

J-1	
Roches gris et vertes	
Fibres d'amiante CHRYSTOLE	55 - 60 %
Autres fibres minérales (brucite)	Traces
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	35 - 40 %

J-2	
Roches gris et vertes	
Fibres d'amiante CHRYSTOLE	65 - 70 %
Autres fibres minérales (brucite)	Traces
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	25 - 30 %

J-3	
Roches gris et vertes	
Fibres d'amiante CHRYSTOLE	75 - 80 %
Autres fibres minérales (brucite)	Traces
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	15 - 20 %

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Cliant :	Luo Bouchard et Uovita Velina	Membre B.C. :	C.O.D.
Nbre Projet :	03-150579	Votre Projet :	Non disponible
Date réception :	Le 31 mars 2005	Date analyses :	Le 31 mars et le 1 avril 2005

J-4	
Roche gris et vert	
Fibres d'amiante CHRYSOÏLE	65 - 70 %
Autres fibres minérales (brucite)	Traces
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	25 - 30 %

LC-1	
Roche gris et vert	
Fibres d'amiante CHRYSOÏLE	45 - 50 %
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	45 - 50 %

LC-2	
Roche gris et vert	
Fibres d'amiante CHRYSOÏLE	25 - 30 %
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	65 - 70 %

LC-3	
Roche gris et vert	
Fibres d'amiante CHRYSOÏLE	25 - 30 %
Autres fibres minérales (brucite)	Traces
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	65 - 70 %

LC-4	
Roche gris et vert	
Fibres d'amiante CHRYSOÏLE	35 - 40 %
Fibres organiques naturelles (cellulose)	Traces
Particules anguleuses, fragments et autres	55 - 60 %

Analysé par :

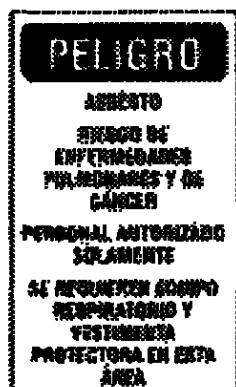
Annie Garand
Annie Garand, Technicienne

Vérifié par :

Martin Gravelle
Martin Gravelle, B.Sc. Chimiste



Notes : Il est reconnu que l'analyse par MJP ne peut donner l'analyse dans un même pourcentage d'incertitude concernant les résultats. Donc, les résultats obtenus par MJP ne peuvent pas être garantis. Cette méthode analytique est semi-quantitative. La précision d'application de la méthode varie de <1 % à 100 % (p/p). BNTC suggère que les données soient rapportées comme « non détecté », « traces » ou « <1% » selon les exigences du client. Le présent certificat ne s'applique qu'aux échantillons analysés. Ce certificat ne peut être reproduit, tout ou en partie, sans la permission écrite de BNTC. Le laboratoire n'est pas responsable de la précision des résultats lorsqu'ils sont utilisés pour des prises de décision. Le laboratoire n'est pas responsable de la représentativité de l'échantillon analysé. Les échantillons sont analysés pour les fibres de 5 à 10 µm ou selon les instructions du client.



OSHA HOJA Informativa

¿Qué es el asbesto?

Asbesto es el nombre de un grupo de minerales de origen natural que se utilizan en varios productos, como el material de construcción y los frenos de automóvil, con el fin de resistir al calor y la corrosión. El asbesto incluye el crisotilo, la amosita, la crocidolita, el asbesto de tremolita, el asbesto de antofilita, el asbesto de actinolita así como cualquiera de estos materiales que hayan sido tratados o modificados químicamente.

¿Cuáles son los peligros de exposición al asbesto para los trabajadores?

La inhalación de fibras de asbesto por los trabajadores puede provocar serias enfermedades en los pulmones y en otros órganos que pueden no aparecer hasta años después de ocurrir la exposición. Por ejemplo, la asbestosis puede generar una acumulación de tejido de tipo cicatrizal en los pulmones resultando en la pérdida de la función pulmonar, la discapacidad y la muerte. Las fibras de asbesto asociadas con este tipo de riesgo de salud son demasiado pequeñas para ser percibidas a simple vista y los fumadores corren un mayor riesgo de desarrollar ciertas enfermedades asociadas con el asbesto.

¿Se expone usted al asbesto?

Pueden quedar expuestos los empleados de la industria general durante la fabricación de productos que contienen asbesto o durante la revisión de frenos y embragues. En la industria de la construcción, la exposición ocurre cuando los trabajadores mueven materiales que contienen asbesto durante la renovación o demolición de edificios. También pueden quedar expuestos los empleados en ambientes marítimos al renovar o desmantelar navíos construidos con materiales que contienen asbestos. Además, pueden quedar expuestos los trabajadores de mantenimiento en los edificios mediante el contacto con materiales deteriorados que contienen asbesto.

¿Existen normas de OSHA que cubren a trabajadores expuestos al asbesto?

Sí. La Administración de Seguridad y Salud Ocupacional (OSHA) ha establecido las siguientes tres normas para proteger a los trabajadores de exposición al asbesto en el lugar de trabajo las cuales se encuentran en *Title 29 of the Code of Federal Regulations (CFR)* (*Título 29 del Código de Regulaciones Federales*):

- 29 CFR 1926.1101 cubre el trabajo de construcción, incluyendo las modificaciones, reparaciones, renovaciones y demoliciones de estructuras que contienen asbesto.
- 29 CFR 1915.1101 cubre la exposición al asbesto durante el trabajo en astilleros.
- 29 CFR 1910.1101 trata de la exposición al asbesto en la industria general, como exposición durante la revisión de frenos y embragues, el trabajo de mantenimiento y la fabricación de productos que contienen asbesto.

Las normas para las industrias de construcción y de astilleros clasifican los riesgos del trabajo con asbesto y prescriben requisitos particulares para cada clasificación:

- La Clase I es la clase de mayor riesgo en los trabajos de asbesto e implica la extracción de aislamiento térmico y de materiales de revestimiento con asbesto rociado o

aplicado a materiales que supuestamente contienen asbesto.

- La Clase II incluye la eliminación de otros tipos de materiales que contienen asbesto y que no son materiales de revestimiento térmico, tales como material de suelo o de techos que contienen asbesto.
- La Clase III se enfoca en operaciones de reparación y el mantenimiento en que se desplazan materiales que contienen asbesto o que supuestamente contienen asbesto.
- La Clase IV trata de las actividades de mantenimiento en las que los empleados limpien desechos y escombros que contienen asbesto.

Existen reglamentos equivalentes en los estados con planes aprobados por OSHA.

¿Cuáles son los niveles permisibles de exposición al asbesto?

La exposición por empleados al asbesto no debe exceder 0.1 fibra por centímetro cúbico (f/cc) de aire promedio en un turno de ocho horas. La exposición a corto plazo no debe exceder un promedio de 1 f/cc promedio en 30 minutos. Está prohibido el mirar empleados para poder cumplir con los requisitos de límites permisibles de exposición.

¿Se requiere que los empleadores monitoreen la exposición?

En el trabajo de construcción y de astilleros, a menos de poder demostrar que las exposiciones por los empleados no sobrepasarán los límites permisibles de exposición ("evaluación negativa de exposición"), se suele requerir un monitoreo diario de los trabajadores en zonas de Clase I y Clase II. Para los trabajadores en otras tareas en las que se prevé que los niveles de exposición sobrepasarán por lo menos uno de los límites permisibles de exposición, es necesario llevar a cabo el monitoreo periódicamente. En la industria general, es necesario realizar el monitoreo inicial para los trabajadores que puedan quedar expuestos a niveles superiores a los límites permisibles de exposición o de excursión. Usted debe llevar a cabo el monitoreo subsiguiente a intervalos razonables, y nunca a intervalos mayores de seis meses para trabajadores que queden expuestos a niveles mayores que los límites permisibles de exposición.

¿Deben los empleadores crear áreas reglamentadas?

Es necesario crear zonas controladas, conocidas como áreas reglamentadas, diseñadas para proteger a los empleados que realizan ciertas tareas con asbesto. Debe limitar el acceso a las zonas reglamentadas a personas autorizadas que llevan la protección respiratoria adecuada. Debe prohibir comer, fumar, beber, mascar tabaco o chicle y ponerse productos cosméticos en estas áreas. Debe colocar carteles de advertencia en cada área reglamentada. En la construcción y en astilleros, los trabajadores deben realizar las tareas de asbesto de Clases I, II y III (y todas las otras tareas en las que las concentraciones de asbesto puedan exceder los límites permisibles de exposición) dentro del área reglamentada. En la industria general, es necesario establecer áreas reglamentadas donde las concentraciones de asbesto puedan exceder los límites permisibles de exposición.

Asbesto

¿Qué métodos de cumplimiento deben utilizar los empleadores para controlar las exposiciones?

Usted debe controlar las exposiciones para que no sobrepasen los límites permisibles de exposición mediante controles de Ingeniería y prácticas laborales en la medida posible. Cuando los controles de Ingeniería y las prácticas laborales factibles no garantizan la protección del trabajador conforme a los límites de exposición, se debe reducir las exposiciones de los empleados a los niveles más bajos posibles y darles protección respiratoria que permita cumplir con los requisitos de los límites permisibles de exposición. En el caso de la construcción y de los astilleros, cada clasificación de trabajo contiene requisitos específicos de control. En la industria general, se prescriben requisitos específicos para la revisión de frenos y de embragues. Por ejemplo, usted debe prohibir ciertas prácticas, como el uso de aire comprimido, para remover asbesto.

¿Cuándo deben los empleadores proveer protección respiratoria a los trabajadores?

Usted debe proporcionar y verificar el uso de equipo respiratorio cuando se exceden los límites permisibles de exposición al asbesto. En la construcción y en los astilleros, se debe exigir que los trabajadores utilicen equipo respiratorio cuando se realicen ciertas tareas. En general, el nivel de exposición determina el tipo de equipo respiratorio que se requiere. Además, las normas especifican el tipo de equipo respiratorio que se debe utilizar para ciertos trabajos con asbesto. (Véase 29 CFR 1910.134.) Los empleadores deben seguir un curso de capacitación en respiradores y tener un permiso médico antes de utilizar el equipo respiratorio.

¿Deben los empleadores proveer vestimenta protectora a los trabajadores?

Sí. Usted debe proveer y exigir el uso de ropa protectora, como overoles, mono completo, gorra, guantes y calzado para todo empleado expuesto a concentraciones de asbesto en el aire que excedan los límites permisibles de exposición al asbesto. Usted debe suministrar y exigir el uso de caretas, gafas de protección venteadas u otro equipo de protección apropiado cuando exista la posibilidad de irritación en los ojos.

¿Deben los empleadores proveer instalaciones de higiene?

Sí. Usted debe instalar zonas de descontaminación y establecer prácticas de higiene para los empleados que se exponen a niveles superiores a los límites permisibles de exposición. Además los empleados no pueden fumar en las áreas de trabajo en las que pueda ocurrir exposición al asbesto.

¿Requieren las normas de OSHA que los empleadores provean entrenamiento?

Sí. En la construcción y los astilleros, usted debe proveer cursos para capacitar a los empleados expuestos a niveles superiores a los límites permisibles de exposición al asbesto y para los empleados que realicen trabajos en cada clasificación de trabajo identificada. Los requisitos específicos de entrenamiento dependen de la clase de trabajo particular que se realiza. En la industria general se debe proveer entrenamiento a todos los

empleados expuestos a niveles superiores a los límites permisibles de exposición de asbesto. También debe proveer entrenamiento sobre asbesto a los empleados que se encargan de limpiezas que estén cubiertas por la norma. Debe colocar etiquetas de advertencias en todos los productos, contenedores y materiales de construcción instalados hechos de asbesto siempre que sea posible.

¿Qué requisitos deben cumplir los empleadores cuando se trata de exámenes médicos?

En la construcción y los astilleros, usted debe brindar exámenes médicos para los trabajadores que, durante 30 días o más por año, realizan tareas de Clases I, II o III o que se exponen a niveles superiores a los límites permisibles de exposición de asbesto. En la industria general debe proveer exámenes médicos para los trabajadores que se exponen a niveles superiores a los límites permisibles de exposición de asbesto.

¿Cuáles son los requisitos de registros para las exposiciones de asbesto?

Debe mantener registros precisos sobre lo siguiente:

- Todas las mediciones realizadas para monitorear la exposición de trabajadores al asbesto, por 30 años.
- Los informes médicos, incluyendo las opiniones escritas de los médicos, durante el tiempo que labora y 30 años adicionales.
- Los registros de entrenamiento, por un año después de la última fecha de empleo.

¿Cómo obtener más información sobre la seguridad y la salud?

OSHA ofrece varias publicaciones, normas, ayuda técnica y herramientas de cumplimiento para ayudarle. Asimismo, ofrece una ayuda extensa mediante consultas en el lugar de trabajo, programas voluntarios de protección, subvenciones, asociaciones estratégicas, planes estatales, entrenamiento y educación. Las Directrices de administración del Programa de seguridad y salud de OSHA (*Registro Federal* 54:3904-3916, 26 de enero de 1989) presentan información detallada esencial para el desarrollo de un buen sistema de administración de seguridad y salud. Esta información y otros datos se encuentran disponibles en el Website de OSHA.

- Para obtener una copia libre de costo de las publicaciones de OSHA, envíe una tarjeta postal con su dirección a OSHA Publications Office, 200 Constitution Avenue, N.W., N-3101, Washington, DC 20210, o envíe una solicitud por fax marcando el (202) 693-2498, o llámenos al (202) 693-1888.
- Para pedir publicaciones de OSHA en línea en www.osha.gov, diríjase a Publicaciones y siga las instrucciones para realizar su pedido.
- Para presentar una queja por teléfono, comunicar una emergencia u obtener consejos, ayuda o productos de OSHA, contacte a su oficina de OSHA más cercana listada bajo "U.S. Department of Labor" en su guía telefónica o llame libre de costo marcando el (800) 321-OSHA (6742). El número de teleprinter (TTY) es (877) 889-5627.
- Para presentar una queja en línea u obtener mayor información sobre los programas federales y estatales de OSHA, visite el Website de OSHA.

Este texto forma parte de una serie de hojas informativas que enfocan programas, políticas o normas de OSHA y no impone ningún requisito de cumplimiento nuevo. Para obtener una lista completa de los requisitos de cumplimiento de las normas y de los reglamentos de OSHA, consulte el Título 29 del Código de Reglamentos Federales. Esta información se hará disponible a personas con discapacidad sensorial cuando se solicite. El teléfono de voz es (202) 693-1888. Véase también el Website de OSHA en www.osha.gov.



Departamento de Trabajo de los EUA
Administración de Seguridad y Salud Ocupacional
2002

ToxFAQs™

Asbesto (Amianto)

(*Asbestos*)

CAS#: 1332-21-4

septiembre de 2001

Esta hoja informativa contesta las preguntas más frecuentes acerca de los efectos del asbesto sobre la salud. Para más información, por favor llame al Centro de Información de ATSDR al 1-888-422-8737. Esta hoja informativa forma parte de una serie de resúmenes acerca de sustancias peligrosas y sus efectos sobre la salud. Es importante que usted entienda esta información ya que esta sustancia puede ser perjudicial. Los efectos de la exposición a cualquier sustancia tóxica dependen de la dosis, la duración, la manera como usted está expuesto, sus hábitos y características personales y de la presencia de otras sustancias químicas.

IMPORTANTE: La exposición al asbesto ocurre generalmente al respirar aire contaminado en lugares de trabajo que usan o manufacturan asbesto. También se encuentra asbesto en el aire de viviendas que están siendo derruidas o renovadas. La exposición al asbesto puede producir problemas serios en los pulmones y además causar cáncer. Se ha encontrado asbesto en 83 de los 1,585 sitios de la Lista de Prioridades Nacionales identificados por la Agencia de Protección del Medio Ambiente de EE.UU. (EPA).

¿Qué es el asbesto?

Asbesto es el nombre asignado a un grupo de seis materiales fibrosos diferentes (amosita, crisolita, crocidolita y las formas fibrosas de tremolita, actinolita, y antofilita) que ocurren en forma natural en el ambiente. Los minerales de asbesto tienen fibras largas y resistentes que se pueden separar y son suficientemente flexibles como para ser entrelazadas y también resisten altas temperaturas. Debido a estas características, el asbesto se ha usado para una gran variedad de productos manufacturados, principalmente en materiales de construcción (tejas para techado, baldosas y azulejos, productos de papel y productos de cemento con asbesto), productos de fricción (embrague de automóviles, frenos, componentes de la transmisión), materias textiles termoresistentes, envases, empaquetaduras, y revestimientos. Algunos productos de vermiculita o de talco pueden contener asbesto.

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¿Qué le sucede al asbesto cuando entra al medio ambiente?

Las fibras de asbesto pueden pasar al aire o al agua a causa de la degradación de depósitos naturales o de productos de asbesto manufacturados. Las fibras de asbesto no se evaporan al aire ni se disuelven en agua. Las fibras de diámetro pequeño y las partículas pequeñas pueden permanecer suspendidas en el aire por largo tiempo y así ser transportadas largas distancias por el viento y el agua antes de depositarse. Las fibras y partículas de mayor tamaño tienden a depositarse más rápido.

Las fibras de asbesto no pueden movilizarse a través del suelo. Las fibras de asbesto generalmente no son degradadas a otros compuestos y permanecerán virtualmente inalteradas por largo tiempo.

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¿Cómo podría yo estar expuesto al asbesto?

Todos estamos expuestos a pequeñas cantidades de asbesto en el aire que respiramos. Estos niveles varían entre 0.00001 y 0.0001 fibras por mililitro de aire; los niveles más altos se encuentran generalmente en ciudades y en áreas industriales.

Gente que trabaja en industrias que fabrican o usan productos de asbesto o que trabajan en la minería de asbesto puede estar expuesta a altos niveles de asbesto. Gente que vive cerca de estas industrias también puede estar expuesta a altos niveles de asbesto en el aire.

Las fibras de asbesto pueden liberarse al aire al perturbar materiales que contienen asbesto durante el uso del producto, demoliciones, mantenimiento, reparación y renovación de edificios o viviendas. En general, la exposición puede ocurrir solamente cuando el material que contiene asbesto es perturbado de manera tal que libera partículas o fibras al aire.

El agua potable puede contener asbesto de fuentes naturales o de cañerías de cemento que contienen asbesto.

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¿Cómo puede perjudicar mi salud el asbesto?

El asbesto afecta principalmente a los pulmones y a la membrana que envuelve a los pulmones, la pleura. Respirar altos niveles de fibras de asbesto por largo tiempo puede producir lesiones que parecen cicatrices en el pulmón y en la pleura. Esta enfermedad se llama asbestosis y ocurre comúnmente en trabajadores expuestos al asbesto, pero no en el público en general. La gente con asbestosis tiene dificultad para respirar, a menudo tiene tos, y en casos graves sufre dilatación del corazón. La asbestosis es una enfermedad grave que eventualmente puede

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producir incapacidad y la muerte.

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Respirar niveles de asbesto más bajos puede producir alteraciones en la pleura, llamadas placas. Las placas pleurales pueden ocurrir en trabajadores y ocasionalmente en gente que vive en áreas con altos niveles ambientales de asbesto. Los efectos de las placas pleurales sobre la respiración generalmente no son serios, pero la exposición a niveles más altos puede producir un engrosamiento de la pleura que puede restringir la respiración.

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ToxFAQs™

¿Qué posibilidades hay de que el asbesto produzca cáncer?

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El Departamento de Salud y Servicios Humanos (DHHS), la Organización Mundial de la Salud (WHO) y la EPA han determinado que el asbesto es carcinógeno para seres humanos.

Se sabe que respirar asbesto puede aumentar el riesgo de cáncer en seres humanos. Hay dos tipos de cáncer producidos por exposición al asbesto: cáncer del pulmón y mesotelioma. El mesotelioma es un cáncer de la pleura o del tejido que envuelve la cavidad abdominal (el peritoneo). El cáncer producido por el asbesto no aparece inmediatamente, sino que se manifiesta después de varios años. Los estudios en trabajadores sugieren también que respirar asbesto puede aumentar las posibilidades de contraer cáncer en otras partes del cuerpo (estómago, intestino, esófago, páncreas y los riñones), aunque esto es más incierto. La identificación y el tratamiento tempranos de todo cáncer pueden aumentar la calidad de vida y la sobrevivencia de la persona.

Recursos

La combinación de exposición al asbesto y al humo de cigarrillo aumenta considerablemente las posibilidades de contraer cáncer del pulmón. Por lo tanto, si usted ha estado expuesto al asbesto, debería dejar de fumar. Esta puede ser la acción más importante que usted puede tomar para mejorar su salud y disminuir el riesgo de contraer cáncer.

[Curso de toxicología](#)

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Recursos externos

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[NIOSH](#)

[OSHA](#)

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¿Cómo puede el asbesto afectar a los niños?

No sabemos si la exposición al asbesto producirá defectos de nacimiento u otros efectos sobre el desarrollo en seres humanos. En animales expuestos al asbesto no se han observado defectos de nacimiento.

Es probable que los efectos sobre la salud de niños expuestos a altos niveles de asbesto sean similares a los observados en adultos.

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¿Cómo pueden las familias reducir el riesgo de exposición al asbesto?

En general, los materiales que contienen asbesto que no son perturbados o dañados no constituyen un riesgo para la salud y por lo tanto pueden dejarse sin tocar. Si usted sospecha que puede estar expuesto al asbesto en su hogar, contacte a su departamento estatal o local de salud o a las oficinas regionales de la EPA para averiguar como examinar su hogar y como encontrar una compañía con experiencia para remover o contener las fibras. 1425

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¿Hay algún examen médico que demuestre que he estado expuesto al asbesto?

Los niveles bajos de asbesto pueden medirse en la orina, las heces, líquidos mucosos o en lavados pulmonares de la población general. Los niveles mayores que el promedio de fibras de asbesto en tejidos pueden confirmar la exposición, pero no pueden predecir si le afectará la salud.

Para evaluar enfermedades relacionadas a la exposición al asbesto se necesitan una historia completa, examen físico y pruebas de diagnóstico. La radiografía del pecho es la mejor herramienta para detectar cambios en los pulmones que resultan de la exposición al asbesto. Pruebas de función pulmonar y sondeos computarizados en tres dimensiones del pulmón también ayudan en el diagnóstico de enfermedades relacionadas al asbesto.

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¿Qué recomendaciones ha hecho el gobierno federal para proteger la salud pública?

En 1989 la EPA prohibió todo nuevo uso del asbesto; los usos establecidos con anterioridad a esta fecha todavía se permiten. La EPA estableció reglamentos que requieren la inspección de escuelas para verificar si hay o no asbesto dañado, y para eliminar o reducir la exposición ya sea removiendo el asbesto o cubriéndolo. La EPA reglamenta la liberación de asbesto de fábricas y durante demolición o renovación de edificios para prevenir que el asbesto pase al ambiente.

La EPA ha propuesto una concentración límite de 7 millones de fibras por litro de agua potable para fibras largas (5 µm de longitud o más). La Administración de Salud y Seguridad Ocupacional (OSHA) ha establecido límites de 100,000 fibras con longitudes de 5 µm o más por metro cúbico de aire en el lugar trabajo durante jornadas de 8 horas diarias, 40 horas semanales.

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Referencias

Agencia para Sustancias Tóxicas y el Registro de Enfermedades. (ATSDR). 2001. Reseña Toxicológica del Asbesto (en inglés). Atlanta, GA: Departamento de Salud y Servicios

Humanos de EE.UU., Servicio de Salud Pública.

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¿Dónde puedo obtener más información?

Agencia para Sustancias Tóxicas y el Registro de Enfermedades
División de Toxicología y Medicina Ambiental
1600 Clifton Road NE, MS F-32
Atlanta, GA 30333
Teléfono: +1 888 422 8737 (libre de cargos)
FAX: 770 488 4178
http://www.atsdr.cdc.gov/es/es_index.html

La ATSDR puede informarle dónde encontrar clínicas de salud ocupacional y ambiental. Sus especialistas pueden reconocer, evaluar y tratar enfermedades causadas por la exposición a sustancias peligrosas. Usted también puede contactar su departamento comunal o estatal de salud o de calidad ambiental si tiene más preguntas o inquietudes.

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● Agencia para Sustancias Tóxicas y el Registro de Enfermedades
1825 Century Blvd, Atlanta, GA 30345
Tel: CDC Contact Center: 800-CDC-INFO • 888-232-6348 (TTY)

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Asbesto

De Wikipedia, la enciclopedia libre

Saltar a navegación, búsqueda

☒ Asbesto.

☐

El **asbesto** es un grupo de minerales metamórficos fibrosos. Están compuestos de silicatos de cadena doble.

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Contaminación por asbesto

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☒ Fibras de asbesto.

Las fibras de asbesto pueden pasar al aire o al agua a causa de la degradación de depósitos naturales o de productos de asbesto manufacturados.

No se evaporan al aire ni se disuelven en agua. Las fibras de diámetro pequeño y las partículas pequeñas pueden permanecer suspendidas en el aire por largo tiempo y ser transportadas largas distancias por el viento y el agua antes de depositarse. Las fibras y partículas de mayor tamaño tienden a depositarse más rápido.

Las fibras de asbesto no pueden movilizarse a través del suelo. Generalmente no son degradadas a otros compuestos y permanecerán virtualmente inalteradas por largo tiempo.

Toxicidad [editar]

Todos estamos expuestos a pequeñas cantidades de asbesto en el aire que respiramos. Estos niveles varían entre 0.00001 y 0.0001 fibras por mililitro de aire; los niveles más altos se encuentran generalmente en ciudades y en áreas industriales.

Gente que trabaja en industrias que fabrican o usan productos de asbesto o que trabajan en la minería de asbesto puede estar expuesta a altos niveles de asbesto. Gente que vive cerca de estas industrias también puede estar expuesta a altos niveles de asbesto en el aire.

fibras de asbesto pueden liberarse al aire al perturbar materiales que contienen asbesto durante el uso del producto, demoliciones, mantenimiento, reparación y renovación de edificios o viviendas. En general, la exposición puede ocurrir solamente cuando el material que contiene asbesto es perturbado de manera tal que libera partículas o fibras al aire.

El agua potable puede contener asbesto de fuentes naturales o de cañerías de cemento que contienen asbesto.

Enfermedades provocadas por el asbesto [editar]



Fibras de asbesto ☐
afectando tejido pulmonar.

El asbesto afecta principalmente a los pulmones y a la membrana que envuelve a los pulmones, la pleura. Respirar altos niveles de fibras de asbesto por largo tiempo puede producir lesiones que parecen cicatrices en el pulmón y en la pleura. Esta enfermedad se llama asbestosis y ocurre comúnmente en trabajadores expuestos al asbesto, pero no en el público en general. La gente con asbestosis tiene dificultad para respirar, a menudo tiene tos, y en casos graves sufre dilatación del corazón. La asbestosis es una enfermedad grave que eventualmente puede producir incapacidad y la muerte.

Respirar niveles de asbesto más bajos puede producir alteraciones en la pleura, llamadas placas. Las placas pleurales

pueden ocurrir en trabajadores y ocasionalmente en gente que vive en áreas con altos niveles ambientales de asbesto. Los efectos de las placas pleurales sobre la respiración generalmente no son serios, pero la exposición a niveles más altos puede producir un engrosamiento de la pleura que puede restringir la respiración.

El Departamento de Salud y Servicios Humanos (DHHS), la Organización Mundial de la Salud (WHO) y la EPA han determinado que el asbesto es carcinógeno para seres humanos.

Se sabe que respirar asbesto puede aumentar el riesgo de cáncer en seres humanos. Hay dos tipos de cáncer producidos por exposición al asbesto: cáncer de pulmón y mesotelioma. El mesotelioma es un cáncer de la pleura o del tejido que envuelve la cavidad abdominal (el peritoneo). El cáncer producido por el asbesto no aparece inmediatamente, sino que se manifiesta después de varios años. Los estudios en trabajadores sugieren también que respirar asbesto puede aumentar las posibilidades de contraer cáncer en otras partes del cuerpo (estómago, intestino, esófago, páncreas y los riñones), aunque esto es más incierto. La identificación y el tratamiento tempranos de todo cáncer pueden aumentar la calidad de vida y la sobrevivencia de la persona.

La combinación de exposición al asbesto y al humo de cigarrillo aumenta considerablemente las posibilidades de contraer cáncer del pulmón. Por lo tanto, si usted ha estado expuesto al asbesto, debería dejar de fumar. Esta puede ser la acción más importante que usted puede tomar para mejorar su salud y disminuir el riesgo de contraer cáncer.

Diagnóstico

[[editar](#)]

Los niveles bajos de asbesto pueden medirse en la orina, las heces, líquidos mucosos o en lavados pulmonares de la población general. Los niveles mayores que el promedio de fibras de asbesto en tejidos pueden confirmar la exposición, pero no pueden predecir si le afectará la salud.

Para evaluar enfermedades relacionadas a la exposición al asbesto se necesitan una historia completa, examen físico y pruebas de diagnóstico. La radiografía del pecho es la mejor herramienta para detectar cambios en los pulmones que resultan de la exposición al asbesto. Pruebas de función pulmonar y sondeos computarizados en tres dimensiones del pulmón también ayudan en el diagnóstico de enfermedades relacionadas al asbesto.

Referencias

[[editar](#)]

- ATSDR en Español - Resúmenes de Salud Pública: Asbesto Departamento de Salud y Sevicios Humanos de EE.UU. (dominio público)
- ATSDR en Español - ToxFAQs™: Asbesto Departamento de Salud y Sevicios Humanos de EE.UU. (dominio público)
- El amianto en el mundo en francés y en inglés
- <http://www.amianto.net/> todo sobre amianto, yacimientos, variedades, propiedades, identificación, legislación, aplicaciones, riesgos



Wikimedia Commons alberga contenido multimedia sobre *asbestos*.

TRABAJADORES EN ESTADOS UNIDOS

La mayoría de trabajadores de asbestos en los Estados Unidos de America son de origen Hispano, algunos lo hacen por el salario que ganan (\$10-\$35 por hora) otros porque la mayoría de Norteamericanos no lo quieren hacer (saben del riesgo y las consecuencias), aunque a los Hispanos se les informa acerca de los riesgos, la mayoría lo hace porque

no tienen otras opciones de trabajos,(la mayoría son indocumentados). Las reglas que se tiene por parte de la EPA (Environmental protection Agency), agencia de protección ambiental, en el caso de la remoción de cualquier tipo de asbestos se debe de hacer mediante métodos totalmente cuidadosos, los que en el 80% no se hace, esto es porque a veces las compañías de medio ambiente se basan en el dinero que van a obtener por un trabajo lo más pronto realizado (que va desde unos pocos miles \$ hasta varios \$millones)

Obtenido de "<http://es.wikipedia.org/wiki/Asbesto>"

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UNITED NATIONS ENVIRONMENT PROGRAMME
INTERNATIONAL LABOUR ORGANISATION
WORLD HEALTH ORGANIZATION

INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY

ENVIRONMENTAL HEALTH CRITERIA 203

CHRYSOTILE ASBESTOS

This report contains the collective views of an international group of experts and does not necessarily represent the decisions or the stated policy of the United Nations Environment Programme, the International Labour Organisation, or the World Health Organization.

First draft prepared by Dr G. Gibbs, Canada (Chapter 2), Mr B.J. Figg, USA (Chapter 3), Professor W.J. Nicholson, USA (Chapter 4), Dr A. Morgan, UK and Professor M. Lippmann, USA (Chapter 5), Dr J.M.G. Davis, UK and Professor B.T. Mossman, USA (Chapter 6), Professor J.C. McDonald, UK, Professor P.J. Landrigan, USA and Professor W.J. Nicholson, USA (Chapter 7), Professor H. Schreier, Canada (Chapter 8).

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World Health Organization

Geneva, 1998

The International Programme on Chemical Safety (IPCS), established in 1980, is a joint venture of the United Nations Environment Programme (UNEP), the International Labour Organisation (ILO), and the World Health Organization (WHO). The overall objectives of the IPCS are to establish the scientific basis for

assessment of the risk to human health and the environment from exposure to chemicals, through international peer review processes, as a prerequisite for the promotion of chemical safety, and to provide technical assistance in strengthening national capacities for the sound management of chemicals.

The Inter-Organization Programme for the Sound Management of Chemicals (IOMC) was established in 1995 by UNEP, ILO, the Food and Agriculture Organization of the United Nations, WHO, the United Nations Industrial Development Organization, the United Nations Institute for Training and Research, and the Organisation for Economic Co-operation and Development (Participating Organizations), following recommendations made by the 1992 UN Conference on Environment and Development to strengthen cooperation and increase coordination in the field of chemical safety. The purpose of the IOMC is to promote coordination of the policies and activities pursued by the Participating Organizations, jointly or separately, to achieve the sound management of chemicals in relation to human health and the environment.

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NOTE TO READERS OF THE CRITERIA MONOGRAPHS

Every effort has been made to present information in the criteria monographs as accurately as possible without unduly delaying their publication. In the interest of all users of the Environmental Health Criteria monographs, readers are requested to communicate any errors that may have occurred to the Director of the International Programme on Chemical Safety, World Health Organization, Geneva, Switzerland, in order that they may be included in corrigenda.

* * *

A detailed data profile and a legal file can be obtained from the International Register of Potentially Toxic Chemicals, Case postale 356, 1219 Châtelaine, Geneva, Switzerland (telephone no. + 41 22 - 9799111, fax no. + 41 22 - 7973460, E-mail irptc@unep.ch).

* * *

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Environmental Health Criteria

PREAMBLE

Objectives

In 1973 the WHO Environmental Health Criteria Programme was initiated with the following objectives:

- (i) to assess information on the relationship between exposure to environmental pollutants and human health, and to provide guidelines for setting exposure limits;
- (ii) to identify new or potential pollutants;
- (iii) to identify gaps in knowledge concerning the health effects of pollutants;
- (iv) to promote the harmonization of toxicological and epidemiological methods in order to have internationally comparable results.

The first Environmental Health Criteria (EHC) monograph, on mercury, was published in 1976 and since that time an ever-increasing number of assessments of chemicals and of physical effects have been produced. In addition, many EHC monographs have been devoted to evaluating toxicological methodology, e.g., for genetic, neurotoxic, teratogenic and nephrotoxic effects. Other publications have been concerned with epidemiological guidelines, evaluation of short-term tests for carcinogens, biomarkers, effects on the elderly and so forth.

Since its inauguration the EHC Programme has widened its scope, and the importance of environmental effects, in addition to health effects, has been increasingly emphasized in the total evaluation of chemicals.

The original impetus for the Programme came from World Health Assembly resolutions and the recommendations of the 1972 UN Conference on the Human Environment. Subsequently the work became an integral part of the International Programme on Chemical Safety (IPCS), a cooperative programme of UNEP, ILO and WHO. In this manner, with the strong support of the new partners, the importance of occupational health and environmental effects was fully recognized. The EHC monographs have become widely established, used and recognized throughout the world.

The recommendations of the 1992 UN Conference on Environment and Development and the subsequent establishment of the Intergovernmental Forum on Chemical Safety with the priorities for action in the six programme areas of Chapter 19, Agenda 21, all lend further weight to the need for EHC assessments of the risks of chemicals.

Scope

The criteria monographs are intended to provide critical reviews on the effect on human health and the environment of chemicals and of combinations of chemicals and physical and biological agents. As such, they include and review studies that are of direct relevance for the evaluation. However, they do not describe every study carried out. Worldwide data are used and are quoted from original studies, not from abstracts or reviews. Both published and unpublished reports are considered and it is incumbent on the authors to assess all the articles cited in the references. Preference is always given to published data. Unpublished data are only used when relevant published data are absent or when they are pivotal to the risk assessment. A detailed policy statement is available that describes the procedures used for unpublished proprietary data so that this information can be used in the evaluation without compromising its confidential nature (WHO (1990) Revised Guidelines for the Preparation of Environmental Health Criteria Monographs. PCS/90.69, Geneva, World Health Organization).

In the evaluation of human health risks, sound human data, whenever available, are preferred to animal data. Animal and *in vitro* studies provide support and are used mainly to supply evidence missing from human studies. It is mandatory that research on human subjects is conducted in full accord with ethical principles, including the provisions of the Helsinki Declaration.

The EHC monographs are intended to assist national and international authorities in making risk assessments and subsequent risk management decisions. They represent a thorough evaluation of risks and are not, in any sense, recommendations for regulation or standard setting. These latter are the exclusive purview of national and regional governments.

Content

The layout of EHC monographs for chemicals is outlined below.

- * Summary -- a review of the salient facts and the risk evaluation of the chemical
- * Identity -- physical and chemical properties, analytical methods
- * Sources of exposure
- * Environmental transport, distribution and transformation
- * Environmental levels and human exposure
- * Kinetics and metabolism in laboratory animals and humans
- * Effects on laboratory mammals and *in vitro* test systems
- * Effects on humans
- * Effects on other organisms in the laboratory and field
- * Evaluation of human health risks and effects on the environment
- * Conclusions and recommendations for protection of human health and the environment

- * Further research
- * Previous evaluations by international bodies, e.g., IARC, JECFA, JMPR

Selection of chemicals

Since the inception of the EHC Programme, the IPCS has organized meetings of scientists to establish lists of priority chemicals for subsequent evaluation. Such meetings have been held in: Ispra, Italy, 1980; Oxford, United Kingdom, 1984; Berlin, Germany, 1987; and North Carolina, USA, 1995. The selection of chemicals has been based on the following criteria: the existence of scientific evidence that the substance presents a hazard to human health and/or the environment; the possible use, persistence, accumulation or degradation of the substance shows that there may be significant human or environmental exposure; the size and nature of populations at risk (both human and other species) and risks for environment; international concern, i.e. the substance is of major interest to several countries; adequate data on the hazards are available.

If an EHC monograph is proposed for a chemical not on the priority list, the IPCS Secretariat consults with the Cooperating Organizations and all the Participating Institutions before embarking on the preparation of the monograph.

Procedures

The order of procedures that result in the publication of an EHC monograph is shown in the flow chart. A designated staff member of

IPCS, responsible for the scientific quality of the document, serves as Responsible Officer (RO). The IPCS Editor is responsible for layout and language. The first draft, prepared by consultants or, more usually, staff from an IPCS Participating Institution, is based initially on data provided from the International Register of Potentially Toxic Chemicals, and reference data bases such as Medline and Toxline.

The draft document, when received by the RO, may require an initial review by a small panel of experts to determine its scientific quality and objectivity. Once the RO finds the document acceptable as a first draft, it is distributed, in its unedited form, to well over 150 EHC contact points throughout the world who are asked to comment on its completeness and accuracy and, where necessary, provide additional material. The contact points, usually designated by governments, may be Participating Institutions, IPCS Focal Points, or individual scientists known for their particular expertise. Generally some four months are allowed before the comments are considered by the RO and author(s). A second draft incorporating comments received and approved by the Director, IPCS, is then distributed to Task Group members, who carry out the peer review, at least six weeks before their meeting.

The Task Group members serve as individual scientists, not as representatives of any organization, government or industry. Their function is to evaluate the accuracy, significance and relevance of the information in the document and to assess the health and environmental risks from exposure to the chemical. A summary and recommendations for further research and improved safety aspects are also required. The composition of the Task Group is dictated by the range of expertise required for the subject of the meeting and by the need for a balanced geographical distribution.

The three cooperating organizations of the IPCS recognize the important role played by nongovernmental organizations. Representatives from relevant national and international associations may be invited to join the Task Group as observers. While observers may provide a valuable contribution to the process, they can only speak at the invitation of the Chairperson. Observers do not participate in the final evaluation of the chemical; this is the sole responsibility of the Task Group members. When the Task Group considers it to be appropriate, it may meet *in camera*.

All individuals who as authors, consultants or advisers participate in the preparation of the EHC monograph must, in addition to serving in their personal capacity as scientists, inform the RO if at any time a conflict of interest, whether actual or potential, could be perceived in their work. They are required to sign a conflict of interest statement. Such a procedure ensures the transparency and probity of the process.

When the Task Group has completed its review and the RO is satisfied as to the scientific correctness and completeness of the document, it then goes for language editing, reference checking, and preparation of camera-ready copy. After approval by the Director, IPCS, the monograph is submitted to the WHO Office of Publications for printing. At this time a copy of the final draft is sent to the Chairperson and Rapporteur of the Task Group to check for any errors.

It is accepted that the following criteria should initiate the updating of an EHC monograph: new data are available that would substantially change the evaluation; there is public concern for health or environmental effects of the agent because of greater

exposure; an appreciable time period has elapsed since the last evaluation.

All Participating Institutions are informed, through the EHC progress report, of the authors and institutions proposed for the drafting of the documents. A comprehensive file of all comments received on drafts of each EHC monograph is maintained and is available on request. The Chairpersons of Task Groups are briefed before each meeting on their role and responsibility in ensuring that these rules are followed.

☒ FIGURE

WHO TASK GROUP ON ENVIRONMENTAL HEALTH CRITERIA FOR CHRYSOTILE ASBESTOS

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^a Professor J.M. Dement chaired the meeting sessions when discussions on Chapters 9, 10 and 11 were held. These sessions were held in camera without the presence of observers. He also chaired the final session when the whole document was adopted.

- ^b Not present at the last session
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^a Present only during first two days of the meeting (i.e. before the
 discussions on Chapters 9, 10 and 11 were held)

^b Not present during the discussions on Chapters 9, 10 and 11, which
 were held *in camera*

IPCS TASK GROUP ON ENVIRONMENTAL HEALTH CRITERIA FOR CHRYSOTILE ASBESTOS

A Task Group on Environmental Health Criteria for Chrysotile
 Asbestos met at WHO Headquarters, Geneva, Switzerland, from 1 to 6
 July 1996. Dr M. Mercier, Director IPCS, opened the Meeting and
 welcomed the participants on behalf of the heads of the three
 cooperating organizations of the IPCS (UNEP/ILO/WHO). The Task Group
 reviewed and revised the third draft of the monograph, made an
 evaluation of the risks for human health and the environment from
 exposure to chrysotile asbestos, and made recommendations for health

protection and further research.

The first drafts were prepared by Dr G. Gibbs, Canada (Chapter 2), Mr B.J. Pigg, USA (Chapter 3), Professor W.J. Nicholson, USA (Chapter 4), Dr A. Morgan, UK and Professor M. Lippmann, USA (Chapter 5), Dr J.M.G. Davis, UK and Professor B.T. Mossman, USA (Chapter 6), Professor J.C. McDonald, UK, Professor P.J. Landrigan, USA and Professor W.J. Nicholson, USA (Chapter 7), Professor H. Schreier, Canada (Chapter 8).

In the light of international comments, the second draft was prepared under the coordination of Professor F. Valiæ, Croatia. Chapter 8 was modified by a group of experts in risk assessment (Professors J. Hughes, USA, J. Peto, UK, and J. Siemiatycki, Canada).

Professor F. Valiæ was responsible for the overall scientific content of the monograph and for the organization of the meeting, and Dr P.G. Jenkins, IPCS Central Unit, for the technical editing of the monograph.

The efforts of all who helped in the preparation and finalization of the monograph are gratefully acknowledged.

ABBREVIATIONS

ACM	asbestos-containing material
AOS	activated oxygen species
ATEM	analytical transmission electron microscopy
BAL	bronchoalveolar lavage
BP	benzo (a)pyrene
CI	confidence interval
EDXA	energy-dispersive X-ray analyser
f	fibre
FGF	fibroblast growth factor
LDH	lactate dehydrogenase
mpcf	millions of particles per cubic foot
mpcm	millions of particles per cubic metre
NHMI	N-nitrosoheptamethyleneimine
OR	odds ratio
p	particle
PCOM	phase contrast optical microscopy
PDGF	platelet-derived growth factor
PMR	proportional mortality ratio
RR	relative risk
SAED	selected area electron diffraction
SEM	scanning electron microscopy
SMR	standardized mortality ratio
TEM	transmission electron microscopy
TPA	12-O-tetradecanoylphorbol-13-acetate
TWA	time-weighted average
UICC	Union Internationale Contre le Cancer (reference asbestos samples)

INTRODUCTION

As early as 1986 the International Programme on Chemical Safety (IPCS) published the Environmental Health Criteria (EHC 53) on the health effects of natural mineral fibres with particular emphasis on asbestos (IPCS, 1986). During the next 7 years, efforts were focused on possible reduction of environmental asbestos exposure (IPCS, 1989; WHO/OCH, 1989), including the evaluation of a number of possible substitute fibres such as man-made mineral fibres (IPCS, 1988), and

selected organic synthetic fibres (IPCS, 1993).

In 1992, four WHO Member States invited the Director-General of WHO to request the IPCS to update that part of EHC 53 concerning the health effects of chrysotile asbestos. The Director-General accepted the request and instructed the IPCS to develop an EHC specifically for chrysotile asbestos taking into consideration that (a) the International Labour Organisation had recommended the discontinuation of the use of crocidolite asbestos; (b) amosite asbestos was, for all practical purposes, no longer exploited; and (c) there was still wide-spread production and use of chrysotile asbestos in the world.

A number of reputable scientists (selected solely on the basis of their contributions to the open scientific literature) were approached with the request to develop individual scientific chapters for the first draft. Chapters 5, 6 and 7 were drafted by two or three authors independently. On the basis of these texts a coherent draft was prepared by the IPCS.

The drafts of chapters 5, 6 and 7 were sent for preliminary review to a limited number of recognized experts proposed by IPCS participating institutions. The full draft of the document was submitted to the standard IPCS worldwide evaluation procedure by circulating it for comments to more than 140 IPCS Contact Points.

Taking into account all the relevant comments, a second draft was developed by the IPCS. Chapter 7, drafted independently by three authors, was modified by a working group of experts and focuses on lung cancer and mesothelioma risks in populations exposed almost exclusively to chrysotile. The discussion in this chapter has been restricted primarily to direct observation from epidemiological studies.

The third draft was submitted for evaluation, modification and finalization to a Task Group of experts appointed by WHO. None of the primary authors was appointed to be a member of the Task Group.

2. SUMMARY

1.1 Identity, physical and chemical properties, sampling and analysis

Chrysotile is a fibrous hydrated magnesium silicate mineral that has been used in many commercial products. It is widely used in global commerce today. Its physical and chemical properties as a mineral are observed to vary among the exploited geological deposits. The minerals that accompany the fibre in ores are many, and among these may be some varieties of fibrous amphibole. Tremolite is thought to be especially important in this respect; its form and concentration range greatly.

Analysis of chrysotile in the workplace currently entails the use of light and electron microscopes. Various instruments and devices have been previously used to monitor environments for the presence and concentration of both total dust and fibres. The membrane filter technique and phase contrast optical microscopy are commonly used today for workplace assay (expressed as fibres per ml air); and the transmission electron microscopy is also employed. Environmental assays require the use of transmission electron microscopy. Tissue burden studies have been employed to improve information regarding exposures. Depending on the degree of attention to detail in these studies, inferences regarding mechanisms and etiology have been drawn.

Gravimetric and thermal precipitator and midjet impinger techniques were previously used for workplace characterization, and

these dust (not fibre) values are the only early exposure indices available for gauging exposure-response relationships. There have been many attempts to convert these values to fibres per volume of air, but these conversions have had very limited success. Conversion factors have been found to be industry-specific and even operation-specific; universal conversion factors carry high variances.

1.2 Sources of occupational and environmental exposure

Low concentrations of chrysotile are found throughout the crustal environment (air, water, ice caps and soil). Both natural and human activities contribute to fibre aerosolization and distribution. Anthropogenic sources include dusts from occupational activities, which cover ore recovery and processing, manufacturing, application, usage and, ultimately disposal.

Production occurs in 25 countries, and there are seven major producers. Annual world production of asbestos peaked at over 5 million tonnes in the mid-1970s but has since declined to a current level of about 3 million tonnes. Manufacturing of chrysotile products is undertaken in more than 100 countries, and Japan is the leading consumer country. The current main activities resulting in potential chrysotile exposure are: (a) mining and milling; (b) processing into products (friction materials, cement pipes and sheets, gaskets and seals, paper and textiles); (c) construction, repair and demolition; (d) transportation and disposal. The asbestos-cement industry is by far the largest user of chrysotile fibres, accounting for about 85% of all use.

Fibres are released during processing, installation and disposal of asbestos-containing products, as well as through normal wear of products in some instances. Manipulation of friable products may be an important source of chrysotile emission.

1.3 Occupational and environmental exposure levels

Based on data mainly from North America, Europe and Japan, in most production sectors workplace exposures in the early 1930s were very high. Levels dropped considerably to the late 1970s and have declined substantially to present day values. In the mining and milling industry in Quebec, the average fibre concentrations in air often exceeded 20 fibres/ml (f/ml) in the 1970s, while they are now generally well below 1 f/ml. In the production of asbestos-cement in Japan, typical mean concentrations were 2.5-9.5 f/ml in 1970s, while mean concentrations of 0.05-0.45 f/ml were reported in 1992. In asbestos textile manufacture in Japan, mean concentrations were between 2.6 and 12.8 f/ml in the period between 1970 and 1975, and 0.1-0.2 f/ml in the period between 1984 and 1986. Trends have been similar in the production of friction materials: based on data available from the same country, mean concentrations of 10-35 f/ml were measured in the period between 1970 and 1975, while levels 0.2-5.5 f/ml were reported in the period between 1984 and 1986. In a plant in the United Kingdom in which a large mortality study was conducted, concentrations were generally above 20 f/ml in the period before 1931 and generally below 1 f/ml during 1970-1979.

Few data on concentrations of fibres associated with the installation and use of chrysotile-containing products are available, although this is easily the most likely place for workers to be exposed. In the maintenance of vehicles, peak concentrations of up to 16 f/ml were reported in the 1970s, while practically all measured levels after 1987 were less than 0.2 f/ml. Time-weighted average exposures during passenger vehicle repair in the 1980s were generally

less than 0.05 f/ml. However, with no controls, blowing off debris from drums resulted in short-term high concentrations of dust.

There is potential for exposure of maintenance personnel to mixed asbestos fibre types due to large quantities of friable asbestos in place. In buildings with control plans, personal exposure of building maintenance personnel in the USA, expressed as 8-h time-weighted averages, was between 0.002 and 0.02 f/ml. These values are of the same order of magnitude as typical exposures during telecommunication switchwork (0.009 f/ml) and above-ceiling work (0.037 f/ml), although higher concentrations were reported in utility space work (0.5 f/ml). Concentrations may be considerably higher where no control plans have been introduced. In one case, short-term episodic concentrations were 1.6 f/ml during sweeping and 15.5 f/ml during dusting of library books in a building with a very friable chrysotile-containing surface formulation. Most other 8-h time-weighted averages are about two orders of magnitude less.

Based on surveys conducted before 1986, fibre concentrations (fibres > 5 µm in length) in outdoor air, measured in Austria, Canada, Germany, South Africa and the USA, ranged between 0.0001 and about 0.01 f/ml, levels in most samples being less than 0.001 f/ml. Means or medians were between 0.00005 and 0.02 f/ml, based on more recent determinations in Canada, Italy, Japan, the Slovak Republic, Switzerland, United Kingdom and USA.

Fibre concentrations in public buildings, even those with friable asbestos-containing materials, are within the range of those measured in ambient air. Concentrations (fibres > 5 µm in length) in buildings in Germany and Canada reported before 1986 were generally less than 0.002 f/ml. In more recent surveys in Belgium, Canada, the Slovak Republic, United Kingdom and USA, mean values were between 0.00005 and 0.0045 f/ml. Only 0.67% of chrysotile fibres were longer than 5 µm.

1.4 Uptake, clearance, retention and translocation

The deposition of inhaled chrysotile asbestos is dependent upon the aerodynamic diameter, the length and the morphology of the fibre. Most airborne chrysotile fibres are considered respirable because their fibre diameters are less than 3 µm, equal to an aerodynamic diameter of about 10 µm. In laboratory rats, chrysotile fibres are deposited primarily at alveolar duct bifurcations.

In the nasopharyngeal and tracheobronchial regions, chrysotile fibres are cleared via mucocilliary clearance. At the alveolar duct bifurcations the fibres are taken up by epithelial cells. Fibre length is an important determinant of alveolar clearance of chrysotile fibres. There is extensive evidence from animal studies that short fibres (less than 5 µm long) are cleared more rapidly than long fibres (longer than 5 µm). The mechanisms of the relatively more rapid clearance of chrysotile fibres compared to those of amphiboles are not completely known. It has been hypothesized that short chrysotile fibres are cleared through phagocytosis by alveolar macrophages, while long chrysotile fibres are cleared mainly by breakage and/or dissolution. To what extent chrysotile fibres are translocated to the interstitium, pleural tissue and other extrathoracic tissues is not fully understood.

Analyses of human lungs of workers exposed to chrysotile asbestos indicate much greater retention of tremolite, an amphibole asbestos commonly associated with commercial chrysotile in small proportions, than of chrysotile. The more rapid removal of chrysotile fibres from the human lung is further supported by findings from animal studies

showing that chrysotile is more rapidly cleared from the lung than are amphiboles including crocidolite and amosite.

Available data from studies in humans and animals are insufficient to evaluate the possible uptake, distribution and excretion of chrysotile fibres from ingestion. Available evidence indicates that, if penetration of chrysotile fibres across the gut wall does occur, it is extremely limited. One study indicated an

increased level of chrysotile fibres in the urine of workers occupationally exposed to chrysotile.

1.5 Effects on animals and cells

Various experimental samples of chrysotile fibres have been shown in numerous long-term inhalation studies to cause fibrogenic and carcinogenic effects in laboratory rats. These effects include interstitial fibrosis and cancer of the lung and pleura. In most cases, there appears to be an association between fibrosis and tumours in the rat lung. Fibrogenic and carcinogenic effects have also been found in long-term animal studies (mainly in rats) using other modes of administration (e.g., intratracheal instillation and intrapleural or intraperitoneal injection).

Exposure/dose-response relationships for chrysotile-induced pulmonary fibrosis, lung cancer and mesothelioma have not been adequately investigated in long-term animal inhalation studies. Inhalation studies conducted to date, mainly using a single exposure concentration, show fibrogenic and carcinogenic responses at airborne fibre concentrations ranging from 100 to a few thousand fibres/ml. When data from various studies are combined, there appears to be a relationship between airborne fibre concentrations and lung cancer incidence. This type of analysis, however, may not be scientifically sound as different experimental conditions were used in available studies.

In non-inhalation experiments (intrapleural and intraperitoneal injection studies), dose-response relationships for mesothelioma have been demonstrated for chrysotile fibres. Data from these types of studies, however, may not be suitable for the evaluations of human risk from inhalation exposure to fibres.

Tremolite asbestos, a minor component mineral of commercial chrysotile, has also been shown to be carcinogenic and fibrogenic in a single inhalation experiment and an intraperitoneal injection study in rats. Exposure/dose-response data are not available to allow direct comparison of the cancer potency of tremolite and chrysotile.

The ability of fibres to induce fibrogenic and carcinogenic effects appears to be dependent on their individual characteristics, including fibre dimension and durability (i.e. biopersistence in target tissues), which are determined in part by the physico-chemical properties. It has been well documented in experimental studies that short fibres (shorter than 5 µm) are less biologically active than long fibres (longer than 5 µm). It is still uncertain, however, whether short fibres have any significant biological activity. Furthermore, it is not known how long a fibre needs to remain in the lung in order to induce preneoplastic effects, since the appearance of asbestos-related cancer generally occurs later in the animal's life.

The mechanisms by which chrysotile and other fibres cause fibrogenic and carcinogenic effects are not completely understood. Possible mechanisms of fibrogenic effects of fibres include chronic

inflammation process mediated by production of growth factors (e.g., TNF-alpha) and reactive oxygen species. With regard to fibre-induced carcinogenicity, several hypotheses have been proposed. These include: DNA damage by reactive oxygen species induced by fibres; direct DNA damage by physical interactions between fibres and target cells; enhancement of cell proliferation by fibres; fibre-provoked chronic inflammatory reactions leading to prolonged release of lysozymal enzymes, reactive oxygen species, cytokines and growth factors; and action by fibres as co-carcinogens or carriers of chemical carcinogens to the target tissues. It is likely, however, that all these mechanisms contribute to the carcinogenicity of chrysotile fibres, as such effects have been observed in various *in vitro* systems of human and mammalian cells.

Overall, the available toxicological data provide clear evidence that chrysotile fibres can cause fibrogenic and carcinogenic hazard to humans. The data, however, are not adequate for providing quantitative estimates of the risk to humans. This is because there are inadequate exposure-response data from inhalation studies, and there are uncertainties concerning the sensitivities of the animal studies for predicting human risk.

Chrysotile fibres have been tested in several oral carcinogenicity studies. Carcinogenic effects have not been reported in available studies.

1.6 Effects on humans

Commercial grades of chrysotile have been associated with an increased risk of pneumoconiosis, lung cancer and mesothelioma in numerous epidemiological studies of exposed workers.

The non-malignant diseases associated with exposure to chrysotile comprise a somewhat complex mixture of clinical and pathological syndromes not readily definable for epidemiological study. The prime concern has been asbestosis, generally implying a disease associated with diffuse interstitial pulmonary fibrosis accompanied by varying degrees of pleural involvement.

Studies of workers exposed to chrysotile in different sectors have broadly demonstrated exposure-response or exposure-effect relationships for chrysotile-induced asbestosis, in so far as increasing levels of exposure have produced increases in the incidence and severity of disease. However, there are difficulties in defining this relationship, due to factors such as uncertainties in diagnosis and the possibility of disease progression on cessation of exposure.

Furthermore, some variation in risk estimates are evident among the available studies. The reasons for the variations are not entirely clear, but may relate to uncertainties in exposure estimates, airborne fibre size distributions in the various industry sectors and statistical models. Asbestotic changes are common following prolonged exposures of 5 to 20 f/ml.

The overall relative risks for lung cancer are generally not elevated in the studies of workers in asbestos-cement production and in some of the cohorts of asbestos-cement production workers. The exposure-response relationship between chrysotile and lung cancer risk appears to be 10-30 times higher in studies of textile workers than in studies of workers in mining and milling industries. The relative risks of lung cancer in the textile manufacturing sector in relation to estimated cumulative exposure are, therefore, some 10-30 times greater than those observed in chrysotile mining. The reasons for this

variation in risk are not clear, so several hypotheses, including variations in fibre size distribution, have been proposed.

Estimation of the risk of mesothelioma is complicated in epidemiological studies by factors such as the rarity of the disease, the lack of mortality rates in the populations used as reference, and problems in diagnosis and reporting. In many cases, therefore, risks have not been calculated, and cruder indicators have been used, such as absolute numbers of cases and deaths, and ratios of mesothelioma over lung cancers or total deaths.

Based on data reviewed in this monograph, the largest number of mesotheliomas has occurred in the chrysotile mining and milling sector. All the observed 38 cases were pleural with the exception of one of low diagnostic probability, which was pleuro-peritoneal. None occurred in workers exposed for less than 2 years. There was a clear dose-response relationship, with crude rates of mesotheliomas (cases/ 1000 person-years) ranging from 0.15 for those with cumulative exposure less than 3530 million particles per m³ (mpcm)-years (< 100 million particles per cubic foot (mpcf)-years) to 0.97 for those with exposures of more than 10 590 mpcm-years (> 300 mpcf-years).

Proportions of deaths attributable to mesotheliomas in cohort studies in the various mining and production sectors range from 0 to 0.8%. Caution should be exercised in interpreting these proportions as studies do not provide comparable data stratifying deaths by exposure intensity, duration of exposure or time since first exposure.

There is evidence that fibrous tremolite causes mesothelioma in humans. Since commercial chrysotile may contain fibrous tremolite, it has been hypothesized that the latter may contribute to the induction of mesotheliomas in some populations exposed primarily to chrysotile. The extent to which the observed excesses of mesothelioma might be attributed to the fibrous tremolite content has not been resolved.

The epidemiological evidence that chrysotile exposure is associated with an increased risk for cancer sites other than the lung or pleura is inconclusive. There is limited information on this issue for chrysotile *per se*, although there is some inconsistent evidence for an association between asbestos exposure (all forms) and laryngeal, kidney and gastrointestinal tract cancers. A significant excess of stomach cancer has been observed in a study of Quebec chrysotile miners and millers, but possible confounding by diet, infections or other risk factors has not been addressed.

It should be recognized that although the epidemiological studies of chrysotile-exposed workers have been primarily limited to the mining and milling, and manufacturing sector, there is evidence, based on the historical pattern of disease associated with exposure to mixed fibre types in western countries, that risks are likely to be greater among workers in construction and possibly other user industries.

1.7 Environmental fate and effects on biota

Serpentine outcroppings occur world-wide. Mineral components, including chrysotile, are eroded through crustal processes and are transported to become a component of the water cycle, sediment population and soil profile. Chrysotile presence and concentrations have been measured in water, air and other units of the crust.

Chrysotile and its associated serpentine minerals chemically degrade at the surface. This produces profound changes in soil pH and



**World Health
Organization**

Elimination of asbestos- related diseases

World Health Assembly Resolution 58.22 from 2005 on cancer prevention and control urged Member States to pay special attention to cancers for which avoidable exposure is a factor, particularly exposure to chemicals at the workplace and the environment. Asbestos is one of the most important occupational carcinogens causing about half of the deaths from occupational cancer (1;2). Furthermore, the Thirteenth Session of the Joint ILO/WHO Committee on Occupational Health in 2003 recommended that special attention should be paid to the elimination of asbestos-related diseases (3).

The term "asbestos" designates a group of naturally occurring fibrous serpentine or amphibole minerals with current or historical commercial usefulness due to their extraordinary tensile strength, poor heat conduction, and relative resistance to chemical attack. The principal varieties of asbestos are chrysotile, a serpentine material, and crocidolite, amosite, anthophyllite, tremolite and actinolite, which are amphiboles (4).

Exposure to asbestos causes a range of diseases, such as lung cancer, mesothelioma, and asbestosis (fibrosis of the lungs), as well as pleural plaques, thickening and effusions (5;6). There is also evidence that it causes laryngeal and possibly some other cancers (7).

Exposures to asbestos and its impact on public health are substantial

Exposure to asbestos occurs through inhalation of fibres primarily from contaminated air in the working environment, as well as from ambient air in the vicinity of point sources, or indoor air in housing and buildings containing friable asbestos materials. The highest levels of exposure occur during repackaging of asbestos containers, mixing with other raw materials and dry cutting of asbestos-containing products with abrasive tools. Exposure can also occur during installation and use of asbestos-containing products and maintenance of vehicles. Friable chrysotile and/or amphibole-containing materials are still in place in many buildings and continue to give rise to exposure to both chrysotile and the amphiboles during maintenance, alteration, removal and demolition (5).

Currently about 125 million people in the world are exposed to asbestos at the workplace (1). According to global estimates at least 90,000 people die each year from asbestos-related lung cancer, mesothelioma and asbestosis resulting from occupational exposures (1;2;8). In addition, it is believed that several thousands of deaths can be attributed to other asbestos-related diseases as well as to non-occupational exposures to asbestos. The burden of asbestos-related diseases is still rising, even in countries that have banned the use of asbestos in the early 1990s. Because of the long latency periods attached to the diseases in question, stopping the use of asbestos now will only result in a decrease in the number of asbestos-related deaths after a number of decades.

All types of asbestos cause cancer in humans

Asbestos (actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite) has been classified by the International Agency for Research on Cancer as being carcinogenic to humans (9). Exposure to

chrysotile, amosite and anthophyllite asbestos and to mixtures containing crocidolite results in an increased risk of lung cancer (9). Mesotheliomas have been observed after occupational exposure to crocidolite, amosite, tremolite and chrysotile, as well as among the general population living in the neighbourhood of asbestos factories and mines and in people living with asbestos workers (9).

The incidence of asbestos-related diseases is related to fibre type, fibre size, fibre dose and to industrial processing of the asbestos (6). No threshold has been identified for the carcinogenic risk of chrysotile (5). Cigarette smoking increases the risk of lung cancer from asbestos exposure (5:10).

Chrysotile is still widely used

Asbestos has been used in thousands of products for a vast number of applications, such as roofing shingles, water supply lines, fire blankets, plastic fillers, and medical packing, as well as clutches and brake linings, gaskets and pads for automobiles. As a result of increasing health concerns, the use of asbestos has declined in many countries. The use of crocidolite and products containing this fibre as well as spraying of all forms of asbestos have been prohibited under the ILO Convention No. 162 from 1986 Concerning Safety in the Use of Asbestos. However, chrysotile asbestos is still widely used, with approximately 90% being employed in asbestos-cement building materials, the largest users of which are developing countries (11). Other remaining uses of chrysotile are friction materials (7%), textiles and other applications (11).

To date, more than 40 countries, including all member states of the European Union, have banned the use of all forms of asbestos, including chrysotile. Other countries have introduced less stringent restrictions. However, some countries have maintained or even increased their production or use of chrysotile in recent years (12). World production of asbestos in the period 2000-2005 has been relatively stable, at between 2,050,000 and 2,400,000 metric tonnes per annum (13:14).

WHO recommendations on prevention of asbestos-related diseases

Bearing in mind that there is no evidence for a threshold for the carcinogenic effect of asbestos and that increased cancer risks have been observed in populations exposed to very low levels (5:9), the most efficient way to eliminate asbestos-related diseases is to stop using all types of asbestos. Continued use of asbestos cement in the construction industry is a particular concern, because the workforce is large, it is difficult to control exposure, and in-place materials have the potential to deteriorate and pose a risk to those carrying out alterations, maintenance and demolition (5). In its various applications, asbestos can be replaced by some fibre materials (15) and by other products which pose less or no risk to health.

Materials containing asbestos should be encapsulated and, in general, it is not recommended to carry out work that is likely to disturb asbestos fibres. If necessary, such work should be carried out only under strict preventive measures to avoid exposure to asbestos, such as encapsulation, wet processes, local exhaust ventilation with filtration, and regular cleaning. It also requires the use of personal protective equipment - special respirators, safety goggles, protective gloves and clothing - and the provision of special facilities for their decontamination (16).

WHO is committed to work with countries towards elimination of asbestos-related diseases in the following strategic directions:

- by recognizing that the most efficient way to eliminate asbestos-related diseases is to stop the use of all types of asbestos;

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- to provide information about solutions for replacing asbestos with safer substitutes and developing economic and technological mechanisms to stimulate its replacement;
 - to take measures to prevent exposure to asbestos in place and during asbestos removal (abatement);
 - to improve early diagnosis, treatment, social and medical rehabilitation of asbestos-related diseases and to establish registries of people with past and/or current exposures to asbestos.

WHO strongly recommends planning for and implementation of these measures as part of a comprehensive national approach for elimination of asbestos-related diseases. Such an approach should also include: developing national profiles; awareness raising; capacity building; an institutional framework; and a national plan of action for elimination of asbestos-related diseases.

WHO will collaborate with ILO on the implementation of the Resolution on Asbestos, adopted by the Ninety-fifth Session of the International Labour Conference (17) and will work with other intergovernmental organizations and civil society towards elimination of asbestos-related diseases worldwide.

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Fichas Internacionales de Seguridad Química

CRISOTILO

ICSC: 0014

☒		☒ Nueva imagen institucional	
CRISOTILO Asbesto serpentina Asbesto blanco $Mg_6Si_4H_8O_{18}/Mg_6(Si_4O_{10})(OH)_8$ Masa molecular: 554 Nº CAS 12001-29-5 Nº RTECS CI16478500 Nº ICSC 0014 Nº NU 2590 (asbesto blanco)			
TIPOS DE PELIGRO/ EXPOSICION	PELIGROS/ SINTOMAS AGUDOS	PREVENCION	PRIMEROS AUXILIOS/ LUCHA CONTRA INCENDIOS
● INCENDIO	No combustible.		En caso de incendio en el entorno: están permitidos todos los agentes extintores.
EXPLOSION			
EXPOSICION		-EVITAR LA DISPERSION DEL POLVO! -EVITAR TODO CONTACTO!	
● INHALACION	Tos.	Protección respiratoria. Sistema cerrado y ventilación.	
● PIEL		Traje de protección.	Quitar las ropas contaminadas. aclarar la piel con agua abundante o ducharse.
● OJOS			Enjuagar con agua abundante durante varios minutos (quitar las lentes de contacto si puede hacerse con facilidad) y proporcionar asistencia médica.
● INGESTION		No comer, ni beber, ni fumar durante el trabajo. Lavarse las manos antes de comer.	Enjuagar la boca.
DERRAMAS Y FUGAS		ALMACENAMIENTO	ENVASADO Y ETIQUETADO
Evacuar la zona de peligro. Consultar a un experto. Barrer la sustancia derramada e introducirla en un recipiente precintable; si fuera necesario, humedecer el polvo para evitar su dispersión. Recoger cuidadosamente el residuo y trasladarlo a continuación a un lugar seguro. (Protección personal adicional: traje de protección completo incluyendo equipo autónomo de respiración).		Mantener bien cerrado.	Usese un envase protector frente al polvo. Clasificación de Peligros NU: 9 Grupo de Envasado NU: III
VEASE AL DORSO INFORMACION IMPORTANTE			

Fichas Internacionales de Seguridad Química

CRISOTILO

ICSC: 0014

D A T O S I M P O R T A N T E S	ESTADO FISICO; ASPECTO Fibras blancas, grises, verdes o amarillas.	VIAS DE EXPOSICION La sustancia se puede absorber por inhalación.
	PELIGROS FISICOS	RIESGO DE INHALACION La evaporación a 20°C es despreciable; sin embargo, se puede alcanzar rápidamente una concentración nociva de partículas en el aire.
	PELIGROS QUIMICOS	EFFECTOS DE EXPOSICION DE CORTA DURACION
	LIMITES DE EXPOSICION TLV (como TWA): 2 fibras/cm ³ (ACGIH 1997-1998).	EFFECTOS DE EXPOSICION PROLONGADA O REPETIDA La sustancia puede afectar al pulmón, dando lugar a fibrosis pulmonar y mesotelioma. Esta sustancia es carcinógena para los seres humanos.
PROPIEDADES FISICAS	Punto de fusión: (Véanse Notas).	Densidad relativa (agua = 1): 2.55
DATOS AMBIENTALES	Esta sustancia puede ser peligrosa para el ambiente; deberja prestarse atención especial a aire. ☒	
NOTAS		
La sustancia se descompone totalmente a la temperatura de 1000°C. El fumar aumenta los efectos perjudiciales de esta sustancia. Está indicado examen médico periódico dependiendo del grado de exposición. NO llevar a casa la ropa de trabajo. Aplicar también las recomendaciones de esta ficha a otras formas de asbestos. Ficha de emergencia de transporte (Transport Emergency Card): TEC (R)-913		
INFORMACION ADICIONAL		
FISQ: 5-055 CRISOTILO		
ICSC: 0014		CRISOTILO
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Ni la CCE ni la IPCS ni sus representantes son responsables del posible uso de esta información. Esta ficha		

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AS-15 AS-15 Armamento. Misil soviético disparado desde el aire, capaz de llevar una ojiva nuclear a una distancia de 3050 Km.

AS-20 AS-20 Armamento. Misil francés aire a superficie impulsado por un motor cohete de doble impulso con combustible sólido, equipado con un sistema de guía con radiocomando; lleva una carga convencional de 30 Kg a una velocidad de Mach 1.7, con alcance máximo de 2.9 a 6.4 Km.

AS-30 AS-30 Armamento. Misil táctico francés, aire a superficie, impulsado por un motor de dos etapas de combustible sólido, equipado con radiocomando o con sistema TCA automático de guía, que lleva carga convencional de 240 kg a velocidad de Mach 1.5, con alcance máximo de 10 km. El AS-30L tiene un sistema automático de guía con iluminación láser.

ASA, A. S. A. American Surgical Association (Asociación Quirúrgica Americana); **American Society of Anesthesiologists** (Sociedad Americana de Anestesiólogos); **Acoustical Society of America** (Sociedad Acústica de América); **American Standards Association** (Asociación Americana de Normas).

Asaphus Asaphus Paleontología. Género de trilobites grandes y lisos, del suborden Asaphina, que alcanzaban longitudes casi de 60 cm; el Asaphus apareció por primera vez en el Cámbrico Medio, pero es característico del Ordovícico Inferior.

asapocynin asapocynina Farmacología. $C_9H_{10}O_7$, sustancia derivada del café de Canadá y otras plantas del género *Apocynum*; se usa como estimulante cardíaco semejante a la digitalina. También, ACETOVALNILLON, acetovalnilina, APOCYNIN, apocinina.

asarone asarona Química orgánica. $C_{12}H_{16}O_3$, sólido cristalino que funde a 67°C; es insoluble en agua y soluble en alcohol; lo producen las plantas del género *Asarum*. Se usa en formulaciones de aceites esenciales.

ASB, A. S. B. American Society of Bacteriologists (Sociedad Americana de Bacteriólogos).

asbestos asbesto Mineralogía. Término general para indicar cualquiera de diversos minerales de silicato que se puedan separar en fibras flexibles largas, delgadas y resistentes al calor; se usa para diversos fines comerciales. Se puede dividir el asbesto en dos grupos estructurales generales: la anfíbola y la serpentina, cada uno de los cuales contiene una serie de especies fibrosas. **Ciencia de materiales.** Que se relaciona con, o que contiene esos materiales. Derivados: asbestos board, cartón de asbesto, asbestos felt, tela de asbesto, asbestos insulation, aislamiento de asbesto, asbestos pipe, tubo de asbesto, asbestos plaster, masilla de asbesto, asbestos roofing, techo de asbesto, asbestos shingles, lámina de asbesto, etcétera.

asbestos cement asbesto cemento Ingeniería de construcción. Mezcla de fibras de asbesto, cemento Portland y agua; se usa para fabricar el tablero llamado "tablero de asbesto" (asbestos sheeting), o "tablero de asbesto cemento" (asbestos-cement board).

asbestos-cement cladding recubrimiento de asbesto cemento Ingeniería de construcción. Formación de una pared, o enlucido de una pared, empleando tableros de asbesto y piezas de muro directamente soportados por bastidores.

asbestosis asbestosis Medicina. Enfermedad de los pulmones, pneumoconiosis, originada por la inhalación de fibras de asbesto; sus síntomas son fibrosis intersticial del pulmón y se asocia con mesotelioma pleural y carcinoma broncogénico.

asbolite asbolita Mineralogía. Agregado mineral suave y negro que contiene óxidos hidratados de manganeso; se clasifica como un tipo de ocre negro y es rico en cobalto, hasta con 32%. También, BLACK COBALT, cobalto negro.

as-brassard rúcton latonado Metalurgia. Estado de un metal o aleación que han sido latonados, pero no sometidos a tratamientos térmicos o mecánicos.

A scale escala de La Acústica. 1. Escala diatónica que comienza en la nota musical patrón, "la", con frecuencia de 440 Hz. 2. Escala de medición de ruido, que se representa mediante L_p , con la cual se calibra la mayor parte de los aparatos medidores de sonido, de modo que el instrumento tenga una respuesta que se aproxime al contorno de sonoridad de 40 fones para un tono de 8000 Hz.

A-scan examen A Óptica. Técnica ultrasónica que se usa en evaluación no destructiva, en la cual se emplea un transductor estacionario junto con un osciloscopio para descubrir grietas u otras fallas internas en un cuerpo.

A-scan barrido A Radiología. Presentación visual de ecos ultrasonográficos en un tubo de rayos catódicos, en la cual un eje representa el tiempo transcurrido durante el regreso de un eco y el otro eje corresponde a la intensidad del eco. **Electrónica.** Véase A DISPLAY.

Ascaphidae Ascaphidae Zoología de vertebrados. Pequeña familia de ranas primitivas del orden Anura que se encuentran en Nueva Zelanda y el noroeste de Estados Unidos.

ascariasis ascariasis Medicina. Infección por gusanos redondos, en especial *Ascaris lumbricoides*, en el intestino delgado; provoca cólicos y diarrea, por lo general en los niños.

ascarid ascárido Zoología de invertebrados. Gusano nemátodo de la familia Ascaridae que comprende a los parásitos intestinales comunes de los moluscos, artrópodos y vertebrados terrestres.

Ascarididae Véase ASCARIDIDEA.

Ascarididae Ascarididae Zoología de invertebrados. Familia de nemátodos de la superfamilia Ascaridoidea, con una región labial bien desarrollada, separada de la región cervical; son parásitos en el tracto intestinal de mamíferos terrestres, reptiles y anfíbios.

Ascaridina Ascaridina Zoología de invertebrados. Suborden de los Rhabditida que comprende a los gusanos nemátodos sin estilete; son parásitos de varios artrópodos, moluscos y vertebrados, incluyendo los seres humanos.

Ascaridoidea Ascaridoidea Zoología de invertebrados. Superfamilia del suborden Ascaridina; gusanos nemátodos de medianos a grandes, parásitos intestinales de vertebrados, con un esófago muy musculado. También, ASCARIDIDEA.

ascaridole ascáridol Química orgánica. $C_{10}H_{16}O_2$, peróxido inestable de terpeno, líquido, que explota si se lo calienta a 115°C; soluble en alcohol, acetona y benceno; se usa para iniciar reacciones de polimerización; antes se usaba en medicina.

Ascaris Ascaris Zoología de invertebrados. Género de gusanos nemátodos con boca de tres labios, que parecen lombrices de tierra; incluye a la lombriz común sin anillos.



Ascaris

Ascaridoidea Véase ASCARIDIDEA.

ascaroid nemátodo nemátodo ascárido Zoología de invertebrados. Gusanos redondos de la superfamilia Ascaridoidea, parásitos en los vertebrados, incluso en los seres humanos; una especie característica es *Ascaris lumbricoides*.

ascaryosis ascariosis Bioquímica. Análisis presente en el lipopolisacárido de algunas cepas de *Yersinia pseudotuberculosis*.

ascend ascender Aviación. Moverse hacia arriba en un vehículo en vuelo, con frecuencia, directamente hacia arriba en una trayectoria casi vertical, a diferencia de una trayectoria de pendiente más gradual en la subida.

ascender ruego ascendente Artes gráficas. Parte de letra minúscula que se prolonga sobre el elemento principal de la letra. Las letras b, d, f, h, k y l tienen ascensores.

ascending aorta aorta ascendente Anatomía. La parte proximal de la aorta que inicia en el ventrículo izquierdo y da lugar a las arterias coronarias derecha e izquierda antes de pasar el arco de la aorta.

ascending branch ramal ascendente, ascenso, subida Mecánica. Parte de la trayectoria de un objeto antes de alcanzar el punto más elevado, a lo largo de la cual la altura crece constantemente al pasar el tiempo.

ascending central series serie central ascendente Matemáticas. Sea $C_1(G)$ el centro de un grupo G , es decir, el subgrupo normal de G formado por todos los elementos de G que conmutan con cada elemento de G . Sea $C_2(G)$ la imagen inversa de $C_1(G)$ bajo la proyección canónica $G \rightarrow G/C_1(G)$. Se puede demostrar, entonces, que $C_2(G)$ es subgrupo normal de G que contiene a $C_1(G)$. A continuación se sigue este proceso en forma inductiva: $C_i(G)$ es la imagen inversa de $C_{i-1}(G)$ bajo la proyección canónica $G \rightarrow G/C_{i-1}(G)$. La sucesión resultante de subgrupos normales de G , representada por $(e) < C_1(G) < C_2(G) < \dots$ es la serie central ascendente de G ; e es el elemento identidad de G , y $<$ quiere decir "es subgrupo normal de". Si $C_n(G) = G$ para cierta n , entonces se dice que G es nilpotente (nilpotent).

ascending chain condition condición de cadena ascendente Matemáticas. Se dice que un módulo A satisface la condición de cadena ascendente en submódulos, o que es cateniano (Noetherian) si para cada cadena $\dots A_3 \supset A_2 \supset A_1$ de submódulos de A , existe un entero, n , tal que $A_i = A_n$ para toda $i \geq n$.

ascending chromatography cromatografía ascendente Química analítica. Técnica de separación en la cual la fase móvil de una mezcla sube por la fase estacionaria debido a la acción capilar.

The Asbestos War

Guest Editor

LAURIE KAZAN-ALLEN

The Asbestos War

LAURIE KAZAN-ALLEN

That asbestos is still being sold despite overwhelming evidence linking it to debilitating and fatal diseases is testament to the effectiveness of a campaign, spear-headed by Canadian interests, to promote a product already banned in many developed countries. Blessed by government and commercial support, asbestos apologists have implemented a long-term coordinated strategy targeting new consumers in Asia, the Far East and Latin America. At industry-backed "conferences" and on government-funded junkets, they spin a web of deceit, telling all who will listen that "chrysotile (white asbestos) can be used safely." The fact that Canada exports over 95% of all the chrysotile it mines suggests that while chrysotile is supposedly safe enough for foreigners, it is not safe enough for Canadians. Asbestos victims in many countries have struggled to gain public recognition of the human cost of asbestos use. In recent years, nongovernmental organizations working with these groups have created a global anti-asbestos virtual network; with the commitment and support of thousands of "virtual members," this network challenges industry's propaganda and exposes the forces that support its cynical attempt to offload this dangerous substance on developing countries. *Key words:* asbestos; industry; victims' rights; globalization; developing countries.

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Although the asbestos industry's disregard for occupational and public health has been well documented, the precise moment when the pursuit of profit became imbued with a military fervor has not been pinpointed. That a state of war has been declared, however, is clearly shown by an e-mail circulated by the Asbestos Institute (AI), Montreal, dated

February 8, 2002: the subject heading is: "WAR report."¹ Following the collapse in Western demand for asbestos, producers have mounted a global campaign to protect remaining markets and develop new ones. Access to generous funding from their supporters has enabled pro-chrysotile lobbyists to bombard government officials and journalists in the developing world with offers of "technical assistance" and free trips to Canada: a well-oiled propaganda machine reassures civil servants and consumers that asbestos can be used "safely under controlled conditions," despite a vast amount of scientific and medical evidence which proves otherwise.

The public debate on asbestos has been skilfully manipulated by industry "experts" who appear on the scene as if by magic in times of trouble. In March 1999, just as U.K. and European Union policymakers were revising proposed asbestos directives, a trade mission arrived in London offering "vetted" journalists the opportunity for an "open and frank briefing" on chrysotile. According to literature obtained at that time, this event was held under the auspices of: "The Asbestos International Association for Environmental and Occupational Health Protection." Judging by the lack of media coverage, the visit of Vangula Pattabhi of Hyderabad Industries (India), Edward Chindori-Chininga, Zimbabwe's Deputy Minister of Mines, Environment and Tourism, Andre Brochu, a trade unionist from Quebec, and Bob Pigg, President of the Asbestos Information Association, was not a success. After one hundred years, the battle for Europe had been lost.

The objective of this series of articles in the *IJOEH* is to provide a public forum in which asbestos victims and their representatives can detail the repercussions of asbestos misuse in their countries, reveal the important work of victim support groups, report on current scientific research, and discuss the work of ban-asbestos campaigners. The papers in this journal address a question posed by industry 30 years ago: "Where would we be without asbestos?"

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A GLOBAL INDUSTRY

From the beginning of the 20th century until the outbreak of World War II, world production of asbestos rose by 2000%. Output continued to grow steadily, peaking in 1975 at 5 million tons. Despite a slight downturn, annual production remained at over 4 million tons until 1991. In 2001, 2 million tons of chrysotile were mined.³ With so much at stake, asbestos companies worked together to protect their "magic mineral," disparaging safer alternatives and attempting to silence critics. Anti-asbestos campaigners were condemned as being alarmist, misinformed, irresponsible, and commercially motivated. It was claimed that an "almost world-wide anti-asbestos psychosis" had been "stirred up" and sustained by multinational producers of non-asbestos alternatives:

How many victims has the anti-asbestos hysteria claimed? How many asbestos-free brakes have caused fatal accidents? How many buildings have collapsed after a fire because the asbestos was removed, or because of a refusal to use it? How many people have been stricken with often fatal disease due to a lack of safe drinking water, because "benevolent" individuals demanded the installation of asbestos-free pipes, which were so expensive plans for water systems were cut back by half?... Chrysotile asbestos can save lives.⁴

In 1999, the Collegium Ramazzini, hardly "ban-asbestos zealots," issued a "Call for an International Ban on Asbestos":

To eliminate the burden of disease and death that is caused worldwide by exposure to asbestos, The Collegium Ramazzini calls for an immediate ban on all mining and use of asbestos. To be effective, the ban must be international in scope and must be enforced in every country in the world... Multinational asbestos corporations present a deplorable history of international exploitation.⁵

Philip Landrigan, the Collegium's President, condemns the "double standards" of industries which manufacture hazardous products such as asbestos:

It is quite hypocritical of those industries to relocate to the least-developed nations and then to claim that workers there can work safely with toxic materials such as asbestos. Anyone who has travelled in the poor nations of South America, sub-Saharan Africa and Southeast Asia will have seen workers using asbestos in the most uncontrolled conditions, for example, cutting asbestos-concrete pipes with circular saws or trowelling asbestos insulation on to walls in the complete absence of any form of respiratory protection. The argument that workers can be protected against asbestos in nations that have no legal infrastructure in occupational health is a cruel joke.⁶

INDUSTRY MOBILIZES: CANADA TRIES TO SET THE AGENDA

As the commercial exploitation of asbestos increased, so did the knowledge of its lethal effects. Factory inspectors, doctors, scientists, and epidemiologists tried unsuccessfully to warn those in charge. The fact that these warnings went unheeded is due, in no small part, to reassuring reports, position papers, and statements issued by asbestos industry representatives: when the use of amosite and crocidolite became indefensible, these materials were sacrificed in the name of chrysotile. As the momentum to ban asbestos grew, many governments took unilateral action.⁷

By the 1980s, Canadian asbestos stakeholders were amongst those most committed to the long-term survival of chrysotile. In 1984, asbestos mine owners in Quebec and representatives from the Canadian and Quebec Governments set up the Asbestos Institute (AI) to promote "the safe use of chrysotile asbestos in Canada and throughout the world." Between 1984 and 2001, the institute received a total of \$5.1 million from three equal donors: the Federal Government, the Quebec Government, and the asbestos industry.⁸ Drawing on these funds, the AI conducted a global campaign targeted at national governments, trade unions, decision makers, civil servants, journalists, scientists, doctors, and consumers.

The AI is the nexus of a web of organizations which includes: the Asbestos Cement Product Producers Association (ACPPA), the Asbestos Information Association/North America (AIA/NA), the Association of Asbestos Cement Product Producers (AACPP), and the Asbestos International Association (AIA).⁹ Painstaking research conducted during 2002, revealed links between the AI and these groups:

- Denis Hamel, an AI Director, is the Director of the ACPPA;
- the office address for the ACPPA, the AIA/NA, and the AACPP is the same postal mail box in Arlington, Virginia; they share the same phone and fax numbers in Montreal;
- Bob Figg, the President of the AIA/NA, is also President of the AACPP and was Director General of the AIA (one of the four sponsors of the Asbestos Institute Web site).

The use of "independent" bodies to corroborate industry's propaganda is not new. In the United Kingdom, the Asbestos Research Council (ARC) fulfilled a similar role more than 30 years ago. The carefully crafted impression of an autonomous science-based organization could not have been further from the truth: the ARC began and remained commercially motivated:

the ARC was run by industrialists and not by scientists... Strategy was set by the management commit-

use, which in turn responded to the wishes of the sponsoring directors ... these men did not see the ARC as fundamentally a council for scientific research. Ultimately, it was an attempt to capture the scientific agenda and influence public policy.¹⁰

AI AND THE CANADIAN GOVERNMENT: AN UNHOLY ALLIANCE

A briefing by federal officials reveals the intimate connection between the Government and the AI:

By supporting the Asbestos Institute, the Government of Canada continues to pursue its goal of promoting safe use of chrysotile, and of other minerals and metals, in other countries. For example, during 1999–2000, the Asbestos Institute led 16 missions to 12 Latin American, African and Asian countries to give seminars and workshops on the safe use of chrysotile to representatives from governments, industry, unions, universities and the media.¹¹

AI personnel take part in the planning and running of trade and diplomatic missions to pressurize foreign governments:

plans [were made] for the federal government, through its embassies, to organize and participate in 16 pro-chrysotile asbestos conferences and lobbying missions in Chile and other foreign countries. Much of the federal participation involves lobbying foreign trade officials to back off potential import bans, and to convince health departments of foreign governments that the research into the dangers of chrysotile asbestos is inconclusive and that science does not support an outright ban on all forms and uses of asbestos.¹²

The underlined portion of the preceding statement is, according to another government document, a gross underexaggeration:

In cooperation with key stakeholders the Government of Canada is continuing to monitor and intervene in markets such as Brazil, Chile and Vietnam where bans are being considered... [When Argentina banned asbestos] Canadian Embassy officials in Buenos Aires in coordination with NRCan and the Asbestos Institute... made presentations to the Argentinean Ministry of Health, and to the Economy, Industry and Mines Department.¹³

According to Journalist Jim Young, AI Director Denis Hamel "travels all over the globe to promote 'safe use' and combat what he calls the zealotry of 'green evangelists' calling for bans. He has logged more than 100 such 'missions,' promoting the Institute's voluntary agreement signed by buyers of Canadian asbestos."¹⁴ The Institute has provided:

financial aid for the creation of a dozen national industry associations in as many countries. These

associations distribute health and safety information to their members, organize training seminars, coordinate dust-monitoring activities with the Asbestos International Association, coordinate government–industry relations and monitor developments.¹⁵

Leaving no stone unturned, the AI participates in a federal program to bring foreign journalists to Canada, hoping they will return home singing the praises of chrysotile:

When Chilean journalist Raul Sohr phoned the Canadian embassy in Santiago last year [1998], he got a lot more than he bargained for. "I was only asking for information on Canadian asbestos," he said. But a helpful embassy official said the Canadian government would fly him to Canada, all expenses paid, and organize an information program... He was handed "\$1,500 in travellers cheques" [upon arrival] to help cover the cost of hotels and meals [by a representative of the Department of Foreign Affairs]. The air ticket, worth \$1,750, was paid for by the Department of Foreign Affairs account at Rider Government Travel Service on Metcalf St. in Ottawa...

There were five other Latin American journalists from Chile, Colombia, the Dominican Republic, El Salvador and Panama, as well as a representative from the Colombian Asbestos Producers' Association [on the journalistic junket]... All the journalists were given little packets of travellers' cheques on arrival.¹⁶

After the visit of six Moroccan journalists to Canada on May 17–23, 1998, a letter was sent from the AI to Gilles Mahoney, in Quebec's Ministry of Natural Resources, asking him to pay his Ministry's contribution to this event, which was itemized as: \$1,272.42 for one plane ticket and \$900 per diem.¹⁷ On May 30, 2002, the Chair of the Board of the AI signed a contribution agreement with the Canadian Government for the receipt of \$500,000 over two years. The purpose of the donation was to help the AI "promote the safe use of chrysotile at the national and international level." Appendix A of the agreement lists eligible activities:

- advance missions in target countries;
- technical missions in target countries;
- national seminars (1 or 2 days);
- specialist training programs (in Canada or abroad);
- labor seminars;
- missions from consuming countries;
- monitoring missions;
- communication activities (including "visits by journalists, scientists and decision-makers from consuming countries").¹⁸

THE LOSS OF EUROPE

Although unilateral bans had already been adopted by nine European countries (Iceland 1983, Norway 1984,

Denmark 1986, Sweden 1986, Austria 1990, The Netherlands 1991, Finland 1992, Italy 1992, and Germany 1993), when France announced its decision to ban asbestos (July 1996), the AI went into meltdown:

The following actions are being taken in order to minimize the impact of the French decision in Europe and at the international level:

At the request of Israel, AIA will be convening a meeting of the Governing Council in the very near future. The European Advisory Council of AIA has developed and is now implementing a strategy aimed at avoiding the adoption of an asbestos ban at the level of the European Union. For your information, The European Commission (DG III) is convening a meeting on July 26th, to gauge the reactions of other member states to the French decision.

The Asbestos Institute will be meeting with the Governments of Canada and Quebec this week...

From the urgency and detailed response of the AI, it is clear that the wider implications of the French ban were clearly understood: France today, Europe tomorrow. What made matters worse, from the Canadian viewpoint, was that France had been a close ally in the chrysotile campaign. The year before the ban was announced, France imported 29,978 metric tons of Canadian chrysotile, 6% of Canada's annual exports; France was Europe's leading consumer, with Spain a very weak runner-up.¹⁹ French politicians and civil servants, no doubt much encouraged by the industry-backed Permanent Committee on Asbestos, had led the resistance to EU restrictions on chrysotile. The surprise adoption of French Decree 96-1133 (as a result of intense campaigning by French anti-asbestos groups, which is discussed later), prohibiting the import and use of chrysotile and all chrysotile-containing products as of January 1, 1997, was thus viewed as a gross betrayal by the Canadian Government and other asbestos stakeholders.

On June 20, 1997, a Canadian request was submitted to the World Trade Organization's (WTO's) Committee on Technical Barriers to Trade that France rescind this "irrational and disproportionate" ban. Behind-the-scenes attempts at resolution failed, and on May 28, 1998, the Government of Canada lodged an official request with the WTO for consultations with the European Commission, the body with exclusive jurisdiction in international trade matters for Member States, "concerning certain measures taken by France for the prohibition of asbestos and products containing asbestos." To make a long story short, Canada lost! The WTO Dispute Settlement Panel (September 18, 2000) and Appellate Body (March 12, 2001) both accepted that: chrysotile is an established carcinogen, there is no safe threshold, and "controlled use" is not an effective alternative to a national ban.

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With French influence in the European Union (EU) lost, Canada's remaining chrysotile markets in the EU were doomed. EU trade and legal policies favor harmonization: the French ban meant there were nine EU countries that had banned asbestos and six that had not. The anti-asbestos forces now had a majority voice in the European debate which led, in 1999, to the adoption of an EU ban. Europe was lost, but the war continued.

THE BATTLE FOR CHILE

Early in 2001, the Republic of Chile gave notice that the import and use of asbestos would be banned by July 2001. On June 29, 2001, the Prime Minister of Canada, Jean Chrétien, personally telephoned the Chilean President Ricardo Lagos in an attempt to persuade him to abandon the prohibition on chrysotile. In an official statement, Chrétien admitted that he "spoke with President Lagos and forcefully made the Canadian case—based on clear scientific evidence—that chrysotile asbestos can be used safely." As the use of asbestos in Chile was declared illegal by Presidential Declaration on July 12, one must assume that President Lagos had not been convinced by Chrétien's arguments. Even after losing this skirmish, however, the Canadians did not cease their interference in Chilean affairs. Louis Perron, a Senior Policy Advisor to the Canadian Government,²⁰ explains why:

in our view Chile is the stumbling block; if we cannot persuade them to the merits of controlled use, I don't think other Latin American country [sic] will follow. We cannot really affect the situation if there is little support from the local industry.

For the documentation of what happened next, one must thank Canadian researcher Ken Rubin, whose applications under the Access to Information Act have brought to light many revealing documents. An e-mail on March 20, 2002, from Margot Edwards, the Commercial Officer at the Canadian Embassy in Chile, to Elizabeth Rohr, in Quebec, says:²¹

Canada (mainly Quebec), as a major exporter of Asbestos to Chile, has undertaken (through NRCan and PMO Office) extensive lobbying in Chile in order to promote safe use of Asbestos in lieu of total ban. Several Government of Canada missions have taken place followed by extensive exchange of technical information. A seminar on the safe use of asbestos and its effects on human health is being organized jointly by the Canadian and Chilean Governments. It will take place in June in Santiago.

The Canadian title of the seminar, *Asbestos: Its Potential Effects on Human Health and How to Ensure its Safe Use*, was unacceptable to the Chileans who changed it to: *The Use of Asbestos and its Effects on Human Health*.²² The Chilean organizers also objected to the revised title of