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## SECTION V - HEALTH HAZARD DATA

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Primary Routes of Exposure: Inhalation, skin, eye

Health Hazards:

Acute: Possible mechanical irritation accompanied by itching or dermatitis. Possible upper respiratory irritation.

Chronic: Mechanical operations performed on this product could generate respirable fibers which, when breathed at very high concentrations repeatedly over long periods of time, may cause lung injury.

Health Hazard Evaluation

Synergy II thermal liner is believed to be safe for its intended use.

Fibers

Each of the synthetic fibers in the blend has been evaluated for health hazards by the manufacturer of the fiber. Mechanical operations such as cutting, or sewing could generate respirable fibrils. Animal studies indicate that prolonged overexposure to such fibrils has the potential for lasting lung damage. Other nonrespirable fibers can be generated during mechanical operations which could cause upper respiratory irritation and cold-like symptoms.

DMAc and fiber additives

Nomex fiber contains a small amount of residual dimethylacetamide (DMAc) from the manufacturing process. Aramid fibers may contain surface coatings of lubricating and anti-static finishes. Other additives designed to enhance specific product performance such as coloring agents are contained in the fiber structure and do not present any known hazardous exposure in handling or use.

At room temperature DMAc does not normally come out of the fiber. When Nomex fiber products are processed at elevated temperatures, > 200°C (392°F), the residual DMAc may be volatilized and accumulate in poorly ventilated areas. Washing, scouring, dyeing, or other operations that expose the Nomex products to solutions and liquids may extract the residual DMAc into the processing solutions and liquids. DMAc is rapidly absorbed through the skin and can be harmful if inhaled or absorbed in sufficient amounts. Animal studies have shown high levels of DMAc exposure can cause liver, kidney, and retinal damage and eye and skin irritation.

More information on Kevlar, Nomex, and DMAc toxicology is presented in the attachment at the end of this MSDS.

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## SECTION VI - EMERGENCY AND FIRST AID PROCEDURES

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Inhalation: If irritation develops move to fresh air.

Skin Contact: If fibers irritate the skin wash with soap and water.

Eye Contact: Flush eyes with water for 15 minutes or until fibers are removed.

Ingestion: N/A

FOR ALL CONDITIONS SEEK MEDICAL ATTENTION IF IRRITATION PERSISTS.

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## SECTION VII - EMPLOYEE PROTECTION

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The following precautions are advisable during cutting and fabrication or other operations that could generate dust while using this material.

Ventilation: General dilution and/or local exhaust ventilation should be provided as necessary to maintain exposures below occupational exposure limits (See Section II).

Respiratory Protection:

A properly fitted NIOSH approved dust respirator should be used when:

- 1) the level of dust in the air exceeds occupational exposure limits
- 2) if irritation occurs

A properly fitted NIOSH approved organic vapor cartridge respirator should be used when this product is used at elevated temperatures, or in a way that might create airborne DMAc or decomposition products in excess of applicable exposure limits.

Use respiratory protection in accordance with your company's respiratory protection program, and OSHA regulations under 29 CFR 1910.134.

Eye Protection: Safety glasses, goggles, or face shields, as necessary.

Protective Clothing: Wear loose fitting long sleeve shirt and pants or other appropriate clothing to protect those areas where irritation is experienced.

Work and Hygienic Practices: Handle in accordance with good industrial hygiene and safety practices.

- Remove dust and fibers from the skin after exposure.
- Use vacuum equipment to remove fibers and dust from clothing. A lint removal brush can be helpful.
- Use vacuum equipment to clean work surfaces.

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SECTION VIII - REACTIVITY DATA

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Stability: Product is stable.

Incompatibility: None reasonably foreseeable.

Decomposition Temperatures:

- DMAc – will volatilize above 200°C (392°F)
- Additives – decomposition will start at 220°C (428°F)
- Nomex – will thermally degrade above 300°C (572°F)
- Kevlar – will thermally degrade above 400°C (749°F)

Hazardous Decomposition Products: CO<sub>2</sub>, CO, oxides of nitrogen and sulfur, and small amounts of hydrogen cyanide, ammonia, aldehydes, aliphatic hydrocarbons, and other toxic gases depending on conditions. Avoid inhalation of decomposition gases.

Hazardous Polymerization: Will not occur.

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SECTION IX - STORAGE AND HANDLING

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No special handling and storage is required. Note that ultraviolet light will cause discoloration, but will not affect mechanical properties.

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SECTION X- ENVIRONMENTAL PROTECTION

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WASTE DISPOSAL: Dispose as a solid non-hazardous waste, in accordance with federal, state, and local regulations.

The following is reprinted from the supplier MSDS

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TOXICOLOGICAL INFORMATION  
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Animal Data

EYE EFFECTS:

NOMEX(R) and KEVLAR(R) brand fibers are untested for eye irritancy. As with other particles, mechanical action of fibers in the eye may cause slight irritation.

DMAc is an eye irritant in animals and man. Eye contact may include eye irritation with discomfort, tearing, or blurring of vision.

SKIN EFFECTS:

NOMEX(R) and KEVLAR(R) fibers are not skin irritants, or skin sensitizers in animals. None of three tests using guinea pigs produced sensitization (KEVLAR(R)).

Skin sensitization has not been observed in human patch tests or in industrial experience. NOMEX(R) and KEVLAR(R) fiber have been used in direct contact with the skin in industrial gloves and protective apparel for many years.

The mechanical action of the fibers may cause slight skin irritation at clothing binding points. Repeated harsh rubbing of the skin with fibrous dust or supported fiber structures (e.g., sized, coated or impregnated fabrics, paper edges, etc.) may cause abrasion, with resulting irritation and rash. Symptoms disappear following cessation of skin contact.

DMAc skin absorption toxicity: LD 50 for rabbits is 2240mg/kg (moderately toxic by skin absorption). ALD for rabbits, when applied in single doses, is 5000mg/kg body weight.

DMAc is a skin irritant, but not a skin sensitizer in animals. In humans, skin contact can cause irritation with discomfort or rash.

ACUTE ORAL EFFECTS:

NOMEX(R) and KEVLAR(R) have very low toxicity by ingestion.

Oral ALD >7500mg/kg in rats. DMAc is slightly toxic by ingestion.

LD50 is 4930mg/kg in female rats.

ACUTE INHALATION EFFECTS:

Industrial experience shows that inhalation of fibrous dust and fly may cause mechanical irritation of the mucous membranes of the nose and throat with resulting dry cough, scratchy throat and runny nose. Symptoms cease upon cessation of exposure.

Human health effects of overexposure to DMAc by inhalation or skin absorption may initially include nonspecific discomfort such as nausea, headache, or weakness; temporary nervous headache, confusion, incoordination, and loss of consciousness; abnormal liver and kidney functions as detected by laboratory tests or jaundice (liver). Skin permeation occurs rapidly and can occur in amounts capable of producing the effects of systemic toxicity. There are no reports of human sensitization. Individuals with pre-existing diseases of the liver may have increased susceptibility to the toxicity of excessive exposure.

SUBCHRONIC INHALATION EFFECTS:

In a two week inhalation study with rats (1983), respirable fibrils (subfibers) of KEVLAR(R) at concentrations of 1000-2000 fibrils per cubic centimeter (f/cc) caused mild non-progressive fibrosis (lung scarring that shrinks with cessation of exposure) and nonspecific effects such as weight loss, and irritation. There were no effects at concentrations of 280f/cc or less.

A two week subchronic test in which mice were exposed to DMAc via inhalation showed liver and testicular effects at high exposure concentrations (300, 500 and 700ppm). No adverse effects were observed at 100ppm.

CHRONIC INHALATION EFFECTS:

NOMEX(R) and KEVLAR(R) brand fibers:

NOMEX(R) fiber does not break down into fibrils when abraded, it produces nonfibrous particles. A 2.5mg dust sample of NOMEX(R), prepared by grinding NOMEX(R) paper was

instilled once into rat lungs. Tissue response was measured histopathologically in groups of rats at periodic sacrifices from 2 days to 2 years. No sign of adverse response to the NOMEX(R) dust was seen.

A two year inhalation study with KEVLAR(R) pulp (refined to increase its respirable fibril content) showed fibrosis at concentrations of 25, 100 and 400 f/cc, and lung lesions in some rats in the group exposed to respirable fibers at concentrations of 100 and 400 f/cc. A panel of 12 pathologists from North America and Europe reviewed these lesions and diagnosed them as "proliferative keratin cysts." They agreed that the lesions are not malignant neoplasms and are most likely not neoplastic. This unique lesion is not found in humans and may be indicative of a nonspecific biological response to the respirable material, rather than an indication of the toxicity of KEVLAR(R). No fibrosis was seen in animals exposed to 2.5 f/cc for two years (and very little at 25f/cc). At no concentrations were fibers found to have migrated beyond the lungs and associated lymph system. Four experiments at fibril concentrations of 2.5f/cc to 400f/cc have shown that fibrils of KEVLAR(R) in the lungs of rats are shortened with time, probably by enzymatic clipping of the polymer chain. (This effect has been independently confirmed in rats by two other laboratories and by DuPont in hamsters. In-vitro tests show fibrils of KEVLAR(R) are shortened in proteolytic enzyme solutions). While not all fibrils disappear, long fibers are cut to an average of less than 5 micrometers and gradually removed. The lower the exposure, the faster fibrils are broken down.

IARC (International Agency for Research on Cancer, the cancer research arm of the United Nations World Health Organization), completed an in-depth review of all valid scientific data relating to para-aramid fibrils in October, 1996. They classified the fibrils as in Group 3, "not classifiable as to their carcinogenicity to humans." That is, the experts found no convincing evidence of carcinogenicity. (While IARC has no regulatory authority, its expert opinions are used for guidance by regulatory authorities worldwide).

#### DMAc:

Toxic effects described in animals from exposure by inhalation, ingestion or skin contact include retinal, liver, lung and kidney effects reduced spermatogenesis, bone marrow effects and ataxia. Tests in animals demonstrate no carcinogenic activity.

If there is significant potential for skin contact with DMAc, biological monitoring should be done to measure the level of DMAc metabolites in urine specimens collected at the end of the shift. It is DuPont practice to limit individual end-of-shift DMAc metabolites in urine levels to 40ppm or below, expressed as Monomethylacetamide (MMAc) and to control average DMAc metabolite in urine levels for the job to 20ppm or below, expressed as MMAc.

#### MUTAGENIC, DEVELOPMENTAL AND REPRODUCTIVE EFFECTS:

##### FIBERS:

In an in-vitro assay, fibrils of KEVLAR(R) produced no chromosomal aberrations in cultured human peripheral blood lymphocytes.

No animal tests have been run to define mutagenic, developmental or reproductive hazards of either NOMEX(R) or KEVLAR(R) fibers.

##### DMAc:

Tests in mammalian cell cultures demonstrate no mutagenic activity. In laboratory tests, application of DMAc to the skin of pregnant rats has caused fetal deaths when the doses were close to the lethal dose level for the mother. Embryonal malformations have been observed at dose levels 20% of the lethal dose and higher. However, when male and female rats were exposed to mean concentrations of DMAc at 31 ppm, 101 ppm, and 291 ppm for 6 hours per day over several weeks no reproductive effects were observed.

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**NOTE:** Keep in mind that the effects of DMAc cited in this MSDS are exposure dependent, and may not appear except at significant exposures. Because the DMAc in NOMEX(R) is not readily available at room temperatures, typical workplace handling has only produced levels of absorbed DMAc that are well below levels at which health effects occur.