CALLERY CHEMICAL

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PENTABORANE SAFETY BULLETIN

ISSUED AUGUST 14, 1998 TO POTENTIAL RECIPIENTS OF PENTABORANE

Callery Chemical Company records indicate that your organization may have purchased or requested a sample of pentaborane (B_5H_9) between 1960 and 1987 or may have previously worked with pentaborane. While once of great interest as a military-sponsored, high-energy liquid rocket propellant, pentaborane is a very dangerous chemical. It is highly toxic by inhalation, skin absorption, or ingestion. Additionally, pentaborane may ignite spontaneously if exposed to air and may react explosively or form shock-sensitive mixtures. Although Callery Chemical Company no longer manufactures pentaborane, we are voluntarily issuing this notice to increase awareness about the hazards of pentaborane and have attached our most recent material safety data sheet (MSDS). While Callery Chemical Company and others have previously published earlier information on pentaborane (much of which was a product of government-funded research in the 1950s and 1960s), such prior information should not be relied upon.

Although a liquid, pentaborane was supplied in compressed-gas cylinders as required by U.S. DOT regulations. Pentaborane shipped by Callery Chemical Company was typically packaged in blue or silver 1-pint or 1-quart steel cylinders. Callery Chemical Company was not the only producer of pentaborane and it is possible that other organizations have shipped pentaborane to you in other types of cylinders. In particular, Callery originally shipped 500-pound cylinders of pentaborane to the U.S. government and some of these cylinders may have been reshipped to you by others.

Callery Chemical Company actively worked with pentaborane in the 1950s when we were retained to operate a government-owned manufacturing facility to produce pentaborane for the military. Although we no longer have any business interest in pentaborane and most Callery employees who directly worked with pentaborane have long since retired, we have great concerns about the potential harm to human health and the environment if pentaborane is handled or disposed of improperly. While we are confident that your organization shares this concern, we are concerned that others may have provided you with incomplete, inaccurate, or misleading information about the feasibility of open burning/detonation or the alleged impracticality of other safer technologies.

We have prepared this Bulletin to alert you that if you have pentaborane in your facility, there are dangerous consequences of improper storage or disposal. We strongly recommend that you locate and isolate all pentaborane or suspected pentaborane at your facility and carefully review the attached MSDS. We also encourage you to copy and share this bulletin with others who may encounter pentaborane in their activities. Additional copies may also be obtained by contacting Mrs. Stephanie Cassidy at 412/967-3216.

Because of the grave consequences that can result from mismanaging pentaborane, the U.S. government has formed a joint U.S. Environmental Protection Agency/U.S. Department of Defense National Task Force to help assure that technical resources and information are available. While we are not a member of the task force and therefore are not in a position to endorse its efforts, we recommend that you contact this task force for information and assistance if your organization is in possession of any pentaborane (even small quantities) or empty pentaborane cylinders. The task force can be reached by contacting Dr. John Glaser, Physical Scientist, U.S. EPA National Risk Management Research Laboratory, 26 West Martin Luther King Drive, Cincinnati, OH 45268 or via 513/569-7568 (telephone), 513/569-7105 (fax), or glaser.john@epamail.epa.gov (e-mail).

Attachment

Note: If you are affiliated with a waste management agency, a treatment/disposal facility, or an environmental consulting/services firm, you have received this Bulletin as a courtesy. Please share this information with colleagues who may encounter pentaborane in a remedial response or waste management setting.

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: **Pentaborane**

Prepared by: CALLERY CHEMICAL COMPANY
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2. COMPOSITION/INFORMATION ON INGREDIENTS

Pentaborane (19624-22-7).....~100 wt%

3. HAZARDS IDENTIFICATION

Emergency Overview: Pentaborane is a colorless to yellow liquid with a characteristic pungent odor that has been described as resembling garlic, acetylene, or sour milk. POISON! May be fatal if inhaled, absorbed through the skin, or swallowed. Extremely flammable. May catch fire if exposed to air. Causes thermal burns. Forms shock-sensitive mixtures with certain other materials. Fight fire from a distance. Keep containers cooled with water. Overpressure of containers may occur in fire.

4. FIRST AID MEASURES

POISON! Obtain immediate medical treatment in all cases. Symptoms may be delayed for up to 48 hours. Emergency and medical personnel should avoid possible exposure to pentaborane. Transport to a medical facility that has been informed about the hazards of pentaborane and is prepared to handle a pentaborane exposure case.
Skin - Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Decontaminate skin by rinsing with 3% ammonia solution and flush with more water. Dispose of and handle contaminated clothing and shoes as waste pentaborane material.
Inhalation - Remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Keep warm and quiet.
Eyes - Remove from exposure. Immediately flush eyes with plenty of water for at least 15 minutes, holding eyes open. Do not use ammonia solution in the eyes.
Ingestion - Give two glasses of water and permit vomiting if nauseated. Never give anything by mouth to an unconscious person.
Note to Physician: Serum boron level along with SGOT and SGPT can be used to confirm pentaborane exposure. See Section 11, Toxicological Information, for additional information.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES: Pentaborane should be considered pyrophoric. It can ignite explosively, but an explosion is not initiated by sudden shock, pressure, or high temperature. It reacts slowly with water at room temperature, releasing flammable hydrogen gas.

Flashpoint (closed cup): 86°F (30ºC) for pure material
Flammable limits:
Lower flammable limit (LFL): 0.42%
Upper flammable limit (UFL): 98%
Autoignition Temperature: 95ºF (35ºC) for pure material, spontaneously flammable if impure.

EXTINGUISHING MEDIA: It is difficult to extinguish a pentaborane fire. Water may be ineffective. For small fires use dry chemical, soda ash, lime or DRY sand. For large fires use DRY sand, dry chemical, soda ash, or lime.
DO NOT use carbon tetrachloride or halogenated extinguishing agents. Begin decontamination as soon as possible. Cool containers that are exposed to flames with water from the side until well after fire is out.

FIRE AND EXPLOSION HAZARDS: While pentaborane is insensitive to shock, it will react explosively or form shock-sensitive mixtures with oxidizing materials, highly oxygenated or halogenated solvents, or organic compounds containing reducible functional groups (e.g., aldehydes, ketones, certain organic acid esters). Pentaborane vapor is heavier than air and may travel along the ground to a distant source of ignition and flashback. Pentaborane burns with a green flame and produces a dense black smoke.

The decomposition of pentaborane in storage containers liberates flammable hydrogen gas which will cause pressure build-up in the containers if not relieved. Venting must be done using a vent-flare system. Decomposition will also produce toxic and flammable higher boron hydrides such as decaborane and pentaborane polymer.

Pentaborane is very soluble in the greases normally used as stopcock lubricants in laboratory equipment. See below, in Section 7, Protective Measures During Repair and Maintenance of Contaminated Equipment, for cleanout procedure.

FIRE FIGHTING PROCEDURES: Allow no exposure to pentaborane liquid or vapor. User should take all precautions to prevent any exposure. Structural firefighting clothing will NOT provide adequate protection. Fire personnel should not expose themselves to any pentaborane product or byproduct; contaminated air, waters, or other materials. Wear a NIOSH approved self-contained breathing apparatus with full facepiece operated in a positive-pressure mode and a fully encapsulating, chemical resistant suit (Level A). Evacuate if fire becomes uncontrollable or container is exposed to a direct flame (small container: evacuate 500 foot radius, large container: evacuate 1/2 mile radius). The fire may be allowed to burn out, if the source of pentaborane can be shut off and the surrounding equipment can be kept cool using water. The recommended extinguishers may also be used, but the fire may re-ignite when application stops. Pentaborane will float on water. Take precautions to confine burning area.

Toxic residues may remain after the fire. Begin decontamination as soon as possible. Do not allow any contact with residues or vapors. Cleanup personnel must wear a NIOSH approved self-contained breathing apparatus with full facepiece operated in a positive-pressure mode and a fully encapsulating, chemical resistant suit (Level A).

To decontaminate area, hose down external surfaces and apply an aqueous solution containing 3% ammonia and 5% trisodium phosphate detergent. After one hour, rinse thoroughly. Dike, collect, and incinerate all contaminated water. Personnel should use the ammonia solution, then soap and water for body, clothing, and equipment cleanup.

6. ACCIDENTAL RELEASE MEASURES

See Section 5, “FIRE FIGHTING MEASURES."

7. HANDLING AND STORAGE

Do not breathe vapors or allow skin to be exposed to pentaborane. Do not get in eyes, on skin, on clothing. Do not carry anything which may be put in the mouth, such as tobacco products, gum, or food. Wash thoroughly after handling. In case of any exposure, immediately begin recommended first aid procedures and seek medical treatment.

Keep under dry nitrogen atmosphere at all times. Use only with clean, dry, completely enclosed systems that have been thoroughly purged with dry nitrogen or argon. When possible, use automated or remote controlled processes. Use only with adequate workplace ventilation. All lines and fittings should be visually inspected on a regular basis for the appearance of liquid or white solids at joints. Keep away from heat, sparks, flame, and direct sunlight. Keep from contact with oxidizing materials, highly oxygenated or halogenated compounds, or organic compounds containing reducible functional groups. Purge and decontaminate all equipment before opening to atmosphere. Thoroughly purge all lines before disconnecting pentaborane cylinder.

Store in a cool, well-ventilated area, away from any ignition sources and direct sunlight.

Since emptied containers retain product residue, follow label warnings even after container is emptied.

PROTECTIVE MEASURES DURING REPAIR AND MAINTENANCE OF CONTAMINATED EQUIPMENT: Do not attempt repair or maintenance of contaminated equipment until it has been cleaned. Eliminate ignition sources. Ventilate area. Wear recommended personal protective equipment (see Section 8 below). Transfer residual pentaborane to a dry nitrogen purged cylinder (always store pentaborane under a dry nitrogen atmosphere) and purge system to be cleaned with dry nitrogen, flaring or scrubbing gases. Fill empty system to be cleaned with dry naphtha and tightpipe solution to drum. Solution will contain pentaborane. Handle it as though it had the same properties as pentaborane. SLOWLY add isopropanol to system, venting any hydrogen gas produced. Finally, SLOWLY add methanol to rinse the system. Components, such as valves, pumps, etc., which have cavities where pentaborane may be trapped, may be immersed in a 10% methanol-in-water solution for one hour to complete the decontamination process. Incinerate all washout solutions.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

NORMAL USE & HANDLING: Allow no exposure to pentaborane liquid and vapor. User should take all precautions to prevent any exposure. Wear a NIOSH approved self-contained breathing apparatus with full facepiece operated in a positive-pressure mode and a fully encapsulating, chemical resistant suit (Level A). Eye wash and safety showers must be available and in good working order.

EMERGENCY HANDLING: Allow no exposure to pentaborane liquid and vapor. User should take all precautions to prevent any exposure. Structural firefighting clothing will NOT provide adequate protection. Wear a NIOSH approved self-contained breathing apparatus with full facepiece operated in a positive-pressure mode and a fully encapsulating, chemical resistant suit (Level A).

EXPOSURE GUIDELINES: Pentaborane has poor warning properties.

OSHA PEL-TWA:	0.005 ppm (0.01 mg/m^3)
ACGIH TLV-TWA:	0.005 ppm (0.013 mg/m^3)
ACGIH TLV-STEL:	0.015 ppm (0.039 mg/m^3)
IDLH:	1 ppm
ODOR THRESHOLD:	0.96 ppm with rapid olfactory fatigue

ENGINEERING CONTROLS: A continuous air monitoring system for pentaborane should be in place prior to beginning work. Provide local exhaust ventilation at any points where leaks may occur. Use flanged or Swagelok™ fittings. Ground all containers before transfer is attempted. All piping that will contain pentaborane should be provided with nitrogen connections and valving in such a manner that a leaking section of the pipe can be purged with nitrogen and isolated from the rest of the system.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless to yellow liquid
ODOR: Characteristic pungent odor that has been described as resembling garlic, acetylene, or sour milk
FREEZING POINT: -52.2°F (-46.8°C)
BOILING POINT: 140.1°F (60.1°C)
VAPOR PRESSURE: 207 mm Hg @ 25°C, 171 mmHg @ 20°C
VAPOR DENSITY (air=l): 2.2
SPECIFIC GRAVITY @ 77°F (25°C): 0.618
VISCOSITY: 171 mmHg @ 20°C
CORROSIVITY: Corrosive to natural rubber, some greases, and some lubricants.
CRITICAL TEMPERATURE: 441°F (227°C)
CRITICAL PRESSURE: 570 psia (38 atm)
HEAT OF COMBUSTION: -29,100 BTU/lb. (-16,200 cal/g)
HEAT OF VAPORIZATION: 219 BTU/lb (122 cal/g)
SURFACE TENSION: 20.8 dynes/cm @ 25°C (0.0208 N/m)
SOLUBILITY IN WATER: Hydrolyzes slowly in water at room temperature.
SOLUBILITY (OTHER THAN WATER): Very soluble in greases including those used in labs as stopcock greases.
THERMAL STABILITY: Relatively stable to 302°F (150°C); begins to decompose above this temperature, generating flammable hydrogen gas and pressure buildup in containers.
FORMULA: B_5H_9

10. STABILITY AND REACTIVITY

STABILITY (CONDITIONS TO AVOID): Stable. Keep away from heat, sparks, flame, and direct sunlight. Temperatures above 302ºF (150ºC) cause decomposition, generating flammable hydrogen gas and pressure buildup in containers.

INCOMPATIBILITY (SPECIFIC MATERIALS TO AVOID): Air, oxygen, oxidizing agents, highly oxygenated or halogenated compounds, compounds with reducible functional groups. Examples are acetone, ammonium chlorate, boron trichloride, carbon disulfide, carbon tetrachloride, chloroform, dimethyl ether, dioxane, freons, and glycol polyethers (such as diglyme), trichloroethane, trichloroethylene.

HAZARDOUS DECOMPOSITION PRODUCTS: Hydrogen, higher boron hydrides (such as decaborane and pentaborane polymer), elemental boron. The decomposition of pentaborane in storage containers liberates flammable hydrogen gas that will cause pressure build-up in the containers if not relieved. Venting must be done using a vent-flare system.

HAZARDOUS POLYMERIZATION: Not known to occur.

11. TOXICOLOGICAL INFORMATION

POISON! May be fatal if inhaled, absorbed through the skin, or swallowed. Causes thermal burns.

HUMAN HEALTH EFFECTS INFORMATION: Pentaborane may ignite and cause thermal burns. Evaporation of pentaborane from the skin is reported to create symptoms of frostbite. Pentaborane is only slowly eliminated from the body and can accumulate to cause toxic effects. Repeated exposures make a person more susceptible to subsequent exposures and periods of no exposure (e.g., weekends) allow partial recovery from toxic effects.

The median detectable concentration for tested humans was 1.3 ppm. Therefore, dangerous concentrations of pentaborane in air may not be detectable by odor. Rapid olfactory fatigue may also occur, which decreases the ability of a person to detect the odor. One investigator wrote that a strong whiff, producing a penetrating feeling in the nose, would produce symptoms.

Symptoms may be delayed for up to 48 hours but have been reported to occur in as little as four minutes with exposure to very high concentration. In humans, minor intoxication has been reported to cause various central nervous system (CNS) symptoms, some of which are dizziness, drowsiness, blurred vision, fatigue, muscle spasms, hallucinations, memory loss, behavioral changes, poor judgment, lethargy, confusion, inability to concentrate, headache, nausea, vomiting, and feelings of constriction in the chest. Exposed persons were also reported to have conjunctivitis and reddening of the skin in the blush area. With moderate intoxication, humans had more obvious symptoms: thick, slurred speech; confused, sleepy appearance; transient spasmodic motion of the eyeball; drooping of the eyelids; and euphoria. With severe intoxication, the following symptoms are reported in one or more exposed persons: spasms, nervous excitation, convulsions, disorientation, agitation, hallucinations, vision problems, fever, progressive lethargy, reddening of skin, hepatitis, liver failure, muscle incoordination and weakness, destruction of skeletal muscle, acidosis, cardiac arrest, breathing and circulatory problems, pneumonia, central nervous system damage, coma, and death.

Follow-up studies of persons exposed to pentaborane are found in the literature. In one study, all sixty-seven intoxicated workers had abnormal electroencephalograms (EEGs) which reverted to normal within five weeks (with two exceptions). No impairment of kidney function was observed over a three year period. In another study, duration of the illness was between 1 and 30 days with the average time 4 days. In a third study, sixty workers exposed and potentially exposed to very low concentrations of pentaborane over a year's time showed no signs of chronic effects at the time of the study. No abnormalities were found in their lungs, liver, or kidneys; blood tests for boranes were negative, and no clinical effects were observed.

To date, 35 severe cases of pentaborane poisoning have been reported in the literature and, until 1982 none of the reported cases involved death or extended disability. The 1982 disposal site incident involved three previously healthy workers: one worker died, one worker recovered, and one worker sustained severe neurologic damage, dementia, quadriplegia, partial deafness, and cortical blindness. All three had inhalation exposure to pentaborane. The one worker who died also had direct skin contact with pentaborane. All three workers showed rapid and severe CNS toxic effects including seizures, opisthotonic spasms along with severe metabolic acidosis without respiratory compensation, rhabdomyolysis, elevated serum transaminase levels, and histologically-determined liver damage.

Along with the three cases of primary exposure described above, there were 15 cases of secondary exposure (12 rescue squad personnel, two bystanders, and one environmental protection officer) who were seen in the emergency room the night of the exposure. One secondary exposure case was admitted. Because no air monitoring was performed during the incident and no serum or urine boron levels were done the night of the incident, the amount of pentaborane these secondary workers were exposed to is unknown. On the night of the exposure, the only symptoms presented by 11 of the 12 rescue workers were conjunctivitis and a red rash in the blush area. The other rescue worker was admitted to the hospital that night after he exhibited myoclonic movements. On the day after the event, nine of the secondary exposure group developed symptoms severe enough to be admitted to the hospital. Thirteen recognized that they were confused and having difficulty concentrating. Electroencephalograms (EEGs) were given to 10, and 7 EEGs showed bitemporal theta waves interpreted as compatible with toxic encephalopathy. There were no significant abnormal findings in any of the clinical chemistry exams.

Fourteen of the 15 secondary exposed workers received follow-up medical evaluations four to twelve weeks later in a study of neuropsychiatric abnormalities following toxic chemical exposure. While the results of physical, neurological, and routine laboratory evaluations were normal, there were a number of indicators (e.g., initial and persistent psychiatric symptoms, neuropsychological deficits, electroencephalographic changes, elevated CNS neurotransmitter levels, and ventricular brain ratios) that provide evidence of CNS damage. Seven of the fourteen were diagnosed with posttraumatic stress disorder (PTSD) defined as a complex response to a psychologically traumatic event with a frequent concomitant physical component to the trauma which may even involve direct damage to the CNS. The study reported that persons diagnosed with PTSD re-experienced trauma through intrusive recollections, recurrent dreams of the event, and inappropriately acting as if the trauma were recurring. Other PTSD symptoms such as numbing of responsiveness, sleep disorder, and hyperalertness, may be caused by a toxicant but have not been reported to persist for more than a few days even with severe pentaborane intoxication.

From this study the physicians concluded that the effects of exposure to pentaborane are longer lasting than previously documented and contradict previously published information that reports most pentaborane exposure symptoms resolve within the first week after exposure. These results suggest that the secondary exposure workers suffered a combination of organic brain insult and psychological trauma.

ANIMAL EFFECTS INFORMATION: Based on animal toxicity data, pentaborane is highly toxic by inhalation of vapor or absorption through the skin. No animal test data is available on oral toxicity, but it is believed that the liquid will be highly

toxic if swallowed. Vapor caused severe irritation and corneal opacity to animals' eyes, and skin and mucous membrane irritation; however, vapor was not absorbed through the skin of tested dogs. In all animal species studied, there was only a slight difference between lethal concentrations and those causing no apparent toxicity. Dogs developed characteristic constriction of the pupils.

Because of the high acute toxicity of pentaborane, the animals' exposures were very brief and the acute exposure effects appeared limited to the central nervous system (CNS). The chronic toxicity of pentaborane was studied in five animal species (monkeys, dogs, rabbits, rats, and hamsters) by daily exposures to 0.2 ppm for 6-months. The exposure symptoms in all species were weight loss, apathy, insensitivity to pain, loss of limb mobility, muscle tremors, and impaired coordination. Partial recovery occurred over weekends when there was no exposure which is typical of the boranes. The mechanism of action was thought to be linked to the inhibition of glycolysis.

TOXICOLOGY DATA: LC50 rat: 7 ppm/4 hours exposure, 19 ppm/2 hours exposure; 67 ppm/5 minutes exposure.

PRIMARY ROUTE(S) OF ENTRY: Inhalation, skin absorption, eye contact, ingestion.

TARGET ORGANS: Eyes, skin, central nervous system (CNS), other organs depending on the extent of the exposure (See Health Effects above).

MEDICAL CONDITIONS GENERALLY RECOGNIZED AS BEING AGGRAVATED BY EXPOSURE: Pre-existing blood disorders; allergies; history of CNS disease, behavioral or personality changes; and liver, kidney, or pulmonary disease. Pre-exposure medical monitoring should include serum boron levels, SGOT, and SGPT.

CARCINOGENICITY DATA: No information; pentaborane is not listed in National Toxicology Program (NTP) Annual Report on Carcinogens, not found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs, not listed by OSHA.

12. ECOLOGICAL INFORMATION

No information found.

13. DISPOSAL CONSIDERATIONS

Dispose in compliance with all local, state, and federal laws and regulations. Treatment, storage, and disposal of pentaborane and containers with residual amounts of pentaborane require extreme caution. Specialized handling techniques and expertise beyond that found at typical hazardous waste treatment, storage, and disposal facilities is required. Assistance may be available from the U.S. Environmental Protection Agency/U.S. Department of Defense National Pentaborane Task Force. The task force can be reached by contacting Dr. John Glaser, Physical Scientist, U.S. EPA National Risk Management Laboratory, 26 West Martin Luther King Drive, Cincinnati, OH 45268 or via 513/569-7568 (telephone), 513/569-7105 (fax), or glaser.john@epamail.epa.gov.

14. TRANSPORT INFORMATION

DOT: Pentaborane, 4.2, UN1380, PGI, POISON - INHALATION HAZARD ZONE A

15. REGULATORY INFORMATION

TSCA INFORMATION: Pentaborane is listed on the TSCA Public Inventory.

OSHA PROCESS SAFETY INFORMATION (29CFR1910.119): Threshold quantity (TQ) for pentaborane is 100 pounds.

SARA 302 INFORMATION (40CFR355.30): Threshold Planning Quantity (TPQ) for pentaborane is 500 pounds.

SARA 304 INFORMATION (40CFR355.40): Reportable quantity (RQ) for pentaborane is 500 pounds.

SARA 313 INFORMATION (40CFR372.65): Pentaborane does not contain a toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372.

CERCLA/SUPERFUND INFORMATION (40CFR302.4): No reportable quantity (RQ) for pentaborane.

OTHER INFORMATION: This product contains pentaborane; therefore, it is subject to the Pennsylvania Worker and Community Right-to-Know Act.

16. OTHER INFORMATION

MSDS STATUS: Replaces MSDS dated 7/24/87.

WARNING: THIS IS A DANGEROUS CHEMICAL PRODUCT. BY FOLLOWING THE DIRECTIONS AND WARNINGS ON THIS MATERIAL SAFETY DATA SHEET, PRODUCT LABELS AND ANY BULLETINS REFERRED TO THEREIN, THE DANGER CAN BE GREATLY REDUCED, BUT NEVER ENTIRELY ELIMINATED. CALLERY CHEMICAL COMPANY MAKES NO WARRANTIES, EXPRESS OR IMPLIED WITH RESPECT TO THIS PRODUCT AND EXPRESSLY DISCLAIMS THE WARRANTY OF MERCHANTABILITY AND ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. USERS ASSUME THE RISK IN HANDLING, USING OR STORING THIS PRODUCT, EVEN IF THEY DO SO IN ACCORDANCE WITH THE INFORMATION AND INSTRUCTIONS GIVEN.

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